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of Engineers**
Hydrologic Engineering Center

HEC-WAT

Watershed Analysis Tool

User's Manual

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14. ABSTRACT The HEC-WAT program provides an interface that will streamline and integrate the analytical process using the tools commonly applied by the multi-disciplinary teams of Corps offices. Although the original goal of HEC-WAT was to help offices perform watershed and/or system-wide studies, it can also be used for smaller studies as well, like a CAP (Continuing Authorities Program) study. The HEC-WAT graphical user interface (GUI) integrates software and software tools that could be used during the analytical process. Software is incorporated in the WAT through the use of a plug-in. The plug-in concept means that the WAT does not "know" anything about the software application code; the individual pieces of software provide the analytical computations, while the WAT provides the framework to coordinate the study. The graphical user interface is illustrated and described in detail in this manual.					
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Watershed Analysis Tool, HEC-WAT, User's Manual

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Acknowledgments

The Watershed Analysis Tool computer program (HEC-WAT) was developed at the US Army Corps of Engineers' Hydrologic Engineering Center (HEC). The WAT is a tool that streamlines the analytical and reporting processes of commonly used software. The WAT has been implemented following software guidelines established at HEC, these guidelines will produce more consistent results when using HEC software in watershed type studies. Also, the guidelines facilitate a common graphical user interface and look-n-feel for HEC software in the PC environment. Recent HEC software implemented under these guidelines are: rainfall-runoff analysis (HEC-HMS), river hydraulics (HEC-RAS), reservoir system analysis (HEC-ResSim), flood damage analysis (HEC-FDA), flood impact analysis (HEC-FIA), statistical analysis (HEC-SSP), and, ecosystems function analysis (HEC-EFM). HEC software implementation is under the guidance of Christopher N. Dunn, Director, Hydrologic Engineering Center.

Design and development of the WAT computer program has been a team effort. The initial design and concepts of the WAT were done by Messrs. Christopher Dunn, Gary Brunner, Jeff Harris, and William Charley. This group also included John DeGeorge of Resources Management Associates (RMA). Once a draft design document was created, the formal design process started and several other individuals joined the team; Mark Jensen, William Scharffenberg, Joan Klipsch, and Penni Baker. The team contributed to the writing of this user's manual.

Mark Ackerman, John DeGeorge, and Shannon Newbold of Resources Management Associates (RMA) developed the graphical user interface, developed the concept of plug-ins, implemented and assisted HEC in the development of the plug-ins, and assisted with debugging and the overall design of the program.

Foreword

The Hydrologic Engineering Center's Watershed Analysis Tool program, HEC-WAT, provides an interface that will streamline and integrate the analytical process using the tools commonly applied by the multi-disciplinary teams of Corps offices. Although the original goal of the WAT was to help offices perform watershed and/or system-wide studies, it can also be used for smaller studies as well, like a CAP (Continuing Authorities Program) study.

The WAT graphical user interface (GUI) integrates software and software tools that could be used during the analytical process. Software is incorporated in the WAT through the use of a plug-in. The plug-in concept means that the WAT does not "know" anything about the software application code; the individual pieces of software provide the analytical computations, while the WAT provides the framework to coordinate the study. The graphical user interface is illustrated and described in detail in this manual.

CHAPTER 1

Introduction

The U.S. Army Corps of Engineers (USACE) conducts watershed and water resources management studies. These studies begin with the definition of problems, issues, and opportunities and continue with various analyses to determine impacts so that appropriate decisions may be made. The studies often require hydrologic/hydraulic, economic, environmental, and social impact analyses. In most cases, varying sections within a district office perform these impact analyses independently with the reporting and visualization of modeling results through independent models. For the project study, coordination, file/data sharing, logistics, reporting of modeling results, and status reporting are often a problem for the modeling teams as well as project management.

The Corps determined that there was a need to streamline and integrate the tools commonly applied by the district and division offices to perform these analyses so that more efficient and coordinated modeling and planning may be performed. Modeling teams would benefit because they would be able to develop their models in a closely coordinated manner, track progress of other models, and automatically retrieve results from previous model runs thus assuring a more efficient and coordinated result. A control and visualization type interface would allow data and results sharing, common schematic assembly, alternative definition and representation, model setup, editing and implementation, and direct data and results visualization. A management team would benefit through the use of a tool that employs a common interface by being able to track project status through each modeling component and being able to display results during public and project status meetings.

1.1 Purpose

The HEC-WAT (Watershed Analysis Tool) program streamlines the analytical and reporting processes while producing more consistent results for watershed type studies. Software guidelines established at HEC have been used in the implementation of the WAT. These guidelines facilitate a common user interface, a common look-n-feel, and provide better interaction between HEC software in the PC environment. Other HEC software implemented under HEC software guidelines are: rainfall-runoff analysis (HEC-HMS), river hydraulics (HEC-RAS), reservoir system analysis (HEC-ResSim), flood damage analysis (HEC-FDA), flood impact

analysis (HEC-FIA), statistical analysis (HEC-SSP), and ecosystem response analysis (HEC-EFM). The WAT software has a windows style user interface and operates on Windows XP and Windows NT.

The terminology, analysis procedures, and output are consistent with requirements of ER 1105-2-100, ER 1105-2-101, EM 1110-2-1619, and other Corps guidance criteria. WAT is designed to facilitate:

- The entry of the appropriate data into each of the individual modeling programs.
- Trade-off analyses as all study alternatives will eventually be created within the WAT using consistent schematics, data, and tools. Their results will be easier to compare and contrast thus making the trade-off analysis easier to perform.
- The analytical process and enhanced coordination among study team members, while producing more consistent results, and shared displays.
- The definition of alternatives through schematic representations, model identification and sequencing, and tabular formats.
- The study status by reviewing reports in the WAT. During any given study, the manager or any other member of the project delivery team (PDT) will be able to determine the study status.
- The reviewing of modeling results at all modeled locations without the direct knowledge of how any of the individual models develop those results. Those attending meetings will be able to see the results directly rather than reading the results from a few locations in a hard copy report or poster.

1.2 Organization of Manual

The organization of this manual is shown in Table 1.1 (see page 1-3). An overview of the WAT is described in Chapter 2. The capabilities of the WAT are described in Chapters 3 through 11.

Table 1.1
Summary of Contents of User's Manual

If you want to find out...	Refer to...
Overview of HEC-WAT	Chapter 2
WAT Framework	Chapter 3
How to create and manage studies	Chapter 4
How to work with layers	Chapter 5
How to create and manage alternatives	Chapter 6
How to create and manage schematics	Chapter 7
How to create and manage analysis periods and events	Chapter 8
How to create and manage simulations	Chapter 9
Computes and Alternative Analysis	Chapter 10
Model Results	Chapter 11
Concept of pug-ins	Appendix B
Tools available from the WAT	Appendix C
How to setup the coordinate system for map layers	Appendix D
Map layer editors	Appendix E
Using the Color Chooser	Appendix F
How to use HEC-DSSVue	Appendix G
Glossary	Appendix H
How to edit model data	Appendix I
How to customize plots	Appendix J
Printing and copying data from the WAT	Appendix K

CHAPTER 2

Overview of HEC-WAT

The HEC-WAT program provides a Graphical User Interface (GUI) that streamlines and integrates the tools commonly applied by the Corps District and Division offices so that more efficient and coordinated modeling and planning may be performed. The WAT GUI provides dialogs for file management, data entry and editing, and viewing output.

2.1 Overview

The WAT is a tool that will help in the performance of water resources studies (Figure 2.1), whether they are CAP (Continuing Authorities Program) studies or large comprehensive studies. A WAT study is comprised of alternatives and analysis periods, with the combination of these two items creating a simulation. Computations executed in the WAT are performed through simulations.

The HEC-WAT software streamlines and integrates tools commonly used by the Corps District and Division offices so that more efficient and coordinated modeling and planning may be performed.

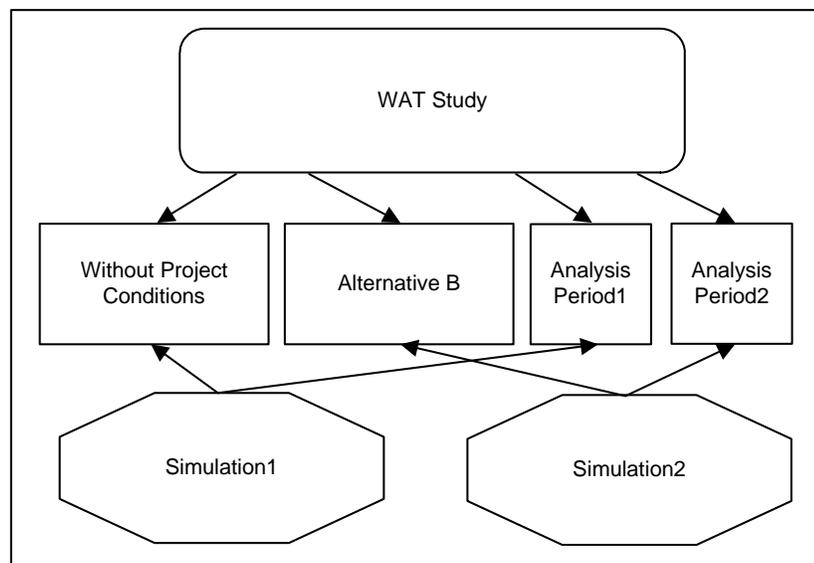


Figure 2.1 A Typical HEC-WAT Study

It allows the Corps and its partners and stakeholders to conduct their studies in a coordinated fashion. The WAT interface streamlines and integrates a water resources study using software commonly applied by the multi-disciplinary teams that comprise a typical Project Delivery Team (PDT). The WAT is not replacing existing software but rather it's an interface that allows unique pieces of software to work together. Software

Software currently implemented in the WAT, includes:
HEC-HMS
HEC-SSP
HEC-RAS
HEC-ResSim
HEC-FIA
HEC-DSSVue
HEC-EFM

such as Hydrologic Modeling Systems (HEC-HMS), Statistical Software Package (HEC-SSP), River Analysis Systems (HEC-RAS), Reservoir System Simulation (HEC-ResSim), Data Storage System Visual Utility Engine (HEC-DSSVue), Flood Impact Analysis (HEC-FIA), and Ecosystem Functions Model (HEC-EFM) are currently implemented within the WAT. This coordination allows a study team to perform many of the necessary hydrologic, hydraulic, environmental, and planning analyses all orchestrated from a single interface.

Coordination begins as each model uses the common schematic that is built within the WAT interface. The common schematic demands that each team use the same nomenclature for each of their models and alternatives. The individual models can be built and edited inside or outside the WAT and model results are viewed from the WAT by selecting the elements found on the schematic. Once the models are located within the WAT, the models can be run in sequence. The storage of data is organized by DSS and a simple DSS linking device is used to connect the models. The models themselves, the input data, and the results are all stored in the WAT's directory structure. Therefore, all data and files used to make decisions are easily retrieved. Alternative analyses can be performed, and output from multiple alternatives can be viewed at the same time making alternative analyses and selection easier.

A common, central framework is provided through the WAT. From the framework, GIS based layers can be loaded such as shapefiles and DEMs; stream networks and schematics can be established; locations (common computation points) can be identified where models would share information; the modeling programs and their sequence order are defined; existing models are imported; and new models are developed. The WAT framework will meet the following objectives: organize and develop alternatives; access modeling programs directly; and, view and compare alternative results.

2.2 Identify a WAT Study

An issue at the beginning of any project study (i.e., reconnaissance, or feasibility) is the definition, study extent, and representation of alternatives. The WAT helps to alleviate this issue by allowing the project study team to jointly define alternatives through schematic representations, model identification and sequencing, and tabular formats.

The study team, under the direction of a Project Manager (PM), will start the analysis process by meeting to acquaint themselves with the type and location of study to be conducted (i.e., reconnaissance, feasibility, watershed, restoration). A typical study team could be composed of a PM,

GIS specialist, hydrologist, hydraulic engineer, water manager (reservoir), economist (flood damage), biologist (water quality), and planner.

The team will determine what data or models already exist and what data and models will need to be built. With the WAT, there is no extracting or copying of other data to a DSS file before a simulation is computed. Therefore, you need to be sure if your study area requires the use of observed data, historical, or other model data, that this data is stored in one DSS file. This requirement is based on the way the WAT links model alternatives together and simulations are computed.

With a map in hand, the PM would lead the study team on choosing the study boundaries, identifying gage locations, sub-basin delineations, points where models would share data (common computation points), damage area centers, and location of measures (reservoirs, levees, etc.). Once this information has been identified then someone from the study team would be chosen to set up the base alternative (*Without Project Conditions*). This should be someone with some knowledge of the study area.

A study, in the WAT is a combination of the data and models and events required to analyze a specific geographic area.

With the study area defined, the study team needs to find out if any models already exist, what data is available, and what is the time window (analysis period) of the available data for the base alternative (*Without Project Conditions*). Once the base alternative is set the study team should identify, name, and gather information for the additional alternatives. These alternatives could include the use of additional flood damage reduction measures, environmental features, or simply represent future conditions. The benefit of the WAT is that each of the modeling teams will be able to use the identical schematic to perform their modeling and naming will be consistent across all models. Each alternative will be tied to a given schematic. Therefore, the alternative definitions will be fully coordinated making for more consistent modeling and results.

2.3 Create a WAT Study

After the study team has identified the study area, then a WAT study can be created (see Figure 2.1, page 2-1). A **study**, in the WAT is a combination of the data and models and events required to analyze a specific geographic area. The first step is to define the schematic for the base alternative, and then schematics for other defined alternatives.

A **schematic** is a physical representation of a stream alignment, and the flood damage reduction and environmental measures that will be modeled. One individual from the study team will build the schematic for the base alternative. The first basic item of a WAT schematic is the stream alignment; this is usually created from importing information from a map

A schematic is a physical representation of a stream alignment, and the flood damage reduction and environmental measures that will be modeled.

layer (shapefile). Once a stream alignment has been built, then common computation points, and existing flood control or restoration measures, will be added to the schematic that will be shared across all models. To aid in the placement of elements on the schematic, background maps of gage locations, reservoir locations, sub-basin delineations, study boundary areas, etc. should be added to the study.

By default, the WAT creates the base alternative – **Without Project Conditions**. The study team has probably defined other alternatives that can be created, as well (Figure 2.2). An **alternative** in the WAT is a way to group a schematic with different operations and model parameters.

An alternative in the WAT is a way to group a schematic with different operations and model parameters.

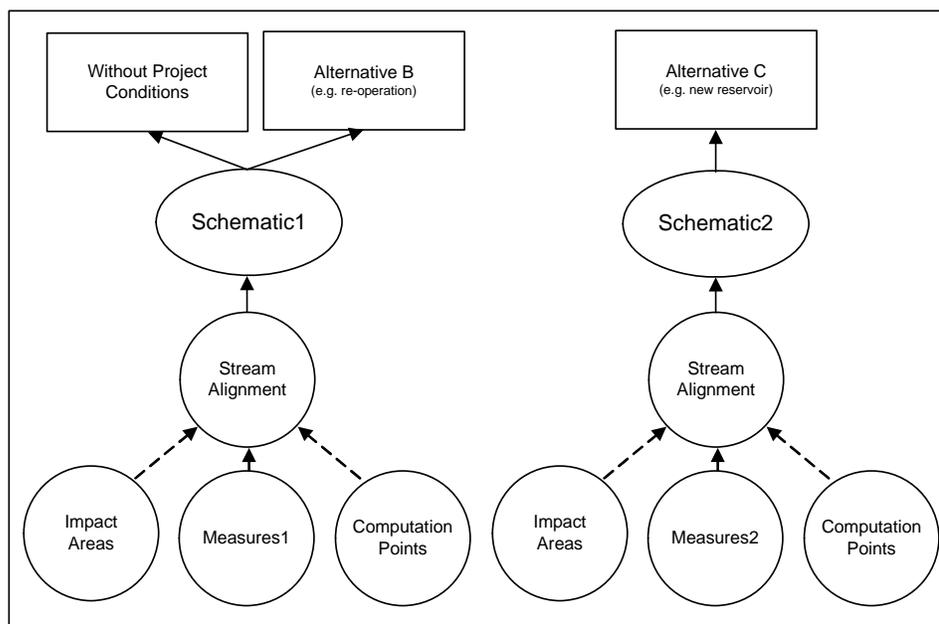


Figure 2.2 Relationship of Alternatives and Schematics

Once an alternative is created, the next step is to create analysis periods. **Analysis periods** define the time window and events that could be associated with an alternative. An **event** is an occurrence of precipitation/snowmelt that leads to some sort of hydrologic response normally associated with a specific time period. The event can be historical or hypothetical or represent the upper limit of a precipitation runoff response.

Analysis periods define the time window and events that could be associated with an alternative.

Now that alternatives and analysis periods have been defined in the WAT, existing models that have been identified for the study can be brought into the WAT either by importing or copying the files into the WAT directory structure. If models are to be built, the WAT provides two options. One is that you can create the models through the WAT by accessing the individual pieces of software directly from the WAT. The other option is for you to copy the files created by the WAT to your computer, and then return the files to the WAT study once you are finished with the modeling. For example, if the RAS model for a study needs to be built, from the

WAT directory structure there is a RAS folder which contains the default RAS files for the study. You can copy these files to your own computer, create the RAS model, and then copy the files back to the WAT study.

Once all the models have been added to the WAT study, simulations (Figure 2.3) can be created. A **simulation** is a combination of an analysis period and event(s) associated with an alternative. For each of these

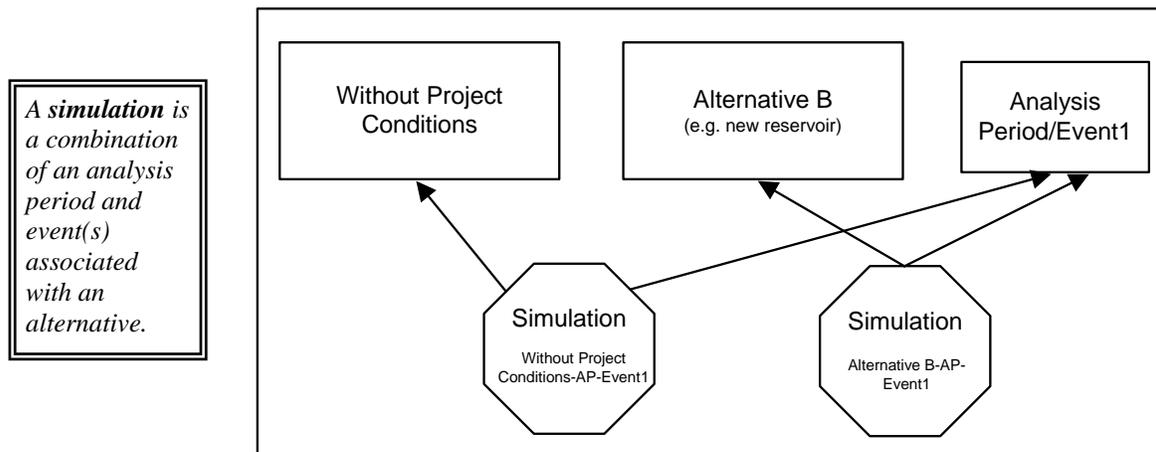


Figure 2.3 Relationship of Alternatives and Analysis Periods to Simulations

combinations, models will need to be selected, the simulation will be computed, and results will be reviewed. The process is then repeated for the other identified alternatives, and after several WAT simulations, alternative result comparison can be reviewed.

2.4 Starting the WAT



When starting the WAT, double-click the HEC-WAT program icon on your desktop, or from the taskbar click **Start**, point to **Programs**, point to **HEC**, and then click **WAT**. The splash dialog box for the WAT will open (Figure 2.4).

The splash dialog box (Figure 2.4) will appear for a few seconds, and then the main window of the WAT will appear. You are now ready to start using the WAT.

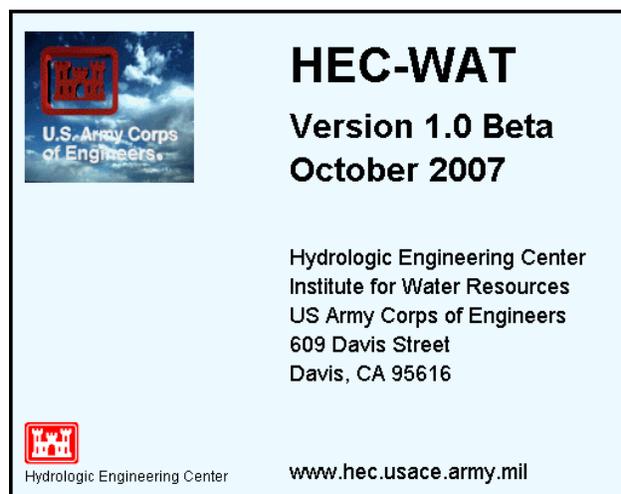


Figure 2.4 HEC-WAT Splash Dialog Box

CHAPTER 3

HEC-WAT Framework

For HEC-WAT, a **study** is a combination of the data and models and events required to analyze a specific geographic area. A study will include all of the background maps needed for the spatial configuration, the stream system associated with the watershed, measures (e.g., reservoirs, levees), gage locations, impact areas, hydrometeorological data, and models for the study.

3.1 Overview

The "plug-in" concept allows the WAT to remain oblivious to the computing requirements of the individual pieces of software, but provides an analysis framework for the programs.

The WAT is an interface that streamlines and integrates a water resources study using software commonly applied by multi-disciplinary teams. The WAT is not replacing existing software but rather provides an interface that allows unique pieces of software to work together. Software such as HEC-HMS, HEC-SSP, HEC-RAS, HEC-ResSim, HEC-DSSVue, HEC-FIA, and HEC-EFM are currently implemented within the WAT. The integration of the programs and tools is accomplished through the use of a concept called a "plug-in". The "**plug-in**" concept allows the WAT to remain oblivious to the computing requirements of the individual pieces of software, but provides an analysis framework for the programs. A "plug-in" can provide the ability to access model parameters and view results of a model from the WAT framework. In other cases the "plug-in" only provides the viewing of results, with the changing of model parameters being done outside of the WAT.

The common framework provides the user with the ability to load GIS based layers such as shapefiles and DEMs; stream networks and schematics can be established; locations where programs would share information (common computation points) can be identified; the programs and their sequence order are defined; existing models are imported; and new models are developed.

3.2 WAT Main Window

The WAT main window (see Figure 3.1, page 3-2) displays the framework for the WAT that will allow you to enter data, review data, create alternatives, run simulations, and view results. The main window is laid

The WAT main window displays the framework for the WAT that will allow you to enter data, review data, create alternatives, run simulations, and view results.

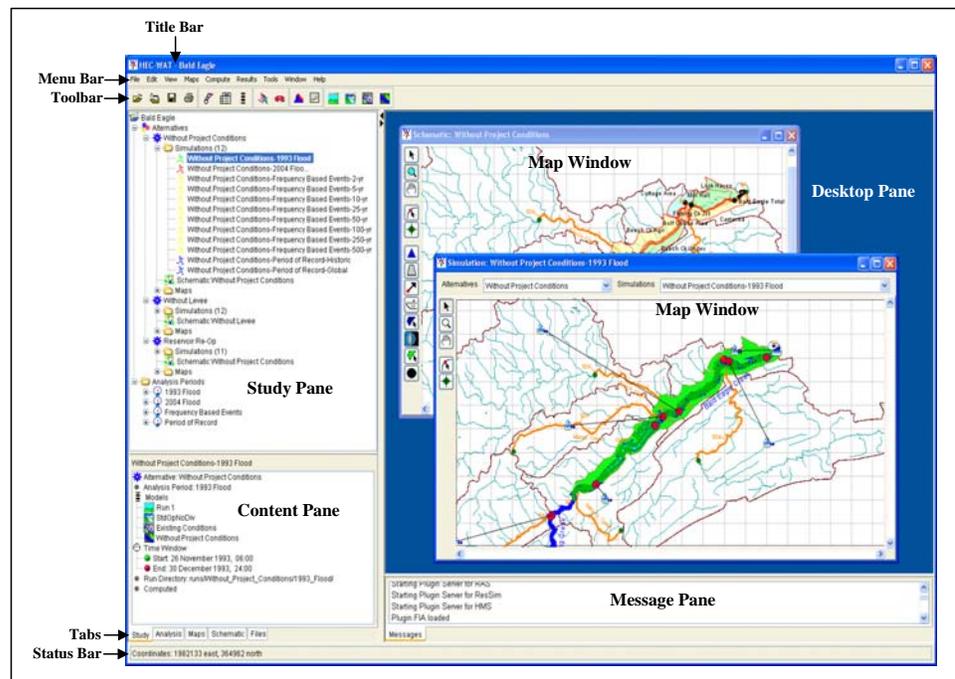


Figure 3.1 HEC-WAT Main Window

out in panes along with a desktop area for viewing results from a common schematic.

The **Title Bar** (Figure 3.1) displays the WAT study title. After a study is opened, the name of the study will appear here. The **Menu Bar** contains the following menus:

- File** This menu is used for study management (creating, opening, closing, saving, details, properties); print the active map, importing model alternatives (ResSim, RAS, FIA), exporting model alternatives (Version 1.0), open recent studies, and exiting the WAT. The following commands are available: **New Study, Open Study, Close Study, Save Study, Study Details, Print Map, Import, Export, Recent Studies** and **Exit**.
- Edit** From this menu you can set the program order, manipulate alternatives and simulations, link the individual models, and access the individual program editors. Available commands are: **Program Order, Alternative and Simulation Manager, Model Linking Editor, HMS, ResSim, RAS, FIA, and EFM**.
- View** This menu is used to setup the WAT main window, you can select toolbars and panes, set display units for plotting and tabulating, and manage layouts for the main window. Available commands are: **Toolbars, Study**

Pane, Messages, Status, Set Display Units, Save Layout, Restore Layout, and Layout Manager.

- Maps** From this menu you are setting up map layers and map windows. You can set spatial properties, zoom the active map window out to its full extents, add map layers, remove map layers, open a new map window, adjust the active map windows properties, save the contents of the active map window as a graphic file, import a stream alignment from an ArcView® shapefile, import impact areas from an ArcView® shapefile, export a stream alignment to an ArcView® shapefile, and, export impact areas to an ArcView® shapefile. Available commands are: **Default Map Properties, Zoom To All, Add Map Layers, Remove Map Layers, New Map Window, Map Window Properties, Save Map Image, Import, and Export.**
- Compute** This menu is used to compute individual simulations, compute multiple simulations, compute by individual programs, and view the compute log for the active simulation. Available commands are: **Compute Manager, Compute, and View Compute Log.**
- Results** From this menu you can select the simulations for comparison, and view results from the integrated software. Available commands are: **Result Comparison Manager, HMS, ResSim, RAS, and FIA.**
- Tools** This menu provides access to DSS data (HEC-DSSVue); access to the Statistical Software Package (HEC-SSP); access to the GeoRAS and GeoHMS software packages; allows creating and editing of scripts; provides options for WAT startup, setting system properties, viewing threads, setup simulation and compute color, and plug-in information; customize menus and toolbars, view WAT program activity, and monitor memory usage. Available commands are: **HECDssVue, SSP, GeoHMS, GeoRAS, Scripts, Options, Customize, Console Output, and Memory Monitor**
- Window** From this menu you control the appearance of the map windows in the **Desktop Pane** (see Figure 3.1, page 3-2) of the WAT main window. You can organize all of the currently opened map windows in either a vertical or horizontal tile, place one map window on top of the next in a cascading fashion, bring the next map window in the

list of currently opened map windows to the top, bring the previous map window that was on top to the top, provide a pick list of the currently opened map windows, and a sub-menu of all the currently opened map windows. Available commands are: **Tile, Cascade, Next Window, Previous Window, Window Selector,** and **Window.**

Help Displays current version information about the WAT.

3.2.1 Toolbar

The toolbar area of the WAT main window (see Figure 3.1, page 3-2) provides quick access to the most frequently used options from the WAT menu bar. There are five available toolbars from the main toolbar:

Toolbars provide quick access to frequently used option in the WAT. There are five toolbars available:

- Standard*
- WAT Tools*
- Management Tools*
- Tools*
- Programs*

Standard There are four tools available from the **Standard Toolbar** (Figure 3.2). The tools allow you to open a study, close a study, save a study, and print the



Figure 3.2 Standard Toolbar

currently selected map window. These tools have the same function as the items under the **File** menu (see Section 3.1, page 3-2).

WAT Tools There are three tools available from the **WAT Tools Toolbar** (Figure 3.3). The tools allow you to link the individual model alternatives



Figure 3.3 WAT Tools Toolbar

(**Modeling Linking Editor**, see Chapter 9, Section 9.5.1, page 9-30); manipulate alternatives and simulations (**Alternative and Simulation Manager**, see Chapters 6, 8, and 9); and, set the program order for the WAT (**Program Order** dialog box, see Chapter 9, Section 9.2, page 9-1).

Management Tools There are two tools available from the **Management Tools Toolbar** (Figure 3.4). The first tool allows you to compute simulations (**Compute Manager**, see



Figure 3.4 Management Tools Toolbar

Chapter 10, Section 10.1.1, page 10-1); and, the second tool is for setting up comparisons of simulation results (**Results Comparison Manager**, see Chapter 10, Section 10.2.1, page 10-7).

Tools

There are four tools available from the **Tools Toolbar** (Figure 3.5). The tools allow you to access DSS data

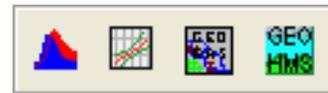


Figure 3.5 Tools Toolbar

(**HEC-DSSVue**, see Appendix G); access the Statistical Software Package (**HEC-SSP**, see Appendix C, Section C.1, page C-1); access the geospatial hydraulic tool **HEC-GeoRAS** (see Appendix C, Section C.2, page C-3); and, access the geospatial hydrology tool **HEC-GeoHMS** (see Appendix C, Section C.3, page C-4).

Programs

There are four tools available from the **Programs Toolbar** (Figure 3.6) that represent the individual software programs available from the WAT:



Figure 3.6 Programs Toolbar

HEC-HMS, HEC-ResSim, HEC-RAS, HEC-FIA, and HEC-EFM. These buttons allow you to directly execute the selected software program from the WAT.

To toggle these toolbars on and off, on the **View** menu, point to **Toolbars**, and select the toolbar you which to toggle on and off.

3.2.2 Panes

*In the WAT graphical user interface, panes are viewing areas that allow the user to view study data. There are four main panes:
Study Pane
Content Pane
Desktop Pane
Message Pane*

Panes are viewing areas that allow you to view WAT study data at the same time or to display different, yet simultaneous, views of WAT study data. The WAT main window has four main panes. The panes are:

Study Pane

This pane (see Figure 3.7, page 3-6) provides an overview of WAT alternatives, simulations, and analysis periods that have been defined for a study. A **WAT alternative** is a way to group a schematic with different operations and model parameters. **Analysis periods** define the time windows and events that could be associated with an alternative. **Simulations** are combinations of analysis periods and events, associated with an alternative. A simulation will be

computed and results will be reviewed. Once a simulation has been computed, you can visually tell the status of the compute (from the **Study Pane**).

The Study Pane provides an overview of WAT alternatives, simulations, and analysis periods that have been defined for a study.

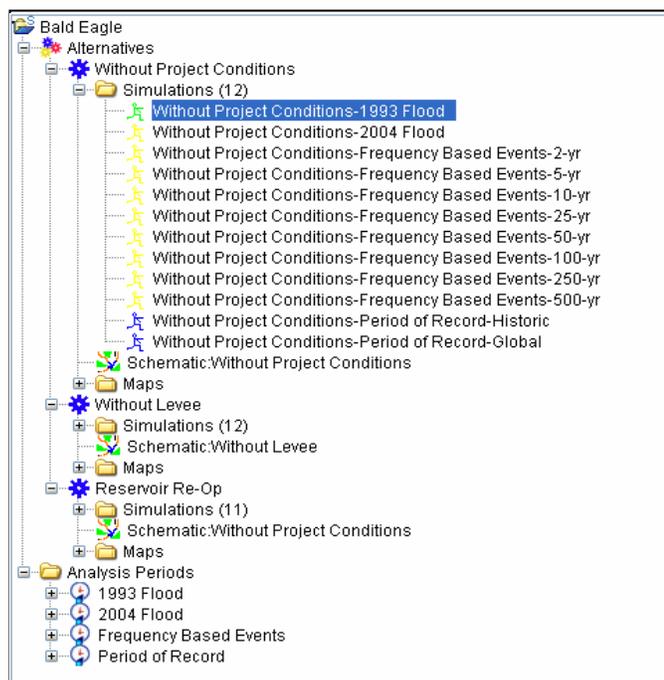


Figure 3.7 Study Pane

The **Study Pane** (Figure 3.7) acts like an explorer tree in the study. The top level is the study, the next level lists the alternatives, and the final level lists the analysis periods. Under the alternatives level is where the simulations for each defined study alternative are located. Each alternative also contains a schematic and associated background maps.

Content Pane The **Content Pane** (Figure 3.8) provides details on the selected WAT component in the **Study Pane**. For example, in Figure 3.7, a WAT simulation has been selected – *Without Project Conditions-1993 Flood*.

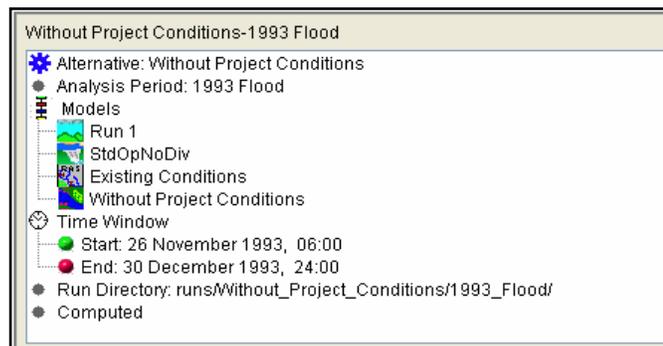


Figure 3.8 Content Pane

The **Content Pane** (see Figure 3.8, page 3-6) displays the elements of that simulation. Information includes the alternative, the analysis period, the model alternatives that were run, the time window, the directory where the results from the simulation were written, and the status of the simulation.

The Desktop Pane is where the different WAT map windows are displayed. This is where the user is viewing model results and interacting graphically with each model.

