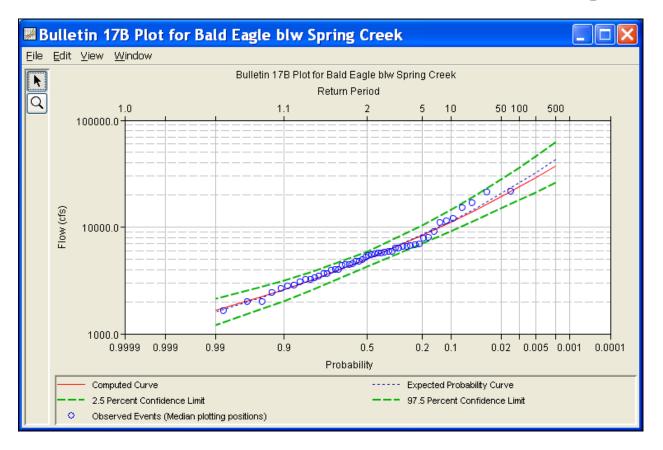


US Army Corps of Engineers Hydrologic Engineering Center

HEC-SSP Statistical Software Package



User's Manual

Version 2.0 October 2010

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HEC-SSP Statistical Software Package

User's Manual

October 2010

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

The HEC-SSP executable code and documentation are public domain and were developed by the Hydrologic Engineering Center for the U.S. Army Corps of Engineers. The software was developed with 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. 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	
Contents	
General Philosophy of the HEC-SSP	
Overview of Program Capabilities User Interface	
Statistical Analysis Components	
Data Storage and Management	
Graphical and Tabular Output	
Overview of This Manual	
CHAPTER 2	.2-1
Installing HEC-SSP	
Contents	
Hardware and Software Requirements	
Installation Procedure To install the software onto your hard disk do the following:	
Uninstall Procedure	
CHAPTER 3	
Working With HEC-SSP - An Overview	
Contents	
Starting HEC-SSP To Start HEC-SSP from Windows:	
Overview of the Software Layout	
Steps in Performing a Bulletin 17B Frequency Analysis	
Starting a New Study	
Adding a Background Map	
Importing, Entering, and Editing Data	
Performing the Bulletin 17B Flow Frequency Analysis	
CHAPTER 4	.4-1
Using the HEC-SSP Data Importer	.4-1
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	
Importing Data from a Text File	
Metadata	
Plotting and Tabulating the Data	4-17
CHAPTER 5	.5-1
Performing a Bulletin 17B Flow Frequency Analysis	
Contents Starting a New Analysis	
General Settings, Options, and Computations	
General Settings.	
Generalized Skew	
Expected Probability Curve	5-4

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

Output Labeling Low Outlier Threshold	
Historic Period Data	
Extracting The Volume-Duration Data	
Analytical Frequency Analysis	
Settings	
Distribution	
Expected Probability Curve	
Skew	
Compute	
Tabular Results	
Plot.	
Statistics	
Graphical Frequency Analysis	
Curve Input	
Plot	
Viewing and Printing Results – Volume Frequency Analysis	
Tabular Output	
Graphical Output	
Viewing the Report File	
CHAPTER 8	8-1
Performing a Duration Analysis	8-1
Contents	
Starting a New Analysis	
General Settings and Options	
General	
Method	
X-Axis Scale	
Y-Axis Scale	
Time Window Modification	
Duration Period	
Options	
Output Labeling	
Plotting Position Formula	
User-Specified Exceedance Ordinates	
Bin Limits	
Compute	
Results	
Tabular Results	
Plot	
Manual Duration Analysis	
Viewing and Printing Results	
Tabular Output	
Graphical Output	
Viewing the Report File	8-14
CHAPTER 9	9-1
Performing a Coincident Frequency Analysis	9-1
Contents	
Starting a New Analysis	9-4
General Settings	
Variable A	
Variable B	
Output Labeling	

Y-Axis Scale	
User Specified Frequency Ordinates	
Variable A	
Variable B	
Response Curves	
Compute	
Results Viewing and Printing Results	
Tabular Output Graphical Output	
Viewing the Report File	
CHAPTER 10	
Performing a Curve Combination Analysis	10-1
Contents	
Starting a New Analysis	
General Settings	
Number of Curves	
Output Labeling	
Data Type	
Y-Axis Scale	
Confidence Limits Method	
Frequency of PMF	
Confidence Limits	
User Specified Frequency Ordinates	
Frequency Curves	
Confidence Limits Compute	
Results	
Viewing and Printing Results	
Tabular Output	
Graphical Output	
Viewing the Report File	
References	
Example Data Sets	
Example 1: Fitting the Log-Pearson Type III Distribution	
Example 2: Analysis with High Outliers	
Example 3: Testing and Adjusting for a Low Outlier	
Example 4: Zero-Flood Years	
Example 5: Confidence Limits and Low Threshold Discharge	
Example 6: Use of Historic Data and Median Plotting Position	
Example 7: Analyzing Stage Data	
Example 8: Using User-Adjusted Statistics	
Example 9: General Frequency – Graphical Analysis	
Example 10: Volume Frequency Analysis, Maximum Flows	
Example 11: Volume Frequency Analysis, Minimum Flows	
Example 12: Duration Analysis, BIN (STATS) Method	
Example 13: Duration Analysis, Rank All Data Method.	
Example 14: Duration Analysis, Manual Entry	
Example 15: Coincident Frequency Analysis, A and B can be Assumed Independent	
Example 16: Coincident Frequency Analysis, A and B can not be Assumed Independent	
Example 17: Curve Combination Analysis, Combine Flow Frequency Curves	
Example 18: Curve Combination Analysis, Combine Stage Frequency Curves	

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. Version 1.1 was released in April, 2009 and included improvements to data entry, results visualization and reporting, and added capability to the volume frequency analysis. These new features are discussed in the User's Manual and in the release notes for Version 1.1. Version 2.0 was released in October 2010 and included three new analyses: a duration analysis, a coincident frequency analysis, and a curve combination analysis. These new features are discussed in the User's Manual and in the release notes for Version 2.0.

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.

CHAPTER 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, a volume frequency analysis on high and low flows, a duration analysis, a coincident frequency analysis, and a curve combination analysis.

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 have received 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, general frequency analyses, volume frequency analyses, duration analyses, coincident frequency analyses, and curve combination 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

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

<u>General Frequency Analysis</u> – 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.

<u>Volume Frequency Analysis</u> – This component of the software allows the user to perform a volume frequency analyses on daily flow or stage data.

<u>Duration Analysis</u> – This component of the software allows the user to perform a duration analysis on any type of data recorded at regular intervals. The duration analysis can be used to show the percent of time that a hydrologic variable is likely to equal or exceed some specific value of interest.

<u>Coincident Frequency Analysis</u> – This component of the software assists the user in computing the exceedance frequency relationship for a variable that is a function of two other variables.

<u>*Curve Combination Analysis*</u> – This component provides a tool for combining frequency curves from multiple sources into one frequency curve.

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, DurationAnalysisResults, CoicidentFreqResults,

CurveCombinationAnalysis, 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 studyby-study basis.

Graphical and Tabular Output

Graphics include a map window, plots of the data, and plots of analysis results. 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 show 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 general frequency analysis editor.

- Chapter 7 provides a detailed discussion on how to use the volume frequency analysis editor.
- Chapter 8 provides a detailed discussion on how to use the duration analysis editor.
- Chapter 9 provides a detailed discussion on how to use the coincident frequency analysis editor.
- Chapter 10 provides a detailed discussion on how to use the curve combination 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, a general frequency analysis, a volumeduration frequency analysis, a duration analysis, a coincident frequency analysis, and a curve combination analysis.

CHAPTER 2

Installing HEC-SSP

You install HEC-SSP using the program installation package available from HEC's web site. The setup program installs the software, documentation, 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 computer 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 1280x1024 or higher resolution, and as large a monitor as possible). Recommend at least a 17" monitor.
- Microsoft 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 site: 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-SSP_2_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-SSP_2_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\2.0 directory with the name "HEC-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 Bulletin 17B "Guidelines for Determining Flood Flow Frequency", dated March 1982, general frequency analyses, volume frequency analyses, duration analyses, coincident frequency analyses, and curve combination 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 a 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:



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 2.0.

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 occupies 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 for the study. The top level of the tree is the study (SSP Examples in this example). Below the study is an analysis branch, a data branch, and a map branch. Under the analysis branch, the first level is the type of analysis. 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. 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.

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.

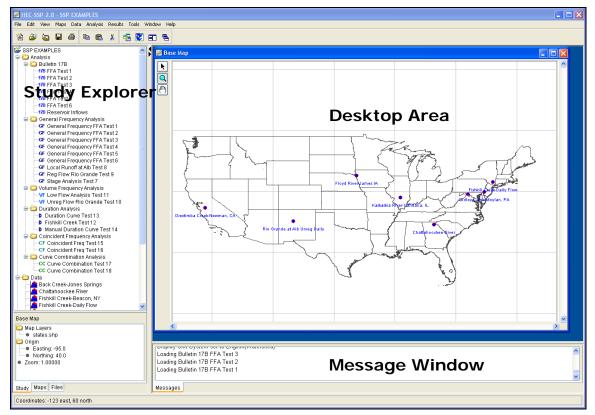


Figure 3-2. The HEC-SSP Main Window.

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

Edit	View	Maps	С	t
X	Cut	Ctrl+X		
	👌 Copy	Ctrl+C		
Ê	A Paste	Ctrl+V		

clipboard features to data in editable fields and tables.

View: The View menu allows the user to control display of the

View	Maps	Data	Analysis	Results
	Toolbars 🕨			
~	Study	Explore	r	
~	Messa	ges Wir	ndow	
~	Status	Windo	W	
~	Toggle Views			Ctrl+T
	Save Current Layout			
Restore Layout				
	Layout Manager			
Set Study Display Units 🔹 🕨				•
	Select	Workin	g Sets	

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 previously saved layout. The Set Study Display Units option allows the user to switch output between English and metric units. The Select Working Sets menu option allows the user to group items in each folder and then display only those items in the user interface. For example, Figure 3-3 shows the Bulletin 17B folder in the study explorer. The Edit Working Set editor, Figure 3-4, was used to group all Bulletin 17B

analyses that started with "FFA" into one working set. The working set

was named "FFA Analyses". This working set was activated by right clicking on top of the Bulletin 17B folder in the study explorer and selecting **Select Working Sets→FFA Analyses**, as shown in Figure 3-5. Only the Bulletin 17B analyses within the working set will then be displayed in the study explorer, as shown in Figure 3-6. To display all Bulletin 17B analysis, right click on top of the Bulletin 17B folder in the study explorer and select **Select Working Sets→No Working Set**.

SSP EXAMPLES				
🖨 🗁 Analysis				
🖨 🧰 Bulletin 17B				
17B FFA Test 2				
17B FFA Test 3				
17B FFA Test 4				
17B FFA Test 5				
17B Reservoir Inflows				

Figure 3-3. Study Explorer before Defining a Working Set.

🧱 Edit Working Set		
Name: FFA An Description:	alyses	
💿 Use Regular Expr	ession	
FFA* O By Name Available	Selected	
Reservoir Inflows	Add FFA Test 1 FFA Test 2 FFA Test 3	
	Add All FFA Test 4 FFA Test 5 FFA Test 6	
	Remove All	
	ок	Cancel

Figure 3-4. Edit Working Set Editor.

😂 SSP EXAMPLES			
😑 🗀 Analysis			
🖮 🗁 Bulletin 17B	, III		
17B FFA Te: New			
-178 FFA Te	FFA Analyses		
178 FFA Te Select Working Set ▶			
	Select		
-17B FFA Test 5			
17B FFA Test 6			
178 Reservoir Inflows			

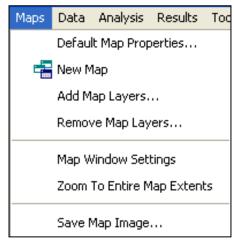
Figure 3-5. Activate a Working Set from the Study Explorer.

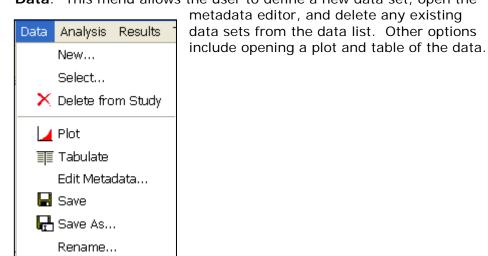
😂 SSP EXAMPLES				
🖨 🗁 Analysis				
🖨 🗁 Bulletin 17B 🛛 < FFA Analyses>				
17B FFA Test 6				

Figure 3-6. Bulletin 17B Folder Only Displays Analyses in Working Set.

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.





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

Analysis: This menu is used to create the various statistical analyses

Analysis	Results	Tools	W	
New				
Ор	en			
🗙 De	lete from	Study		
🖪 Sa	ve			
🖶 Sa	ve As			
Re	name			
Co	mpute Ma	anager		

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.

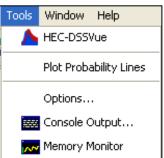
Results: This menu allows the user to graph and tabulate any of the

Results	Tools	Window		
Graph	I			
Table				
Report				
Summary Report				
Defau	lt Plot I	ine Styles		

existing analyses that have been computed. Additionally, the user can request to view the report file from a analysis. Users must select at least one analysis in the Study Explorer before selecting Graph, Table, Report, or Summary Report. If more than one analysis of the same type are selected (this is accomplished by holding down the control Default Plot Line Styles | key while clicking on the various analyses),

the Graph and Summary Report options will include results from all analyses that are selected. 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, Plot Probability Lines,



es HEC-DSSVue, Plot Probability Lines, 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 Plot Probability Lines option opens an editor, shown in Figure 3-7, that lets the user add, delete, or edit the probability lines and axis labels that are displayed in all frequency

curve plots. The Options menu item opens the Options editor that allows the user to set default HEC-SSP options. The **Results** tab in the Options editor, shown in Figure 3-8, allows the user to set the number of decimal digits that are displayed in all results.

Plot Probability Lines					
Label	Return Period	Value			
0.9999	1.0	0.9999			
0.999		0.999			
0.99		0.99			
0.9	1.1	0.9			
0.5	2	0.5			
0.2	5	0.2			
0.1	10	0.1			
0.02	50	0.02			
0.01	100	0.01			
0.005	200	0.0050			
0.002	500	0.0020			
0.001	1000	0.0010			
0.0001	10000	1.0E-4			
0.00001	100000	1.0E-5			
0.000001	1000000	1.0E-6			
		OK Cancel			

Figure 3-7. Plot Probability Lines Editor.

🞇 Options 🛛 🔀					
General System Properties Results					
Number of decimal digits to show in results					
Flow Digits: 1 😂					
Precipitation Digits: 1 😂					
Stage Digits: 2 📚					
Stats Digits: 4 📚					
Volume Digits: 1 📚					
OK Cancel Apply					

Figure 3-8. Dialog for Controlling the Number of Decimal Digits Shown in Result Tables and Reports.

Window: This menu includes Tile, Cascade, Next Window, Previous

Window Help					
Tile					
🔁 Cascade					
🕞 Next Window	Ctrl+Tab				
🚛 Previous Window	Ctrl+Shift+Tab				
Window Selector					
Window	•				

Window, Window Selector, and Window. 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 importer, 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.	
Help	
Use	er's Manual
Ins	tall Example Data
	rms and Conditions For Use out HEC-SSP
1	

Also on the HEC-SSP main window is a Tool Bar. The buttons on the tool bar provide 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 using HEC-SSP. Similar steps are required when performing other statistical analyses.

- 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 open the **Create New Study** window as shown in Figure 3-9. 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 with the same name as the user-entered study name. This study directory is where the HEC-SSP 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.

📓 Create New Study	/
Study <u>N</u> ame:	
<u>D</u> escription:	
Directory:	C:\Temp\
<u>U</u> nit System:	English 🔽
<u>C</u> oordinate System:	X-Y <u>E</u> dit
	OK Cancel

Figure 3-9. New Study Window.

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 to open a shortcut 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 3-10, 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 within the study folder.

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 3-11. This map contains a shapefile of state boundaries and data locations.

😹 Select Map 1	to Add		
Look <u>i</u> n:	: 🚞 states	💌 🤌 🔁	•
D Recent	🖻 s_01au07	shp	🗌 Create Copy
Desktop			
My Documents			
My Computer			
My Network Places	File <u>n</u> ame: Files of <u>t</u> ype:	s_01au07.shp Arc Shapefile (*.shp)	Open Cancel

Figure 3-10. Select a Map Layer to add to the Base Map.

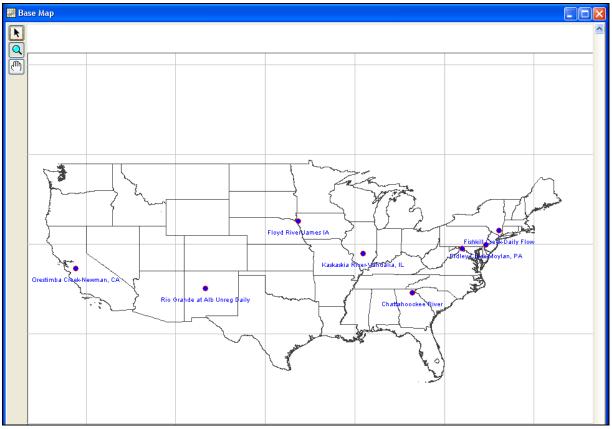


Figure 3-11. Example Background Map.

If more than one map layer is going to be added to 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 cannot 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 values. To bring data into HEC-SSP go to the **Data** menu and select **New**. This will bring up the **Data Importer** as shown in Figure 3-12.

🞇 Data Importer -						
Name:		Short ID:				
Description:						
Study DSS File: C:\Documents	and Settings\q0hecmjf\Deskto	p\ssp\SSP_Examples\SSP_EXAM	PLES.dss			
Study DSS Path:						
Data Source Details						
Location						
🔿 HEC-DSS 🛛 💿 USG	38 Website 🔷 MS Exce	el 🔿 Manual 🔿 Ti	ext File			
USGS Website						
Data Type: Annual Peak Data	a 💌				<u>^</u>	
Retrieve data for:						
🗹 Flow 🗌 Stage						
Get USGS Station ID's by St	tate					
		Basin Name		_ocation	=	
Import Data	Station ID's	(A Part)		(B Part)		
	~		~		×	
					<u> </u>	
					~	
Plot Tabulate					Close	

Figure 3-12. HEC-SSP Data Importer.

As shown in Figure 3-12, the Data Importer 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 Importer 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 five 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, manually entering the data into a table, and import the data from a text file. All of these methods will import data into the study DSS file.

For this example, importing data from the USGS website will be shown. For a complete description of the data importer see Chapter 4. To import data from the USGS website, first select the **USGS Website** option from the list of five options available in the Location panel. Next, select **Annual Peak Data** as the data type and make sure the **Flow** option is selected. The next step is to press the button labeled **Get USGS Station ID's by State**. When this button is pressed a window will appear (Figure 3-13) allowing the user to select a state from which to get data.

🗷 Obtain stations by state 🛛 🔀
Select State: Pennsylvania
Select State: Pennsylvania 💉 Data Type: Annual Peak Data
OK Cancel

Figure 3-13. 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 3-14. 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 during which the data will be downloaded from the USGS website and saved to 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, and the USGS data quality codes. The quality codes will be added as an addition object to the Data folder.

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 Importer. Metadata can also be viewed or edited by opening the **Metadata Editor**. To open this editor, place the mouse on top of a data object in the Data folder and click the right mouse button. The shortcut menu contains an **Edit Metadata** option, as shown in Figure 3-15. The metadata editor is shown in Figure 3-16.

lame:			Short ID:		
escription:					
tudy DSS File: C:\Doc	umonto and Pattingol	q0hecmjf\Desktop\ssp\SSP_Exa	mploo)888 EVAMBLE8 doo		
	uments and settings.	donectriji(Desklop(ssp(55P_Exa	Implestaar_EXAMPLEa.uss		
tudy DSS Path:					
ata Rourao In L II					
oata Source Details					
Location					
O HEC-DSS	 USGS Website 	🔿 MS Excel 💦 🔿 Ma	anual 🔿 Text File		
U HEC-Daa	O 0303 Website	O MO EXCEL			
USGS Website					
	02022500	Even all Overall	Oaultan, BA	11000	
	03023500	French Creek	Carlton, PA	USGS	2
	03024000	French Creek	Utica, PA	USGS	
	03025000	Sugar Creek	Sugarcreek, PA	USGS	
	03025200	Patchel Run	Franklin, PA	USGS	
	03025500	Allegheny River	Franklin, PA	USGS	
	03026400	Richey Run	Emlenton, PA	USGS	
	03026500	Sevenmile Run	Rasselas, PA	USGS	
	03027500	EB Clarion River	EB Clarion River Dam, PA	USGS	
	03028000	West Branch Clarion River	Wilcox, PA	USGS	
	03028500	Clarion River	Johnsonburg, PA	USGS	
✓	03029000	Clarion River	Ridgway, PA	USGS	
	03029200	Clear Creek	Sigel, PA	USGS	
	03029400	Toms Run	Cooksburg, PA	USGS	
	03029500	Clarion River	Cooksburg, PA	USGS	
	03030500	Clarion River	Piney, PA	USGS	
	03030852	Clarion River	Callensburg, PA	USGS	
	03031000	Clarion River	St. Petersburg, PA	USGS	
	03031500	Allegheny River	Parker, PA	USGS	
	03031780	Mill Creek	Brockway, PA	USGS	
	03031950	Big Run	Sprankle Mills, PA	USGS	
	03032500	Redbank Creek	St. Charles, PA	USGS	
	03033222	Beaver Run	Troutville, PA	USGS	
	03033225	East Branch Mahoning Creek	Big Run, PA	USGS	×
Import to Oturty DO	O Filo				
Import to Study DS	SFILE				

Figure 3-14. Example of Choosing Gages from a USGS State List to Import.

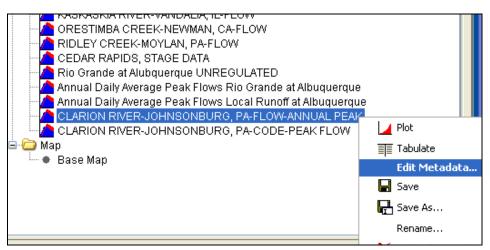


Figure 3-15. Open the Metadata Editor Using the Right Mouse Click Menu.

Chapter 3 - Working with HEC-SSP - An Overview

HEC-SSP User's Manual

🞇 Metadata Editor - CLARION RIVER-JOHNSONBURG, PA-FLOW-ANNUAL PEAK*					
Name:	CLARI	Short ID:			
Description:	Down				
Study DSS File:	C:\Doo	cuments and Settings\q0hecmjf\Desktop\SSP_	_Examples\SSF	P_EXAMPLES.dss	
Study DSS Path:	/CLAR	RION RIVER/JOHNSONBURG, PA/FLOW-ANNU	JAL PEAK//IR-C	CENTURY/USGS/	
State:	Penns	sylvania	County:	Elk	
Stream:	Clario	n River	Location:	Johnsonburg, PA	
Drainage Area:	204		DA Units:		
Gage Operator:	USGS	}	USGS No:		3028500
Gage Datum:	10		HUC:	05010005	
Vertical Datum:	NGVD)29 💌	•		
Description:					
Coordinate Loo	ation E	Data			
Coordinate Sys	stem:	Lat/Long 🗸 C	oordinate ID:		0
Horizontal Date	um:	NAD27 D	atum Units:	Degrees Minutes Seconds	~
Coordinate X V	alue:	-784043 C	oordinate Y Val	alue:	412910
				OK Cancel	Apply

Figure 3-16. Metadata can be Viewed or Edited by Opening the Metadata Editor.

As shown in Figure 3-16, 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. In addition to editing the metadata, the Metadata Editor allows the user to change the name of the data, enter a short identifier, and enter a longer description.

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 four data sources. Therefore, entering the metadata is required if the user wants it to be carried along with the study.

After the data is imported into the study, the user can select any one of the gages in the Data folder and **Plot** or **Tabulate** the data. The plot and tabulate options are available from the Data menu and from a shortcut menu that opens by clicking the right mouse button when the

pointer is located on top of the gage object in the Data folder. If you select the **Plot** option, you will get a plot of the peak flow data for that gage. If you select the **Tabulate** option, you will get a table containing the data. Data values can be edited within the table; however, the editing mode must be turned on. To turn on editing, select the **Edit→Allow Editing** menu option. Use the **File→Save** or **File→Save As** menu option to save the data when you are satisfied with edits.

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

Edit Metadata
📕 Plot
🗐 Tabulate
Rename
🗙 Delete

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 in the map and a shortcut menu will appear as shown. The user has the option to edit the metadata, plot, tabulate, rename, 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 an empty Bulletin 17B editor. As shown in Figure 3-17, the user must enter a name for the analysis, a description (optional), and select a flow data set (gage data stored in study 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 editor 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 open 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.

🞇 Bulletin 17B Editor -*		
Name:		
Generalized Skew Ise 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	Plotting Position ○ Weibull (A and B = 0) ③ 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:	Confidence Limits Defaults (0.05, 0.95) User Entered Values Upper Limit: Lower Limit: Time Window Modification DSS Range is Start Date End Date
Compute Plot Curve View Rep	ort Print	OK Cancel Apply

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

Viewing and Printing Results

Tabular output can be viewed by selecting the **Tabular Results** tab. When this tab is pressed, a set of tables will appear as shown in Figure 3-18. 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. The user can control the number of decimal digits shown in the result tables and in reports. Select Options from the Tools menu and then open the **Results** tab, as shown in Figure 3-8.

HEC-SSP User's Manual

lame:	Ridgway PA Flow Frequency Anal							
escription:	Flow frequency anal	Flow frequency analysis for the Clarion River at Ridgway Pennsylvania						
low Data Set:	CLARION RIVER-RI	DGWAY, PA-FLOW-ANNUAL PEAK						
) SS File Name:		Settings\q0hecmjf\My Documents\H	EC Brojecto		Clarian DiverClarian Diver dee			
Report File:								
		VISSP Projects\Clarion River\Bulleti	n17bResults	NRIdgway_PA_Flow_Frequer	icy_Analysis\Ridgway_PA_Flow	-Frequency_Analysis.rpt		
General Option	S Tabular Results							
		Frequency Curve for: CLA	ARION RIVER	R-RIDGWAY, PA-FLOW-ANNU	JAL PEAK			
Percent Exceed	t Chance	Computed Curve Flow in cfs		ected Prob.	Confidence Lin Flow in cfs	nits		
Exceeu	ance	FIOWINCIS	FIU	wincis	0.05	0.95		
	0.1	80597.9		120125.7	176085.3	49198.9		
	0.2	67541.3		93322.1	139913.9	42532.1		
	0.5	52729.6		66829.6	101479.7	34652.		
	1.0	43153.0		51705.5	78325.4	29325.		
	2.0	34803.6			59405.5	24483.		
5.0		25403.3			39775.4	18729.		
	10.0	19352.6 14055.0		20319.7 14402.5	28275.4 19129.3	14779.` 11071.:		
	50.0	7845.2		7845.2	9885.9	6205.		
	80.0	4544.0		4450.9	5775.1	3328.		
	90.0	3465.2		3333.3	4519.9	2390.		
	95.0	2790.7		2625.6	3739.2	1824.		
	99.0	1892.2		1672.8	2683.3	1113.		
	Syst	tem Statistics			Number of Events			
	Log T	ransform: Flow		Event		Number		
	Statistic	Value		Historic Events				
Mean			3.906	High Outliers				
Standard Dev 0.292		Low Outliers Zero Or Missing						
Station Skew			0.233	Systematic Events		2		
Regional Skew				Historic Period		2		
Weighted Skew				The second Foreign				
Adopted Skew			0.233					

Figure 3-18. 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 3-19. 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 title is listed at the top. The plot title 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 shortcut 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.

Additional points and lines can be added to a plot by placing the mouse anywhere in the plot area and clicking the right mouse button. Then select the **Add Marker** option to add a line or **Add Marker**

Point to add a point. Draw properties can be edited for these userdefined lines and points by placing the mouse on top of the point or line and clicking the right mouse button. Then select the **Edit Properties** option in the shortcut menu.

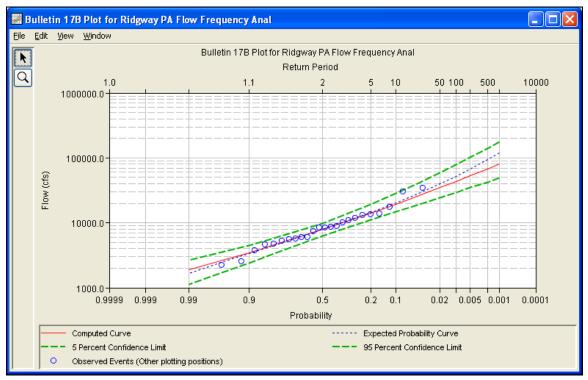


Figure 3-19. Flow Frequency Curve Plot.

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 report as shown in Figure 3-20.

Ridgway_PA_Flow_Frequency_Anal.rpt
Eile Edit Search Format
File: Projects\Clarion River\Bulletin17bResults\Ridgway_PA_Flow_Frequency_Anal\Ridgway_PA_Flow_Frequency_Anal.rpt
Bulletin 17B Frequency Analysis 14 Sep 2010 04:13 PM
Input Data
Analysis Name: Ridgway PA Flow Frequency Anal Description: Flow frequency analysis for the Clarion River at Ridgway Pennsylvania
Data Set Name: CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK DSS File Name: C:\Documents and Settings\qOhecmjf\My Documents\HEC_Projects\HECSSPDEV\SSP Proj DSS Pathname: /CLARION RIVER/RIDGWAY, PA/FLOW-ANNUAL PEAK/Oljan1900/IR-CENTURY/USGS/
Report File Name: C:\Documents and Settings\q0hecmjf\My Documents\HEC_Projects\HECSSPDEV\SSP 1 XML File Name: C:\Documents and Settings\q0hecmjf\My Documents\HEC_Projects\HECSSPDEV\SSP Proj
Start Date: End Date:
Skew Option: Use Station Skew Regional Skew: 0.134 Regional Skew MSE: 0.304
Plotting Position Type: Other Plotting Position Constant A: 0.0 Plotting Position Constant B: 0.0
Upper Confidence Level: 0.05 Lower Confidence Level: 0.95
Use non-standard frequencies Frequency: 0.1
Frequency: 0.2 Frequency: 0.5
Frequency: 1.0 Frequency: 2.0
Frequency: 5.0
Frequency: 10.0 Frequency: 20.0
Frequency: 50.0 Frequency: 80.0
Frequency: 90.0
1:1.1:1 1:1

Figure 3-20. Report File from Bulletin 17B Frequency Analysis.

CHAPTER 4

Using the HEC-SSP Data Importer

The HEC-SSP Data Importer 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) and data stored at regular intervals, like hourly flow data.

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
- Entering Data from a Text File
- 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 Importer**. To open the data importer, go to the **Data** menu and select **New** from the list of options. This will bring up a data importer as shown in Figure 4-1.

📈 Data Importer								
Name:			Short ID:					
Description:	Description:							
Study DSS File:	C:\Documents and Settings\c	0hecmjf\Desktop\ssp\SSP_Exan						
Study DSS Path:		<u> </u>						
Data Source De	etails							
Location								
O HEC-DSS	 USGS Website 	🔿 MS Excel 🛛 🔿 Mar	nual 🔿 Text File					
CUSGS Website								
Data Type: Ar	nnual Peak Data	~						
Retrieve data fo								
	Stage							
Get USGS S	tation ID's by State							
Impor		Basin Name	Location	Other Qualifier				
Data		(A Part)	(B Part)	(F Part)				
		×	· · · · · · · · · · · · · · · · · · ·	<u> </u>				
					~			
Plot	Tabulate				Close			

Figure 4-1. HEC-SSP Data Importer.

At the top of the Data Importer, the user can enter a **Name** for the new data set. Optionally, the user can 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 user does not have to enter a name when importing or manually entering data. The program will automatically name the data using USGS names or HEC-DSS pathname parts. If a **Name** is entered then it will be combined with the USGS gage name or HEC-DSS pathname parts to create a unique name. The user can rename a data set by selecting the data set in the study explorer and clicking the right mouse button. A shortcut menu should open with a **Rename** menu option;

however, the data set must be selected in the study explorer before this menu option is active.

The Data Importer 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 five 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, entering the data manually, and importing from a text file.

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 importer. Selecting **HEC-DSS** will change the view of the Data Importer to look like Figure 4-2.

🞇 Data Importer -					
Name:			Short ID:		
Description:					
Study DSS File: C:\Temp\SSP_	Examples\SSP_EXA	MPLES.dss			
Study DSS Path:					
Data Source Details					
	10/-h-it-				
● HEC-DSS ● USGS	Website 🔘	MS Excel 🛛 🔿 I	Manual 🔿 Text File		
HEC-DSS					
Selected DSS File:	C:\Temp\SSP_Exa	mples\SSP_EXAMPL	.ES.dss		
Selected DSS Pathname:					
Search A: FISHKILL CRE	EK.	✓ C:	▼ E:		
By Parts: B;		✓ C. ✓ D:	E. ▼ F:		
	Devit D			Deut E	
Number Part A 2 FISHKILL CREEK	Part B BEACON	Part C FREQ-FLOW	Part D / range	Part E 🔺	Part F BULLETIN 17B_F
3 FISHKILL CREEK	BEACON	FREQ-FLOW	MAX ANALYTICAL		GENFREQ_GENE
4 FISHKILL CREEK	BEACON	FREQ-FLOW			GENFREQ_GENE
5 FISHKILL CREEK	BEACON BEACON	FREQ-FLOW FLOW	MAX GRAPHICAL 05Mar1945 - 19Mar1968	IR-CENTURY	GENFREQ_GENE
1 FISHKILL CREEK	BEACON	FLOW	USIMAR1945 - 19Mar1966	IR-CENTORY	
FISHKILL CREEK/BEACON/FLOW/	EMar1045 10Mar108				<u> </u>
I ISHNEE CILER/DEACON/ EO/WC	JJMai 1945 - 19Mai 190	MIX-CENTOR I M			
					~
Import to Study DSS File	Clear Selections				
Plot 📰 Tabulate]				Close

Figure 4-2. Data Importer 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 importer will look like Figure 4-3.

💹 Data Importer	1-							
Name:			Short ID:					
Description:								
Study DSS File:	C:\Documents and Settings\qC	hecmjf\Desktop\ssp\SSP_Exan		ES.dss				
Study DSS Path:								
Data Source De	etails							
Location								
O HEC-DSS	 USGS Website 	🔿 MS Excel 🛛 🔿 Mar	iual 🔿 Text	File				
USGS Website								
Data Type: Ar	nual Peak Data	*						
Retrieve data fo								
Flow	Stage							
Get USGS S	tation ID's by State							
Impor		Basin Name		ocation	Other Qualifier		≡	
Data		(A Part)	((B Part)	(F Part)	~		
	<u> </u>	×		~		~		
						-		
							~	
Plot	Tabulate					Clo	se	

Figure 4-3. HEC-SSP Data Importer 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). Then choose to import **Flow** and/or **Stage** 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.

🗷 Obtain	stations by s	state 🗙
Select State:	Pennsylvania	
	Annual Peak Data	<u> </u>
	ОК	Cancel

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 be displayed in the table at the bottom of the data importer. An example of the data importer with a list of USGS gages is shown in Figure 4-5.

lame:			Short ID:		
escription:					
tudy DSS File: Con					
Cal	Documents and Settings	q0hecmjf\Desktop\ssp\SSP_Exa	imples\SSP_EXAMPLES.dss		
tudy DSS Path:					
ata Source Detail:	3				
	2 				
Location					
🔘 HEC-DSS	💿 USGS Website	🔘 MS Excel 🛛 🔘 Ma	anual 🔿 Text File		
USGS Website					
USGS WEDSILE					
	03023100	French Creek	Meadville, PA	USGS	
	03023300	Van Horne Creek	Kerrtown, PA	USGS	
	03023500	French Creek	Carlton, PA	USGS	
	03024000	French Creek	Utica, PA	USGS	
	03025000	Sugar Creek	Sugarcreek, PA	USGS	
	03025200	Patchel Run	Franklin, PA	USGS	
	03025500	Allegheny River	Franklin, PA	USGS	
	03026400	Richey Run	Emlenton, PA	USGS	
	03026500	Sevenmile Run	Rasselas, PA	USGS	
	03027500	EB Clarion River	EB Clarion River Dam, PA	USGS	
Image: A state of the state	03028000	West Branch Clarion River	Wilcox, PA	USGS	
	03028500	Clarion River	Johnsonburg, PA	USGS	
Image: A start of the start	03029000	Clarion River	Ridgway, PA	USGS	
	03029200	Clear Creek	Sigel, PA	USGS	
	03029400	Toms Run	Cooksburg, PA	USGS	
	03029500	Clarion River	Cooksburg, PA	USGS	
	03030500	Clarion River	Piney, PA	USGS	
	03030852	Clarion River	Callensburg, PA	USGS	
	03031000	Clarion River	St. Petersburg, PA	USGS	
	03031500	Allegheny River	Parker, PA	USGS	
	03031780	Mill Creek	Brockway, PA	USGS	
	03031950	Big Run	Sprankle Mills, PA	USGS	
	03032500	Redbank Creek	St. Charles, PA	USGS	~
			· · ·		
Import to Study	DSS File				_
					<u> </u>

Figure 4-5. Data Importer 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 the Data Quality Codes if they are available. The program issues a message that data quality codes are available and adds the codes as an additional data set to the Data folder. For an explanation of the codes, please visit the USGS website.

Warning: all data downloaded 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 (the program does not import quality codes for daily, instantaneous, and real time data). 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.

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
А	Year of occurrence is unknown or not exact
В	Month or Day of occurrence is unknown or not exact
С	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 4-1. Quality Codes for USGS Annual Peak Flow Data.

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 importer will change as shown in Figure 4-6. The first step in importing data from an Excel spreadsheet is to select browse button, , at the end of the **Excel File** field. Once an Excel file is selected, a data view window will open showing the data contained in the selected spreadsheet. An example Excel[®] Data Viewer is shown in Figure 4-7.

Chapter 4 - Using the HEC-SSP Data Importer

📓 Data Importer	1 -						
Name:			Short ID:				
Description:							
Study DSS File:	C:\Temp\SSP_Examples\SS	P_EXAMPLES.dss					
Study DSS Path:							
Data Source D	etails						
Location							
O HEC-DSS	🔘 USGS Website	💿 MS Excel 🛛 🔿 M	lanual 🔿 Text File				
Excel File:							
Worksheet:			Block				
Data Units:							
DSS Pathnan	ne Parts						
A:		B:	C: FLO	V-PEAK			
D:		E: IR-CENTURY	💌 F:				
Pathname: //	FLOW-PEAK//IR-CENTURY//						
	1		1				
C	Ordinate	Date	Time	Value			
	Units						
Type Type							
Import to Stu	Idy DSS File No Excel File	e selected					
Plot	Plot Tabulate Close						

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

Peak	Flow	Data		
		A	В	
1				
2				
3				
4		Date	Peak Flow	
5		14 May 1995	1204	
6		27 Jun 1996	765	
7		13Jan 1997	2100	
8		14Feb1998	1356	
9		21Mar 1999	1879	
10		02Apr2000	905	
11		30May2001	1648	
12		30 Jun 2002	2890	
Sheet1	She	et2 Sheet3		
				OK Cancel

Figure 4-7. Example Excel Data Viewer.

The next step is to highlight the date and data values 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 Data 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 step 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 (make sure to edit the C-part pathname if data is not annual peaks). 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

Another 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.

📈 Data Importer -					
Name:			Short ID:		
Description:					
Study DSS File: C:\Temp\S	SP_Examples\SSP_E	EXAMPLES.dss			
Study DSS Path:					
Data Source Details					
Location					
OHEC-DSS OU	ISGS Website	🔿 MS Excel 📀	Manual 🚫 Text File		
⊢Pathname Parts					
		B:			
A:			C:		
D:		E: IR-CENTURY	💌 F:		
Pathname: ////IR-CEN	ITURY//				
Otarit Diatas			Units:		
Start Date: Start Time:					
			Type: INST-VAL		
Paste					
Manual Entry Automa	tic Generation			1	
Ordinate		Date	Time	Value	
	1 2				<u> </u>
	3				<u> </u>
Import to Study DSS File					
Plot Tabula	ate				Close

Figure 4-8. Data Importer 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 as well as the data type. 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, C, E, and F part of the DSS pathname. 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). Another option for getting data into the table is to copy it to the clipboard and then paste it into

the table. The table supports pasting data one column at a time or you can paste the date, time, and value information all at once. When 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.

Importing Data from a Text File

The fifth option for importing data into HEC-SSP is a comma delimited **Text File**. When this option is selected, the data importer will change as shown in Figure 4-9.

📈 Data Importe	r -					
Name:			Short ID:			
Description:						
Study DSS File:	C:\Documents and Setti	ings\q0hecmjf\Desktop\ssp\SSP_E	xamples\SSP_EXAMPLES.ds	s		
Study DSS Path:						
Data Source D	etails					
Location						
O HEC-DSS	🔿 USGS Websit	te 🔿 MS Excel 🔿	Manual 💿 Text File			
File:		Sta	art Date:		Start Time:	
Data Units:						
DSS Pathnar	ne Parts					
A:		B:		C: FLOW-P	EAK	
D:		E: IR-CENTURY	~	F:		
		E. IN-CENTORT		· ·		
Pathname: 🗴	//FLOW-PEAK//IR-CENTU	JRY//				
	Ordinate	Date	Time		Value	
	Units Type					
Import to Stu	udy DSS File					
Plot	Tabulate					Close
						0.000

Figure 4-9. Data Importer with Text File Option Selected.

The first step in importing data from a comma delimited Text File is to press the Select File, , button at the end of the **File** field. Once a comma delimited text file is selected, a data view window will open showing the data contained in the selected file. An example text file data viewer is shown in Figure 4-10.

🕌 Alpha Versi	on. Time Se	ries Column	ar import.	File: bo040fl	ow.csv 🔳 🗖 🔀
<u>F</u> ile					
Row\Col	1	2	3	4	
1	Site	Date	Hour	Flow(cfs)	A 1997 -
2	bo040	13AUG1993	24:00	6.346	
3	bo040	14AUG1993	24:00	6.017	
4	bo040	15AUG1993	24:00	5.983	
5	bo040	16AUG1993	24:00	6.218	
6	bo040	17AUG1993	24:00	6.493	
7	bo040	18AUG1993	24:00	6.692	
8	bo040	19AUG1993	24:00	7.040	
9	bo040	20AUG1993	24:00	7.116	
10	bo040	21AUG1993	24:00	7.029	
11	bo040	22AUG1993	24:00	6.958	
12	bo040	23AUG1993	24:00	6.771	
13	bo040	24AUG1993	24:00	7.754	
14	bo040	25AUG1993	24:00	20.967	
15	bo040	26AUG1993	24:00	7.237	
16	bo040	27AUG1993	24:00	5.922	
17	bo040	28AUG1993	24:00	5.835	
18	bo040	29AUG1993	24:00	6.044	
19	bo040	30AUG1993	24:00	6.635	
20	bo040	31AUG1993	24:00	6.974	
21	bo040	01SEP1993	24:00	7.006	
22	bo040	02SEP1993	24:00	7.082	
23	bo040	03SEP1993	24:00	6.635	
24	bo040	04SEP1993	24:00	5.918	
75	bo040	059EP1003	24.00	80.38	<u>⊻</u>
				Import	Cancel

Figure 4-10. Example Text File Data Viewer.

The next step is to highlight the date, time, and data columns. Only highlight the data that will be imported, not the column headings. If there are column headings then they need to be identified. To do this, select the row or rows that do not contain data to be imported. Then click the right mouse button and select the **Skip Row(s)** menu option, as shown in Figure 4-11.

🍰 Alpha Ve	rsion. Time	Series Column	ar import.	File: bo040flo	w.csv	
File						
Row\Col	1	2	3	4		
1	Site	Date	Hour	Flow(cfs)		^
Skip Ro	ow(s)	13AUG1993	24:00	6.346		
Pathnam	e Part Row 🕨	14AUG1993	24:00	6.017		_
Units R		15AUG1993	24:00	5.983		
5	DUU40	16AUG1993	24:00	6.218		
6	bo040	17AUG1993	24:00	6.493		
7	bo040	18AUG1993	24:00	6.692		
8	bo040	19AUG1993	24:00	7.040		
9	bo040	20AUG1993	24:00	7.116		
10	bo040	21AUG1993	24:00	7.029		
11	bo040	22AUG1993	24:00	6.958		
12	bo040	23AUG1993	24:00	6.771		
13	bo040	24AUG1993	24:00	7.754		
14	bo040	25AUG1993	24:00	20.967		
15	bo040	26AUG1993	24:00	7.237		
16	bo040	27AUG1993	24:00	5.922		
17	bo040	28AUG1993	24:00	5.835		
18	bo040	29AUG1993	24:00	6.044		
19	bo040	30AUG1993	24:00	6.635		
20	bo040	31AUG1993	24:00	6.974		
21	bo040	01SEP1993	24:00	7.006		
22	bo040	028EP1993	24:00	7.082		
23	bo040	03SEP1993	24:00	6.635		
24	bo040	04SEP1993	24:00	5.918		
25	ho040	059EP1003	24.00	850.9		×
				Import		Cancel

Figure 4-11. Identify Rows that do not Contain Data to be Imported.

To identify the date and time columns, place the mouse pointer on the column number at the top of the table and click the right mouse button. Then move the mouse pointer to the **Date – Time Column** option to see an additional menu of options, as shown in Figure 4-12. Figure 4-12 shows that column 2 will be defined as the date column. The date must be in the Day, Month, Year format (ddmmyyyy). The data viewer will highlight the date and time columns once they have been defined.

🛎 Alpha Version. Time Series Columnar import. File: bo040flow.csv 📃 🗖 🔀						
File						
Row\Col	1	2	- Rkin Column			
1	Site	Date	Skip Columr	I	fs)	<u>^</u>
2	bo040	13AUG199	Date - Time Co	olumn 🕨	Dat	e and Time Column
3	bo040	14AUG199	Set Data Col	lumn	Dat	e Column
4	bo040	15AUG199	Clear Colum	nn	Tim	ie Column
5	bo040	16AUG1993	24:00	6.218	Day	(Column
6	bo040	17AUG1993	24:00	6.493	Mor	nth Column
7	bo040	18AUG1993	24:00	6.692	Yea	ır Column
8	bo040	19AUG1993	24:00	7.040	Month-Day Column	
9	bo040	20AUG1993	24:00	7.116	Day-Month Column	
10	bo040	21AUG1993	24:00	7.029	Mor	nth-Year Column
11	bo040	22AUG1993	24:00	6.958		
12	bo040	2241101002	24.00	6 771		

Figure 4-12. Identify Date and Time Columns.

To define the data column, place the mouse pointer on the column number at the top of the table and click the right mouse button. Then choose the **Set Data Column** menu option from the shortcut menu. Another editor will open, as shown in Figure 4-13, that allows the user to define the pathname parts, data units, and data type. After defining these data properties, click the **Import Now** button to import the data and data properties into the Data Importer. You can edit the data values or data properties in the data importer before importing the data to the study. The final step is to press the **Import to Study DSS File** button, and the data will be imported.

<u>≗</u>	
Pathname Parts	B: C:
D:	E: 1DAY Y F:
Pathname: /////DAY//	
Start Date: 13Aug1993	Units:
Start Time: 24:00	Type: INST-VAL
	Import Now Cancel OK

Figure 4-13. Editor for Defining the Data Properties.

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. When using one of the other four methods for importing data, the user can manually enter metadata by selecting the **Details** tab, as shown in Figure 4-14. 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. If coordinate system data are entered, data icons and text labels will show up on the background map at the specified locations.

Metadata can be viewed and edited any time after the data has been imported into the study by opening the **Metadata Editor**. To open the Metadata Editor, place the mouse pointer on top of a data set in the Data folder and then click the right mouse button. Choose the **Edit Metadata** option from the shortcut menu, as shown in Figure 4-15. The Metadata Editor will look exactly like the Details tab on the Data Importer. The Metadata Editor can also be opened from the Data menu and from a shortcut menu that opens by right clicking on a data icon in a background map.

Chapter 4 - Using the HEC-SSP Data Importer

📈 Data Importer							
Name:	Short ID:						
Description:							
Study DSS File:	C:\Temp\SSP_Examples\SSP_EXAMPLES.dss						
Study DSS Path:							
Data Source De	etails						
State:	County:						
Stream:	Location:						
Drainage Area:	DA Units:						
Gage Operator:	USGS No:						
Gage Datum:	HUC:						
Vertical Datum:	No Coordinate System						
Description:							
⊂Coordinate Loo	cation Data						
Coordinate Sys	stem: No Coordinate System						
Horizontal Date		~					
Coordinate X V							
Plot	Tabulate Cl	lose					

Figure 4-14. Details Tab on the HEC-SSP Data Importer.