Desktop Pane This pane (Figure 3.9) is where the different map windows (see Section 3.2.4, page 3-9) available from the WAT will display. For example, in Figure 3.9, the **Desktop Pane** contains a map window of a selected simulation and a map window of a selected schematic. These two map windows provide the user with a graphical representation of a simulation and a schematic, respectively.

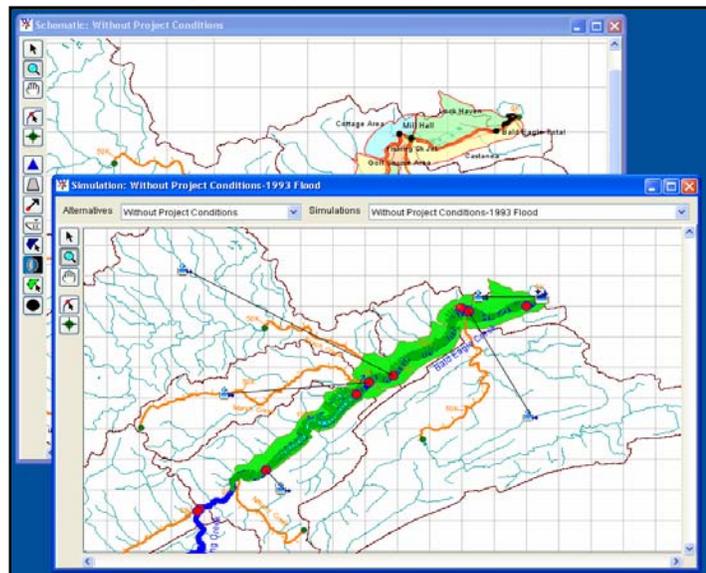


Figure 3.9 Desktop Pane

Message Pane The **Message Pane** (Figure 3.10) contains messages that the WAT program is providing for informational purposes. The information in the **Message Pane** is a record of the WAT program activity, recording the opening of a study, opening map windows, accessing DSS, and many other WAT activities.

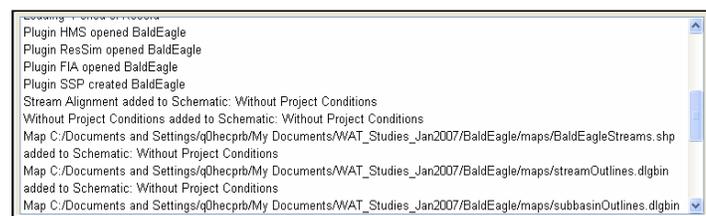


Figure 3.10 Message Pane

3.2.3 Tabs

The WAT tabs provide different views of the available data in a study and users can perform certain operations for a study from the tabs. There are five tabs:

Study The default tab (see Figure 3.1, page 3-2) which provides a view of study data. Also, you can create, edit, and delete alternatives, analysis periods, events, and simulations.

Analysis The **Analysis Tab** (Figure 3.11) provides a view for comparing results for the selected analysis group. You can select which alternatives to compare, which alternative will be the base alternative, and select analysis groups.

Tabs are a WAT graphical user interface item that provides different views of data and depending on the tab the user can perform certain operations. There are five tabs:

*Study
Analysis
Maps
Schematic
Files*

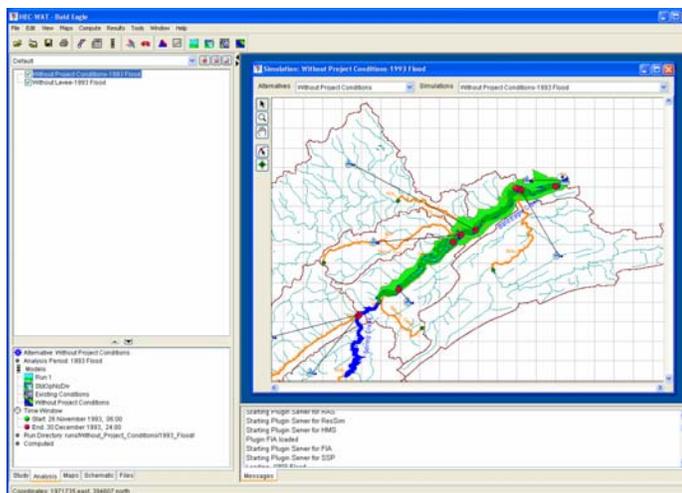


Figure 3.11 Analysis Tab

Maps The **Maps Tab** (Figure 3.12) provides a view of the selected map window; this includes the map layers, stream

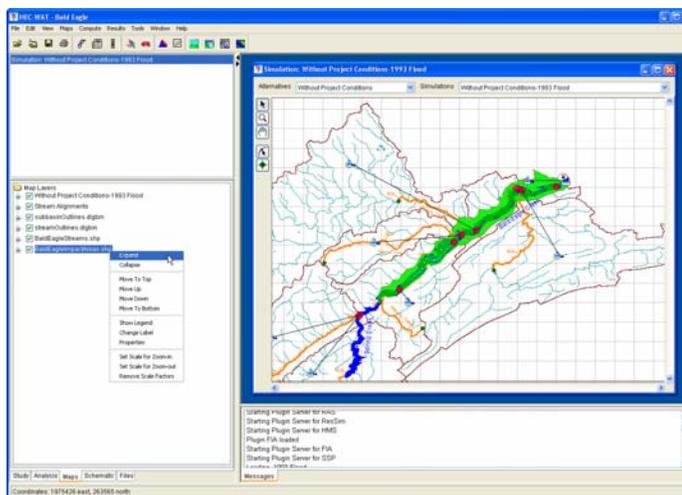


Figure 3.12 Maps Tab

alignment, and information specific to what is being displayed by the selected map window.

Schematic The **Schematic Tab** (Figure 3.13) is where the schematics are created, edited, and deleted.

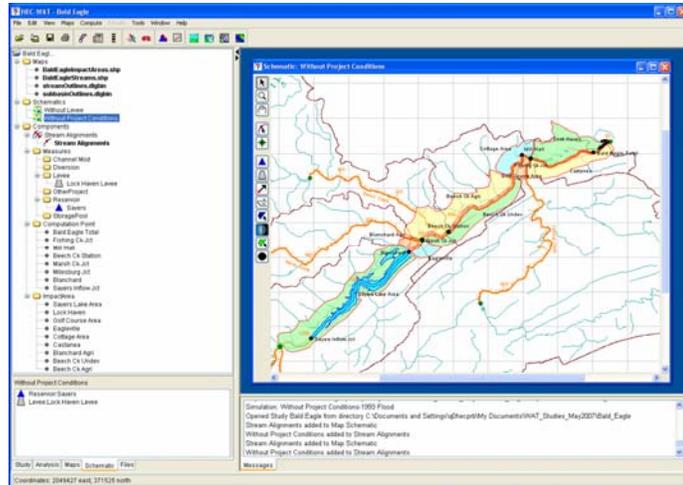


Figure 3.13 Schematic Tab

Files The **Files Tab** (Figure 3.14) provides a view of the files and directory structure of the currently opened WAT study.

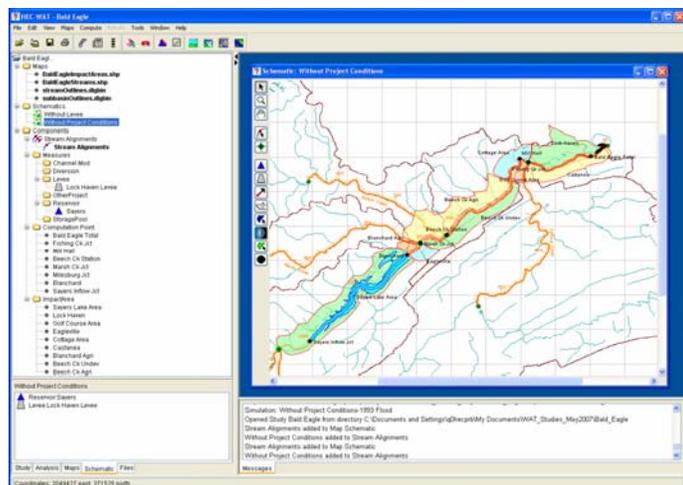


Figure 3.14 Files Tab

3.2.4 Map Windows

Map windows are a way to graphically display stream alignments, schematics, alternatives, and simulations. From an alternative map window you can open editors and view results. A schematic map window allows you to edit, modify, and delete measures, common computation points, impact areas, and make adjustments to the stream alignment. The

simulation map window (Figure 3.15) is where you can edit individual model parameters and view results.

Map windows graphically display the major components for a WAT study (i.e., stream alignments, schematics, simulations, etc.).

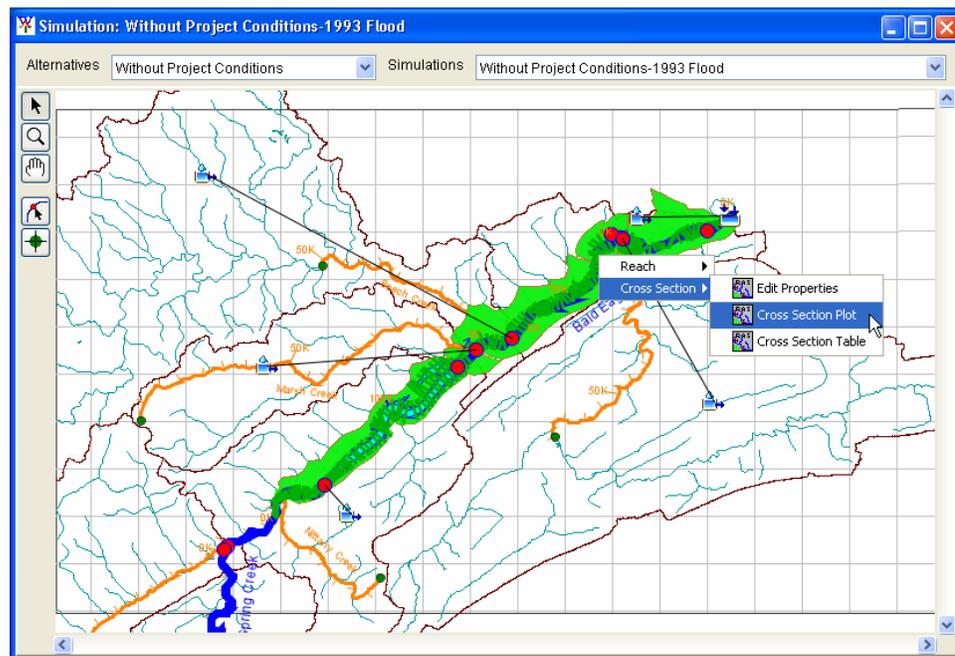


Figure 3.15 Simulation Map Window

3.3 Plug-Ins

The WAT incorporates individual pieces of software such as our suite of software (HEC-RAS, HEC-HMS, HEC-ResSim, HEC-EFM, HEC-FIA, and HEC-FDA) through the use of a "plug-in".

The primary purpose of the WAT is to streamline and integrate a water resources study using software commonly applied by multi-disciplinary teams. The integration of the models and tools is accomplished through the use of a concept called a "**plug-in**". By using the "plug-in" concept the WAT incorporates individual pieces of software such as our suite of software (HEC-RAS, HEC-HMS, HEC-ResSim, HEC-EFM, HEC-FIA, and HEC-FDA) and allows them to work together in a coordinated fashion so that water resources, economic, and environmental decisions can be made from the same interface.

The "plug-in" concept allows the WAT to remain oblivious of the computing requirements of the individual pieces of software, but provides an analysis framework for the models. A "plug-in" can provide integrated schematic elements, access to model editors, access to model results, and the ability to perform model computations all from the WAT framework. For further details on the "plug-in" concept, see Appendix B.

CHAPTER 4

Creating and Managing Studies

Data management by HEC-WAT is largely done behind the scenes. Files are automatically created and named by the WAT to store information. Simulation information is stored in an HEC-DSS file, while general information, alternative descriptions, and simulation descriptions are all stored in ASCII text files.

4.1 Managing Studies

In the WAT, the set of files associated with a particular watershed is called a **study**. The WAT creates a directory (folder) with the study name specified, and stores all the files associated with the study in that directory.

Commands available in the **File** menu (Figure 4.1) allow you to create a new study, open an existing study, close the current study, save the current study, and create a copy of the current study.

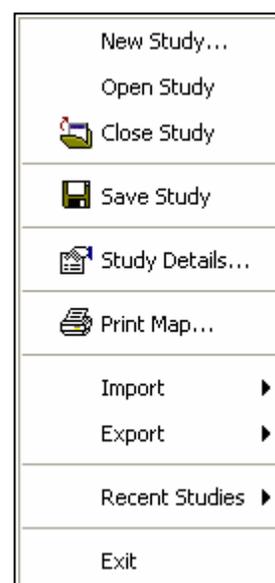


Figure 4.1 File Menu Commands

4.1.1 Creating a New Study

To create a new study:

1. On the **File** menu, click **New Study**.
2. In the **New Study** dialog box (see Figure 4.2, page 4-2), enter a name (required) in the **Study Name** box, and in the **Description** box, enter a description (optional, but recommended) for the new study.
3. In the **Directory** box, either enter the name of the directory where you want to store your WAT study, or click the button, and an **Open Browser** (see Figure 4.3, page 4-2) will open. You can navigate to the directory you want to store the WAT study on your computer or network.

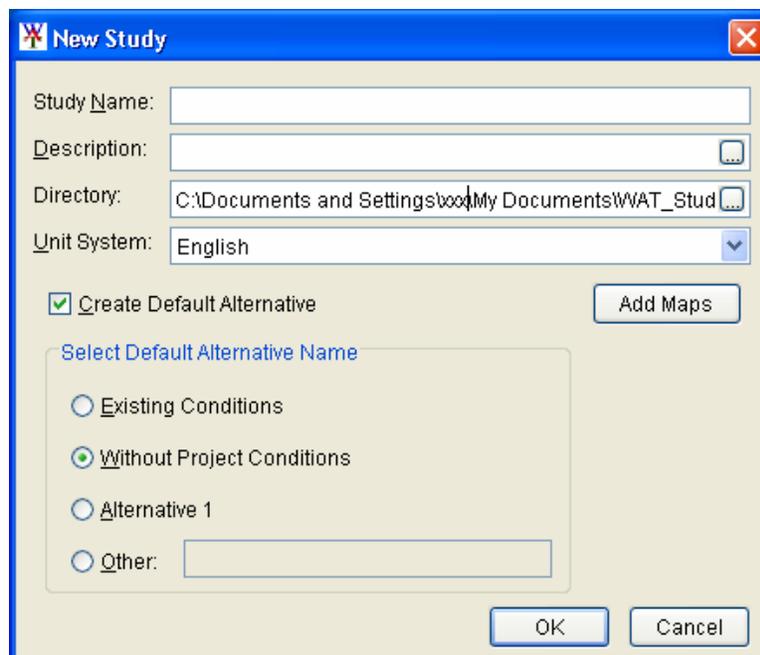


Figure 4.2 New Study Dialog Box

4. By default the WAT creates a default alternative – *Without Project Conditions*. If you want the default alternative to have a different name you have several choices, including **Other** (Figure 4.2) which allows you to name the default alternative

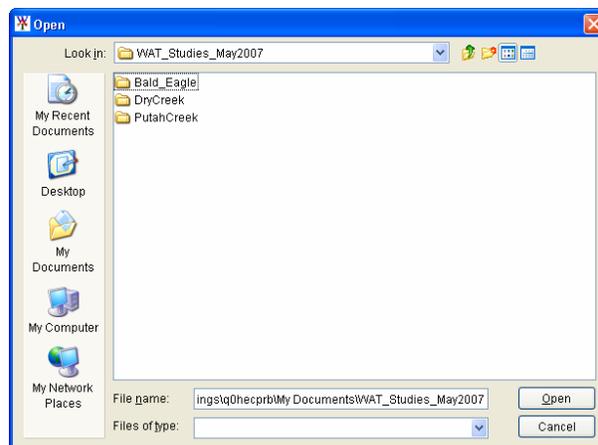


Figure 4.3 Open Browser

- anything you want. If you don't want to create an alternative, click **Create Default Alternative**.
5. You can add map layers (see Chapter 5) to your study if you wish. Click **Add Maps**, the **Select Map to Add** browser will open (see Figure 4.4, page 4-3). If you want the WAT to copy the map layers to the study directory (*maps* folder) click **Create Copy**. Select the desired map layers and click **Open**. The **Select Map to Add** browser (see Figure 4.4, page 4.3) will close.
6. Click **OK**, the **New Study** dialog box will close (Figure 4.2). The WAT main window will now have the name of the study in the title bar.
7. A schematic map window will open in the **Desktop Pane** (see Chapter 3, Section, 3.2.2, page 3-7) and in the **Study Pane** (see

- Chapter 3, Section 3.2.2, page 3-6) the study name and the default alternative will be displayed.
8. A directory with the study name and associated files will be created for the study. For further details on the study directory and files, see Section 4.2 (page 4-5).

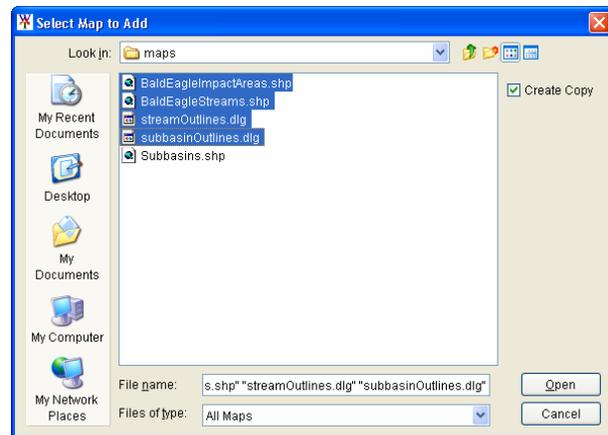


Figure 4.4 Select Map to Add Browser

4.1.2 Opening an Existing Study

There are two ways to open existing studies in the WAT. One way is to open a study by selecting it from the list of most-recently-opened studies. On the **File** menu (see Figure 4.1, page 4-1), point to **Recent Studies**, from the list of the most recently opened five studies, click on the name of the study you wish to open, and the WAT will automatically load the selected study. The second way to open an existing study is described below.

To open an existing study:

1. On the **File** menu, click **Open Study**, an **Open Browser** (see Figure 4.3, page 4-2) will open.
2. From the **Open Browser**, browse to the location of the existing WAT study. By default, the WAT is looking for a file with the extension **.sty*.
3. Select the study name, click **Open**, the **Open Browser** will close, and the selected study will open in the WAT.

4.1.3 Close a Study

To close an active study, on the **File** menu (see Figure 4.1, page 4-1), click **Close Study**, if there have been no changes made to the study, then the study will automatically close. If changes have been made a **Save File** dialog box will open (see Figure 4.5, page 4-4).

The WAT keeps track of changes being made to a study by the major study components – alternatives, analysis periods, and simulations. The list of items that will appear in the table on the **Save File** dialog box will

be all of the items that you have changed during a session. By default, everything is selected for saving; however, you have the choice of being able to pick and choose by component what changes to save. For example, from Figure 4.5, say for some reason you do not want to save any changes you made to the *Without Levee* alternative, click in the **Save** column of the table, this unselects the alternative. Therefore, when you click **OK**, the changes that were made for the *Without Levee* alternative are gone.

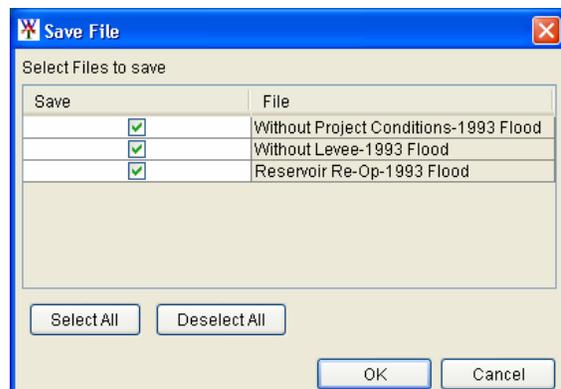


Figure 4.5 Save File Dialog Box

4.1.4 Save a Study

To save a study on the **File** menu (see Figure 4.1, page 4-1), click **Save Study**, the WAT will automatically save the study.

4.1.5 Study Details

One of the objectives of the WAT is to provide information regarding the status of the study, to the manager or any other member of the project delivery team. Some of the information required needs to be entered by the study team, from the **Study Properties** dialog box (Figure 4.6). This dialog box has three tabs – **Contacts**, **Model Info**, and **Simulations**.

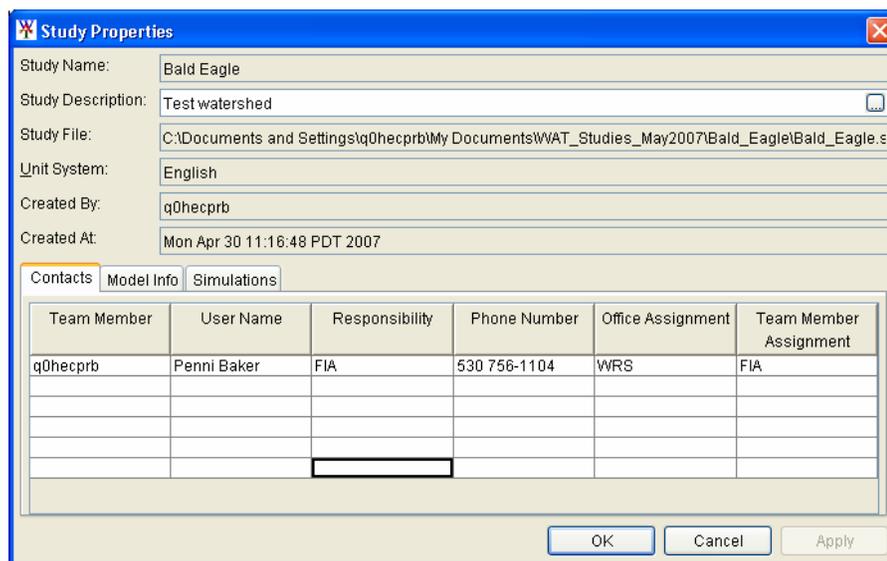


Figure 4.6 Study Properties Dialog Box

Information that can be entered is: team member name, user name, team member's model responsibility, team member who has imported a model alternative, date imported, and much more. The **Study Properties** dialog box also provides information about the study: the study name, description, location of the study file, the unit system chosen, who created the study, and the data and time the study was created.

4.2 Study Directories and Files

Figure 4.7 (page 4-6) shows an example of how the WAT organizes the directories and files that it creates in the study directory. In this example, the study directory is */BaldEagle*. As data is entered, other files and subdirectories are created. Table 4.1 (pages 4-7 thru 4-8) describes each directory and file that is shown in Figure 4.7 (page 4-6).

4.3 Automatic Backup Files

As you add a stream alignment, map layers, and data to a study the files and directories listed in Table 4.1 (page 4-7) are created, along with automatic backup files. For example, a *baldeagle.sty* file and a *baldeagle.sty.bak* file are created when the study is created. If you add a map layer for example, the *.bak* file would not have any reference to the added map layer, the backup file reflects the state previous to the current changes. So every time you **Save** a study, the **.bak* file is updated to the previous state.

Automatic backup files are created for all study files, alternative files, analysis period files, simulation files, and results files. DSS files are not automatically backed up. Since the *.bak* file reflects the previous state of that file, the user can go back to the previous state by eliminating the *.bak* extension. This would allow the information for that previous state to become the current state. The overall effect would be "undoing" all changes you made in the last cycle.

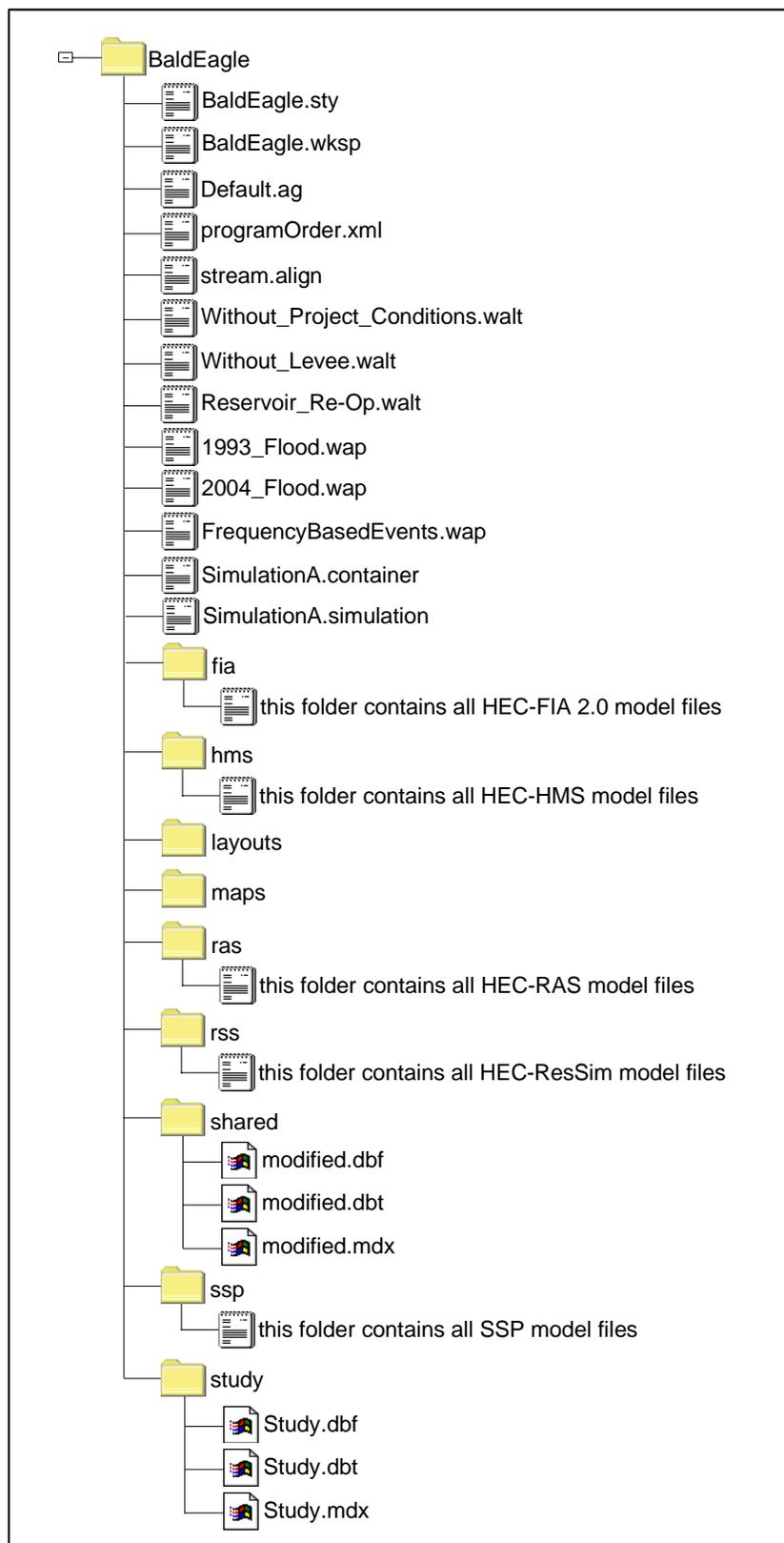


Figure 4.7 Example HEC-WAT Study Directory Structure

File or Directory Name	Contents
 BaldEagle	Study directory that is created when a user creates a new study (see Section 4.1.1, page 4-1).
 BaldEagle.sty  Bald Eagle.sty.bak	ASCII text files created by the WAT when a study is created. Contains the name and description of the study, what user created the study, map coordinate information, and references to the stream alignment and the schematic data. The <i>*.bak</i> file is an automatic backup file of the <i>*.sty</i> file.
 BaldEagle.wksp  Bald Eagle.wksp.bak	ASCII text files created by the WAT when a study is created. Contains the name and description of the study, location of stream alignment file, and location of any map layers that have been added to the study. The <i>*.bak</i> file is an automatic backup file of the <i>*.wksp</i> file.
 Default.ag  Default.ag.bak	ASCIISerializer text file created by the WAT when a study is created. Contains information for a default analysis group. The <i>Default.ag.bak</i> file is an automatic backup file of the <i>Default.ag</i> file.
 programOrder.xml  programOrder.xml.bak	An XML file created by the WAT when a study is created. Contains information on the program order that can be defined by the WAT. Initially, contains the default program order: HEC-HMS, HEC-ResSim, HEC-RAS, and HEC-FIA. The <i>programOrder.xml.bak</i> file is an automatic backup file of the <i>programOrder.xml</i> file.
 stream.align  stream.align.bak	ASCII text files created by the WAT when a study is created. Contains the name, description, and other information that define the stream alignment (stream nodes, vertex points, stream element(s), etc.). The <i>stream.align.bak</i> file is an automatic backup file of the <i>stream.align</i> file.
 Without_Project_Conditions.walt  Without_Project_Conditions.walt.bak	ASCII text file created by the WAT when a study is created, contains information on the default alternative. Contains the name, associated stream alignment, and other information. The <i>Without_Project_Conditions.walt.bak</i> file is an automatic backup file of the <i>Without_Project_Conditions.walt</i> file.
 fia	Sub-directory created by the WAT when a study is created. This folder contains all HEC-FIA 2.0 model files.
 hms	Sub-directory created by the WAT when a study is created. This folder contains all HEC-HMS model files.

Table 4.1 Example HEC-WAT Directories and Files

File or Directory Name	Contents
 layouts	Sub-directory created by the WAT when a study is created. This folder contains the saved layouts for the WAT Desktop Pane .
 maps	Sub-directory created by the WAT when a study is created. Used to store map layers and GIS coverages associated with a study.
 ras	Sub-directory created by the WAT when a study is created. This folder contains all HEC-RAS model files.
 rss	Sub-directory created by the WAT when a study is created. This folder contains all HEC-ResSim model files.
 shared	Sub-directory created by the WAT when a study is created. This directory is a place to store files that might be used by the study.
 ssp	Sub-directory created by the WAT when a study is created. This folder contains all HEC-SSP model files.
 study	Sub-directory created by the WAT when a study is created. This directory contains the information created from the Schematic Tab . Contains database files (*.dbf, *.dbt, *.mdx) that contain the data when creating measures, impact areas, and common computation points.

Table 4.1 Example HEC-WAT Directories and Files (continued)

CHAPTER 5

Using Layers

5.1 Concept of Layers

There are several types of layers available in the HEC-WAT software. The **Stream Alignment Layer** is specifically for the stream alignment, which is discussed in Chapter 7. Map layers are used in the WAT to visualize a system layout and or a flood inundation. The WAT program creates primary layers when a user creates a stream alignment, schematic, alternatives, and a simulation. This chapter covers map and primary layers.

5.2 Map Layers

To help you visualize a study area, the WAT has the capability to display maps of study features. Sub-basin boundaries, watershed boundary, and stream gage locations, are just a few of the digital maps of study features that can be displayed in the WAT.

5.2.1 Map Layer Formats

In the WAT, digital maps are referred to as **map layers**. When a map layer is included in a watershed, the program displays it as a color picture. In the Beta Version, the map layers are used for visual purposes only. In future versions, depending on the type of map layer, the program will interact with map layers as data sources. The map layer formats that the WAT can display are listed in Table 5.1 (page 5-2).

Arc Shapefiles (.shp)

This layer type is the native data structure for the ArcGIS® program. Shapefiles store non-topological geometry and attribute information for the spatial features of a data set. Usually there are three files associated with a shapefile: *.dbf, *.shp, and *.shx. The .shp file contains the shapes (point, polylines, or polygons) that are displayed in the layer. Each shape has a record in the .dbf file containing descriptive data

called "attributes." The *.shx* file contains an index that links each shape to its record in the *.dbf* file.

Table 5.1
Map Layer Formats Supported by HEC-WAT

Description	Common Filename Extension
USGS digital line graph	.dlg
AutoCAD® DXF	.dxf
Arc Shapefile	.shp
Raster image	.img, .jpg, .gif
ASCII NetTin	.net
USGS DEM	.dem
ArcInfo® DEM	.asc

AutoCAD® DXF (.dxf)

A Drawing Interchange File (*.dxf*) is created by a Computer-Aided Design (CAD) package, AutoCAD®. This format is a tagged data representation of an AutoCad® drawing file. **Tagged data** is where each data element is preceded by a group code. A **group code** is an integer indicating the type of data element. The file created is a vector-based graphic. The DXF format is commonly used for data export from other CAD and GIS programs.

Raster Image

The raster image formats supported by the WAT are JPEG format (**.jpg*) and Graphics Interchange Format (**.gif*). For the WAT to access these file types, an **.img* (ASCII text) file must be created by the user outside of the WAT. The file needs to contain the information shown in Figure 5.1,

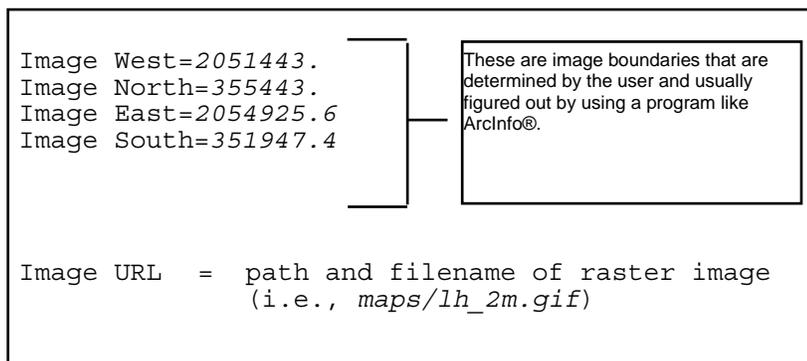


Figure 5.1 Raster Image File

this information needs to match the easting and northing parameters stated in the **Map Default Properties for *StudyName*** dialog box (see Section 5.2.5, page 5-7).

USGS Digital Line Graph (.dlg)

USGS Digital Line Graphs (DLG) are created from two sources using manual and automated digitizing methods. The two sources are aerial photographs or cartographic sources. DLG files are vector representations of the data. When the WAT interacts with a *.dlg* file it automatically creates a *.dlgbin* file for use.

USGS DEM (.dem)

The USGS Geological Survey publishes the file format USGS DEM. A raster file format, *.dem* files usually contain terrain elevations, but the file format can be used for representing any surface. The format, published by the USGS, allows internal documentation of coordinate system, date of publication, etc. These values are referenced horizontally, either to a Universal Transverse Mercator (UTM) projection or to a geographic coordinate system.

ASCII NetTin (.net)

This is an ASCII file format used to represent a triangulated irregular network (TIN). TIN data are stored in a simple format that defines the nodes, edges, and triangles contained in the TIN. This format is common for transferring TIN data between software.

ArcInfo® DEM (.asc)

This is an ASCII file format representation of a grid generated by ArcInfo®. The file consists of keywords followed by values defining the number of columns, number of rows, lower left corner, cell size, no data value, and each cell value.

5.2.2 Adding Map Layers

You can add as many types of map layers as you need. However, you must make sure that all map layers use the same origin and measurement

units. In GIS jargon, all map layers must use the same projection. You can add map layers to your study from any of the WAT tabs.

All map layers must use the same origin and measurement unit, which in GIS jargon, means all map layers must use the same projection.

When a map layer is added to the study, the WAT reads the coordinates of points, lines, and polygons on the map layer and resets the geographic extents of your study to the smallest rectangle that will contain all objects in the map layer. When adding more than one map layer, you must ensure that each is projected in the same coordinate system. For example, if you add a digital line graph (DLG) map layer that shows the major streams in an area, the geographical extents will change according to the projection of that DLG. If that DLG is projected in state plane coordinates in feet, the WAT will set the geographic extents accordingly, and the units of the stream alignment (described in Chapter 7) will be in feet.

To add map layers:

1. On the **Maps** menu, click **Add Map Layers**, and the **Select Map to Add** browser will open (Figure 5.2).
2. The browser defaults to the study directory, but you can retrieve maps from anywhere on your computer. From the study directory is a maps directory, which is where HEC encourages you to copy your various maps.
3. If you want the WAT to copy the selected map layer to the study directory, click **Create Copy**.
4. From the **Select Map to Add** browser, select the desired map layer format from the **Files of type** list, locate the file of the desired map layer format, select filename, and click **Open**. The browser will close and the map layer will appear in the active map window.
5. If you select the **Maps** tab there will now be an entry for the added map layer.

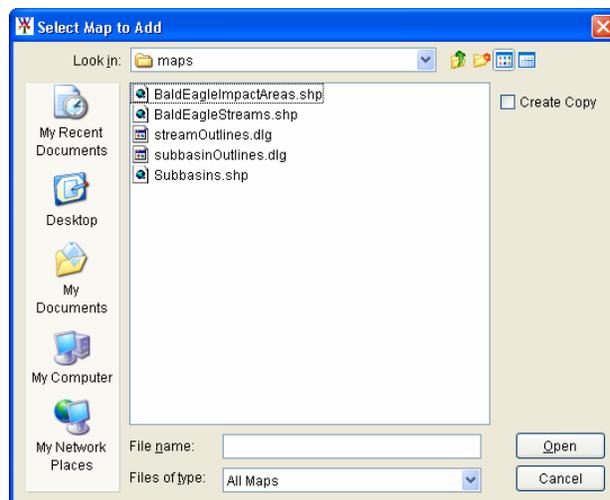


Figure 5.2 Select Map to Add Browser

5.2.3 Removing Map Layers

To remove map layers:

1. On the **Maps** menu, click **Remove Map Layers**.
2. The **Remove Map** dialog box will open (Figure 5.3).
3. From the **Existing** box there is list of map layers, select a map layer by clicking on the name.
4. In the **Remove** box, the name of the selected map layer will appear in the **Name** box.
5. Click **Remove**, a warning message will appear, asking you if you really want to remove the map layer from the study, click **Yes**.
6. The warning message will close, the **Remove Map** dialog box will close, and the map layer will be gone from the active map window.

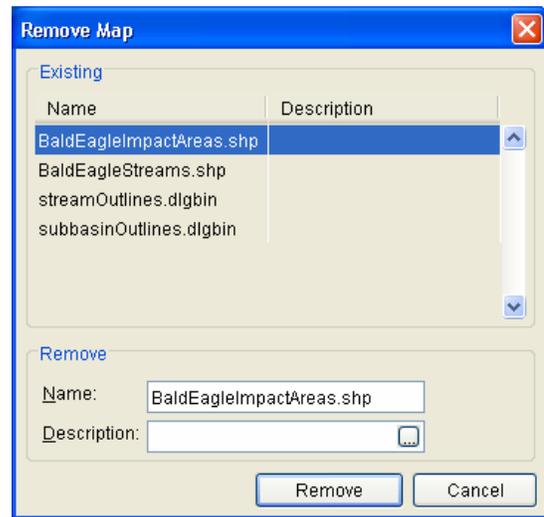


Figure 5.3 Remove Map Dialog Box

5.2.4 Shortcut Menu for Map Layers

The shortcut menu for map layers is accessed by right-clicking on any map layer that is listed in the **Maps Tab** (see Chapter 3, Section 3.2.3, page 3-8). This list of map layers refers to the currently active map window (see Chapter 3, Section 3.2.4, page 3-9) that is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). The shortcut menu provides several ways to manipulate map layers. This ability to manipulate depends on the type of map layer, since the WAT does not provide the same capabilities to all recognized map layer formats (see Table 5.1, page 5-2). The available commands are:

Expand – expands the selected map layer's tree; the tree provides information on the available elements of a map layer, and details provided are based on what the WAT recognizes for the individual map layer format.

Collapse – collapses the selected map layer's tree; the tree provides information on the available elements of a map layer, and details provided are based on what the WAT recognizes for the individual map layer format.

Move to Top – moves the selected map layer to the top of the tree

Move Up – moves the selected map layer up the tree one position

Move Down – moves the selected map layer down the tree one position

Move to Bottom – moves the active map layer to the bottom of the tree

Show Legend – shows the legend for the active map layer in the tree structure.

Change Label – allows you to change the label of the map layer in the **Maps Tab**. This does not change the filename of the map layer.

Properties – shows the properties of the selected map layer. See Appendix E for further details on the available map layer editors.

Set Scale for Zoom-in – set the zoom-in visualization scale for the selected map layer

Set Scale for Zoom-out – set the zoom-out visualization scale for the selected map layer

Remove Scale Factors – disable or clear all scale settings for the selected map layer

5.2.5 Geographic Reference for Map Layers

For the WAT to have the flexibility to use virtually any grid coordinates convenient for water resources studies, the WAT uses a user-selected coordinate system, called the World Coordinate System (WCS).

To maintain a geographic reference (also called a geo-reference), the WAT uses a user-selected coordinate system, called the World Coordinate System (WCS). This superimposes a grid on layer features to establish x- and y-coordinates in WCS for each point on the layer. The x-coordinate is referred to as "easting" and the y-coordinate is referred to as "northing". You can select the extent of this grid, the dimensions of the cells of the grid, the units of measurement of the grid, and even the location of the origin of the grid. Because of this flexibility, you can specify and use virtually any grid coordinates convenient for water resources studies. To do so:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure 5.4, page 5-7). By default, the **Map Extents** tab is selected.
2. The information in the **Map Extents** tab includes:
 - **Coordinate System.** This box identifies the established coordinate system for a study. To edit the coordinate system, click **Edit**, and the **Map Coordinate Information** dialog box (see Figure 5.5, page 5-7) will open. See Appendix D for

Note that the geographic extents of your layers must be selected carefully, and must be consistent for all layers to ensure that the entire study is included.

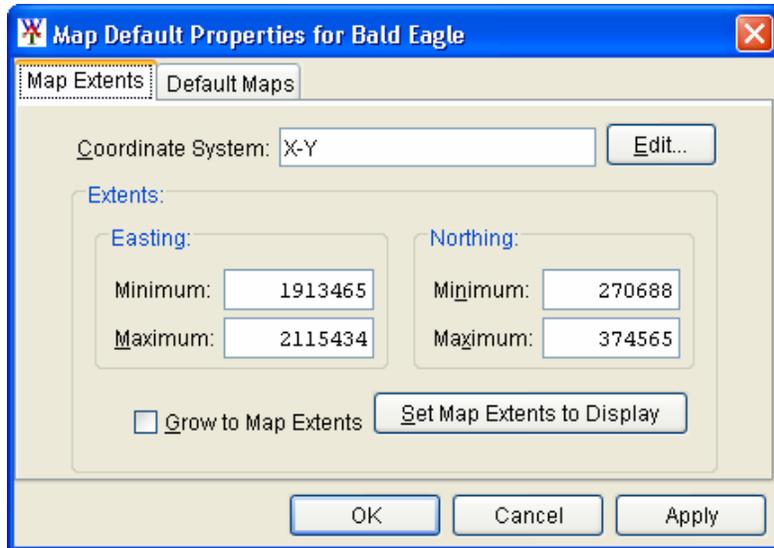


Figure 5.4 Map Default Properties for *StudyName* Dialog Box

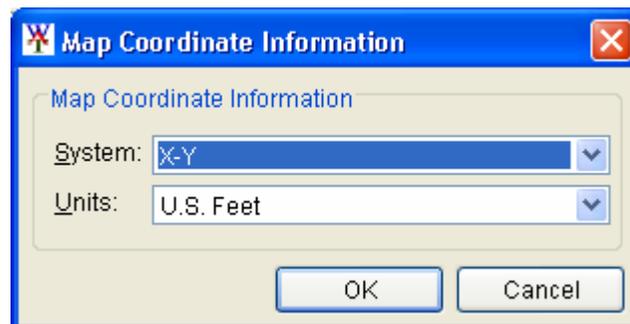


Figure 5.5 Map Coordinate Information Dialog Box

details on editing the coordinate system. Remember that all layers must exist in one unified coordinate system.

- **Extents – Easting Minimum, Maximum, Northing Minimum, and Maximum.** These values indicate the location of the left, right, bottom and top borders (respectively) of the grid in the map window.
- **Grow to Map Extents.** When selected, the WAT automatically sets the geographic extents to define the smallest rectangle that encompasses all the objects in the study.
- **Set Map Extents to Display.** This will set the limits of the map window. If you zoom in on an area, and click **Set Map Extents to Display**, the **Map Default Properties for StudyName** dialog box (Figure 5.4) extents will change to the zoomed area.

Note that the geographic extents of your layers must be selected carefully to ensure that the entire study is included. Further, the extents you specify and the coordinate system you use must be consistent for all the layers. Therefore, you may need to use GIS tools to transform the layers from one

coordinate system to another before using them with the WAT. The WAT has no coordinate system transformation tools.

5.2.6 Setting Visualization Scales - Map Layer

The easy way to set the visualization scale for map layers is outlined in the following steps:

1. From a map window zoom-in to the point at which you want the map layer to become visible.
2. From the **Maps Tab**, in the **Content Pane**, right-click on the map layer. From the shortcut menu, click **Set Scale for Zoom-in**, the visualization scale is set automatically for that map layer.
3. If you go to the map window and zoom-out, the map layer you selected will no longer display. Inversely, if you want the map layer to become visible as you zoom-out, from the shortcut menu click **Set Scale for Zoom-out**.
4. Visualization scale settings can be cleared or disabled for a map layer. From the shortcut menu, click **Remove Scale Factors**, the current visualization scale for that particular map layer is cleared.

Another way to set the visualization scale for a map layer is the specific map layer's properties dialog box. The following steps outline the procedure:

1. From the **Maps Tab**, right-click on a map layer, from the shortcut menu, click **Properties**, the map layer specific properties dialog box will open (Figure 5.6).

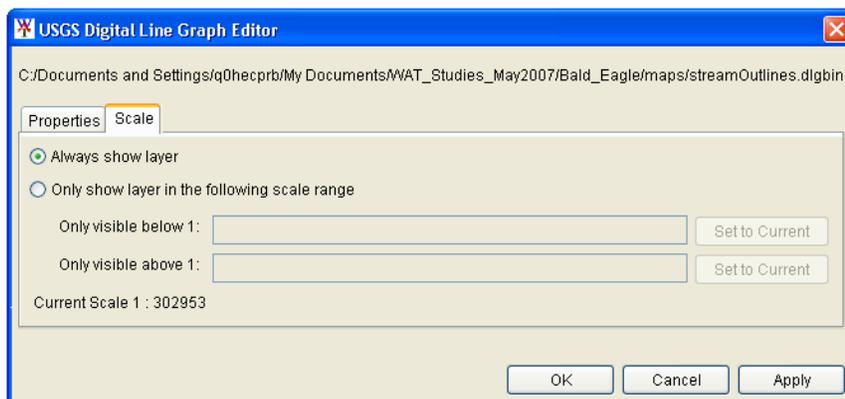


Figure 5.6 Map Layer Properties Dialog Box - Scale Tab

2. Click **Scale**, both zoom-in and zoom-out scale factors can be set from the map layer property dialog box. By default the map layer is set for **Always show layer**. To set visualization scales click **Only show layer in the following scale range**.

3. To set the scale so that the map layer becomes visible as you zoom-in, you can set the scale to the current scale by clicking **Set to Current**. If you wish to enter a value, from the **Only visible below 1:** box enter the scale factor.
4. To set the scale so that the map layer becomes visible as you zoom-out, you can set the scale to the current scale by clicking **Set to Current**. If you wish to enter a value, from the **Only visible above 1:** box enter the scale factor.
5. Click **OK**, the map layer specific properties dialog box closes, and the visualization scale is set for the map layer.

5.3 Primary Layers

The WAT program creates primary layers when a user creates a stream alignment, schematics, alternatives, and simulations. These primary layers appear in the **Maps Tab**. Depending on which type of map window that is open, you will be able to access different primary layers.

5.3.1 Stream Alignment Layer

The **Stream Alignment Layer** contains the stream alignment (see Chapter 7, Section 7.8, page 7-13) that you imported or digitized on the map window, is visible in the **Maps Tab**, and is available in all map window types. This layer has sub-layers for each stream alignment element, and can be accessed by expanding the tree for the **Stream Alignment Layer**. To expand the tree, click the plus sign; to collapse the tree, click the minus sign.

The Stream Alignment Layer contains the stream alignment displayed in the active map window. This primary layer has three sub-layers which represent the components of a stream alignment.

When you expand the tree, you can see the different sub-layers for the stream alignment. There are three – **Stream Junctions**, **Streams**, and **Stream Nodes**. A **stream junction** is where two streams connect, and is represented by a bright green circle on the stream alignment. A **stream node** is a location (a dark green circle) on a stream that provides stream stationing information. By default, the WAT creates two automatically, and a user can add stream nodes to a stream. A **stream** in a stream alignment is a multi-segmented line with beginning and ending stream nodes. If, for some reason you do not want to see the stream junctions for the entire stream alignment, you would clear **Stream Junctions**, and the stream junctions would no longer display in the active map window. To view the stream junctions, you would click **Stream Junctions**. This procedure applies to all of the sub-layers.

Stream Alignment Properties

For the **Stream Alignment Layer**, you can configure the appearance of the streams and their labels, configure the appearance of the stream junctions and stream nodes, and, set the visualization scaling for the **Stream Alignment Layer**. To configure these properties, from the **Maps Tab**, right-click on **Stream Alignment**. From the shortcut menu, click **Properties**, the **Stream Alignment Properties** dialog box will open (Figure 5.7).

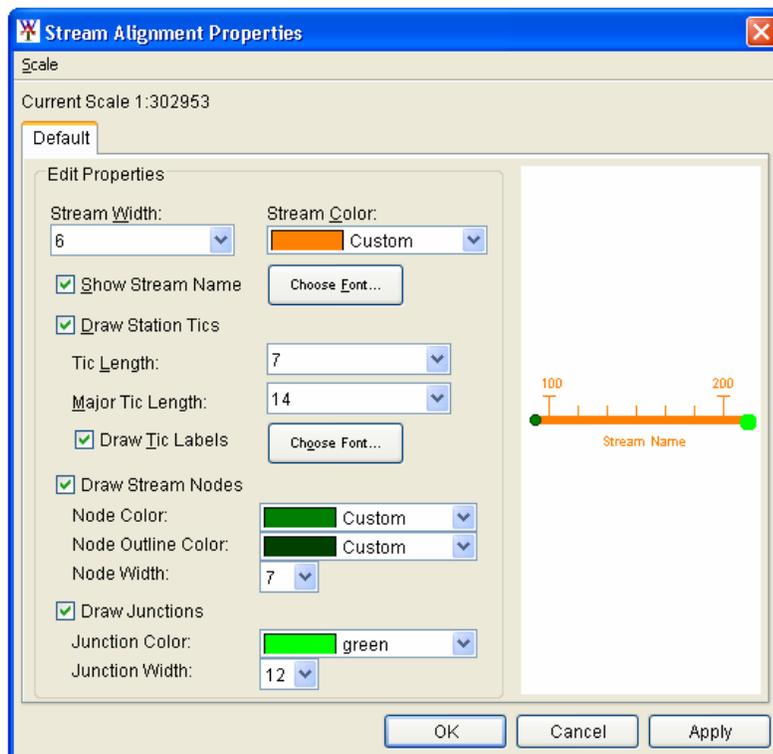


Figure 5.7 Stream Alignment Properties Dialog Box

A stream in a stream alignment is a multi-segmented line with beginning and ending stream nodes. Stream properties include width, color, appearance of stream labels, displaying stream names, and tic marks

Streams

To change the appearance of all streams in the map window:

1. You can set the width of the lines that represent the streams in your stream alignment from the **Stream Width** list (Figure 5.8).
2. You can select the color of the lines that represent the streams in your stream alignment

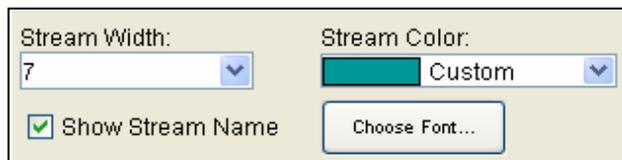


Figure 5.8 Stream Alignment Properties - Streams

from the **Stream Color** list (Figure 5.8). The default color is orange, there are several colors to choose from, plus you can create your own colors from a color chooser. From the **Stream Color** list,

click **Custom**, the **Choose A Color** dialog box (Figure 5.9) will open. See Appendix F for further details on the color chooser.

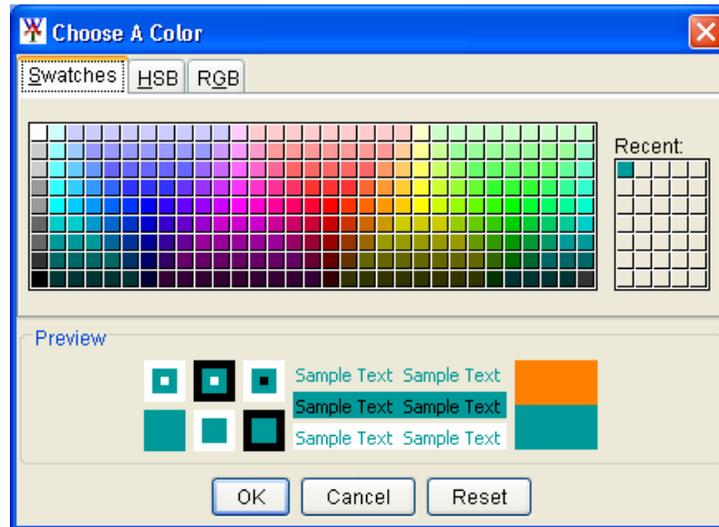


Figure 5.9 Choose A Color Dialog Box

3. Either changing the width or color of the streams, can be previewed in the example to the right of the **Edit Properties** box (Figure 5.10). For the changes to appear in the map window, click **Apply**, and the map window will update.
4. By default, the labels for the streams appear in the active map window. If you do not want the labels displayed, clear **Show Stream Name** (see Figure 5.8, page 5-10); click **Apply**, all of the stream labels no longer display in the map window.
5. To change the font of the stream labels, click **Choose Font** (see Figure 5.8, page 5-10), next to **Show Stream Name**. A **Font Chooser** opens (Figure 5.11), select the font type from the **Type** list, and select a size using the **Size** slider. Click **OK**, the **Font Chooser** closes, from the **Stream Alignment Properties** dialog box (see Figure 5.7, page 5-10), click **Apply**, now all of the stream labels will appear in the font and size you choose.

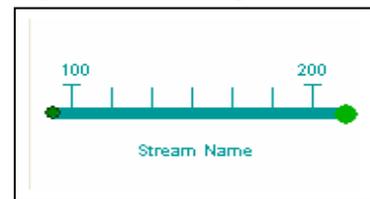


Figure 5.10 Preview Changes



Figure 5.11 Font Chooser

Tic marks appear on a stream representing the stream stationing of the stream. There are two types of tic marks – minor and major, to change the appearance of tic marks in the stream alignment:

Tic marks represent the stream stations of a stream. There are two types – minor and major. Tic marks properties include display of tic marks, length of minor and major, display of tic mark labels, and appearance of tic mark labels.

1. If you do not want to display the tic marks clear **Draw Station Tics** (Figure 5.12), click **Apply**, all of the tic marks no longer display in the active map window.

Figure 5.12 Stream Alignment Properties - Tic Marks

2. From the **Tic Length** list, you can set the length of the minor tic marks. To change the length of the major tic marks, from the **Major Tic Length**

Length list (Figure 5.12), you can select the length of the major tic marks. For the changes to appear in the active map window, from the **Stream Alignment Properties** dialog box (see Figure 5.7, page 5-10) click **Apply**, and the map window will update.

3. By default, the labels for the tic marks appear in the active map window. If you do not want the labels to display, clear **Draw Tic Labels** (Figure 5.12). To change the font of the tic mark labels, click **Choose Font**, a **Font Chooser** opens (see Figure 5.11, page 5-11), select the font type from the **Type** list, and select a size using the **Size** slider. Click **OK**, the **Font Chooser** closes, from the **Stream Alignment Properties** dialog box (see Figure 5.7, page 5-10), click **Apply**. Now all of the tic mark labels will appear in the font and size you choose.

Stream Nodes

To change the appearance of all stream nodes in the map window:

1. If you do not want to display the stream nodes clear **Draw Stream Nodes** (Figure 5.13), from the **Stream Alignment Properties** dialog box (see Figure 5.7, page 5-10)click **Apply**, all of the stream nodes no longer display in the active map window.

Figure 5.13 Stream Alignment Properties - Stream Nodes

2. You can select the color of the stream nodes in your stream alignment from the **Node Color** list (Figure 5.13). The default color is green, there are several colors to choose from, plus you can create your own colors from a color chooser. From the **Node Color** list, click **Custom**, the **Choose A Color** dialog box (see Figure 5.9, page 5-11) will open. See Appendix F for further details on the color chooser.

3. You can select the color of the outline of stream nodes in your stream alignment from the **Node Outline Color** list (Figure 5.13). The default color is dark green, there are several colors to choose

A stream node is a location (a dark green circle) on a stream that provides stream stationing information. Stream node properties include displaying stream nodes, color, outline color, and width

from, plus you can create your own colors from a color chooser. From the **Node Outline Color** list, click **Custom**, the **Choose A Color** dialog box (see Figure 5.9, page 5-11) will open. See Appendix F for further details on the color chooser.

4. You can set the width of the stream nodes in your stream alignment from the **Node Width** list (see Figure 5.13, page 5-12).

Stream Junctions

A stream junction is where two streams connect, and is represented by a bright green circle on the stream alignment. Stream junction properties include displaying stream junctions, color, and width.

To change the appearance of all stream junctions in the active map window:

1. If you do not want to display the stream junctions clear **Draw Junctions** (Figure 5.14), from the **Stream Alignment Properties** dialog box (see Figure 5.7, page 5-10) click **Apply**, all of the stream junctions no longer display in the active map window.
2. You can select the color of the stream junctions in your stream alignment from the **Junction Color** list (Figure 5.14). The default color is darkgreen, there are several colors to choose from, plus you can create your own colors from a color chooser. From the **Junction Color** list, click **Custom**, the **Choose A Color** dialog box (see Figure 5.9, page 5-11) will open. See Appendix F for further details on the color chooser.
3. You can set the width of the stream junctions in your stream alignment from the **Junction Width** list (Figure 5.14).



Figure 5.14 Stream Alignment Properties - Stream Junctions

Scale

Visualization scale can be set for the **Stream Alignment Layer**:

1. To set the visualization scale for the stream alignment to a default, from the **Scale** menu, click **Set to Defaults**. The visualization scale is set automatically.
2. To enter your own scale factor, from the **Scale** menu, click **New**. The **Create new Scale** dialog box opens (Figure 5.15), in the **Scale** box, enter your values for the scale factor.

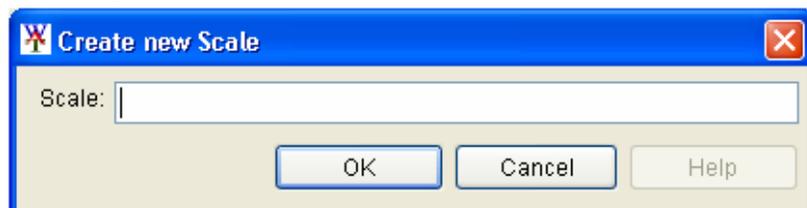


Figure 5.15 Create new Scale Dialog Box

- Click **OK**, the **Create new Scale** dialog box closes (see Figure 5.15, page 5-13), and the visualization scale is set for the stream alignment.

5.3.2 Simulation Layer

When a simulation map window is open, the **Simulation Layer** for that map window is available. In Figure 5.16, the **Simulation Layer** is *Without Project Conditions-1993 Flood*. The **Simulation Layer** contains the graphical representations of each program being run for the active

The Simulation Layer contains the graphical representation of each piece of software that has been included in the active simulation. Each piece of software is represented as a sub-layer.

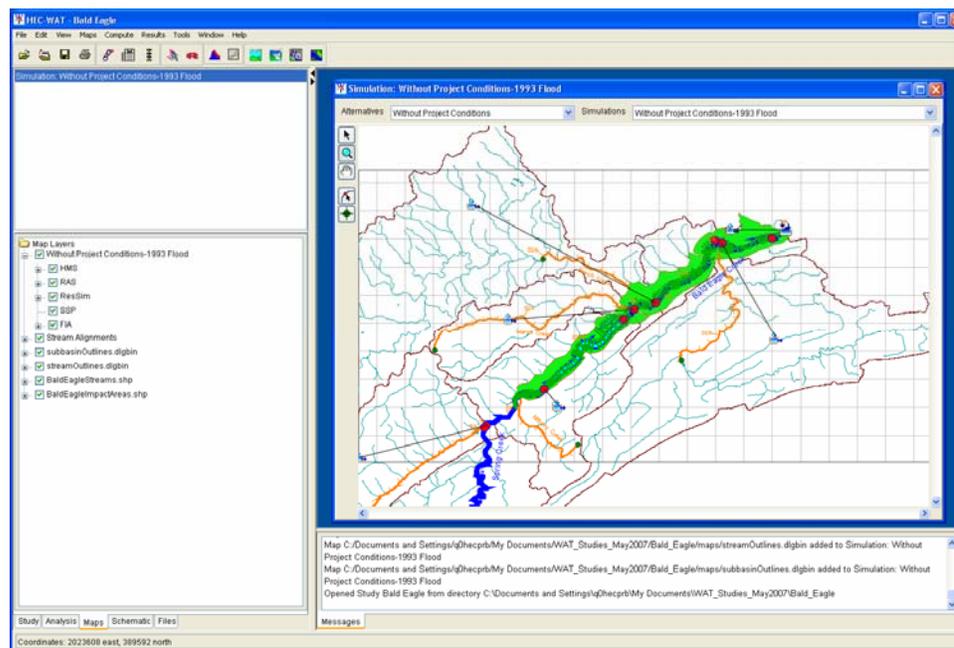


Figure 5.16 Simulation Layer

simulation. When you expand the tree, you can see the different sub-layers that represent each program. Therefore, if you did not want to see the impact areas, clear **FIA**. The impact areas will no longer be visible in the simulation map window. To view the impact areas, click **FIA**. This procedure applies to all of the sub-layers of the simulation layer.

5.3.3 Shortcut Menu for Primary Layers

The shortcut menu for primary layers is accessed by a right-clicking on any primary layer that is listed in the **Maps Tab** (see Chapter 3, Section 3.2.3, page 3-8). This list of map layers refers to the currently active map window (see Chapter 3, Section 3.2.4, page 3-9) that is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). The shortcut menu provides several ways to manipulate primary layers:

Expand – expands the selected primary layer's tree; the tree provides information on the available elements of a primary layer, and details provided are based on what the WAT recognizes for the individual primary layer.

Collapse – collapses the selected primary layer's tree; the tree provides information on the available elements of a primary layer, and details provided are based on what the WAT recognizes for the individual primary layer.

Move to Top – moves the selected primary layer to the top of the tree

Move Up – moves the selected primary layer up the tree one position

Move Down – moves the selected primary layer down the tree one position

Move to Bottom – moves the selected primary layer to the bottom of the tree

Properties – shows the properties of the selected primary layer.

5.4 Layer Visualization Scaling

Layers may be set to become visible or invisible as you zoom-in or zoom-out on the active map window. Generally, this capability allows you to display finer levels of detail as you zoom-in on regions in the map window and avoid clutter when displaying the full area. This might include detailed map layers to become visible, and raster or other images to appear that are not as distinguishable at a courser zoom level.

CHAPTER 6

Creating and Managing Alternatives

6.1 Overview

The start of most studies involves defining the problem, the study extent, and representation of the alternatives to be evaluated. HEC-WAT will help define alternatives through schematic representations, model identification and compute sequencing. An **alternative** in the WAT is a representation of the physical and operational system, and groups a schematic with different measures, operations, and model parameters.

6.2 Default Alternative

When a WAT study is created (see Chapter 4, Section 4.1.1, page 4-1), a default alternative is generated (Figure 6.1). This alternative is given the name *Without Project Conditions*, the user can select several other name choices, or, a user can also create an alternative name.

An alternative in the WAT is a representation of the physical and operational system, and groups a schematic with different measures, operations, and model parameters.

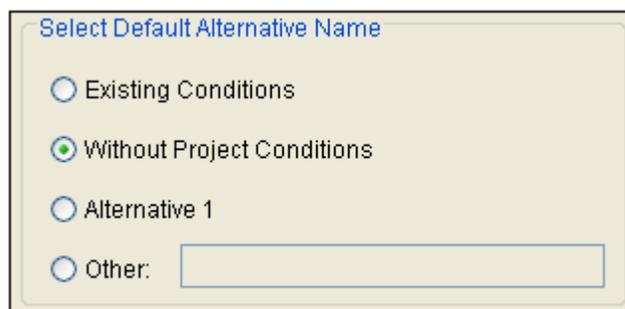


Figure 6.1 Default Alternative Name

Once the study is created, a schematic map window opens in the **Desktop Pane** (Chapter 3). The first action following the creation of the default alternative should be to define the default schematic (Chapter 7). After defining the default schematic, analysis periods and simulations can then be created for the default alternative.

6.3 Alternative and Simulation Manager

After the default alternative has been created, the remaining alternatives that have been identified by the study team need to be developed. The

WAT provides two ways to organize and develop alternatives; one way is from the **Alternative and Simulation Manager** (Figure 6.2), and the other way is from the **Study Pane** (see Section 6.4, page 6-11). This section covers using the **Alternative and Simulation Manager** for organizing and developing alternatives.

The Alternative and Simulation Manager provides a convenient way to organize and develop the main components for a WAT study – alternatives, analysis period (events), and simulations.

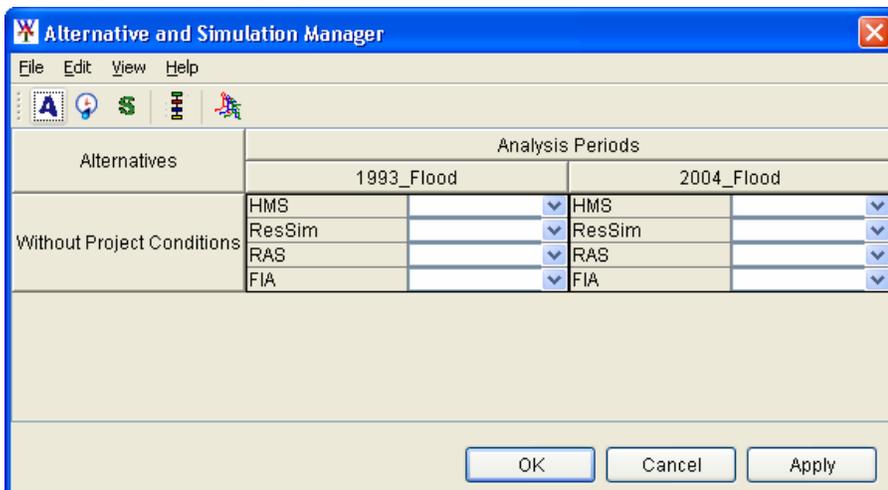


Figure 6.2 Alternative and Simulation Manager

In the WAT, the **Alternative and Simulation Manager** (Figure 6.2) provides a convenient way to organize and develop the main components for a WAT study – alternatives, analysis period (events), and simulations. This chapter will focus on the organization and development of alternatives. The **Alternative and Simulation Manager** has three areas where you can access commands that will allow you to create, delete, and rename alternatives. These areas are the **Table** (see Section 6.3.1, page 6-2), **Toolbar** (see Section 6.3.2, page 6-10) and **Menu Bar** (see Section 6.3.3, page 6-10). These areas and the available commands are described in the following sections.

To access the **Alternative and Simulation Manager**, from the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . Another way to access the **Alternative and Simulation Manager** is from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**. From either method the **Alternative and Simulation Manager** will open (Figure 6.2).

6.3.1 Table

The **Alternative and Simulation Manager** (Figure 6.2) table allows organization of a study's alternatives; a way to track the state of data sets needed for each model, create analysis periods, and create simulations. Since the focus of this chapter is alternatives, this section will only focus

on the available commands from the table to develop and organize alternatives.

Alternatives

The table allows organization of a study's alternatives; a way to track the state of data sets needed for each model, create analysis periods, and create simulations.

The alternatives shortcut menu (Figure 6.3) is available from the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2) table, by right-clicking on the column header

Alternatives. This shortcut menu will allow you to create,

rename, and delete alternatives. The following sections provide further details.

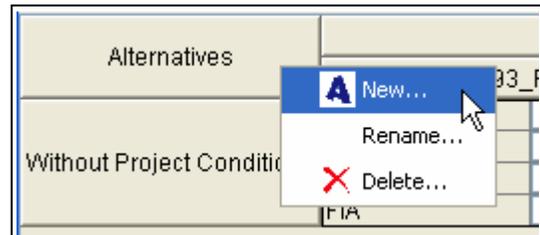


Figure 6.3 Alternatives Shortcut Menu

Creating an Alternative

To create an alternative:

1. From the alternatives shortcut menu (Figure 6.3), click **New**, the **Create New Alternative** dialog box will open (Figure 6.4).