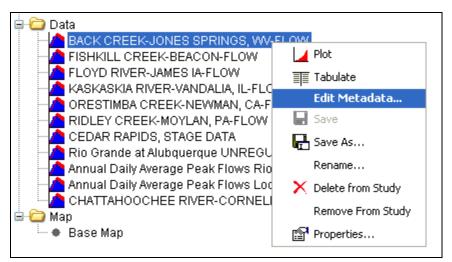


Figure 4-15. Menu Option for Opening the Metadata Editor.

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 explorer. A shortcut menu will open when clicking the right mouse button while a data set is selected. The shortcut 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 study explorer before these options are available. If you select the **Plot** option, you will get a plot similar to the one shown in Figure 4-16.

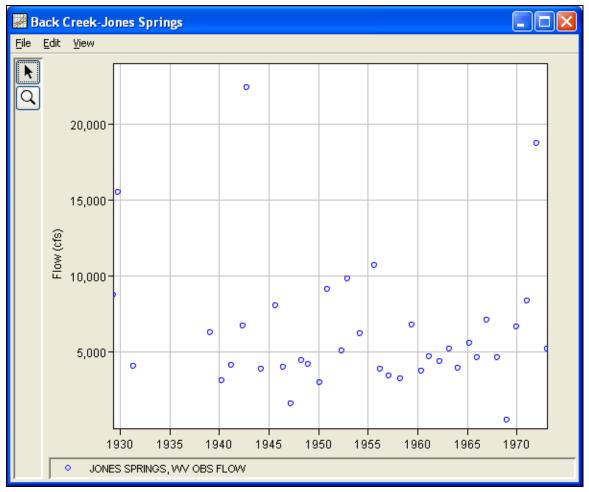


Figure 4-16. Plot of Peak Annual Flow Data.

If you select the **Tabulate** option, a table will open with the data listed as shown in Figure 4-17. Data values in the table can be edited after selecting the **Edit** \rightarrow **Allow Editing** menu option. To save any edits, select the **File** \rightarrow **Save** menu option.

∧ лваск с	REEK/JONES SP	RINGS, WV/FL	ow/ 🔳 🗖	×
<u>File E</u> dit y	<u>/</u> iew			
Ordinate	Date	Time	JONES SPRIN FLOW OBS	
Units			CFS	^
Туре			INST-VAL	
1	17 Apr 1929	12:00	8,750	
2	23 Oct 1929	12:00	15,500	
3	08 May 1931	12:00	4,060	
4	04 Feb 1939	12:00	6,300	
5	20 Apr 1940	12:00	3,130	
6	06 Apr 1941	12:00	4,160	
7	22 May 1942	12:00	6,700	
8	15 Oct 1942	12:00	22,400	
9	24 Mar 1944	12:00	3,880	
10	18 Sep 1945	12:00	8,050	≡
11	03 Jun 1946	12:00	4,020	
12	15 Mar 1947	12:00	1,600	
13	14 Apr 1948	12:00	4,460	
14	31 Dec 1948	12:00	4,230	
15	02 Feb 1950	12:00	3,010	
16	05 Dec 1950	12:00	9,150	
17	28 Apr 1952	12:00	5,100	
18	22 Nov 1952	12:00	9,820	
19	02 Mar 1954	12:00	6,200	
20	19 Aug 1955	12:00	10,700	
21	15 Mar 1956	12:00	3,880	_
22	10 Feb 1957	12:00	3,420	
23	27 Mar 1958	12:00	3,240	
24	03 Jun 1959	12:00	6,800	
25	09 May 1960	12:00	3,740	
26	19 Feb 1961	12:00	4,700	
27	22 Mar 1962	12:00	4,380	
28	20 Mar 1963	12:00	5,190	~

Figure 4-17. Table Containing 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 in 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.

🕌 Bulletin 17B Editor -		
Name: Image: I		
General Options Tabular Results Generalized Skew	Plotting Position	Confidence Limits
 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 	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:	 Defaults (0.05, 0.95) User Entered Values Upper Limit: Lower Limit: Time Window Modification DSS Range is start date end date
Compute Plot Curve View Report	Print	OK Cancel Apply

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). The list of data that can be selected for a Bulletin 17B analysis will only include those data that have an irregular interval, like IR-CENTURY and IR-YEAR (E-part pathname). 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 **Tabular 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 	
O 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

Expected Probablity Curve
 Compute Expected Prob.Curve
O Do Not Compute Excpected Prob.

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 Median plotting position formula. The generalized plotting position equation is:

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

Plotting Position
Weibull (A and B = 0)
Median (A and B = 0.3)
Hazen (A and B = 0.5)
Other (Specify 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

Confidence Limits	excee
 Defaults (0.05, 0.95) User Entered Values 	compu outlin 9. By the 90
Upper Limit:	(i.e. the second contract of the second contr
	(i.e. 9 0.05).

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

	_ U
Time Window Modification	S
	T
DSS Range is 13DEC1940 - 18SEP2004	e
-	f
start date	a
	b
end date	e
	<u> </u>

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.

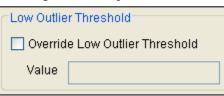
😹 Bulletin 17B Editor -*			
Bulletin 17B Editor -* Name: Description: Flow Data Set: DSS File Name: Report File: General Options Tabular Results Low Outlier Threshold Override Low Outlier Threshold Value	Historic Period Data Use Historic Data Historic Period Start Year: End Year: Override High Outlier Threst Historic Water Year	🗌 Use	ecified Frequency Ordinates Values from Table Below ency in Percent
Compute Plot Curve	View Report Print	 ОК	Cancel 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. When applying the outlier tests, HEC-SSP will identify both high and low outliers. However, only low outliers will be removed from the data set when performing the analysis. If a high outlier is identified in the data set, the analyst should try to incorporate historical period information to extend the time period for which the high outlier(s) is

considered to be the maximum value(s). Further discussion of outlier thresholds can be found in Bulletin 17B. To use the low outlier threshold, simply check the box and enter the value.

Historic Period Data

All historic data that provides reliable estimates of flood peaks outside the systematic record should be used in order to improve the

		trequ	
Historic Period Data		com	
		Flood	
📃 Use Historic Data		infor	
A REAL PROPERTY A		outsi	
Historic Period		syste	
Start Year:		reco	
		be u	
End Year:		exte	
		reco	
Override High Outlier Thres	hold:	large	
L		to a	
Historic Events			
Water Year	Peak	long	
		of th	
		syste	
		reco	

Jency putations. d mation ide of the ematic rd can often sed to nd the rd of the est events historic od much er than that e ematic rd. 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.

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

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

	<u> </u>	
ſ	User Specified Frequency Ordinates	
	Use Values from Table below	
	Frequency in Percent	
	0.2	
	0.5	
	1.0	
	2.0	

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 shortcut 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. 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.

Multiple Bulletin 17B analyses can be computed using the **Compute Manager**. Select the **Analysis**-**Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finished computing the analyses.

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.

🕌 Bulletin 1	17B Edito	r -Ridgway PA Fl	ow Fre	equency Anal	ysis		
Name:	Ridgway PA Flow Frequency Analysis						
Description:	Flow frequency	Flow frequency analysis for the Clarion River at Ridgway Pennsylvania					
Flow Data Set:	CLARION RIVI	ER-RIDGWAY, PA-FLOW-AI	NNUAL PE	AK		*	
DSS File Name:	C:\Documents	and Settings\g0hecmjf\My	Document	ts\SSP Projects\Clari	on River/Clarion River.ds	ss 🛄	
Report File:							
General Option	s Tabular Res	ults					
		Frequency Curve for: CLAR		R-RIDGWAY, PA-FLO	W-ANNUAL PEAK		
Percent Ch Exceedal		Computed Curve Flow in cfs	Expected Prob. Flow in cfs		Confidence Limits Flow in cfs		
Excedu		1 Iow III CI3		low in cis	0.05	0.95	
	0.1	73,164		105,071	155,246	45,431	
	0.2	62,227		83,619	125,785	39,748	
	0.5	49,521		61,622	93,562	32,891	
	1.0	41,103		48,626	73,564	28,156	
	2.0			38,050	56,801 	23,771 18,444	
	10.0	19,237		20,310	28,065	14,701	
	20.0	14,114		14,451	19,225	11,114	
	50.0	7,933		7,933	10,003	6,280	
	80.0	4,555		4,458	5,788	3,338	
	90.0	3,436		3,299	4,486	2,366	
	95.0 99.0	2,735 1,800		2,563 1,573	3,674 2,573	1,778	
	55.0	1,000		1,575	2,070	1,044	
	Syster	n Statistics		Number of Events			
	Log Tran	sform: Flow,		Event		Number	
Sta	tistic	Value		Historic Events		0	
Mean			3.906	High Outliers Low Outliers		0	
Standard Dev			0.292			0	
		0.233	Zero Or Missing Systematic Events		24		
Weighted Skew			0.000	Historic Period			
Adopted Skew 0.134							
Compute	e Plot Cu	rve View Report	Print]	ок с	ancel Apply	

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. Data in the frequency curve table can be re-sorted. Click the **Percent Chance Exceedance** column header (two mouse clicks are required the first

time). The percent chance exceedance ordinates, along with frequency curve and confidence limits values, will sort so that the lowest values are on top or the highest values are on top. 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 shortcut menu. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the x-axis.

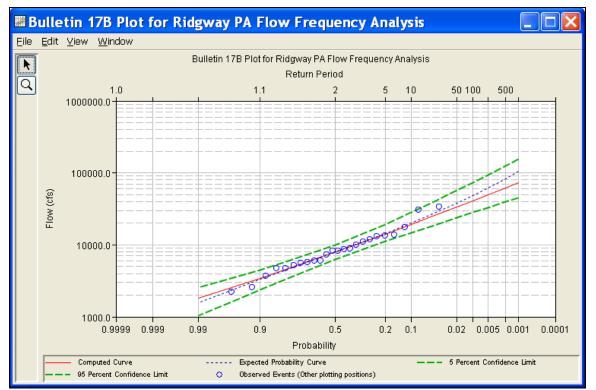


Figure 5-4. Example Frequency Curve Plot.

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 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 shortcut 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 is used for developing graphics in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

Viewing the Report File

When the Bulletin 17B computations are performed, a report file of the statistical computations is created. 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 editor to view the report file. When this button is pressed a window will appear containing the report as shown in Figure 5-5.

Eile Edit Search Format							
File: Ints\SSP Projects\Clarion River\Bulletin17bResults\Ridgway_PA_Flow_Frequency_Analysis\Ridgway_PA_Flow_Frequency_Analysis.rpt							
End of Input Data							
<< Low Outlier Te							
Based on 24 even		ent outli	er test va	alue K(N) =	2.467		
0 low out1	ier(s) ident	tified be	low test w	value of l.	532.58		
1 100 0401	,-,						
 << High Outlier T	 est >>						
Based on 24 even	 ts, 10 perce	ent outli	er test va	alue K(N) =	2.467		
U nign outl	ier(s) ident	tified ab	ove test v	varue or 42	,311.6		
Pinel Devil							
Final Results							
<< Plotting Positions >>							
)W-ANNUAL	PEAK				
CLARION RIVER-RID	GWAY, PA-FLO					-	
CLARION RIVER-RID Events Anal 	GWAY, PA-FLO yzed FLOW	 	Ordere Vater	d Events FLOW	Other	-	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	 Rank	Ordere Water Year	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID Events Anal: Day Mon Year	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953	d Events FLOW CFS	Other Plot Pos	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1953 1945 1953	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680	Other Plot Pos	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1953 1945 1953	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 40.00 48.00 52.00	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1953 1945 1953	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00	- - - - - - - - - - - - - -	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1953 1945 1953	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1953 1945 1953	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00 64.00	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953 1945 1953 1948 1950 1947 1944 1999 2003 1941	ed Events FLOW CFS 34,000 30,400 17,500 13,400 13,100 11,700 10,900 10,900 8,900 8,680 8,280 8,280 7,300 6,030 5,920 5,960	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 40.00 48.00 52.00 56.00 60.00 64.00 68.00	- 	
CLARION RIVER-RID Events Anal: Day Mon Year Day Mon Year 1 13 Dec 1940 1 19 Jul 1942 26 May 1943 1 27 Mar 1944 1 03 Mar 1944 1 03 Mar 1944 1 03 Mar 1945 1 28 May 1946 1 29 Mar 1946 1 22 May 1948 1 29 Mar 1950 1 25 Nov 1950 1 18 Jan 1952 1 23 May 1953 1 14 Aug 1994 20 Jan 1996 1 08 Nov 1996 1 08 Nov 1996 1 08 Nov 1996 1 08 Nov 1996	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	Ordere Water Year 1942 1996 1951 2004 1953 1943 1954 1954 1955 1953 1948 1950 1947 1944 1999 2003 1941 1998	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 10,000 8,980 8,680 8,280 8,280 7,300 6,030 5,920 5,510	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00 68.00 72.00	- 	
CLARION RIVER-RID Events Anal: Day Mon Year Day Mon Year 1 13 Dec 1940 1 19 Jul 1942 26 May 1943 17 Mar 1944 26 May 1943 17 Mar 1944 03 Mar 1945 28 May 1946 28 May 1946 29 Mar 1950 22 May 1949 29 Mar 1950 25 Nov 1950 1 18 Jan 1952 23 May 1953 1 14 Aug 1994 20 Jan 1995 1 9 Jan 1996 08 Nov 1996 08 Jan 1998 1 24 Jan 1999	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 6 7 8 9 10 11 12 13 14 15 16 17 18 19	Ordere Water Year 1942 1996 1951 2004 1943 1943 1944 1952 1945 1953 1948 1950 1947 1944 1999 2003 1941 1998 2000	d Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 8,900 8,680 8,280 8,280 8,280 8,280 8,280 8,280 8,280 5,510 5,510 5,220	0ther Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00 64.00 68.00 72.00 76.00		
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953 1948 1950 1947 1944 1950 1947 1944 1999 2003 1941 1998 2000 2002	ed Events FLOW CFS 34,000 30,400 17,500 13,400 13,100 11,700 10,900 10,000 8,900 8,680 8,280 8,280 8,280 7,300 6,030 5,920 5,660 5,510 5,520 4,660	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 40.00 48.00 52.00 56.00 60.00 64.00 68.00 72.00 76.00 80.00	- 	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank Rank 1 2 3 4 5 6 7 8 9 10 11 11 12 11 12 11 12 13 14 15 16 17 18 19 20 20 21	Ordere Water Year 1942 1996 1951 2004 1943 1946 1952 1945 1952 1945 1953 1948 1950 1947 1944 1999 2003 1941 1998 2000 2002 2002 2097	d Events FLOW CFS 34,000 30,400 17,500 13,400 13,100 11,700 10,900 10,000 8,900 8,680 8,280 8,280 8,280 7,300 6,030 5,920 5,510 5,220 4,660 4,630	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 40.00 48.00 52.00 56.00 64.00 68.00 72.00 76.00 80.00 84.00	- - - - - - - - - - - - - -	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953 1948 1950 1947 1944 1950 1947 1944 1999 2003 1941 1998 2000 2002	ed Events FLOW CFS 34,000 30,400 17,500 13,400 13,100 11,700 10,900 10,000 8,900 8,680 8,280 8,280 8,280 7,300 6,030 5,920 5,660 5,510 5,520 4,660	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 40.00 48.00 52.00 56.00 60.00 64.00 68.00 72.00 76.00 80.00	- - - - - - - - - - - - - -	
CLARION RIVER-RID 	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 23 24	Ordere Water Year 1942 1996 1951 2004 1953 1943 1944 1952 1953 1945 1953 1948 1950 1947 1944 1999 2003 1941 1998 2000 2002 2097 1949	ed Events FLOW CFS 34,000 30,400 17,500 13,700 13,400 13,100 11,700 10,900 10,900 10,000 8,980 8,280 8,280 8,280 8,280 7,300 6,030 5,920 5,510 5,220 4,660 3,710	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00 68.00 72.00 76.00 80.00 84.00	- - - - - - - - - - - - - -	
CLARION RIVER-RID Events Anal: Day Mon Year Day Mon Year 1 13 Dec 1940 1 19 Jul 1942 2 6 May 1943 1 7 Mar 1944 1 03 Mar 1945 2 8 May 1946 1 05 Apr 1947 1 2 Apr 1948 2 2 May 1949 1 20 Jan 1950 1 4 Aug 1994 2 0 Jan 1995 1 19 Jan 1995 1 9 Jan 1996 0 8 Nov 1996 0 8 Nov 1996 0 8 Nou 1996 0 8 Jan 1998 1 24 Jan 1999 1 3 May 2002 1 1 May 2002 1 01 Aug 2003	GWAY, PA-FLC 	Rank 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	Ordere Water Year 1942 1996 1951 2004 1943 1946 1994 1952 1945 1953 1948 1950 1947 1947 1944 1999 2003 1941 1998 2000 2002 2002 2002 2002	ed Events FLOW CFS 34,000 30,400 17,500 13,100 13,100 10,000 10,000 8,900 8,900 8,280 8,280 8,280 8,280 7,300 6,030 5,920 5,660 5,510 5,220 4,660 4,630 3,710 2,530	Other Plot Pos 4.00 8.00 12.00 16.00 20.00 24.00 28.00 32.00 36.00 40.00 44.00 48.00 52.00 56.00 60.00 64.00 68.00 72.00 76.00 80.00 80.00 88.00 92.00		

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

Plots, tables and reports can also be created by selecting menu options from the **Results** menu. At least one Bulletin 17B analysis must be selected in the study explorer before selecting one of the menu options on the Results menu. Results from multiple analyses are combined in one graph if they are selected in the study explorer when the **Graph** menu option is selected. The **Results**→**Summary Report** menu

option will create a summary table of statistics and frequency curve ordinates for the selected analyses as shown in Figure 5-6.

FFA Test 2 FLOYD RIVER-JAMES IA-FLOW 349.4 671.3 955.3 1471.8 3404.8 8018.8 12638.5 18470.8 28425.7 37981.6 FFA Test 3 BACK CREEK-JOMES SPRINGS, WV-FLOW 2004.3 2524.6 2901.0 3490.3 5238.5 8449.0 11181.3 14322.2 19266.5 23729.8 FFA Test 4 ORESTIMBA CREEK-NEWMAN, CA-FLOW 15.2 61.8 121.9 266.5 1043.8 3450.0 6041.4 9289.3 14572.3 19296.3 FTA Test 5 KASKASKIA RIVER-VANDALIA, IL-FLOW 3283.5 4792.4 5905.6 7552.2 122624.3 22082.5 25659.4 38061.7 50712.8 6153.1	
hilletin 17B Simmary Report fon Jan 05 21:14:51 PST 2009 "able 1 Summary of Statistics "analysis Data Mame Dev Stn PFA Test 1 PISHKILL CREEK-BEACON-FLOW 3.378 0.255 0.730 0.600 0.677 0 0 24 FFA Test 2 FLOYD RIVER-JAMES IA-FLOW 3.374 0.447 0.175 -0.000 0.074 0 0 24 FFA Test 2 FLOYD RIVER-JAMES IA-FLOW 3.547 0.447 0.175 -0.000 0.074 0 0 39 82 FFA Test 4 ORSSTIMBA CREEK-NEWMAN, CA-FLOW 3.741 0.213 0.623 0.500 -0.472 -0.472 0 1 6 42 FFA Test 5 RIDLEY CREEK-MOYLAN, PA-FLOW 3.120 0.283 1.088 0.400 0.890 1 0 0 2.4 132 "able 2 Summary of Frequency Curve Ordinates	
ulletin 175 Summary Report able 1 Summary of Statistics mane Mean Std	
able 1 Summary of Statistics name Nean Sta Sta Rgml With Add to Statistics PA Test 1 FISHKILL CREEK-BEACON-FLOW 3.378 O.255 O.730 O.600 O.677 O O	

Figure 5-6. Summary Table for Selected Bulletin 17B Analyses.

CHAPTER 6

Performing a General 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 or perform a graphical fit to the data. This chapter discusses in detail how to use the General Frequency Analysis editor in 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 general frequency analysis can be started in two ways, either by right clicking on the General Frequency Analysis folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **General Frequency Analysis**. When a new general frequency analysis is selected, the General Frequency Analysis editor will appear as shown in Figure 6-1.

🞇 General Frequency Analysis Editor -*	
Name:	
Description:	
Data Set:	
DSS File Name:	
Report File:	
General Options Analytical Graphical	
Log Transform	Plotting Position
⊙ Use Log Transform	• Weibull (A and B = 0)
O Do Not use Log Transform	O Median (A and B = 0.3)
Confidence Limits	O Hazen (A and B = 0.5)
• Defaults (0.05, 0.95)	Other (Specify A, B)
Ouser Entered Values	Plotting position computed using formula
Upper Limit:	(m-A)/(n+1-A-B) Where:
Lower Limit	m=Rank, 1=Largest N=Number of Years
	A,B=Constants
Time Window Modification	A:
DSS Range is	В:
Start Date	
End Date	
Plot Analytical Plot Graphical Compute Curve View Report	OK Cancel Apply

Figure 6-1. General 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). The list of data that can be selected for a general frequency analysis will only include those data that have an irregular interval, like IR-CENTURY and IR-YEAR (E-part pathname). 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 General Frequency Analysis 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 ${\bf Use}$

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

● Use Log Transform ● Use Log Transform ● Do not use Log Transform

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

Plotting Position
⊙ Weibull (A and B = 0)
O Median (A and B = 0.3)
O Hazen (A and B = 0.5)
Other (Specify A, B)

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 General 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 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 general 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.

Confidence Limits				
⊙ Defaults (0.05, 0.95)				
O User Entered Values				
Upper Limit:				
Lower Limit:				

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 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

	Time Window M	lodification	
te	DSS Range is	13DEC1940 - 18SEP2004	
	📃 start date		
	📃 end date		
toc			

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 General Frequency Analysis editor will appear as shown in Figure 6-2.

Chapter 6 - Performing a General Frequency Analysis

HEC-SSP User's Manual

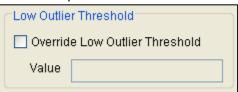
😹 General Frequ	ency Analysis Editor -*		
Name:			
Description:			
Data Set:			▼
DSS File Name:			
Report File:			
General Options	Analytical Graphical		
Low Outlier Thr	eshold	Historic Period Data	User Specified Frequency Ordinates
Override Lov	w Outlier Threshold	Use Historic Data	Use Values from Table Below
Value		← Historic Period	Frequency in Percent
⊂Output Labeling		Start Year:	
DSS Data Nam		End Year:	
		Override High Outlier Threshold:	
Change L DSS Data Unit:			
		Historic Events	
Change L	abel	Water Year Pe	Peak
	Compute Curve Curve	ical View Report 🚳 Print	OK Cancel Apply
	Company Course Course		On Cancer 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 General 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. When applying the outlier tests, HEC-SSP will identify both high and low outliers. However, only low outliers will be removed from the data set when performing the analysis. If a high outlier is identified in the data set, the analyst should try to incorporate historical period information to extend the time period for which the high outlier (s) is considered to be the maximum value(s). Further discussion of outlier thresholds can be found in Bulletin 17B. To use the low outlier threshold, simply check the box and enter the value.

Historic Period Data

All historic data that provides reliable estimates outside the systematic record should be used in order to 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 Period Data					
🔲 Use Historic Data					
Historic Period					
Start Year:	Start Year:				
End Year:					
Override High Outlier Threshold:					
Historic Events					
Water Year Peak					

historic data as recommended in Bulletin 17B. This calculation is applied in the same manner in the General Frequency Analysis. То 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.

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 default values listed in percent chance exceedance

User Specified Frequency Ordinates	
Use Values from Table Below	
Frequency in Percent	
	0.2
	0.5
	1.0
	2.0

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 shortcut 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 are 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

Output Labeling		the
DSS Data Name is	FLOW	we the
📃 Change Label	FLOW	the
DSS Data Units are	cfs	lab
📃 Change Label	cfs	

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 General 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.

🕌 General F	Frequency -Ridgway General Frequency Analysis		
Name: Ridgway General Frequency Analysis Description:			
Settings Tabul	ular Results Plot		
Log Transform Distribution: LogPearsonIII	Log Transformation: On Distribution: Ouse Station Skew		
Do Not Compute Expected Prob. Curve			
Compute	Plot Analytical Curve View Report	el Apply	

Figure 6-3. Analytical Analysis Tab of the General Frequency Analysis 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,

Log Transformation: log transform is	On
Distribution	
LogNormal	*

Pearson III, and LogPearson III. 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 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

-Generalized Skew	
Our Station Skew	
O Use Weighted Skew	
🔘 Use Regional Skew	
Regional Skew:	0.000
Reg. Skew MSE:	0.302

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

Expected Probablity Curve
Ocmpute Expected Prob. Curve
O Do Not Compute Expected Prob. Curve

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 General Frequency Analysis editor. 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.

Multiple General Frequency analyses can be computed using the **Compute Manager**. Select the **Analysis**-**Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finished computing the analyses.

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.

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. Data in the frequency curve table can be re-sorted. Click the **Percent Chance Exceedance** column header (two mouse clicks are required the first time). The percent chance exceedance ordinates, along with frequency curve and confidence limits values, will sort so that the lowest values are on top or the highest values are on top.

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.

🛓 General F	req	uency -Ridgwa	y General Fr	equency An	alysis					
Name:	Ridgy	vay General Frequency A	\nalysis							
Description:										
·										
Data Set:	Data Set: CLARION RIVER-RIDGWAY, PA-FLOW-ANNUAL PEAK									
DSS File Name:	/Docu	iments and Settings/q0h	iecmjf/My Document	s/SSP Projects/Cla	rion River/Clarion	_River.dss				
Report File:	uency	/Results\Ridgway_Gene	ral_Frequency_Anal	lysis\Ridgway_Gen	eral_Frequency_A	nalysis.rpt				
General Options	Ana	lytical Graphical								
	_									
Settings Tabula	ar Res	ults Plot								
Percent Chan	nce	Cur	ve based on Data		Curve base	d on User-Adjuste	d Statistics			
Exceedance	e [Computed	Confiden	ce Limits	Computed	Confidenc	e Limits			
		Curve	Flow in	n CFS	Curve	Flow in	n CFS			
		Flow in CFS	0.95	0.05	Flow in CFS	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 80.0	7,845.2	9,885.9	6,205.5	7,701.6	8,604.5	6,884.8 3,946.0			
	90.0	4,544.0 3,465.2	5,775.1 4,519.9	3,328.5 2,390.9	4,532.3 3,519.7	5,123.3 4,036.2	2,999.7			
	95.0	2,790.7	3,739.2	1,824.4	2,891.5	3,361.2	2,999.7			
	55.0	2,130.1	5,133.2	1,024.4	2,031.3	5,501.2	2,417.7			
Sy	stern \$	Statistics	Numb	er 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 Log T	ransformation: O	n			
Regional Skew			Zero Or Missing		0 Distri	bution: L	ogPearsonIII			
Weighted Skew	·	0.000	Systematic Events		24		-			
Adopted Skew		0.233	Historic Period							
	Plo	t Plot	٦							
e	Ana	alytical Graphical								
Compute	Cu	rve Curve	View Report	Print	ОК	Cancel	Apply			

Figure 6-4. Tabular Results Tab for Analytical 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.

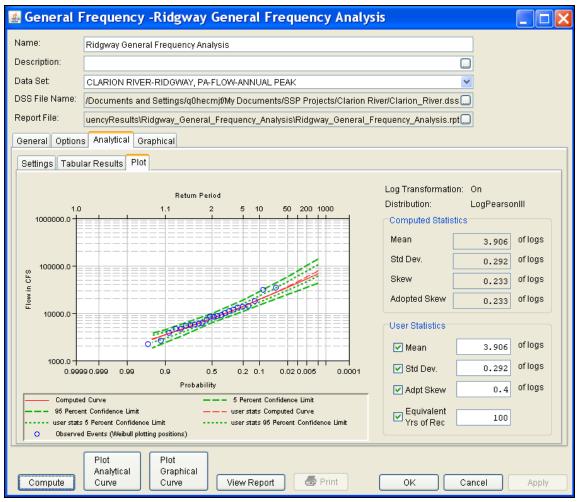


Figure 6-5. Plot Tab of the General Frequency Analytical Analysis.

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 enables 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 describing 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 rather than 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 for 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. The **Data Type** and **Equivalent** Years of Record options are required to compute the confidence limits using the order statistics method that is discussed in ETL 1110-2-537. If the data is not flow or stage, select the **Flow** data type when the graphical frequency curve is approximately analytic for extreme probabilities (frequency curve is not relatively flat for extreme probabilities). Select the Stage data type when the graphical frequency curve is relatively flat for extreme probabilities (ETL 1110-2-537). When the user enters values into the frequency curve 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.



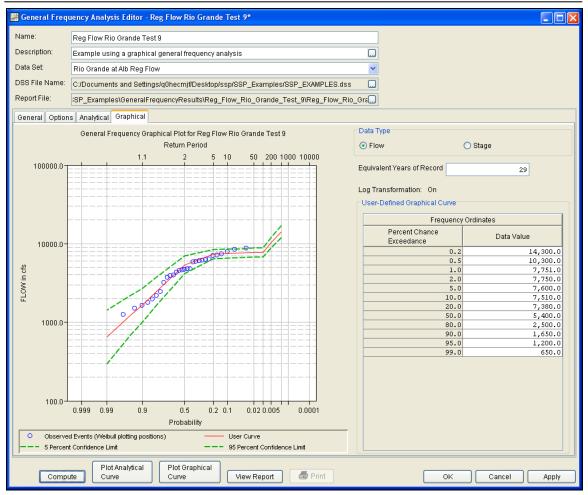


Figure 6-6. Graphical Tab of the General Frequency Analysis Editor.

Viewing and Printing Results

The user can view output for the frequency analysis directly from the General Frequency Analysis 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 General Frequency Analysis 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.

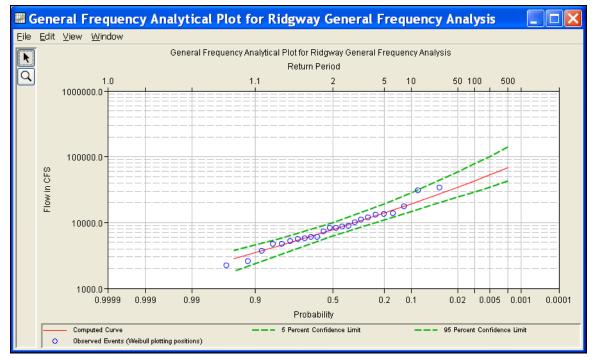


Figure 6-7. Analytical Analysis Frequency Curve Plot.

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 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 shortcut menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the xaxis. 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 is used for developing plots in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

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.

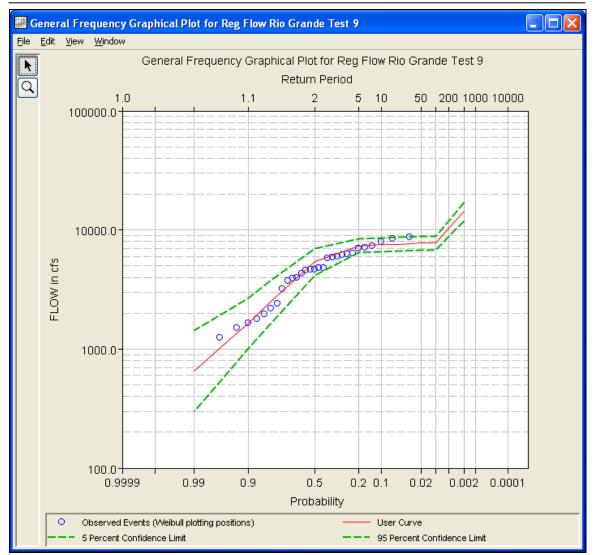


Figure 6-8. Graphical Analysis Frequency Curve Plot.

Viewing the Report File

When the General Frequency analysis computations are performed, a report file of the statistical computations is created. 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 and describing 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 editor. When this button is pressed, a window will appear containing the report as shown in Figure 6-9.

Ridgway_Genera	al_Frequency	y_Analy	sis.rpt			×
<u>Eile E</u> dit <u>S</u> earch F <u>o</u> rmat						
File: Irion River\GeneralFrequ	iencyResults\Ridgw	ay_General	_Frequency_/	Analysis\Ridgv	/ay_General_Frequen	cy_Analysis.rpt
Based on 24 events, 1	0 percent outli	er test va	alue K(N) =	2.467		
0 high outlier(s) identified ab	ove test t	value of 42	,311.6		
Final Results						
<< Plotting Positions CLARION RIVER-RIDGWAY,		PEAK				
Events Analyzed	 I		ed Events	I		
1	FLOW	Water	FLOW	Weibull		
Day Mon Year 	CFS Rank 	Year 	CFS	Plot Pos 		
	60.0 1	1942	34,000.0	4.00		
	100.0 2 100.0 3	1996 1951	30,400.0 17,500.0	8.00 12.00		
17 Mar 1944 7,3	00.0 4	2004	13,700.0	16.00		
	100.0 5 .00.0 6	1943 1946	13,400.0 13,100.0	20.00 24.00		
05 Apr 1947 8,2	80.0 7	1994	11,700.0	28.00 I		
	80.0 8 10.0 9	1952 1945	10,900.0 10,000.0	32.00 36.00		
29 Mar 1950 8,2	80.0 10	1953	8,900.0	40.00		
	00.0 11 00.0 12	1948 1950	8,680.0 8,280.0	44.00 48.00		
	00.0 12	1930	8,280.0	52.00		
	00.0 14	1944	7,300.0	56.00		
	30.0 15 00.0 16	1999 2003	6,030.0 5,920.0	60.00 64.00		
	30.0 17	1941	5,660.0	68.00		
	10.0 18 30.0 19	1998 2000	5,510.0 5,220.0	72.00 76.00		
04 Apr 2000 5,2	20.0 20	2002	4,660.0	80.00		
	.90.0 21 60.0 22	1997 1949	4,630.0 3,710.0	84.00 88.00		
01 Aug 2003 5,9	20.0 23	1995	2,530.0	92.00 I		
18 Sep 2004 13,7	'00.0 24 	2001	2,190.0	96.00		
<< Skew Weighting >>						
Based on 24 events, me	an-square error	of static)n skew =	0.226		
Mean-square error of r	egional skew is	undefined	1.			
C. England and Course and						
<< Frequency Curve >> CLARION RIVER-RIDGWAY,	PA-FLOW-ANNUAL	PEAK				
Computed Expecte	d Percent	Ca	nfidence L	imite		
Curve Probabil		1 1	0.05	0.95		
Flow, CFS	Exceedanc	- •	Flow, CF			
67,541.3	0.2		,913.9	42,532.1		~
<	ш					>
						4.4
				1:11	.1	1:1

Figure 6-9. General Frequency Analysis Report File.

Plots, tables and reports can also be created by selecting menu options from the **Results** menu. At least one General Frequency analysis must be selected in the study explorer before selecting one of the menu options on the Results menu. Results from multiple analyses are combined in one graph if they are selected in the study explorer when the **Graph** menu option is selected. The **Results→Summary Report** menu option will create a summary table of statistics and frequency curve ordinates for the selected analyses as shown in Figure 6-10.

🗷 GeneralFrequencySun	nmary.rpt													×
<u>Eile E</u> dit <u>S</u> earch F <u>o</u> rmat														
File: C:\Temp\SSP_Examples\Genera	IFrequencyResults\GeneralFrequencySumma	ry.rpt												
General Frequency Summary Rep Mon Jan 05 22:19:31 PST 2009	ort													
Table 1 Summary of Statistics														
Analysis Name	Data Name	Mean	Std Dev		S tn R	kew ml	Waht					o/ Syst g Evnt		
General Frequency FFA Test 1		3.378	0.255			600	0.677	0.677			0	0 24		
General Frequency FFA Test 2	FLOYD RIVER-JAMES IA-FLOW	3.547	0.447	0.1	75 -0.	300	0.074	0.074	0	1	ō.	0 39	82	
	BACK CREEK-JONES SPRINGS, WV-FLOW ORESTIMBA CREEK-NEWMAN, CA-FLOW	3.741 2.975	0.231 0.678			500 300	0.586 -0.472	0.586 -0.472	0	0 0	1	0 38 6 42		
Table 2 Summary of Frequency														
Analysis	Data									Chang		edance		
Name 	Name		99	95	90		80 	50	20		10	5	2	
General Frequency FFA Test 1 General Frequency FFA Test 2		83) 34:		038.5 671.3	1192.1 955.3	1438 1471			657.1 018.8	49 126	59.9 38 5	6506.1 18470.8		1
General Frequency FFA Test 3	BACK CREEK-JONES SPRINGS, WV-FLOW	200	4.3 2	524.6	2901.0	3490	.3 52	38.5 8	449.0	111	31.3	14322.2	19266.5	2
General Frequency FFA Test 4	ORESTIMBA CREEK-NEWMAN, CA-FLOW	1.	5.2	61.8	121.9	266	.5 10	43.8 3	450.0	60	41.4	9289.3	14572.3	1
														~
									_			_		>
										1:	1:1		1:1	

Figure 6-10. Summary Table for Selected General Frequency Analyses.

CHAPTER 7

Performing a Volume Frequency Analysis

The current version of HEC-SSP allows the user to perform a volume frequency analysis of flow data. In this type of analysis, frequency curves are developed using daily average flows. Runoff volumes are expressed as average flows over a time duration. For example, the 3-day flow is the average flow over a three day period. The volume from the 3-day flow would be computed by multiplying the 3-day flow (in cfs) by 259200 seconds (3-days). Typical volume frequency analyses would develop frequency curves for a number of volumes (flow-duration), like the 1, 3, 7, 15, 30, 60, 90, 120, and 180 day volumes. 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 Frequency Analysis editor in HEC-SSP.

Contents

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

Starting a New Volume Frequency Analysis

A volume 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 Frequency Analysis editor will appear as shown in Figure 7-1.

Wolume Frequency Analysis Editor -*		
✓ Volume Frequency Analysis Editor -* Name: Description: Data Set: DSS File Name: Report File: General Options Duration Table Analytical Graphic 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) • Other Starting Plot Yearly Data	Image: Second Structure 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 Start Date End Date End Date Season To Define a Subset of the Year Season Start: NOTE: season must be within a year, as defined in the Year Specification
Plot Duration Plot Analytical	Plot Graphical	
Compute Data Curve	Curve View Report	Print OK Cancel Apply

Figure 7-1. Volume Frequency Analysis Editor.

The user is required to enter a **Name** for the analysis; while a **Description** is optional. A data set 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). The list of data that can be selected for a volume frequency analysis will only include those data that have a regular interval, like 1HOUR and 1DAY (E-part pathname). 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 Frequency Analysis 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)
O Median (A and B = 0.3)
O Hazen (A and B = 0.5)
O 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 determine if a river could supply a given demand. A low flow analysis could also be beneficial for water quality and reservoir storage 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 hydrologic regime. If high flows generally occur between November

Year Specification
O Water Year (starts Oct 1)
🔿 Calendar Year (starts Jan 1)
Other
starting
Plot Yearly Data

and May, then the year should not start between these months. This will minimize the possibility that the same flood event is used for 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. The program will create a graph like the one shown in Figure 7-2 when the **Plot Yearly Data** button is pressed. 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.

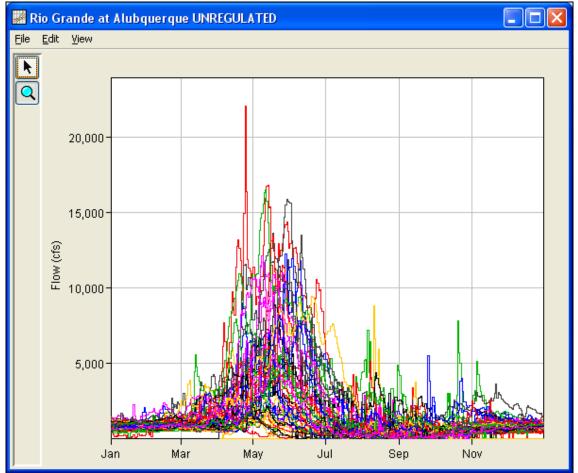


Figure 7-2. Plot Showing when Flood Events Typically Occur.

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.

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.

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	

Options

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

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

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

General Options Duration Table Analytical Graphical							
Flow Durations	User Specified Frequer	icy Ordinates	Historic Period	Data			
Change or add to default values	Use Values from Ta	able Below	🔲 Use Histori	ic Data			
Duration in days	Frequency in Percent		Historic Perio	d			
1		0.1	Start Year:				0
15		0.5	End Year:				0
<u> </u>		1.0	Duration		Overrie	de High Outlier	r Thresh
		5.0	1-day				
		10.0 20.0	7-day 15-day				
		50.0	60-day				
		80.0	120-day				
		90.0 95.0					
		99.0					
			Historic Event	s			
			Year	1-day	7-day	15-day	60-day
					_		
Output Labeling	Low Outlier Threshold						
DSS Data Name is FLOW	Override Low Outlie	r Threshold					
Change Label FLOW	Duration	Override Low Outlier Thre					
DSS Data Units are CFS	1-day						
Change Label CFS	7-day 15-day						
	60-day						
	120-day						
			<				>

Figure 7-3. Volume Frequency Analysis 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 or

Flow Durations	
Change or add to default values	
Duration in days	
	1
	3
	- 7
	15
	30
	60
	90
1	120
1	183

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 shortcut 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

User Specified Frequency Ordinat	
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 shortcut 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.

Output Labeling	
DSS Data Name is	
🗌 Change Label	
DSS Data Units are	
Change Label	

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 Volume Frequency

Analysis. The outlier magnitudes calculated by the Bulletin 17B procedure are used as default values

Low Outlier Threshold	Threshold
Duration	Override Low Outlier Threshold
1-day	
7-day	
15-day	
60-day	
120-day	

for the high and low outlier thresholds in HEC-SSP. The user has the option to enter a different low outlier threshold for each duration. If a value is entered for the low outlier threshold, then this value will override the computed value from the Bulletin 17B methodology. When analyzing maximum flows, HEC-SSP will identify both high and low outliers. However, only low outliers will be removed from the data set when performing the analysis. If a high outlier is identified in the data set, the analyst should try to incorporate historical period information to extend the time period for which the high outlier(s) is considered to be the maximum value(s). 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 a value for one duration or all durations.

When **Analyzing Minimums** is selected on the General tab, then the Low Outlier Threshold criteria becomes the High Outlier Threshold. When applying the outlier tests, HEC-SSP will identify both high and low outliers. However, only high outliers will be removed from the data set when performing the analysis. If a low outlier is identified in the data set, the analyst should try to incorporate historical period information to extend the time period for which the low outlier(s) is considered to be the minimum value(s).

Historic Period Data

All historic data that provides reliable estimates outside the systematic record should be used in order to 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 calculation is applied in the same manner in the Volume 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 for each duration as shown in Figure 7-4. 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**. 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. If **Analyze Minimums** is selected on the General tab then the High Threshold becomes the Low Threshold. The program will treat systematic values that are lower than the low threshold as historic annual minimums.

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).

Historic Period [Data						
🔲 Use Historia	: Data						
Historic Period							
Start Year:	art Year:						
End Year:						0	
Duration			Override	Override High Outlier Threshold			
1-day							
7-day							
15-day							
60-day 120-day							
			1				
Historic Events		1	1		1 1		
Year	1-day	7-day	15-day	60-day	120-day		

Figure 7-4. Historic Period Data on the Options Tab.

Extracting The Volume-Duration Data

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 Frequency Analysis editor will appear as shown in Figure 7-5. 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 as one continuous record. For each duration, the program computes a time-series of average flow. These time-series are written to the study DSS file and can be viewed using HEC-DSSVue. Then the program extracts the annual maximum/minimum flows and populates the duration table.

The **Allow Editing** checkbox in the upper left portion of the Duration Table tab allows the user to manually edit values in the volumeduration table. The table becomes editable when the **Allow Editing** box is checked. Then the user can overwrite the extracted volumeduration data. In addition, the program will no longer extract volumeduration data during a compute and the **Extract Volume-Duration Data** button becomes inactive.

When computing the analysis, the program will issue a warning message if any of the maximum/minimum flows occur a specific number of days after the beginning of the year. The number of days is determined by the duration plus five days. For example, for a fifteen-day duration, the program issues a warning if the maximum/minimum is within twenty days after the beginning of the year. If water year is chosen, then the program issues a warning if the maximum/minimum occurs between October 1 – October 20. This warning is an attempt to let the user know if a maximum or minimum flow is generated by an event that began in the previous year. The goal is to prevent a scenario in which the same flow event causes maximum/minimum flows in consecutive years; this is why it is important to choose an appropriate annual starting date.

Allow Editi	ng										
					Volume-Du	ration Data					
			Hig	hest Mean Va	lue for Duratio	n, Average Da	aily FLOW in Cl	FS			
Year	1		- 7		15	5	60)	12		
ŀ	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	
1942	04/24/1942	22076.4	05/15/1942	15345.8	06/05/1942	13098.6	06/14/1942	12137.3	07/06/1942	7930.9	
1943	04/28/1943	4733.9	05/02/1943	4638.1	05/08/1943	4440.3	06/03/1943	2574.3	07/02/1943	1849.8	
1944	05/17/1944	13601.6	05/22/1944	12334.9	05/28/1944	11501.7	07/05/1944	7056.9	07/22/1944	4460.3	
1945	05/08/1945	12140.6	05/13/1945	11199.2	05/18/1945	10358.1	06/19/1945	6137.1	07/09/1945	3794.1	
1946	04/23/1946	2998.8	04/27/1946	2733.6	05/03/1946	2273.0	05/17/1946	1230.4	05/31/1946	978.5	
1947	05/12/1947	7003.5	05/15/1947	5848.5	05/18/1947	5118.0	06/15/1947	2709.0	06/28/1947	1789.8	
1948	05/28/1948	12273.5	06/11/1948	10224.5	06/09/1948	9950.8	06/18/1948	7014.3	07/10/1948	4567.1	
1949	06/23/1949	10556.0	06/27/1949	9642.2		8133.2	06/30/1949	5828.4	07/30/1949	4386.0	
1950	04/24/1950	2901.1	04/27/1950	2711.6	04/30/1950	2396.7	05/04/1950	1549.3	06/12/1950	1319.9	
1951	05/10/1951	1881.6	05/14/1951	1718.3	05/23/1951	1610.7	06/14/1951	1082.0	06/05/1951	868.6	
1952	05/08/1952	11669.4	05/11/1952	10749.8	05/19/1952	9703.8	06/22/1952	7147.2	07/22/1952	4704.7	
1953	05/31/1953	2706.0	06/04/1953	2497.2	06/06/1953	2283.0	06/20/1953	1729.2	06/28/1953	1298.6	
1954	05/18/1954	2122.1	04/21/1954	2050.3	04/28/1954	1929.1	06/04/1954	1595.2	06/07/1954	1131.6	
1955	09/25/1955	5496.6	05/29/1955	2694.8	05/30/1955	2349.9	06/21/1955	1559.2	08/29/1955	1154.8	
1956	05/07/1956	1766.1	05/11/1956	1722.1	05/11/1956	1626.0	06/11/1956	1172.4	06/14/1956	941.9	
1957	06/09/1957	9403.5	06/11/1957	8794.2		7865.2	07/06/1957	5357.9	09/01/1957	4360.3	
1958	05/14/1958	12590.1	05/17/1958	12047.0	05/23/1958	11492.6	06/14/1958	9129.4	06/22/1958	5433.5	
1959	08/26/1959	2539.4	05/20/1959	1821.9	05/20/1959	1624.9	06/05/1959	1049.9	06/01/1959	844.6	
1960	04/13/1960	6034.5	04/16/1960	5335.6	04/24/1960	4832.5	05/22/1960	3299.1	06/27/1960	2482.6	
1961	05/04/1961	5695.4	05/07/1961	5052.7	05/07/1961	4518.2	06/06/1961	3084.0	06/28/1961	2001.7	
1962	04/22/1962	9023.2	04/27/1962	8121.7	05/02/1962	7289.3	05/28/1962	4879.4	06/12/1962	3108.6	
1963	04/15/1963	2477.4	04/16/1963	2288.6	04/16/1963	2097.4	05/15/1963	1514.7	06/04/1963	1115.2	
1964	05/15/1964	2353.4	05/19/1964	2237.5	05/25/1964	1963.8	06/10/1964	1293.1	06/17/1964	938.8	
1965	06/19/1965	8007.6	05/26/1965	7162.8	05/27/1965	5995.5	06/30/1965	5202.7	08/11/1965	3916.0	
1966	05/11/1966	3704.0	05/12/1966	3470.1	05/14/1966	3276.3	05/15/1966	2629.1	06/13/1966	2047.8	
1967	08/10/1967	8810.2	08/16/1967	5186.4	08/20/1967	3533.9	09/14/1967	1653.6	09/08/1967	1341.5	
1968	05/24/1968	5432.6	05/29/1968	5095.6	06/05/1968	4918.1	07/01/1968	3315.0	08/25/1968	2410.0	
1969	05/06/1969	5866.6	05/08/1969	5070.9	05/27/1969	4960.4	06/22/1969	4148.6	07/29/1969	2963.4	

Figure 7-5. Volume-Duration Table.

The user must **Compute** the analysis before viewing a frequency plot of the volume-duration data. The plot created by pressing the **Plot Duration Data** button, located at the bottom of a Volume Frequency Analysis editor, shows the annual maximum/minimum volumes plotted using the user specified plotting position method, as shown in Figure 7-6.

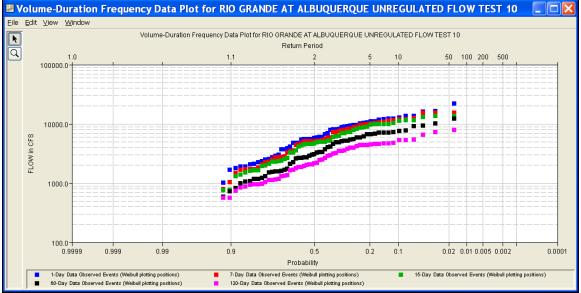


Figure 7-6. Plot of Volume-Duration Data.

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 Frequency Analysis editor, the window will appear as shown in Figure 7-7. As shown, four additional tabs will appear on the screen: Settings, Tabular Results, Plot, and Statistics. HEC-SSP User's Manual

General Options Duration Table Analytical Grap	phical		
Settings Tabular Results Plot Statistics			
Log Transformation: On	Skew		
Distribution:	O Use Station Skew		
LogPearsonIII	Ose Weighted Skew		
Expected Probability Curve	🔿 Use Regional Skew		
O Compute Expected Prob.Curve	Duration	Reg. Skew	R.Skew MSE
O Do Not Compute Excpected Prob.	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
	Plot Graphical		
Compute Data Curve	Curve View Report	🖨 Print 🛛 🛛 OK	Cancel Apply

Figure 7-7. Analytical Tab of the Volume Frequency Analysis Editor.

Settings

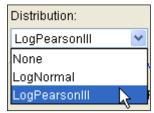
In addition to settings on the General and Options tabs, there are more options on the Settings tab the user must define in order to perform an Analytical Frequency analysis on the volume-duration data. These settings include:

- 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.



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

Expected Probablity Curve=

Compute Expected Prob. Curve

O Do Not Compute Expected Prob. Curve

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 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

Ose Weighted Ske Ose Service of Ske		
O Use Regional Ske	w 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

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



Frequency Analysis 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.

Multiple Volume Frequency analyses can be computed using the **Compute Manager**. Select the **Analysis→Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finishes computing the analyses.

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 7-8. The top portion of this table contains the analytical frequency curves for each duration. Data in the frequency curves can be resorted. Click the **Percent Chance Exceedance** column header (two mouse clicks are required the first time). The percent chance exceedance ordinates, along with the frequency curves, will sort so that the lowest values are on top or the highest values are on top. 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 7-8. 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.

General Options Dura	tion Table Analytical	Graphical										
Settings Tabular Resu	Its Plot Statistics											
	Volume-Duration Frequency Curves for South Fork Wailua River, Average Daily FLOW in CFS											
Percent Chance Exceedance	1	3	7	15	30	60						
0.2	14304.0	7093.4	4012.9	2374.7	1479.0	974.2						
0.5	11993.6	6041.0	3428.9	2049.2	1304.8	860.9						
1.0	10354.8	5283.0	3009.3	1812.3	1173.4	775.8						
2.0	8804.8	4555.4	2607.1	1582.5	1041.9	691.1						
5.0	6881.8	3635.8	2099.0	1288.0	866.8	578.8						
10.0	5510.8	2965.9	1728.5	1069.9	731.8	492.3						
20.0	4193.8	2308.1	1363.5	851.8	591.8	402.7						
50.0	2456.0	1410.3	860.7	545.3	385.1	269.8						
80.0	1414.5	847.1	538.8	344.4	243.0	177.0						
90.0	1053.0	644.5	420.4	269.4	188.6	140.8						
95.0	822.4	512.4	341.9	219.4	152.0	116.0						
99.0	512.8	330.4	231.1	148.2	99.7	79.7						
Statistics	1	3	7	15	30	60						
Mean	3.385	3.144	2.932	2.733	2.576	2.425						
Standard Dev.	0.281	0.259	0.240	0.234	0.230	0.212						
Station Skew	-0.109	-0.122	-0.064	-0.105	-0.249	-0.185						
Regional Skew												
Weighted Skew												
Adopted Skew	-0.109	-0.122	-0.064	-0.105	-0.249	-0.185						
#Years	97	97	97	97	97	97						
# Zero/Missing	0	0	0	0	0	0						
Compute Data	uration Plot Ana Curve	lytical Plot Graph Curve	ical View Repor	t 🖨 Print	ок с:	ancel Apply						

Figure 7-8. 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 7-9. 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 7-9. Plot of Analytical Results for a Volume Frequency Analysis.

Statistics

As discussed in EM 1110-2-1415, a necessary step in a volumefrequency 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 7-10. 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.

Chapter 7 - Performing a Volume Frequency Analysis

General Options D	Duration Table Analytica	l Graphical				
Settings Tabular R	Results Plot Statistics					
0.00 0.05 0.15 0.25 0.20 0.25 0.30				Log Transformation: Distribution: X-axis Parameter Mean	On LogPearsonIII Y-axis Par V Skew Update Plot	ameter V
2.5 Sample Statistics	2.6 2.7 2.8	2.9 3 3.1 Mean 3	3.2 3.3	15	30	60
Mean	3.385	3.144	2.932	2.733	2.576	2.425
Standard Dev.	0.281	0.259	0.240	0.234	0.230	0.212
Station Skew	-0.109	-0.122	-0.064	-0.105		
Adopted Skew	-0.109	-0.122	-0.064	-0.105	-0.249	-0.185
Use Adjusted Statistics	1	3	7	15	30	60
🗹 Mean	3.385	3.144	2.932	2.733	2.576	2.425
Standar						
Adopted	-0.05	-0.1	-0.15	-0.2	-0.25	-0.3
	Plot Duration Plot. Data Curv	Analytical Plot Gra e Curve	phical View Repor	t 🕘 Print	ок	Cancel Apply

Figure 7-10. Statistics Tab in the Volume Frequency Analysis 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 a frequency curve to the data. A graphical curve 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 Frequency analysis editor, the window will appear as shown in Figure 7-11. As indicated, two additional tabs will appear on the screen, **Curve Input** and **Plot**.

Curve Input Plot	117/0				Log Transformation: On					
Volume-Duration Frequency Curves for CHATTAHOOCHEE RIVER-CORNELIA, GA-FLOW, Average Daily FLOW in CFS										
Percent Chance 1 7 30 60 90 Exceedance 1 7 30 60 90										
0.2										
0.5										
1.0										
2.0										
10.0										
20.0										
50.0										
80.0										
90.0										
95.0										
99.0		<u> </u>								
Plot Duratio Compute Data	n Plot Analytical Curve	Plot Graphical Curve View R	eport 💿 Print	ОК	Cancel Apply					

Figure 7-11. Graphical Curve Table for a Volume 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 7-12. 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.

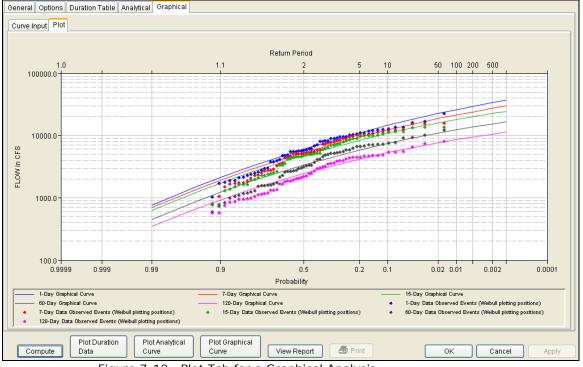


Figure 7-12. Plot Tab for a Graphical Analysis.

Viewing and Printing Results – Volume Frequency Analysis

The user can view output for the frequency analysis directly from the Volume Frequency Analysis 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 Frequency Analysis 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 Frequency Analysis editor or by selecting the **Plot** tab under the Analytical or Graphical tabs. There are three plot buttons at the bottom of the Volume Frequency Analysis 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 userdefined 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 7-13. 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.

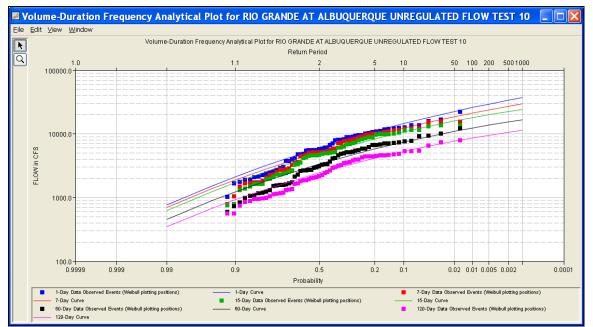


Figure 7-13. Plot of Systematic Data and Analytical Frequency Curves.

All plots opened by selecting one of the plot buttons at the bottom of the Volume Frequency Analysis 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 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 shortcut menu will open with customization options. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the x-axis. 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 is used for developing plots in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

Viewing the Report File

Computational results for a volume 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 Frequency Analysis editor to open the report, as shown in Figure 7-14.

South_Fork_Wailua_River.rpt	×
Eile Edit Search Format	
File: C:/HEC-SSP Build 2008-02-13\projects\volume-duration_testing\VolumeFrequencyAna	alysisResults\South_Fork_Wailua_River\South_Fork_Wailua_I
Volume-Duration Analysis 18 Jun 2008 02:47 PM	
Input Data	
Analysis Name: South Fork Wailua River Description:	
Data Set Name: SF WAILUA RIVER-LIHUE, KAUAI, HI-FLOW DSS File Name: C:\HEC-SSP Build 2008-02-13\projects\volume-duration_te: DSS Pathname: /SF WAILUA RIVER/LIHUE, KAUAI, HI/FLOW//1DAY/USCS/	sting\volume-duration_testing.dss
Project Path: C:\HEC-SSP Build 2008-02-13\projects\volume-duration_tes Report File Name: C:\HEC-SSP Build 2008-02-13\projects\volume-duration Result File Name: C:\HEC-SSP Build 2008-02-13\projects\volume-duration	_testing\VolumeFrequencyAnalysisResults\South
Analyze Maximums	
Analysis Year: Calendar Year	
Record Start Date: 01 Jan 1912 Record End Date: 17 Jun 2008	
User-Specified Durations Duration: 1 day Duration: 3 days Duration: 7 days Duration: 15 days Duration: 30 days Duration: 60 days	
Plotting Position Type: Weibull	
Probability Distribution Type: Pearson Type III Use Log Transform	
Upper Confidence Level: 0.05 Lower Confidence Level: 0.95	
Use Default Frequencies	
Skew Option: Use Station Skew Regional Skew: Regional Skew MSE:	
Display ordinate values using 0 digits in fraction part of value	
End of Input Data	
Statistical Analysis of 1-day Maximum values	
Based on 97 events, 10 percent outlier test value K(N) = 3.006	
0 low outlier(s) identified below test value of 348.13	
<	·
	1:11:1 1:1

Figure 7-14. Volume Frequency Analysis Report.

Plots, tables and reports can also be created by selecting menu options from the **Results** menu. At least one volume frequency analysis must be selected in the study explorer before selecting one of the menu options on the Results menu. Results from multiple analyses are combined in one graph if they are selected in the study explorer when the **Graph** menu option is selected. The **Results**-**Summary Report** menu option will create a summary table of statistics and frequency curve ordinates for the selected analyses as shown in Figure 7-15.

le: C1TempISSP_ExamplestVolumeFrequencyAnalysisResultsV	folumeFrequencySummary rpt													
Volume Frequency Summary Report for Am 05 22:17:24 PST 2009 Table 1 Summary of Statistics														
Analysis Name	Data Name	Duration	Rean	Std Dev	Stn	Rgml	Wght	Adpt	Evnt	Hi Lo	Mang E	mt Per	.d	
RIG GRANDE AT ALBUIQUERQUE UNREGULATED FLOM TEST 10 RIG GRANDE AT ALBUIQUERQUE UNREGULATED FLOM TEST 10	Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED	1-Day 7-Day 15-Day 60-Day	3.731 3.670 3.621 3.470 3.334	0.319 0.346 0.340 0.341	-0.448 -0.539 -0.532 -0.339 -0.231			-0.448 -0.539 -0.532 -0.339 -0.231	0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0	61 61 61 61 61	-	
Table 2 Summary of Frequency Curve Ordinates Annlysis Sawe	Data Nunc	Duration	99			80)	Percen 20	it Chang 10	e Excee	dance 5	2	······
LIO GRANDE AT ALBUQUERQUE UNREGULATED FLOU TEST 10 10 GRANDE AT ALBUQUERQUE UNREGULATED FLOU TEST 10	Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED Rio Grande at Alubquerque UNREGULATED	1-Day 7-Day 15-Day 60-Day	773.0 575.1 500.1 392.4 363.5	1470. 1178. 1035. 756.	4 2043.2 5 1677.7 5 1480.3 5 1053.6	2963.0 2806.2 2225.9 1548.7	\$601. \$007. 4485. 3085.	1009 908 819 8578	3.1 5.4 3.2	13240.5 11956.0 10821.9 7845.9 5307.9	1473- 1336 997	4.6 18 5.5 16 2.9 12	1292.7 2 1628.0 1 1899.3 1	23416.0 20905.0 19028.1 15203.0 10116.1
able 3 Summary of User Statistics and Frequency Cu malysis	Data	Duration	Rean	Std	Adpt -								ent Chang	
	Data Name Rio Grande at Alubquerque UNREGULATED	1-Day	1000.000	3td 0.330 0.320	Adpt -	99 714.4	95 1400.0	90 1973.4 1765.2		80 5.3 57	50	Perc 20 10315.0 8791.1	ent Chang 10 13624.3 11472.4) 16

Figure 7-15. Summary Table for a Volume Frequency Analysis.

CHAPTER 8

Performing a Duration Analysis

This chapter discusses in detail how to use the Duration Analysis editor in HEC-SSP. A duration analysis can be performed on flow and stage data as well as other data types. All regular interval data can be used in a duration analysis and an option is included to manually define a duration curve.

Contents

- Starting a New Analysis
- General Settings and Options
- Analytical Duration Analysis
- Manual Analysis
- Viewing and Printing Results

Starting a New Analysis

A duration analysis can be started in two ways, either by right clicking on the Duration Analysis folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Duration Analysis**. When a new duration analysis is selected, the Duration Analysis editor will appear as shown in Figure 8-1.

🧱 Duration Analysis Editor -*		
Name:		
General Options Results Manual Entry Method Rank All Data Values Bin (STATS) X-Axis Scale Linear Probability Y-Axis Scale Linear Log 	Time Window Modification End Points DSS Range is Start Date End Date Duration Period Annual Start of Period	
Compute Plot Duration Curve View Report 6	Print	OK Cancel Apply

Figure 8-1. Duration 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) can be selected from the available data sets stored in the current study DSS file (see Chapter 4 for importing data into the study). The list of data that can be selected for a duration analysis will only include those data that have a regular interval, like 1HOUR and 1DAY (E-part pathname). Choose "None" for the Data Set when defining the duration curve manually on the **Manual Entry** tab. 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 analysis. Contained on the Duration Analysis editor are four tabs. The tabs are labeled **General**, **Options**, **Results**, and **Manual Entry**. This section of the manual explains the use of the General and Options tabs.

General

The first tab contains general settings for performing the duration analysis (Figure 8-1). These settings include:

- Method
- X-Axis Scale
- Y-Axis Scale
- Time Window Modification
- Duration Period

Method

This option allows the user to choose the **Rank All Data Values** or **Bin (STATS)** method for computing the duration analysis; the rank all

Method
💿 Rank All Data Values
O Bin (STATS)

data values method is the preferred choice. This method computes the duration curve by sorting the data from largest to smallest, ranking the values from 1 to n, and using: P = 100 * [M / (n+1)] where M is the ranked

position and n is the number of events. The Bin method uses a similar procedure as in the STATS program for computing the duration curve (HEC, 1996). The data is grouped into bins (classes) and the duration curve is computed using the number of data in each bin.

X-Axis Scale

This option allows the user to choose the scale of the x-axis. The

X-Axis Scale	
💿 Linear	
🚫 Probablity	
(

options are **Linear** and **Probability**. This option will affect the x-axis scale in the duration curve plot and how the "interpolated" frequency curve is computed. The program will use a probability scale when interpolating the final duration curve

to the user specified exceedance ordinates.

Y-Axis Scale

This option allows the user to choose the scale of the y-axis. The options are **Linear** and **Log**. This option will affect the y-axis scale in

Y-Axis Scale	
💿 Linear	
🔿 Log	

the duration curve plot, how the program computes evenly spaced bins when the Bin (Stats) method is selected, and how the "interpolated" frequency curve is computed. One option for computing bins is to let the program define the bins at evenly spaced

intervals between the minimum and maximum values from the selected data set. When **Log** is set as the y-axis scale, the program will convert the minimum and maximum values to log space before computing the evenly spaced bin limits. Also, the program will use log scale when interpolating the final duration curve to the user specified exceedance ordinates.

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 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

Time Window M	lodification	
DSS Range is	13DEC1940 - 18SEP2004	
📃 start date		
🔲 end date		

that are contained 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.

Duration Period

This option allows the user to compute multiple duration curves for different time windows within the year. If **Annual** is selected, then the program uses all the data when computing the duration curve. If **Quarterly** is selected, then the program separates the data into quarters and computes a separate duration curve for each quarter. For example, a duration curve for the 1st quarter includes all data measured from Jan 1 – March 31. The program will compute a separate duration curve for each month of the year when the **Monthly** option is selected. The **User-Defined** option lets the user define one or multiple periods within the year. Then the program will perform the duration analysis using data only measured during the user-

de	fined period(s).	
	uration Period	
	Annual	
	Annual	
	Quarterly	
	Monthly	
	Jser-Defined	

Options

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

- Output Labeling
- Plotting Position Formula
- User-Specified Exceedance Ordinates
- Bin Limits

When the Options tab is selected, the Duration Analysis editor will appear as shown in Figure 8-2.

🔛 Duration Anal	ysis Editor -*		
Name: Description: Data Set: DSS File Name: Report File:	None		
General Option Output Labelin DSS Data Na Change DSS Data Un Change Plotting Positi Rank/(N+1 Rank/N	me is Label Label Label Label Do Formula	User-Specified Exceedance Ordinates Change or Add to Default Values Percent of Time Exceeded	Bin Limits Evenly Spaced # Bins Extract Bin Limits 90.0
Cor	npute Plot Duration Curve	View Report 🖉 Print	OK Cancel Apply

Figure 8-2. Duration Analysis Editor with Options Tab Selected.

Output Labeling

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

Output Labeling	· · · · · · · · · · · · · · · · · · ·
DSS Data Name is	
🗌 Change Label	
DSS Data Units are	
📃 Change Label	

contained in the output tables and plots. The user can change both the name of the data as well as the units of the data. The output labeling does not result in the conversion of data from one unit system to another; it only affects

what is displayed on table headings and the y-axis of the results plot.

Plotting Position Formula

This option allows the user to choose how the duration curve is computed (this option is not available when the **Bin** method is selected). When **Rank/(N+1)** is selected the program will compute the duration curve using: P = 100 * [M/(n+1)] where M is the ranked position and n is the number of events. When **Rank/N** is selected the

program will compute the duration curve using: P = 100 * [M/n]

Plotting Position Formula	
⊙ Rank/(N+1)	
🔘 Rank/N	

where M is the ranked position and n is the number of events.

User-Specified Exceedance Ordinates

This option allows the user to change the ordinates used in computing the resulting duration curves. The default values listed in percent of

User-Specified Exceedance Ordinates	
Change or add to default values	
Percent of	
Time Exceeded	
	99.0
	95.0
	90.0
	80.0
	50.0
	25.0
	15.0
	10.0
	5.0
	2.0
	1.0
	0.1

time exceedance are 99, 95, 90, 80, 50, 25, 15, 10, 5, 2, 1, and 0.1. Check the box next to Change or add to default values to change or add additional values. Once this box is checked, the user can add/remove rows and edit the ordinates. 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 shortcut 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 **Change or add to default values** option is not checked. Finally, all values in the table must be between 0 and 100.

Bin Limits

The **Bin Limits** panel is only active when the **Bin (STATS)** method is selected on the General tab. This option helps the user to define the limits, the minimum and maximum values, for each bin. There are two options; **Evenly Spaced** and **User-Defined**. When **Evenly Spaced** is selected the user must also enter the number of bins. The **Extract Bin Limits** button will automatically populate the bin limits table by first extracting the minimum and maximum values from the data set and then linearly interpolating evenly spaced bin limits. If Log is selected as the Y-axis scale on the General tab, then the program converts the minimum and maximum values to log space before computing the evenly spaced bin limits. The **User-Defined**

option lets the user manually enter the bin limits. The user must ensure the minimum and maximum values from the data set are contained in the bin limits table. For example, if the minimum flow from the data set is 100.0 then the first row in the table must be less than or equal to 100.0. Additional rows can be added to the table. Place the mouse pointer on top of the table and click the right mouse button. Then select the **Insert Row(s)**... menu option to open an editor for specifying the number of rows to insert into the table.

Bin Limits	
Evenly Spaced	~
10 # Bins Extract Bin Limits	
	545.78 33,338.20
	66,130.62
	98,923.05
	131,715.47 164,507.89
	197,300.31
	230,092.73
	262,885.16
	295,677.58
	328,470.00

Compute

Once the new analysis has been defined, and the user has all of the General and Options information selected the way they want,

Compute performing the computations is simply a matter of pressing the **Compute** button at the bottom of the Duration Analysis editor. 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.

Multiple Duration analyses can be computed using the **Compute Manager**. Select the **Analysis**-**Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finished computing the analyses.

Results

This section of the manual describes results that are available for the Duration analysis. When the user selects the **Results** tab on the Duration Analysis editor, the window will appear as shown in Figure 8-3. As shown, two additional tabs will appear on the screen: **Tabular Results** and **Plot**.

📓 Duration Anal	ysis Susquehanna Standard Method	
Name:	Susquehanna Standard Method	
Description:		
Data Set:	SUSQUEHANNA RIVER	▼
DSS File Name:	C:\Temp\Duration_Analysis\Duration_Analysis.dss	
Report File:	isResults\Susquehanna_Standard_Method\Susquehanna_St	tandard_Method.rp1
General Option	s Results Manual Entry	
Tabular Results		
Tabalar resource		
	Percent of	Annual - FLOW
	Time Exceeded 99.00	997.77
	99.00	1486.70
	90.00	1938.05
	80.00	3005.92
	50.00	8095.90
	25.00	18022.25
	15.00	26771.70
	10.00	34462.00
	5.00	49097.55
	2.00	72793.26 91998.09
	1.00 0.10	170943.05
Compu	te 🛛 🛛 Plot Duration Curve 🛛 View Report 🖉 Pri	rint OK Cancel Apply

Figure 8-3. Results Tab of the Duration Analysis Editor.

Tabular Results

The **Tabular Results** tab will bring up a table of results for the duration analysis. The tabular results are different for the **Rank All Data Values** and **Bin (STATS)** methods. An example of tabular results for a **Rank All Data Values** analysis is shown in Figure 8-3. The results table will contain multiple duration curves if the Quarterly, Monthly, or the User Defined options are selected as the Duration Period. Data in the duration curve table can be re-sorted. Click the **Percent of Time Exceeded** column header (two mouse clicks are required the first time). The percent of time exceeded ordinates,

along with the duration curve values, will sort so that the lowest values are on top or the highest values are on top.

The tabular results tab will look different when the **Bin (STATS)** method is used to compute the duration analysis. As shown in Figure 8-4, there are two tables. The first table contains summary information about the bins and the second table contains the interpolated duration curve.

reneral Options Results Manual Entry Tabular Results Plot										
Class Number	Lower Bin Limit	Upper Bin Limit	Number in Bin	Accum Number	Percent Equal or Exceeded	T				
1	1.0	2.0	5	8766	100.0	ĵ ,				
2	2.0	3.0	4	8761	99.9					
3	3.0	4.0	8	8757						
4	4.0	5.0	22	8749						
5	5.0	6.0	37	8727						
6	6.0	8.0	66	8690						
7	8.0	10.0	95	8624						
8	10.0	15.0	254	8529						
9	15.0	20.0	261 423	8275						
10	20.0	30.0	423	8014	91.4	1				
	Percent of			Annual - FLOW		Т				
	Time Exceeded					I				
		99.0			6.4	1				
		95.0			14.2	2				
		90.0			23.3					
		80.0			45.0					
		50.0			171.4					
		25.0			358.2					
		15.0			518.6					
		10.0			662.1					
		5.0			906.4					
		2.0			1257.3	3				

Figure 8-4. Results Tab for a Bin (STATS) analysis.

Plot

In addition to tabular results, a **Plot** tab is available for viewing a graphical plot of the duration curves. When the Plot tab is selected the window will change to what is shown in Figure 8-5. The plot contains the computed duration curve and the duration curve interpolated to the user-defined ordinates (defined on the Options tab). Multiple duration curves will be graphed if the Quarterly, Monthly, or User Defined options are selected as the duration period.

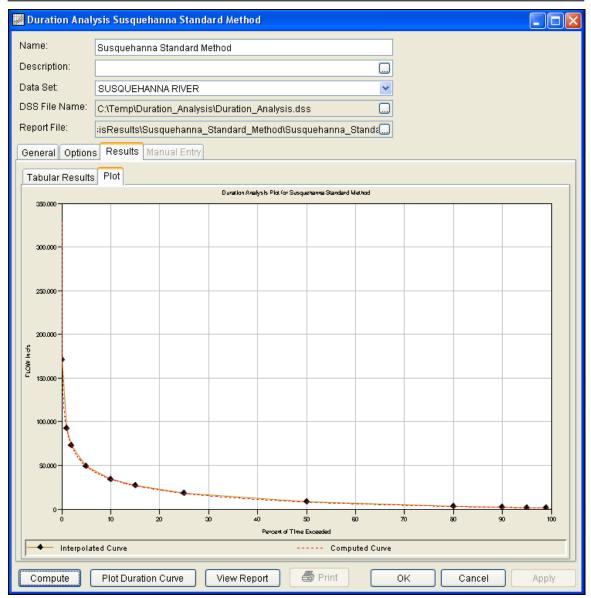
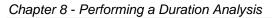


Figure 8-5. Plot Tab of the Duration Analysis.

Manual Duration Analysis

The user has the option to manually define a duration curve. This option would be used when a duration curve has been computed outside of HEC-SSP. The "None" data set must be selected in order to define a duration curve manually. When the **Manual Entry** tab is selected, the editor will display a plot and table as shown in Figure 8-6. The table allows the user to enter data values for the percent of time exceedance 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.



📓 Duration Anal	ysis Manual Er	ntry Curv	e													
Name:	Manual Entry C	urve]								
Description:							[ז								
Data Set:	None			~												
DSS File Name:	C:\Temp\Durat	ion_Analy:	sis\Duration_Ar	nalysis.dss				ו								
Report File:	C:\Temp\Duration	TemplDuration_Analysis\DurationAnalysisResults\Manual_Entry_Curve\Manual_Entry_Curve.rp(
General Option	s Results Ma	nual Entry														
Variable							Manu	ial Dura	tion Anal	ysis Plot	for Manu	ial Entry C	Curve			
	Name:	Flow			180,000-											1
	Units:	cfs														
					160,000-											
	Percent of he Exceeded			Flow	1 40 000											
	IC EXCOUNCE	99.0		912.78	140,000-											
		95.0 90.0		2380.78 4215.77	120,000-											
		80.0 50.0		7885.77 18895.76	120,000											
		25.0		28070.74	" 100,000-											
		15.0 10.0		31740.74 35969.63	년 80'000- 199'999											
		5.0 2.0		56297.92 76763.32	≗ 80,000-											
		1.0		95047.58		\setminus										
		0.1		175618.73	60,000-										-	
					40,000-								-			
					20,000-											
					0-											
) 1	0 2	03					70 8	80 9	0 10	oo
									Percent	of Time	Exceede	d				
					Manu	al-Entry Cu	irve									
	Compute	Plot Dur	ation Curve	View Report	Print							ж	Car	ncel	Appl	y 🚽

Figure 8-6. Manual Entry Tab of the Duration Analysis Editor.

Viewing and Printing Results

The user can view output for the duration analysis directly from the Duration Analysis editor (Tabular and Graphical output) or by using the buttons at the bottom of the editor. Results can also be opened by selecting the duration analysis in the study explorer and then choosing the **Graph**, **Table**, or **Report** option available from the **Results** menu.

Tabular Output

Once the computations for the duration analysis are completed, the user can view tabular output by selecting the **Tabular Results** tab under the **Results** 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 Duration Analysis 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 duration curve can be obtained by selecting either the **Plot** tab under the results tab, or by pressing the button labeled **Plot Duration Curve** at the bottom of the Duration Analysis editor. When the Plot Duration Curve button is pressed, a duration curve plot will appear in a separate window as shown in Figure 8-7.

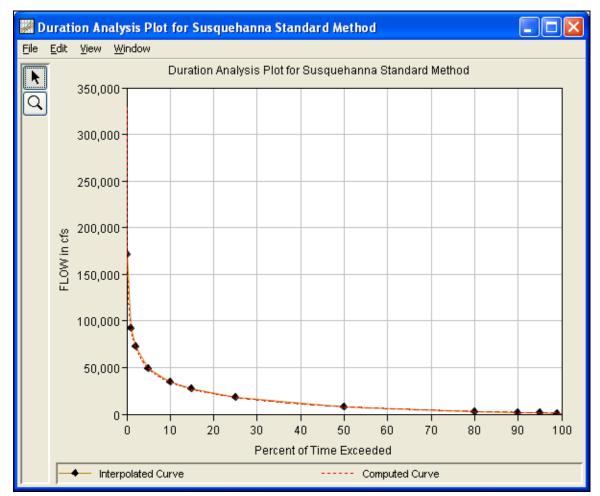


Figure 8-7. Duration Curve Plot.

The duration 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 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 shortcut menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the xaxis. 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 is used for developing plots in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

Viewing the Report File

A report file is created when the duration analysis computations are performed. The report file contains information about the duration analysis and the final results. To view the report file press the **View Report** button at the bottom of the Duration Analysis editor. When this button is pressed, a window will appear containing the report as shown in Figure 8-8.

HEC-SSP User's Manual

🗱 Susquehanna_Standard_Method.rpt		×
Eile Edit Search Format		
File: C:\Temp\Duration_Analysis\DurationAnalysisResults\Susquehanna_Standard_Method\Susquehanna_Standard_Method.rpt		
Duration Analysis 17 Mar 2010 10:43 AM		
Input Data		
Analysis Name: Susquehanna Standard Method Description:		
DSS File Name: C:\Temp\Duration_Analysis\Duration_Analysis.dss DSS Pathname: /SUSQUEHANNA RIVER/BLOOMSBURG, PA/FLOW/OIJAN1899/IDAY/COMPUTED2/		
Project Path: C:\Temp\Duration_Analysis Report File Name: C:\Temp\Duration_Analysis\DurationAnalysisResults\Susquehanna_Standard_Method\Susquehanna_Standard_Method.rr Result File Name: C:\Temp\Duration_Analysis\DurationAnalysisResults\Susquehanna_Standard_Method\Susquehanna_Standard_Method.xr		
Duration Analysis Method: Standard		
Duration Flot Position Method: Rank/(N+1)		
X-Axis Scale: Linear		
Duration Period: Annual		
Use Standard Percent Exceedance		
Display ordinate values using 2 digits in fraction part of value		
End of Input Data		
Annual Duration Analysis		
Time Period: 01Jan - 31Dec		
Number Valid Values: 40480 Number Vising Values: 0		
Minimum Value: 545.78 Maximum Value: 328,470.00		
I Percent of FLOW I Time Exceeded cfs I I 99.0 997.77 I 99.0 997.77 I 99.0 1,486.70 I 90.0 1,938.05 I 80.0 3,005.92 I 0.0 3,005.92 I 1 50.0 18,022.25 1 5.0 16,022.25 1 5.0 26,771.70		
	40:140:1	40:1

Figure 8-8. Duration Analysis Report File.

CHAPTER 9

Performing a Coincident Frequency Analysis

This chapter discusses in detail how to use the Coincident Frequency Analysis editor in HEC-SSP. A coincident frequency analysis can be performed on any data type; flow, stage, precipitation, wind, etc. The coincident frequency analysis requires both duration and frequency curves. These can be computed by existing analyses in the HEC-SSP study or they can be entered manually in the coincident frequency analysis editor.

The Coincident Frequency Analysis is designed following guidelines in EM 1110-2-1415. This analysis tool can be used to compute the exceedance frequency relationship for a variable that is a function of two other variables. An example is illustrated in Figure 9-1. In this example, the stage at the damage site on the tributary, variable C, is a function of stream flow from the tributary, variable A, and the stage in the mainstem river, variable B.

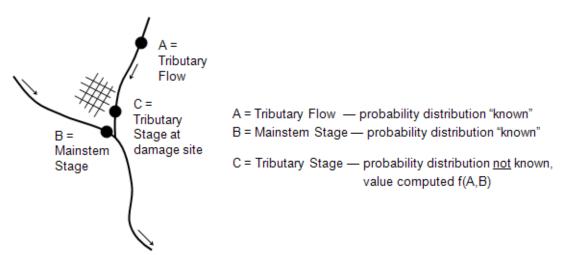


Figure 9-1. Example Application of the Coincident Frequency Analysis.

The general procedure for performing a coincident frequency analysis, using HEC-SSP is described below.

 Develop a duration curve for variable B. This can be done using the Duration Analysis editor or it can be defined manually in the Coincident Frequency Analysis editor. Then discretize the duration curve to determine index values for variable B. The index values should be defined so that the area under the discretized duration curve approximates the original duration curve. Figure 9-2 shows a flow duration curve that has been discretized using 9 index points. The index points are taken at the midpoint of each discrete segment and there are more index points along the steeper portion of the duration curve. The Coincident Frequency Analysis editor can be used to define the index points and to estimate the proportion of time for each index point. For example, the 9th index point in Figure 9-2 is taken at the midpoint for the discrete segment from 100 to 60 percent of time exceeded. The flow value at this point represents the variable B index occurring 40 percent of the time. The 8th index point is taken at the midpoint for the discrete segment from 60 to 40 percent of time exceeded. The flow value at this point represents the variable B index occurring 20 percent of the time. The proportion of time assigned to each index point will be used to compute the variable C frequency curve.

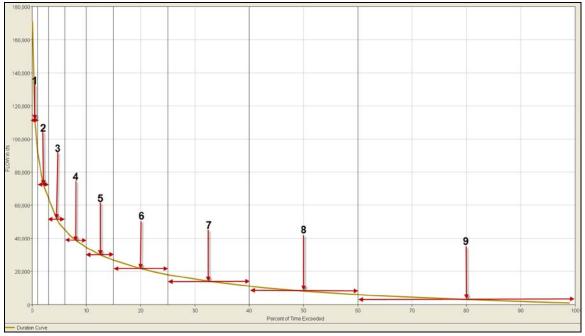


Figure 9-2. Variable B Duration Curve Divided into Discrete Segments.

2) Different procedures are required depending on whether variables A and B are independent or not independent of one another. When variables A and B are assumed independent of one another, develop a frequency curve of variable A. The frequency curve can come from an existing Bulletin 17B or General Frequency analysis or it can be defined manually in the Coincident Frequency Analysis editor. If variables A and B are not independent of one another, then develop a frequency curve of variable A for each variable B index value. In this case, the variable A frequency curves must be defined manually in the Coincident Frequency Analysis editor. This involves extracting annual peak values for variable A that occur for each discrete range identified on the variable B duration curve and performing a separate frequency analysis on each set of variable A data.

3) Develop the response of variable C for combinations of variable A and variable B. This could be done using a hydrology or hydraulics model. For the example shown in Figure 9-1, a flow value from the variable A frequency curve would be applied to the tributary and the index flow (or stage) from the variable B duration curve would be applied to the mainstem. The hydraulics model would be used to compute the variable C stage at some reference point on the tributary. This model simulation would be computed for many combinations of variable A and variable B. Figure 9-3 shows example output from a hydraulics model. The model was used to generate output from multiple combinations of variable A and B values. In this example, there were 12 variable A values and 9 index values from variable B. This resulted in 108 simulation results. The table shown in Figure 9-3 is referred to as the Response Curves table in HEC-SSP and these values must be entered by the user.

	Variable B Index Values										
Variable A	B1=3005.92	B2=8095.90	B3=14053.68	B4=21795.00	B5=30089.62	B6=38967.52	B7=51657.13	B8=72793.26	B9=112646.41		
	C = f(A,B1)	C = f(A, B2)	C = f(A,B3)	C = f(A, B4)	C = f(A,B5)	C = f(A,B6)	C = f(A,B7)	C = f(A,B8)	C = f(A, B9)		
66,039	481.38	481.37	481.37	481.37	481.37	481.36	481.36	481.36	481.69		
54,354	477.24	477.24	477.25	477.26	477.28	477.32	477.37	477.5	477.91		
46,370	475.02	475.03	475.05	475.07	475.11	475.18	475.31	475.48			
39,053	473.03	473.04	473.07	473.11	473.18	473.28	473.47	473.77	474.45		
30,296	470.94	470.95	470.98	471.02	471.09	471.2	471.42	471.89	472.78		
24,265	469.59	469.61	469.64	469.69	469.77	469.9	470.13	470.71	471.74		
18,631	467.78	467.91	467.97	468.07	468.22	468.42	468.78	469.54	470.82		
11,395	465.04	465.06	465.27	465.47	465.71	466.04	466.64	467.86	469.75		
7,095	463.82	463.82	463.82	463.89	464.09	464.52	465.33	466.87	469.21		
5,578	463.37	463.37	463.36	463.38	463.52	463.99	464.88	466.57	469.03		
4,589	463.02	463.02	463.02	463.02	463.14	463.65	464.62	466.36	468.94		
3,210	462.47	462.47	462.47	462.47	462.59	463.2	464.28	466.12	468.82		
Variable C Results Values											

Figure 9-3. Response of Variable C for Combinations of Variable A and Variable B.

4) The program computes the variable C frequency curve by first using the response curves to compute conditional frequency curves of variable C. This is done by assigning the same frequency from the variable A value to the corresponding variable C value. Then for a selected value of variable C, the frequency value from each condition frequency curve is multiplied by the corresponding proportion of time (probability) from the variable B index value. The values are summed to obtain the frequency of the selected value of variable C. This is done for a number of values of variable C until a complete frequency curve is created.

Contents

- Starting a New Analysis
- General Settings
- Variable A
- Variable B
- Response Curves
- Viewing and Printing Results

Starting a New Analysis

A coincident frequency analysis can be started in two ways, either by right clicking on the Coincident Frequency Analysis folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Coincident Frequency Analysis**. When a new coincident frequency analysis is selected, the Coincident Frequency Analysis editor will appear as shown in Figure 9-4.

🞇 Coincident Frequency Analysis Editor 🔸	
Name:	
Variable A A and B can be Assumed Independent (Marginal Frequency Curve for A) A and B can not be Assumed Independent (Conditional Frequency Curves for A) Variable B Number of Index Values Output Labeling Data Name	User Specified Frequency Ordinates Use Values from Table Below Frequency in Percent 0.2 0.5 1.0 2.0 5.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
Compute Plot View Report 🚭 Print	OK Cancel Apply

Figure 9-4. Coincident Frequency Analysis Editor.

The user is required to enter a **Name** for the analysis, while a **Description** is optional. Once a Name is entered, 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

Once the analysis name has been entered, the user can begin to perform the computations. Contained on the Coincident Frequency Analysis editor are five tabs. The tabs are labeled **General**, **Variable A**, **Variable B**, **Response Curves**, and **Results**. The first tab contains general settings for performing the coincident frequency analysis (Figure 9-4). These settings include:

- Variable A
- Variable B
- Output Labeling
- Y-Axis Scale
- User Specified Frequency Ordinates

Variable A

This option allows the user to choose whether the coincident frequency analysis assumes variables A and B are independent or dependent. When variables A and B can be assumed independent, there will be only one frequency curve for variable A. A conditional variable A frequency curve assumes variables A and B are not independent, so there will be a separate variable A frequency curve for each variable B index value.

Variable A

- O A and B can be Assumed Independent (Marginal Frequency Curve for A)
- 🔘 A and B can not be Assumed Independent (Conditional Frequency Curves for A)

Variable B

This option allows the user to define the number of index values for variable B. The index points are used to discretize the duration curve. A probability, or a proportion of time, will be assigned to each index point.



Output Labeling

This option allows the user to enter labels for data contained in the

Output Label	ing	
Data Name	stage	
Data Units	feet	

output tables and plots. The user must enter the name of the data as well as the data units. The output labeling does not result in the conversion of data

from one unit system to another; it only affects what is displayed on table headings and the y-axis of the results plot.

Y-Axis Scale

This option allows the user to choose the scale of the y-axis. The options are **Linear** and **Log**. This option will affect the y-axis scale in the coincident frequency curve plot.



User Specified Frequency Ordinates

-(User Specified Frequency Ordinates		
[
	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		
1			

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 shortcut 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.

Variable A

The **Variable A** tab is used to define the frequency curve for variable A. This tab will look different based on the user's selection on the General Tab. The Variable A tab will look like Figure 9-5 when "A and B can be Assumed Independent" is selected on the General tab. Since variables A and B are independent, there will only be one frequency curve for variable A.

As shown in Figure 9-5, the user can choose to define the curve manually or select an existing study analysis. When the **Manual Entry** option is selected, the user must define the **Data Name** and **Data Units**. Then the user must enter the frequency curve for variable A. A frequency curve value must be defined for each percent chance exceedance ordinate in the table. When the **Existing Study Analysis** option is selected, the dropdown list will be active and the user can choose any Bulletin 17B or General Frequency analysis in the HEC-SSP study. The variable A frequency curve table will be populated with the frequency curve when an analysis is selected. The program uses the statistics from the selected analysis and computes the frequency curve that populates the table.

General Variable A Variable B Response	Curves Results	
Specify Frequency Curve	Variable A Frequency Curve	
🔿 Manual Entry	Percent Chance	FLOW
Data Name flow	Exceedance	
Data Units	0.2	66039
Data Units Cfs	0.5	54354
 Existing Study Analysis 	1.0	46370
Children olday Analysis	2.0	39053
Flow Frequency Variabl 💌	5.0	30296
	10.0	24265
	20.0	18631
	50.0	11395
	80.0	7095
	90.0	5578
	95.0	4589
	99.0	3210
Plot		

Figure 9-5. Variable A Tab when Variable A and B are Independent.

The Variable A tab will look like Figure 9-6 when "A and B can not be Assumed Independent" is selected on the General tab. A conditional variable A frequency curve assumes variables A and B are not independent, so there will be a separate variable A frequency curve for each variable B index value.

As shown in Figure 9-6, the user must define the **Data Name** and **Data Units**. Then the user must manually enter the variable A frequency curve for each index value of variable B. This involves extracting the annual peak values for variable A that occur for each discrete range identified on the variable B duration curve and performing a separate frequency analysis on each set of variable A data. Also, a frequency curve value must be defined for each Percent Chance Exceedance ordinate in the table.

General Variable A V	/ariable B Respons	e Curves Results			
Variable A					
Data Name Flow					
Data Units _{cfs}					
Variable A Conditional	Frequency Curves				
Percent Chance	Flow P(A B1)	Flow P(A B2)	Flow P(A B3)	Flow P(A B4)	Flow P(A B5)
Exceedance					
0.2	4537.1	19449.6	23672.2	30310.3	58705.1
0.5	3877.3	14805.0	18661.1	25442.6	48847.3
1.0	3395.8	11950.8	15487.2	22082.8	41974.6
2.0	2928.9	9563.9	12760.5	18972.0	35567.7
5.0	2332.0	6996.3	9729.8	15193.6	27746.8
10.0	1892.9	5413.5	7793.8	12543.4	22256.0
20.0	1458.8	4073.3	6098.4	10015.3	17042.9
50.0	865.0	2551.6	4083.9	6650.2	10233.1
80.0	496.5	1756.0	2973.9	4537.1	6147.9
90.0	366.6	1495.2	2598.0	3754.6	4711.5
95.0	283.4	1331.1	2357.9	3228.5	3782.4
99.0	171.9	1111.0	2031.2	2463.7	2505.9
					,
Plot					

Figure 9-6. Variable A Tab when Variable A and B are not Independent.

Press the **Plot** button located at the lower left corner of the Variable A tab to open a plot of the variable A frequency curve(s).

Variable B

The **Variable B** tab is used to define the duration curve for variable B and the index points with an associated probability. The index points will be used by the user when developing the response curves

(response of variable C to each combination of variables A and B). The associated probability represents the proportion of time that each index point can be expected to occur.

As shown in Figure 9-7, the left side of the variable B tab is used to select the duration curve from an existing Duration Curve analysis. Once selected, the program populates the duration curve table. Press the **Plot** button located at the lower left corner of the Variable B tab to open a plot of the variable B duration curve.

General Variable A Variable B Response Curves Results	
Duration Curve	Develop Probabilities from Duration Curve
Import Duration Curve	Number of Index Points 9
Duration Curve Test 13	 Define Automatically
Percent of Annual - FLOW	O Define from Index Points
Time Exceeded	O Define from Probabilities
99.0 997.8 95.0 1486.7	O User-Specified Index Points and Probability Ranges
90.0 1938.1	Generate Table
80.0 3005.9	
50.0 8095.9	Probability Index Break Point
25.0 18022.2	40.00 3005.92 100.00
15.0 26771.7 10.0 34462.0	20.00 8095.90 60.00
10.0 34462.0 5.0 49097.6	15.00 15044.34 40.00
2.0 72793.3	10.00 22396.97 25.00
1.0 91998.1	5.00 30616.85 15.00
0.1 170942.6	4.00 40316.22 10.00 2.00 52046.03 6.00
	3.00 33040.83
	2.00 72793.20 4.00
	1.00 135856.13 0.00
Plot	

Figure 9-7. Variable B Tab.

After the duration curve has been selected, the right side of the variable B tab is used to define the index points and associated probabilities used to discretize the duration curve. The number of index points is defined on the General tab and is included on the Variable B tab to let the user know how many index points must be defined in the table. There are 4 methods for defining the index values and the associated probabilities. The user selects one of the methods, edits the table, and then clicks the **Generate Table** button in order for the program to finish populating the table. The following text describes each method.

Define Automatically. The program will use a predefined pattern of probability ranges when this option is selected, as contained in Table 9-1, to populate the **Probability** column. The pattern is dependent on the number of index points and the default probability patterns do not extend beyond nine index points. If more than nine index points have been selected for the analysis, then use one of the other methods for defining the index points and **Break Point** columns when the **Generate Table** button is pressed. The **Break Point** column is computed using the probability pattern. The first row in this column is

always 100. The second break point is computed by subtracting the first probability value from the first break point value. The third break point is computed by subtracting the second probability value from the second break point value. This procedure is followed until the last break point is computed; it should always have a value of 0. The **Index** values are taken from the duration curve at the midpoint between each break point range. For example, if the first break point was 100 and the second was 60 then the first **Index** value would be the value from the duration curve at 80 percent time exceeded.

Number of Index Points							
Index	3	4	5	6	7	8	9
1	20	15	45	35	35	35	40
2	60	35	40	30	25	20	20
3	10	35	10	20	20	15	15
4		15	4	10	10	10	10
5			1	4	6	10	5
6				1	3	6	4
7					1	3	3
8						1	3
9							1

Table 9-1. Default Probability Patterns.

Define from Index Points. The number of rows is set by the number of index points. In this case, the **Index** column is edited by the user; the user must enter an index value in each row. When the **Generate Table** button is pressed, the program will compute the **Break Point** and the **Probability** values. First, the program will use the selected duration curve and interpolate a percent of time exceeded for each user-defined index value. Then break points are computed so that they are half way between the percent of time exceeded values (the first and last break points will be 100 and 0). The probability values are computed based on the break points. For example, the first probability value is computed by subtracting the second break point value from the first. The second probability value is computed by subtracting the second. This procedure is followed until the last probability value is computed.

Define from Probabilities. The number of rows is set by the number of index points. In this case, the **Probability** column is edited by the user; the user must enter a probability value in each row (the probability values should add up to 100). When the **Generate Table** button is pressed, the **Break Point** column is computed using the user-entered probability pattern. For example, the first row in the break point column is 100; therefore, the second break point is computed by subtracting the first probability value from the first break point value. The third break point is computed by subtracting the

second probability value from the second break point value. This procedure is followed until the last break point is computed; it should always have a value of 0. The **Index** values are taken from the duration curve at the midpoint between each break point range. For example, if the first break point was 100 and the second was 60 then the first **Index** value would be the value from the duration curve at 80 percent time exceeded.