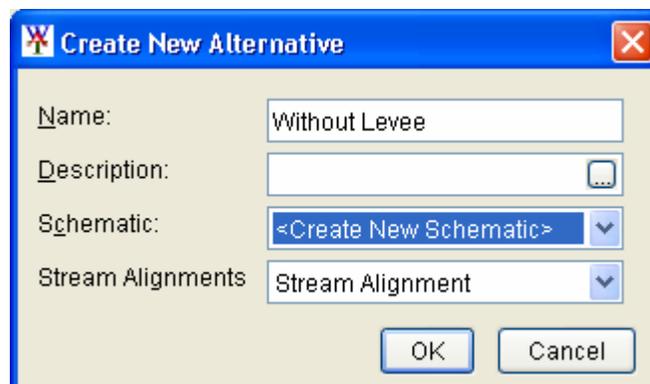


Figure 6.4 Create New Alternative Dialog Box

*To access the **Alternative and Simulation Manager**, from the WAT main window, from the **WAT Tools** toolbar click*



2. In the **Name** box enter the name (required), and in the **Description** box, enter a description (optional, but recommended).
3. Each alternative requires a schematic to provide the layout of the study area measures and components. From the **Schematic** list, select a previously defined schematic, or create a schematic for the alternative (see Step 7).
4. A stream alignment is also required with an alternative, from the **Stream Alignment** list, select **Stream Alignment**, which is the default stream alignment name.
5. Click **OK**, if there is not a map window open in the **Desktop Pane**, the **Create New Alternative** dialog box (Figure 6.4) will close and an alternative map window will open in the **Desktop Pane**.

6. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box will open (Figure 6.5). You can choose whether to open the alternative map window in the current map window or in a new map window, click **OK**. The **Select Map** dialog box and the **Create New Alternative** dialog box (see Figure 6.4, page 6-3) will both close, and the alternative map window for the new alternative will appear in the **Desktop Pane**.

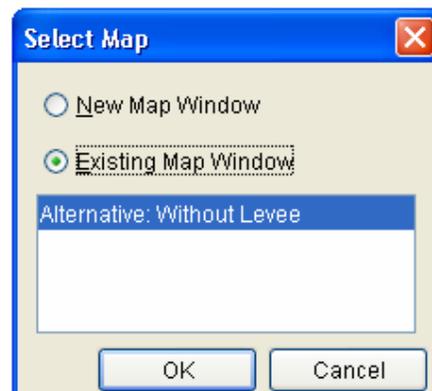


Figure 6.5 Select Map Dialog Box

7. If you need to create a new schematic for the alternative, from the **Schematic** list, click **<Create New Schematic>**. When you click **OK**, the **Enter Schematic Name** dialog box will open (Figure 6.6). The name of the alternative will appear in the **Name** box for the new schematic. You can accept this name or enter a name for the schematic in the **Name** box.

Another way to access the **Alternative and Simulation Manager**, from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**.

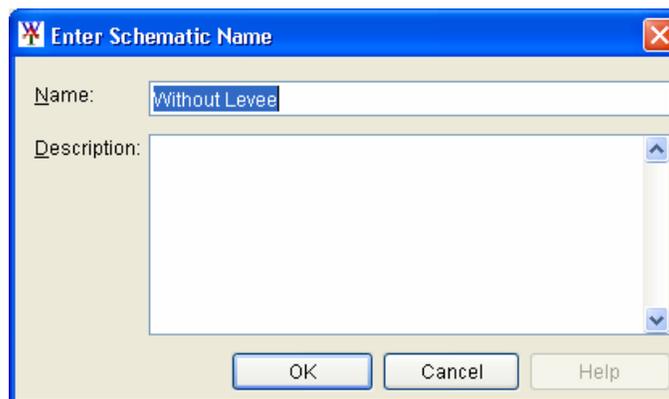


Figure 6.6 Enter Schematic Name Dialog Box

8. Click **OK**, if there is not a map window open in the **Desktop Pane**, the **Enter Schematic Name** dialog box (Figure 6.6) will close and a schematic map window will open in the **Desktop Pane**.
9. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box (Figure 6.5) will open. You can choose whether to open the schematic map window in the current map window or in a new map window, click **OK**. The **Select Map** dialog box (Figure 6.5) and the **Enter Schematic Name** dialog box (Figure 6.6) will both close, and the schematic map window for the new schematic will appear in the **Desktop Pane**.
10. The alternative name will now appear in the table on the **Alternative and Simulation Manager**, under the **Alternatives** column header (see Figure 6.2, page 6-2).

Renaming Alternatives

If you want to rename an alternative, but you want to choose from a list of the developed alternatives for a study:

1. From the alternatives shortcut menu (see Figure 6.3, page 6-3), click **Rename**, the **Rename Alternative** dialog box will open (Figure 6.7).

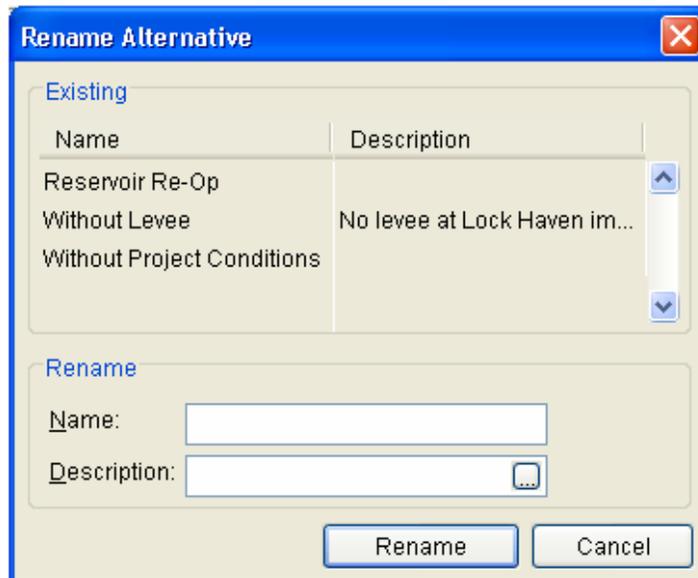


Figure 6.7 Rename Alternative Dialog Box

2. From the **Existing** list select an alternative, in the **Rename** box the name and description of the selected alternative will appear.
3. In the **Name** box, enter the new name, and enter a description in the **Description** box if needed (recommended).
4. Click **Rename**, a warning message will appear asking you if you really want to rename the selected alternative. Click **Yes**, the warning message and the **Rename Alternative** dialog box will close, and on the table (see Figure 6.2, page 6-2), under the **Alternatives** column the renamed alternative will appear.

Deleting Alternatives

If you want to delete an alternative, but you want to choose from a list of the developed alternatives for a study:

1. From the alternatives shortcut menu (see Figure 6.3, page 6-3), click **Delete**, the **Delete Alternative(s)** dialog box will open (see Figure 6.8, page 6-6).
2. From the **Existing** list select an alternative, in the **Delete** box the name and description of the selected alternative will appear.

- Click **Delete**, a warning message will appear asking you if you really want to delete the selected alternative. Click **Yes**, the

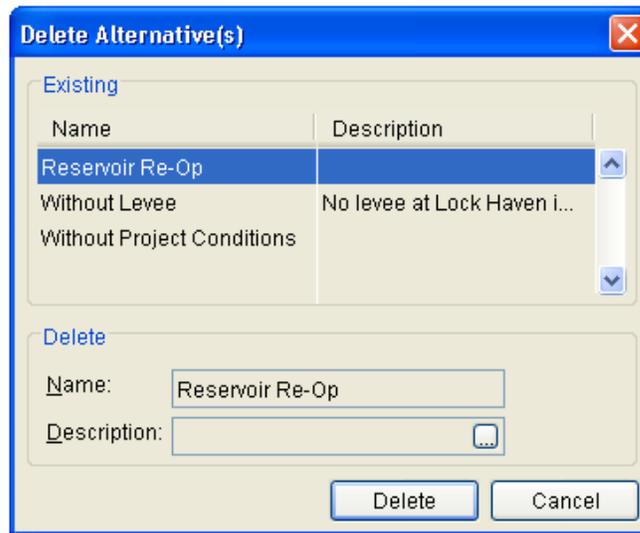


Figure 6.8 Delete Alternative(s) Dialog Box

warning message will close and a second warning message will appear. This message is reminding you that by deleting this alternative you will also delete the listed simulations. Click **Yes**, the warning message will close and the alternative will no longer appear under the **Alternatives** column of the table (see Figure 6.2, page 6-2).

Individual Alternative

The individual alternative shortcut menu (Figure 6.9) is available from the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2), by right-clicking on an alternative name in the table. This shortcut menu will allow you to view the selected alternative in a map window, edit, make a copy, rename, delete from the study, and view the properties of the alternative. The following sections provide further details.

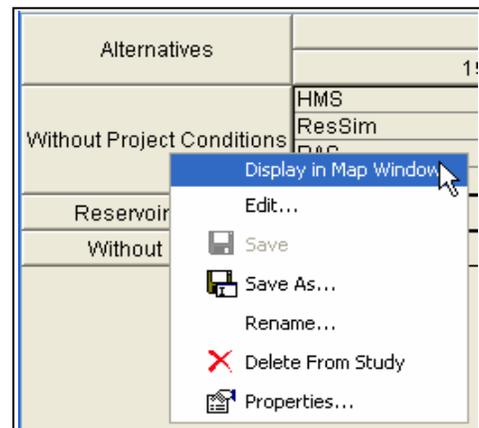


Figure 6.9 Individual Alternative Shortcut Menu

Viewing an Alternative

To view an alternative in a map window:

1. From the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Display in Map Window**.
2. If there is not a map window open in the **Desktop Pane**, the alternative map window for the alternative will open in the **Desktop Pane**. From the alternative map window you can edit the stream alignment, measures, impact areas, and adjust background maps associated with the alternative.
3. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box (see Figure 6.5, page 6-4) will open. You can choose whether to open the alternative map window in the current map window or in a new map window, click **OK**. The **Select Map** dialog box (see Figure 6.5, page 6-4) will close, and the alternative map window for the selected alternative will appear in the **Desktop Pane**.

Editing an Alternative

To edit an alternative:

1. From the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Edit**. The **Alternative Editor** will open (Figure 6.10).

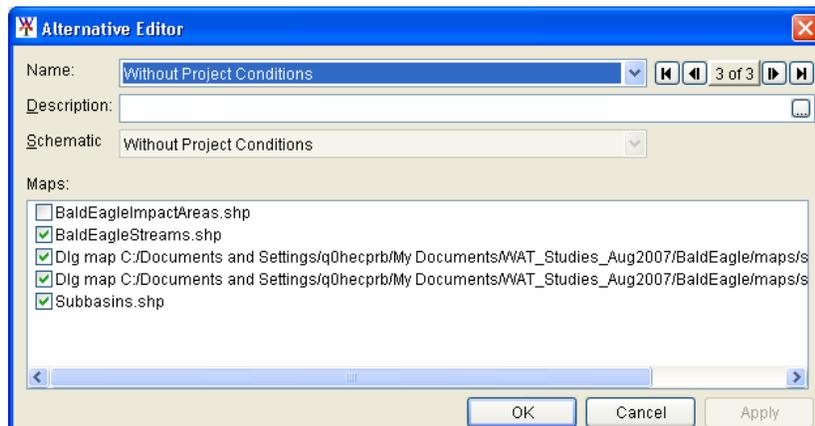


Figure 6.10 Alternative Editor

2. You can edit the description and turn on and off the background maps associated with the selected alternative. The editor also provides information on the schematic associated with the selected alternative.
3. Click **OK**, the **Alternative Editor** will close and the information you changed will be saved.

Making a Copy of an Existing Alternative

To make a copy of an existing alternative:

1. From the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Save As**. The **Save Alternative As** dialog box will open (Figure 6.11). The information displayed in the dialog box represents the alternative you have selected to make a copy of.

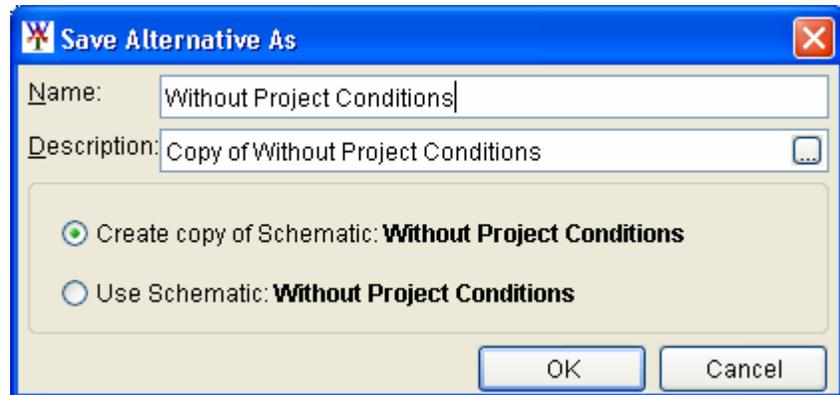


Figure 6.11 Save Alternative As Dialog Box

2. In the **Name** box, enter the name (required) of the new alternative, and in the **Description** box, enter a description (optional, but recommended).
3. You can also choose to create a copy of the associated schematic (will create a new schematic with the new alternative name) or use the associated schematic of the alternative you have selected to make a copy of.
4. The alternative name will now appear in the table on the **Alternative and Simulation Manager**, under the **Alternatives** column header (see Figure 6.2, page 6-2).

Renaming an Alternative

To rename an alternative:

1. From the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Rename**. The **Rename Alternative** dialog box will open (Figure 6.12).

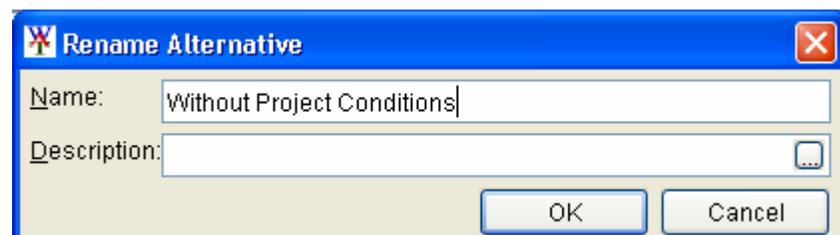


Figure 6.12 Rename Alternative Dialog Box

2. In the **Name** box, enter the new name, and enter a description in the **Description** box if needed (recommended).
3. Click **OK**, a warning message will appear asking you if you really want to rename the selected alternative. Click **Yes**, the warning

message and the **Rename Alternatives** dialog box (see Figure 6.12, page 6-8) will close, and in the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2), on the table the name of the selected alternative will be changed.

Deleting an Alternative

To delete an alternative, right-click on an alternative in the table, from the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Delete From Study**. A warning message will appear asking you if you really want to delete the selected alternative. Click **Yes**, the warning message will close and a second warning message will appear. This message is reminding you that by deleting this alternative you will also delete the listed simulations. Click **Yes**, the alternative will no longer appear on the table in the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2).

Alternative Properties

The properties of an alternative include the name and description for the Beta Version. For Version 1.0 properties that will be displayed are: stream alignment, list of measures, common computation points, and impact areas. To view the properties of an alternative:

1. From the individual alternative shortcut menu (see Figure 6.9, page 6-6), click **Properties**. The **Properties for AlternativeName** dialog box will open (Figure 6.13).

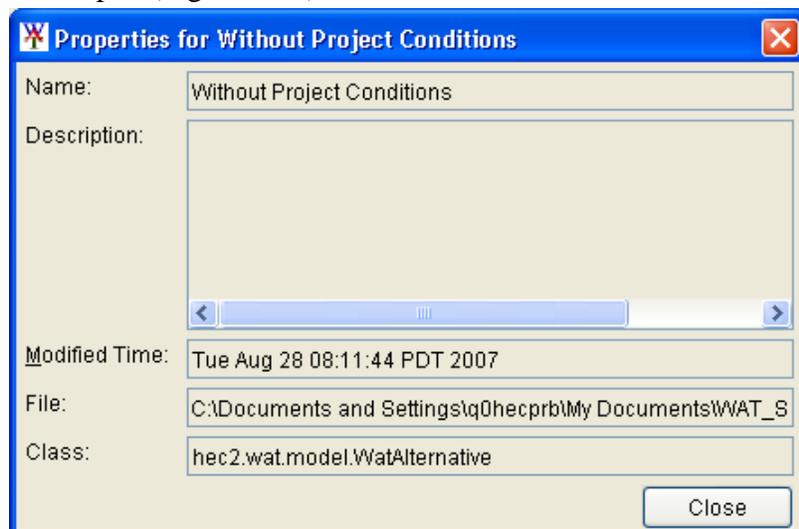


Figure 6.13 Properties for *AlternativeName* Dialog Box

2. For the Beta Version the properties for viewing are the name and description of the selected alternative; the date and time the alternative was last modified; the location of the alternative file;

and, the name of the file which contains information about the alternative.

6.3.2 Toolbar

From the toolbar of the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2), you can create an alternative. Click  , the **Create New Alternative** dialog box will open (see Figure 6.4, page 6-3). The steps for creating an alternative are the same as in **Creating an Alternative**, under Section 6.3.1, page 6-3.

6.3.3 Menu Bar

From the **Menu Bar** of the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2), you can create an alternative, rename alternatives, and delete alternatives.

Creating an Alternative

To create an alternative:

1. On the **File** menu, point to **Alternatives**, and then click **New**, the **Create New Alternative** dialog box will open (see Figure 6.4, page 6-3).
2. The steps for creating an alternative are the same as in the **Creating an Alternative**, under Section 6.3.1, page 6-3.

Renaming Alternatives

If you want to rename an alternative, but you want to choose from a list of the developed alternatives for a study:

1. On the **File** menu, point to **Alternatives**, and then click **Rename**, the **Rename Alternative** dialog box will open (see Figure 6.7, page 6-5).
2. The steps for renaming an alternative are the same as in **Renaming Alternatives**, under Section 6.3.1, page 6-5.

Deleting Alternatives

If you want to delete an alternative, but you want to choose from a list of the developed alternatives for a study:

1. On the **File** menu, point to **Alternatives**, and then click **Delete**, the **Delete Alternative(s)** dialog box will open (see Figure 6.8, page 6-6).
2. The steps for deleting an alternative are the same as in **Deleting Alternatives**, under Section 6.3.1 page 6-5.

6.3.4 ToolTips

From the **Alternative and Simulation Manager** (Figure 6.14) you can review information regarding the status of certain elements of the study. For example, in Figure 6.14, if you hover the mouse pointer over the FIA model alternative associated with the *Without Project Conditions_1993*

A tooltip is a graphical user interface element used in conjunction with a cursor. The user hovers the mouse pointer (cursor) over an item, and a small box appears with supplementary information regarding the item being hovered over.

Alternatives		1993 Flood	
Without Project Conditions	HMS	Run 1	▼
	ResSim	StdOpNoDiv	▼
	RAS	Existing Conditions	▼
	FIA	Without Project Conditions	▼
Without Levee	HMS	Description:	▼
	ResSim	Imported By: Penni Baker	▼
	RAS	Imported Date: 30 Jun 2007	▼
		Conditions	▼

Figure 6.14 Alternative and Simulation Manager - Tooltip

Flood simulation, a small box will appear, this is a tool tip. This tooltip provides the description of the model alternative, who imported the model alternative, and the date the model alternative was imported. See Chapter 4, Section 4.1.5 (page 4-4) for details on how the information is entered.

6.4 Study Pane

The user can also create, edit, rename, and delete alternatives from the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-5). This section of the chapter describes how to perform these operations directly from the **Study Pane**.

6.4.1 Alternatives

The alternatives shortcut menu (Figure 6.15) is available from the **Study Pane**, by right-clicking on the **Alternatives** folder. This shortcut menu will allow you to create, rename, and delete alternatives. The following sections provide further details.

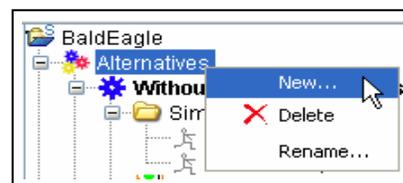


Figure 6.15 Alternatives Shortcut Menu

Creating an Alternative

To create an alternative from the **Study** pane:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Alternatives** folder, from the alternatives shortcut menu (see Figure 6.15, page 6-11), click **New**, a dialog box similar to the **Create New Alternative** dialog box will open (see Figure 6.4, page 6-3).
2. The steps for creating an alternative are the same as in the **Creating an Alternative**, under Section 6.3.1, page 6-3.

Deleting Alternatives

Study Pane provides an overview of WAT alternatives, simulations and analysis periods.

If you want to delete an alternative, but you want to choose from a list of the developed alternatives for a study:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Alternatives** folder, from the alternatives shortcut menu (see Figure 6.15, page 6-11), from the shortcut menu, click **Delete**. The **Delete Alternatives** dialog box will open (see Figure 6.8, page 6-6).
2. The steps for deleting an alternative are the same as in **Deleting Alternatives**, under Section 6.3.1 page 6-5.

Renaming Alternatives

If you want to rename an alternative, but you want to choose from a list of the developed alternatives for a study:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Alternatives** folder, from the alternatives shortcut menu (see Figure 6.15, page 6-11), from the shortcut menu, click **Rename**. The **Rename Alternatives** dialog box will open (see Figure 6.7, page 6-5).
2. The steps for renaming an alternative are the same as in **Renaming Alternatives**, under Section 6.3.1, page 6-5.

6.4.2 Individual Alternative

The individual alternative shortcut menu (see Figure 6.16, page 6-13) is available from the **Study Pane**, by right-clicking on an alternative name under the **Alternatives** folder. This shortcut menu will allow you to view the selected alternative in a map window, edit, make a copy, rename, delete from the study, and view the properties of the alternative. The following sections provide further details.

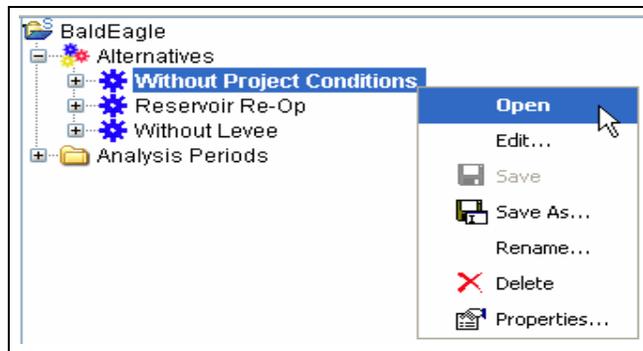


Figure 6.16 Individual Alternative Shortcut Menu

Viewing an Alternative

To view an alternative in a map window:

1. From the **Study Tab**, on the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the individual alternative shortcut menu (Figure 6.16), click **Open**.
2. The steps for viewing an alternative are the same as in **Viewing an Alternative**, under Section 6.3.1, page 6-6.

Editing an Alternative

To edit an alternative:

1. From the **Study Tab**, on the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the individual alternative shortcut menu (Figure 6.16), click **Edit**. The **Alternative Editor** will open (see Figure 6.10, page 6-7).
2. The steps for editing an alternative are the same as in **Editing an Alternative**, under Section 6.3.1, page 6-7.

Saving an Alternative

To save an alternative, from the **Study Tab**, from the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the shortcut menu, click **Save**. Any changes that have occurred to the selected alternative will be saved by the WAT.

Making a Copy of an Existing Alternative

To make a copy of an existing alternative:

1. From the **Study Tab**, on the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the individual alternative shortcut menu (Figure 6.16), click **Save As**.

2. The steps for making a copy of an existing alternative are the same as in **Making a Copy of an Existing Alternative**, under Section 6.3.1, page 6-7.

Renaming an Alternative

1. From the **Study Tab**, on the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the individual alternative shortcut menu (see Figure 6.16, page 6-13), click **Rename**. The **Rename Alternatives** dialog box will open (see Figure 6.12, page 6-8).
2. The steps for renaming an alternative are the same as in **Renaming an Alternative**, under Section 6.3.1, page 6-8.

Deleting an Alternative

1. From the **Study Tab**, on the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the individual alternative shortcut menu (see Figure 6.15, page 6-13), click **Delete**.
2. The steps for deleting an alternative are the same as in **Deleting an Alternative**, under Section 6.3.1, page 6-9.

Alternative Properties

The properties of an alternative include the name and description for the Beta Version. For Version 1.0 properties that will be displayed are: stream alignment, list of measures, common computation points, and impact areas. To view the properties of an alternative:

1. From the **Study Tab**, from the **Study Pane**, from the **Alternatives** folder, right-click on an alternative, from the shortcut menu, click **Properties**.
2. The steps for accessing alternative properties are the same as in **Alternative Properties**, under Section 6.3.1, page 6-9.

CHAPTER 7

Schematics

7.1 Concepts

Once a study has been created and background maps have been collected, the next step is the development of the common schematic. A **schematic** is a physical representation of a stream alignment, and the flood damage reduction and environmental measures that will be modeled. The schematic also provides a common starting point for construction of compatible model data sets. A common schematic assures the naming convention, measure identification and location for the study is consistent throughout the modeling disciplines. The individual models can be edited and their results viewed from HEC-WAT by selecting the elements found on the common schematic.

The common schematic will provide geo-referencing, stream referencing (stream alignment), common physical features (measures), data exchange locations (common computation points) and a set of features present for a particular modeling scenario (schematics).

7.2 Elements of a Schematic

The following sections describe in general terms the main elements of a schematic and the tools provided by the WAT to create schematics. Also, further details on each element are provided in the subsequent sections of this chapter.

7.2.1 Stream Alignment

The backbone of any schematic is the stream alignment (see Figure 7.1, page 7-2), and is the starting point in creating a schematic. A stream alignment is a one-dimensional river coordinate system, which defines the natural downstream flow network. Also, from the stream centerline, stationing will be provided relative to its global location and specific to the study. See Section 7.8 (page 7-13) for further details on establishing and modifying a stream alignment.

A stream alignment is a one-dimensional river coordinate system, which defines the natural downstream flow network.

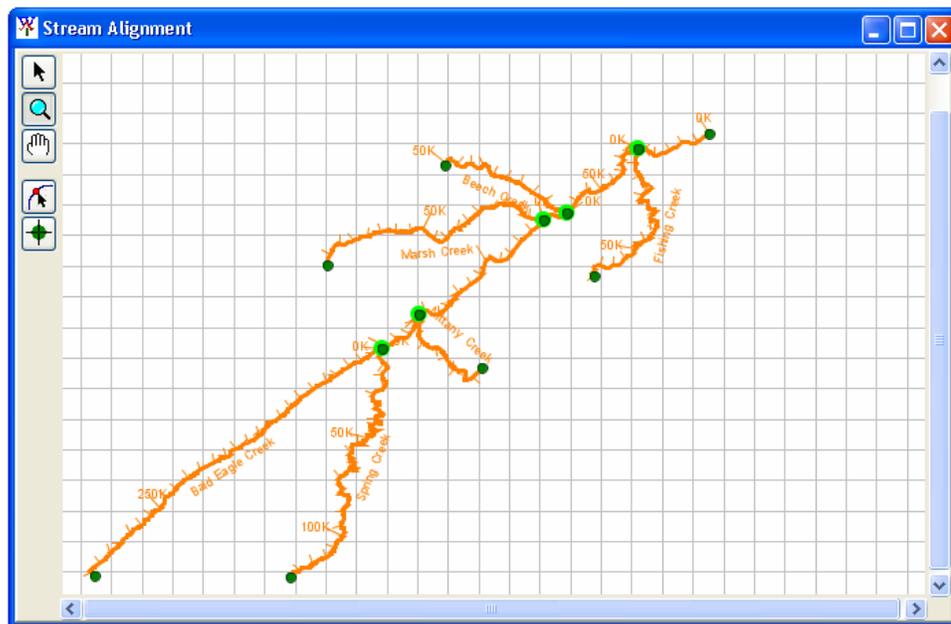


Figure 7.1 Stream Alignment

7.2.2 Measures

Measures (Figure 7.2) for the WAT include structural/non-structural measures (flood damage reduction), and/or ecosystem measures. **Structural measures** are physical modifications designed to reduce the frequency of damaging levels of flood inundation, and include dams with

Measures for the WAT include structural/non-structural measures (flood damage reduction), and/or ecosystem measures.

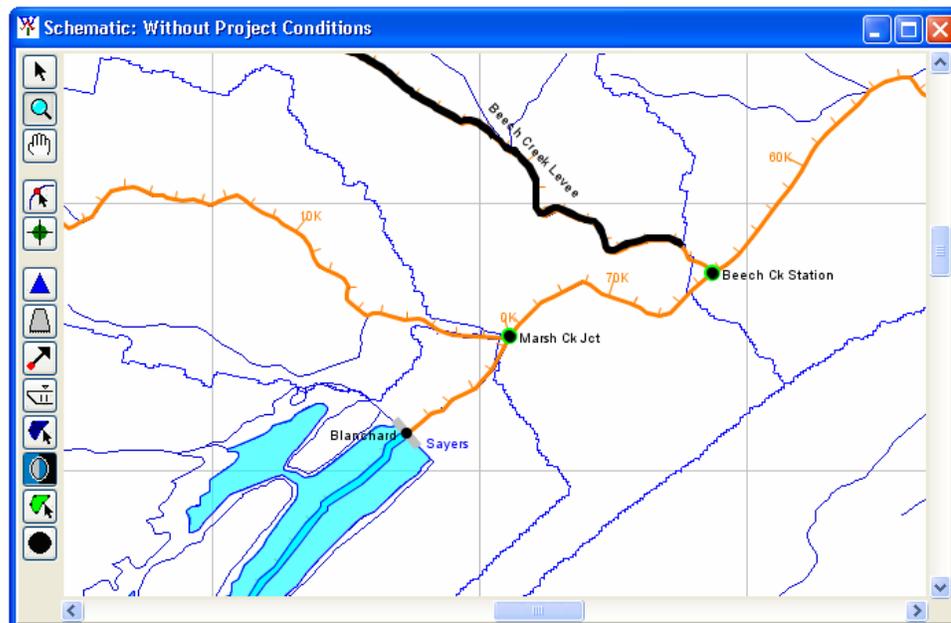


Figure 7.2 Measures

reservoirs, levees, channelization measures, walls, diversion channels, pumps, bridge modifications, and ice-control structures. **Non-structural measures** are activities that reduce flood damage without significantly

altering the nature or extent of flooding (e.g., flood proofing, relocation of structures, raising structures). **Ecosystem restoration measures** are physical modifications or other actions that improve the value and function of an ecosystem (e.g., channel restoration, removal of drainage structures or levees). There are various measures that you can define for the WAT, but this User's Manual will only focus on reservoirs (see Section 7.9.1, page 7-31) and levees (see Section 7.9.2, page 7-378). Other measures available in the WAT are diversions, channel improvements, off-channel storage, and other projects.

7.2.3 Common Computation Points

Common computation points (Figure 7.3) are locations where one model transfers data to another model, or where results are needed for model development or alternative analysis, or where input boundary conditions

Common computation points are locations where one model transfers data to another model, a location where results are needed for model development or alternative analysis, or locations where input boundary conditions are to be defined.

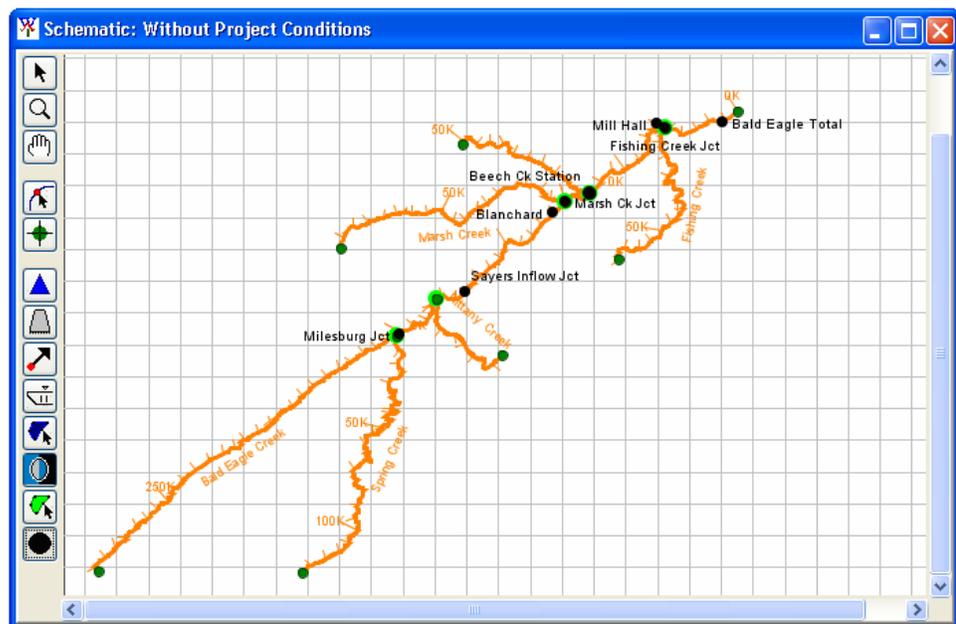


Figure 7.3 Common Computation Points

are to be defined. The common computation points need to be consistent for all models and should be placed on the stream alignment based on knowledge of possible study alternatives. The entire study team should be involved in the definition of the common computation points. For further details on common computation points and how to create, edit, and modify, see Section 7.10 (page 7-43).

7.2.4 Impact Areas

An **impact area** (see Figure 7.4, page 7-4) is any distinct portion of a study that is affected by rising or falling stage in a stream, river, lake, or

An *impact area* is any distinct portion of a study area that is affected by rising or falling stage in a stream, river, lake, or reservoir.