User-Specified Index Points and Probability Ranges. This option can only be selected when the user does not select an existing Duration Curve to import. This would be applicable for the case where the user developed the duration curve outside of HEC-SSP and developed the index points and associated probabilities. As shown in Figure 9-8, the user must specify both the **Probability** and **Index** values; the user must enter values in each row. When the **Generate Table** button is pressed, the **Break Point** column is computed using the user-entered probability pattern. For example, the first row in the break point column is 100; therefore, the second break point is computed by subtracting the first probability value from the first break point value. The third break point is computed by subtracting the second break point value. This procedure is followed until the last break point is computed; it should always have a value of 0.

General Variable A Variable B Response Curves Results			
Duration Curve	Develop Probabilities from Duration	Curve	
Import Duration Curve	Number of Index Points 7		
None	O Define Automatically		
Percent of	O Define from Index Points		
Time Exceeded	O Define from Probabilities		
	 User-Specified Index Points and I 	Probability Ranges	
	Generate Table		
	· · · · · · · · · · · · · · · · · · ·		Dreak Daint
	Probability	Index	Break Point
	30.94	2605.47	100.00 69.06
	25.94	7353.61	43.13
	18.81	15292.50	24.31
	12.00	25240.55 40682.11	12.31
	3.56	63907.37	5.50
	1.94		1.94
			0.00
Plot			

Figure 9-8. User-Specified Option to Define Index Points and Probability Ranges.

Response Curves

The Response Curves tab is used to define the response of variable C to each combination of variable A and variable B. This analysis is

performed outside of HEC-SSP. For example, a hydraulics model could be used to apply flow values from the variable A frequency curve to the tributary and the index flow (or stage) from the variable B duration curve would be applied to the mainstem. The hydraulics model would be used to compute the variable C stage at some reference point on the tributary for multiple combinations of variable A and variable B. The peak variable C stage is the value to input into the Response Curves table.

As shown in Figure 9-9, there are two options for the Response Curves table; Same Variable A for each index or Different Variable A for each index. When the Same Variable A for each index option is selected, there is only one Variable A column in the response curves table. The user can manually fill in the values for Variable A or press the Import Variable A button. When the button is pressed, the program will import the values on the Variable A tab. The user can edit the Variable A values after they are imported. When the Different Variable A for each index option is selected, there is a separate Variable A column for each variable B index value, as shown in Figure 9-10. The user can manually fill in the values for Variable A or press the **Import Variable A** button. When the button is pressed, the program will import the values from the Variable A tab. The user can edit the Variable A values after they are imported. In most cases, the Different Variable A for each index options will be used when performing a conditional analysis (variables A and B can not be assumed independent). In this case, a separated variable A frequency curve was defined for each variable B index value; therefore, when the Import Variable A button is pressed the program will import the corresponding frequency curve into the response curves table.

The user must compute the variable C value given the combinations of variables A and B. Figure 9-9 contains 12 values of variable A and 9 index values for variable B. Therefore, the user would have 108 combinations of variables A and B to compute values of variable C. Once computed, the user would manually enter the variable C values into the response curves table. For example, the first value in the first variable C column in Figure 9-9 is 481.38. This was computed using a variable A value of 66039 and a variable B value of 3005.92.

The **Plot Response Surface** button will open a plot similar to the one shown in Figure 9-11. Each line in the response surface plot shows the variable C versus variable A relationship for a given variable B index value.

Same Varia	ble A for each in	dev							
-									
Different Va	riable A for each	index							
Import V	ariable A								
Variable A	B1=3005.92	B2=8095.90	B3=14053.68	B4=21795.00	B5=30089.62	B6=38967.52	B7=51657.13	B8=72793.26	B9=112646.4
	C = f(A,B1)	C = f(A,B2)	C = f(A,B3)	C = f(A, B4)	C = f(A,B5)	C = f(A,B6)	C = f(A,B7)	C = f(A,B8)	C = f(A,B9)
66039	481.38	481.37	481.37	481.37	481.37	481.36	481.36	481.36	481.6
54354	477.24	477.24	477.25	477.26	477.28	477.32	477.37	477.5	477.
46370	475.02	475.03	475.05	475.07	475.11	475.18	475.31	475.48	475.
39053	473.03	473.04	473.07	473.11	473.18	473.28	473.47	473.77	474.
30296	470.94	470.95	470.98	471.02	471.09	471.2	471.42	471.89	472.
24265	469.59	469.61	469.64	469.69	469.77	469.9	470.13	470.71	471.
18631	467.78	467.91	467.97	468.07	468.22	468.42	468.78	469.54	470.
11395	465.04	465.06	465.27	465.47	465.71	466.04	466.64	467.86	469.
7095	463.82	463.82	463.82	463.89	464.09	464.52	465.33	466.87	469.
5578	463.37	463.37	463.36	463.38	463.52	463.99	464.88	466.57	469.
4589	463.02	463.02	463.02	463.02	463.14	463.65	464.62	466.36	468.
3210	462.47	462.47	462.47	462.47	462.59	463.2	464.28	466.12	468.
3210	462.47	462.47	462.47	462.47	462.59	463.2	464.28	466.12	468

Figure 9-9. Response Curves Tab for Same Variable A for Each Variable B Index.

General Variab	General Variable A Variable B Response Curves Results								
Variable A	(ariable A								
🔿 Same Variat) Same Variable A for each index								
· ·									
 Different Var 	iable A for each ir	ndex							
Import Va	ariable A								
Variable A	B1=3334.00	Variable A	B2=12975.25	Variable A	B3=34462.00	Variable A	B4=62059.41	Variable A	B5=112646.41
	C = f(A,B1)		C = f(A, B2)		C = f(A,B3)		C = f(A, B4)		C = f(A,B5)
4537.1	463.01	19449.6	468.2	23672.2	469.54	30310.3	471.22	58705.1	478.81
3877.3	462.76	14805.0	466.5	18661.1	468.06	25442.6	470.17	48847.3	476.08
3395.8	462.55	11950.8	465.3	15487.2	466.96	22082.8	469.39	41974.6	474.44
2928.9	462.35	9563.9	464.49	12760.5	465.97	18972.0	468.53	35567.7	472.99
2332.0	462.05	6996.3	463.8	9729.8	464.8	15193.6	467.35	27746.8	471.39
1892.9	461.8	5413.5	463.31	7793.8	464.09	12543.4	466.47	22256.0	470.31
1458.8	461.54	4073.3	462.83	6098.4	463.54	10015.3	465.61	17042.9	469.19
865.0	461.12	2551.6	462.16	4083.9	462.84	6650.2	464.42	10233.1	467.59
496.5	460.81	1756.0	461.73	2973.9	462.37	4537.1	463.71	6147.9	466.68
366.6	460.69	1495.2	461.56	2598.0	462.18	3754.6	463.45	4711.5	466.4
283.4	460.59	1331.1	461.46	2357.9	462.06	3228.5	463.29	3782.4	466.22
171.9	460.46	1111.0	461.31	2031.2	461.89	2463.7	463.07	2505.9	466.02
Plot Resp	oonse Surface								

Figure 9-10. Response Curves Tab for Different Variable A for Each Variable B Index.



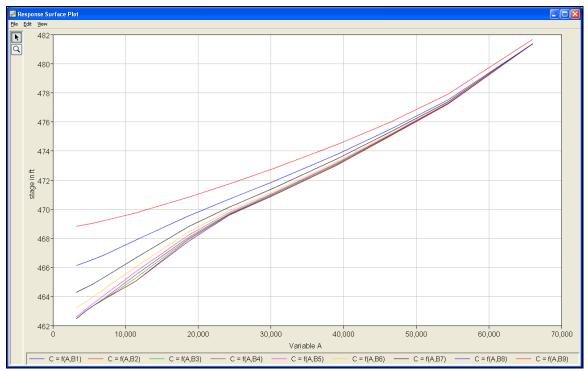


Figure 9-11. Plot of Response Curves.

Compute

Once the new analysis has been defined, and the user has all of the information defined on the General, Variable A, Variable B, Response Curves tabs, performing the computations is simply a matter of pressing the **Compute** button at the bottom of the Coincident Frequency Analysis editor. 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.

The following describes how the variable C coincident frequency curve is computed.

- The program uses the variable A frequency curve(s) and the variable A values in the response curves table to assign a frequency of exceedance to each variable C value in the response curves table.
- 2) The program finds the minimum and maximum values of variable C in the response curves table.
- The program defines 20 evenly spaced values of variable C inbetween the minimum and maximum values (20 values include the minimum and maximum values).

- 4) For each variable C from step 3, the program will look-up the exceedance frequency value from each response curve in step 1 and multiply by the corresponding proportion of time (using the probability defined on the Variable B tab) obtained from the variable B index value. These "weighted" values from each response curve are summed to compute the variable C frequency curve.
- 5) The curve is interpolated to the selected exceedance ordinates defined on the General tab.

Multiple coincident frequency analyses can be computed using the **Compute Manager**. Select the **Analysis**-**Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finishes computing the analyses.

Results

This section of the manual describes results that are available for the Coincident Frequency analysis. When the user selects the **Results** tab on the Coincident Frequency Analysis editor, the window will appear as shown in Figure 9-12. Both tabular and graphical results are included. The percent chance exceedance ordinates are the same as those defined on the General tab. In addition, the Data Name and Data Units defined on the General tab are used in the column header in the results table and the y-axis label in the plot. Data in the frequency curve table can be re-sorted. Click the **Percent Chance Exceedance** column header (two mouse clicks are required the first time). The percent chance exceedance ordinates, along with frequency values, will sort so that the lowest values are on top or the highest values are on top.

Chapter 9 - Performing a Coincident Frequency Analysis

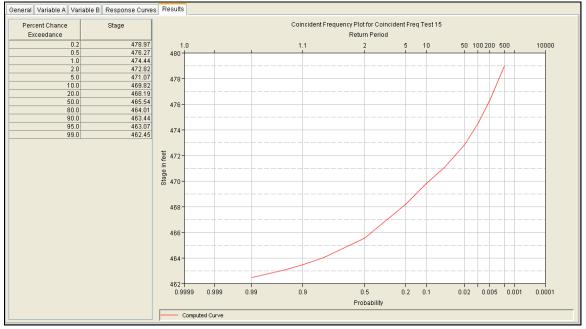


Figure 9-12. Results Tab of the Coincident Frequency Analysis Editor.

Viewing and Printing Results

The user can view output for the coincident frequency analysis directly from the Coincident Frequency Analysis editor (tabular and graphical output) or by using the buttons at the bottom of the editor.

Tabular Output

Once the computations for the coincident frequency analysis are completed, the user can view tabular output by selecting the **Results** tab. The tabular results can be printed by using the **Print** button at the bottom of the coincident frequency analysis 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. Result tables can also be created from the **Results** menu. At least one coincident frequency analysis must be selected in the study explorer before selecting the **Results→Table** option.

Graphical Output

Graphical output of the coincident frequency analysis can be obtained by selecting either the **Results** tab, or by pressing the **Plot** button at the bottom of the coincident frequency analysis editor. When the Plot button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 9-13. Result graphs can also be created from the **Results** menu. At least one coincident frequency analysis must be selected in the study explorer before selecting the **Results** \rightarrow **Graph** option. Results will be graphed in the same plot if multiple coincident frequency analyses are selected in the study explorer when opening a graph from the **Results** menu.

The coincident 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 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.

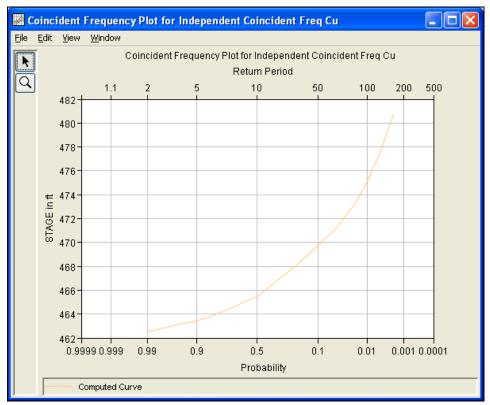


Figure 9-13. Coincident Frequency Analysis Plot.

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 shortcut menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the xaxis. 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 is used for developing plots in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

Viewing the Report File

A report file is created when the coincident frequency analysis computations are performed. The report file lists the input data, user settings, 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 Coincident Frequency Analysis editor. When this button is pressed, a window will appear containing the report as shown in Figure 9-14.

HEC-SSP User's Manual

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Figure 9-14. Coincident Frequency Analysis Report File.

CHAPTER 10

Performing a Curve Combination Analysis

The Curve Combination analysis provides a tool for combining frequency curves (and confidence limits) from multiple sources. One example is shown in Figure 10-1. This example includes observed historic measurements of annual maximum stage, results from a hydrology model, and an estimate of the maximum stage from the probable maximum flood. The curve combination tool can be used to develop one frequency curve that combines all these sources of information.

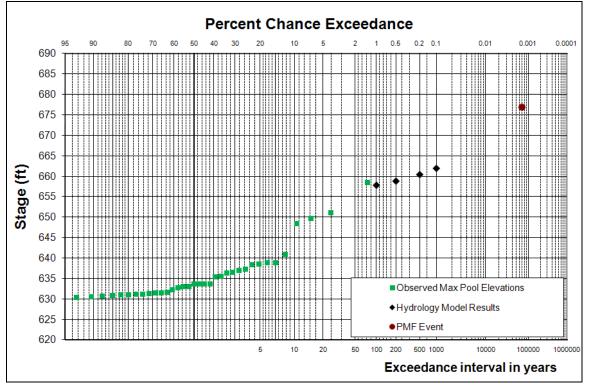


Figure 10-1. Example of Data used in a Curve Combination Analysis.

Contents

- Starting a New Analysis
- General Settings
- Frequency Curves
- Confidence Limits
- Viewing and Printing Results

Starting a New Analysis

A curve combination analysis can be started in two ways, either by right clicking on the Curve Combination Analysis folder in the study explorer and selecting **New**, or by going to the **Analysis** menu and selecting **New** and then **Curve Combination Analysis**. When a new curve combination analysis is selected, the Curve Combination Analysis editor will appear as shown in 10-2.

🞇 Curve Combination Analysis Editor -		
Name: Description: DSS File Name: Report File:		
General Frequency Curves Confidence Li Number of Curves		User Specified Frequency Ordinates Use Values from Table Below Frequency in Percent 0.00001 0.1 0.2 0.5 1.0 2.0 5.0 10.0 5.0 10.0 5.0 10.0 5.0 10.0 90.0 90.0 90.0 99.0
Compute Plot	View Report SPrint	OK Cancel Apply

Figure 10-2. Curve Combination Analysis Editor.

The user is required to enter a **Name** for the analysis, while a **Description** is optional. Once a Name is entered, 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

Once the analysis name has been entered, the user can begin to perform the analysis. Contained on the Curve Combination Analysis editor are four tabs. The tabs are labeled **General**, **Frequency Curves**, **Confidence Limits**, and **Results**. The first tab contains general settings for performing the curve combination analysis (Figure 10-2). These settings include:

- Number of Curves
- Output Labeling
- Data Type
- Y-Axis Scale
- Confidence Limits Method
- Frequency of PMF
- Confidence Limits
- User Specified Frequency Ordinates

Number of Curves

This option lets the user choose the number of frequency curves to combine. Both the Frequency Curves and Confidence Limits tabs will update based on the number of curves.



Output Labeling

This option allows the user to enter labels for data contained in the

-Output Label	ing
Data Name	stage
Data Units	feet

output tables and plots. The user must enter the name of the data as well as the data units. The output labeling does not result in the conversion of data

from one unit system to another; it only affects what is displayed on table headings and the y-axis of the results plot.

Data Type

The user is required to select the data type for the combined <u>frequency curve</u>; the options are **Flow** and **Stage**. This is required for

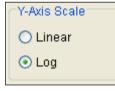
Data Type
🔘 Flow
💿 Stage

the Order Statistics method to compute the confidence limits, different equations are used depending on the data type. Developing confidence limits for graphical frequency curves and the order statistics method is discussed in ETL 1110-2-537. If the data is not flow or stage,

select the **Flow** data type when the graphical frequency curve is approximately analytic for extreme probabilities (frequency curve is not relatively flat for extreme probabilities). Select the **Stage** data type when the graphical frequency curve is relatively flat for extreme probabilities (ETL 1110-2-537).

Y-Axis Scale

This option allows the user to choose the scale of the Y-axis in the



curve combination plot. The options are **Linear** and **Log**.

Confidence Limits Method

This option lets the user choose the method for computing the confidence limits around the combined frequency curve. The options include **None**, **User Defined Confidence Limits**, **User Defined Weights**, and **Order Statistics**.

Confidence Limits Method
○ None
O User Defined Confidence Limits
O User Defined Weights
 Order Statistics

None. When the None option is selected, the Confidence Limits tab will become disabled and the program will only compute the combined frequency curve.

User Defined Confidence Limits. When the User Defined Confidence Limits option is select, the Confidence Limits tab will become disabled and the Upper and Lower Confidence Limits columns in the table on the Results tab will become enabled. The user can manually enter the confidence limits into this table and the program will plot the curves along with the combined frequency curve when the compute button is pressed. The user must specify an upper and lower confidence limit value for each ordinate in the table on the Results tab before pressing the compute button.

User Defined Weights. When the User Defined Weights option is selected, the Confidents Limits panel on the General tab becomes active as well as the Confidence Limits tab. The Confidence Limits tab provides tables for defining the upper and lower confidence limits for each frequency curve in the analysis. The user can select the confidence limits from an existing analysis, define the limits manually, or have HEC-SSP compute them using the order statistics method. After the confidence limits have been defined, the user must provide a weight for each pair of confidence limits. The program uses the weight for computing the combined confidence limits.

Order Statistics. When the Order Statistics option is selected, the Confidents Limits panel on the General tab becomes active as well as the Confidence Limits tab. The Confidence Limits tab is used to compute the confidence limits using the order statistics method. The order statistics method is described in ETL 1110-2-537.

Frequency of PMF

This option provides a tool for estimating the frequency of the Probable Maximum Flood (PMF) using regional precipitation. The method scales the probability of the PMF by comparing the Probable Maximum Precipitation (PMP) to the largest observed regional historical precipitation and using an established institutional range of probabilities for the PMF. By utilizing regional precipitation data, this procedure inherently includes the effects of regional weather patterns, distance from moisture sources, orographic effects, etc. In areas where the largest observed regional historical precipitation has approached the PMP, the method would yield a probability towards the more frequent end of the established institutional range. Likewise, in areas where the largest observed regional historical precipitation is much lower than the PMP, the probability of the PMF would tend towards the less frequent end of the established institutional range.

This option is not necessary in order to use the Curve Combination analysis to combine frequency curves. It was added to assist users when developing frequency curves that included estimates of the PMF. The user must check the box, **Estimate Frequency of PMF using Regional Precipitation**, to use this tool to estimate the probability of the PMF. Before the **Compute Frequency of PMF** button can be pressed, the user must enter the PMP depth, the maximum regional historic precipitation, and probabilities for the low and high ends of the established range of the PMF. The frequency of the PMF, estimated with this tool, should be multiplied by 100 before entering it into the User Specified Frequency Ordinates table.

Frequency of PMF	
Estimate Frequency of PMF using Regional Precipitation	
PMP Depth (in)	27.2
Max Reg Precip (in)	19.5
Low End PMF Range (0.001)	0.0010
High End of PMF Range (0.0000001)	0.0000001
Compute Frequency of PMF	0.0000737

The following equation is used to calculate the probability of the PMF:

$$AEP = 10^{-[(1-Ratio)\times Range + Min.Value]}$$

where *Ratio* is the largest observed regional historical precipitation divided by the PMP, *Range* is the established institutional range for the probability of the PMF (for the US Army Corps of Engineers this is 10^{-3} to 10^{-7}), and *MinValue* is the minimum value of the established institutional range. When solving the equation, *Range* and *MinValue* are the exponents from the established institutional range. If the institutional range was 10^{-3} to 10^{-7} , then *Range* would be 4 and the *MinValue* would be 3.

Confidence Limits

Confidence limits provide a measure of the uncertainty in the computed value for a given exceedance probability. The computation

of confidence limits is an option defined in the **Confidence Limits Method** panel. The Confidence Limits panel is only active when the **User Defined Weights** or the **Order Statistics** method is selected. By default, HEC-SSP calculates the 90 percent confidence interval (i.e. the 5% and 95% confidence limits). The confidence limits must be entered

Confidence Limits	1
💿 Defaults (0.05, 0.95)	
O User Entered Values	
Upper Limit:	
Lower Limit:	

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

User Specified Frequency Ordinates

OUser Specified Frequency O	rdinates
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

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 0.00001, 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 shortcut 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.

Frequency Curves

The Frequency Curves tab is used to define the frequency curves and the user-defined weights used by the program to combine the curves into one frequency curve. As shown in Figure 10-3, the Frequency Curves tab contains a panel for each frequency curve; the number of frequency curves is defined on the General tab. The frequency curve ordinates in the Frequency in Percent column are defined on the General tab. The user has the option to enter the frequency curve manually or to pick an existing Bulletin 17B or General Frequency analysis. If an **Existing Study Analysis** is selected, the program uses the statistics from the selected analysis and computes the frequency curve that populates the table. The frequency curve will only be computed for those frequency ordinates included within the selected analysis. The program will not extrapolate frequency curve values. For example, if the selected Bulletin 17B analysis computed a frequency curve from 99 to 0.2 percent chance exceedance then values less than 0.2 percent chance exceedance will not be populated in the curve combination analysis. The user can always add additional frequency ordinates to a Bulletin 17B or General Frequency analysis if needed. If Manual Entry is selected, then the user can enter frequency curve values for a few or all the frequency curve ordinates. The user must also enter the weights used to combine the frequency curves. Finally, the equivalent years of record must be defined when using the order statistics method to compute the confidence limits.

The program will import the years of record from the selected analysis when the **Existing Study Analysis** option is selected. The user must manually enter the equivalent years of record when the **Manual Entry** option is selected.

As shown in Figure 10-3, the frequency curves do not have to have a value for each ordinate; however, each frequency curve ordinate must have at least one frequency curve value. In addition, a user-defined weight does not have to be entered for each frequency curve value; however, the weights for a frequency curve ordinate must sum to 1.

The Plot Curves button will open a graph showing all frequency curves defined on the frequency curves tab, as show in Figure 10-4.

General Frequency Cu	urves Confidence Limi	its Results						
Specify Frequency Curve 1 Specify Frequency Curve 2								
🔘 Manual Entry	Manual Entry Manual Entry							
 Existing Study Anal 	ysis			O Existing Study Anal	ysis			
17B bald each creek int	flows		*				~	
Equivalent Years of Re	Equivalent Years of Record 57			Equivalent Years of Record 10				
Frequency in Percent	Frequency Curve	Weight		Frequency in Percent	Frequency Curve	Weight		
0.1	56,189.570		0.2	0.1	51,000.000	0.	.8	
0.2	48,883.434		0.2	0.2	44,200.000	0.	.8	
0.5	40,216.547		0.2	0.5	36,200.000	0.		
1.0	34,337.543		0.5	1.0	30,800.000	0.	.5	
2.0	28,981.055		1.0	2.0				
5.0	22,606.697		1.0	5.0				
10.0	18,238.400		1.0	10.0			-1	
20.0	14,168.021		1.0	20.0			_	
50.0	8,937.897		1.0	50.0			_	
80.0	5,803.284		1.0	80.0			-	
90.0	4,682.909		1.0	90.0			-	
95.0	3,945.176 2,899.741		1.0	99.0			-1	
Plot Curves								

Figure 10-3. Curve Combination Analysis Frequency Curves Tab.

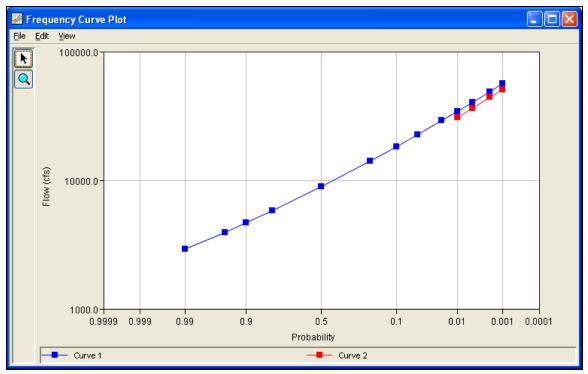


Figure 10-4. Plot of Frequency Curves Defined on the Frequency Curves Tab.

Confidence Limits

The Confidence Limits tab is used to define the confidence limits and the user-defined weights used by the program to combine the confidence limits into one pair of upper and lower confidence limits. The confidence limits tab will change based on the **Confidence Limits Method** selected on the General Tab.

The Confidence Limits tab will look similar to Figure 10-5 when the User Defined Weights option is selected on the General tab. The Confidence Limits tab contains a panel for each frequency curve; the number of frequency curves is defined on the General tab. The frequency curve ordinates in the Frequency in Percent column are defined on the General tab. The user has the option to enter the confidence limits manually, compute the confidence limits using the order statistics method, or pick an existing Bulletin 17B or General Frequency analysis. If Manual Entry is selected, then the user can enter confidence limits values for a few or all the frequency curve ordinates. If Compute using Order Statistics Method is selected, then the Compute Confidence Limits button will become active. When this button is pressed, the program will compute the upper and lower confidence limits using the order statistics method (and the equivalent years of record defined on the Frequency Curves tab) and automatically populate the table. If Existing Study Analysis is

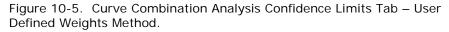
selected, the program uses the statistics from the selected analysis and computes the confidence limits that populate the table. The confidence limits will only be computed for those frequency ordinates included within the selected analysis. The program will not extrapolate confidence limits values. For example, if the selected Bulletin 17B analysis computed a frequency curve from 99 to 0.2 percent chance exceedance then values less than 0.2 percent chance exceedance will not be populated in the curve combination analysis. The user can always add additional frequency ordinates to a Bulletin 17B or General Frequency analysis if needed. The user must enter the weights used to combine the confidence limits. The **Import Weights from Frequency Curves Tab** button will import the same weights as defined on the **Frequency Curves** tab.

As shown in Figure 10-5, the confidence limits do not have to have a value for each ordinate; however, each frequency curve ordinate must have at least one upper and lower confidence limits value. In addition, a user-defined weight does not have to be entered for each upper and lower confidence limits pair; however, the weights for a frequency curve ordinate must sum to 1.

The Confidence Limits tab will look similar to Figure 10-6 when the **Order Statistics** option is selected on the General tab. The user must enter an equivalent years of record for each frequency ordinate. The program will compute the combined frequency curve and then the confidence limits using the order statistics method when the **Compute Confidence Limits** button is pressed. As shown in Figure 10-6, the upper and lower confidence limits will be populated in the table and a plot is created showing the combined frequency curve along with the computed confidence limits.

HEC-SSP User's Manual

General Frequency Curves Confidence Limits Results									
Specify Frequency Cu	urve 1			Specify Frequency Curve 2					
🔘 Manual Entry					💿 Manual Entry				
O Compute using O	rder Statistics Method	ł			O Compute using C	order Statistics Metho	bd		
Existing Study Ana	alysis				O Existing Study An	alysis			
Equivalent Years of Record	Equivalent Years 57					Equivalent Years 25 of Record			
Compute Confide	ince Limits				Compute Confide	ence Limits			
Percent Chance Exceedance	Upper Confidence Limits	Lower Confidence Limits	Weight (0.0 to 1.0)		Percent Chance Exceedance	Upper Confidence Limits	Lower Confidence Limits	Weight (0.0 to 1.0)	
0.1	80330	43006	0.2		0.1	70125	41000		0.8
0.2	68235	38055	0.2		0.2	60775	37500		0.8
0.5	54314	32048	0.2		0.5	49775	29100		0.8
0.75	48851	29577	0.5		0.75	42500	25000		0.5
1.0	45175	27870	1.0		1.0				
2.0	37097	23974	1.0		2.0				
5.0	27850	19194	1.0		5.0				
10.0	21795	15795	1.0		10.0				/
20.0	16420	12494	1.0		20.0				
50.0	10045 6585	7945	<u> </u>		50.0 80.0				
90.0	5396	3932	1.0		90.0				
95.0	4615	3332	1.0		95.0				
99.0	3501	2269	1.0		99.0				
Import Weights from	Frequency Curves T	ab							



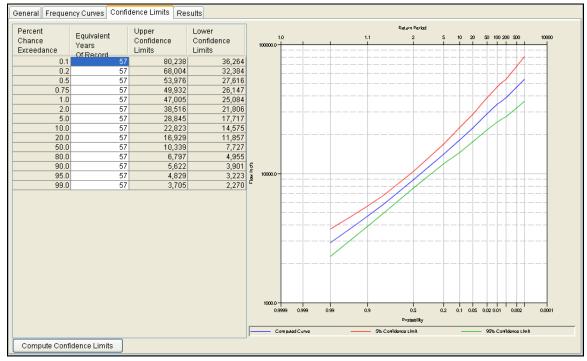


Figure 10-6. Curve Combination Analysis Confidence Limits Tab - Order Statistics Method.

Compute

Once the new analysis has been defined, and the user has all of the information defined on the General, Frequency Curves, and Confidence Limits tabs, performing the computation is simply a matter of pressing the **Compute** button at the bottom of the Curve Combination Analysis editor. 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.

Multiple curve combination analyses can be computed using the **Compute Manager**. Select the **Analysis**-**Compute Manager** menu option to open the Compute Manager. Select the analyses to be computed and then press the **Compute** button. Close the compute dialogs and Compute Manager when the program finished computing the analyses.

Results

This section describes results that are available for the Curve Combination analysis. When the user selects the **Results** tab on the Curve Combination Analysis editor, the window will appear as shown in Figure 10-7. Both tabular and graphical results are included. The percent chance exceedance ordinates are the same as those defined on the General tab. In addition, the Data Name and Data Units defined on the General tab are used in the y-axis label in the plot. The user must enter the upper and lower confidence limits when the User **Defined Confidence Limits** option is selected on the General tab; otherwise, the program computes the confidence limits when the compute button is pressed. Data in the frequency curve table can be re-sorted. Click the Percent Chance Exceedance column header (two mouse clicks are required the first time). The percent chance exceedance ordinates, along with frequency curve and confidence limits values, will sort so that the lowest values are on top or the highest values are on top.



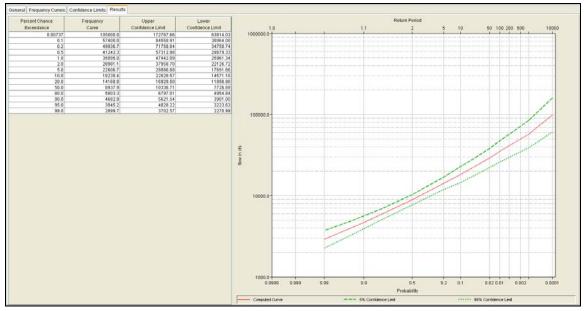


Figure 10-7. Results Tab of the Curve Combination Analysis Editor.

Viewing and Printing Results

The user can view output for the curve combination analysis directly from the Curve Combination Analysis editor (tabular and graphical output) or by using the buttons at the bottom of the editor.

Tabular Output

Once the computations for the curve combination analysis are completed, the user can view tabular output by selecting the **Results** tab. The tabular results can be printed by using the **Print** button at the bottom of the curve combination analysis 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. Result tables can also be opened from the **Results** menu. At least one curve combination analysis must be selected in the study explorer before selecting the **Results→Table** option.

Graphical Output

Graphical output of the curve combination analysis can be obtained by selecting either the **Results** tab, or by pressing the **Plot** button at the bottom of the curve combination analysis editor. When the Plot button is pressed, a frequency curve plot will appear in a separate window as shown in Figure 10-8. Result graphs can also be created from the **Results** menu. At least one curve combination analysis must be selected in the study explorer before selecting the **Results** \rightarrow **Graph** option. Results will be graphed in the same plot if multiple curve

combination analyses are selected in the study explorer when opening a graph from the **Results** menu.

The curve combination 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 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.

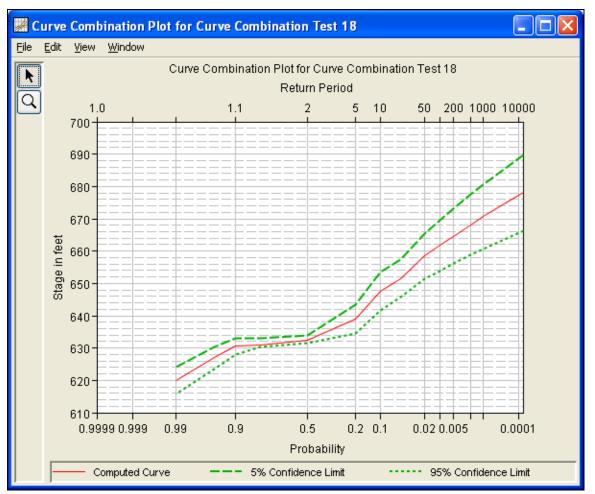


Figure 10-8. Curve Combination Analysis Plot.

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 shortcut menu will appear with further customizing options when the user right-clicks on a line on the graph or the legend. Both the Y and X-axis properties can be edited by placing the mouse on top of axis and clicking the right mouse button. Then select the **Edit Properties** menu option in the shortcut menu. For example, the user can turn on minor tic marks for the y-axis and modify the minimum and maximum scale for the xaxis. 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 is used for developing plots in HEC-DSSVue and several other HEC software programs. Please refer to the HEC-DSSVue User's Manual for details on customizing plots.

Viewing the Report File

A report file is created when the curve combination analysis computations are performed. The report file lists the input data, user settings, 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 Curve Combination Analysis editor. When this button is pressed, a window will appear containing the report as shown in Figure 10-9.

curve_comb_test.rpt							
Elle Edit Search Format							
File: C:\Documents and Settings\q0hecmjtDesktop\ssp\Curve Combination\curve_combination\CurveCobinationAnalysis\curve_comb_test\curve_comb_test.rp							
Input Data -							^
Analysis Name: c	www.ac.b.t.at						
Description:	urve comb test						
Project Path: C:						nation ombination\CurveCobins	ti an àn a la
						ombination\CurveCobins ombination\CurveCobins	
Repute Tite Adme		und seconnys,	doucow)r (bepweeb	(DDp)Carte comb.	inderen,earec_ee		icioinaidi j
DSS File Name: C	:\Documents and	Settings\q0h	ecmjf\Desktop\ss	p∖Curve Combinat	tion\curve_combi	ination\curve_combinat	tion.dss
Di		A					
Display ordinate	e values using 4	digits in fr	action part or v	aiue			
							_
Frequency	Ordinate	Ordinate	Upper		Confidence		
Percent		Weight	Confidence Limit	Confidence Limit	Weight		
	ا ا				 		
0.0001292							
0.1000000	56,189.5703	0.2	80,329.5391	43,005.8984	0.2		
0.2000000							
0.5000000	40,216.5469						
1.0000000							
2.0000000	28,981.0547						
5.0000000	22,606.6973						
10.0000000							
20.0000000	14,168.0205		16,419.9316				
50.0000000 80.0000000	8,937.8975						
90.0000000	5,803.2837 4,682.9087		5,395.6274				
95.0000000	3,945.1755						
99.0000000	2,899.7412						
-							
			1				~
					59:9059:9	10 5	59:90

Figure 10-9. Curve Combination Analysis Report File.

APPENDIX 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 Engineering Center, December 1996. STATS, Statistical Analysis of Time Series Data, User's Manual.

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

U.S. Army Corps of Engineers, Uncertainty Estimates for Nonanalystic Frequency Curves, ETL 1110-2-537. October 1997, Washington, D.C.

APPENDIX 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 Frequency Analysis, Maximum Flows.
- 11. Volume Frequency Analysis, Minimum Flows.
- 12. Duration Analysis, Bin (STATS) Method.
- 13. Duration Analysis, Rank All Data Method.
- 14. Duration Analysis, Manual Entry.
- 15. Coincident Frequency Analysis, A and B can be Assumed Independent.
- 16. Coincident Frequency Analysis, A and B can not be Assumed Independent.
- 17. Curve Combination Analysis, Combine Flow Frequency Curves.
- 18. Curve Combination Analysis, Combine Stage Frequency Curves.

When the "SSP Examples" study file is open, the screen will appear as shown in Figure B-1. There are six Bulletin 17B analyses, nine General Frequency analyses, two Volume Frequency analyses, three Duration analyses, two Coincidence Frequency analyses, and two Curve Combination analyses in this study. The following sections document each of the example data sets.

HEC-SSP User's Manual

Appendix B – Example Data Sets

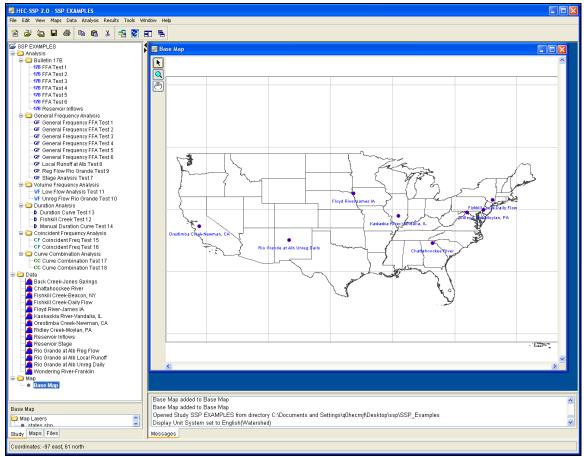


Figure B-1. SSP Examples Study.

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, NY**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-2.

🔥 /FISHKILL CREEK/BEACON/FLOW/ 🔳 🗖 🔀							
<u>F</u> ile <u>E</u> dit <u>V</u> iew							
Ordinate	Date	Time	BEACON FLOW OBS				
Units			cfs				
Туре			INST-VAL				
1	05 Mar 1945	12:00	2,290.0				
2	27 Dec 1945	12:00	1,470.0				
3	14 Mar 1947	24:00	2,220.0				
4	18 Mar 1948	24:00	2,970.0				
5	01 Jan 1949	24:00	3,020.0				
6	09 Mar 1950	12:00	1,210.0				
7	01 Apr 1951	12:00	2,490.0				
8	12 Mar 1952	12:00	3,170.0				
9	25 Jan 1953	12:00	3,220.0				
10	13 Sep 1954	12:00	1,760.0				
11	20 Aug 1955	12:00	8,800.0				
12	16 Oct 1955	12:00	8,280.0				
13	10 Apr 1957	12:00	1,310.0				
14	21 Dec 1957	12:00	2,500.0				
15	11 Feb 1959	12:00	1,960.0				
16	06 Apr 1960	12:00	2,140.0				
17	26 Feb 1961	12:00	4,340.0				
18	13 Mar 1962	12:00	3,060.0				
19	28 Mar 1963	12:00	1,780.0				
20	26 Jan 1964	12:00	1,380.0				
21	09 Feb 1965	12:00	980.0				
22	15 Feb 1966	12:00	1,040.0				
23	30 Mar 1967	12:00	1,580.0				
24	19 Mar 1968	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.

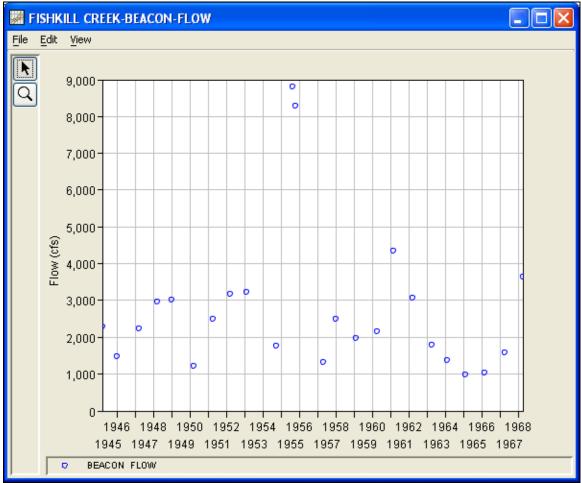


Figure B-3. Plot of the Fishkill Creek Data.

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 E	iditor - FFA Test 1			
Name: Description:	FFA Test 1 WRC Appendix 12, Example 1 - Fitting	who has Deeveen Tune III District the		
Flow Data Set:	Fishkill Creek-Beacon, NY) the Log-Pearson Type III Distribution		
DSS File Name:		NDesktop\ssp\SSP_Examples\SSP_EXAM	PLES das	
Report File:		NDesktop\ssp\SSP_Examples\Bulletin17b		
General Option	s Tabular Results			
⊂Generalized Sk		⊂ Plotting Position	⊂ Confidence Limits	
🔿 Use Stati	on Skew	• Weibull (A and B = 0)	 Defaults (0.05, 0.95) 	
💿 Use Weig	ghted Skew	O Median (A and B = 0.3)	O User Entered Values	
🔿 Use Req	ional Skew	O Hazen (A and B = 0.5)	Upper Limit:	0
Region	al Skew: 0.6	O Other (Specify A, B)	Lower Limit:	0
Reg. Sł	kew MSE: 0.302	Plotting position computed using formula		
		(m-A)/(n+1-A-B)	Time Window Modification	
Expected Prob	ablity Curve	Where: m=Rank, 1=Largest	DSS Range is 05MAR1945 - 19MAR196	
💿 Compute E	Expected Prob. Curve	N=Number of Years A,B=Constants	Start Date	
🔿 Do Not Co	mpute Expected Prob. Curve	A: 0	End Date	
		B: 0		
Comp	oute Plot Curve View Rep	port 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 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.

HEC-SSP User's Manual

📈 Bulletin 17B E	ditor - FFA Test 1*				
Name:	FFA Test 1				
Description:	WRC Appendix 12, Examp	ole 1 - Fitting the Log-Pearson 1	ype III Distribution		
Flow Data Set:	Fishkill Creek-Beacon, N	(~
DSS File Name:	C:\Documents and Setting	gs\q0hecmjf\Desktop\ssp\SSP_	_Examples\SSP_EXAMPLES.	dss	
Report File:	C:\Documents and Setting	gs\q0hecmjf\Desktop\ssp\SSP_	_Examples\Bulletin17bResult	ts\FFA_Test_1\FFA_Test_1.rpt	
General Option	^S Tabular Results				^
Low Outlier Thi	eshold w Outlier Threshold 0	Historic Period Data Use Historic Data Historic Period Start Year: End Year: Override High Outlier Three Historic Water Year		User Specified Frequency Ordinates Use Values from Table Below Frequency in Percent 0.2 0.5 1.0 2.0 5.0 10.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	
Comp	ute 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 open stating **Compute Complete**. Close this window and then select the **Tabular Results** tab. The analysis window should look like Figure B-6.

Name:	FFA Test 1				FFA Test 1						
Description:	WRC Appendix 1:	2, Example 1 - Fitting the Log-P	earson Ty	pe III Distribution							
Flow Data Set:	Fishkill Creek-Be	acon. NY				•					
DSS File Name:		nd Settings\q0hecmjf\Desktop\s		vomplool000 EVAMDLES	'dee						
	obotamento a										
Report File:	C:\Documents ar	nd Settings\q0hecmjf\Desktop\s	sp\SSP_E	xamples\Bulletin17bResu	Its\FFA_Test_1\FFA_Test_1	.rpt					
General Option	ns Tabular Result	s									
		Frequency C	urve for: Fis	shkill Creek-Beacon, NY							
Percent		Computed Curve		ected Prob.	Confidence Li Flow in cfs						
Exceeda	nce	Flow in cfs	Flov	wincfs	0.05	0.95					
	0.2	18828		27494	38021	12103					
	0.5	14215		18603	26365	9605					
	1.0	11388		13910	19773	7995					
	2.0	9031		10419	14656	6589					
	5.0	6506		7058	9635	4993					
	10.0	4959		5206	6847	3946					
	20.0	3657			4721 2660	2996 1796					
	80.0	1438			1760	1798					
	90.0	1192		1163	1485	880					
	95.0	1038		1000	1313	741					
	99.0	830		778	1083	559					
	Syster	n Statistics			Number of Events						
	Log Tra	nsform: Flow		Event		Number					
9	Statistic	Value		Historic Events		0					
Mean			3.368	High Outliers Low Outliers		0					
Standard Dev 0.246			Zero Or Missing		0						
Station Skew 0.730		Systematic Events		24							
Regional Skew Weighted Skew			0.600	Historic Period							
Adopted Skew			0.668								

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.

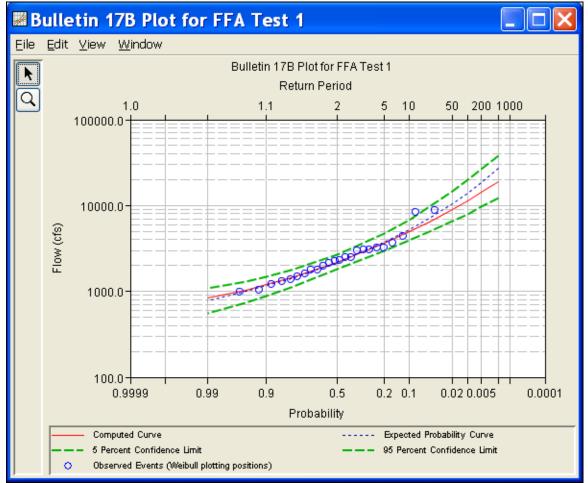


Figure B-7. Plotted Frequency Curves for Test Example 1.

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.

```
FFA_Test_1.rpt
                                                                                                   ×
<u>File Edit Search Format</u>
File: C:\Documents and Settings\g0hecmjf\Desktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_1\FFA_Test_1.rpt
                                                                                                  ^
 Bulletin 17B Frequency Analysis
    14 Sep 2010 01:30 PM
            _____
 --- Input Data ---
 Analysis Name: FFA Test l
 Description: WRC Appendix 12, Example 1 - Fitting the Log-Pearson Type III Distribution
 Fishkill Creek at Beacon, NY
 Data Set Name: Fishkill Creek-Beacon, NY
 DSS File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss
 DSS Pathname: /FISHKILL CREEK/BEACON/FLOW/Oljan1900/IR-CENTURY/OBS/
 Report File Name: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResu
 XML File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResults'
 Start Date:
 End Date:
 Skew Option: Use Weighted Skew
 Regional Skew: 0.6
 Regional Skew MSE: 0.302
 Plotting Position Type: Weibull
 Upper Confidence Level: 0.05
 Lower Confidence Level: 0.95
 Display ordinate values using 1 digits in fraction part of value
 --- End of Input Data ---
 << High Outlier Test >>
  Based on 24 events, 10 percent outlier test deviate \mathrm{K}(\mathrm{N}) = 2.467
                       Computed high outlier test value = 9,424.96
         0 high outlier(s) identified above test value of 9,424.96
 << Low Outlier Test >>
  Based on 24 events, 10 percent outlier test deviate K(N) = 2.467
                           Computed low outlier test value = 578.66
            O low outlier(s) identified below test value of 578.66
                                                                                                  ~
                                                                                               >
                                                                  1:1..1:1
                                                                                           1:1
```

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" in the study explorer and then select Tabulate. The data will appear as shown in Figure B-9.

👙 /FLOYD RIVER	JAMES IA/FLOW	/01JA 🔳 🗖	X
<u>File E</u> dit <u>V</u> iew			
		JAMES IA	
Ordinate	Date / Time	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	1
34	21 Jul 68 12:00	829	
35	05 Apr 69 12:00	17,300	1
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.

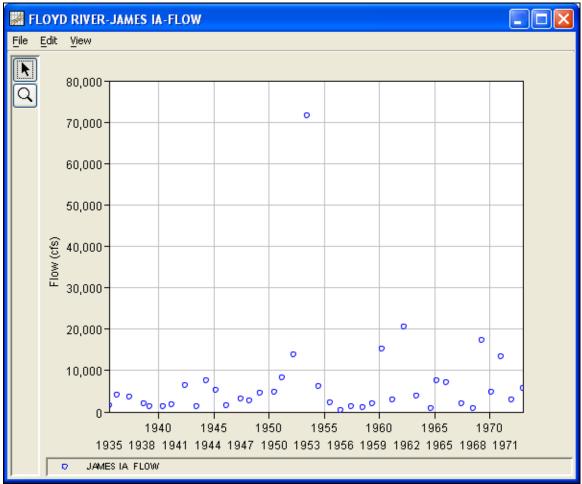


Figure B-10. Plot of Floyd River Data

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.

HEC-SSP User's Manual

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 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.

HEC-SSP User's Manual

📈 Bulletin 17B I	ditor - FFA Test 2*				
Name:	FFA Test 2				
Description:	WRC Appendix 12, Exam	ple 2 - Adjusting for a high outlier			
Flow Data Set:	Floyd River-James IA				~
DSS File Name:	C:\Documents and Settin	igs\q0hecmjf\Desktop\ssp\SSP_Ex	amples\SSP_EXAMPLES.ds	35	
Report File:	C:\Documents and Settin	igs\q0hecmjf\Desktop\ssp\SSP_Ex	amples\Bulletin17bResults\I	FFA_Test_2\FFA_Test_2.rpt	
General Option	S Tabular Results				^
Low Outlier Th	reshold w Outlier Threshold 0	Historic Period Data Use Historic Data Historic Period Start Year: End Year: Override High Outlier Threshold Historic Ev Water Year		1 1 2 5 8 9 9	
Com	oute 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 un-checking 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 open stating **Compute Complete.** Close this window and then select the **Tabular Results** tab. The analysis window should look like Figure B-13.

Bulletin 17B B	iditor - FFA Test	2						
Name:	FFA Test 2	FFA Test 2						
Description:	WRC Appendix 12	, Example 2 - Adjusting for a	high outlier					
Flow Data Set:	Floyd River-James	s IA						
DSS File Name:		d Settings\q0hecmjf\Desktop	eenicop E	vemplee)990 EVAMDI E	2 dec			
Report File:								
Report File.	C:\Documents and	ocuments and Settings\q0hecmjf\Desktop\Ssp\SSP_Examples\Bulletin17bResults\FFA_Test_2\FFA_Test_2.rpt						
General Option	s Tabular Results							
		Frequenc	v Curve for:	Floyd River-James IA				
					Confidence	Limits		
Percent C Exceedar		Computed Curve Flow in cfs		ected Prob. w in cfs	Flow in	cfs		
Exceedan	ice	FIOW III CIS	FIU	will clo	0.05	0.95		
	0.2	68690		87684	146181	40257		
	0.5	49600		59583	98492	30413		
	1.0	37981 28425		43796 31614	71334 50327	24142		
	5.0	18470			30068	12842		
	10.0	12638	13725		19215	9149		
	20.0	8018			11354	6026		
	50.0	3404			4458	2596		
	80.0	1471	1442		1958	1038		
	90.0	955			1318	630		
	95.0	671		632	961	418		
	99.0	349		308	542	190		
	System	n Statistics			Number of Events			
	Log Trar	isform: Flow		Event		Number		
S	tatistic	Value		Historic Events		(
Mean			3.537	High Outliers		· · · · · · · · · · · · · · · · · · ·		
Standard Dev 0.438		Low Outliers		(
Station Skew 0.165		Zero Or Missing Systematic Events		39				
Regional Skew			-0.300	Historic Period				
Weighted Skew Adopted Skew			0.075 0.075					
Comp	oute Plot Cui	ve View Report	Print		ОК	Cancel Apply		

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

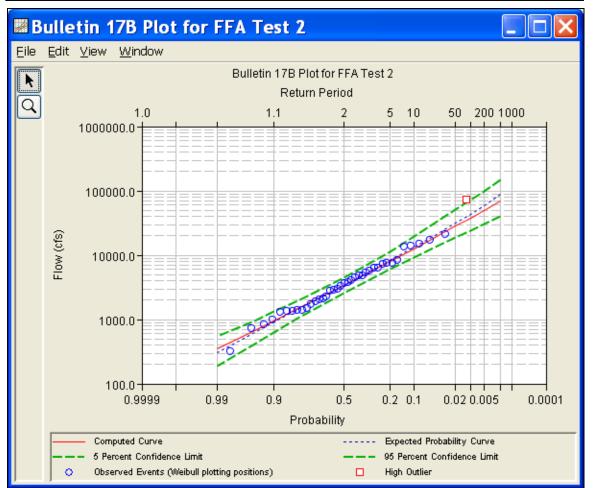
Computed Curve (Log-Pearson III results)

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.



HEC-SSP User's Manual

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.

FFA_Test_2.rpt	
<u> E</u> ile <u>E</u> dit <u>S</u> earch F <u>o</u> rmat	
File: C:\Documents and Settings\g0he	ecmjftDesktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_2\FFA_Test_2.rpt
Bulletin 17B Frequency Analys	
14 Sep 2010 01:32 PM	510
Input Data	
Analysis Name: FFA Test 2	
Description: WRC Appendix 12, Floyd River at James, IA	, Example 2 - Adjusting for a high outlier
Floyd River at James, IA	
Data Set Name: Floyd River-Ja	
	and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss AMES IA/FLOW/Oljan1900/IR-CENTURY/OBS/
	ts and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResu; and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResults`
Start Date:	
End Date:	
Skew Option: Use Weighted Ske	ew
Regional Skew: -0.3 Regional Skew MSE: 0.302	
Plotting Position Type: Weibu	all
Upper Confidence Level: 0.05	
Lower Confidence Level: 0.95	
Use High Outlier Threshold High Outlier Threshold: 70000	0.0
Use Historic Data Historic Period Start Year: 1	1892
Historic Period End Year:	
Display ordinate values using	g l digits in fraction part of value
	· · ·
End of Input Data	
Preliminary Results	
<< Plotting Positions >> Floyd River-James IA	
Events Analyzed	Ordered Events
I FLOW I	Ordered Events Water FLOW Weibull Rank Year CFS Plot Pos
28 Jun 1935 1,460.0	1 1953 71,500.0* 2.50
10 Mar 1936 4,050.0 27 May 1937 3.570 0	2 1962 20,600.0 5.00 3 1969 17.300.0 7.50
15 Sep 1938 2,060.0	1 1953 71,500.0* 2.50 2 1962 20,600.0 5.00 3 1969 17,300.0 7.50 4 1960 15,100.0 10.00
<	
	1:1.1:1 1:1
Figure D 1	

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**" in the study pane and then select **Tabulate**. The data will appear as shown in Figure B-16.

🖆 /BACK CREEK/JONES SPRINGS, WV/F 🔳 🗖 🔀					
File Edit View					
		JONES SPRIN			
Ordinate	Date / Time	FLOW			
Units		CFS			
Туре		INST-VAL			
1	17 Apr 29 12:0				
2	23 Oct 29 12:0				
3	08 May 31 12:0				
4	04 Feb 39 12:0				
5	20 Apr 40 12:0	0 3,130			
6	06 Apr 41 12:0				
7	22 May 42 12:0	0 6,700			
8	15 Oct 42 12:0	0 22,400			
9	24 Mar 44 12:0	0 3,880			
10	18 Sep 45 12:0	0 8,050			
11	03 Jun 46 12:0	0 4,020			
12	15 Mar 47 12:0	0 1,600			
13	14 Apr 48 12:0	0 4,460			
14	31 Dec 48 12:0	0 4,230			
15	02 Feb 50 12:0	0 3,010			
16	05 Dec 50 12:0	0 9,150			
17	28 Apr 52 12:0	0 5,100			
18	22 Nov 52 12:0	0 9,820			
19	02 Mar 54 12:0	0 6,200			
20	19 Aug 55 12:0				
21	15 Mar 56 12:0				
22	10 Feb 57 12:0				
23	27 Mar 58 12:0				
24	03 Jun 59 12:0	0 6,800			
25	09 May 60 12:0	0 3,740			
26	19 Feb 61 12:0				
27	22 Mar 62 12:0				
28	20 Mar 63 12:0	0 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.

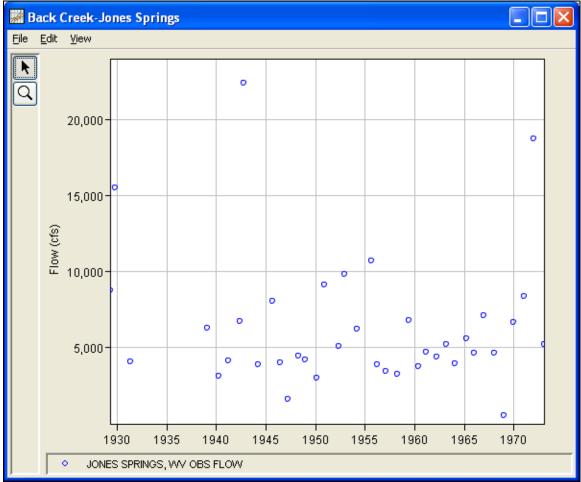


Figure B-17. Plot of Back Creek Data.

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.

HEC-SSP User's Manual

📈 Bulletin 17B E	iditor - FFA Test 3		
Name:	FFA Test 3		
Description:	WRC Appendix 12, Example 3 - Testir	ng and adjusting for a low outlier	
Flow Data Set:	Back Creek-Jones Springs		
DSS File Name:	C:\Documents and Settings\q0hecmjt	\Desktop\ssp\SSP_Examples\SSP_EXAMP	PLES.dss
Report File:	C:\Documents and Settings\q0hecmjt	\Desktop\ssp\SSP_Examples\Bulletin17bR	Results\FFA_Test_3\FFA_Test_3.rpt
General Option	s Tabular Results		
Generalized Sk	æw	Plotting Position	Confidence Limits
🔿 Use Statio	on Skew	• Weibull (A and B = 0)	⊙ Defaults (0.05, 0.95)
💿 Use Weig	ahted Skew	🔘 Median (A and B = 0.3)	O User Entered Values
O Use Regi		O Hazen (A and B = 0.5)	Upper Limit: 0
		Other (Specify A, B)	Lower Limit: 0
-		Plotting position computed	
Neg. JA	ew MSE: 0.302	using formula (m-A)/(n+1-A-B)	Time Window Modification
Expected Proba	ablity Curve	Where:	DSS Range is 17APR1929 - 01JAN1973
 Compute E 	Expected Prob. Curve	m=Rank, 1=Largest N=Number of Years	Start Date
	mpute Expected Prob. Curve	A,B=Constants	End Date
		A:0	
		B:0	
Comp	oute Plot Curve View Reg	port 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 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 F	ditor - 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				*
DSS File Name:	C:\Documents and Settings\q0h	hecmjflDesktop\ssp\SSP_Exam	ples\SSP_EXAMPLES.ds:	8	
Report File:	C:\Documents and Settings\q0h	hecmjflDesktop\ssp\SSP_Exam	ples\Bulletin17bResults\F	FA_Test_3\FFA_Test_3.rpt	
General Option	S Tabular Results				^
Low Outlier Thi	w Outlier Threshold	oric Period Data Use Historic Data istoric Period tart Year: nd Year: verride High Outlier Threshold: Historic Event Water Year	0 5 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 90.0 99.0 99.0	
Comp	ute Plot Curve Vie	w Report Print		OK Cancel Appl	y

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 open stating **Compute Complete.** Close this window and select the **Tabular Results** tab. The analysis window should look like Figure B-20.

Name:	FFA Test 3					
Description:	WRC Appendix	12, Example 3 - Testing and adj	justing for a	low outlier		(
low Data Set:	Back Creek-Jo	nes Springs				
) SS File Name:) -l	
		and Settings\q0hecmjf\Desktop\				(
Report File:	C:\Documents	and Settings\q0hecmjf\Desktop\	ssp\SSP_E	xamples\Bulletin17bResu	Ilts\FFA_Test_3\FFA_Test_	,3.rpt
General Option	is Tabular Resu	lits				
		Frequency C	urve for: Ba	ck Creek-Jones Springs		
Percent C	Chance	Computed Curve	Exp	ected Prob.	Confidence L	
Exceedar	nce	Flow in cfs		w in cfs	Flow in cf	
		274.60		45252	0.05	0.95
	0.2	37159 28934		45353	59928	2663: 2150
	1.0	23729		26457	34676	1814
	2.0	19266		20431	26933	15154
	5.0	14322			18852	1169
	10.0	11181			14053	938
	20.0	8449		8563	10157	726
	50.0	5238	5238		6045	4521
	80.0	3490			4070	2891
	90.0	2901		2856	3434	2334
	95.0 99.0	2524 2004		2466	3029	1982 1500
	Syst	em Statistics			Number of Events	
	Log T	ransform: Flow		Event		Number
Statistic Value			Historic Events			
Mean			3.741	High Outliers Low Outliers		
		0.232	Zero Or Missing			
Station Skew 0.624		Systematic Events		38		
Regional Skew			0.500	Historic Period		
Weighted Skew Adopted Skew			0.577 0.577			

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 one 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.

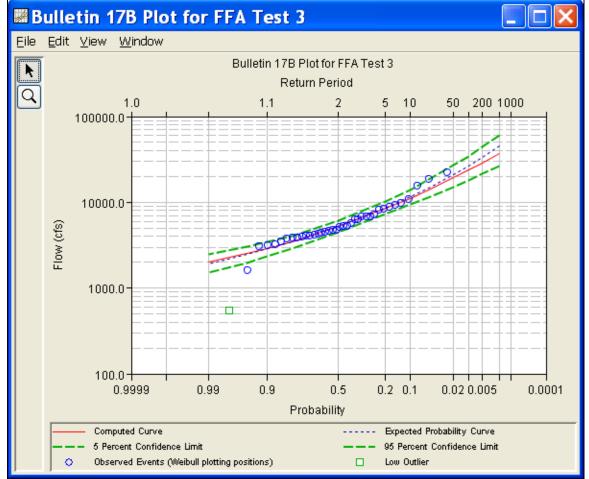


Figure B-21. Pot for Test Example 3.

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.

HEC-SSP User's Manual

Image: FFA_Test_3.rpt
Eile Edit Search Format
File: C:\Documents and Settings\q0hecmjfMy Documents\SSP Projects\SSP_Examples\Bulletin17bResults\FFA_Test_3\FFA_Test_3.rpt
Bulletin 17B Frequency Analysis 20 Jun 2008 04:16 PM
Input Data
Analysis Name: FFA Test 3 Description: WRC Appendix 12, Example 3 - Testing and adjusting for a low outlier Back Creek near Jones Spring, WV WRC Appendix 12, Example 3 - Testing and adjusting for a low outlier Back Creek near Jones Spring, WV
Data Set Name: BACK CREEK-JONES SPRINGS, WV-FLOW DSS File Name: C:\Documents and Settings\qOhecmjf\My Documents\SSP Projects\SSP_Examples\SSP_EXAMPLES.dss DSS Pathname: /BACK CREEK/JONES SPRINGS, WV/FLOW/Oljan1900/IR-CENTURY//
Report File Name: C:\Documents and Settings\qOhecmjf\My Documents\SSP Projects\SSP_Examples\Bulletin17bRe: XML File Name: C:\Documents and Settings\qOhecmjf\My Documents\SSP Projects\SSP_Examples\Bulletin17bResul
Start Date: End Date:
Skew Option: Use Weighted Skew Regional Skew: 0.5 Regional Skew MSE: 0.302
Plotting Position Type: Weibull
Upper Confidence Level: 0.05 Lower Confidence Level: 0.95
Display ordinate values using 0 digits in fraction part of value
End of Input Data
Preliminary Results
<< Skew Weighting >>
Based on 38 events, mean-square error of station skew = 0.197 Mean-square error of regional skew = 0.302
<< Frequency Curve >> BACK CREEK-JONES SPRINGS, WV-FLOW
Computed Expected Percent Confidence Limits Curve Probability Chance 0.05 0.95 FLOW, CFS Exceedance FLOW, CFS
I 27,933 31,314 0.2 I 43,279 20,460 I I 23,968 26,190 0.5 I 35,953 17,924 ✓
1:1.1:1 1:1

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**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-23.

🔹 /ORESTIMBA CREEK/NEWMAN, CA/FL 🔳 🗖 🔀							
<u>File Edit V</u> iew							
NEWMAN, CA							
Ordinate	Date / Time	FLOW					
Units		CFS					
Туре		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.

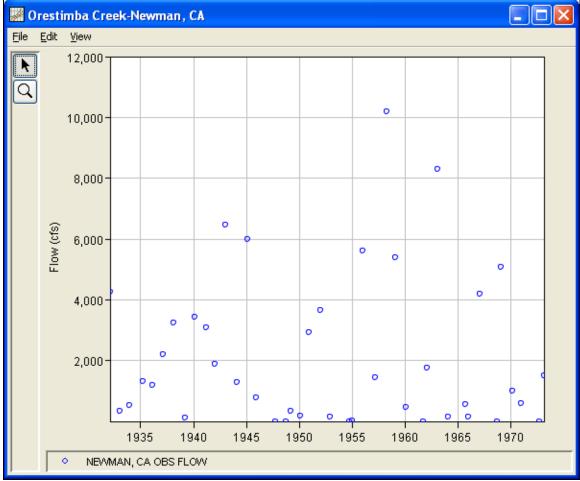


Figure B-24. Plot of Orestimba Creek Data.

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: Description: Flow Data Set: DSS File Name: Report File: General Option		mjfiDesktop\ssp\SSP_Examples\SSP_	EXAMPLES.dss tin17bResults\FFA_Test_4\FFA_Test_4.rpt	
O Use Region Region Reg. S Expected Prot ⊙ Compute	ion Skew ighted Skew gional Skew nal Skew: -0.3 kew MSE: 0.302	 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 B: 0 	Confidence Limits Defaults (0.05, 0.95) User Entered Values Upper Limit: Lower Limit: Time Window Modification DSS Range is 08FEB1932 - 11FEB193 Start Date End Date 	
Comp	ute Plot Curve View Re	eport 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 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.

HEC-SSP User's Manual

😹 Bulletin 17B E	ditor - FFA Test 4				
Name:	FFA Test 4				
Description:	WRC Appendix 12, Exan	nple 4 - Zero flood years			
Flow Data Set:	Orestimba Creek-Newn	ian, CA			~
DSS File Name:	C:\Documents and Setti	ngs\q0hecmjf\Desktop\ssp\SSP_Exa	imples\SSP_EXAMPLES.ds	s	
Report File:	C:\Documents and Setti	ngs\q0hecmjf\Desktop\ssp\SSP_Exa	mples\Bulletin17bResults\	FFA_Test_4\FFA_Test_4.rpt	
General Option:	S Tabular Results				^
Low Outlier Thr	eshold	Historic Period Data		User Specified Frequency Ordinates	
Override Lo	w Outlier Threshold	🔲 Use Historic Data		Use Values from Table Below	
Value	0			Frequency in Percent	
		Start Year:		0.2	
		End Year:		0.5	
		Override High Outlier Threshold	d:	2.0	
				10.0	≡
		Historic Eve		20.0	
		Water Year	Peak	80.0	
				90.0	
				99.0	
					~
Comp	ute Plot Curve	View Report Print		OK Cancel App	ly

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 open stating **Compute Complete.** Close this window and then select the **Tabular Results** tab. The analysis window should look Figure B-27.

🔏 Bulletin 17B E	ditor - FFA Te	st 4					
Name:	FFA Test 4						
Description:	WRC Appendix	WRC Appendix 12, Example 4 - Zero flood years					
Flow Data Set:	Orestimba Cre	ek-Newman, CA				~	
DSS File Name:	C:\Documents :	and Settings\g0hecmif\Desktop	Nssp\SSP E	xamples\SSP_EXAMPL	_ES.dss		
Report File:	C:\Documents :	and Settings\q0hecmjf\Desktop	I\ssp\SSP_E	xamples\Bulletin17bRe	esults\FFA_Test_4\FFA_T		
General Options	s Tabular Resu	lits					
		Frequency Cu	irve for: Ores	timba Creek-Newman,	CA		
Percent C		Computed Curve		ected Prob.		nce Limits rin cfs	
Exceedan	Le	Flow in cfs	FIO	wincfs —	0.05	0.95	
	0.2	32545		39023	80009		
	0.5	24623		28469	57347		
	1.0	19296		21763	42905		
	2.0	14572		16030	30754		
	5.0	9289		9920	18093		
	10.0	6041		6308	10955		
	20.0	3450		3534	5762		
	50.0	1043		1043	1559		
	80.0	266		257	404		
	90.0	121		<u> </u>	196		
	95.0 99.0	61 15		12	106		
	Curt	em Statistics	1		Number of Events		
		ransform: Flow		Event		Number	
St	tatistic	Value		Historic Events		0	
Mean			2.966	High Outliers		0	
Standard Dev 0.668			Low Outliers		1		
Station Skew -0.568			Zero Or Missing		6		
Regional Skew -0.300			Systematic Events		42		
Weighted Skew -0.473				Historic Period			
Adopted Skew -0.473							
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 six 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.

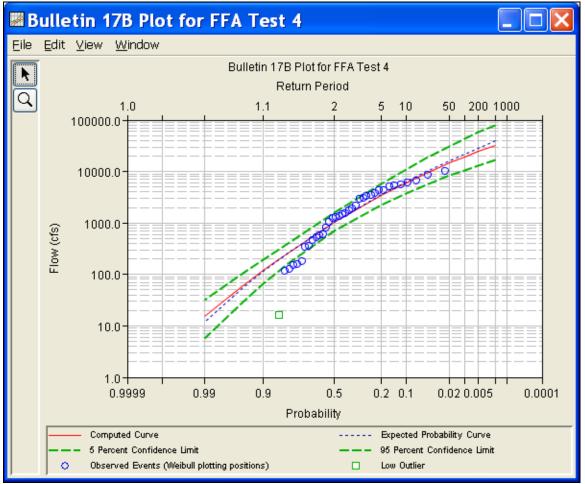


Figure B-28. Plot of Test Example 4 Results.

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.

```
FFA_Test_4.rpt
                                                                                                ×
<u>File Edit Search Format</u>
File: C:\Documents and Settings\g0hecmjf\Desktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_4\FFA_Test_4.rpt
                                                                                                ^
 Bulletin 17B Frequency Analysis
    14 Sep 2010 01:39 PM
           _____
 --- Input Data ---
 Analysis Name: FFA Test 4
 Description: WRC Appendix 12, Example 4 - Zero flood years
 Orestimba Creek near Newman, CA
 Data Set Name: Orestimba Creek-Newman, CA
 DSS File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss
 DSS Pathname: /ORESTIMBA CREEK/NEWMAN, CA/FLOW/Oljan1900/IR-CENTURY/OBS/
 Report File Name: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResu
 XML File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResults'
 Start Date:
 End Date:
 Skew Option: Use Weighted Skew
 Regional Skew: -0.3
 Regional Skew MSE: 0.302
 Plotting Position Type: Weibull
 Upper Confidence Level: 0.05
 Lower Confidence Level: 0.95
 Display ordinate values using 0 digits in fraction part of value
 --- End of Input Data ---
 --- Preliminary Results ---
 Note: Adopted skew equals station skew and preliminary
 frequency statistics are for the conditional frequency curve
 because of zero or missing events.
 << Frequency Curve >>
 Orestimba Creek-Newman, CA
      _____
                          . _ _ _ .
    Computed Expected | Percent | Confidence Limits
Curve Probability | Chance | 0.05 0.
FLOW, CFS | Exceedance | FLOW, CFS
                                                            0.95 |
        20,376
                   22,737 |
                                  0.2
                                         1
                                                46,565
                                                            11,197
                 19,187 |
                                0.5
        17,439
                                                38,604
                                                             9,771 |
                  16,403 | 1.0 |
13,525 | 2.0 |
        15,067
                                                32,382
                                                             8,593 |
        12,590
                                                26,116
                                                             7,332 |
                                                                                                ¥
                                                                                             >
 <
                                                                 1:1..1:1
                                                                                         1:1
```

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**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-30.

Eile Edit View	
VANDALIA, IL	
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	1
42 15 Apr 52 12:00 10,500	1
43 05 Mar 53 12:00 5,680	
44 19 Apr 54 12:00 505	
45 25 Apr 55 12:00 5,000	1
46 27 Feb 56 12:00 7,840	
47 29 Jun 57 12:00 62,700	1
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.

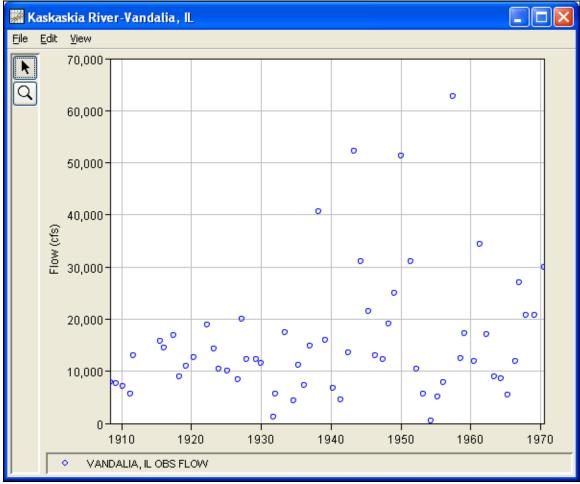


Figure B-31. HEC-SSP Plot of the Kaskaskia River Data.

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 I	Editor - FFA Test 5*							
Name:	FFA Test 5							
Description:	Example using other confidence limits and a base peak discharge							
Flow Data Set:	Example using other confidence limits and a base peak discharge							
DSS File Name:	C1Documents and Settings1q0hecmjftDesktop1ssp1SSP_Examples1SSP_EXAMPLES.dss							
Report File:	C:\Documents and Settings\q0hecmjf	\Desktop\ssp\SSP_Examples\Bulletin17bF	Results\FFA_Test_5\FFA_Test_5.rpt					
General Option	s Tabular Results							
Generalized SI	kew	Plotting Position	Confidence Limits					
🔿 Use Stati	on Skew	• Weibull (A and B = 0)	O Defaults (0.05, 0.95)					
💿 Use Wei	ahted Skew	🔘 Median (A and B = 0.3)	O User Entered Values					
O Use Req	-	O Hazen (A and B = 0.5)	Upper Limit: 0.01					
		O Other (Specify A, B)	Lower Limit: 0.99					
-		Plotting position computed	Time Window Modification					
itteg. of	Kew MSE: 0.302	using formula (m-A)/(n+1-A-B)						
Expected Prob	ablity Curve	Where: m=Rank, 1=Largest N=Number of Years A,B=Constants	DSS Range is 06MAY1908 - 16JUN1970					
 Compute I 	Expected Prob. Curve		Start Date					
🔿 Do Not Co	mpute Expected Prob. Curve		End Date					
		B;0						
Com	oute Plot Curve View Rep	ort 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 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 E	ditor - FFA Test 5*					
Name:	FFA Test 5					
Description:	Example using other conf	idence limits and a base peak d	lischarge			
Flow Data Set:	Kaskaskia River-Vandalia	a, IL			~	
DSS File Name:	C:\Documents and Setting	gs\q0hecmjf\Desktop\ssp\SSP_	Examples\SSP_EXAMPLES.dss			
Report File:	C:\Documents and Setting	gs\q0hecmjf\Desktop\ssp\SSP_	Examples\Bulletin17bResults\FF	A_Test_5\FFA_Test_5.rpt		
General Option	s Tabular Results					
CLow Outlier Thr	reshold	Historic Period Data		User Specified Frequency Or	dinates	
Verride Lo	w Outlier Threshold	🔲 Use Historic Data		Use Values from Table B	elow	
Value	2000	Historic Period		Frequency in Percent		
		Start Year:			0.2	
		End Year:			0.5	
		Override High Outlier Three	shold:		2.0	
					10.0	
		Histori Water Year	c Events Peak		20.0 50.0	
		vvaler rear	Feak		80.0 90.0	
					95.0	
					99.0	
Comp	oute 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 cfs 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 open 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-V						×
DSS File Name:					DI EQ doo		
		d Settings\q0hecmjf\Desktop					
Report File:	C:\Documents an	d Settings\q0hecmjf\Desktop -)\ssp\SSP_E	xamples\Bulletin17bF	Results\FFA_Test_5	NFFA_Test_5.rp	t 🛄
General Option	s Tabular Results						
		Frequency C	urve for: Kas	skaskia River-Vandalia	a, IL		1
		0	_	and Deels	с	onfidence Limit	s
Percent C Exceedar		Computed Curve Flow in cfs		ected Prob. w in cfs		Flow in cfs	
Execceden					0.01		0.99
	0.2	92314		102679		63830	62771
	0.5	73871		79994	1	23959	51997
	1.0	61633		65543		98905	44582
	2.0	50712 38061		53082 39138		77643 54542	37733
	10.0	29659		39138		40301	29433
	20.0	29059		22277		28410	18050
	50.0	12824		12824		15554	10554
	80.0	7652		7593		9369	5937
	90.0	5905		5820		7396	4367
	95.0	4792		4685		6147	3393
	99.0	3283		3136		4428	2131
	Systen	n Statistics			Number of	Events	
	Log Trar	isform: Flow		Eve	nt	Nu	mber
S	tatistic	Value		Historic Events			0
Mean			4.116	High Outliers		0	
		0.274			2		
Station Skew 0.399		0.399	Zero Or Missing Systematic Events		60		
		-0.400	Historic Period				
Weighted Skew			0.182	Filstonic Fellou			
Adopted Skew 0.182							
Comp	oute Plot Cu	ve View Report	Print		ОК	Cance	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)

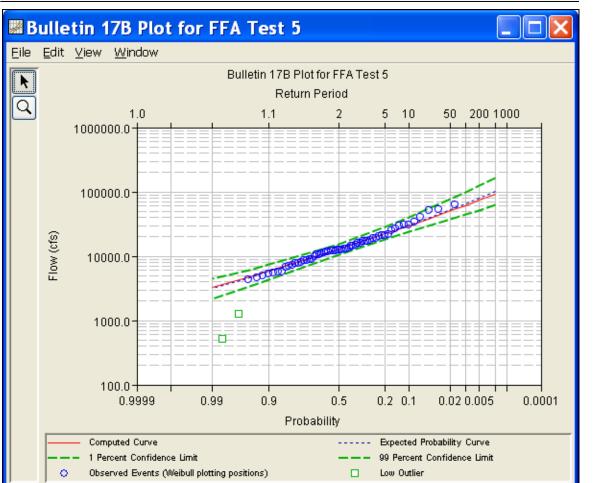
Expected Probability Curve

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 two 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.



HEC-SSP User's Manual

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.

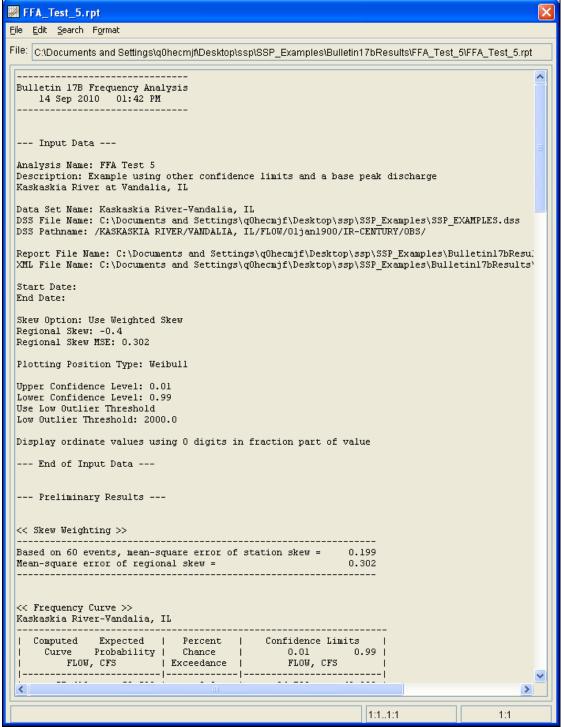


Figure B-36. Report File for Test Example 5.

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**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-37.

👙 /RIDLEY CREEK/MOYLAN, PA/FLOW/ 🔳 🗖 🔀					
<u>File E</u> dit <u>V</u> iew					
		MOYLAN, PA			
Ordinate	Date / Time	FLOW			
Units		CFS			
Туре		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.

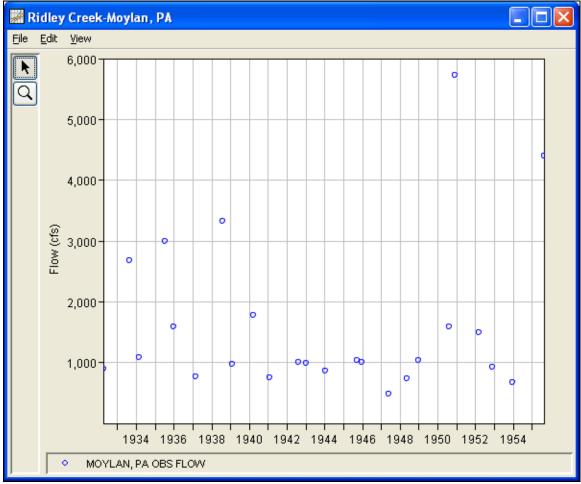


Figure B-38. Plot of the Ridley Creek Data.

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.

Appendix B – Example Data Sets

HEC-SSP User's Manual

📓 Bulletin 17B E	ditor - FFA Test 6		
Name:	FFA Test 6		
Description:	Example using Median plot positions	, historic data, and period of knowledge be	yond last year of data 🛄
Flow Data Set:	Ridley Creek-Moylan, PA		~
DSS File Name:	C:\Documents and Settings\q0hecmj	f\Desktop\ssp\SSP_Examples\SSP_EXAMI	PLES.dss
Report File:	C:\Documents and Settings\q0hecmj	f\Desktop\ssp\SSP_Examples\Bulletin17bl	Results\FFA_Test_6\FFA_Test_6.rpt
General Options	s Tabular Results		
Generalized Sk	æw	Plotting Position	Confidence Limits
🔿 Use Statio	on Skew	O Weibull (A and B = 0)	⊙ Defaults (0.05, 0.95)
💿 Use Weig	ahted Skew	⊙ Median (A and B = 0.3)	O User Entered Values
O Use Regi		O Hazen (A and B = 0.5)	Upper Limit: 0
	al Skew: 0.4	Other (Specify A, B)	Lower Limit: 0
_	xew MSE: 0.302	Plotting position computed	
	0.302	using formula (m-A)/(n+1-A-B)	Time Window Modification
Expected Proba	ablity Curve	Where: m=Rank, 1=Largest	DSS Range is 28MAR1932 - 18AUG1955
💿 Compute E	Expected Prob. Curve	N=Number of Years	Start Date
🔿 Do Not Cor	mpute Expected Prob. Curve	A,B=Constants	End Date
		B: 0	
Comp	ute Plot Curve View Re	port 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 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.

Name: FFA Test 6 Description: Example using Median plot positions, historic data, and period of knowledge beyond last year of data Image: Character and Settings/q0hecm/dDeskdop/ssp/SSP_Examples/SSP_EXAMPLES.dss Flow Data Set. C:Nocuments and Settings/q0hecm/dDeskdop/ssp/SSP_Examples/SSP_EXAMPLES.dss Image: Character and Settings/q0hecm/dDeskdop/ssp/SSP_Examples/SSP_EXAMPLES.dss Ceneral Options Tabular Results Image: Comparison of the settings/q0hecm/dDeskdop/ssp/SSP_Examples/SSP_Examp	📈 Bulletin 17B F	iditor - FFA Test 6				
Flow Data Set: Ridley Creek-Moylan, PA DSS File Name: C\Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.dss Report File: C\Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_6.rpt General Options Tabular Results Image: Start Period Coverride Low Outlier Threshold Image: Start Period Value 0 Historic Period Start Year: Image: Start Year: 1974 Override High Outlier Threshold: 100 Image: Water Year Peak 1843 15000.0 96.0 96.0	Name:	FFA Test 6				
DSS File Name: C:\Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\BSP_EXAMPLES.dss Report File: C:\Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA	Description:	Example using Median (plot positions, historic data, and peri	od of knowledge beyond last ye	ear of data	
Report File: C:Documents and Settings\q0hecmjt\Desktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA_Test_6.rpt General Options Tabular Results Low Outlier Threshold Historic Period Data User Specified Frequency Ordinates Override Low Outlier Threshold I Use Historic Data Use Values from Table Below Value I Historic Period 10 Start Year: 1974 0.2 Override High Outlier Threshold: 100 100 Historic Events 20.0 10.0 Water Year Peak 60.0 0 90.0 90.0	Flow Data Set:	Ridley Creek-Moylan, PA	4			~
General Options Tabular Results Low Outlier Threshold Override Low Outlier Threshold Value Iterative Control of the second property	DSS File Name:	C:\Documents and Setti	ngs\q0hecmjf\Desktop\ssp\SSP_Ex	amples\SSP_EXAMPLES.dss		
Low Outlier Threshold Historic Period Data User Specified Frequency Ordinates Override Low Outlier Threshold I Use Historic Data Use Values from Table Below Historic Period Start Year: 0.5 End Year: 1974 0.5 Override High Outlier Threshold: 5.0 Historic Events 20.0 Water Year Peak 00.0 90.0 95.0	Report File:	C:\Documents and Setti	ngs\q0hecmjf\Desktop\ssp\SSP_Ex	amples\Bulletin17bResults\FF.	A_Test_6\FFA_Test_6.rpt	
Override Low Outlier Threshold ✓ Use Historic Data Value ● Historic Period Start Year: Start Year: 1974 Override High Outlier Threshold: 0.2 Historic Events 0.0 Water Year Peak 1843 15000.0 96.0	General Option	s Tabular Results				
Value 0 Historic Period 5tart Year: Start Year: 0.5 End Year: 1974 Override High Outlier Threshold: 5.0 Historic Events 20.0 Water Year Peak 1843 15000.0 95.0 95.0	Low Outlier Th	reshold	Historic Period Data		User Specified Frequency Ord	dinates
Historic Pendu Prequency in Percent Start Year: 0.5 End Year: 1974 Override High Outlier Threshold: 5.0 Historic Events 20.0 Water Year Peak 1843 15000.0 96.0 96.0	🗌 Override Lo	w Outlier Threshold	🔽 Use Historic Data		Use Values from Table B	elow
Start Year: 0.2 End Year: 1974 Override High Outlier Threshold: 5.0 Historic Events 20.0 Water Year Peak 1843 15000.0 95.0 95.0	Value	0	Historic Period		Frequency in Percent	
End Year: 1974 1.0 Override High Outlier Threshold: 5.0 3.0 Historic Events 20.0 3.0 Water Year Peak 30.0 1843 15000.0 90.0 95.0 95.0 95.0			Start Year:			
Override High Outlier Threshold: 2.0 Historic Events 10.0 Water Year Peak 1843 15000.0 90.0 90.0 95.0 95.0			End Year:	1974		1.0
Historic Events 10.0 Water Year Peak 50.0 1843 15000.0 90.0 95.0 95.0 95.0			Override High Outlier Threshol			
Water Year Peak 50.0 1843 15000.0 90.0 95.0 95.0 95.0						10.0
1843 15000.0 90.0 95.0						50.0
						33.0
Compute Plot Curve View Report Print OK Cancel Apply	Comr	Plot Curve	View Report Print		OK Cancel	Annly

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 open 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.

🔛 Bulletin 17B B	ditor - FFA T	est 6				
Name:	FFA Test 6					
Description:	Example usin	g Median plot positions, historic (data and no	riad of knowledge boy	and lact year of data	
Flow Data Set:			uata, anu po	andu or knowledge bey	ond last year of data	
						¥
DSS File Name:	C:\Documents	and Settings\q0hecmjf\Desktop	\ssp\SSP_E	xamples\SSP_EXAMP	PLES.dss	
Report File: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA_Test_6.rpt					est_6.rpt	
General Option	s Tabular Res	ults				
		Frequency	Curve for: R	tidley Creek-Moylan, P	A	
					Confiden	ce Limits
Percent C Exceedan		Computed Curve Flow in cfs		ected Prob. w in cfs	Flow	in cfs
Exceedan	100	110001111013	110	WIIICIS	0.05	0.95
	0.2	17500		28945	41571	10177
	0.5	12096 9065		17226	25680 17650	7517 5924
	2.0	6724		8084	11994	4621
	5.0	4435		4914	7037	3253
	10.0	3162		3359	4595	2427
	20.0	2181		2243	2920	1734
	50.0	1198		1198	1495	949
	80.0	754		743	952	557
	90.0 95.0	543		607 525	800 709	441 373
	99.0	444		420	594	289
		stem Statistics			Number of Events	
	Log	Transform: Flow		Ever	nt	Number
	tatistic	Value		Historic Events High Outliers		1
Mean			3.120	Low Outliers		0
Standard Dev Station Skew			0.284	Zero Or Missing		
Regional Skew			0.400	Systematic Events		24
Weighted Skew			0.400	Historic Period		132
Adopted Skew			0.890			
Comp	pute Plot	Curve View Report	Print		ОК	Cancel Apply

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.

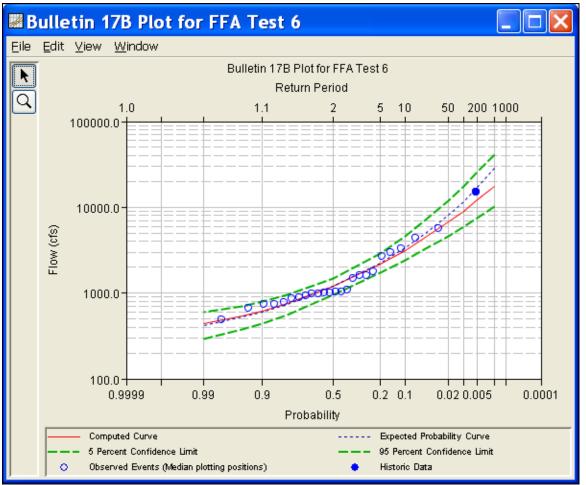


Figure B-42. Plot of the Frequency Curve Results for Test Example 6.

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

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.

FFA_Test_6.rpt
<u>File E</u> dit <u>S</u> earch F <u>o</u> rmat
File: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\Bulletin17bResults\FFA_Test_6\FFA_Test_6.rpt
Bulletin 17B Frequency Analysis 14 Sep 2010 01:44 PM
Input Data
Analysis Name: FFA Test 6 Description: Example using Median plot positions, historic data, and period of knowledge beyon Ridley Creek at Moylan, PA
Data Set Name: Ridley Creek-Moylan, PA DSS File Name: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss DSS Pathname: /RIDLEY CREEK/MOYLAN, PA/FLOW/Oljan1900/IR-CENTURY/OBS/
Report File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResu XML File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\Bulletinl7bResults
Start Date: End Date:
Skew Option: Use Weighted Skew Regional Skew: 0.4 Regional Skew MSE: 0.302
Plotting Position Type: Median
Upper Confidence Level: 0.05 Lower Confidence Level: 0.95
Use Historic Data Historic Period Start Year: Historic Period End Year: 1974 Year: 1843 Value: 15,000
Display ordinate values using 0 digits in fraction part of value
End of Input Data
Preliminary Results
<< Plotting Positions >> Ridley Creek-Moylan, PA
Events Analyzed Ordered Events
FLOW Water FLOW Median Day Mon Year CFS Rank Year CFS Plot Pos
28 Mar 1932 891 1 1951 5,720 2.87
23 Aug 1933 2,680 2 1955 4,390 6.97 05 Mar 1934 1,080 3 1938 3,320 11.07
09 Jul 1935 3,000 4 1935 3,000 15.16 03 Jan 1936 1,590 5 1933 2,680 19.26

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 annual maximum stage data for a reservoir. The period of record used for this example is from 1948 to 2004. To view the data, right-click on the data record labeled "**Reservoir Stage**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-44.

//RESERVOIR/STAGE/	01JAN1948 - 01JAN200	4/IR-CENTUR 🔳 🗖	X
<u>File E</u> dit <u>V</u> iew			
		RESERVOIR	
Ordinate	Date / Time	STAGE	
		OBSERVED	
Units		feet	~
Туре		INST-VAL	
1	01 Jan 1948, 12:00	631.88	
2	01 Jan 1949, 12:00	630.17	
3	01 Jan 1950, 12:00	647.47	
4	01 Jan 1951, 12:00	631.82	
5	01 Jan 1952, 12:00	632.88	
6	01 Jan 1953, 12:00	655.37	
7	01 Jan 1954, 12:00	647.63	
8	01 Jan 1955, 12:00		
10	01 Jan 1956, 12:00 01 Jan 1957, 12:00	640.65	
10	01 Jan 1958, 12:00	634.49	
12	01 Jan 1959, 12:00	637.49	=
13	01 Jan 1960, 12:00	632.36	
14	01 Jan 1961, 12:00	638.02	
15	01 Jan 1962, 12:00	630.59	
16	01 Jan 1963, 12:00	626.77	
17	01 Jan 1964, 12:00	630.28	
18	01 Jan 1965, 12:00	630.12	
19	01 Jan 1966, 12:00	630.79	
20	01 Jan 1967, 12:00	637.63	
21	01 Jan 1968, 12:00	632.21	
22	01 Jan 1969, 12:00	632.10	
23	01 Jan 1970, 12:00	623.00	
24	01 Jan 1971, 12:00	630.40	_
25	01 Jan 1972, 12:00	658.40	
26	01 Jan 1973, 12:00	630.80 631.60	
27	01 Jan 1974, 12:00 01 Jan 1975, 12:00	638.40	
20	01 Jan 1976, 12:00	633.60	
30	01 Jan 1977, 12:00	635.60	
31	01 Jan 1978, 12:00	640.80	
32	01 Jan 1979, 12:00	637.20	
33	01 Jan 1980, 12:00	630.72	
34	01 Jan 1981, 12:00	632.78	
35	01 Jan 1982, 12:00	635.37	
36	01 Jan 1983, 12:00	631.42	
37	01 Jan 1984, 12:00	638.84	V
	04 1-9 4005 4000	000.70	

Figure B-44. Tabulation of the Peak Stage Data for Example 7.

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.

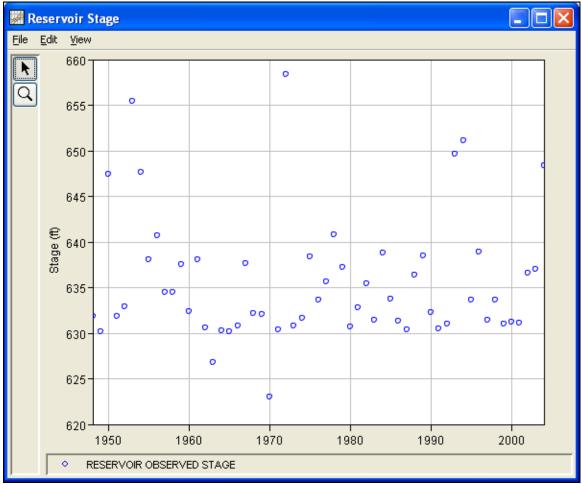


Figure B-45. Plot of the Reservoir Stage Data.

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 **Do Not 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.

Appendix B – Example Data Sets

HEC-SSP	User's Manual
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📓 General Freq	uency Analysis Editor - Stage Analysis Test 7					
Name:	Stage Analysis Test 7					
Description:	ixample 7, Analysis of Reservoir Stage Data					
Data Set:	Reservoir Stage					
DSS File Name:	C:/Documents and Settings/q0hecmj#Desktop/ssp/SSP_Examples/SSP_EXAMPLES.dss					
Report File:	aport File: sktop\ssp\SSP_Examples\GeneralFrequencyResults\Stage_Analysis_Test_7\Stage_Analysis_Test_7.rp					
General Option	s Analytical Graphical					
Log Transform		Plotting Position				
🔿 Use Log T	ransform	Weibull (A and B = 0)				
💿 Do Not us	e Log Transform	O Median (A and B = 0.3)				
Confidence Lir	nite	○ Hazen (A and B = 0.5)				
		Other (Specify A, B)				
 Defaults 		Plotting position computed using formula				
O User Ent	ered values	(m-A)/(n+1-A-B) Where:				
Upper Limit:	0.95	m=Rank, 1=Largest				
Lower Limit:	0.05	N=Number of Years A,B=Constants				
		A:				
Time Window I	Modification	B:				
DSS Range is	01JAN1948 - 01JAN2004					
📃 Start Date						
📃 End Date						
	Dist Analytical Dist Orankias					
Compute	Plot Analytical 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. Features on this tab include the **Low Outlier Threshold**, adding **Historic Date** to the analysis, an option to override the default **Frequency Ordinates**, and **Output Labeling**. The 0.1 percent frequency ordinate was added to the **User Specified Frequency Ordinates** table.

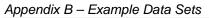
HEC-SSP User's Manual

A	opendix	В-	Exampl	le Data	Sets
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😹 General Freq	uency Analysis Editor - Stage An	alysis Test 7			
Name: Description: Data Set: DSS File Name: Report File: General Option Low Outlier Th Override Lo Value	Stage Analysis Test 7 Example 7, Analysis of Reservoir Stage C:/Documents and Settings/q0hec sktoptssptSSP_ExamplestGeneral Analytical Graphical reshold w Outlier Threshold g me is STAGE abel ts are	tage Data mjØDesktop/ssp/SSP_Example	lysis_Test_7\Stage_Analys	User Specified Frequency Ordinates User Specified Frequency Ordinates Use Values from Table Below Frequency in Percent	0.1 1.0 2.0 5.0 10.0 12.0 15.0 30.0 50.0 30.0 50.0 90.0 99.0 99.0
Compute		aphical View Report	🖨 Print	OK Cancel	Apply

Figure B-47. General Frequency Analysis Editor with Options Tab Shown for Test Example 7.

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, a graphical analysis was performed on the peak stage data. Shown in Figure B-48 is the **Graphical** tab. The frequency curve was entered manually into the **User-Defined Graphical Curve** table. When the **Compute** button is pressed, the program plots the graphical frequency curve along with the annual maximum peak stage values.