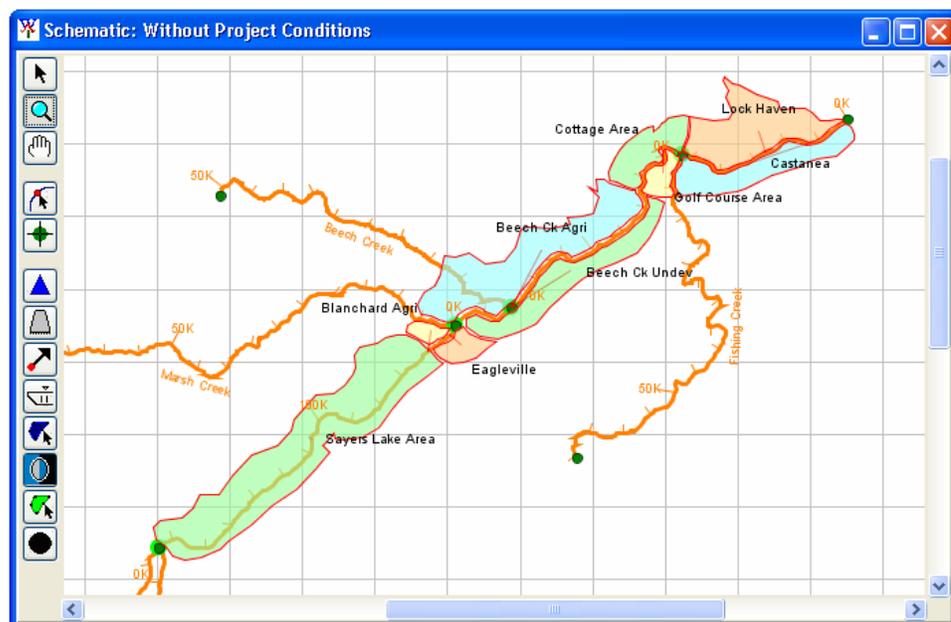


Figure 7.4 Impact Areas

reservoir. The boundaries of an impact area are defined by a closed polygon, and you characterize the effects of rising or falling stage by describing the property, project, and/or population at risk in the area bounded by the polygon. Impact areas are an optional element, and are only required when you want to compute impacts at damage area centers in the study area, and you have an HEC-FIA model as part of your WAT modeling effort. For further details on impact areas and how to create, edit, and modify, see Section 7.11 (page 7-49).

7.3 Study Element Tools

There are tools available to view and create the study elements from the schematic map window. These tools are as follows:

- 
Pointer/Selector Tool – use this tool to edit, rename, and delete elements (does not include stream alignment elements). Commands available for editing existing study elements are available by selecting the **Pointer/Selector Tool**, and right-clicking on a study element.
- 
Zoom Tool - use this tool to zoom in and out of map windows. To zoom in, hold the left mouse button down and outline the area you want to enlarge. To zoom out, click the right mouse button (right-click). The zoom out is done by a factor of two and positions the clicked location at the center of the map window.

-  **Pan Tool** – use this tool to move the map window while you are zoomed in.
-  **Impact Area Tool** - use this tool to create, delete, rename, and edit impact areas. See Section 7.11 (page 7-48) for more detail on creating, deleting, renaming, and editing impact areas.
-  **Computation Point Tool** - use this tool to create, delete, rename, and edit common computation points. Common computation points are locations where one model transfers data to another model, where results are needed for model development, or where input boundary conditions are to be defined. See Section 7.10 (page 7-43) for more detail on creating, deleting, renaming, and editing common computation points.
-  **Stream Alignment Tool** - use this tool to create, delete, and edit streams that make up the stream alignment (see Section 7.8, page 7-13).
-  **Stream Node Tool** - use this tool to create, delete, and edit stream nodes (see Section 7.8.5, page 7-23) and stream junctions (see Section 7.8.7, page 7-25) on the stream alignment.

7.4 Measure Tools

-  **Reservoir Tool** - use this tool to create, delete, rename, and edit reservoirs. See Section 7.9.1 (page 7-31) for more detail on creating, deleting, renaming, and editing reservoirs.
-  **Levee Tool** - use this tool to create, delete, rename, and edit levees. See Section 7.9.2 (page 7-37) for more details on creating, deleting, renaming, and editing levees.
-  **Diversion Tool** - use this tool to create, delete, rename, and edit diversions. A diversion has to be started on the stream alignment. To create a diversion, select the **Diversion Tool**, hold down the **CTRL** key, and click on the stream alignment. Each click creates a vertex point along the diversion. When reaching the end point of the diversion, release the **CTRL** key, and click. You will be asked to name the diversion. After naming the diversion, the diversion will appear on the active map window. Commands available for editing an existing diversion are available by selecting the **Diversion Tool**, and right-clicking on a diversion.
-  **Channel Modification Tool** - use this tool to create, delete, rename, and edit channel modifications. A channel modification

has to be created on the stream alignment. To create a channel modification, select the **Channel Modification Tool**, hold down the **CTRL** key, click on the upstream end of the channel modification, release the **CTRL** key, and drag along the stream alignment to the downstream end of the channel modification and click. You will be asked to name the channel modification. After naming the channel modification, the channel modification will appear on the active map window. Commands available for editing an existing channel modification are available by selecting the **Channel Modification Tool**, and right-clicking on a channel modification.



Off-Channel Storage Area Tool - use this tool to create, delete, rename, and edit off-channel storage areas. To create an off-channel storage area, select the **Off-Channel Storage Area Tool** and hold down the **CTRL** key while clicking the mouse button. Each click creates a vertex point, which is the boundary of the polygon. When reaching the end point, release the **CTRL** key and click. You will be asked to name the off-channel storage area. After naming the off-channel storage area, the off-channel storage area will appear on the active map window. Commands available for editing an existing off-channel storage area are available by selecting the **Off-Channel Storage Area Tool**, and right-clicking on an off-channel storage area.



Other Project Tool - use this tool to create, delete, rename, and edit other projects. This tool enables the placement of elements that represent "other" projects, such as pump stations. To create an "other" project, select the **Other Project Tool** and hold down the **CTRL** key and click. You will be asked to name the "other" project. After naming the "other" project, the "other" project will appear on the active map window. Commands available for editing an existing "other" projects are available by selecting the **Other Project Tool**, and right-clicking on an "other" project.

7.5 Creating the Default Schematic

When a new study is created in the WAT, a default alternative is created (see Chapter 6) with either a WAT default name (*Without Project Conditions*) or a user-defined name. After the alternative has been created, the default schematic needs to be defined, this will have the same name as the default alternative. The first step in defining the default schematic is to create the stream alignment (see Section 7.8, page 7-13) and then add measures (see Section 7.9, page 7-31), common computation points (see Section 7.10, page 7-43), and impact areas (see Section 7.11, page 7-48) to the schematic.

To define the default schematic:

1. Once a study is created, the default schematic map window will open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7).
2. Add a map layer (Chapter 5) that will guide you in creating your stream alignment. You will either digitize the stream alignment by hand or import a stream alignment. See Section 7.8 (page 7-13) for further details on creating a stream alignment.
3. Once the stream alignment is established you will need to add the measures that describe the default alternative. There are several types of measures (see Section 7.9, page 7-31) that you can add, but for the Beta version, this manual will concentrate on reservoirs (see Section 7.9.1, page 7-31) and levees (see Section 7.9.2, page 7-37).
4. After measures have been defined, you should add common computation points (see Section 7.10, page 7-43) to the default schematic. Common computation points are locations where the models associated with the alternative will hand off data to each other, the user can view results, or locations where input boundary conditions are defined.
5. An optional element to add to the default schematic is impact areas. Impact areas are required if you want to compute impacts at damage area centers in the study area, and you have an HEC-FIA model as part of your alternative. See Section 7.11 (page 7-48) for further details on defining impact areas.
6. Once you have your default schematic complete, be sure to save your schematic data. You can now create other alternatives and schematics based on the default schematic.

A schematic is a physical representation of a stream alignment, and the flood damage reduction and environmental measures that will be modeled.

7.6 Creating Schematics

There are two ways to create a schematic, one is from the **Schematic Tab**, and the other is when you are creating an alternative (Chapter 6).

To create a schematic from the **Schematic Tab**:

1. From the **Schematic Tab**, on the **Study Pane** (Figure 7.5), right-click on the **Schematics**, folder, from the shortcut menu click **New**. The **New Schematics** dialog box will open (see Figure 7.6, page 7-8).
2. In the **Name** box enter the name (required), and in the **Description** box, enter a description (optional, but recommended).

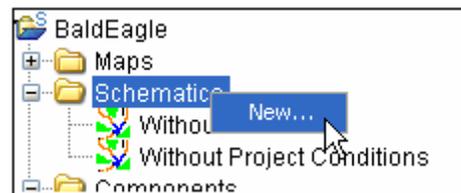


Figure 7.5 Creating a New Schematic

- Click **OK**, the **New Schematics** dialog box will close. In the **Study Pane** (see Figure 7.5, page 7-7), the **Schematics** folder will now contain the new schematic. You now need to edit the schematic, to add the correct measures for the alternative that is associated with this schematic.

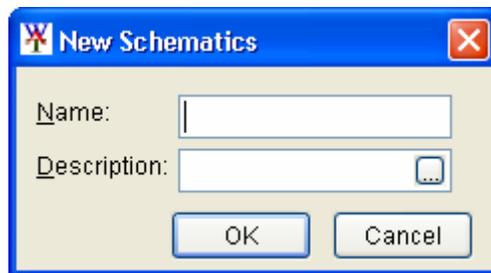


Figure 7.6 New Schematics Dialog Box

To create a schematic when you are creating an alternative:

- From the **Study Tab**, on the **Study Pane** (Figure 7.7), right-click on the **Alternatives** folder, from the shortcut menu click **New**. The **New Alternatives** dialog box will open (Figure 7.8).

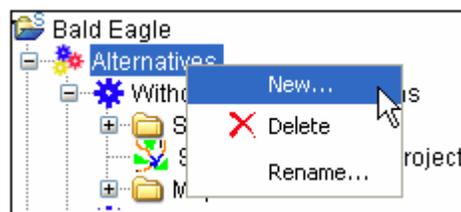


Figure 7.7 Creating a New Alternative

- Enter the alternative name in the **Name** box enter the name (required), and an optional (recommended) description in the **Description** box.

The schematic also provides a common starting point for construction of compatible model data sets.

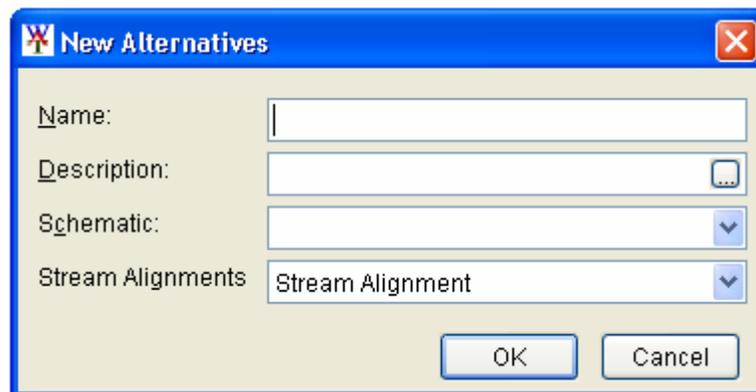


Figure 7.8 New Alternatives Dialog Box

- Each alternative requires a schematic to provide the layout of the study area measures and components. Select a previously defined schematic, or create a schematic for the alternative from the **Schematic** list (see Step 7).
- A stream alignment is also required with an alternative, from the **Stream Alignments** list, select **Stream Alignment**, which is the default stream alignment name.
- Click **OK**, if there is not a map window open in the **Desktop Pane**, the **New Alternatives** dialog box will close (Figure 7.8) and a map window will open in the **Desktop Pane** representing the alternative.
- If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box will open

(Figure 7.9). You can choose whether to open the alternative in the current map window or in a new map window, click **OK**. The **Select Map** dialog box and the **New Alternatives** dialog box (see Figure 7.8, page 7-8) will both close, and the map window for the new alternative will appear in the **Desktop** pane.

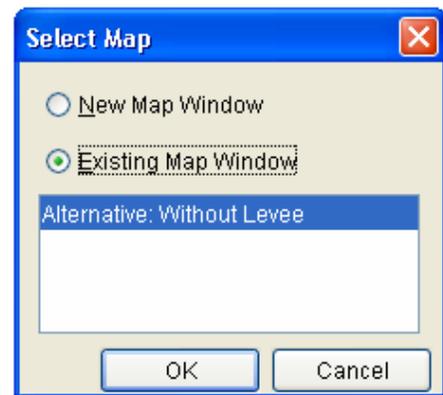


Figure 7.9 Select Map Dialog Box

7. If you want to create a new schematic for the alternative, from the **Schematic** list, click *<Create New Schematic>*. When you click **OK**, the **Enter Schematic Name** dialog box will open (Figure 7.10). By default the name of the alternative will appear in the **Name** box for the new schematic, you can accept this name or enter a name for the schematic in the **Name** box.

A common schematic assures the naming convention, measure identification and location for the study is consistent throughout the modeling disciplines.

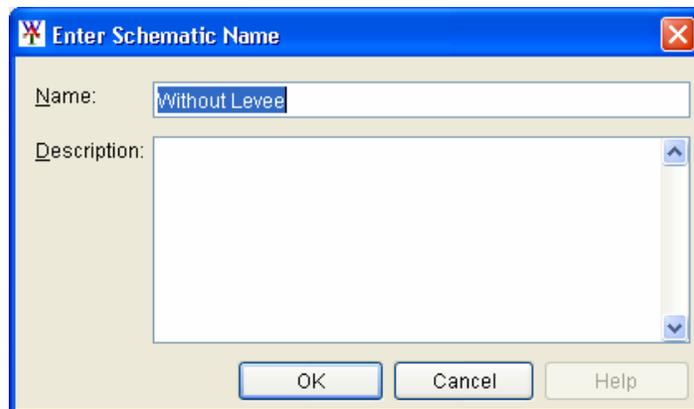


Figure 7.10 Enter Schematic Name Dialog Box

8. Click **OK**, if there is not a map window open in the **Desktop Pane**, the **Enter Schematic Name** dialog box (Figure 7.10) will close and a map window will open in the **Desktop Pane** representing the schematic.
9. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box (Figure 7.9) will open. You can choose whether to open the schematic in the current map window or in a new map window, click **OK**. The **Select Map** dialog box (Figure 7.9) and the **Enter Schematic Name** dialog box (Figure 7.10) will both close and the map window for the new schematic will appear in the **Desktop Pane**.
10. The schematic name will now appear on the **Schematic Tab**, under the **Schematics** folder (see Figure 7.5, page 7-7). You now need to edit the schematic by adding measures, common computation points, and impact areas.

7.7 Existing Schematics

After creating a schematic, you can view the schematic, edit certain properties of a schematic, save the active schematic, create a copy of an existing schematic, delete a schematic that is not associated with an alternative, and view an existing schematic's properties. All of these tasks are accomplished through the schematic shortcut menu (Figure 7.11). To access the schematic shortcut menu, from the **Schematic Tab**, on the **Study Pane**, right-click on an existing schematic under the **Schematics** folder; and, the schematic shortcut menu will appear.

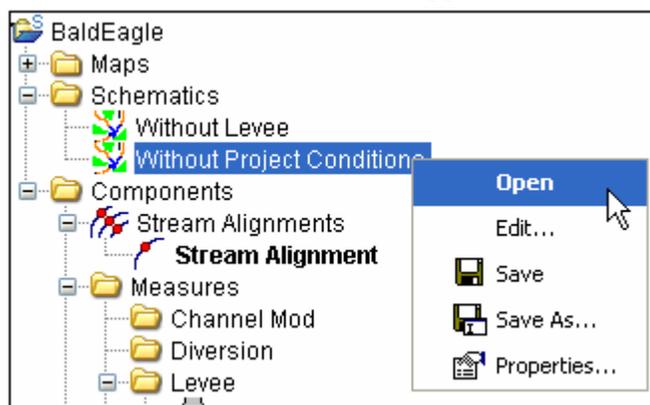


Figure 7.11 Schematic Shortcut Menu

7.7.1 Viewing a Schematic

To view a schematic in a map window:

1. From the schematics shortcut menu (Figure 7.11) click **Open**.
2. If there is not a map window open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the map window for the selected schematic will open in the **Desktop Pane**. From the map window you can edit the stream alignment, add measures (reservoirs, levees), and impact areas for the schematic.
3. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box (see Figure 7.9, page 7-9) will open. You can choose whether to open the schematic in the current map window or in a new map window, click **OK**. The **Select Map** dialog box (see Figure 7.9, page 7-9) will close, and the map window for the selected schematic will appear in the **Desktop Pane**.

7.7.2 Editing an Existing Schematic

To edit the description, or to add and remove measures from an existing schematic:

1. From the schematics shortcut menu (see Figure 7.11, page 7-10) click **Edit**. The **Schematic Editor** will open (Figure 7.12).

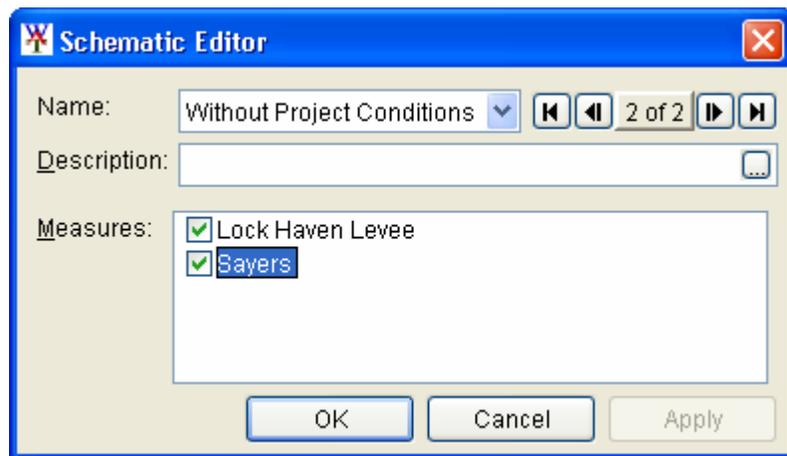


Figure 7.12 Schematic Editor

2. In the **Description** box you can edit the description of schematic.
3. From the **Measures** box you can add or remove measures from a schematic by selecting the measures. For example (Figure 7.12), if you decide for this schematic not to include the *Lock Haven Levee*, clear **Lock Haven Levee**. The *Lock Haven Levee* will now be removed from the schematic.
4. Click **OK**, the **Schematic Editor** will close, and if the map window associated with the schematic is open, the measure will no longer display in the map window.

7.7.3 Saving a Schematic

To save the active schematic, from the schematic shortcut menu (see Figure 7.11, page 7-10), click **Save**. Any changes that have occurred to the selected schematic will be saved by the WAT.

7.7.4 Making a Copy of an Existing Schematic

To make a copy of an existing schematic:

1. From the schematics shortcut menu (see Figure 7.11, page 7-10), click **Save As**. The **Save Schematic As** dialog box will open (see Figure 7.13, page 7-12).
2. The information displayed in the dialog box represents the schematic you have chosen to make a copy of.
3. In the **Name** box, enter the name (required) of the new schematic, and in the **Description** box, enter a description (optional, but recommended).

- Click **OK**, the **Save Schematic As** dialog box (Figure 7.13) will close, and in the **Study Pane**; under the **Schematics** folder the new schematic name will appear.

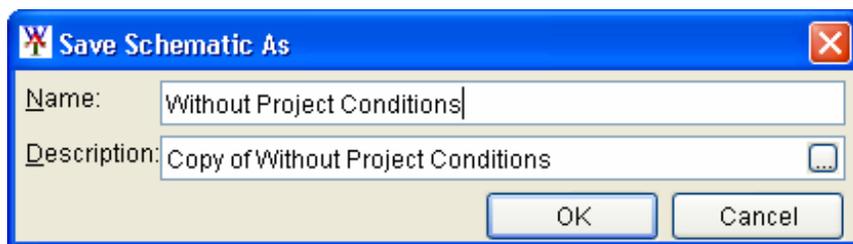


Figure 7.13 Save Schematic As Dialog Box

7.7.5 Deleting a Schematic

You can only delete a schematic that is not associated with an alternative. For example, in Figure 7.11 (page 7-10), the *Without Project Conditions* schematic is associated with an alternative, so the **Delete** command does not display on the schematic shortcut menu. To delete a schematic not associated with an alternative:

- From the **Schematic Tab**, on the **Study Pane**, from the **Schematics** folder, right-click on a schematic that is not associated with an alternative. From the **Schematics** shortcut menu (Figure 7.14), click **Delete**.

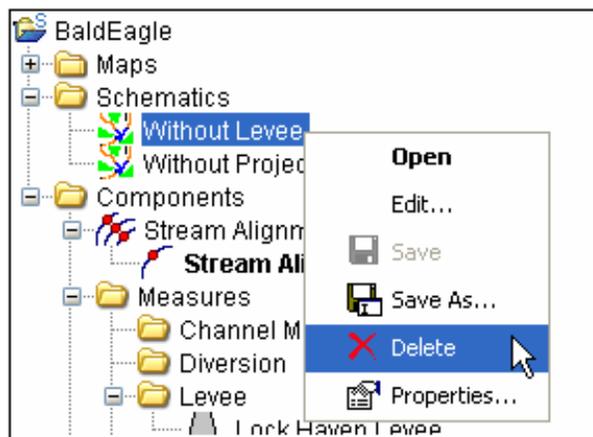


Figure 7.14 Schematic Shortcut Menu - Delete

- A message window will open, asking you if you really want to delete the selected schematic. Click **Yes**, the schematic name will no longer appear under the **Schematics** folder on the **Study Pane**.

7.7.6 Schematic Properties

The properties of a schematic include the name and description for the Beta Version. For Version 1.0 properties that will be displayed are:

stream alignment, list of measures, common computation points, and impact areas. To view the properties of a schematic:

1. From the schematics shortcut menu (see Figure 7.11, page 7-10), click **Properties**. The **Properties for SchematicName** dialog box will open (Figure 7.15).

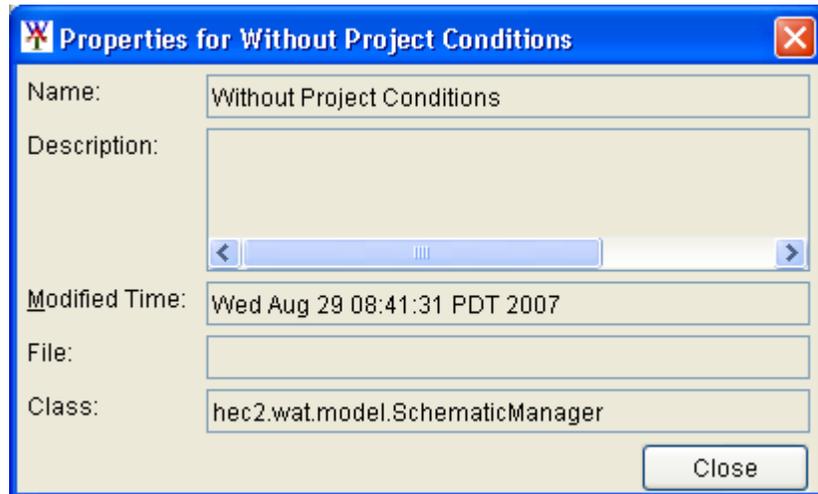


Figure 7.15 Properties for *SchematicName* Dialog Box

2. For the Beta Version the properties for viewing are the name and description of the selected schematic; the date and time the schematic was last modified; the location of the schematic file; and, the name of the file which contains information about the schematic.

7.8 Establishing the Stream Alignment

Stream alignments represent the stream system in the study. The alignment indicates where confluences and bifurcations occur and provides a sense of distance and scale. Stream alignments are composed of a series of streams, stream nodes, and stream junctions (see Figure 7.16, page 7-14). A **stream** typically begins or ends at a confluence, bifurcation, or at the boundary of the river system. A stream is composed of vertex points, with the beginning and ending vertex points being stream nodes.

Streams are drawn as multi-segmented lines. Each stream must have at least two stream nodes, defining the beginning and end of the stream. Streams, stream nodes, and stream junctions, are illustrated in Figure 7.17 (page 7-14).

The WAT creates and labels stream stations (or river stations) along each stream. The station at the downstream end of a stream is Station 0 (zero), and the stationing increases upstream along the stream according to the

A stream alignment represents the stream system in the watershed. The alignment indicates where confluences and bifurcations occur and provides a sense of distance and scale. In the WAT, stream alignments are composed of a series of streams.

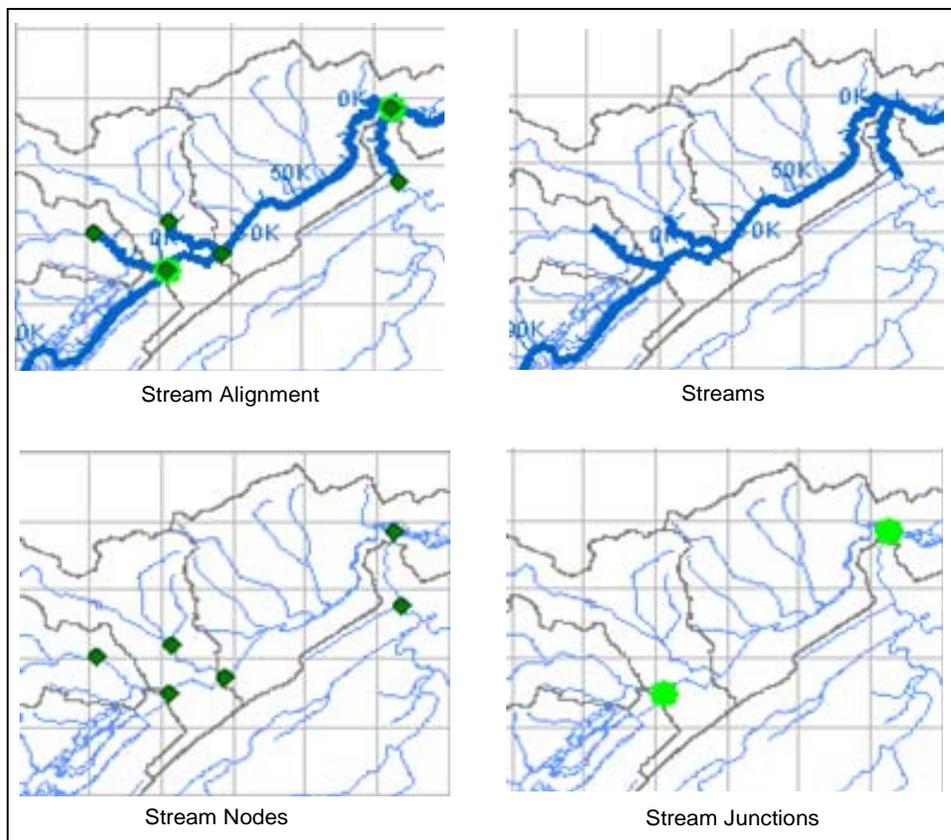


Figure 7.16 Stream Alignment Parts

linear distance between vertices on the stream in the study coordinate system. You can override the default stationing by editing the station values of the stream nodes at the upstream and downstream ends of the stream, as well as by adding additional nodes along the stream.

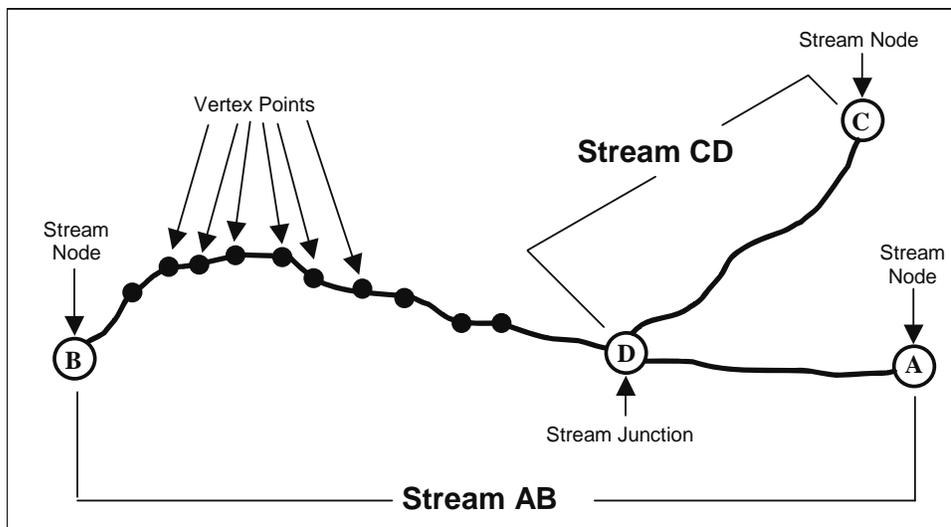


Figure 7.17 Relationships of Streams in a Stream Alignment

Stream stationing is based on the geographic extents that are defined when a stream is drawn. If the geo-extents are based on a map layer, the units for the stream stationing are the same as the map layer (i.e., feet, meters).

In the Beta Version of the WAT there is no indication of what the units are, in future versions there will be a way for the user to view the units.

A stream alignment created without an underlying map layer will use the default coordinate system of X-Y. This default does not have any units attached to it. More information on the coordinate system is contained in Appendix D.

7.8.1 Creating the Default Stream Alignment

If your stream alignment is going to be based on a map layer, the map layer should already have been included in the study. The details on how to include a map layer are given in Chapter 5. The map layer should contain water features, such as stream channels and reservoirs. Use this map layer as a guide while creating the stream alignment. By doing this, the units of the labels on the stream alignment will be the same as the units of the water feature layer (i.e., if your water feature layer is projected in state plane coordinates (feet), then the labels on the stream alignment will be in feet).

You can either digitize a stream alignment by hand or import a stream alignment from an ArcView® shapefile. The following are the steps for digitizing a stream alignment; see Section 7.8.10 (page 7-28) for details on importing a stream alignment.

To create the default stream alignment for a new study:

1. When a new study is created (see Chapter 4, Section 4.1.1, page 4-1), the default stream alignment is created (*Stream Alignment*) and a schematic map window is automatically opened in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7).
2. The default stream alignment is blank, to begin building the default stream alignment; find a location on the map window where you want to start a stream. Streams should be created from upstream to downstream. Hold down the **CTRL** key, while clicking the mouse button. Each click creates a vertex point (see Figure 7.18, page 7-16), on your stream. The first vertex point is the upstream or beginning stream node of a stream.
3. For the most downstream or last vertex point, release the **CTRL** key, and then click the mouse button. This creates the ending stream node of the stream. You have now created a single stream.
4. The **Create New Stream** dialog box will open (see Figure 7.19, page 7-16). You can either accept the default name or enter a new name (required) in the **Name** box. If needed, you can enter an optional description (recommended) in the **Description** box. Click **OK**, the **Create New Stream** dialog box will close.



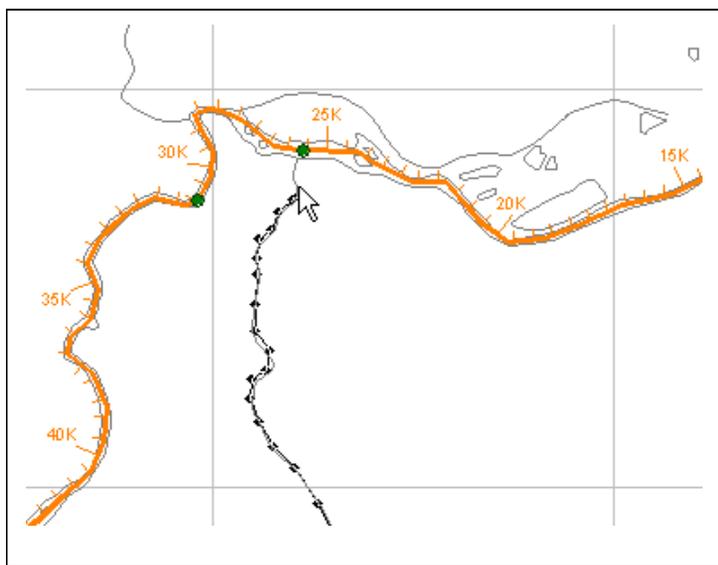


Figure 7.18 Creating a Stream

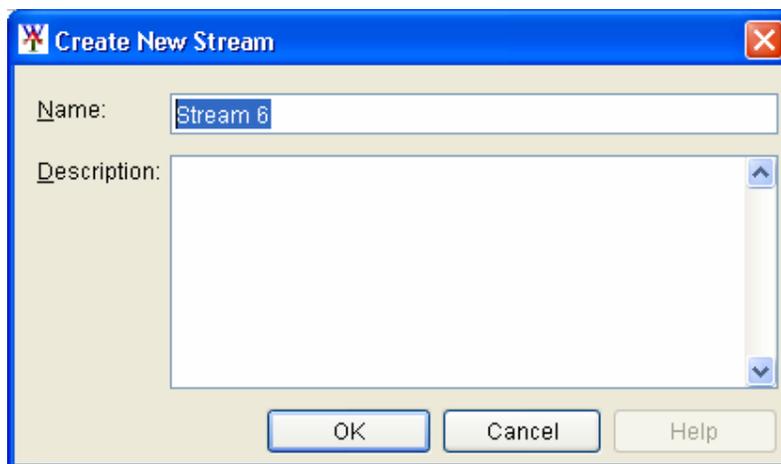


Figure 7.19 Create New Stream Dialog Box

5. Repeat steps 2 through 4 to add more streams to your stream alignment.
6. To connect a stream to an existing stream, place the first or last click of the new stream on the existing stream where you want the two streams to join. After naming the new stream, a message box will appear asking if you want to connect the new stream to the existing stream. Click **Yes** if you want the two streams connected. Otherwise, click **No** and the new stream will not be connected to the existing stream.
7. Once you have completed your stream alignment, save your work.

The **Zoom Tool** (see Section 7.3, page 7-4) can be used to help define the stream alignment. Use it to magnify the stream network, which makes defining the vertices along a stream easier.

7.8.2 Existing Stream Alignments

After creating a stream alignment, you can view the stream alignment, save the stream alignment, create a copy of an existing stream alignment, delete a stream alignment, view an existing stream alignment's properties, and, reverse direction of all streams that make up a stream alignment. All of these tasks are accomplished through the stream alignment shortcut menu (Figure 7.20). The stream alignment shortcut menu is available from the **Schematic Tab**, on the **Study Pane**, and then right-click on an existing stream alignment under the **Components** folder.

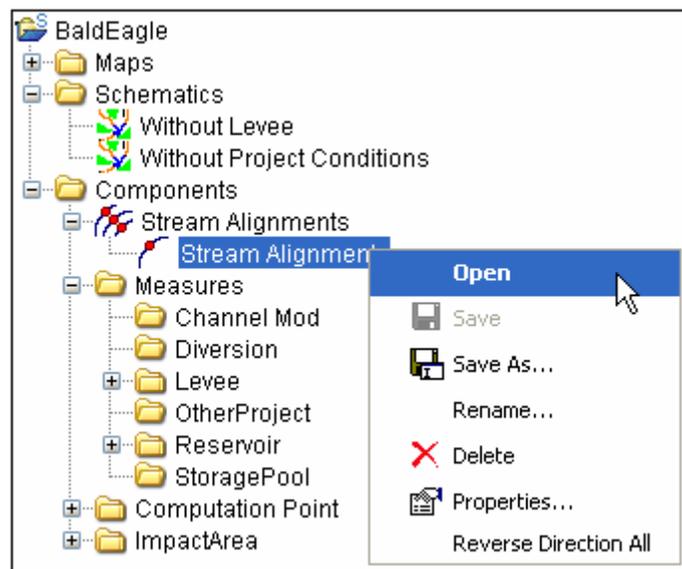


Figure 7.20 Stream Alignment Shortcut Menu

Viewing a Stream Alignment

To view a stream alignment in a map window:

1. From the stream alignment shortcut menu (Figure 7.20) click **Open**.
2. If there is not a map window open in the **Desktop Pane**, the map window for the selected stream alignment will open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). From the map window you can edit the streams, stream nodes, and stream junctions that make-up the stream alignment.
3. If a map window is open in the **Desktop Pane**, a message box will open letting you know that the stream alignment is already displayed in the active map window. If you wish to open a separate map window for the stream alignment, click **Yes**. The message box will close, and a map window will open with the selected stream alignment displayed.

Saving a Stream Alignment

To save the active stream alignment, from the stream alignment shortcut menu (see Figure 7.20, page 7-17), click **Save**. Any changes that have occurred to the selected stream alignment will be saved by the WAT.

Making a Copy of an Existing Stream Alignment

To make a copy of an existing stream alignment:

1. From the stream alignment shortcut menu (see Figure 7.20, page 7-17) click **Save As**. The **Save Stream Alignment As** dialog box will open (Figure 7.21). The information displayed in the dialog box represents the stream alignment you have chosen to make a copy of.
2. In the **Name** box, enter the name (required) of the new stream alignment, and in the **Description** box, enter a description (optional, but recommended).
3. Click **OK**, the **Save Stream Alignment As** dialog box will close, and in the **Study Pane**, the **Stream Alignments** folder will now contain the new stream alignment.

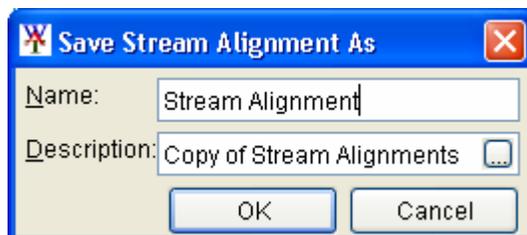


Figure 7.21 Save Stream Alignment As Dialog Box

Renaming an Existing Stream Alignment

To rename an existing stream alignment:

1. From the stream alignment shortcut menu (see Figure 7.20, page 7-17) click **Rename**. The **Rename Stream Alignment** dialog box will open (Figure 7.22). The information displayed in the dialog box represents the stream alignment you have chosen to rename.

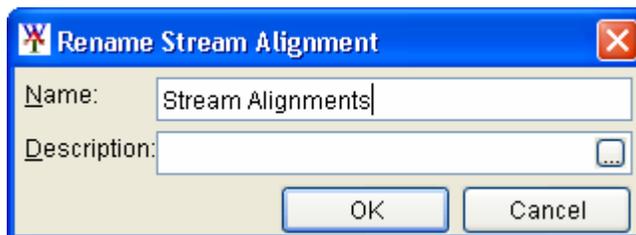


Figure 7.22 Rename Stream Alignment Dialog Box

2. In the **Name** box, enter the name (required) of the new stream alignment, and in the **Description** box, enter a description (optional, but recommended).

3. Click **OK**, the **Rename Stream Alignment** dialog box (see Figure 7.22, page 7-18) will close, and in the **Study Pane**, the **Stream Alignments** folder will now contain the renamed stream alignment.

Deleting an Existing Stream Alignment

To delete an existing stream alignment:

From the stream alignment shortcut menu (see Figure 7.20, page 7-17), click **Delete**. A message window will open, asking you if you really want to delete the selected stream alignment. Click **Yes**, the stream alignment name will no longer appear under the **Stream Alignments** folder on the **Study Pane**.

Stream Alignment Properties

To view certain properties of a stream alignment, from the stream alignment shortcut menu (see Figure 7.20, page 7-17), click **Properties**. The **Properties for Stream Alignment** dialog box will open (Figure 7.23). Properties that you can view include: name of the active stream alignment, description, last time the stream alignment was modified, the file name and location of the stream alignment, and the geographic extents of the stream alignment.

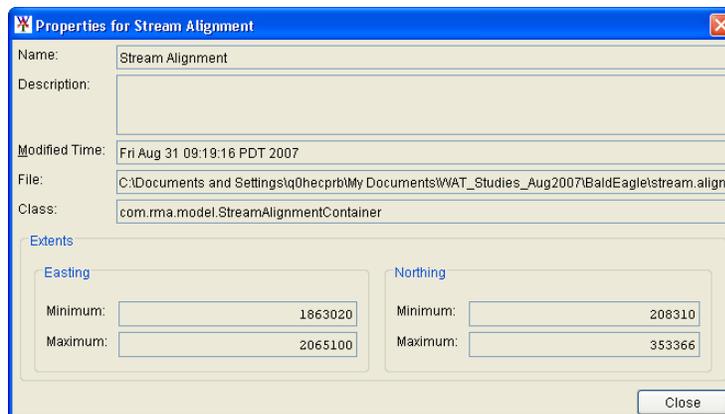


Figure 7.23 Properties for Stream Alignment Dialog Box

Reverse Direction of All Streams in a Stream Alignment

When importing a stream alignment from ArcView® shapefiles or when digitizing a stream alignment, individual streams can be in the wrong direction (downstream to upstream). You can reverse the direction of individual streams (see **Reverse Direction of a Stream**, under Section 7.8.3, page 7-21), but if all your streams are in the wrong direction, the WAT has provided an option to handle this.

From the stream alignment shortcut menu (see Figure 7.20, page 7-17), click **Reverse Direction All**. A warning message box will appear, warning you that reversing the streams direction will reverse the default stationing for all the streams in the stream alignment. Click **Yes**, the warning message box will close, and all streams associated with the stream alignment will have reversed direction.

7.8.3 Editing a Stream Alignment – Streams



After establishing a stream alignment, you can rename and edit the description for individual streams, delete individual streams, reverse the direction of a stream, disconnect a stream at both the upstream or downstream end, and view the stream stationing and coordinates of the stream nodes on a stream. All of these tasks are accomplished through the stream shortcut menu (Figure 7.24). To access the stream shortcut menu, the **Stream Alignment Tool** must be selected, and from the map window, right-click on a stream.

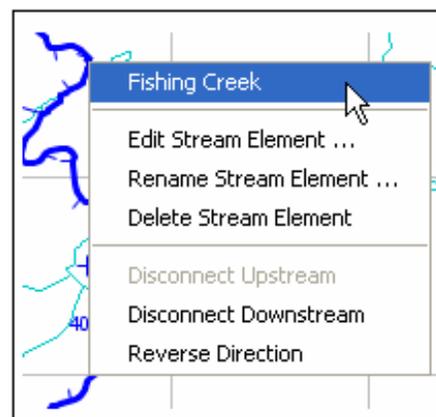


Figure 7.24 Stream Shortcut Menu

Renaming a Stream

To rename a stream:

1. Press the **Stream Alignment Tool** from the toolbar, right-click on the stream you want to rename, and click **Rename Stream Element** from the stream shortcut menu (Figure 7.24).
2. The **Rename Stream** dialog box opens (see Figure 7.25, page 7-21). Enter the new name in the **Name** box (required) and description in the **Description** box (optional, but recommended). Click **OK** and the dialog box will close. The new name of the stream will be shown on the map window.

*A **stream** is a segment of the stream alignment that is composed of vertex points, with the beginning and ending vertex points being stream nodes.*

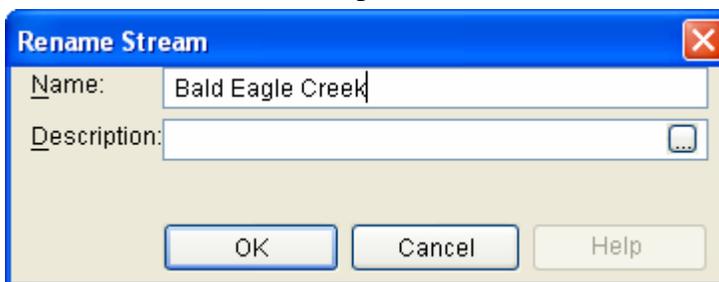


Figure 7.25 Rename Stream Dialog Box

Deleting a Stream

To delete a stream:

1. Press the **Stream Alignment Tool** from the toolbar, right-click on the stream you want to delete and click **Delete Stream Element** from the stream shortcut menu (see Figure 7.24, page 7-20).
2. A warning message will open asking you whether you really want to delete the selected stream. Click **Yes**, the warning message will close and the stream will be deleted from the map window.

Reverse Direction of a Stream

If you draw a stream in the wrong direction (downstream to upstream), the WAT provides a way for you to reverse the direction of a stream, instead of having to delete and redraw the stream.

To reverse direction of a stream:

1. Press the **Stream Alignment Tool** from the toolbar, right-click on the stream you want to reverse and click **Reverse Direction** from the stream shortcut menu (see Figure 7.24, page 7-20).
2. A warning message will appear asking if you really want to reverse the direction of the stream. Click **Yes**, the warning message will close and the stream's direction will be reversed.

Disconnecting a Stream

If you want to disconnect a stream from another stream, the WAT will allow you to do so at either the upstream or downstream end of the stream.

To disconnect a stream from another stream:

1. Press the **Stream Alignment Tool** from the toolbar, right-click on the stream you want to disconnect and either click **Disconnect Upstream** or **Disconnect Downstream** from the stream shortcut menu (see Figure 7.24, page 7-20).
2. The stream will now be disconnected from the stream at the location you chose. On the map window, the upstream or downstream point will physically move away from the connecting stream and a stream node will remain on the connecting stream.

Editing a Stream

The previous sections have described the editing that you can do to a stream. **Edit Stream Element** allows you to edit a stream's description

and view the stream's stationing and coordinates of the upstream and downstream stream nodes, plus any stream nodes in between the two.

To edit the description of a stream:

Stream stationing is based on the geographic extents that are defined when a stream is drawn. Watershed adopted stations along a stream normally denoted as miles (kilometers) above the mouth of a stream.

1. Press the **Stream Alignment Tool** from the toolbar, right-click on the stream element you want to edit, click **Edit Stream Element** from the stream shortcut menu (see Figure 7.24, page 7-20), the **Stream Editor** will open (Figure 7.26).

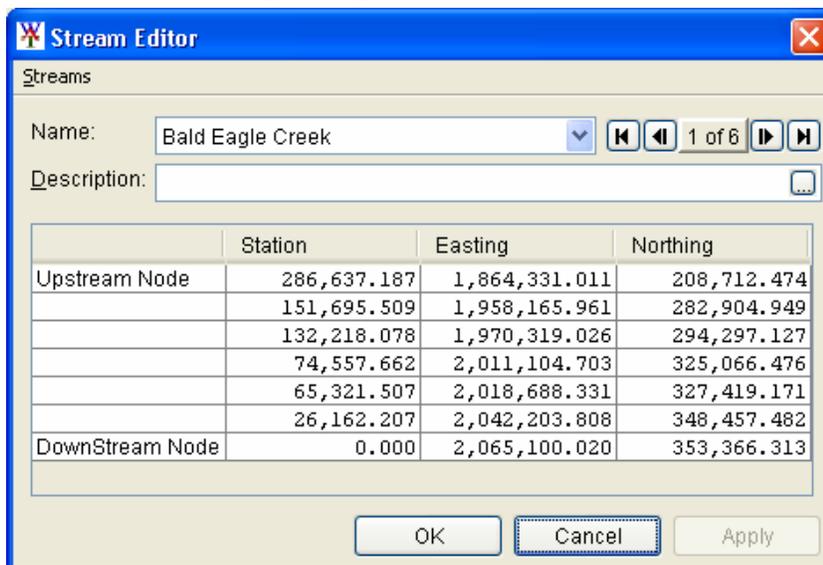


Figure 7.26 Stream Editor

2. You can either enter a new description (recommended) or edit the description of the stream in the **Description** box.
3. The table provides you with the stream stationing and coordinates of the stream nodes that are on the selected stream and is informational only.
4. Click **OK**, the **Stream Editor** will close.

7.8.4 Graphically Editing a Stream Alignment – Streams



After establishing a stream alignment, you can graphically edit the individual streams of the stream alignment. By using the **Stream Alignment Tool**, the **CTRL** key, and the **SHIFT** key, you can edit individual streams by adding, moving, and deleting vertex points. This is done graphically on the schematic in the active map window.

Adding Vertices to a Stream

To add vertex points to an existing stream:

A vertex point is a point with known coordinates on a stream in the stream alignment.

1. Press the **Stream Alignment Tool** from the toolbar, double-click on a stream that you want to add a vertex point to, and the stream will turn red, with blue points that represent vertices.
2. Place the pointer on the selected stream where you want to add a vertex point. Hold down the **CTRL** key and click. A blue point will now appear on the selected stream, which represents a new vertex point.

Moving the Vertices of a Stream

To move vertex points on an existing stream:

1. Press the **Stream Alignment Tool** from the toolbar; double-click on the stream where you want to move a vertex point. The selected stream will turn red, and the individual vertex points will be blue points.
2. Click on the vertex point you wish to move and then drag the vertex point to a new location; this is illustrated in Figure 7.27.

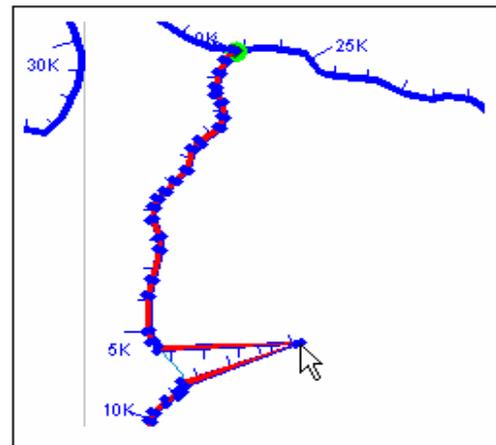


Figure 7.27 Move a Vertex Point

Deleting Vertices from a Stream

To delete vertex points from an existing stream:

1. Press the **Stream Alignment Tool** from the toolbar; double-click on the stream where you want to delete a vertex point. The selected stream will turn red, and the individual vertex points will be blue points.
2. Hold down the **SHIFT+CTRL** keys and click on the vertex point to be deleted. The blue vertex point will disappear from the stream.

7.8.5 Editing a Stream Alignment - Stream Nodes



After establishing the stream alignment, you can edit and delete the individual stream nodes of the stream alignment. Both of these tasks are accomplished through the stream node shortcut menu (see Figure 7.28, page 7-24). To access the stream node shortcut menu, the **Stream Node** tool must be selected, and from the map window right-click on a stream node.

Establishing Stream Stationing

The WAT creates a beginning and ending stream node for each stream. Stream nodes are also created where streams meet (stream junctions). Stream nodes are used to establish stationing for a stream. To establish stream stationing for a stream, you can edit the stream nodes. To edit a stream node:

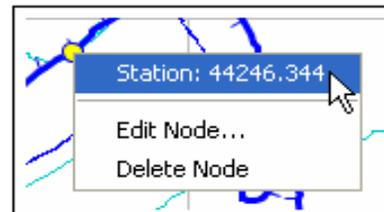


Figure 7.28 Stream Node Shortcut Menu

1. Press the **Stream Node Tool** from the toolbar, right-click on the stream node that you want to edit. From the stream node shortcut menu (Figure 7.28) click **Edit Node**; the **Stream Node Editor** will open (Figure 7.29).

Stream nodes are created where streams meet (stream junctions), and are used to establish stationing for a stream.

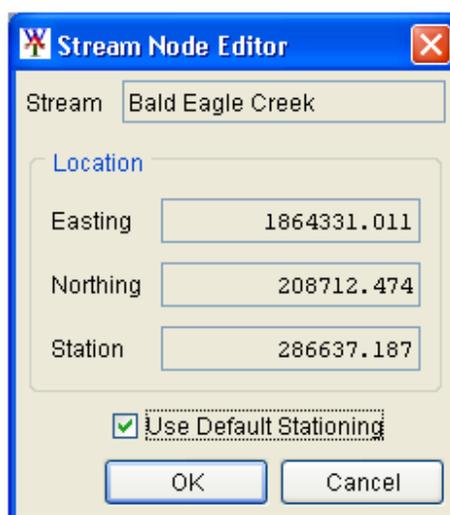


Figure 7.29 Stream Node Editor

2. The default stream station has the downstream node at zero (0) and the upstream node is based on the coordinate system you used when digitizing the stream alignment. To change the stream stationing, clear **Use Default Stationing**. The **Station** box can now be edited.
3. Click **OK**, the **Stream Node Editor** will close. Based on what you enter, the WAT will automatically adjust the stream stationing for the stream associated with the stream node. This includes the upstream and downstream nodes.

Deleting a Stream Node

To delete a stream node, press the **Stream Node Tool** from the toolbar, right-click on the stream node that you want to delete. From the stream node shortcut menu (Figure 7.28) click **Delete Node**. A warning message will open asking you whether you really want to delete the selected stream node. Click **Yes**, the warning message will close and the stream node will

be deleted from the stream alignment. You cannot delete the beginning and ending stream nodes of a stream element.

7.8.6 Graphically Editing a Stream Alignment – Stream Nodes



After establishing a stream alignment, you can graphically edit the individual stream nodes of the stream alignment. By using the **Stream Node Tool**, and the **CTRL** key, you can add and move stream nodes. This is done graphically on the schematic in the active map window.

Adding a Stream Node

Two stream nodes are created automatically – beginning and ending stream nodes of a stream. You can add stream nodes to a stream by pressing the **Stream Node Tool** from the toolbar. Using the **Stream Node Tool**, place the pointer on the stream where you want to add a stream node. Hold down the **CTRL** key and click. A circle will now appear on the stream that indicates the new stream node.

Moving a Stream Node

To move a stream node, press the **Stream Node Tool** from the toolbar; double-click on the stream node that you want to move. It becomes a yellow circle with a black outline and four small black dots (Figure 7.30). To move the stream node, click and drag the stream node along the stream to its new position. You cannot move the beginning and ending stream nodes of a stream.

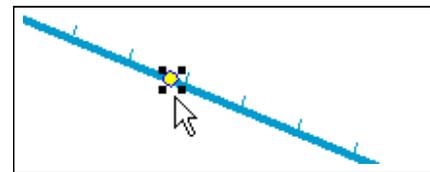
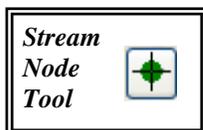


Figure 7.30 Move a Stream Node

7.8.7 Editing a Stream Alignment - Stream Junctions



When two streams intersect, a stream junction is created. A stream junction is multiple stream nodes at one location and is represented by a dark green circle with a light green halo around the circle. You can establish stream stationing at a stream junction. This task is accomplished through the stream junction shortcut menu (Figure 7.31). To access the stream junction shortcut menu, the **Stream Node** tool must be selected, and from the map window right-click on a stream junction.



Figure 7.31 Stream Junction Shortcut Menu

Editing a Stream Junction

To edit a stream junction:

1. Press the **Stream Node Tool** from the toolbar, right-click on the stream junction that you want to edit. From the stream junction shortcut menu (Figure 7.31), click **Edit Stream Junction**. The **Stream Junction Editor** will open (Figure 7.32).

When two streams intersect, a **stream junction** is created. A stream junction is multiple stream nodes at one location and is represented by a dark green circle with a light green halo around the circle.

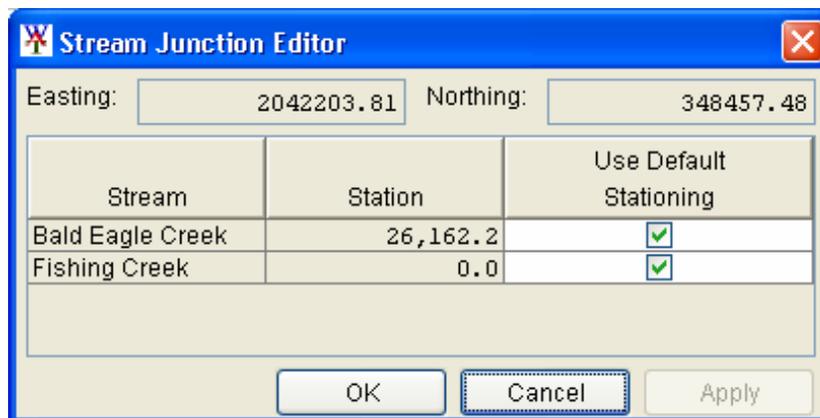
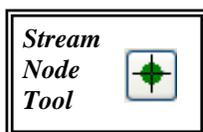


Figure 7.32 Stream Junction Editor

2. The editor displays information about the stream nodes associated with the stream junction. To change the stream stationing for a stream node, clear the checkbox for a stream node from the **Use Default Stationing** column of the table. The cell in the **Station** column becomes active. Based on what you enter, the WAT will automatically adjust the stream stationing for the stream associated with the stream node.
3. Click **OK**, the **Stream Junction Editor** will close.

7.8.8 Graphically Editing a Stream Alignment – Stream Junctions



After establishing a stream alignment, you can graphically edit the individual stream junctions of the stream alignment. By using the **Stream Node Tool**, you can move a stream junction. This is done graphically on the schematic in the active map window.

Moving a Stream Junction

To move a stream junction press the **Stream Node Tool** from the toolbar; double-click on the stream junction that you want to move. It becomes a green circle with a black outline and four small black dots (see Figure 7.33, page 7-27). Click and drag the stream junction along the stream element to its new position.

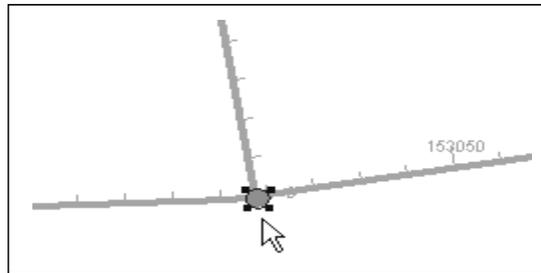


Figure 7.33 Move a Stream Junction

7.8.9 Changing Stream Alignment Properties

Stream alignment properties that can be changed include: color of streams, stream nodes, and stream junctions; the width of streams, stream nodes, and stream junctions; font for the stream name; tic mark properties; and set visualization scaling for the stream alignment.

To change stream alignment properties:

1. From the **Maps Tab**, right-click on **Stream Alignment** in the tree. From the shortcut menu, click **Properties**.
2. The **Stream Alignment Properties** dialog box will open (Figure 7.34).

The Stream Alignment Layer contains the stream alignment displayed in the active map window. This primary layer has three sub-layers which represent the elements of a stream alignment.

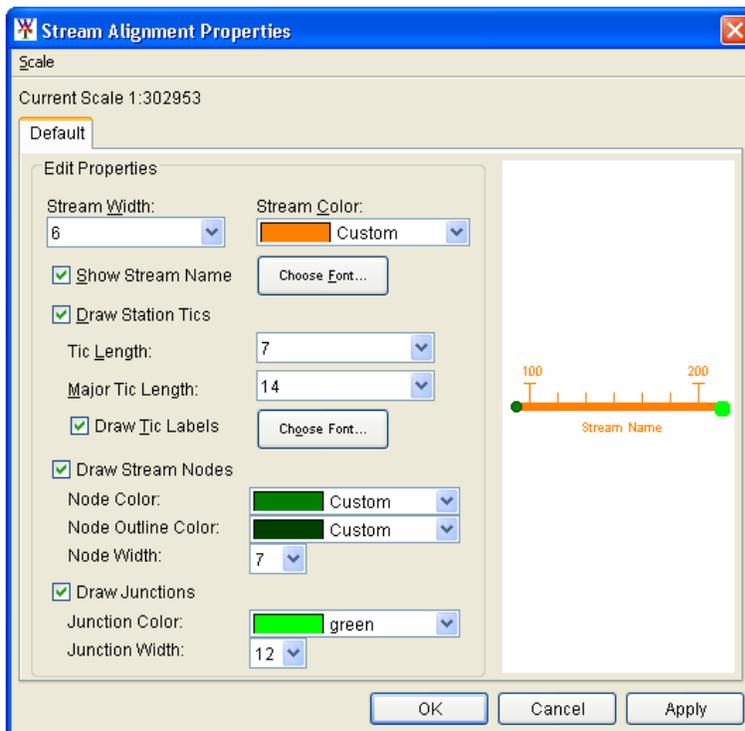


Figure 7.34 Stream Alignment Properties Dialog Box

3. To change the color of the stream alignment, select a color from the **Stream Color** list. The example to the right of the **Edit Properties**

- box (see Figure 7.34, page 7-27) will preview the selected color.
- Click **OK**, the **Stream Alignment Properties** dialog box (see Figure 7.34, page 7-27) will close and the color change will appear in the map window.
 - For further details on changing stream alignment properties, see Chapter 5, **Stream Alignment Properties**, under Section 5.3.1, page 5-9.

7.8.10 Importing a Stream Alignment

To import a stream alignment you must have as an active map layer (Chapter 5) an ArcView® shapefile (see Chapter 5, Section 5.2.1, page 5-1) that represents the stream system of your watershed. This shapefile must have an attribute that is the name of each stream, and each stream must form a contiguous line with at least one upstream point and one downstream point.

To import a stream alignment:

- From the WAT main window, on the **Maps** menu, point to **Import**, and then click **Stream Alignment**.
- The **Import Stream Alignment** dialog box will open (Figure 7.35).

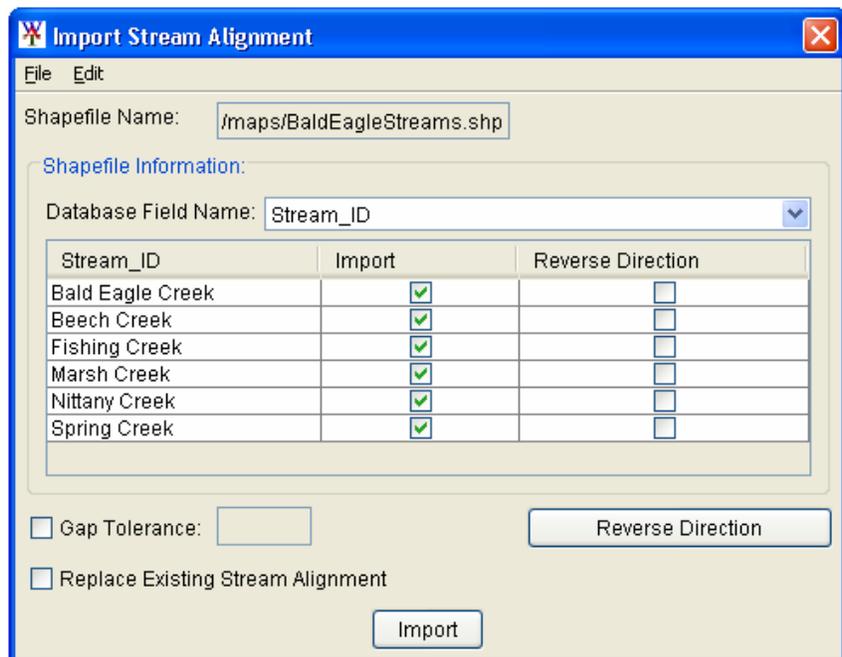


Figure 7.35 Import Stream Alignment Dialog Box

- In the **Shapefile Name** box, the name of the ArcView® shapefile that the WAT has chosen is displayed. The WAT automatically selects the first shapefile that contains polylines; if this is not the correct shapefile, on the **File** menu, click **Choose Shapefile**.

- The **Choose Shapefile** dialog box will open (Figure 7.36). The **Available** box lists the available polyline shapefiles that you have added as map layers. The **Selected** box shows the polyline

To import a stream alignment, you must have an ArcView® shapefile active as a map layer. This shapefile must have an attribute that is the name of each stream, and each stream must form a contiguous line with at least one upstream point and one downstream point.

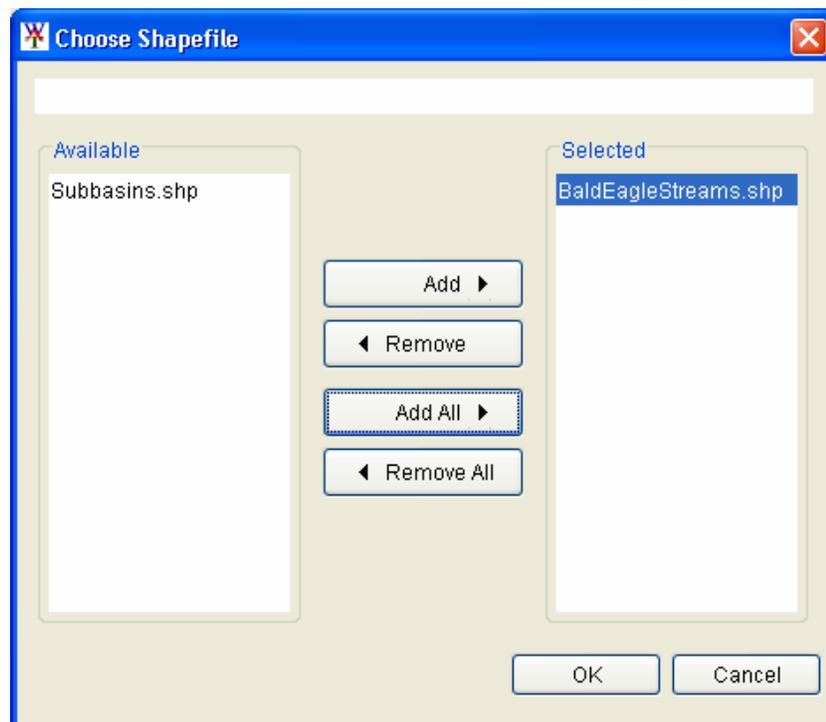


Figure 7.36 Choose Shapefile Dialog Box

shapefile that has been selected. To choose a different polyline shapefile, use the **Add** and **Remove** buttons to get the correct shapefile. In the example, Figure 7.36, the correct polyline shapefile is *BaldEagleStreams.shp*. Click **OK**, the **Choose Shapefile** dialog box (Figure 7.36) will close.

- Once the correct shapefile has been chosen, the program automatically searches for a database field name of **Stream_ID**. If there is not a database field name of **Stream_ID** in the shapefile you choose, you must select the database field name that contains the names of each stream from the **Database Field Name** list. In the example, Figure 7.35 (page 7-28), for the shapefile *BaldEagleStreams.shp*, the database field name is *Stream_ID*.
- When you have selected the correct database field name, the table will list the stream names. If each stream is a contiguous line with one upstream point and one downstream point, then the checkbox in the **Import** column of the table (see Figure 7.35, page 7-28) will be set. If there is something wrong with the line that represents a stream, the checkbox will not be set, and the WAT will not import that stream element.
- Gap Tolerance** is used to connect stream elements that have a gap between the end point and the junction with another stream. By default, the **Gap Tolerance** is set to zero (0.0), so the WAT can connect streams to other streams that are right on top of each other.

If you click **Gap Tolerance**, then you need to enter a value larger than zero in the **Gap Tolerance** box (see Figure 7.35, page 7-28), which will allow the WAT to connect streams that might have a larger gap between them.

9. The **Replace Existing Stream Alignment** flag, allows you to replace the existing stream alignment with the one you are currently importing from the selected ArcView® shapefile.
10. When importing a stream alignment from an ArcView shapefile, the individual streams can be in the wrong direction (downstream to upstream). You can reverse the direction of individual streams or all streams. From the **Import Stream Alignment** dialog box (see Figure 7.35, page 7-28), click **Reverse Direction**. This will place a check mark in the **Reverse Direction** column of the table for all streams. If you know that only individual streams have an issue, click in the **Reverse Direction** to select the stream.
11. Once everything is set, click **Import**. The stream alignment will be automatically drawn in the map window. A message box will appear letting you know that the stream alignment imported successfully, click **OK** and the message box will close. From the **File** menu, click **Close**, the **Import Stream Alignment** dialog box will close (see Figure 7.35, page 7-28).

7.8.11 Exporting a Stream Alignment

If you have digitized a stream alignment, you can save that stream alignment as an ArcView® shapefile. To export a stream alignment you must have a stream alignment in the map window.

To export a stream alignment:

1. On the **Maps** menu, point to **Export**, and then click **Stream Alignment**.
2. A **Save** browser will open (Figure 7.37). Enter a name in the **File name** box. Click **OK**, the **Save** browser will close, and you will have an ArcView® shapefile of the displayed stream alignment.

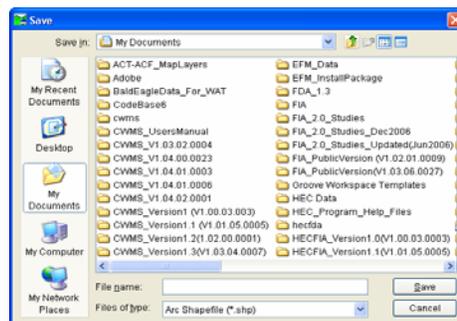


Figure 7.37 Save Browser

7.8.12 Saving Stream Alignment Data

To save your stream alignment input, from the **Stream Alignment** shortcut menu (see Figure 7.20, page 7-17), click **Save**, your stream

alignment has been saved. Another way to save data is on the **File** menu, click **Save Study**. Both commands will save all of the stream alignment input to the appropriate files created and used by the WAT for the stream alignment.

7.9 Measures

Measures are components of an existing or proposed physical system and provide a starting point for implementation in a particular model. All models must incorporate the presence of measures in the system, although the measures maybe represented very differently from model to model. In the Beta Version, measure data consists of the measure type, name, description, and location.

7.9.1 Reservoirs

A **reservoir** is the impoundment created behind dams, or behind navigation locks and dams. For the WAT a reservoir also includes the dam built on a stream to store water for uses such as flood damage reduction, hydroelectric power generation, recreation use, and water supply, etc.