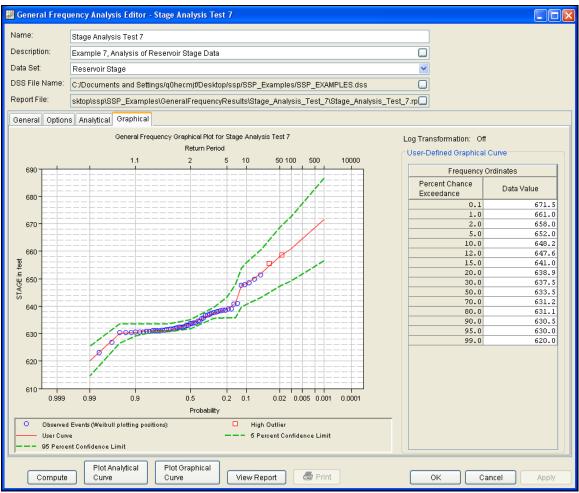


Figure B-48. General Frequency Graphical Tab Shown for Test Example 7.

In addition to the table and plot available on the Graphical tab, a plot of the graphical frequency curves 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-49.

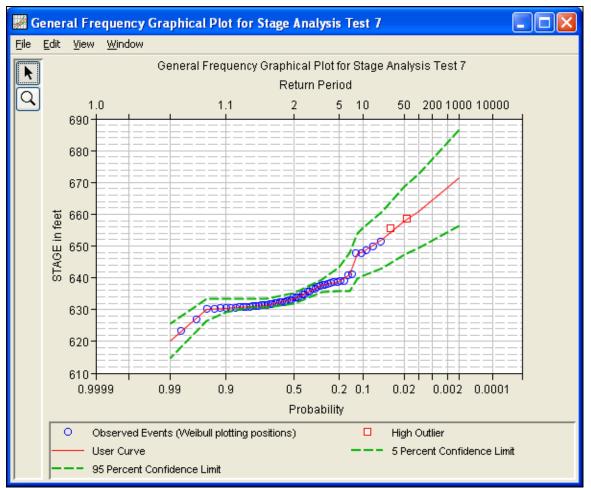


Figure B-49. Plot of the Frequency Curve Results for Test Example 7.

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-50 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, the final computed frequency curve results, and the user-defined graphical frequency curve. 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: C:\Documents and Settings\q	0hecmif\Desktop\;	ssp\SSP Examples\G	eneralFreque	ncvResults\Stage
			oucrici	
			odorrer	<u>~</u>
<pre><< Systematic Statistics >:</pre>	>			
Reservoir Stage				
		 mher of Events		
STAGE, feet				
Mean 635 Standard Dev 6	.61 Histor:	ic Events	0	
Standard Dev 6 Station Skew 1	.90 High 0	utliers 2 Fliers (2	
Regional Skew	Zero E	vents (
Regional Skew Weighted Skew	Missin	g Events (
Adopted Skew				
'				
< User-Defined Graphical	Frequency Curv	e >>		
Reservoir Stage				
Computed Expected Curve Probability STAGE, feet	Chance	0.05	0.95	
STAGE, feet	Exceedance	STAGE, fee	et	
		686.59		
661.00	1.000	672.70	649.30	
658.00	2.000 5.000	668.73 660.80	647.27	
652.00		660.80 655.77		
647.60	1 12,000	L 653-86		
I 641.00	15.000	647.94		
I 638.90	20.000	643.30		
637.50 633.50	30.000 50.000	639.52 635.17	631.83 631.83	
631.19		633.52	630.76	
I 631.10	80.000	633.52 633.52		
1 630.50	90.000	633.52		
630.00 620.00	95.000 99.000	633.52 625.45	626.48 614.55	
				~
<				>
		244:	65244:65	244:65

Figure B-50. 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 "**Rio Grande at Alb Local Runoff**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-51.

Л	RIO GRANDE/LOCAL_INF	LOWS_ALBUQUERQUE/FLOW	/01JAN1900/IR	<
<u>F</u> ile	<u>E</u> dit <u>V</u> iew			
	Ordinate	Date / Time	LOCAL_INFLOWS_ALBUQU FLOW CALC	
	Units		CFS .	~
	Type		PER-AVER	H
	1		1,175.0	
	2		1,297.0	
	3	21 Aug 1946, 24:00	978.0	
	4		741.0	
	5		2,313.0	
	6		1,891.0	
	7		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		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		361.0	
	22		1,677.0 -	-
	23		1,487.0	
	24		4,186.0	
	25		911.0	
	26		1,519.0	
	27	· · ·	847.0	
	28		2,229.0	
	29		1,190.0	
	30		1,259.0	
	31	· ·	1,065.0	
	32		1,319.0	
	33	· · ·	1,291.0	
	34		1,013.0	
	35		1,492.0	
	ac	01 Jun 1070 - 24-00	1 067 0	1

Figure B-51. Tabulation of the Peak Flow 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-52.

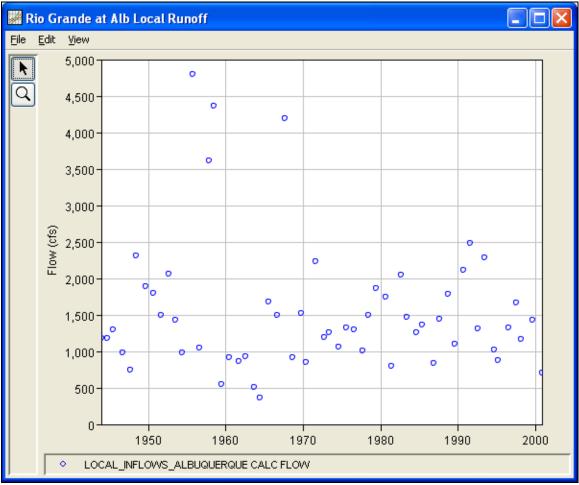


Figure B-52. Plot of Data for Example 8.

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 Alb Test 8** from the study explorer, or from the **Analysis** menu select open, then select **Local Runoff at Alb 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-53.

HEC-SSP User's Manual

Figure B-53. 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**.

Shown in Figure B-54 is the General Frequency analysis editor with the **Options Tab** selected. Features on this tab include the **Low Outlier Threshold**, an option to use **Historic Data**, an option to override the default **Frequency Ordinates**, and **Output Labeling**. All defaults settings were selected for this example.

Appendix B – Example Data Sets

💹 General Frequ	uency Analysis Editor - Local Runo	ff at Alb Test 8							
Name:	Local Runoff at Alb Test 8								
Description:	This examples shows how to enter us	ser adjusted statistics							
Data Set:	Rio Grande at Alb Local Runoff								
DSS File Name:	C/Documents and Settings/g0hecmjf/Desktop/ssp/SSP_Examples/SSP_EXAMPLES.dss								
Report File:	ples\GeneralFrequencyResults\Loca	I_Runoff_at_Alb_Test_8\Local_Ri	unoff_at_Alb_Test_8.rp						
General Option:	S Analytical Graphical								
CLow Outlier Thr	reshold	Historic Period Data		CUser Specified Frequency Ordinates					
Override Lo	w Outlier Threshold	Use Historic Data		Use Values from Table Below					
Value		Historic Period							
		Start Year:		Frequency in Percent	0.2				
Output Labeling			0		0.5				
DSS Data Nam	ne is FLOW	End Year:	0		2.0				
🗌 Change L	abel	Override High Outlier Thres	hold:		5.0 10.0				
DSS Data Unit	sare CFS	Historic	Events		20.0				
🗌 Change L	abel	Water Year	Peak		50.0 80.0				
					90.0				
					95.0 99.0				
					33.0				
	Plot Analytical Plot Gra								
Compu	ite Curve Curve	View Report	🖨 Print	OK Cancel	Apply				

Figure B-54. General Frequency Analysis Editor with Options Tab Shown for Test Example 8.

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. Shown in Figure B-55 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.

HEC-SSP User's Manual

🔛 General Freq	uency Analysis Editor - Local Ru	unoff at Alb Test 8	. 🗆 🗙					
Name:	Local Runoff at Alb Test 8							
Description:	This examples shows how to ente	er user adjusted statistics						
Data Set:	Rio Grande at Alb Local Runoff	v						
DSS File Name:		/Documents and Settings/q0hecmjf/Desktop/ssp/SSP_Examples/SSP_EXAMPLES.dss						
Report File:	iles\GeneralFrequencyResults\Local_Runoff_at_Alb_Test_8\Local_Runoff_at_Alb_Test_8.rp							
General Option	s Analytical Graphical							
	lar Results Plot							
Log Transform		Ceneralized Skew						
- Distribution:		⊙ Use Station Skew						
LogPearsonII	~	O Lies Weinklad Olevu						
		O Use Weighted Skew						
		O Use Regional Skew	_					
		Regional Skew:						
		Reg. Skew MSE:						
		Expected Probability Curve						
		Compute Expected Prob. Curve						
		Do Not Compute Expected Prob. Curve						
		t Graphical						
Compu	ute Curve Cur	ive View Report SPrint OK Cancel	Apply					

Figure B-55. 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 open stating **Compute Complete.** Close this window and then select the **Plot** tab within the analytical analysis. The analytical plot window should look Figure B-56.



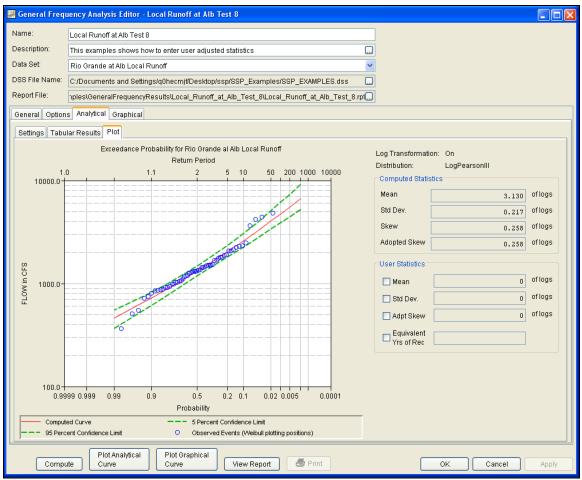
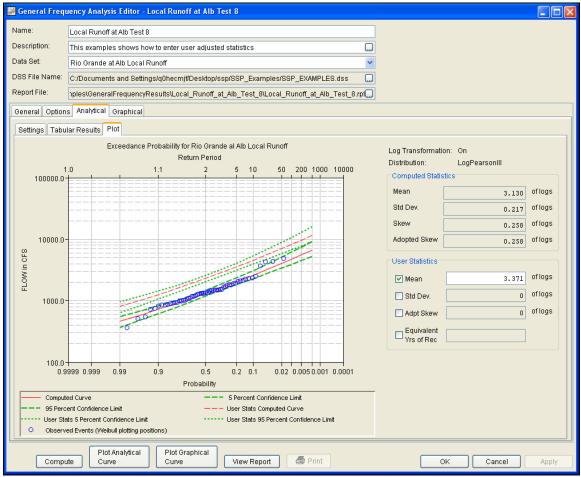


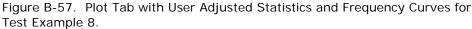
Figure B-56. The Plot Tab for Test Example 8.

As shown in Figure B-56, 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-57 shows that the frequency curve computed from the useradjusted statistics is added to the graph. This figure 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.





Select the **Tabular Results** tab to see information for both the computed and user-adjusted frequency curves. As shown in Figure B-58, 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 Frequ	ency Analy	ysis Editor - Local Runoff at	Alb Test 8					
Name:	ame: Local Runoff at Alb Test 8							
	This examp	oles shows how to enter user adjusted statistics						
Data Set:	Rio Grande	e at Alb Local Runoff			*			
DSS File Name:	C:/Docume	nts and Settings/q0hecmjf/Des	ktop/ssp/SSP_Examples/	SSP_EXAMPLES.dss				
Report File:	nlesiGene	ralFrequencyResults\Local_Ru	noff at Alb Test 81 oral	Runoff at Alb Test	8 ml			
General Options					0.10100			
Settings Tabula	ar Results	Plot						
		Cu	ve based on Data		Curve ba	ised on User-Adjusted St	atistics	
Percent Ch	ance	Computed	Confidence	Limits	Computed	Confidence Limits		
Exceedance	e	Curve	FLOW in C	CFS	Curve	FLOW in CFS		
		FLOW in CFS	0.05	0.95	FLOW in CFS	0.95	0.05	
	0.2	6673	9163	5261	11617	15951	9158	
	0.5	5531	7356	4459	9628	12806	7762	
	1.0	4752	6163	3899	8272	10728	6788	
III	2.0 5.0	4039 3185	5102 3878	3375	7031	8882	5876	
	10.0	2595	3070	2729	4518	5344	3945	
	20.0	2042	2346	1814	3554	4084	3945	
	50.0	1321	1475	1182	2300		2058	
	80.0	881	993	766	1534	1728	1333	
	90.0	722	824	612	1256	1435	1066	
	95.0	615	713	511	1071	1242	889	
	99.0	463	553	368	807	962	641	
System Statistics			Number of Events					
	Statistic Value 3.130		Event Number		lber 0			
Mean Standard Dev		0.217	High Outliers		0			
Station Skew		0.217	Low Outliers		0	Log Transformation: (On 🔰	
Regional Skew		0.200	Zero Or Missing		0	Distribution: I	_ogPearsonIII	
Weighted Skew		Systematic Events 57		57				
Adopted Skew 0.258		Historic Period						
Comput		ot Analytical Plot Graphic urve Curve	al View Report	Print		OK Ca	ncel Apply	

Figure B-58. 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-59.

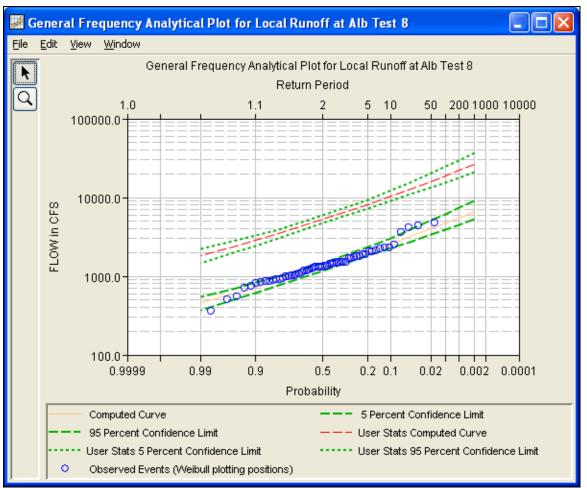


Figure B-59. Plot of the Frequency Curve Results for Test Example 8.

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-60 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.

	u þe			
<u>File E</u> dit <u>S</u> earch F <u>o</u> rmat				
File: C:\Documents and Settings\q0)hecmjf\Desktop\s	sp\SSP_Examples\Gen	eralFrequ	iencyResults\Local_Runoff_at_Alb_Test_8\L
1 3,185 1 1 2,595 1 1 2,042 1 1 1,321 1 1 881 1 1 722 1 1 615 1 1 463 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	9,163 7,356 6,163 5,102 3,878 3,070 2,346 1,475 993 824 713 553	5,261 4,459 3,899 3,375 2,729 2,266 1,814 1,182 766 612 511 368	
Rio Grande al Alb Local Run Log Transform: FLOW, CFS	 Nu	umber of Events	 	
 Mean 3.130 Histor Standard Dev 0.217 High C Station Skew 0.258 Low Ou Regional Skew Zero E Weighted Skew Missir Adopted Skew 0.258 System 		ic Events Atliers 0 Cliers 0 vents 0 g Events 0 Atic Events		
End of Analytical Frequ << User Frequency Curve >> Rio Grande al Alb Local Run Computed Expected Curve Probability FLOW, CFS	off Percent	Confidence Lim	its 0.95	
1 11,617 1 11,617 1 9,628 1 8,272 1 7,031 1 5,544 1 3,554 1 2,300 1 1,256 1 1,256	0.2 0.5 1.0 2.0 5.0 10.0 20.0 50.0	15,951 12,806 10,728 8,882 6,752 5,344 4,084 2,567	9,158 7,762 6,788 5,876 4,751	
< User Statistics >>	99.0	962	641	×
				1:11:1 1:1

Figure B-60. 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 "**Rio Grande at Alb Reg Flow**" in the study explorer and then select **Tabulate**. The data will appear as shown in Figure B-61.

🔥 /RIO GRANDE/RIO GRANDE AT ALBUQ 🔳 🗖 🔀						
1	<u>V</u> iew					
Ordinate	Date	Time	RIO GRANDE FLOW REGULATED			
Units			cfs			
Туре			INST-VAL			
1	01 Jan 1974	24:00	1,950.0			
2	24 May 1975	24:00	5,800.0			
3	21 May 1976	24:00	3,170.0			
4	18 Aug 1977	24:00	1,640.0			
5	24 May 1978	24:00	4,320.0			
6	01 Jun 1979	24:00	7,870.0			
7	28 May 1980	24:00	7,130.0			
8	05 May 1981	24:00	2,170.0			
9	09 Jun 1982	24:00	4,630.0			
10	12 Jun 1983	24:00	7,330.0			
11	27 May 1984	24:00	8,500.0			
12	24 Apr 1985	24:00	8,650.0			
13	07 Aug 1986	24:00	4,670.0			
14	22 Jul 1987	24:00	6,120.0			
15	01 Apr 1988	24:00	3,880.0			
16	27 Apr 1989	24:00	3,710.0			
17	12 May 1990	24:00	2,420.0			
18	07 Aug 1991	24:00	4,800.0			
19	12 May 1992	24:00	5,900.0			
20	05 Jun 1993	24:00	7,000.0			
21	12 May 1994	24:00	6,250.0			
22	25 May 1995	24:00	6,370.0			
23	22 Feb 1996	24:00	1,770.0			
24	11 Jun 1997	24:00	5,980.0			
25	09 May 1998	24:00	3,940.0			
26	01 Jun 1999	24:00	4,550.0			
27	03 Jun 2000	24:00	1,500.0			
28	23 May 2001	24:00	4,760.0			
29	15 May 2002	24:00	1,240.0			

Figure B-61. Tabulation of the Peak Flow 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-62.

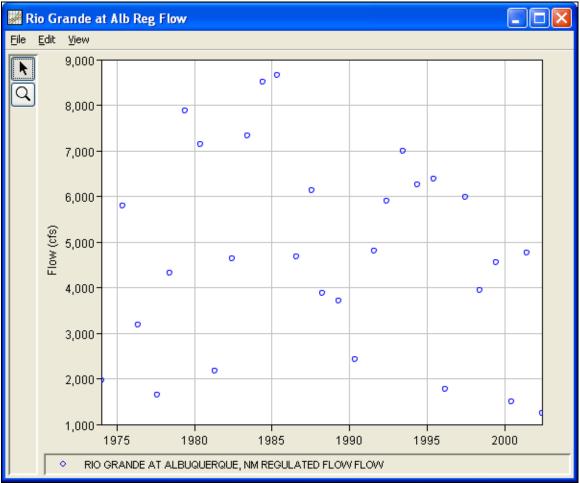


Figure B-62. Plot of Data for Example 9.

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 **Reg Flow Rio Grande Test 9** from the study explorer, or from the **Analysis** menu select open, then select **Reg 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-63.

HEC-SSP User's Manual

Figure B-63. General Frequency Analysis Editor for Test Example 9.

Shown in Figure B-63 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**.

Shown in Figure B-64 is the General Frequency analysis editor with the **Options Tab** selected. Features on this tab include the **Low Outlier Threshold**, an option to use **Historic Data**, an option to override the default **Frequency Ordinates**, and **Output Labeling**. All defaults settings were selected for this example.



📈 General Frequ	uency Analysis Editor - Reg Flow R	io Grande Test 9*							
Name:	Reg Flow Rio Grande Test 9								
Description:	Example using a graphical general fro	auency analysis							
Data Set:	Rio Grande at Alb Reg Flow								
DSS File Name:	C/Documents and Settings/q0hecmif/Desktop/ssp/SSP_Examples/SSP_EXAMPLES.dss								
Report File:	JeneralFrequencyResults\Reg_Flow_	· · · - ·							
	S Analytical Graphical	IND_ONAIDE_TEST_SWREG_TIOW_	Nio_orande_rest_stpl						
CLow Outlier Th		⊂Historic Period Data		CUser Specified Frequency Ordinates					
	w Outlier Threshold	🔲 Use Historic Data		Use Values from Table Below					
Value		Historic Period		Frequency in Percent					
⊂Output Labelin	g	Start Year:	0		0.2				
DSS Data Nan	neis FLOW	End Year:			1.0				
		Override High Outlier Thre	shold		2.0				
🗌 Change L					10.0				
DSS Data Unit	ts are ofs	Historia	Events		20.0 50.0				
🗌 Change L	abel ofs	Water Year	Peak		80.0				
					90.0				
					95.0 99.0				
					55.0				
	Plot Analytical Plot Gr	aphical							
Compu		View Report	🚭 Print	OK Cancel	Apply				

Figure B-64. General Frequency Analysis Editor with Options Tab Shown for Test Example 9.

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, a graphical analysis was performed. Shown in Figure B-65 is the Graphical analysis tab. As shown, a graph containing the systematic data and graphical curve is on the left side and a table containing the user-entered frequency curve is on the right side of the window. The frequency curve was entered manually into the User-Defined Graphical Curve table. When the Compute button is pressed, the program plots the graphical frequency curve along with the annual maximum flow values. For this example, a reservoir model was used to route synthetic hydrographs through the reservoir 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.

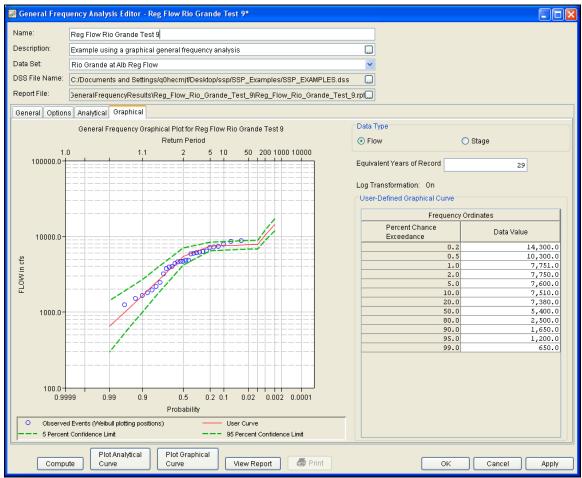


Figure B-65. Graphical Tab Shown for Test Example 9.

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-66.

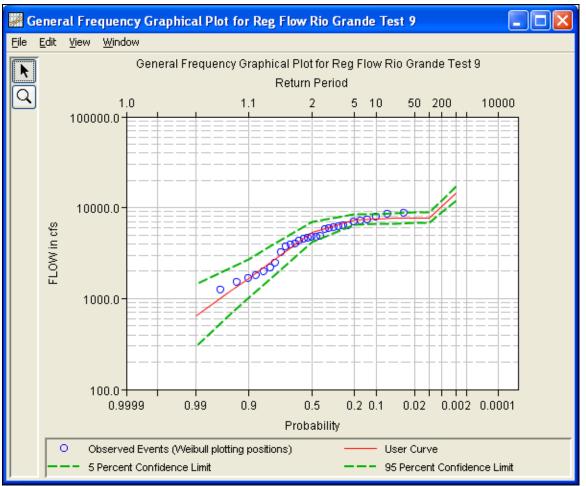


Figure B-66. Plot of the Frequency Curve Results for Test Example 9.

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-67 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.

HEC-SSP User's Manual

Reg_Flow_Rio_Grande_Test_9.rpt
Eile Edit Search Format
File: \Desktop\ssp\SSP_Examples\GeneralFrequencyResults\Reg_Flow_Rio_Grande_Test_9\Reg_Flow_Rio_Grande_Test_9.rpt
·
General Frequency Analysis 13 Sep 2010 11:06 AM
Input Data
Analysis Name: Reg Flow Rio Grande Test 9 Description: Example using a graphical general frequency analysis
Data Set Name: Rio Grande at Alb Reg Flow DSS File Name: C:/Documents and Settings/qOhecmjf/Desktop/ssp/SSP_Examples/SSP_EXAMPLES.dss DSS Pathname: /RIO GRANDE/RIO GRANDE AT ALBUQUERQUE, NM/FLOW/OIJAN1900/IR-CENTURY/REGULATED FLOW/
Start Date: End Date:
Project Path: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples Report File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\GeneralFrequencyResu Result File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\GeneralFrequencyResu
Plotting Position Type: Weibull
Probability Distribution Type: None Use Log Transform
User-Specified Frequencies
Frequency: 0.2 Frequency: 0.5
Frequency: 1.0
Frequency: 2.0 Frequency: 5.0
Frequency: 10.0
Frequency: 20.0
Frequency: 50.0 Frequency: 80.0
Frequency: 90.0
Frequency: 95.0
Frequency: 99.0
Display ordinate values using 1 digits in fraction part of value
End of Input Data
<pre> << Low Outlier Test >></pre>
Based on 29 events, 10 percent outlier test deviate K(N) = 2.549 Computed low outlier test value = 1,004.42
0 low outlier(s) identified below test value of 1,004.42
1:1.1:1 1:1

Figure B-67. Report File for Test Example 9.

Example 10: Volume Frequency Analysis, Maximum Flows

This example demonstrates how to perform a Volume 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 Alb Unreg Daily**" in the study explorer and then select **Plot**. The data will appear as shown in Figure B-68.

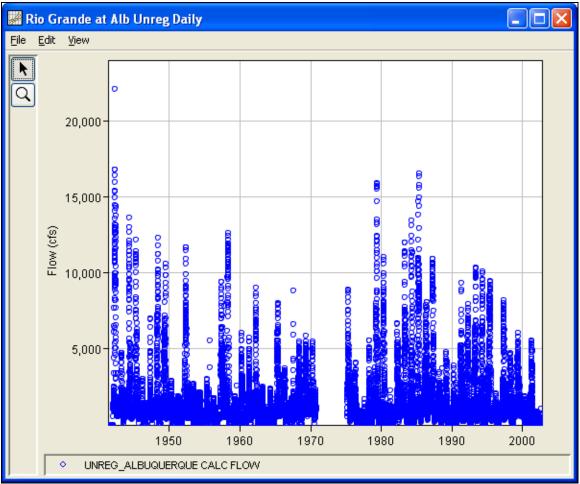


Figure B-68. Plot of Daily Average Flow for Example 10.

A Volume Frequency analysis has been developed for this example. To open the Volume Frequency Analysis editor for test example 10, either double-click on the analysis labeled **Unreg Flow Rio Grande Test 10** from the study explorer, or from the **Analysis** menu select open, then select **Unreg Flow Rio Grande Test 10** from the list of available analyses. When test 10 is opened, the Volume Frequency Analysis editor will appear as shown in Figure B-69.

🧱 Volume Frequency Analysis Editor - Unreg Fl	ow Rio Grande Test 10		
Name: Unreg Flow Rio Grande Test 10 Description: Unregulated Volume-Duration Ana Data Set Rio Grande at Alb Unreg Daily DSS File Name: ocuments and Settings\q0hecmjft	alysis Rio Grande at Albuquerque Desktop\ssp\SSP_Examples\SSP_EXAI le_Test_10\Unreg_Flow_Rio_Grande_1		
Plot Duration Data Compute	Plot Graphical Curve View Report	Print OK Cancel	Apply

Figure B-69. Volume Frequency Analysis Editor for Test Example 10.

Shown in Figure B-69 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-70 is the Volume 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 flowduration and frequency ordinate tables were modified.

💹 Volume Frequ	iency Analysis Editor - Unreg Flo	w Rio Grande Test 10		
Name:	Unreg Flow Rio Grande Test 10			
Description:	Unregulated Volume-Duration Analy			
Data Set:	Rio Grande at Alb Unreg Daily	~		
DSS File Name:	ocuments and Settings\q0hecmjf\D	esktop\ssp\SSP_Examples\SSP_EXAMPLES.ds:		
Report File:	sResults\Unreg_Flow_Rio_Grande	_Test_10\Unreg_Flow_Rio_Grande_Test_10.rp1		
General Option	S Duration Table Analytical Grap	hical		
Flow Durations	3	User Specified Frequency Ordinates	Historic Period Data	
Change or	r add to default values	✓ Use Values from Table Below	🔲 Use Historic Dat	ta
Duration in d	lavs	Frequency in Percent	Historic Period	
	1	0.1	Start Year:	0
	7	0.2	End Year:	0
	60	1.0	Duration	Override High O
	120	2.0	1-day	overnde riigh o
		10.0	7-day	
		20.0	15-day	
		50.0	60-day 120-day	
		90.0	120-uay	
		95.0		
		99.0		
			Historic Events	
			Year	1-day 7-day
Output Labelin	g	Low Outlier Threshold		
DSS Data Nar	ne is FLOW	Override Low Outlier Threshold		
🗌 Change L	abel FLOW	Duration Override Low Outli		
DSS Data Unit	ts are CFS	1-day		
	abel CFS	7-day		
🗌 Change L	abei CFS	15-day 60-day		
		120-day		
			<	>
<u></u>	Plot Plot	Plot		
Compute	Duration Analytical Data Curve	Graphical Curve View Report 🚭 Print	ОКПС	Cancel Apply
Compare				Cancel Colophy

Figure B-70. 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-71.

Appendix B – Example Data Sets

ime:	Unrea Flov	v Rio Grande	Test 10								
scription:	Unregulate	Unregulated Volume-Duration Analysis Rio Grande at Albuquerque									
				s Nio Oranue	at Albuqueiqu						
ita Set:		e at Alb Unreg	g Daily				~				
3S File Name	c ocuments :	and Settings\	q0hecmjf\Des	ktop\ssp\SSP	_Examples\S	SP_EXAMPLE	S.ds:				
port File:	sResults\U	Inreg_Flow_F	Rio_Grande_T	est_10\Unreg	Flow_Rio_G	rande_Test_	10.rpt				
eneral Optio	Duration	Table Analy	tical Graphic	.al							
		Anal		, ai							
Allow Editir	ng										
					Volume-Dur	ration Data					
			Hig	hest Mean Va	lue for Duratio	n, Average Da	aily FLOW in C	FS			
Year -	1		7		16	5	61)	12	0	
i i	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	
1942	04/24/1942	22076.4	05/15/1942	15345.8	06/05/1942	13098.6	06/14/1942	12137.3	07/06/1942	7930.9	
1943	04/28/1943	4733.9	05/02/1943	4638.1	05/08/1943	4440.3	06/03/1943	2574.3	07/02/1943	1849.8	
1944	05/17/1944	13601.6	05/22/1944	12334.9	05/28/1944	11501.7	07/05/1944	7056.9	07/22/1944	4460.3	
1945	05/08/1945	12140.6	05/13/1945	11199.2		10358.1	06/19/1945	6137.1	07/09/1945	3794.1	
1946	04/23/1946	2998.8	04/27/1946	2733.6	05/03/1946	2273.0	05/17/1946	1230.4		978.5	
1947	05/12/1947	7003.5	05/15/1947	5848.5	05/18/1947	5118.0	06/15/1947	2709.0		1789.8	
1948	05/28/1948	12273.5		10224.5		9950.8	06/18/1948	7014.3		4567.1	
1949	06/23/1949	10556.0	06/27/1949	9642.2	06/30/1949	8133.2	06/30/1949	5828.4		4386.0	
1950	04/24/1950	2901.1	04/27/1950	2711.6	04/30/1950	2396.7	05/04/1950	1549.3		1319.9	
1951	05/10/1951	1881.6	05/14/1951	1718.3	05/23/1951	1610.7	06/14/1951	1082.0		868.6	
1952	05/08/1952	11669.4	05/11/1952	10749.8	05/19/1952	9703.8	06/22/1952	7147.2	07/22/1952	4704.7	
1953	05/31/1953	2706.0		2497.2	06/06/1953	2283.0	06/20/1953	1729.2		1298.6	
1954	05/18/1954	2122.1	04/21/1954	2050.3	04/28/1954	1929.1	06/04/1954	1595.2		1131.6	
1955	09/25/1955	5496.6	05/29/1955	2694.8	05/30/1955	2349.9	06/21/1955	1559.2		1154.8	
1956	05/07/1956	1766.1	05/11/1956	1722.1	05/11/1956	1626.0	06/11/1956	1172.4		941.9	
1957	06/09/1957	9403.5	06/11/1957	8794.2	06/15/1957	7865.2	07/06/1957	5357.9	09/01/1957	4360.3	
1958	05/14/1958	12590.1	05/17/1958	12047.0	05/23/1958	11492.6	06/14/1958	9129.4		5433.5	
1959	08/26/1959	2539.4	05/20/1959	1821.9	05/20/1959	1624.9	06/05/1959	1049.9		844.6	
1960	04/13/1960	6034.5	04/16/1960	5335.6	04/24/1960	4832.5	05/22/1960	3299.1	06/27/1960	2482.6	
1961 1962	05/04/1961	5695.4 9023.2	05/07/1961 04/27/1962	5052.7 8121.7	05/07/1961 05/02/1962	4518.2 7289.3	06/06/1961	3084.0 4879.4	06/28/1961	2001.7 3108.6	
1962	04/22/1962	2477.4	04/27/1962	2288.6	05/02/1962	2097.4	05/28/1962	4879.4	06/04/1963	1115.2	
1903	05/15/1963	2353.4	05/19/1964	2200.0	05/25/1964	1963.8	06/10/1963	1293.1	06/17/1963	938.8	
1965	06/19/1965	8007.6	05/26/1965	7162.8	05/23/1984	5995.5	06/30/1965	5202.7	08/11/1965	3916.0	
1966	05/11/1966	3704.0		3470.1	05/14/1966	3276.3	05/15/1966	2629.1	06/13/1966	2047.8	
1967	08/10/1967	8810.2	08/16/1967	5186.4		3533.9	09/14/1967	1653.6		1341.5	
1968	05/24/1968	5432.6	05/29/1968	5095.6	06/05/1968	4918.1	07/01/1968	3315.0		2410.0	
1969	05/06/1969	5866.6	05/08/1969	5070.9	05/27/1969	4960.4	06/22/1969	4148.6	07/29/1969	2963.4	
1970	05/15/1970	5473.9	05/19/1970	5035.6	05/23/1970	4542.2	06/17/1970	2634.1	06/17/1970	1918.2	
	05404075		05/00/075		05/20/4 075	7400.0	00/04/4.075		00/00/4 07/	2405.7	
Extract Volume-Duration Data											
	Plot	Plot	PI	ot							
	Duration			raphical							
Compute	Data	Curve		urve	View Report	- B P	rint	ОК	Cance		pply

Figure B-71. 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-72 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.

Appendix B – Example Data Sets

HEC-SSP	User's	Manual
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📈 Volume Frequ	ency Analysis Editor - Unreg I	Flow Rio Grande Test 10*									
Name:	Unreg Flow Rio Grande Test 10										
Description:	Unregulated Volume-Duration Analysis Rio Grande at Albuquerque										
Data Set:	Rio Grande at Alb Unreg Daily										
DSS File Name:	ocuments and Settings\q0hecmj	bcuments and Settings\u00ecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.ds:									
Report File:	sResults\Unreg_Flow_Rio_Gram	ide_Test_10\Unreg_Flow_Rio_Grande_Test_10.rpt									
General Option	s Duration Table Analytical G	aphical									
Settings Tabu	lar Results Plot Statistics										
Log Transform	ation: On	Skew									
Distribution:		 Use Station Skew 									
LogPearsonIII	~	O Use Weighted Skew									
Expected Prol	pablity Curve	O Use Regional Skew									
🔿 Compute	Expected Prob. Curve										
💿 Do Not C	ompute Expected Prob. Curve	Duration Reg. Skew R.Skew MSE									
		7									
		60									
		120									
	Plot Plot	Plot									
	Duration Analytical	Graphical									
Compute	Data Curve	Curve View Report Sprint OK Cance	el Apply								

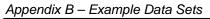
Figure B-72. Settings Tab Shown for Test Example 10.

Press the **Compute** button to perform the analysis. A message window will open stating that a few of the annual maximums occurred during the beginning of the year. The message suggests that the user change the year/season specification to capture independent events. You want to minimize the possibility that the same flood event is used for consecutive years. Press the OK button to finish the compute. Once the computations have been completed, a message window will open stating **Compute Complete**. Close this window and then select the **Tabular Results** tab within the analytical analysis. The results table should look Figure B-73. 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.

Name: Unreg Flow Rio Grande Test 10									
escription:	Unregulated Volume-Duration Analysis Rio Grande at Albuquerque								
-	-		Joio I no oranae atrabaq						
L	Rio Grani	de at Alb Unreg Daily		~					
)SS File Name: (ocuments	and Settings\q0hecmjf\D	esktop\ssp\SSP_Examp	les\SSP_EXAMPLES.ds:)				
Report File:	sResults\	Unreg_Flow_Rio_Grande	_Test_10\Unreg_Flow_F	Rio_Grande_Test_10.rpt					
Jeneral Options	Duratio	n Table Analytical Grap	hical						
Settings Tabula	ar Results	Plot Statistics							
		Volume Frequency C	urves for Unreg Flow Rio	Grande Test 10, Average	Daily FLOW in CFS				
Percent									
Chance		1	7	15	60	120			
Exceedan	ce								
0.1		33513.9	29283.5	26730.5	23521.3	15790.6 🔼			
0.2		30589.9	26911.6	24548.9	21009.0	14031.4			
0.5		26689.7	23679.9	21577.4	17789.0	11821.6			
2.0		23714.2	21161.7 18579.3	19263.4	15433.2	10235.5 8720.7			
5.0		20716.6	15060.7	16891.9 13664.2	13148.2	6820.9			
10.0		13641.4	12307.4	11142.4	8111.6	5452.9			
20.0		10497.1	9447.3	8527.8	6040.2	4129.0			
50.0		6044.8	5344.1	4791.2	3297.9	2372.8			
80.0		3248.0	2768.6	2461.1	1703.4	1324.5			
90.0		2281.5	1892.8	1673.9	1178.9	965.1			
95.0		1678.6	1355.9	1193.6	859.5	738.4 🛩			
				tistics					
Percent	(
Chance		1	7	15	60	120			
Exceedan	ice	·	·			120			
Mean		3.760	3.701	3.653	3.501	3.366			
Standard D	Dev.	0.305	0.320			0.294			
Station Sk		-0.418	-0.506			-0.183			
Regional S	kew								
Weighted S									
Adopted Sk	kew	-0.418	-0.508			-0.183			
# Years		57	57			57			
# Zero/Miss		4				4			
#Years with Mis	sing D	6		7 7	7	7			
	Plot Duratio	n Plot Analytical	Plot Graphical						

Figure B-73. Tabular Results Tab for Test Example 10.

As shown in Figure B-74, 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.



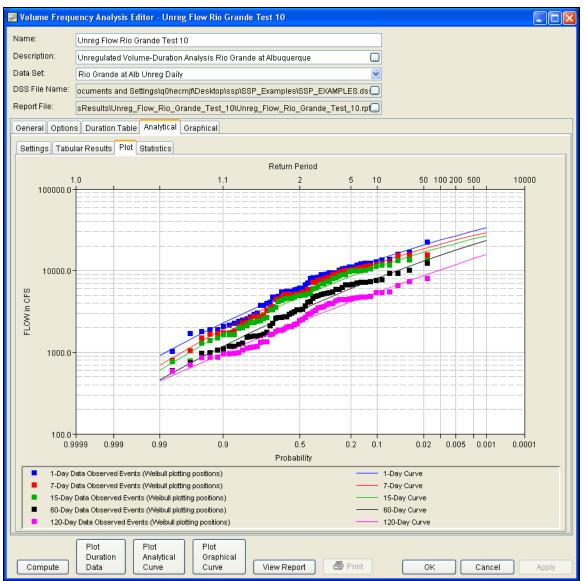


Figure B-74. Plot Tab for Example 10.

For this example, the standard deviation and the adopted skew values were modified to make sure the volume frequency curves were consistent. As shown in Figure B-75, 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-76 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

📈 Volume Frequ	ency Analysis Editor - L	Inreg Flow Rio Gran	de Test 10)*					
Name:	Unreg Flow Rio Grande Test 10								
Description:	Unregulated Volume-Duration Analysis Rio Grande at Albuquerque								
Data Set:	Rio Grande at Alb Unreg Daily								
DSS File Name:	ocuments and Settings\ql] Dhecmjf\Desktop\ssp\8	SP_Examp	oles\SSP_EXAMPLES.ds:					
Report File:	sResults\Unreg_Flow_Ri	o_Grande_Test_10\Ur	reg_Flow_	Rio_Grande_Test_10.rpt					
General Option	s Duration Table Analyti	cal Graphical							
Settings Tabu	lar Results Plot Statistic	s							
-0.15									
-0.20									
-0.25									
-0.30-	•			Log Transfor	mation: On				
8 -0.35- 0 40-				Distribution:	LogPearsonIII				
·0.40			•	X-axis Parame		Parameter			
-0.45-	•			Mean	Skew	<u> </u>			
-0.50					Update Plot]			
-0.55 3.35	3.4 3.45 3.5 3.5 M	55 3.6 3.65 3. ean	7 3.75	3.8					
Sample Statist		7		15	60	120			
Mean Standard Dev.		.760	3.701 0.320	3.653 0.324	3.501 0.328	3.366			
Station Skew	-0.	.418	-0.506	-0.509	-0.312	-0.183			
Adopted Skew	-U.	.418	-0.506	-0.509	-0.312	-0.183			
Use Adjust Statist		7		15	60	120			
Mean		3.76 305	3.701 0.31	3.653 0.315	3.501 0.32	3.366 0.32			
Adopte		182	-0.5	-0.5	-0.45	-0.45			
	Plot Plot Duration Analyti								
Compute	Data Curve	Curve	View F	Report 🖉 Print	ОК	Cancel Apply			

Figure B-75. Statistics Tab for Test Example 10.



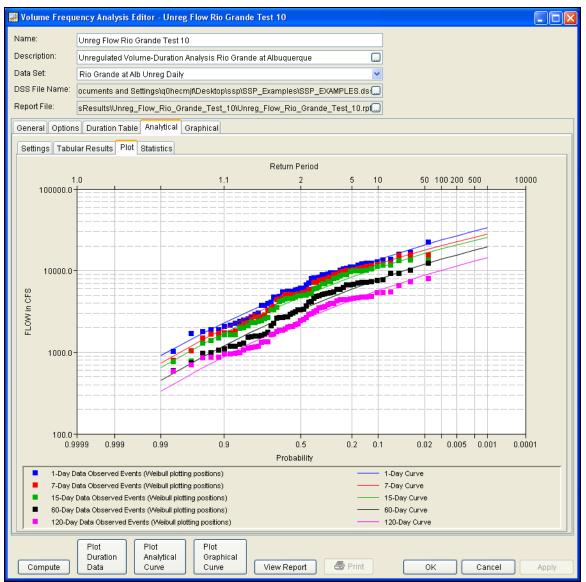


Figure B-76. Plot Tab for Example 10 After the Statistics were Adjusted on the Statistics Tab.

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-77.

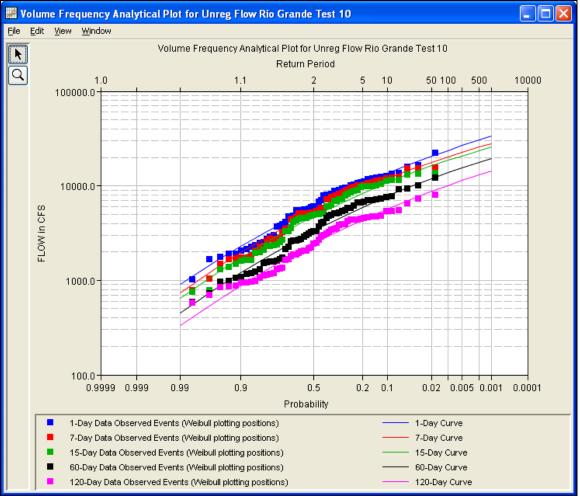


Figure B-77. Plot of the Frequency Curve Results for Test Example 10.

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-78 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.

	: <u>S</u> earch F	<mark>o_Grande_Te</mark> ormat	st_10.1pt				
e: Juss	splSSP Exa	mples\Volume	FrequencvAnalvsi	sResults\Unrea FI	ow Rio Gran	de_Test_10\Unreg_Flow_	Rio Grande Test 10 m
	opioor _2×4		i i oquoiio)i iliai)oi		0.11.10_01411		
							^
	ew Weighti						
				station skew =			
lean-s	square err	or of region	hal skew is un	defined.			
	equency Cu		ily (1-day Max				
(10 GI	at #		(1-day Max			-	
			Percent		e Limits	1	
C		0.00	Chance Exceedance	1	0.95		
				FLUW, 48,234 43,374 37,022 22,287 27,626 21,594 17,142 12,782 7,067 3,833		·	
	33,514		0.1	48,234	25,408	1	
	30,590 26,690		0.2	1 43,374 1 37,022	20,759	1	
	23,714		1.0	32,287	18,682	i	
	20,717 16,714		2.0	27,626	16,552	1	
	13,641		10.0	1 17,142	11,330	1	
	10,497		20.0	1 12,782	8,881	Ì	
	6,045 3,248		50.0 80.0	1 7,067 I 3,833	5,183 2,676	1	
	2,281		90.0	2,761	1,801	1	
	1,679		95.0	2,091	1,801 1,268	1	
	909		99.0 	1,211	643	1	
			I	1		1	
· ~ ~ ~ ~	stomotic 9	Statistics >:					
			∽ ily (l-day Max	:)			
		cansform: J, CFS	N	Number of Events	;		
					·I		
Mea Sta	an andard Dev		760 Histor 305 High O	utliers			
St.	stion Skew	-0.	419 I Town 01	tliers	0 1		
Reg	gional Ske	2W -	Zero E	vents g Events			
Wei Ado	ighted Ske opted Skew	τ -0	Missin 418 System	ig Events latic Events	4 57		
	-						
En	nd of Anal	lytical Freq	lency Curve	-			
<	-	- ··					>
						1:11:1	1:1

Figure B-78. Report File for Test Example 10.

Example 11: Volume Frequency Analysis, Minimum Flows

This example demonstrates how to create a low flow Volume 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**" in the study explorer and then select **Plot**. The data will appear as shown in Figure B-79.

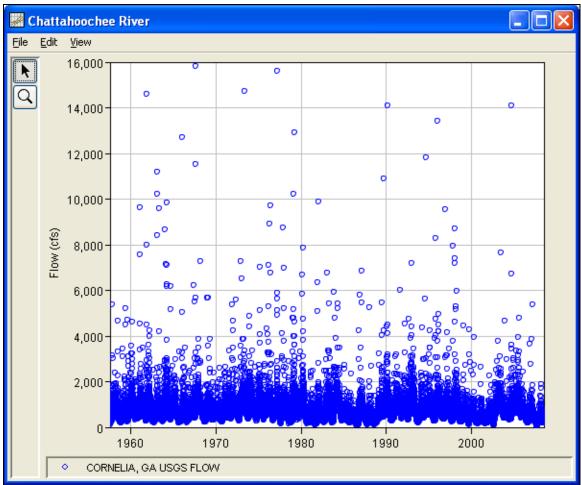


Figure B-79. Plot of Daily Average Flow for Example 11.

A Volume Frequency analysis has been developed for this example. To open the Volume Frequency Analysis editor for test example 11, either double-click on the analysis labeled **Low Flow Analysis Test 11** from the study explorer, or from the **Analysis** menu select open, then

select **Low Flow Analysis Test 11** from the list of available analyses. When test 11 is opened, the Volume Frequency Analysis editor will appear as shown in Figure B-80.

Wolume Frequency Analysis Editor	Low Flow Analysis Test 11*								
Description: This example shows I Data Set: Chattahoochee River DSS File Name: ocuments and Setting Report File: encyAnalysisResultsu	ocuments and Settings\q0hecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.ds{] encyAnalysisResults\Low_Flow_Analysis_Test_11\Low_Flow_Analysis_Test_11.rpf[] ns Duration Table Analytical Graphical								
 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 O1Ja Plot Yearly Data 	 Weibuli (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)/(m+1.A-B) Where: m=Rank, 1=Largest A,B=Constants A,B=Constants A; B: In Date In Date Interpret Season End: Interpret Season Start: Season Start: Season Start: Season End: Interpret Season Start: Season Start: S								
Compute Plot Plot Ana Data Cu									

Figure B-80. Volume Frequency Analysis Editor for Test Example 11.

Shown in Figure B-80 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-81 is the Volume 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**.

Wolume Frequency Analysis Edite	pr - Low Flow Analysis Test 11*	
Data Set: Chattahoochee Rive DSS File Name: ocuments and Settir	s how to perform a low flow analysis using HEC-SSP er	
Flow Durations Change or add to default values Duration in days	User Specified Frequency Ordinates Use Values from Table Below Frequency in Percent 1 7 30 60 90 500 100 200 500 90 90	Historic Period Data Use Historic Data Historic Period Start Year: 0 End Year: 0 Duration Override Low O 1-day 7-day 30-day 60-day 90-day 90-day Historic Events Year Year 1-day 7-day 30-day
	High Outlier Threshold Override High Outlier Threshold Duration Override High Outli 1-day 7-day 30-day 60-day 90-day	

Figure B-81. 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-82.