Creating a Reservoir

To add a reservoir:



1. From the **Schematic Tab**, on the **Schematics** folder, right-click on the schematic that requires a reservoir to be added. From the shortcut menu, click **Open**; a schematic map window will open.
2. On the map toolbar, press the **Reservoir Tool**.
3. Hold down the **CTRL** key and click on the stream alignment to place the upstream end of the reservoir. Release the **CTRL** key; drag the mouse to the downstream end of the reservoir and click.
4. The **Name New Reservoir** dialog box will open (Figure 7.38). Enter the new **Name** (required) and **Description** (optional, but recommended). Click **OK**, the **Name New Reservoir** dialog box will close.



Figure 7.38 Name New Reservoir Dialog Box

A reservoir is the impoundment created behind dams, or behind navigation locks and dams. For the WAT a reservoir also includes the dam built on a stream to store water for uses such as flood damage reduction, hydroelectric power generation, recreation use, and water supply, etc.

- The reservoir will now appear on the schematic as a cyan triangle (reservoir pool), a blue line (storage reach), a gray rectangle (dam), and two common computation points that represent the upstream and downstream ends of the reservoir, as shown in Figure 7.39.

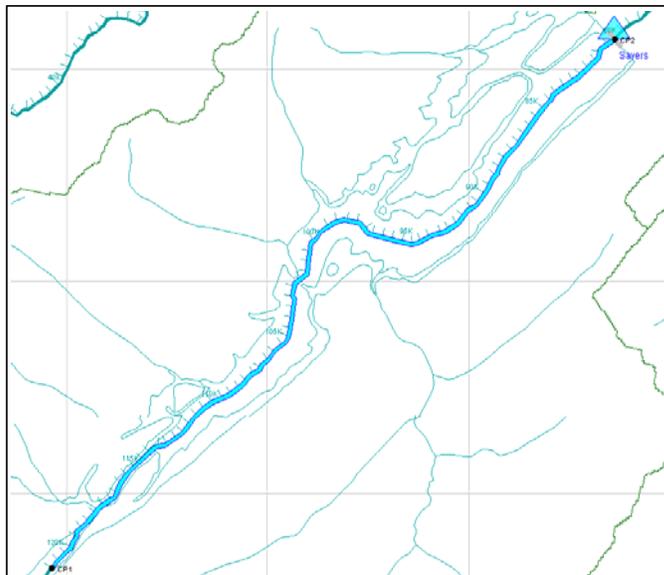


Figure 7.39 A Reservoir Added to the Map Window

- The default representation of the reservoir pool is a triangle; you can edit this triangle if you want a more detailed representation of the pool. With the **Reservoir Tool** pressed, double click on the reservoir. The triangle (Figure 7.40) will now be green with a blue outline color. Also, there are three vertex points (blue), and at the apex of the triangle is the reservoir label, which is represented by a yellow circle.

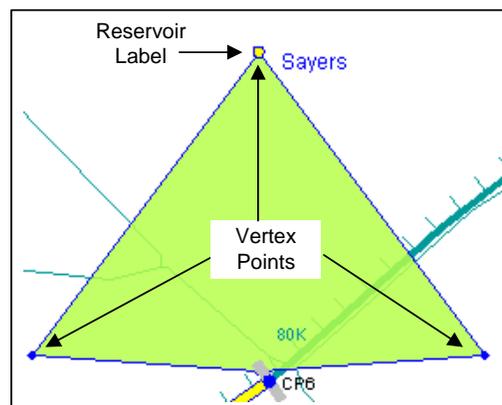


Figure 7.40 Reservoir Pool

- By clicking and dragging the yellow circle you can move the reservoir label to an appropriate location. Just like on the stream alignment you can add, move, and delete vertex points. Figure 7.41 (page 7-33) illustrates how the reservoir pool shown in Figure 7.40 has been edited to give a more detailed representation of the reservoir pool.
- When a reservoir is created there are two common computation points that are created with default names. It is recommended that you change the names of the two common computation points. These two common computations points represent the inflow and outflow junctions of the reservoir and should be renamed accordingly.

A reservoir in the WAT is represented as a reservoir pool (cyan triangle), a storage reach (blue line), a dam (gray rectangle), and two common computation points that represent the upstream and downstream ends of the reservoir

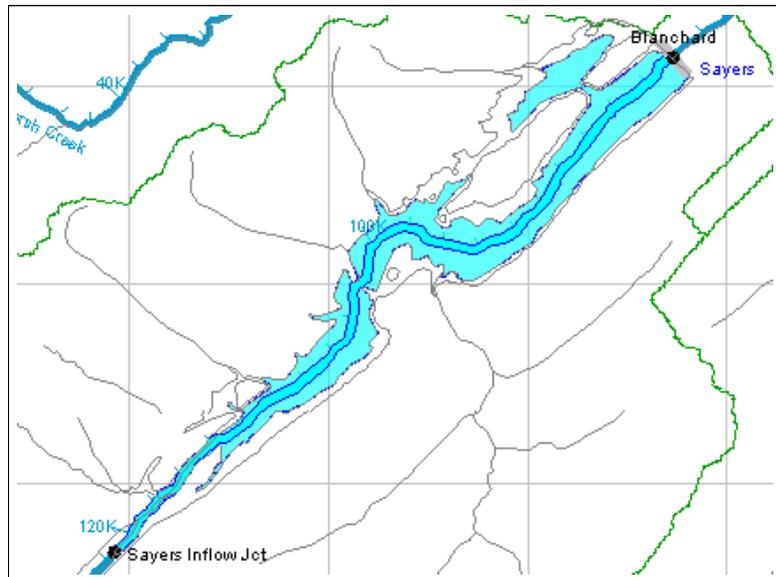


Figure 7.41 Detailed Representation of a Reservoir Pool

9. To change the name of a common computation point, press the **Computation Point Tool**, right click on one of the common computation points. From the shortcut menu, click **Rename Computation Point**; the **Rename Computation Point** dialog box will open (Figure 7.42).

In the **Name** box, enter the new name, and in the **Description**

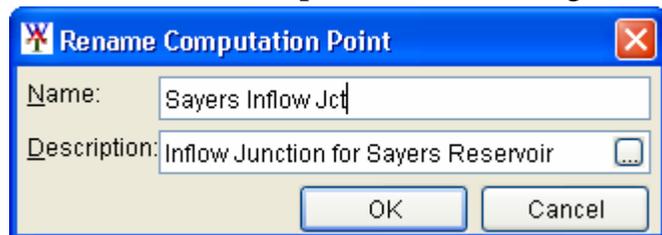


Figure 7.42 Rename Computation Point Dialog Box

box enter a

description (optional, but recommended). For example, in Figure 7.41, the inflow junction for the *Sayers Reservoir* has been labeled *Sayers Inflow Jct*, and the outflow junction has been labeled *Blanchard* since there is a gage that is named and very close to the outflow junction of the reservoir. For further information on common computation points see Section 7.10 (page 7-43).

Editing an Existing Reservoir

After drawing a reservoir in the display area, you can rename an individual reservoir, remove a reservoir from the active configuration, delete individual reservoirs, create configuration notes for individual reservoirs, and edit individual reservoir properties. All of these tasks are accomplished through the reservoir shortcut menu (see Figure 7.43, page 7-34). To access the reservoir shortcut menu, from a schematic, and with the **Reservoir Tool** (on the map toolbar, press the **Reservoir Tool**) selected, right-click on a reservoir.

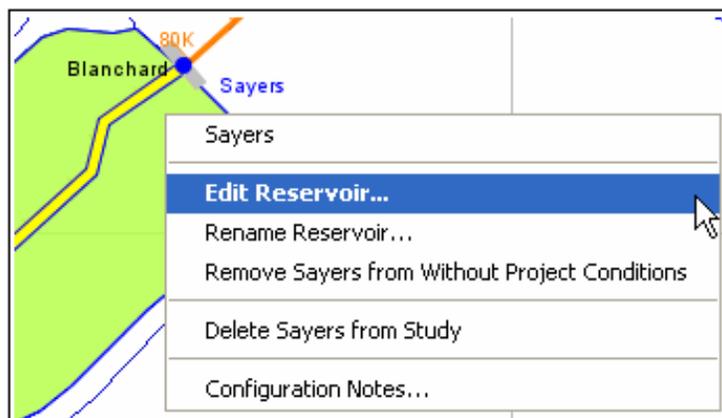


Figure 7.43 Reservoir Shortcut Menu

Renaming a Reservoir

To rename a reservoir:

1. Right-click on the reservoir that you want to rename, and click **Rename Reservoir** from the reservoir shortcut menu (Figure 7.43).
2. The **Rename Reservoir** dialog box will open (Figure 7.44). Enter the new **Name** (required) and **Description** (optional, but recommended) for the reservoir.

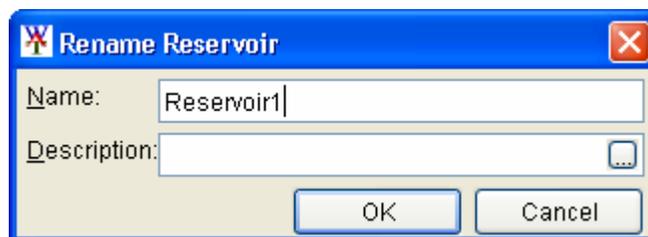


Figure 7.44 Rename Reservoir Dialog Box

3. Click **OK**, a warning message will open asking you if you really want to rename the selected reservoir. Click **Yes**, the warning message and the **Rename Reservoir** dialog box will close, and the reservoir will display the new name.

Removing a Reservoir from a Schematic

The WAT allows you to remove reservoirs from existing schematics. The reservoir will be removed from the schematic, but not from the study.

To remove a reservoir from a schematic:

1. Right-click on the reservoir you want to remove from the active schematic, and click **Remove ReservoirName from SchematicName** from the reservoir shortcut menu (Figure 7.43).

2. A warning message will open asking you if you are sure you want to remove the selected reservoir from the current schematic. Click **Yes**, the warning message will close, and the reservoir will disappear from the schematic.

Deleting a Reservoir

To delete a reservoir:

1. Right-click on the reservoir you want to delete, and click **Delete ReservoirName from Study** from the reservoir shortcut menu (see Figure 7.43, page 7-34).
2. A warning message will open asking you if you really want to delete the selected reservoir. Click **Yes**, another warning message will open asking you if you wish to delete the computation points associated with the reservoir. Click **Yes**, the warning message will close, the reservoir and computation points will no longer appear in the schematic and both have been removed from the study.

Adding Schematic Notes for a Reservoir

Schematic notes allow you to add information about a reservoir specific to a schematic. Schematic notes are helpful when multiple schematics have been defined.

To add schematic notes for a reservoir:

1. Right-click on the reservoir that you want to add schematic notes to, and click **Configuration Notes** from the reservoir shortcut menu (see Figure 7.43, page 7-34).
2. The **Notes:** dialog box (Figure 7.45) will open. Enter information in the **Configuration Notes** box that describes the selected reservoir for the current schematic.

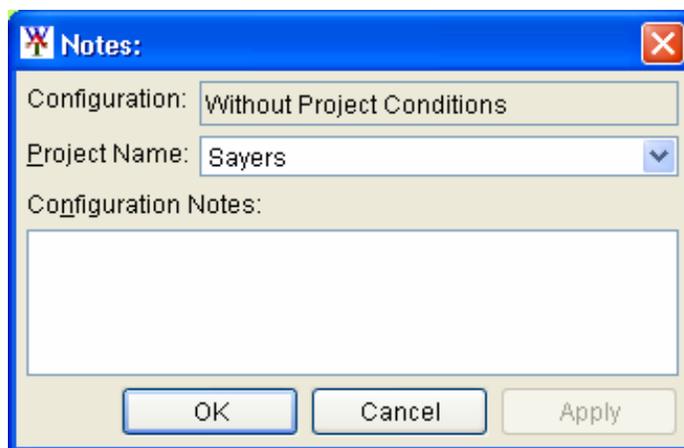


Figure 7.45 Notes: Dialog Box

Editing Reservoir Properties

You can edit the properties of a reservoir you have created. Properties that can be changed are the description, whether the reservoir is an existing project, whether the reservoir is a Corps project, and enter the year the reservoir came on-line.

To edit reservoir properties:

1. Right-click on the reservoir whose properties you would like to change, and click **Edit Reservoir** from the reservoir shortcut menu (see Figure 7.43, page 7-34).
2. The **Reservoir Properties Editor** will open (Figure 7.46). From the **Description** box you can edit or add a description.

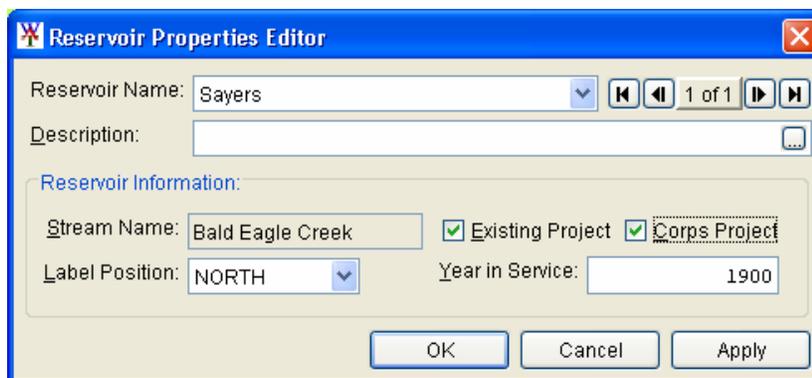


Figure 7.46 Reservoir Properties Editor

3. If the selected reservoir is an existing project, select the **Existing Project** check box (Figure 7.46).
4. If the reservoir is a Corps project, select the **Corps Project** check box.
5. If you know what year the reservoir came on-line, enter a year in the **Year in Service** box. For the Beta Version this is just informational and is not used in any computation.

Graphically Editing a Reservoir



After creating a reservoir, you can graphically edit the reservoir. By using the **Reservoir Tool**, the **CTRL** key, and the **SHIFT** key, you can edit a reservoir by adding, moving, and deleting vertex points. This is done graphically on the schematic in the active map window.

Adding Vertices to a Reservoir

To add vertex points to an existing reservoir:

1. Double-click on the reservoir that you want to add a vertex point to, and the polygon will turn green.
2. Place the pointer on the selected reservoir where you want to add a vertex point. Hold down the **CTRL** key and click. A blue point will now appear on the selected reservoir, which represents a new vertex point.

Moving the Vertices of a Reservoir

To move vertex points on an existing reservoir:

1. Double-click on the reservoir where you want to move a vertex point. The selected reservoir will turn green, and the individual vertex points will turn blue.
2. Click on the vertex point you wish to move, and drag the vertex point to a new location, this is illustrated in Figure 7.47.

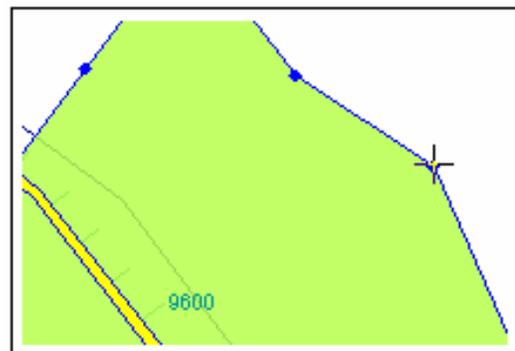


Figure 7.47 Move a Vertex Point

Deleting Vertices from a Reservoir

To delete vertex points from an existing reservoir:

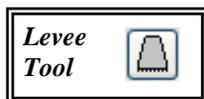
1. Double-click on the reservoir where you want to delete a vertex point. The selected reservoir will turn green, and the individual vertex points will turn blue.
2. Hold down the **SHIFT+CTRL** keys, and click on the vertex point that you want to delete. The vertex point will disappear from the reservoir.

7.9.2 Levees

A **levee/floodwall** is a man-made barrier built along a stream to provide protection from flooding. A levee/floodwall can reduce flood damage by preventing flood stages from reaching a potential damage area.

Creating a Levee

To add a levee:



1. From the **Schematic Tab**, from the **Schematics** folder, right-click on the schematic that requires a levee to be added. From the shortcut menu, click **Open**; a schematic map window will open.
2. On the map toolbar, press the **Levee Tool**.
3. Hold down the **CTRL** key and click on the stream alignment to place the upstream end of the levee. Release the **CTRL** key, drag the mouse to the downstream end of the levee and click.
4. The **Name New Levee** dialog box opens (Figure 7.48). Enter the new **Name** (required) and **Description** (optional, but recommended). Click **OK**, the **Name New Levee** dialog box will close.



Figure 7.48 Name New Levee Dialog Box

5. The levee will now appear on the schematic as a black line, as shown in Figure 7.49.

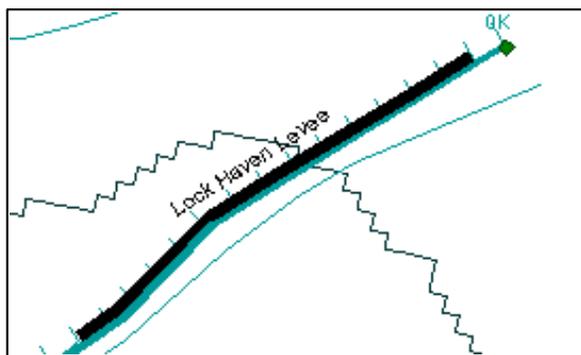
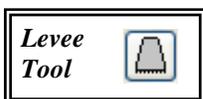


Figure 7.49 A Levee Added to the Schematic

Editing an Existing Levee



After drawing a levee on the schematic, you can rename an individual levee, remove a levee from the active schematic, delete individual levees, create schematic notes for individual levees, and edit individual levee properties. All of these tasks are accomplished through the levee shortcut menu (see Figure 7.50, page 7-39). To access the levee shortcut menu, from a schematic, and with the **Levee Tool** (on the map toolbar, press the **Levee Tool**) selected, right-click on a levee.

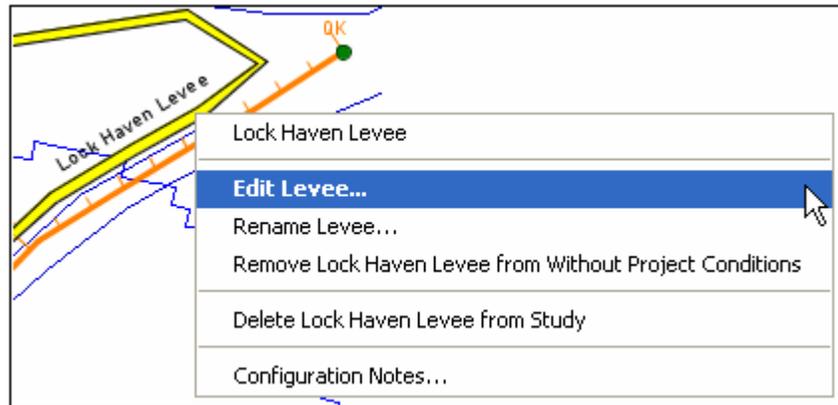


Figure 7.50 Levee Shortcut Menu

Renaming a Levee

To rename a levee:

1. Right-click on the levee that you want to rename, and click **Rename Levee** from the levee shortcut menu (Figure 7.50).
2. The **Rename Levee** dialog box will open (Figure 7.51). Enter the new **Name** (required) and **Description** (optional, but recommended) for the levee.



Figure 7.51 Rename Levee Dialog Box

3. Click **OK**, a warning message will open asking you if you really want to rename the selected levee. Click **Yes**, the warning message and the **Rename** dialog boxes will close, and the levee will display the new name.

Removing a Levee from a Schematic

The WAT allows you to remove levees from existing schematics. The levee will be removed from the schematic, but not from the study.

To remove a levee from a schematic:

1. Right-click on the levee you want to remove from the active schematic, and click **Remove LeveeName from SchematicName** from the levee shortcut menu (Figure 7.50).

2. A warning message will open asking you if you are sure you want to remove the selected levee from the current schematic. Click **Yes**, the warning message will close, and the levee will disappear from the schematic.

Deleting a Levee

To delete a levee:

1. Right-click on the levee you want to delete, and click **Delete LeveeName from Study** from the levee shortcut menu (see Figure 7.50, page 7-39).
2. A warning message will open asking you if you really want to delete the selected levee. Click **Yes**, the warning message will close, the levee will no longer appear in the schematic and has been removed from the study.

Adding Schematic Notes for a Levee

Schematic notes allow you to add information about a levee specific to a schematic. Schematic notes are helpful when multiple schematics have been defined.

To add schematic notes for a levee:

1. Right-click on the levee you want to add schematic notes too, and click **Configuration Notes** from the levee shortcut menu (see Figure 7.50, page 7-39).
2. The **Notes:** dialog box will open (see Figure 7.45, page 7-35). Enter information in the **Configuration Notes** box that describes the selected levee for the current schematic.

Editing Levee Properties

You can now edit the properties of a levee you have created. Properties that can be changed are: the description of the levee; whether the levee is an existing project; whether the levee is a Corps project; the year the levee came on-line; what stream the levee is located on; the start and end stations of the levee; adjust the distance (offset) from the stream the levee is placed; and, what stream bank the levee is located on.

To edit levee properties:

1. Right-click on the levee whose properties you would like to change, and click **Edit Levee** from the levee shortcut menu (see Figure 7.50, page 7-39).

- The **Levee Properties Editor** will open (Figure 7.52).

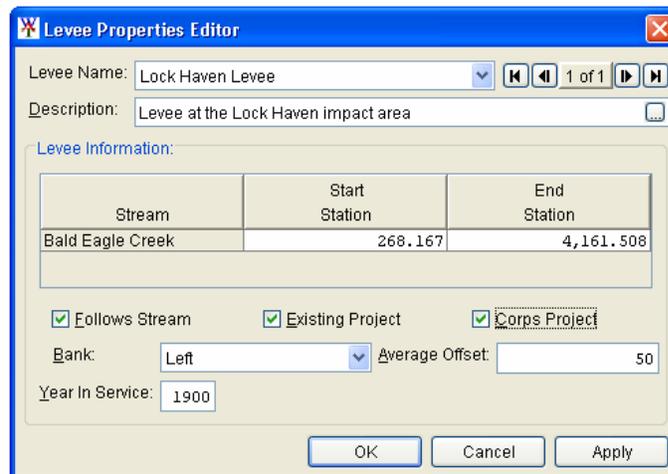


Figure 7.52 Levee Properties Editor

- From the **Description** box you can edit or add a description.
- If the selected levee is an existing project, click **Existing Project**.
- If the levee is a Corps project, select **Corps Project** (Figure 7.52).
- The table shows the stream the levee is on and the stream stationing for the starting and ending stations of the levee. If you want to change the starting and ending stations of the levee, edit the cells under the **Start Station** and **End Station** columns in the table.
- By default a levee will follow a stream, so the **Follows Stream** check box will be selected. However, not all levees follow a stream exactly, so if you want to give a more detailed representation of the levee, clear **Follows Stream**. Now if you double click on the levee, vertex points (black circles) appear. Just like on the stream alignment you can add, move, and delete vertex points. Figure 7.53 illustrates how the levee shown in Figure 7.49 (page 7-38) has been edited to give a more detailed representation.

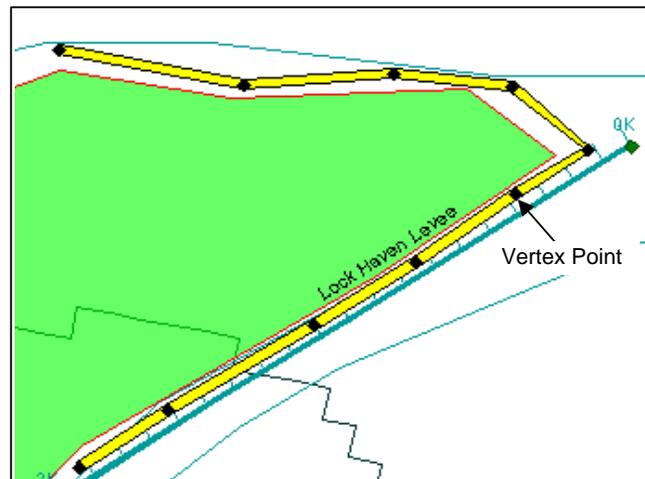
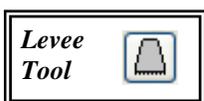


Figure 7.53 Detailed Representation of a Levee

- The program automatically determines which stream bank the levee is located on. If you want to change the stream bank location, from

- the **Bank** list (see Figure 7.52, page 7-41) select the appropriate stream bank.
9. If you know what year the levee came on-line, enter a year in the **Year in Service** box. For the Beta Version this is just informational and is not used in any computation.
 10. When a levee is created, a default-offset distance from the stream alignment is set. The default offset is shown in the **Average Offset** box (see Figure 7.52, page 7-41) and is 50. To change the offset, in the **Average Offset** box change the value, click **Apply**. The levee on the schematic will move according to the new offset value.
 11. Click **OK**, the **Levee Properties Editor** (see Figure 7.52, page 7-41) will close.

Graphically Editing a Levee



After creating a levee, you can graphically edit the levee. By using the **Levee Tool**, the **CTRL** key, and the **SHIFT** key, you can edit a levee by adding, moving, and deleting vertex points. This is done graphically on the schematic in the active map window.

Adding Vertices to a Levee

To add vertex points to an existing levee:

1. Double-click on the levee that you want to add a vertex point to, and the line will turn yellow.
2. Place the pointer on the selected levee where you want to add a vertex point. Hold down the **CTRL** key and click. A black point will now appear on the selected levee, which represents a new vertex point.

Moving the Vertices of a Levee

To move vertex points on an existing levee:

1. Double-click on the levee where you want to move a vertex point. The selected levee will turn yellow, and the individual vertex points will turn black.
2. Click on the vertex point you wish to move, and drag the vertex point to a new location, this is illustrated in Figure 7.54.

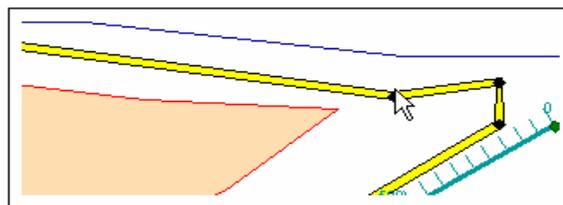


Figure 7.54 Move a Vertex Point

Deleting Vertices from a Levee

To delete vertex points from an existing levee:

1. Double-click on the levee where you want to delete a vertex point. The selected levee will turn yellow, and the individual vertex points will turn black.
2. Hold down the **SHIFT+CTRL** keys, and click on the vertex point that you want to delete. The vertex point will disappear from the levee.

7.9.3 Saving Measure Data

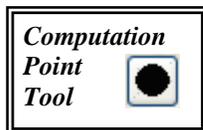
To save your input for measures, on the **File** menu, click **Save Study**. This will save all of the data for measures to the appropriate files created and used by the WAT for measures.

7.10 Common Computation Points

Common computation points are locations where one model transfers data to another model, or where results are needed for model development or alternative analysis, or where input boundary conditions are to be defined. The common computation points need to be consistent for all models and should be placed on the stream alignment based on knowledge of possible study alternatives. The entire study team should be involved in the definition of the common computation points.

7.10.1 Creating a Common Computation Point

To add a common computation point:



1. From the **Schematic Tab**, on the **Schematics** folder, right-click on the schematic that requires a common computation point to be added. From the shortcut menu, click **Open**; a schematic map window will open.
2. On the map toolbar, press the **Computation Point Tool**.
3. Hold down the **CTRL** key and click on the stream alignment to place the common computation point.
4. The **Name New Computation Point** dialog box will open (see Figure 7.55, page 7-44). Enter the new **Name** (required) and **Description** (optional, but recommended). Click **OK**, the **Name New Computation Point** dialog box will close.

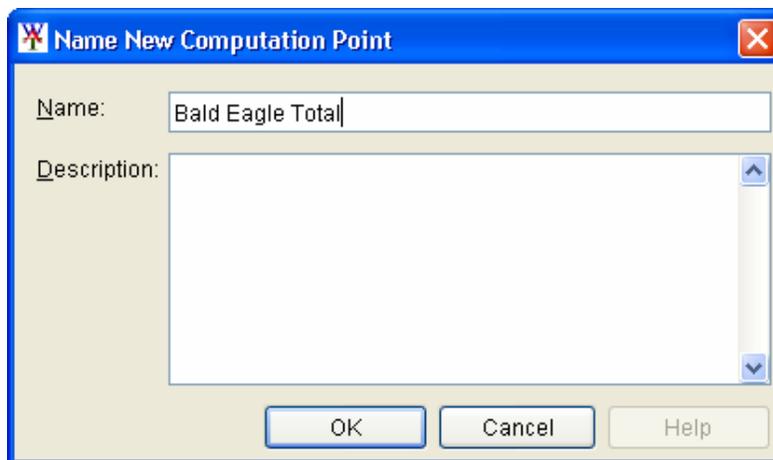


Figure 7.55 Name New Computation Point Dialog Box

5. The common computation point will now appear in the map window as a black circle.



To add a common computation point at a stream junction (see Section 7.8.5, page 7-23):

1. From the **Schematic Tab**, right-click on the schematic that requires a common computation point to be added. From the shortcut menu, click **Open**; a schematic map window will open.
2. On the map toolbar, press the **Computation Point Tool**.
3. Hold down the **CTRL** key and click on the stream junction to place a common computation point.
4. A slightly different **Name New Computation Point** dialog box will open (Figure 7.56). Enter the new **Name** (required) and **Description** (optional, but recommended).

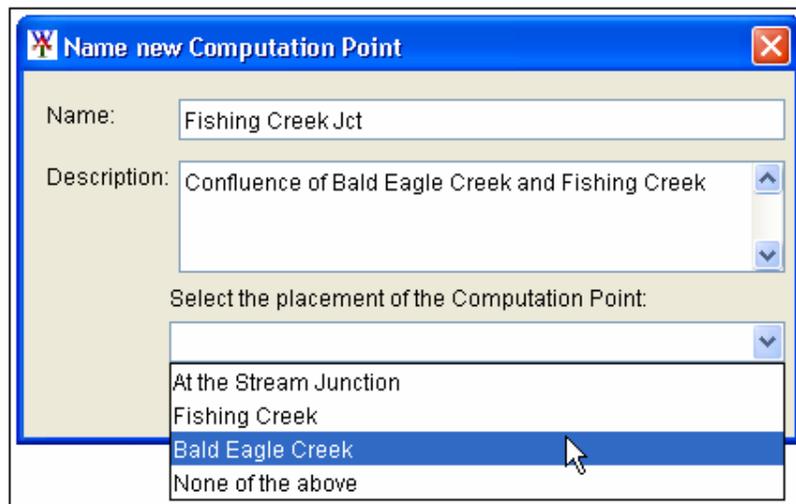


Figure 7.56 Name New Computation Point Dialog Box at a Stream Junction

5. From the **Select the Placement of the Computation Point** list, you determine exactly where the common computation point will be

placed. You chose to have the common computation point placed on the stream junction, along one of the streams that form the stream junction, or none of the above. For example, in Figure 7.56 (page 7-44), the common computation point will be placed on the stream junction.

6. Click **OK**, the **Name New Computation Point** dialog box will close. The common computation point will now appear in the display area as a black circle.

7.10.2 Editing an Existing Common Computation Point

After drawing a common computation point in the map window, you can rename an individual common computation point, delete individual common computation points, and edit individual common computation point properties.

All of these tasks are accomplished through the common computation point shortcut menu (Figure 7.57). To access the computation point shortcut menu, from a schematic map window, and with the

Computation Point Tool (on the map toolbar, press the **Computation Point Tool**) selected, right-click on a common computation point.

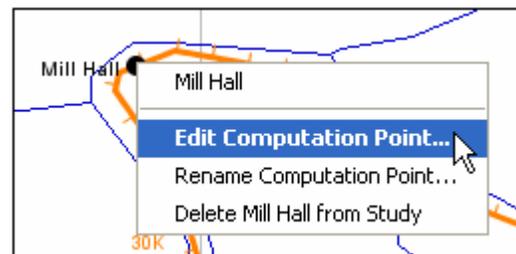
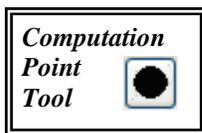


Figure 7.57 Common Computation Point Shortcut Menu

Renaming a Common Computation Point

To rename a common computation point:

1. Right-click on the common computation point you want to rename, and click **Rename Computation Point** from the common computation point shortcut menu (Figure 7.57).
2. The **Rename Computation Point** dialog box opens (Figure 7.58). The new **Name** (required) and **Description** (optional, but recommended) are entered for the common computation point.

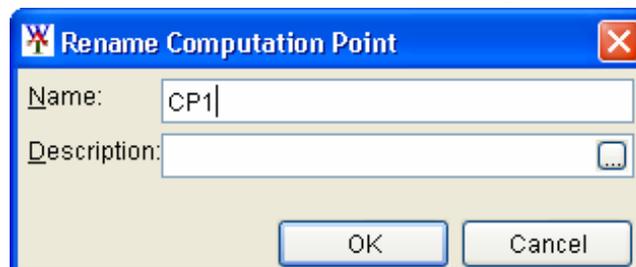


Figure 7.58 Rename Computation Point Dialog Box

3. Click **OK**, a warning message will open asking you if you really want to rename the selected common computation point. Click **Yes**, the warning message and the **Rename Computation Point** dialog boxes will close, and the common computation point will display the new name.

Deleting a Common Computation Point

Common computation points created with a project (i.e., reservoirs) or an impact area cannot be deleted. These common computation points are deleted when the project or impact area is deleted.

To delete a common computation point:

1. Right-click on the common computation point you want to delete, and click **Delete *ComputationPointName* from Study** from the common computation point shortcut menu (see Figure 7.57, page 7-45).
2. A warning message will open asking you if you really want to delete the selected common computation point. Click **Yes**, the warning message will close and the common computation point will no longer appear in the map window.

Editing Common Computation Point Properties

The general properties of a common computation point that you can edit include: the description of the computation point; the stream associated with the common computation point; the position of the common computation point label on the map window; the stream stationing associated with the common computation point; the easting and northing coordinates of the common computation point; if the common computation point was system generated what projects generated that common computation point; and, place the common computation point on the stream alignment.

To edit common computation point properties:

1. Right-click on the common computation point whose properties you would like to change, and click **Edit Computation Point** from the common computation point shortcut menu (see Figure 7.57, page 7-45).
2. The **Computation Point Properties Editor** will open (see Figure 7.59, page 7-47). From the **Description** box you can edit or add a description (recommended).