Appendix B – Example Data Sets

HEC-SSP User's Manual

📈 Volume Fre	quency Analy	ysis Editor -	Low Flow Ar	nalysis Test	11*						
Name:	ne: Low Flow Analysis Test 11										
Description:	This examp	ple shows ho	w to perform a	low flow ana	lysis using HE	EC-SSP					
Data Set:	Chattahoo	chee River					~				
DSS File Nam	e. ocuments a	and Settings\	q0hecmjf\Des	ktop\ssp\SSP	_Examples\S	SP_EXAMPLE	:S.ds:				
Report File:	encyAnalys	isResults\Lo	w_Flow_Analy	sis_Test_11	Low_Flow_Ar	alysis_Test_	11.rp1				
General Ont	ions Duration	Table Anal	dical Granhic	al							
		A THE	nicul orapine	, ai							
Allow Edit	ing										
					Volume-Du	ration Data					
			Lov	vest Mean Va	lue for Duratio	n, Average Da	ily FLOW in C	FS			
Year	1		7		3) (6	D	9()	
	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	Date	FLOW	
1958	12/13/1958	202.0	12/26/1958	266.4	12/21/1958	299.4	12/26/1958	307.1	12/26/1958	332.6	
1959	08/30/1959	222.0	08/30/1959	306.3		370.7	01/01/1959	342.9		344.5	
1960	07/17/1960	325.0	07/19/1960	427.9	12/10/1960	467.0	12/31/1960	507.8	12/31/1960	572.5	
1961	11/12/1961	270.0	10/29/1961	367.9	11/12/1961	378.6	12/09/1961	413.8	12/09/1961	444.2	
1962	10/28/1962	198.0	11/08/1962	258.6		282.0		328.4		352.5	
1963	10/20/1963	244.0	10/21/1963	288.4	11/04/1963	304.9	11/28/1963	338.0	11/22/1963	372.3	
1964	09/27/1964	300.0	09/28/1964	337.9	09/29/1964	414.9	09/28/1964	483.4		459.9	
1965	09/26/1965 09/11/1966	175.0 200.0	12/24/1965	277.1 267.3	09/29/1965 01/02/1966	303.6 303.2	12/29/1965 01/02/1966	349.2 348.2	12/31/1965 01/04/1966	357.8 348.9	
1960	08/19/1967	380.0	08/19/1967	476.9	01/02/1900	576.0	01/02/1967	625.7	01/04/1967	577.2	
1968	09/15/1968	245.0	08/30/1968	297.0		352.4	10/15/1968	363.7	11/07/1968	372.4	
1969	10/19/1969	296.0	10/30/1969	366.4	10/31/1969	425.0	08/15/1969	510.5	01/01/1969	516.4	
1970	10/04/1970	229.0	10/08/1970	261.6	10/18/1970	306.8	10/19/1970	344.5	10/28/1970	404.9	
1971	10/31/1971	363.0	10/13/1971	436.6	01/01/1971	451.0	01/03/1971	473.0		495.0	1
1972	10/15/1972	290.0	09/16/1972	345.1	09/29/1972	398.8	10/22/1972	421.2	11/02/1972	472.7	1
1973	10/27/1973	372.0	10/27/1973	444.1	11/18/1973	453.2	11/20/1973	501.4	11/20/1973	556.4	
1974	11/08/1974	278.0	11/11/1974	372.0	11/16/1974	408.3	11/18/1974	442.1	12/07/1974	487.2	
1975	08/24/1975	307.0	08/27/1975	390.7	09/06/1975	454.6	09/16/1975	542.4		518.8	
1976	09/23/1976	288.0	09/23/1976	372.9		433.2	10/06/1976	491.5		510.1	
1977	09/03/1977	153.0	09/05/1977	249.4	09/04/1977	332.9	09/06/1977	351.0	09/13/1977	413.5	
1978	07/30/1978	162.0	11/08/1978	279.6	11/13/1978	286.5	11/26/1978	310.6	11/29/1978	354.1 415.5	
1979 1980	08/18/1979 09/14/1980	295.0 155.0	08/22/1979 09/16/1980	393.0 282.3	08/25/1979 09/19/1980	519.1 331.5	01/01/1979 09/28/1980	472.0 384.4	01/01/1979	415.5	
1980	10/04/1980	100.0	10/09/1980	282.3	10/25/1981	187.3	11/17/1981	225.4	10/25/1981	403.3	
1981	10/03/1982	120.0	10/03/1981	252.7	10/07/1982	304.9	10/12/1982	380.8		361.2	
1983	08/28/1983	194.0	08/24/1983	302.6	09/03/1983	363.7	10/12/1983	382.0	11/13/1983	397.3	
1984	11/18/1984	282.0	11/27/1984	364.1	10/21/1984	409.4	11/27/1984	432.9		456.2	
1985	10/20/1985	191.0	10/13/1985	288.0	10/20/1985	317.8	10/31/1985	352.2	11/28/1985	413.2	
1986	07/20/1986	94.0	07/22/1986	124.1	07/23/1986	152.2	08/18/1986	161.3	08/31/1986	189.4	
	Extract Volume-Duration Data										
	Plot	Plot	PI								
Compute	Duration			raphical	Mary Den er	- Br	rint	01			n n lu
Compute	Data	Curve		urve	View Report			ок	Cance		pply

Figure B-82. 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-83 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 Frequ	uency Analysis Editor - Low Flow An	alysis Test 11*								
Name:	Low Flow Analysis Test 11									
Description:	This example shows how to perform a	low flow analysis using HEC-SSP								
Data Set:	Chattahoochee River	✓								
DSS File Name:	ocuments and Settings\q0hecmjf\Desl	dop\ssp\SSP_Examples\SSP_EXAMPLES.ds:								
Report File:										
General Option	ns Duration Table Analytical Graphic	al								
Settings Tabu	ular Results Plot Statistics									
Log Transform	nation: On	Skew								
Distribution:		● Use Station Skew								
LogPearsonII	II 💌	O Use Weighted Skew								
Expected Pro		O Use Regional Skew								
🔿 Compute	e Expected Prob. Curve		R.Skew MSE							
💿 Do Not C	Compute Expected Prob. Curve	1								
		7 30								
		00								
		30								
	Plot Plot Plot									
Compute		aphical View Report 🗇 Print	OK Cancel Apply							

Figure B-83. Settings Tab Shown for Test Example 11.

Press the **Compute** button to perform the analysis. A message window will open stating that a few of the annual maximums occurred during the beginning of the year. The message suggests that the user change the year/season specification to capture independent events. You want to minimize the possibility that the same flood event is used for consecutive years. Press the OK button to finish the computation. Once the computations have been completed, a message window will open stating **Compute Complete**. Close this window and then select the **Tabular Results** tab within the analytical analysis. The results table should look Figure B-84. 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 durations.

Appendix B – Example Data Sets

	ecmjflDesktop\ssp\SSP_Ex	amples\SSP_EXAMPLES.ds:	~			
Chattahoochee River	ecmjflDesktop\ssp\SSP_Ex	amples\SSP_EXAMPLES.ds:	~			
ocuments and Settings\q0he		amples\SSP_EXAMPLES.ds:				
encyAnalysisResults\Low_Fl	low Analysis Test 11\Low		DSS File Name: ocuments and Settings\q0hecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.ds{			
	Report File: encyAnalysisResults\Low_Flow_Analysis_Test_11\Low_Flow_Analysis_Test_11.rpt					
Duration Table Analytical	Graphical					
r Results Plot Statistics						
Volume Fre	equency Curves for Low Flo	w Analysis Test 11, Average Da	aily FLOW in CFS			
	7	30	60	90		
				656.4		
				592.4		
				553.3		
				502.1 397.7		
				294.2		
				234.2		
				205.8		
				166.9		
				143.7		
			104.5	124.3		
	45.5		84.7	103.2 🞽		
		olalistics		[
1	7	20	60	90		
		30	60	90		
	2.254	2.444 2.50	1 2552	2.579		
02				0.143		
				-0.888		
		-0.30	-0.377	-0.000		
	-0.758 -	1.201 -0.98	9 -0.977	-0.888		
	50			50		
	0					
# Years with Missing D 0 1 1 1 1						
	Ce 1	Volume Frequency Curves for Low Flo 1 7 470.4 44 404.3 44 367.1 4 321.4 33 236.4 33 161.4 22 128.1 11 040.0 11 80.7 1 67.4 1 56.7 1 67.4 1 7 2.351 1 7 ce 1 2.351 1 ew -0.758 - - kew - 50 - 101 0	Volume Frequency Curves for Low Flow Analysis Test 11, Average D volume Frequency Curves for Low Flow Analysis Test 11, Average D 1 7 30 2 470.4 491.6 572.1 404.3 453.3 517.2 367.1 426.2 482.3 321.4 387.5 436.7 236.4 300.3 338.5 161.4 208.6 241.7 128.1 164.2 195.3 104.0 131.3 160.6 80.7 99.1 126.1 67.4 80.7 105.8 56.7 66.0 89.3 45.5 50.9 71.8 Statistics v 0.182 0.171 0.15 ew -0.758 -1.201 -0.98 kew - - - 10 0 0 50 53	Volume Frequency Curves for Low Flow Analysis Test 11, Average Daily FLOW in CF8 1 7 30 60 470.4 491.6 572.1 628.2 404.3 453.3 517.2 569.1 30 367.1 426.2 4482.3 531.6 321.4 387.5 435.7 481.5 236.4 300.3 338.5 377.0 161.4 208.6 241.7 272.3 161.4 208.6 241.7 272.3 104.0 131.3 160.6 183.7 80.7 99.1 126.1 145.5 67.4 80.7 105.8 123.0 65.7 66.0 89.3 104.5 45.5 50.9 71.8 84.7 Statistics Vev 0 Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan= 2"Colspan="2">Colspan= 2"Colspan="2">Colspan= 2"Colspan="2">Colspan= 2"Colspan="2">Colspan= 2"Colspan="2"Colspan="2">Colspan= 2"Colspan= 2"Colspan="2"Colspan="2"Colspan="2"Colspan="2"Colspa		

Figure B-84. Tabular Results Tab for Test Example 11.

As shown in Figure B-85, the **Plot** 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.

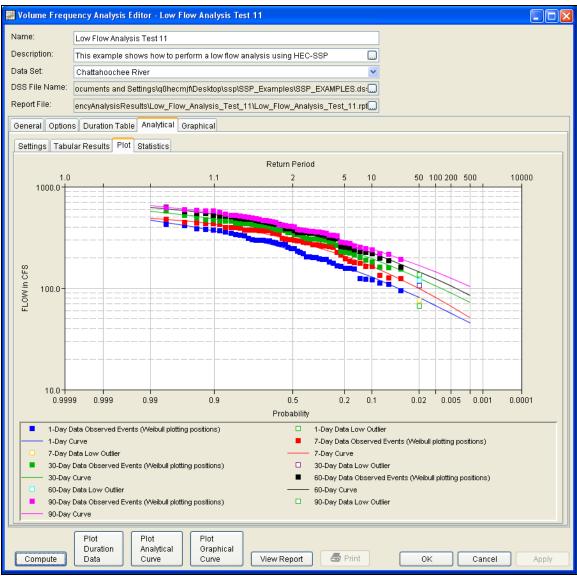


Figure B-85. Plot for Test Example 11.

For this example, the standard deviation and the adopted skew were modified to make sure the volume frequency curves were consistent. As shown in Figure B-86, 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-87 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.

Appendix B – Example Data Sets

HEC-SSP User's Manual

📓 Volume Frequ	iency Analysis Editor - Low	Flow Analysis Test 11*			
Name:	Low Flow Analysis Test 11				
Description:	This example shows how to p	erform a low flow analysis ι	sing HEC-SSP		
Data Set:	Chattahoochee River			~	
DSS File Name:	ocuments and Settings\q0hec	mjf\Desktop\ssp\SSP_Exan	nples\SSP_EXAMPLES.ds:		
Report File:	encyAnalysisResults\Low_Flo	w Analysis Test 11\Low F	low Analysis Test 11.rpt		
General Options Duration Table Analytical Graphical					
		oraphical			
Settings Tabu	lar Results Plot Statistics				
-0.8					
0.0			1		
-0.9			 Log Transfor 	mation: On	
			Distribution:	LogPearsonIII	
ັສ -1.0- ສັ			X-axis Parame	eter Y-axis	Parameter
-1.1			Mean	🖌 Skew	✓
-1.2	•			Update Plot	
2.35	2.4 2.45	2.5 2.55			
2.35	2.4 2.45 Mean	2.5 2.55			
Sample Statis Mean	tics 1 2.351	7 2.444	30 2.504	60 2.552	90 2.579
Standard Dev.	0.182	0.171	0.159	0.154	0.143
Station Skew Adopted Skew	-0.758	-1.201 -1.201	-0.989 -0.989	-0.977 -0.977	-0.888 -0.888
Use Adjust Statist		7	30	60	90
🗹 Mean	2.351	2.444	2.504	2.552	2.579
Standa		0.175 -0.88	0.17 -0.86	0.165 -0.84	0.16
	u	-0.00	-0.80	-0.04	-0.82
	Plot Plot Duration Analytical	Plot Graphical			
Compute	Data Curve		/ Report 🛛 🖨 Print	ОК	Cancel Apply

Figure B-86. Statistics Tab for Test Example 11.

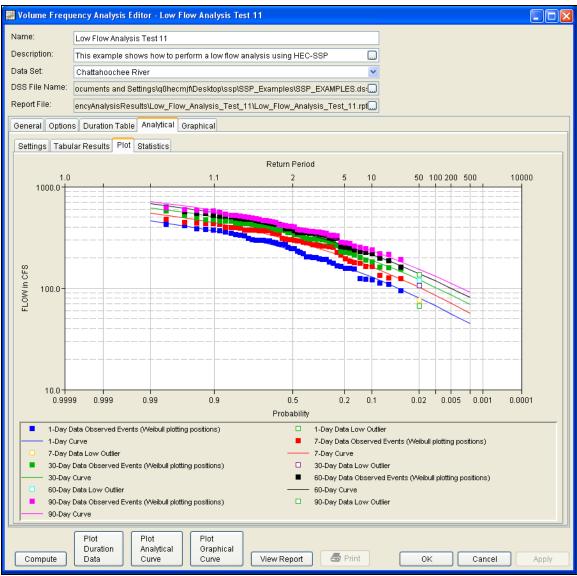


Figure B-87. Plot Tab for Test Example 11.

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-88.

Appendix B – Example Data Sets

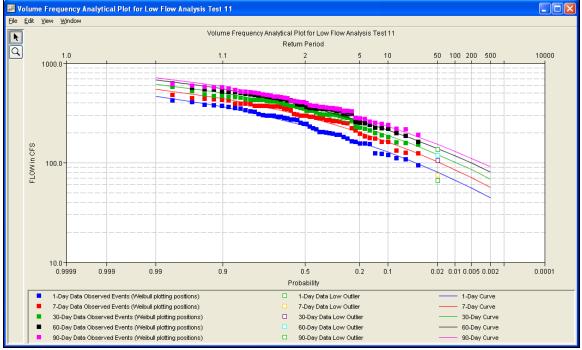


Figure B-88. Plot of the Frequency Curve Results for Test Example 11.

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-89 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.

Edit Sparch Figmat File: mpRDesktopicspi2SP_ExamplestVolumeFrequencyAnalysisResultsULow_Flow_Analysis_Test_111Low_Flow_Analysis_Test_111 Statistical Analysis of 1-day Hinimum values	Low_Flow_Analysis_Test_11.rp			
Statistical Analysis of 1-day Minimum values Note: Data are missing for all or part of 0 years in analysis period. Warning: 1 events occur in first 6 days of analysis year for 1-day duration. Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Preliminary Results <	e <u>E</u> dit <u>S</u> earch F <u>o</u> rmat			
Note: Data are missing for all or part of 0 years in analysis period. Warning: 1 events occur in first 6 days of analysis year for 1-day duration. Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Preliminary Results << Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Mean-square error of regional skew is undefined.	File: mjftDesktop\ssp\SSP_Examples\VolumeFrequencyAnalysisResults\Low_Flow_Analysis_Test_11\Low_Flow_Analysis_Test_11.rpt			
Note: Data are missing for all or part of 0 years in analysis period. Warning: 1 events occur in first 6 days of analysis year for 1-day duration. Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Preliminary Results << Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Meen-square error of regional skew is undefined.	Statistical Analysis of 1-day Minimum values			
Warning: 1 events occur in first 6 days of analysis year for 1-day duration. Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Freliminary Results <<				
Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Preliminary Results << Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Mean-square error of regional skew is undefined.	Note: Data are missing for all	. or part of O years in an	alysis period.	
Suggest reviewing data and changing the year/season specification on the General tab to capture indeper Preliminary Results << Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Mean-square error of regional skew is undefined.	Marning: 1 events occur in fil	st 6 days of analysis yea	for l-day duration.	
Preliminary Results <pre> << Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Mean-square error of regional skew is undefined</pre>	-		-	ral tah to canture indeper
<pre><< Skew Weighting >> Based on 50 events, mean-square error of station skew = 0.163 Mean-square error of regional skew is undefined</pre>		nging die year/season spe		tar cab co captare indeper
Based on 50 events, mean-square error of station skew = 0.163 Hean-square error of regional skew is undefined. 	Preliminary Results			
Mean-square error of regional skew is undefined.	<< Skew Weighting >>			
<pre> </pre> <pre> </pre> <pre> </pre> <pre> Chattahoochee River (l-day Min) </pre> <pre> </pre> <pre> </pre> <pre> </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> </pre> <pre> </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> Computed Expected Percent Confidence Limits </pre> <pre> <td></td><td></td><td>0.163</td><td></td></pre>			0.163	
Chattahoochee River (1-day Min) 	Mean-square error of regional	skew is undefined.		
Chattahoochee River (1-day Min) 				
Computed Expected Percent Confidence Limits Curve Probability Chance Non- 0.05 0.95 FLOW, CFS Exceedance FLOW, CFS				
Curve Probability Chance Non- 0.05 0.95 FLOW, CFS Exceedance FLOW, CFS 1 470 99.0 564 409 404 99.0 474 357 367 90.0 424 327 321 80.0 365 289 236 50.0 262 214 161 20.0 179 143 128 10.0 145 110 128 1.0 120 86 81 2.0 96 64 67 1.0 82 52 57 0.2 58 33				
404 95.0 474 357 367 90.0 424 327 321 80.0 365 289 236 10.0 262 214 161 20.0 179 143 128 10.0 145 110 104 5.0 20 86 81 1.0 82 52 67 0.5 70 42 45 0.2 58 33				
367 90.0 424 327 321 80.0 365 289 236 50.0 262 214 161 20.0 179 143 128 10.0 145 110 104 5.0 120 86 81 2.0 96 64 67 0.5 70 42 45 0.2 58 33 0.2 58 33 0.2 58 33 0.2 58 33				
236 50.0 262 214 161 20.0 179 143 128 10.0 145 110 104 5.0 120 86 81 2.0 96 64 67 1.0 82 52 57 0.5 70 42 45 0.2 58 33		90.0 424		
1 128 10.0 145 110 1 104 5.0 120 86 1 81 2.0 96 64 1 67 1.0 82 52 1 57 0.5 70 42 1 45 0.2 58 33 1 0.2 58 33 1 Log Transform: 1 FLOW, CFS Number of Events 1 FLOW, CFS Number of Events 1 Mean 2.351 Historic Events 0 1 Standard Dev 0.182 High Outliers 0	236 1	50.0 262	·	
1 104 5.0 120 86 1 81 2.0 96 64 1 67 1.0 82 52 1 57 0.5 70 42 1 45 0.2 58 33 1				
81 2.0 96 64 67 1.0 82 52 57 0.5 70 42 45 0.2 58 33				
1 57 0.5 1 70 42 1 45 0.2 58 33 1 0.2 58 33 1 1 Log Transform: 1 1 1 1 FLOW, CFS Number of Events 1 1 FLOW, CFS Number of Events 1 1 Mean 2.351 Historic Events 0 1 Standard Dev 0.182 High Outliers 0	81 1			
45 0.2 58 33				
<pre> // / / / / / / / / / / / / / / /</pre>			•	
I Log Transform: I I FLOW, CFS I I FLOW, CFS Number of Events I Mean 2.351 I Mean 2.351 I Standard Dev 0.182 I Standard Dev 0.182	 << Systematic Statistics >>	II	1	
I FLOW, CFS I Number of Events I I Mean 2.351 Historic Events 0 I I Standard Dev 0.182 High Outliers 0 I				
Standard Dev 0.182 High Outliers 0		 Number of Events		
	Mean 2.351 Standard Dev 0.182	Historic Events High Outliers	v ,	✓
	<			>
1:11:1 1:1			1:1.1:1	1:1

Figure B-89. Report File for Test Example 11.

Example 12: Duration Analysis, BIN (STATS) Method

This example demonstrates how to use the Duration analysis. The data for this example is daily average flow from the Fishkill Creek (Beacon NY) USGS stream gage. The period of record used for this example is from 01 Oct, 1944 to 30 Sep, 1968. To view the data, right-click on the data record labeled "**Fishkill Creek-Daily Flow**" in the study explorer and then select **Plot**. The data will appear as shown in Figure B-90.

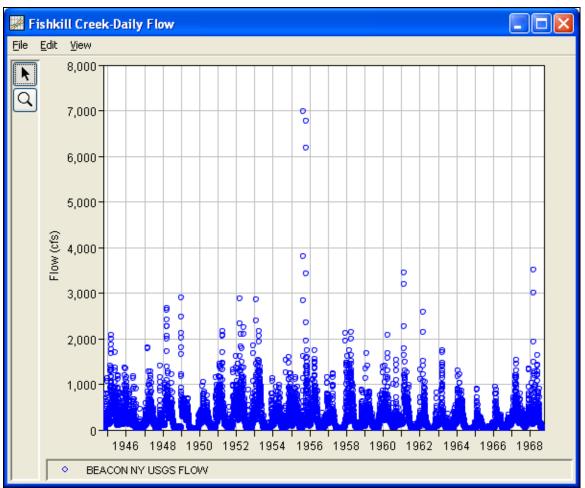


Figure B-90. Plot of the Daily Average Flow for Example 12.

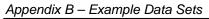
A Duration analysis has been developed for this example. To open the analysis editor for Test Example 12, either double-click on the analysis labeled **Fishkill Creek Test 12** from the study explorer, or from the **Analysis** menu select open, then select **Fishkill Creek Test 12** from the list of available analyses. When Test 12 is opened, the duration analysis editor will appear as shown in Figure B-91.

📈 Duration Anal	ysis Editor - Fishkill Creek Test 12			
Name: Description:	Fishkill Creek Test 12			
Data Set:	nkill Creek-Daily Flow			
DSS File Name:	C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Exam			
Report File:	p\SSP_Examples\DurationAnalysisResults\Fishkill_Creek_Tes	t_12\Fishkill_Creek_Test_12.rpt		
General Option	s Results Manual Entry			
Method		Time Window Modification		
🔘 Rank All Dat		End Points		
 Bin (STATS) 		DSS Range is 010CT1944 - 30SI	EP1968	
-X-Axis Scale		Start Date		
💿 Linear		End Date		
🔘 Probablity		· · · · · · · · · · · · · · · · · · ·		
Y-Axis Scale		Duration Period		
💿 Linear		Annual		~
🔿 Log		Start of Period	End of Period	
C	ompute Plot Duration Curve View Report	Print	OK Cancel	Apply

Figure B-91. Duration Analysis Editor for Test Example 12.

Shown in Figure B-91 are the general settings that were used to perform this duration analysis. For this analysis, the **Bin (STATS)** method was selected, the x-axis scale was set to **Linear**, the y-axis scale was set to **Linear**, and the **Annual** duration period was selected.

The **Options Tab** is shown in Figure B-92. Features on this tab include **Output Labeling**, the **Percent of Time Exceeded** ordinates, and **Bin Limits**. The Bin Limits panel is active in this example because the Bin (STATS) method was selected on the General tab. The User-Defined bin limits method was selected and the bin limits were entered manually.



🐺 Duration Anal	ysis Editor - Fishkill Creek Test 12*		
Name: Description: Data Set: DSS File Name: Report File:		Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss ishkill_Creek_Test_12/Fishkill_Creek_Test_12.rpf	
	Results Manual Entry		
Output Labelin	ng me is FLOW Label FLOW its are CFS Label CFS	User-Specified Exceedance Ordinates 	Bin Limits User-Defined
Com	pute Plot Duration Curve V	/iew Report 🖉 Print	OK Cancel Apply

Figure B-92. Duration Analysis Editor with Options Tab Shown for Test Example 12.

Once all of the General and Optional settings are set or selected, the user can choose to compute the analysis by pressing the **Compute** button. Once the computations have been completed, a message window will open stating **Compute Complete.** Close this window and then select the **Results** tab, shown in Figure B-93.

🔛 Duration Anal	ysis Editor -	Fishkill Creek Test 12				
Name:	Fishkill Cree	ek Test 12				
Description:						
Data Set:	Fishkill Cree	ek-Daily Flow		~		
DSS File Name:		·	toniconiqqp Evamplaciqqe			
	DSS File Name: C:Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.dss Report File: p\SSP_Examples\DurationAnalysisResults\Fishkill_Creek_Test_12\Fishkill_Creek_Test_12.rpt					
Report File.	pissP_Exar	nples(DurationAnalysisResults	Fishkill_Creek_Test_12\Fisi	hkill_Creek_Test_12.rpt[]		
General Option	s Results	Manual Entry				
Tabular Results	Plot					
Class N	umber	Lower Bin Limit	Upper Bin Limit	Number in Bin	Accum Number	Percent Equal or Exceeded
	1		2.0	5	8766	
	2		3.0	4	8761	99.9
	3		4.0	8	8757	99.9
	4		5.0	22	8749	
	5		6.0	37	8727	99.6
	6		8.0 10.0	66 95	8690	99.1 98.4
			15.0	254	8529	
	9		20.0	254	8275	
	10		30.0	423	8014	91.4
	11		40.0	405	7591	86.6
	12		50.0	359	7186	
	13		60.0	332	6827	77.9
	14		80.0	480	6495	
			100.0	100	0015	
		Percent of			Annual - FLOW	
		Time Exceeded				
			99.0			6.4
			95.0			14.0
			90.0			22.9
			80.0			44.8
						171.4 360.5
			25.0			520.0
			10.0			671.6
			5.0			916.9
			2.0			1326.1
1.0				1503.6		
			0.1			3039.0
					3769.5	
			0.01			6707.8
Ci	ompute	Plot Duration Curve Vi	ew Report 🛛 🎒 Print	J	ОК	Cancel Apply

Figure B-93. The Results Tab for Test Example 12.

As shown in Figure B-93, the **Result** tab contains both tabular and graphical results. The **Tabular Results** tab contains a table with information about the bins, like the lower bin limit, the number of values in the bin, the accumulated number of values greater than or equal to the lower bin limit, and the percent of time equaled or exceeded for each bin. Tabular results also include a table of the duration curve interpolated to the percent of time exceeded ordinates defined on the Options tab. The **Plot** tab contains a graph of the duration curve, shown in Figure B-94. The plot includes the computed duration curve and the duration curve interpolated to the user-defined percent of time exceeded ordinates. The duration curve plot can also be opened by pressing the **Plot Duration Curve** button at the bottom of the analysis window.

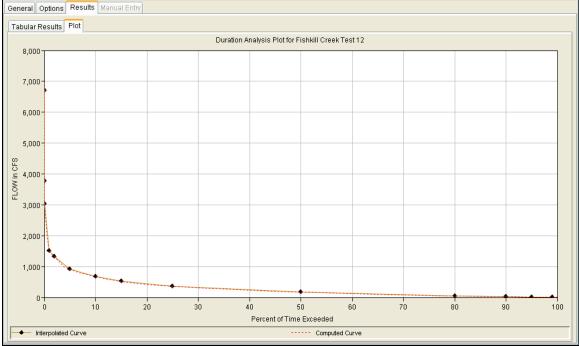


Figure B-94. Plot Tab for Test Example 12.

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 input data and results for the analysis. 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-95 is the report file for Test Example 12.

Fishkill_C	reek_Test_12.rpt					X
<u>File E</u> dit <u>S</u> ea	rch F <u>o</u> rmat					
File: C:\Docur	ments and Settings\c	ninecmitDesk	topisspi8SP	Examples\Durat	ionAnalysisResults\Fishl	kill Creek Test 12\Fi
		1			,	
						<u>^</u>
Annual Dur	ation Analysis					
Fishkill C	reek-Daily Flow					
Time Perio	d: OlJan - 31Dec					
	lid Values: ssing Values:	8766 0				
	-	Ŭ				
Minimum V Maximum V		1.1				
Naximum v	arue: 0,	,970.0				
1	Lower	Number	I	Percent	-	
Bin	Bin	in	Accum	Equal or	I	
Number	Limit	Bin	Number	Exceeded		
	1.0	5	8766	100.000		
2						
3 4						
1 41						
i 6 i	6.0	66 I	8690 J	99.133	l	
8 9	10.0 15.0					
i 10 i	20.0					
14	60.0	480 J	6495	74.093	l	
						=
18						
19						
i 22 i						
24 25						
26	2,000.0	32	41	0.468		
28 29						
i 30 i						~
<						>
					1:11:1	1:1

Figure B-95. Report File for Test Example 12.

Example 13: Duration Analysis, Rank All Data Method

This example demonstrates how to use the Duration analysis. The data for this example is daily average flow and the period of record is from 01 Apr, 1899 to 28 Jan, 2010. To view the data, right-click on the data record labeled "**Wondering River-Franklin**" in the study explorer and then select **Plot**. The data will appear as shown in Figure B-96.

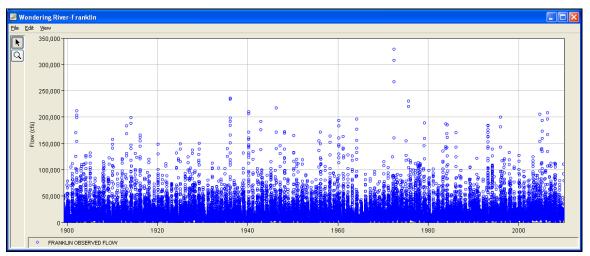


Figure B-96. Plot of the Daily Average Flow for Example 13.

A Duration analysis has been developed for this example. To open the analysis editor for Test Example 13, either double-click on the analysis labeled **Duration Curve Test 13** from the study explorer, or from the **Analysis** menu select open, then select **Duration Curve Test 13** from the list of available analyses. When Test 13 is opened, the duration analysis editor will appear as shown in Figure B-97.

🔛 Duration Ana	ysis Editor - Duration Curve Test 13		
Name:	Duration Curve Test 13		
Description:			
Data Set:	Wondering River-Franklin		
DSS File Name:	C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Exam	ples\SSP_EXAMPLES.dss	
Report File:	3SP_Examples\DurationAnalysisResults\Duration_Curve_Test	13\Duration_Curve_Test_13.rpl	
General Option	s Results Manual Entry		
Method		Time Window Modification	
💿 Rank All Dat	a Values	End Points	
O Bin (STATS)		DSS Range is 01APR1899 - 28JAN2010	
X-Axis Scale		Start Date	
📀 Linear		End Date	
🔿 Probablity		Duration Derivat	
Y-Axis Scale		Duration Period	
🔿 Linear		Annual	<u>∼</u>
💿 Log		Start of Period	End of Period
C	ompute Plot Duration Curve View Report	Print	OK Cancel Apply

Figure B-97. Duration Analysis Editor for Test Example 13.

Shown in Figure B-97 are the general settings that were used to perform this duration analysis. For this analysis, the **Rank All DataValues** method was selected, x-axis scale was set to **Linear**, the y-axis scale was set to **Log**, and the **Annual** duration period was selected.

The **Options Tab** is shown in Figure B-98. Features on this tab include **Output Labeling**, the **Percent of Time Exceeded** ordinates, and **Bin Limits**. The Bin Limits panel is not active in this example because the Bin (STATS) method was not selected on the General tab.

Appendix B – Example Data Sets

🔛 Duration Anal	ysis Editor - Duration Curve Test 13		
Name:	Duration Curve Test 13		
Description:			
Data Set:	Wondering River-Franklin	×	
DSS File Name:	C:\Documents and Settings\q0hecmjf\Des	ktop\ssp\SSP_Examples\SSP_EXAMPLES.dss 🛛 🛄	
Report File:	3SP_Examples\DurationAnalysisResults\D	Duration_Curve_Test_13\Duration_Curve_Test_13.rpt	
General Option	s Results Manual Entry		
⊂Output Labelin	ng	User-Specified Exceedance Ordinates	Bin Limits
DSS Data Na	meis FLOW	Change or Add to Default Values	User-Defined
🗌 Change	Label FLOW	Percent of	
DSS Data Un	its are ofs	Time Exceeded 99.0	
🗌 Change	Label ofs	95.0	
⊂Plotting Positi	on Formula	90.0	
 Rank/(N+1 		50.0	
O Rank/N	,	15.0	
		10.0	
		2.0	
		0.1	
CI	ompute Plot Duration Curve V	iew Report 🖉 Print	OK Cancel Apply

Figure B-98. Duration Analysis Editor with Options Tab Shown for Test Example 13.

Once all of the General and Optional settings are set or selected, the user can choose to compute the analysis by pressing the **Compute** button. Once the computations have been completed, a message window will open stating **Compute Complete.** Close this window and then select the **Results** tab, shown in Figure B-99.

Appendix B – Example Data Sets

🔛 Duration Anal	ysis Editor - Duration Curve Test 13	
Name: Description:	Duration Curve Test 13	
Data Set:	Wondering River-Franklin	
DSS File Name:	C:\Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\SSP	EXAMPLES.dss
Report File:	3SP_Examples\DurationAnalysisResults\Duration_Curve_Test_13\Durat	
General Option	s Results Manual Entry	
Tabular Result		
	Percent of	Annual - FLOW
	Time Exceeded	Annuai - PLOW
	99.0	997.8
	95.0 90.0	1486.7 1938.1
	80.0	3005.9
	50.0	8095.9
	25.0	18022.2
	15.0	26771.7
	10.0	34462.0
	5.0	49097.6
	<u>2.0</u> 1.0	72793.3 91998.1
	0.1	91998.1 170943.0
C	ompute Plot Duration Curve View Report 🔗 Print	OK Cancel Apply

Figure B-99. The Results Tab for Test Example 13.

As shown in Figure B-99, the **Result** tab contains both tabular and graphical results. The **Tabular Results** tab contains a table of the duration curve interpolated to the percent of time exceeded ordinates defined on the Options tab. The **Plot** tab contains a graph of the duration curve. The plot includes the computed duration curve and the duration curve interpolated to the user-defined percent of time exceeded ordinates. The duration curve plot can also be opened by pressing the **Plot Duration Curve** button at the bottom of the analysis window, shown in Figure B-100.

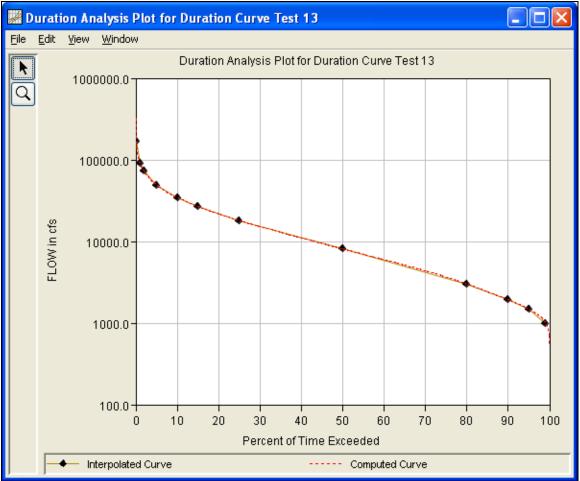


Figure B-100. Plot Tab for Test Example 13.

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 input data and results for the analysis. 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-101 is the report file for Test Example 13.

Duration_Curve_	Test_13.rpt			X
<u>File E</u> dit <u>S</u> earch F <u>o</u> rr	nat			
File: q0hecmjf\Deskto	p\ssp\SSP_Example	s\DurationAnalysisResults\Dura	ation_Curve_Test_13\Duratio	n_Curve_Test_13.rpt
Duration Analysis	s Method: Standa	cd		
Duration Plot Pos	sition Method: Ra	ank/(N+1)		
X-Axis Scale: Lir	lear			
Y-Axis Scale: Log	yarithmic			
Duration Period:	Annual			
Use Standard Perc	cent Exceedance			
Display ordinate	values using 1 o	ligits in fraction part o	f value	
End of Input	Data			
Annual Duration A				
Wondering River-H				
Time Period: OlJa				
Number Valid Val Number Missing V				
Minimum Value: Maximum Value:				
Maximum varue.	320,470.0			
Percent of	FLOW	-		
Time Exceeded		•		
j 99.0 j	997.8			
90.0	1,938.0			
1 80.0	3,005.9	l		
50.0 25.0	8,095.9 18.022.2			
15.0	26 771 7	I		
1 10.0 1	34,462.0	l		
5.0				
1.0				
0.1 	170,943.0			
<				×
		,		
			1:11:1	1:1

Figure B-101. Report File for Test Example 13.

Example 14: Duration Analysis, Manual Entry

This example demonstrates how to use the Duration analysis and enter the duration curve manually. To open the analysis editor for example 14, either double-click on the analysis labeled **Manual Duration Curve Test 14** from the study explorer, or from the **Analysis** menu select open, then select **Manual Duration Curve Test 14** from the list of available analyses. As shown in Figure B-102, the "None" data set was selected for this analysis. The **Manual Entry** tab becomes active when the "None" data set is selected (the **Result** tab will become inactive).

🞇 Duration Analysis Editor - Manual Duratio	on Curve Test 14	
Name: Manual Duration Curve Test 1	14	
Description:		
Data Set: None		
DSS File Name: C:\Documents and Settings\q	q0hecmjftDesktop\ssp\SSP_Examples\SSP_EXAMPLES.dss	
Report File: vurationAnalysisResults\Manu	ual_Duration_Curve_Test_14\Manual_Duration_Curve_Test_14.rpl	
General Options Results Manual Entry		
Method	Time Window Modification	
 Rank All Data Values 	End Points	
O Bin (STATS)	DSS Range is	
X-Axis Scale	Start Date	
⊙ Linear	End Date	
O Probablity	C Duration Period	
Y-Axis Scale	Annual	~
O Linear		of Period
⊙ Log		
Compute Plot Duration Cu	turve View Report @ Print	OK Cancel Apply

Figure B-102. Duration Analysis Editor for Test Example 14.

The y-axis scale was set to **Log** while all other default options were selected on the General and Options tabs. Figure B-103 shows the **Manual Entry** tab for Test Example 14. A variable name of "FLOW" and units of "cfs" were entered as well as the duration curve. The program will plot the duration curve when the **Compute** button is pressed.

Appendix B – Example Data Sets

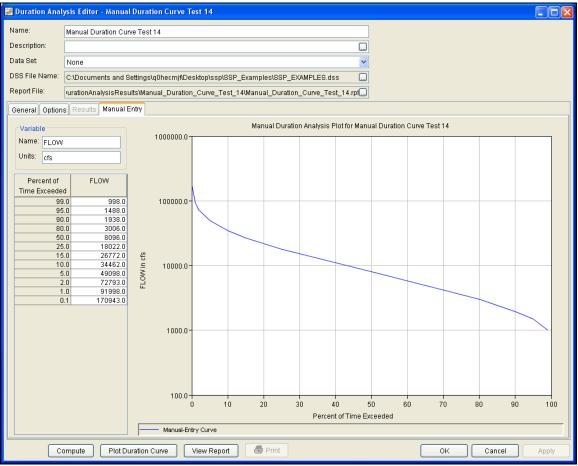


Figure B-103. Duration Analysis Editor with Options Tab Shown for Test Example 14.

The duration curve plot can also be opened by pressing the **Plot Duration Curve** button at the bottom of the analysis window, shown in Figure B-104.

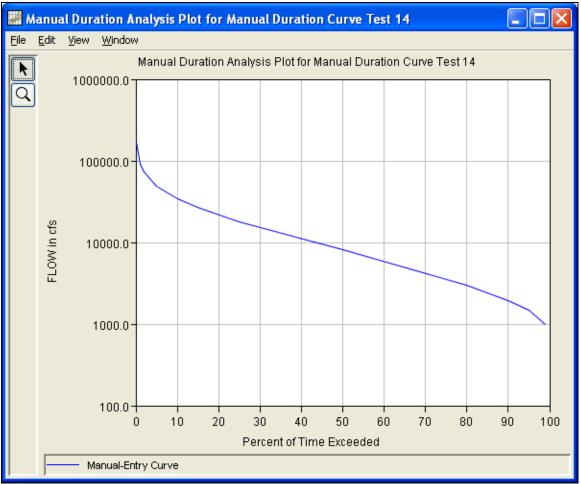


Figure B-104. Plot Tab for Test Example 14.

Example 15: Coincident Frequency Analysis, A and B can be Assumed Independent

This example demonstrates how to create a coincident frequency analysis. Figure B-105 illustrates the scenario for Example 15. The goal of this example is to develop a stage-frequency curve at a point along the tributary (variable C) given flows on the tributary (variable A) and flows in the mainstem (variable B). Large flows on the mainstem do cause backwater along the tributary and thus affect the stage at the point of interest. The data for this example comes from an existing flow frequency curve for Variable A and an existing flow duration curve for Variable B. An HEC-RAS model was used to simulate the response of Variable C (stage at the point of interest) for multiple combinations of flow on the tributary and flow in the mainstem.

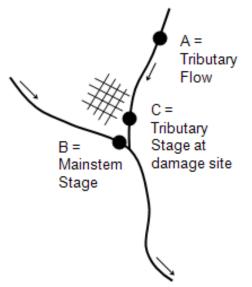


Figure B-105. Scenario for Example 15.

A Coincident Frequency analysis has been developed for this example. To open the Coincident Frequency Analysis editor for test example 15, either double-click on the analysis labeled **Coincident Freq Test 15** from the study explorer, or from the **Analysis** menu select open, then select **Coincident Freq Test 15** from the list of available analyses. When test 15 is opened, the Coincident Frequency Analysis editor will appear as shown in Figure B-106.

💹 Coincident Fr	equency Analysis Editor - Coincident Freq Test 15		
Name:	Coincident Freq Test 15]	
Description:]	
DSS File Name:]	
Report File:	$s\coincident\coincident_Freq_Test_15\coincident_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Freq_Test_15\coincident_Fres_Test_15\coincident_Fres_Test_15\coincident_Fres_Test_15\coincident_Fres_Test_15\coincident_Fres_15\coincident_Fres_Test_15\coinci$]	
General Variab	le A Variable B Response Curves Results		_
Variable A		User Specified Frequency Ordinates	
	be Assumed Independent (Marginal Frequency Curve for A)	Use Values from Table Below	
O A and B can	not be Assumed Independent (Conditional Frequency Curves for A)	Frequency in Percent	
Variable B		0.2	
Number of Inde	x Values 9 📚	1.0	
Output Labeling	J	5.0	
Data Name St	age	10.0 20.0	
Data Units _{fe}	et	50.0	
Y-Axis Scale		90.0 95.0	
📀 Linear		99.0	
🔿 Log			
Co	mpute Plot View Report 👼 Print	OK Cancel Apply	

Figure B-106. General Tab Shown for Test Example 15.

Shown in Figure B-106 are the general settings for this coincident frequency analysis. For this analysis, the **A and B can be Assumed Independent (Marginal Frequency Curve for A)** option was selected. This would be determined by performing a correlation analysis between variables A and B; little correlation would indicate that variables A and B could be assumed independent. The number of variable B index values was set to 9, the **Data Name** was set to "Stage" and the **Data Units** to "feet", and the y-axis scale was set to **Linear**.

Shown in Figure B-107 is the Coincident Frequency Analysis editor with the **Variable A Tab** selected. The **Manual Entry** option was selected and a **Data Name** of "Flow" and **Data Units** of "cfs" were entered. The frequency curve values were manually entered into the **Variable A Frequency Curve** table.

Appendix B – Example Data Sets

🔛 Coincident Fr	equency Analysis Editor - Co	ncident Freq Test 15									
Name:	Coincident Freq Test 15										
Description:											
DSS File Name:	uments and Settings\q0hecmjf\[Desktop\ssp\SSP_Examples\SSP_EXAMPLES.ds:									
Report File:	Report File: stCoincidentFreqResultstCoincident_Freq_Test_15tCoincident_Freq_Test_15.rpf										
General Variab	le A Variable B Response Cur	ves Results	<u> </u>								
Specify Frequer	ncy Curve	Variable A Frequency Curve									
 Manual Entry Data Name Flore 		Percent Chance Exceedance	Flow								
		0.2	60219.2								
Data Units ofs	»	0.5	50625.0								
🔘 Existing Stud	dy Analysis	1.0	43870.4 37515.8								
	~	5.0	29667.4								
		10.0	24083.0								
		20.0	18708.5								
		80.0	7119.0								
		90.0	5530.3								
		95.0	4489.3								
		99.0	3035.9								
		L									
Co	mpute Plot View R	eport 🖉 Print	OK Cancel Apply								

Figure B-107. Variable A Tab for Test Example 15.

Shown in Figure B-108 is the Coincident Frequency Analysis editor with the Variable B tab selected. The Duration Curve from Test 13 was selected in the drop-down list. Once selected, the duration curve table automatically fills with the computed ordinates from the duration curve. In the Develop Probabilities from Duration Curve panel, the Define Automatically option was selected. This option uses a predefined probability pattern to discretize the duration curve into index points. The Generate Table button was pressed in order activate the predefined probability pattern. In this example, the first index value is 3005.92 (cfs). This value is taken at the midpoint between percent of time exceeded values at 100 and 60 percent (from Duration Curve Test 13). This index value is assigned a probability of 40 percent; this flow value could be expected 40 percent of the time. The second index value is 8095.9. This value is taken at the midpoint between percent of time exceeded values at 60 and 40 percent and is assigned a probability of 20 percent.

Name:	Coincident Freq Tes	st 15				
Description:						
DSS File Name:	uments and Settings	s\q0hecmjf\Desktop\ssp\SSF	_Examples\SSP_EXAM	PLES.ds:		
Report File:	s\CoincidentFreqRe	sults\Coincident_Freq_Test	_15\Coincident_Freq_Te	est_15.rpl		
General Variabl	le A Variable B Re	sponse Curves Results				
Duration Curve			Develop Probabilities	from Duration (Curve	
⊂Import Duration	n Curve		Number of Index Poil	nts 9		
Duration Curv	vo Toot 12	~				
Duration Curv			 Define Automatica 			
	cent of	Annual - FLOW	O Define from Index			
Time E	Exceeded 99.0	997.8	 Define from Proba 			
	99.0	1486.7	O User-Specified In	lex Points and F	Probability Ranges	
	90.0	1938.1	Generate Tak	le		
	80.0 50.0	3005.9 8095.9				Break Point
	25.0	18022.2	Probability	40.000	ndex 3005.920	100.000
	15.0	26771.7		20.000	8095.900	60.000
	10.0 	34462.0 49097.6		15.000	15044.345	40.000 25.000
	2.0	72793.3		10.000	22396.975	15.000
	1.0	91998.1		5.000	30616.850 40316.220	10.000
	0.1	170943.0		3.000	53046.835	6.000
				2.000	72793.258	3.000
				1.000	135856.384	1.000
						0.000
	_					
Plot						

Figure B-108. Variable B Tab for Test Example 15.

Once the Variable A and Variable B tabs have been completed, the user can populate the response curves table. Figure B-109 shows the Response Curves tab for Test Example 15. The Same Variable A for Each Index option was selected and the Import Variable A button was pressed to automatically copy values from the Variable A tab and fill in the Variable A column. The remaining columns in the table were populated with results from a hydraulics model. For example, the first value in the second column is 479.16. This value is the stage at the point of interest given a flow of 60219.18 (cfs) on the tributary (variable A) and a flow of 3005.92 (cfs) on the mainstem (variable B). A total of 108 simulations were required from the hydraulics model to fill in the response curves table. Figure B-110 shows a plot of the response surface. The plot shows variable A (x-axis) and variable C (y-axis). For this example, the response surface shows that flows greater than 53000 (7th index point) on the mainstem affect the stage at the point of interest on the tributary. When the flow in the mainstem is below 53000 (cfs), only the flow on the tributary affects the stage at the point of interest.

Appendix B – Example Data Sets

🔛 Coincident F	requency Anal	ysis Editor - Co	oincident Freq	Test 15									
Name:	Coincident Fre	eq Test 15											
Description:													
Report File: s\CoincidentFreqResults\Coincident_Freq_Test_15\Coincident_Freq_Test_15.rpl													
General Variable A Variable B Response Curves Results													
⊂Variable A													
Romo Vorio	ble A for Each Ir	dovi											
🔘 Different Va	riable A for Each	Index											
Import V	ariable A												
Variable A	B1=3005.920	B2=8095.900	B3=15044.345	B4=22396.975	B5=30616.850	B6=40316.220	B7=53046.835	B8=72793.258	B9=135856.3				
	C = f(A,B1)	C = f(A,B2)	C = f(A, B3)	C = f(A,B4)	C = f(A, B5)	C = f(A,B6)	C = f(A,B7)	C = f(A,B8)	C = f(A,B9)				
60219.18	479.16	479.16	479.17	479.17	479.18	479.2	479.22	479.28	479.87				
50625.04	476.2	476.21	476.22	476.23	476.26	476.32	476.4	476.52	477.43				
43870.38	474.34	474.35	474.37	474.4	474.45	474.53	474.68	474.88	475.92				
37515.81	472.62	472.64	472.66	472.72	472.79	472.9	473.1	473.42	474.71				
29667.41	470.81	470.83	470.84	470.89	470.96	471.08	471.3	471.77	473.35				
24083.02	469.54	469.57	469.6	469.65	469.74	469.87	470.1	470.68	472.44				
18708.51	467.81	467.94	468.0	468.11	468.26	468.45	468.82	469.56	471.65				
11540.61	465.1	465.11	465.38	465.55	465.78	466.11	466.73	467.89	470.73				
7118.99	463.83	463.83	463.83	463.9	464.12	464.58	465.39	466.88	470.23				
5530.28	463.35	463.35	463.34	463.37	463.52	464.03	464.93	466.55	470.08				
4489.29	462.99	462.99	462.99	462.99	463.12	463.67	464.66	466.34	470.0				
3035.89	462.39	462.39	462.39	462.39	462.55	463.21	464.3	466.1	469.89				
Plot Res	ponse Surface												
	ompute F	Plot View	Report	Print			ок	Cancel	Apply				

Figure B-109. Response Curves Tab for Example 15.

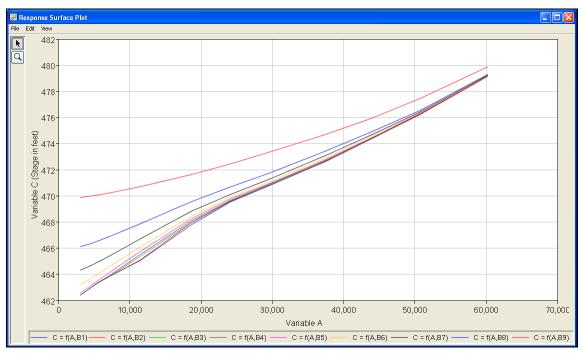


Figure B-110. Response Curves Plot for Example 15.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will open stating **Compute Complete**. Close this window and then select the **Results** tab. The results tab should look Figure B-111. The left portion of the results tab contains the computed variable C frequency curve and the right portion of the results tab contains a plot of the computed variable C frequency curve.

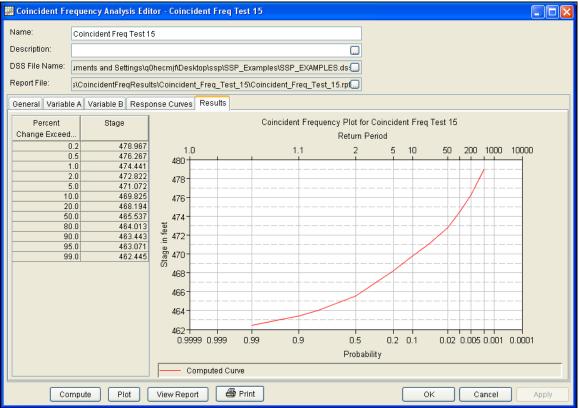


Figure B-111. Results Tab for Test Example 15.

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 by pressing the **Plot** button from the bottom of the analysis. 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 input data and results. 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-112 is the report file for Test Example 15.

C:\Documents :	and Settings\qUheci	nji Desklopisspis:	SP_ExampleS(CU	ncidentFreqResults\Coinc	ident_Freq_Test_15(Coinci	dent_Freq_Test_15.rpt
S File Name: 1	C:\Documents and	i Settings\gObe	ecmif\Deskton\:	sp\SSP_Examples\SSP_1	FXAMPLES, des	
Axis Scale: L		- 0000111gb (40110		.op (
splay ordinat.	e values using (3 digits in fra	action part of	value		
urginal Freque	ncy for Variable	- A				
Exceedance		1				
Percent	cfs -	1				
0.2						
0.5 1.0	43,870.400)				
2.0 5.0						
10.0	24,083.000	וו				
20.0 50.0						
80.0 90.0	7,119.000)				
95.0	4,489.300)				
99.0	3,035.900) 				
Occurrance Frequency		Exceedance Break Point	Exceedance			
Occurrance	Index	Exceedance Break Point Percent 	Exceedance Percent			
Occurrance Frequency Percent 40.0	Index Value 3,005.920	Exceedance Break Point Percent 100.0 60.0	Exceedance Percent			
Occurrance Frequency Percent 	Index Value 3,005.920	Exceedance Break Point Percent 100.0 60.0	Exceedance Percent 80.0 50.0			
Occurrance Frequency Percent 40.0	Index Value 3,005.920	Exceedance Break Point Percent 100.0 60.0 40.0	Exceedance Percent 80.0 50.0 32.5			
Occurrance Frequency Percent 40.0 20.0	Index Value 3,005.920 8,095.900	Exceedance Break Point Percent 100.0 60.0 40.0 25.0	Exceedance Percent 80.0 50.0 32.5 20.0			
Occurrance Frequency Percent 40.0 20.0 15.0	Index Value 3,005.920 8,095.900 15,044.345	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0			
Occurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5			
Occurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 4.0 3.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 2.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 2.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 2.0 1.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 1.0 1.0 1.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258 135,856.384 for Variable Bl	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0 	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 1.0 1.0 1.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258 135,856.384 	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 = 3,005.92	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			
Occurrance Frequency Percent 40.0 15.0 15.0 10.0 20.0 10.0 2.0 1.0 1.0 2.0 1.0 2.0 2.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258 135,856.384 	Exceedance Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0 	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5			

Figure B-112. Report File for Test Example 15.

Example 16: Coincident Frequency Analysis, A and B can not be Assumed Independent

This example demonstrates how to create a coincident frequency analysis when variables A and B are not independent. Figure B-113 illustrates the scenario for Example 16. The goal of this example is to develop a stage-frequency curve at a point along the tributary (variable C) given flows on the tributary (variable A) and flows in the mainstem (variable B). Large flows on the mainstem do cause backwater along the tributary and thus affect the stage at the point of interest. The data for this example comes from existing conditional flow frequency curves for Variable A and an existing flow duration curve for variable B. An HEC-RAS model was used to simulate the response of variable C (stage at the point of interest) for multiple combinations of flow on the tributary and flow in the mainstem.

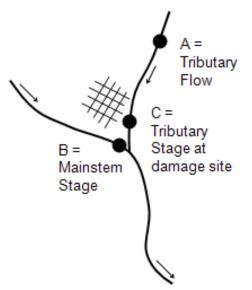


Figure B-113. Scenario for Example 16.

A Coincident Frequency analysis has been developed for this example. To open the Coincident Frequency analysis editor for test example 16, either double-click on the analysis labeled **Coincident Freq Test 16** from the study explorer, or from the **Analysis** menu select open, then select **Coincident Freq Test 16** from the list of available analyses. When test 16 is opened, the Coincident Frequency analysis editor will appear as shown in Figure B-114.

📈 Coincident Fr	equency Analysis Editor - Coincident Freg Test 16*	
Name:	Coincident Freq Test 16	
Description:		
DSS File Name:	Iments and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.ds:	
Report File:	$s\coincidentFreqResults\coincident_Freq_Test_16\coincident_Freq_Test_16.rpl \square \\$	
General Variab	le A Variable B Response Curves Results	
Variable A		User Specified Frequency Ordinates
🔘 A and B can	be Assumed Independent (Marginal Frequency Curve for A)	Use Values from Table Below
A and B can	not be Assumed Independent (Conditional Frequency Curves for A)	Frequency in Percent
Variable B		0.2
Number of Inde	x Values 9 🗢	1.0
Output Labeling		2.0
Data Name St	age	10.0
Data Units fee	et	20.0 50.0
		80.0
Y-Axis Scale		95.0
 Linear Log 		99.0
Co	mpute Plot View Report 📾 Print	OK Cancel Apply

Figure B-114. General Tab Shown for Test Example 16.

Shown in Figure B-114 are the general settings for this coincident frequency analysis. For this analysis, the **A and B can not be Assumed Independent (Conditional Frequency Curve for A)** option was selected. This would be determined by performing a correlation analysis between variables A and B; a correlation coefficient in the range of 0.3 - 0.7 would indicate that variables A and B could not be assumed independent. The number of variable B index values was set to 9, the **Data Name** was set to "Stage" and the **Data Units** to "feet", and the Y-Axis scale was set to Linear.

Shown in Figure B-115 is the Coincident Frequency Analysis editor with the **Variable A Tab** selected. A **Data Name** of "Flow" and **Data Units** of "cfs" were entered. A separate frequency curve for variable A was developed for each index value defined on the Variable B tab. For example, the frequency curve in the "Flow P(A|B1)" column is the variable A frequency curve for the 1st variable B index value. The variable B tab shows the 1st index value, 3005.92, is assigned a proportion of time of 40 percent. Therefore, the 1st variable A frequency curve was developed using annual peak flows on the tributary when flows in the mainstem were in the range of the 1st variable B index value. For this example, a multivariate lognormal random number generator was used to develop a large enough data set so that variable A frequency curves could be computed for each variable B index value. The random numbers were generated using statistics from the annual peak flows occurring on the tributary,

statistics from the coincident (same day) flows occurring on the main stem, and the covariance between the two datasets.

Coincident Fre	equency Analy	ysis Editor - Co	incident Freq	Test 16*								
lame:	Coincident Fre	q Test 16										
escription:												
) SS File Name:	iments and Se	ttings\g0hecmjf	DesktonissniS:	3P Examples)9	SP EXAMPLES	Dish:						
Report File: 3\CoincidentFreqResults\Coincident_Freq_Test_16\Coincident_Freq_Test_16.rpt												
tepon File.	stCoincidentFre	eqResults\Coinc	ident_Freq_Te	st_16\Coincider	nt_Freq_Test_1	6.rp1						
General Variabl	e A Variable B	Response Cu	rves Results									
Variable A												
Data Name Floy												
	Ÿ											
Data Units cfs												
Variable A Condi	itional Frequen	ty Curves										
					-							
	Flow P(A B1)	Flow P(A B2)	Flow P(A B3)	Flow P(A B4)	Flow P(A B5)	Flow P(A B6)	Flow P(A B7)	Flow P(A B8)	Flow P(A B9)			
Exceedance	12464.0	40024.0	60004.0		70700.0	7204.2.0	0.000.0	05007.0	00407.0			
0.2	42464.0 35167.0	49934.0 42772.0	60221.0 51234.0	63239.0 53979.0	72700.0	73813.0	86602.0 72786.0	85327.0 72502.0				
1.0	31681.0	37642.0	44837.0	47368.0	53880.0	54634.0	63062.0	63384.0				
2.0	27412.0	32738.0	38757.0	41066.0	46467.0	47088.0	53916.0	54727.0				
5.0	22063.0	26553.0	31147.0	33150.0	37217.0	37677.0	42623.0	43907.0				
10.0	18193.0	22045.0	25649.0	27407.0	30554.0	30906.0	34589.0	36102.0				
20.0	14404.0	17598.0	20274.0	21767.0	24063.0	24314.0	26861.0	28484.0				
50.0	9214.0	11437.0	12928.0	14008.0	15237.0	15366.0	16558.0	18101.0				
80.0	5894.0	7432.0	8244.0	9015.0	9648.0	9711.0	10207.0	11502.0				
90.0	4666.0	5933.0	6516.0	7160.0	7598.0	7640.0	7927.0	9075.0				
95.0	3848.0	4926.0	5366.0	5920.0	6238.0	6267.0	6433.0	7462.0				
99.0	2680.0	3475.0	3728.0	4143.0	4309.0	4322.0	4348.0	5169.0				
Plot	ר ר											
FIUL	J											
Cor	mpute P	lot View F	Report	Print			ОК	Cance	I Apply			

Figure B-115. Variable A Tab for Test Example 16.

Shown in Figure B-116 is the Coincident Frequency analysis editor with the **Variable B Tab** selected. No duration curve was selected for this example. In the **Develop Probabilities from Duration Curve** panel, the **User-Specified Index Points and Probability Ranges** option was selected. The probabilities and index values were defined manually and the Generate Table button was pressed in order to compute the Break Points.

Appendix B – Example Data Sets

🞇 Coincident Frequency Analysis Editor - Coincident Freq 1	Test 16*				×
Name: Coincident Freq Test 16					
Description:					
DSS File Name: C:\Documents and Settings\q0hecmjf\Desktop\s	ssp\SSP_Examples\SSP_EX				
Report File: op\ssp\SSP_Examples\CoincidentFreqResults\	Coincident_Freq_Test_16\C	pinci			
General Variable A Variable B Response Curves Results					^
Duration Curve	Develop Probabilities from	Duration Curve			
Import Duration Curve	Number of Index Points	9			
None	 Define Automatically 				
Provented	O Define from Index Poin	ts			
Percent of Time Exceeded	O Define from Probabiliti	es			
	 User-Specified Index P 		Ranges		
			rungeo		
	Generate Table				
	Probability	Index		Break Point	
		40.000	3005.920	100.000	
		20.000	8095.900	60.000	
		15.000	15044.345	25.000	
		10.000 5.000	22396.975 30616.850	15.000	
		4.000	40316.220	10.000	
		3.000	53046.835	6.000	
		2.000	72793.258	3.000	
		1.000	135856.401	1.000	
				0.000	
Plot					~
Compute Plot View Report	Print	(ок с	ancel Apply	

Figure B-116. Variable B Tab for Test Example 16.

Once the Variable A and Variable B tabs have been completed, the user can populate the response curves table. Figure B-117 shows the Response Curves tab for Test Example 16. The Different Variable A for Each Index option was selected. When selected, a separate Variable A column is added for each variable B index value. For example, the first Variable A column is linked to the C = f(A, B1)column. The second variable A column is lined to the C = f(A, B2), and so on. The Import Variable A button was pressed to automatically copy values from the Variable A tab to fill in appropriate Variable A column. The remaining columns in the table were populated with results from the hydraulics model. For example, the first value in the second column is 473.95. This value is the stage at the point of interest given a flow of 42464 (cfs) on the tributary (variable A) and a flow of 3005.92 (cfs) on the mainstem (variable B). A total of 108 simulations were required from the hydraulics model to fill in the response curves table.

HEC-SSP User's Manual

lame:	Coincider	nt Freq Test 1	6														
escription:	-																
SS File Name	e: C:IDocum	nents and Se	ttings%q0hecm	nDesktopiss	p\SSP_Examp	lestSSP_EXA	MPLES.dss										
eport File:	ngs\q0he	cmifDesktop	AssplSSP_Exa	mples\Coinc	identFreqRes	ults\Coincider	nt_Freq_Test_	16/ICoincider	nt_Freq_Test_	16.rpt							
eneral Varia	able A Varia	ble B Resp	onse Curves	Results													
Variable A																	
O Same Vari	lable à for Ea	ch Index															
		No. Company															
Different V	/ariable A for I	Each Index															
		-															
import	Variable A																
Variable A B	81=3005.9	Variable A	B2=8095.9	Variable A	B3=15044	Variable A	84=22396	Variable A	B5=30616	Variable A	B6=40316	Variable A	B7=53046	Variable A	B8=72793	Variable A	B9=13585
	C = f(A,B1)		C = f(A,B2)		C = f(A,B3)		C = f(A, B4)		C = f(A,B5)		C = f(A,B6)		C = f(A,87)		C = f(A,B8)		C = KA B9
42464.0	C = f(A,B1) 473.95	49934.0	C = f(A,B2) 476.02	60221.0	C = f(A,B3) 479.17	63239.0	C = f(A,B4) 400.23	72700.0	C = f(A,B5) 405.01	73013.0	C = f(A,B6) 405.40	86602.0	C = f(A,B7) 490.16	05327.0	C = f(A,B8) 409.67	89497.0	C = f(A,B9 490.7
42464.0 36167.0	C = f(A,B1) 473.95 472.28	49934.0	C = f(A,B2) 476.02 474.05	60221.0 51234.0	C = f(A,B3) 479.17 476.39	63239.0 53979.0	C = f(A,B4) 400.23 477.16	72700.0	C = f(A,B5) 405.01 479.71	73013.0 62595.0	C = f(A,B6) 495.49 480.02	86602.0 72786.0	C = f(A,B7) 490.16 485.01	05327.0 72502.0	C = f(A,B8) 409.67 484.87	09497.0 76333.0	C = f(A,B9 490.7 486.3
42464.0 36167.0 31681.0	C = f(A,B1) 473.95 472.28 471.24	49934.0 42772.0 37642.0	C = 5(A,B2) 476.02 474.05 472.67	60221.0 51234.0 44837.0	C = f(A,B3) 479.17 476.39 474.63	63239.0 53979.0 47368.0	C = f(A,B4) 400.23 477.16 475.35	72700.0 61695.0 53880.0	C = \$(A,B5) 405.01 479.71 477.15	73013.0 62595.0 54634.0	C = f(A,86) 495.49 480.02 477.4	06602.0 72786.0 63062.0	C = f(A,B7) 490.16 485.01 480.19	05327.0 72502.0 63384.0	C = f(A,B8) 409.67 484.87 480.49	09497.0 76333.0 66942.0	C = f(A,B9, 490.7 486.3 482.1
42464.0 36167.0 31681.0 27412.0	C = f(A,B1) 473.95 472.28 471.24 470.33	49934.0 42772.0 37642.0 32738.0	C = f(A,82) 476.02 474.05 472.67 471.48	60221.0 51234.0 44837.0 30757.0	C = f(A,B3) 479.17 476.39 474.63 472.99	63239.0 53979.0 47368.0 41066.0	C = f(A,B4) 400.23 477.16 475.36 473.65	72700.0 61695.0 53880.0 46467.0	C = f(A,B5) 405.01 479.71 477.15 475.14	73013.0 62595.0 54634.0 47088.0	C = f(A,B6) 495.49 480.02 477.4 475.38	96602.0 72786.0 63062.0 53916.0	C = NA,87) 490.16 485.01 480.19 477.25	05327.0 72502.0 63384.0 54727.0	C = f(A,B8) 409.67 484.87 480.49 477.61	09497.0 76333.0 66942.0 57997.0	C = f(A,B9 490.7 486.3 482.1 479.2
42464.0 36167.0 31691.0 27412.0 22063.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96	49934.0 42772.0 37642.0 32738.0 26553.0	C = 5(A,82) 476.02 474.05 472.67 471.48 470.15	60221.0 51234.0 44937.0 30757.0 31147.0	C = f(A,B3) 479.17 476.39 474.63 472.99 471.18	63239.0 53979.0 47368.0 41066.0 33150.0	C = 1(A,B4) 400.23 477.16 475.35 473.65 473.65 471.64	72700.0 61695.0 53880.0 46467.0 37217.0	C = f(A,B5) 405.01 479.71 477.15 475.14 472.71	73013.0 62595.0 54634.0 47088.0 37677.0	C = f(A,B6) 495.49 480.02 477.4 475.38 472.94	96602.0 72786.0 63062.0 53916.0 42623.0	C = f(A,B7) 490.16 485.01 480.19 477.25 474.37	05327.0 72502.0 63384.0 54727.0 43907.0	C = f(A,B8) 409.67 484.87 480.49 477.61 474.89	09497.0 76333.0 66942.0 57997.0 46769.0	C = NA, B9 490.7 486.3 482.1 479.2 476.5
42464.0 36167.0 31681.0 27412.0 22063.0 18193.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96 467.64	49934.0 42772.0 37642.0 32738.0 28553.0 22045.0	C = f(A,B2) 476.02 474.05 472.67 471.48 470.15 469.01	60221.0 51234.0 44837.0 30757.0 31147.0 25649.0	C = f(A,B3) 479.17 476.39 474.63 472.99 471.18 469.97	63239.0 53979.0 47368.0 41066.0 33150.0 27407.0	C = f(A,B4) 400.23 477.16 475.35 473.65 473.65 471.64 470.41	72700.0 61695.0 53880.0 46467.0 37217.0 30554.0	C = f(A,B5) 405.01 479.71 477.15 475.14 472.71 471.15	73013.0 62595.0 54634.0 47088.0 37677.0 30906.0	C = f(A,B6) 405.40 480.02 477.4 475.38 472.94 471.34	06602.0 72786.0 63062.0 53916.0 42623.0 34589.0	C = f(A,B7) 490.16 485.01 480.19 477.25 474.37 472.4	05327.0 72502.0 63384.0 54727.0 43907.0 36102.0	C = f(A,B9) 409.67 484.87 490.49 477.61 474.89 473.11	09497.0 76333.0 66942.0 57997.0 46769.0 39631.0	C = KA,89 490.7 486.3 482.1 479.2 476.5 474.9
42464.0 36167.0 31681.0 27412.0 22063.0 18193.0 14404.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96 467.64 466.22	49934.0 42772.0 37642.0 32738.0 28553.0 22045.0 17598.0	C = f(A,B2) 476.02 474.05 472.67 471.48 470.15 469.01 467.53	60221.0 51234.0 44837.0 30757.0 31147.0 25649.0 20274.0	C = f(A,B3) 479.17 476.39 474.63 472.99 471.18 469.97 468.51	63239.0 53979.0 47368.0 41066.0 33150.0 27407.0 21767.0	C = f(A,B4) 400.23 477.16 475.35 473.65 473.65 471.64 470.41 469.05	72700.0 61695.0 53880.0 46467.0 37217.0 30554.0 24063.0	C = \$(A,B5) 405.01 479.71 477.15 475.14 472.71 472.71 471.15 469.73	73013.0 62595.0 54634.0 47088.0 37677.0 30906.0 24314.0	C = f(A,B6) 405.40 480.02 477.4 475.38 472.94 471.34 469.92	06602.0 72786.0 63062.0 53916.0 42623.0 34589.0 26061.0	C = RAB7) 490.16 485.01 480.19 477.25 474.37 472.4 470.7	05327.0 72502.0 63384.0 54727.0 43907.0 36102.0 28484.0	C = f(A,B9) 409.67 484.87 480.49 477.61 474.89 473.11 471.54	09497.0 76333.0 66942.0 57997.0 46769.0 39631.0 30648.0	C = NA, B9 490.7 486.3 482.1 479.2 476.5 474.9 473.5
42464.0 36167.0 31681.0 27412.0 22063.0 18193.0 14404.0 9214.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96 467.64 466.22 464.39	49934.0 42772.0 37642.0 32739.0 26553.0 22045.0 17598.0 11437.0	C = f(A,B2) 476.02 474.05 472.67 471.48 470.15 469.01	60221.0 51234.0 44837.0 30757.0 31147.0 25649.0	C = \$(A,B3) 479.17 476.39 474.63 472.99 471.16 469.97 460.51 465.93	63239.0 53979.0 47368.0 41066.0 33150.0 27407.0	C = f(A,B4) 400.23 477.18 475.35 473.65 473.65 471.64 470.41 469.05 486.48	72700.0 61695.0 53880.0 46467.0 37217.0 30554.0	C = \$(A,B5) 405.01 479.71 477.15 475.14 472.71 477.15 469.73 467.11	73013.0 62595.0 54634.0 47088.0 37677.0 30906.0	C = f(A,B6) 405.40 480.02 477.4 475.38 472.94 471.34 469.92 467.4	06602.0 72786.0 63062.0 53916.0 42623.0 34599.0 26061.0 16558.0	C = RAB7) 490.16 485.01 480.19 477.25 474.37 472.4 470.7 488.23	05327.0 72502.0 63384.0 54727.0 43907.0 36102.0 28484.0 18101.0	C = f(A,B8) 409.67 484.87 480.49 477.61 474.89 473.11 471.54 469.42	89497.0 76333.0 66942.0 57997.0 46769.0 38631.0 30648.0 19682.0	C = KAB9 490.7 486.3 482.1 479.2 476.5 474.9 473.5 471.7
42464.0 36167.0 31691.0 27412.0 22063.0 19193.0 14404.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96 467.64 466.22	49934.0 42772.0 37642.0 32738.0 28553.0 22045.0 17598.0	C = \$(A,B2) 476.02 474.05 472.67 471.48 470.15 469.01 467.53 465.08 465.08 465.91	60221.0 51234.0 44837.0 30757.0 31147.0 25649.0 20274.0 12928.0	C = f(A,B3) 479.17 476.39 474.63 472.99 471.16 469.97 468.51 465.93 464.14	63239.0 53979.0 47368.0 41066.0 33150.0 27407.0 21767.0 14008.0	C = f(A,B4) 400.223 477.16 475.36 473.65 471.64 470.41 469.05 466.48 466.48 464.59	72700.0 61895.0 53880.0 46467.0 37217.0 30554.0 24063.0 15237.0	C = 8(A,B5) 405.01 479.71 477.15 475.14 472.71 471.15 469.73 469.73 467.11	73013.0 62505.0 54634.0 47068.0 37677.0 30906.0 24314.0 15366.0	C = f(A,B6) 405.40 480.02 477.4 475.38 472.94 471.34 469.92 467.4 465.49	06602.0 72786.0 63062.0 53916.0 42623.0 34589.0 26061.0	C = RA, B7) 490.16 485.01 480.19 477.25 474.37 472.4 470.7 468.23 466.32	05327.0 72502.0 63384.0 54727.0 43907.0 36102.0 28484.0	C = f(A,B8) 409.67 484.87 420.49 477.61 474.89 473.11 471.54 469.42 469.42 467.89	09497.0 76333.0 66942.0 57997.0 46769.0 39631.0 30648.0	C = MAB9 490.7 486.3 482.1 479.5 4776.5 4774.9 473.5 471.7 470.8
42464.0 36167.0 31681.0 27412.0 22063.0 18193.0 14404.0 9214.0 5894.0	C = f(A,B1) 473.95 472.28 471.24 470.33 468.96 467.64 466.22 464.39 463.46	49934.0 42772.0 37642.0 32739.0 28553.0 22045.0 17599.0 11437.0 7432.0	C = \$(A,B2) 476.02 474.05 472.67 471.48 470.15 469.01 467.53 465.08 465.08 465.91	60221.0 51234.0 44837.0 30757.0 31147.0 25649.0 20274.0 12928.0 8244.0	C = f(A,B3) 479.17 476.39 474.63 472.99 471.16 469.97 460.51 465.93 466.414 463.66	63239.0 53979.0 47368.0 41066.0 33150.0 27407.0 21767.0 14008.0 9015.0	C = f(A,B4) 400.23 477.16 475.35 473.65 471.64 470.41 469.05 466.45 466.45 463.91	72700.0 61895.0 53880.0 46467.0 37217.0 30554.0 24063.0 15237.0 9648.0	C = 1(A,B5) 405.01 479.71 477.15 475.14 472.71 471.15 469.73 469.73 467.11 465.08 464.29	73013.0 62595.0 54634.0 47088.0 37677.0 30906.0 24314.0 15366.0 9711.0	C = f(A,B6) 405.40 405.40 477.4 475.38 472.94 471.34 469.92 467.4 465.49 465.49 464.76	06602.0 72786.0 63062.0 53916.0 42623.0 34698.0 26061.0 16558.0 10207.0	C = 8(A,B7) 490.16 485.01 480.19 477.25 474.37 472.4 470.7 468.23 466.32 465.62	05327.0 72502.0 63384.0 54727.0 43907.0 36102.0 28484.0 18101.0 11502.0	C = f(A,B8) 499.67 484.87 420.49 477.61 474.89 473.11 471.54 469.42 467.89 467.31	09497.0 76333.0 66942.0 57997.0 46769.0 36631.0 30648.0 19682.0 12639.0	C = 1(A, B9) 490.7 486.3 482.1 479.2 476.5 474.9 473.5 474.9 473.5 471.7 470.8 470.5 470.3

Figure B-117. Response Curves Tab for Example 16.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will open stating **Compute Complete.** Close this window and then select the **Results** tab. The **Results** tab should look Figure B-118. The left portion of the results tab contains the computed variable C frequency curve and the right portion of the results tab contains a plot of the computed variable C frequency curve.

Appendix B – Example Data Sets

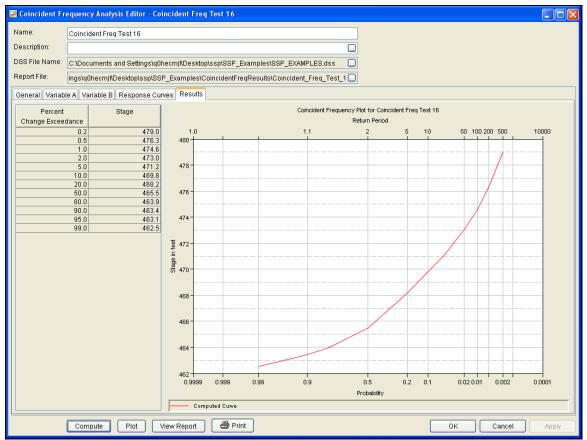


Figure B-118. Results Tab for Test Example 16.

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 by pressing the **Plot** button from the bottom of the analysis. 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 input data and results. 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-119 is the report file for Test Example 16.

C:\Documents a	and Settings\q0hecr	njf\Desktop\ssp\S	SP_Examples\Co	ncidentFreqResults\	Coincident_Freq_T	est_16\Coinci	dent_Freq_Test_16.	.rpt
95.0 99.0	5,169.000 -							
Exceedance	quency P(A B9)							
Percent 0.2 0.5	1 76,333.000) į						
1.0 2.0 5.0 10.0	57,997.000 46,769.000)						
20.0 50.0 80.0 90.0	19,682.000 12,639.000 10,027.000)))						
95.0 99.0								
dex-Value Tab	le for Variable	в						
	Index	Exceedance Break Point Percent		- 				
Dccurrance Frequency	Index	Break Point Percent 100.0	Exceedance Percent 80.0					
Occurrance Frequency Percent 	Index Value 	Break Point Percent 100.0 60.0	Exceedance Percent 80.0 50.0					
Occurrance Frequency Percent 40.0	Index Value 	Break Point Percent 100.0 60.0 40.0	Exceedance Percent 					
Occurrance Frequency Percent 40.0 20.0 	Index Value 3,005.920 8,095.900	Break Point Percent 100.0 60.0 40.0 25.0	Exceedance Percent 80.0 50.0 32.5 20.0					
Occurrance Frequency Percent 40.0 20.0 15.0	Index Value 3,005.920 8,095.900 15,044.345	Break Point Percent 100.0 60.0 40.0 25.0 15.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5					
0ccurrance Frequency Percent 40.0 20.0 15.0 10.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0					
Occurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5					
Occurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0					
Occurrance Frequency Percent 40.0 20.0 15.0 10.0 4.0 3.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5					
Decurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 2.0 1.0	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5					
Variable A Cocurrance Frequency Percent 40.0 20.0 15.0 10.0 3.0 1.0 Percent 10.0 10.	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258 135,856.401 135,856.401 for Variable B1	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0 = 3,005.92	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5					
Decurrance Frequency Percent 40.0 20.0 15.0 10.0 5.0 4.0 3.0 2.0 1.0 1.0 2.0 4.0 3.0 2.0 4.0 3.0 1.0 2.0 4.0 3.0 1.0 2.0 4.0 3.0 1.0 1.0 3.0 1.0 1.	Index Value 3,005.920 8,095.900 15,044.345 22,396.975 30,616.850 40,316.220 53,046.835 72,793.258 135,856.401 135,856.401 1 C = f(A,B1) 1 feet 1 473.950 1 472.280	Break Point Percent 100.0 60.0 40.0 25.0 15.0 10.0 6.0 3.0 1.0 0.0 	Exceedance Percent 80.0 50.0 32.5 20.0 12.5 8.0 4.5 2.0 0.5					

Figure B-119. Report File for Test Example 16.

Example 17: Curve Combination Analysis, Combine Flow Frequency Curves

This example demonstrates how to create a curve combination analysis to combine multiple flow frequency curves. In this example, a flow frequency curve from a log-Pearson III analysis will be combined with information from a hydrology model, frequency precipitation applied to a calibrated rainfall-runoff model, and an estimate of the PMF. The frequency of the PMF is set to 0.00737 percent for this example.

A Curve Combination analysis has been developed for this example. To open the Curve Combination Analysis editor for test example 17, either double-click on the analysis labeled **Curve Combination Test 17** from the study explorer, or from the **Analysis** menu select open, then select **Curve Combination Test 17** from the list of available analyses. When test 17 is opened, the Curve Combination Analysis editor will appear as shown in Figure B-120.

🔛 Curve Combin	ation Analysis Editor - Curve Cor	nbination Test 17*		
Name: Description:	Curve Combination Test 17			
DSS File Name:	C:\Documents and Settings\q0hecn	njftDesktop\ssp\SSP_Examples\SSP_EX	AMPLES.dss	
Report File:	amples\CurveCobinationAnalysis\C	Curve_Combination_Test_17\Curve_Com	ibination_Test_17.rpt	
General Freque	ency Curves Confidence Limits Re	sults		
Output Labeling	3 🗘	Frequency of PMF		User Specified Frequency Ordinates
Data Name 👖	DW	PMP Depth (in) Max Reg Precip (in)		Frequency in Percent 0.00737 0.1
Data Units cf	is	Low End PMF Range (0.001)	0.0	0.2 0.5 1.0
 Flow Stage 		High End of PMF Range (0.0000001) Compute Frequency of PMF	0.0	2.0 5.0 10.0
Y-Axis Scale		Confidence Limits		20.0 50.0 80.0
⊙ Log		 Defaults (0.05, 0.95) User Entered Values 		90.0 90.0 95.0 93.0
Confidence Lim	its Method	Upper Limit:	0.05	33.0
	d Confidence Limits	Lower Limit:	0.95	
 User Definer Order Statist 	-			
	Compute Plot View	v Report 🖉 Print		OK Cancel Apply

Figure B-120. General Tab Shown for Test Example 17.

Shown in Figure B-120 are the general settings for this curve combination analysis. The number of curves to combine was set to 3, "flow" was entered as the **Data Name**, and "cfs" was entered as the **Data Units**. The **Data Type** of "Flow" and **Y-Axis Scale** of "Log"

were selected. "Order Statistics" was selected as the **Confidence Limits Method**. Finally, a frequency of 0.00737 was added to the **User Specified Frequency Ordinates table**.

Shown in Figure B-121 is the Curve Combination analysis editor with the **Frequency Curves** tab selected. Frequency curve 1 was imported from an existing Bulletin 17B analysis. The **Existing Study Analysis** option was selected and then the Bulletin 17B analysis named "Reservoir Inflows" was selected. The second frequency curve was entered manually using output from a hydrology model. The third frequency curve contains an estimate of the PMF. After the frequency curves were defined, a weight was specified for each ordinate in the frequency curves. The program uses these weights when computing the combined frequency curve.

📈 Curve Combinat	tion Analysis Editor -	Curve Combination	n Test 17*							
Name: k	Curve Combination Test	17								
Description:										
)					
DSS File Name:	COCuments and Settin	ngs\q0hecmjf\Deskto	p\ssp\SSP_Examples	SSP_EXAMPLES.dss						
Report File:	amples\CurveCobination	nAnalysis\Curve_Cor	nbination_Test_17\Cu	irve_Combination_Tes	st_17.rpi					
General Frequency Curves Confidence Limits Results										
CSpecify Frequenc	y Curve 1		Specify Frequency (ourve 2		Specify Frequency C	Curve 3			
🔿 Manual Entry			 Manual Entry 			 Manual Entry 				
 Existing Study 	Analysis		C Existing Study Ar	nalysis		O Existing Study Ar	nalysis			
178 Reservoir Inflo	JWS	~			~			~		
Equivalent Years	of Record 57		Equivalent Years of	Record 20		Equivalent Years of	Record 20			
Frequency	Frequency Curve	Weight	Frequency	Frequency Curve	Weight	Frequency	Frequency Curve	Weight		
in Percent		(0.0 to 1.0)	in Percent		(0.0 to 1.0)	in Percent		(0.0 to 1.0)		
0.0073			0.00737			0.00737	105,000.0	1.0		
0			0.1	57,400.0	1.0	0.1				
0		0.2	0.2	50,200.0	0.8	0.2				
0		0.2	0.5	41,500.0	0.8	0.5				
1		0.4	1.0	35,600.0	0.6	1.0				
2		1.0	2.0			2.0				
5		1.0	5.0			5.0				
20		1.0	20.0			20.0				
50		1.0	50.0			50.0				
80		1.0	80.0			80.0				
90		1.0	90.0			90.0				
95		1.0	95.0			95.0				
99		1.0	99.0			99.0				
Plot Curves										
[Compute Plot	View Report	Print				OK Canc	el Apply		

Figure B-121. Frequency Curves Tab for Test Example 17.

Shown in Figure B-122 is the Curve Combination analysis editor with the **Confidence Limits** tab selected. Since the Order Statistics method was selected as the confidence limits method, the user must define an equivalent years of record for each frequency curve ordinate. The program uses the equivalent years of record when computing the confidence limits using the order statistics method. When the **Compute Confidence Limits** button is selected, the program will first compute the combined frequency curve and then compute the confidence limits around the computed frequency curve using the order statistics method.

Appendix B – Example Data Sets

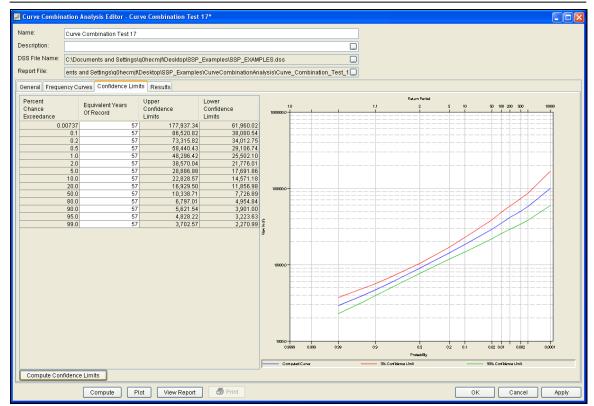


Figure B-122. Confidence Limits Tab for Test Example 17.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will open stating **Compute Complete.** Close this window and then select the **Results** tab. The results tab should look Figure B-123. The left portion of the results tab contains the computed frequency curve with confidence limits and the right portion of the results tab contains a plot of the computed combined frequency curve.

HEC-SSP User's Manual

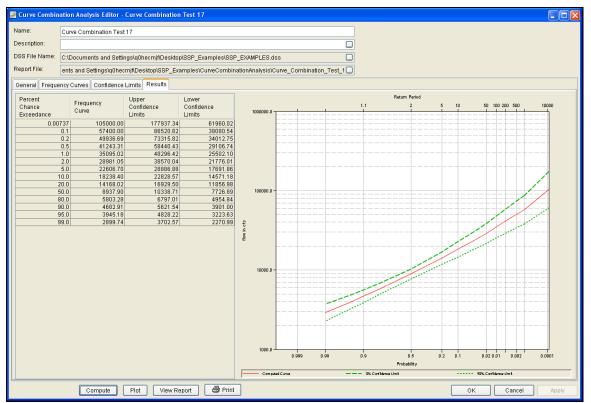


Figure B-123. Results Tab for Test Example 17.

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 by pressing the **Plot** button from the bottom of the analysis. 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 input data and results. 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-124 is the report file for Test Example 17.

Kurve_Combinat	tion_Test_17 <u>.rpt</u>		X					
Ele Edit Search Format								
File: C:Documents and Settings\q0hecmjfDesktop\ssp\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_Test_17\Curve_Combination_Test_17								
Curve Combination Analysis 08 Sep 2010 02:46 PM								
Input Data -	Input Data							
Analysis Name: Curve Combination Test 17 Description:								
Report File Name	Project Path: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples Report File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_ Result File Name: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_;							
	DSS File Name: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP_Examples\SSP_EXAMPLES.dss							
	Confidence Limits Method: Order Statistics Display ordinate values using 3 digits in fraction part of value							
	· · · · · · · · · · · · · · · · · · ·							
Frequency Percent 	Ordinate 	Ordinate Weight						
-								
0.10000								
0.20000								
0.50000								
1.00000								
2.00000	28,981.055	1.0						
5.00000	22,606.697	1.0						
10.00000	18,238.400	1.0						
20.00000	14,168.021							
50.00000								
80.00000								
90.00000								
95.00000								
99.00000 ·	2,899.741 							
Frequency	Ordinate	Ordinato						
Percent Percent		Weight						
0.00737								
0.20000								
0.50000								
1.00000 2.00000		0.6						
<pre>1 2.00000 1 5 00000 </pre>			×					
			1:1.1:1 1:1					

Figure B-124. Report File for Test Example 17.

Example 18: Curve Combination Analysis, Combine Stage Frequency Curves

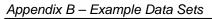
This example demonstrates how to create a curve combination analysis to combine multiple stage frequency curves. In this example, a stage frequency curve that was fit graphically to observed annual maximum stage data will be combined with information from a hydrology model, frequency precipitation applied to a calibrated rainfall-runoff model, and the maximum stage from the probable maximum flood simulation.

A Curve Combination analysis has been developed for this example. To open the Curve Combination Analysis editor for test example 18, either double-click on the analysis labeled **Curve Combination Test 18** from the study explorer, or from the **Analysis** menu select open, then select **Curve Combination Test 18** from the list of available analyses. When test 18 is opened, the Curve Combination Analysis editor will appear as shown in Figure B-125.

Figure B-125. General Tab Shown for Test Example 18.

Shown in Figure B-125 are the general settings for this curve combination analysis. The number of curves to combine was set to 3, "Stage" was entered as the **Data Name**, and "feet" was entered as the **Data Units**. The **Data Type** of "Stage" and **Y-Axis Scale** of "Linear" were selected. "Order Statistics" was selected as the **Confidence Limits Method**. The Frequency of PMF panel was used to estimate the frequency of the PMF event using observed regional maximum precipitation. The 72-hour PMP for a storm of 450 square miles was 29.2 inches and the greatest regional 72-hour observed precipitation for a 450 square mile storm was 19.5 inches. The recommended values for the low and high range of the PMF were entered and the **Compute Frequency of PMF** button was pressed. This resulted in an estimated probability for the PMF of 0.0000737 or 0.00737 percent. This value was added to the **User Specified Frequency Ordinates** table.

Shown in Figure B-126 is the Curve Combination analysis editor with the **Frequency Curves** tab selected. Frequency curve 1 was entered manually by copying the graphical frequency curve from the Reservoir Inflows general frequency analysis. The second frequency curve was entered manually using output from a hydrology model. The third frequency curve contains an estimate of the maximum stage from the PMF. After the frequency curves were defined, a weight was specified for each ordinate in the frequency curves. The program uses these weights when computing the combined frequency curve.



🞇 Curve Combination Analysis Editor - Curve Combination Test 18									
Name:	Curve Combination Tes	118							
Description:									
DSS File Name:	C:\Documents and Settings\q0hecmittDesktop\ssp\SSP_Examples\SSP_EXAMPLES.dss								
Report File: amplestCurveCobinationAnalysistCurve_Combination_Test_18/Curve_Combination_Test_18/rp(
	General Frequency Curves Confidence Limits Results								
Specify Frequen			CSpecify Frequency (Durve 2		Specify Frequency	Curve 3		
Manual Entry			 Manual Entry 				Manual Entry		
 Existing Stud 	y Analysis		Existing Study A	nalysis		Existing Study A	Existing Study Analysis		
		~			~				
Equivalent Year	Equivalent Years of Record 57			Equivalent Years of Record 15			Equivalent Years of Record 15		
Frequency	Frequency Curve	Weight	Frequency	Frequency Curve	Weight	Frequency	Frequency Curve	Weight	
in Percent		(0.0 to 1.0)	in Percent		(0.0 to 1.0)	in Percent		(0.0 to 1.0)	
0.007	'37 0.1		0.00737	670.7	1.0	0.00737	678.1	1.0	
	0.2		0.2		1.0	0.2	•		
	0.5		0.2		1.0	0.5			
	1.0 661.0	0.2	1.0		0.8	1.0			
	2.0 658.0	0.4	2.0		0.6	2.0			
	5.0 651.5	1.0	5.0			5.0			
	0.0 647.5 0.0 639.0	1.0	20.0			10.0			
	0.0 632.5	1.0	50.0			50.0			
	0.0 631.0	1.0		80.0			80.0		
	0.0 630.5	1.0	90.0			90.0			
	5.0 627.0	1.0		95.0			95.0		
9	9.0 620.0	1.0	99.0			99.0			
Plot Curves									
	Compute Plot View Report S Print OK Cancel Apply								

Figure B-126. Frequency Curves Tab for Test Example 18.

Shown in Figure B-127 is the Curve Combination Analysis editor with the **Confidence Limits** tab selected. Since the Order Statistics method was selected as the confidence limits method, the user must define an equivalent years of record for each frequency curve ordinate. The program uses the equivalent years of record when computing the confidence limits using the order statistics method. When the **Compute Confidence Limits** button is selected, the program will first compute the combined frequency curve and then compute the confidence limits around the computed frequency curve using the order statistics method.

Appendix B - Example Data Sets

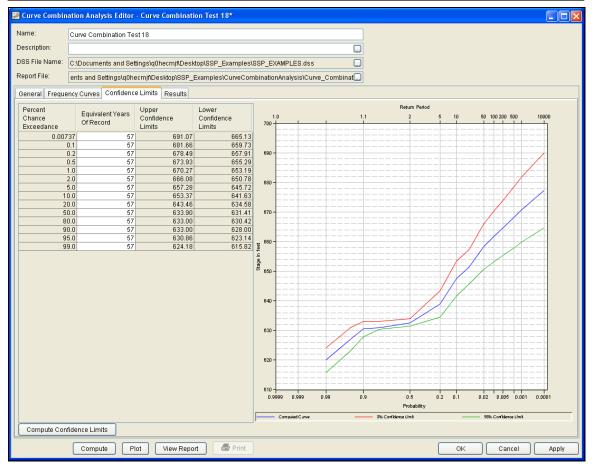


Figure B-127. Confidence Limits Tab for Test Example 18.

Press the **Compute** button to perform the analysis. Once the computations have been completed, a message window will open stating **Compute Complete.** Close this window and then select the **Results** tab. The results tab should look like Figure B-128. The left portion of the results tab contains the computed frequency curve with confidence limits and the right portion of the results tab contains a plot of the computed combined frequency curve.

HEC-SSP User's Manual

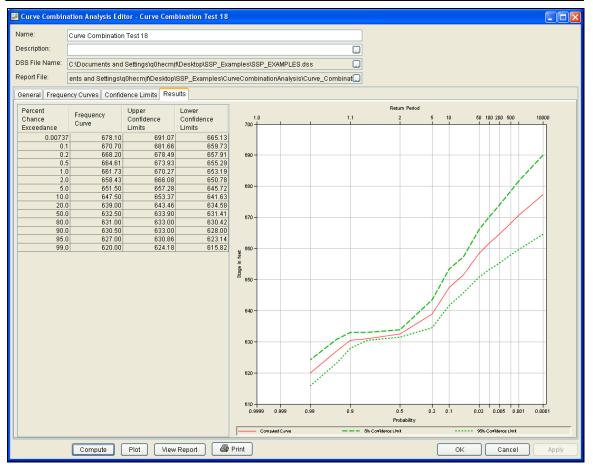


Figure B-128. Results Tab for Test Example 18.

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 by pressing the **Plot** button from the bottom of the analysis. 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 input data and results. 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-129 is the report file for Test Example 18.

Kurve_Combinat	tion Test 18.rpt		X					
Eile Edit Search Format								
File: Documents and Settings\q0hecmjftDesktop\ssp\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_Test_18\Curve_Combination_Test_18.rp								
	Curve Combination Analysis							
	08 Sep 2010 03:53 PM							
Input Data	Input Data							
Description:	Analysis Name: Curve Combination Test 18 Description:							
pepolipoion.	bescription.							
	Project Path: C:\Documents and Settings\qOhecmjf\Desktop\ssp\SSP_Examples							
			qOhecmjf\Desktop\ssp\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_					
Result File Nam	Result File Name: C:\Documents and Settings\q0hecmjf\Desktop\SSP_Examples\CurveCobinationAnalysis\Curve_Combination_							
DSS File Name:	DSS File Name: C:\Documents and Settings\q0hecmjf\Desktop\ssp\SSP Examples\SSP EXAMPLES.dss							
Confidence Limi	ts Method: Orden	Statistics						
Dignley ordinate	e melues using ?	digite in fr	action part of value					
Dispiny Orainac	e varues using .) argies in ri	accion part of value					
	Ordinate							
Percent		Weight						
0.00737								
0.10000								
0.20000								
0.50000								
1.00000 2.00000								
5.00000	651,500	1.0 1						
10.00000	647.500	1.0						
1 20.00000 1	639.000	1.0						
50.00000	632.500	1.0						
80.00000 90.00000	631.000	1.0						
95.00000	627.000	1.0						
99.00000	620.000	1.0						
Frequency	Ordinate	Ordinate						
Percent		Weight						
1								
0.00737								
0.20000	668,201	1.0						
0.50000	664.607	1.0						
1.00000	661.911	0.8						
2.00000	658.716	U.6						
<								
			1:1.1:1 1:1					

Figure B-129. Report File for Test Example 18.