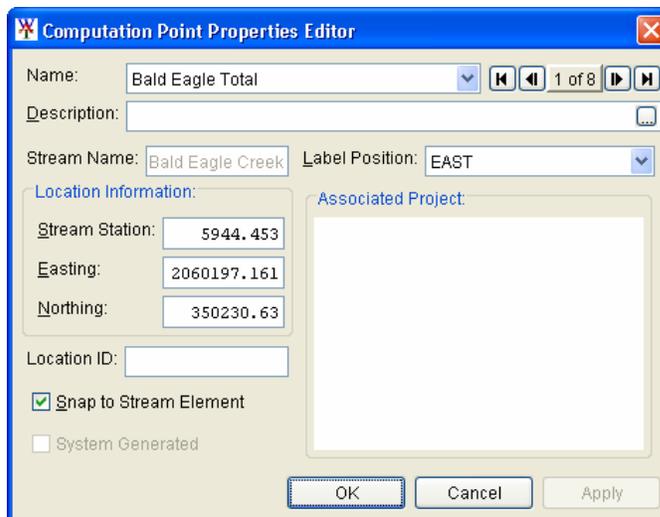
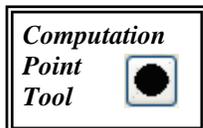


Figure 7.59 Computation Point Properties Editor

3. By default the WAT automatically decides which stream the common computation point is located on. The **Stream Name** box (Figure 7.59) provides you with this information and is not editable.
4. The WAT automatically generates the stream station for the common computation point. If you want to change the stream station, in the **Stream Station** box enter a new value.
5. The **Label Position** list allows you to place the common computation point label on the map window.
6. The location of the common computation point is displayed by the northing and easting coordinates. These values are not editable.
7. By default, a common computation point is placed on a stream in the stream alignment. If you wish to have a common computation point that is not on a stream, clear the **Snap to Steam Element** check box.
8. Once you have cleared the **Snap to Stream Element**, you can edit the easting and northing coordinates of the common computation point, and you can move the common computation point off the stream alignment.

7.10.3 Graphically Editing a Common Computation Point



After creating a common computation point, you can graphically edit a common computation point. By using the **Computation Point Tool**, you can move common computation points. This is done graphically on the schematic in the active map window.

Moving a Common Computation Point

To move a computation point:

1. On the map toolbar, press the **Computation Point Tool**.
2. Double click on a common computation point (Figure 7.60).
3. The common computation point now has four little black dots (handles) at each corner. Click and drag the common computation point to where you want the common computation point to be positioned, and release. The common computation point will now appear on the map window in its new position.

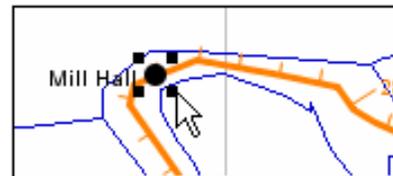


Figure 7.60 Move a Common Computation Point

4. You will only be able to move the common computation point along a stream. By default a common computation point must live on a stream. If you want a common computation point not to be on the stream alignment, you must change a setting in the editor (see **Edit Common Computation Point Properties**, under Section 7.10.2, page 7-47, Steps 7 and 8)..

7.10.4 Saving Common Computation Point Data

To save your input for common computation points, on the **File** menu, click **Save Study**. This will save all of the data for common computation points to the appropriate files created and used by the WAT for common computation points.

7.11 Impact Areas

An **impact area** is any distinct portion of a study that is affected by rising or falling stage in a stream, river, lake, or reservoir. Impact areas are an optional element, and are only required when you want to compute impacts at damage area centers in the study area, and you have an HEC-FIA model as part of your WAT modeling effort.

You can use underlying map layers to aid in placing impact areas at the proper location on the schematic. Besides location, a map layer can also give you a concept of the dimensions of an impact area. However, the Beta version of the WAT does not have any geo-referencing attached to the impact area polygon.

7.11.1 Creating an Impact Area

You can either digitize your impact areas by hand or import impact areas from an ArcView® shapefile. The following are the steps for digitizing

impact areas; see Section 7.11.4 (page 7-54) for details on importing your impact areas.

To add an impact area to the schematic:



1. From the **Schematic Tab**, from the **Schematics** folder, right-click on the schematic that requires a common computation point to be added. From the shortcut menu, click **Open**; a schematic map window will open.
2. On the map toolbar, press the **Impact Area Tool**.
3. Hold down the **CTRL** key while clicking the mouse button. Each click creates a vertex point (Figure 7.61), which is the boundary of the polygon. When reaching the end point, release the **CTRL** key and click.

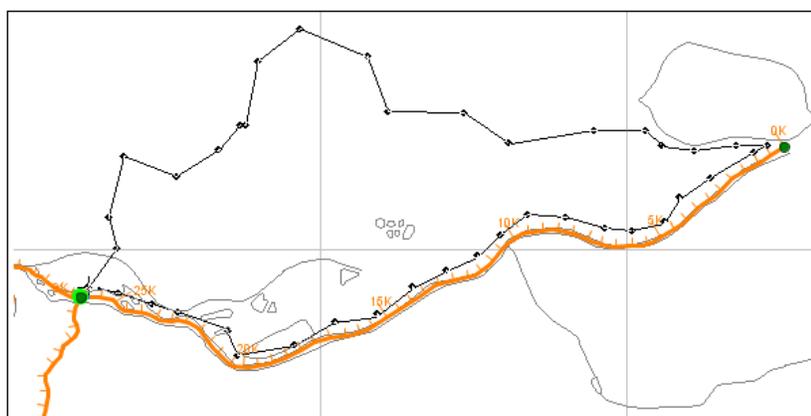


Figure 7.61 Add an Impact Area to the Schematic

4. The **Name New Impact Area** dialog box will open (Figure 7.62). You must enter a name, and if needed, you can enter a description. Click **OK**, the **Name New Impact Area** dialog box will close.

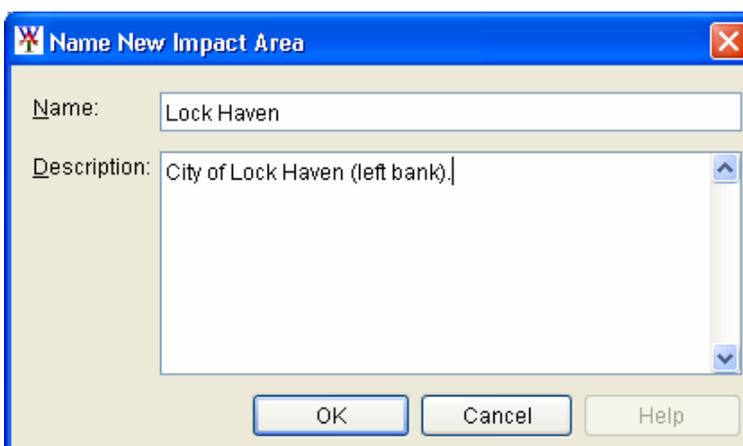


Figure 7.62 Name New Impact Area Dialog Box

5. The impact area will now appear in the display area as a green polygon with a name. Repeat steps 3 and 4 for each impact area in your watershed.

7.11.2 Editing an Existing Impact Area

After drawing an impact area on the schematic, you can rename an individual impact area, delete individual impact areas, create schematic notes for individual impact areas, and edit individual impact areas properties. All of these tasks are accomplished through the impact area shortcut menu (Figure 7.63).

To access the impact area shortcut menu, from a schematic, and with the **Impact Area Tool** (on the map toolbar, press the **Impact Area Tool**) selected, right-click on an impact area.

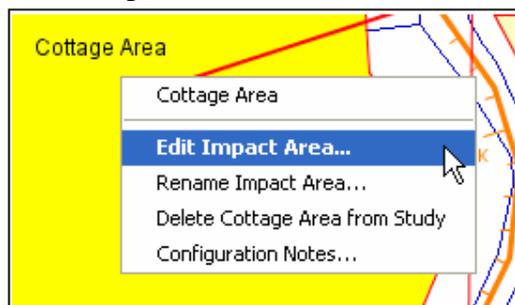


Figure 7.63 Impact Area Shortcut Menu

Renaming an Impact Area

To rename an impact area:

1. Right-click on the impact area you want to rename, and click **Rename Impact Area** from the impact area shortcut menu (Figure 7.63).
2. The **Rename Impact Area** dialog box will open (Figure 7.64). Enter the new **Name** (required) and **Description** (optional, but recommended for the impact area).
3. Click **OK**, a warning message will open asking you if you really want to rename the selected impact area. Click **Yes**, the warning message and the **Rename Impact Area** dialog boxes will close, and the impact area will display the new name.

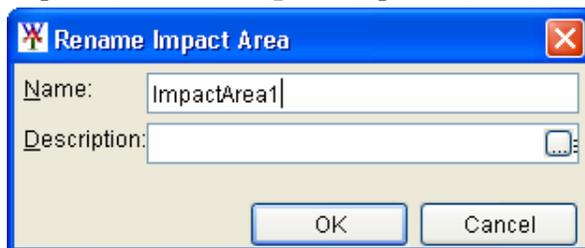


Figure 7.64 Rename Impact Area Dialog Box

Deleting an Impact Area

To delete an impact area:

1. Right-click on the impact area you want to delete, and click **Delete ImpactAreaName from Study** from the impact area shortcut menu (Figure 7.63).
2. A warning message will open asking you if you really want to delete the selected impact area. Click **Yes**, the warning message

will close, and the impact area will no longer appear in the display area.

Adding Schematic Notes for an Impact Area

Schematic notes allow you to add information about an impact area specific to a schematic. These are useful for describing impact areas that belong to schematics that include non-structural measures. If there are non-structural attributes for an impact area, you can have a symbol appear in the schematic for the selected impact area. Schematic notes are only added when other schematics have been defined.

To add schematic notes for an impact area:

1. Right-click on the impact area you want to add schematic notes to, and click **Configuration Notes** from the impact area shortcut menu (see Figure 7.63, page 7-50).
2. The **Configuration Notes Editor** will open (Figure 7.65). The **Configuration** box displays the current schematic. Enter information about this impact area for the current schematic in the **Configuration Notes** box.

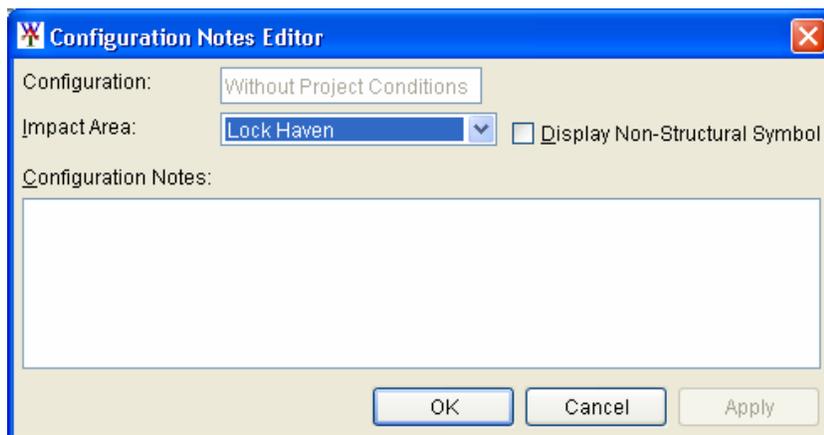


Figure 7.65 Configuration Notes Editor

3. If the notes are in regards to non-structural attributes, select **Display Non-Structural Symbol**. This will cause a symbol to appear in the selected impact area on the schematic.

Editing Impact Area Properties

In a schematic, you can describe the general and aesthetic properties of an impact area. The impact area properties that you can edit in a schematic include: the description of the impact area; the stream associated with the impact area; what bank of the stream the impact area is on; the color of the impact area polygon; the position of the impact area label on the display area; the geographical location of the index station; and, the geographical

location of the beginning and ending stations of the impact area polygon.

To edit impact area properties:

1. Right-click on the impact area whose properties you would like to change, and click **Edit Impact Area** from the available shortcut menu (see Figure 7.63, page 7-50).
2. The **Impact Area Properties Editor** will open (Figure 7.66).

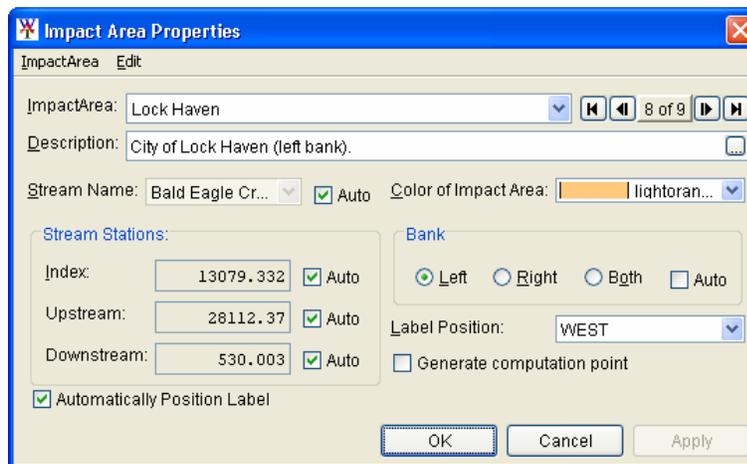


Figure 7.66 Impact Area Properties Editor

3. If the **Auto** check box is selected for an item, the value for this data item is automatically updated as the polygon or index location is moved in the display area. By default, when a polygon is drawn in the display area, these values are filled in automatically. If the check box is cleared, data can be entered manually into these fields, and the value will cease to be automatically updated if changes are made to the polygon. However, reselecting the check box allows the values to be automatically determined when edits are made in the display area.
4. From the **Description** box (Figure 7.66) you can edit or add a description.
5. If the default stream name selected by the WAT is incorrect, clear the **Auto** check box, and from the **Stream Name** list select the appropriate stream name.
6. If the default bank selected by the WAT is incorrect, clear the **Auto** check box, and select the appropriate stream bank from the **Bank** box.
7. By default, the color of the impact area polygon that you have drawn is green. You can change the color by selecting a different color from the **Color** list.
8. The **Label Position** list allows you to place the impact area label on the display area.
9. For each impact area, the WAT generates an index station; this index station is a location. If you want to place the index station yourself, clear the **Auto** check box next to the **Index** box (see

- Figure 7.66, page 7-52), and then enter the new stream stationing in the **Index** box.
10. Each impact area has a beginning and ending station that the program automatically computes. If you want to change the stream stationing the program has generated, clear the **Auto** check box next to the **Upstream** and **Downstream** boxes, and enter the new stream stationing in the **Upstream** box and the **Downstream** box.
 11. Click **OK**, the **Impact Area Properties Editor** (see Figure 7.66, page 7-52) will close.

7.11.3 Graphically Editing an Impact Area



After creating an impact area, you can graphically edit the impact area. By using the **Impact Area Tool**, the **CTRL** key, and the **SHIFT** key, you can edit an impact area by adding, moving, and deleting vertex points. This is done graphically on the schematic in the active map window.

Adding Vertices to an Impact Area

To add vertex points to an existing impact area:

1. Double-click on an impact area that you want to add a vertex point to, and the impact area will turn yellow.
2. Place the pointer on the selected impact area where you want to add a vertex point. Hold down the **CTRL** key and click. A red point will now appear on the selected impact area, which represents a new vertex point.

Moving the Vertices of an Impact Area

To move vertex points on an existing impact area:

1. Double-click on an impact area where you want to move a vertex point. The selected impact area will turn yellow, and the individual vertex points will turn red.
2. Click on the vertex point you wish to move, and drag the vertex point to a new location, this is illustrated in Figure 7.67.

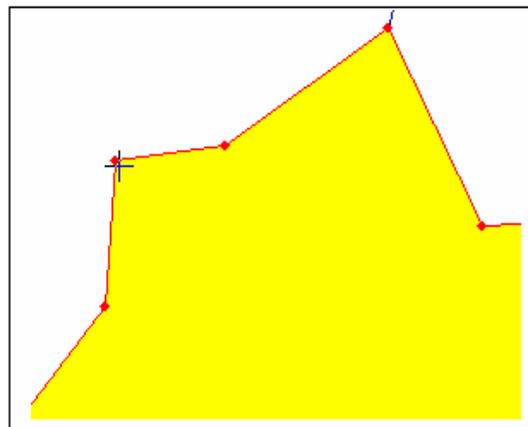


Figure 7.67 Move a Vertex Point

Deleting Vertices from an Impact Area

To delete vertex points from an existing impact area:

1. Double-click on an impact area where you want to delete a vertex point. The selected impact area will turn yellow, and the individual vertex points will turn red.
2. Hold down the **SHIFT+CTRL** keys, and click on the vertex point that you want to delete. The vertex point will disappear from the impact area.

7.11.4 Importing Impact Areas

To import impact areas, you must have as an active map layer (see Chapter 5, Section 5.2.2, page 5-3) that is an ArcView® shapefile (see Chapter 5, Section 5.2.1, page 5-1) that represents the impact areas that are in your study. This shapefile must have an attribute that is the name of each impact area, and each impact area must form a contiguous polygon.

To import impact areas:

1. On the **Maps** menu, point to **Import**, and then click **Impact Areas**.
2. The **Import Impact Areas** dialog box will open (Figure 7.68).

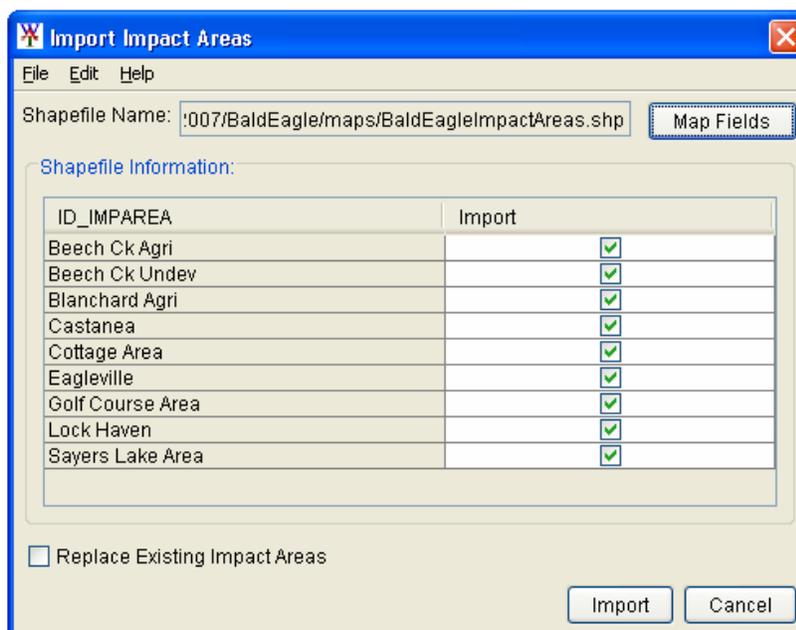


Figure 7.68 Import Impact Areas Dialog Box

3. In the **Shapefile Name** box, the name of the ArcView® shapefile that the WAT has chosen is displayed. The WAT automatically selects the first shapefile that contains polygons; if this is not the correct shapefile, on the **File** menu, click **Choose Shapefile**.

- The **Choose Shapefile** dialog box will open (Figure 7.69). The **Available** box lists the available polygon shapefiles that you have added as map layers. The **Selected** box shows the polygon

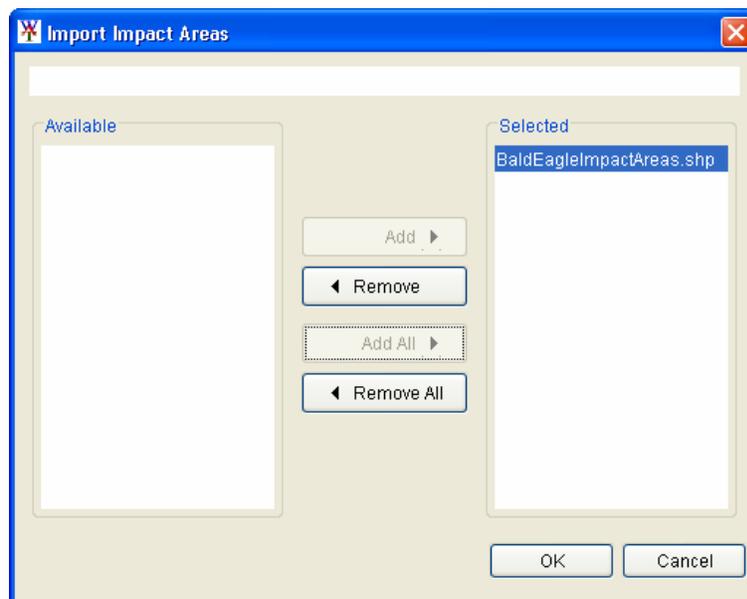


Figure 7.69 Choose Shapefile Dialog Box

shapefile that has been selected. To choose a different polygon shapefile, use the **Add** and **Remove** buttons to get the correct shapefile. In the example, Figure 7.69; the correct polygon shapefile is *BaldEagleImpactAreas.shp*.

- Once the correct shapefile has been selected, click **OK**. The **Choose Shapefile** dialog box will close.
- Once the correct shapefile has been chosen, the program automatically searches for a database fieldname of **ID_IMPAREA** (see Figure 7.68, page 7-54). If **ID_IMPAREA** is not a fieldname, you must select the database fieldname that contains the names of each impact area.

Click **Map Fields**, a dialog box opens (Figure 7.70). From the **ImpactArea Name Attribute** list, select the fieldname that contains the names of each impact area. Click **OK**, the dialog box closes and the left column of the table will reflect the

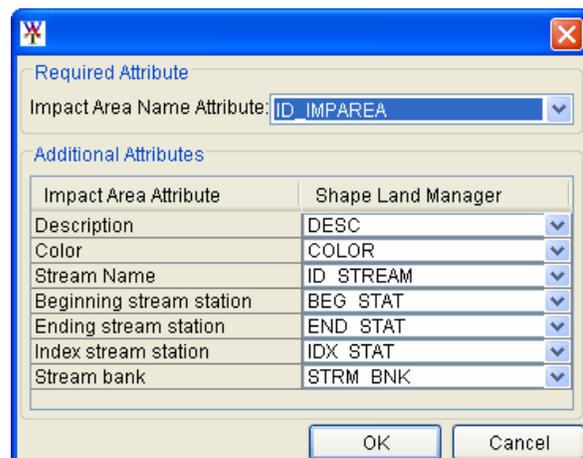


Figure 7.70 Database Fieldname Selection

fieldname in the column header. In the example, Figure 7.68 (page

- 7-54), for the shapefile *BaldEagleImpactAreas.shp*, the database field name is *ID_IMPAREA*.
7. When you have selected the correct database field name, the table will list the impact area names. If each impact area is a contiguous polygon, then the check box in the **Import** column of the table will be set. If there is something wrong with the polygon that represents an impact area, the check box will not be set, and the WAT will not import that impact area.
 8. The **Replace Existing Impact Areas** flag allows you to replace the existing impact areas with the one you are currently importing from the selected ArcView® shapefile.
 9. Once everything is set, click **Import**. A message box will appear stating the impact areas have imported successfully, click **OK** and the message box will close. The impact areas will be automatically drawn in the schematic. From the **File** menu, choose **Close**, the **Import Impact Areas** dialog box will close (see Figure 7.68, page 7-54).

7.11.5 Exporting Impact Areas

If you have digitized impact areas, you can save the impact areas as an ArcView® shapefile. To export impact areas you must have impact areas in the schematic.

To export impact areas:

1. On the **Maps** menu, point to **Export**, and then click **Impact Areas**.
3. A **Save File** browser will open (Figure 7.71). Enter a name in the **File name** box. Click **OK**, the **Save File** browser will close, and you will have an ArcView® shapefile of the displayed impact areas.

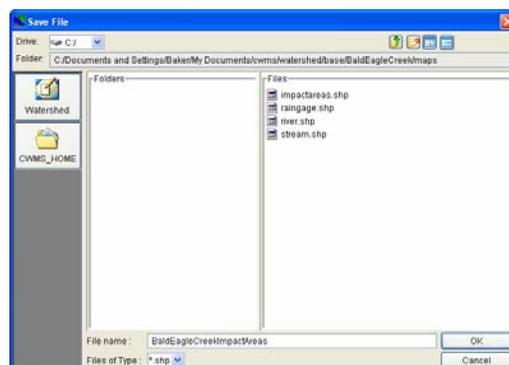


Figure 7.71 Save File Browser

7.11.6 Saving Impact Area Data

To save your input for impact areas, on the **File** menu, click **Save Study**. This will save all of the data for impact areas to the appropriate files created and used by the WAT for impact areas.

CHAPTER 8

Analysis Periods/Events

8.1 Overview

Analysis periods define the time window and events that could be associated with an alternative, and will be used for all the models.

Analysis periods define the time window and events that could be associated with an alternative, and will be used for all the models. An analysis period can represent single or multiple events. For example, a historical event, such as the 1993 flood, would be entered as a single event for a specific analysis period (time window). However, the development of frequency based storm events would be represented as multiple events under a single analysis period. An **event** is an occurrence of precipitation/snowmelt that leads to some sort of hydrologic response normally associated with a specific time period. An event can be historical or hypothetical, or it could represent a long term simulation (e.g., a fifty year simulation). Once the user has defined an alternative (such as the *Without Project Conditions* alternative), the next step is to create analysis periods and events.

8.2 Alternative and Simulation Manager

After the default alternative has been created, the next step is to create analysis periods (which include events). The WAT provides two ways to organize and develop analysis periods; one way is from the **Alternative and Simulation Manager** (Figure 8.1), and the other way is from the

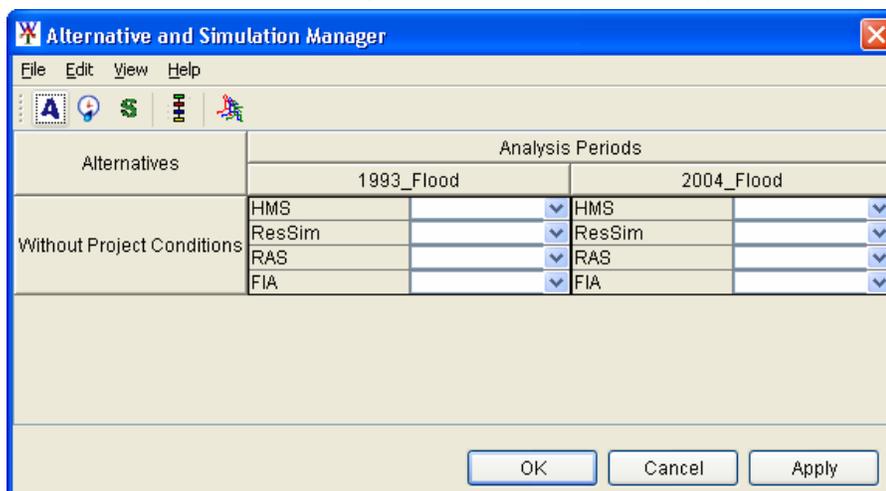


Figure 8.1 Alternative and Simulation Manager

Study Pane (see Section 8.3, page 8-10). This section covers using the **Alternative and Simulation Manager** for organizing and developing analysis periods.

In the WAT, the **Alternative and Simulation Manager** (see Figure 8.1, page 8-1) provides a convenient way to organize and develop the main components for a WAT study – alternatives, analysis period (events), and simulations. This chapter will focus on the organization and development of analysis periods. The **Alternative and Simulation Manager** has three areas where you can access commands that will allow you to create, delete, and rename analysis periods. These areas are the **Table** (Section 8.2.1), **Toolbar** (see Section 8.2.2, page 8-9) and **Menu Bar** (see Section 8.2.3, page 8-9). These areas and the available commands are described in the following sections.

To access the **Alternative and Simulation Manager**, from the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . Another way to access the **Alternative and Simulation Manager** is from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**. From either method the **Alternative and Simulation Manager** will open (see Figure 8.1, page 8-1).

8.2.1 Table

The **Alternative and Simulation Manager** (see Figure 8.1, page 8-1) table allows organization of a study's alternatives; a way to track the state of data sets needed for each model, create analysis periods, and create simulations. Since the focus of this chapter is analysis periods, this section will only focus on the available commands from the table to develop and organize analysis periods.

Analysis Periods

The analysis period shortcut menu (Figure 8.2) is available from the **Alternative and Simulation Manager** (see Figure 8.1, page 8-1) table, by right-clicking on the column header **Analysis Periods**. This shortcut menu will allow you to create, rename, and delete analysis periods. The following sections provide further details.

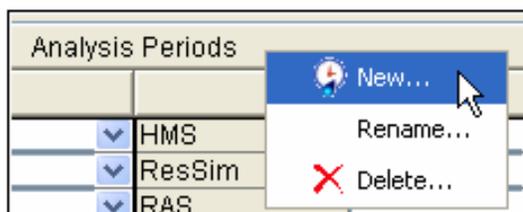


Figure 8.2 Analysis Periods Shortcut Menu

Creating an Analysis Period

To create an analysis period:

To access the *Alternative and Simulation Manager*, from the WAT main window, from the **WAT Tools** toolbar click



1. From the analysis periods shortcut menu (see Figure 8.2, page 8-2), click **New**, the **Create New Analysis Period** dialog box will open (Figure 8.3).

Figure 8.3 Create New Analysis Period Dialog Box

2. In the **Name** box, enter a name (required) for the analysis period. Optionally (but recommended), you can enter a description in the **Description** box.
3. In the **Time Window** box, you will enter a start date in the **Start Date** box, a start time in the **Start Time** box. For the end date of the time window you will enter that in the **End Date** box, and the end time in the **End Time** box.
4. If the analysis period does not have multiple events (e.g., 2-yr, 20-yr, 50-yr, etc. for the same time window), click **OK**. The **Create New Analysis Period** dialog box (Figure 8.3) will close. On the **Alternative and Simulation Manager** (see Figure 8.1, page 8-1), below the **Analysis Periods** header in the table will be a header that will contain the name of the analysis period that you just created.
5. If the analysis period contains multiple events, from the **Create New Analysis Period** dialog box (Figure 8.3), click **Use Multiple Events**. The **Add Event** and **Delete Event** buttons become active. To add an event, click **Add Event**, this will add a row to the **Event Table** (see Figure 8.4, page 8-4). Click **Add Event** for as many events as you want to add to the analysis period.
6. The events are given a default name and time window; you can edit this name and the time window for each event.

7. You can also place the events in order by clicking the up and down arrows to the right of the **Event Table** (Figure 8.4).

Event	Start Date	Start Time	End Date	End Time
2-yr	26Nov1993	0600	30Dec1993	2400
5-yr	26Nov1993	0600	30Dec1993	2400
10-yr	26Nov1993	0600	30Dec1993	2400
25-yr	26Nov1993	0600	30Dec1993	2400
50-yr	26Nov1993	0600	30Dec1993	2400
100-yr	26Nov1993	0600	30Dec1993	2400
250-yr	26Nov1993	0600	30Dec1993	2400
Event8	26Nov1993	0600	30Dec1993	2400

Figure 8.4 Create New Analysis Period Dialog Box – Event Table

8. If you wish to delete an event, select the event from the **Event Table**, and click **Delete Event**. The event will be removed from the **Event Table**.
9. Once you have your events defined, click **OK**. The **Create New Analysis Period** dialog box (see Figure 8.3, page 8-3) will close. On the **Alternative and Simulation Manager** (Figure 8.5), below the **Analysis Periods** header in the table will be a header that will contain the name of the analysis period that you just created and its

The table allows organization of a study's alternatives; a way to track the state of data sets needed for each model, create analysis periods, and create simulations.

Figure 8.5 Alternative and Simulation Manager – Analysis Periods and Events

associated events. You will notice the first column in the multiple events analysis period header in the table (Figure 8.5) is blank. That column will be used later to help define the software/models to be used for that alternative.

10. If you have more analysis periods to create, repeat Steps 1-9 until you have defined all your analysis periods and events for the study.
11. Once you are finished with defining your analysis periods and events, your next step will be to import your models (see Chapter 9, Section 9.3, page 9-4).

Renaming Analysis Periods

If you want to rename an analysis period, but you want to choose from a list of the developed analysis periods for a study:

1. From the analysis periods shortcut menu (see Figure 8.2, page 8-2), click **Rename**, the **Rename Analysis Period** dialog box will open (Figure 8.6).

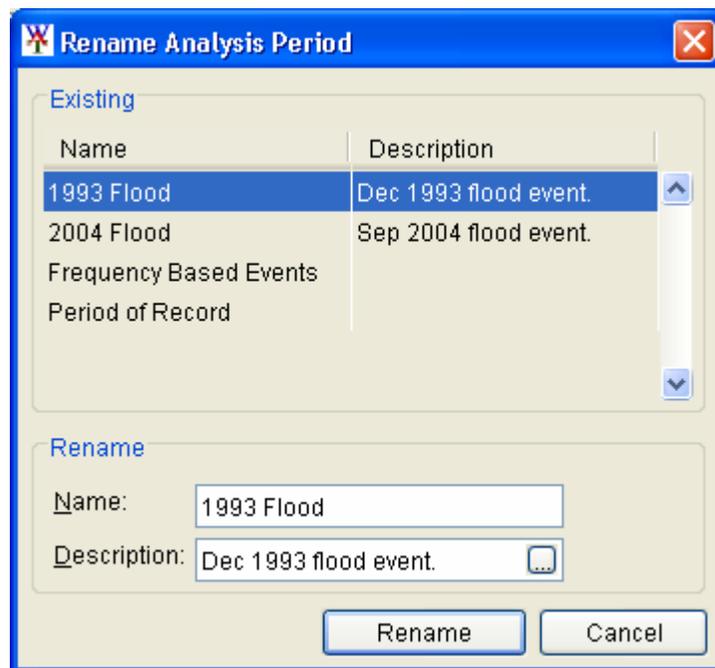


Figure 8.6 Rename Analysis Period Dialog Box

2. From the **Existing** list select an analysis period, in the **Rename** box the name and description of the selected analysis period will appear.
3. In the **Name** box, enter the new name, and enter a description in the **Description** box if needed (recommended).
4. Click **Rename**, a warning message will appear asking you if you really want to rename the selected analysis period. Click **Yes**, the warning message and the **Rename Analysis Period** dialog box (Figure 8.6) will close, and on the table, under the **Analysis Periods** column (see Figure 8.5, page 8-4) the renamed analysis period will appear.

Deleting Analysis Periods

If you want to delete an analysis period, but you want to choose from a list of the developed analysis periods for a study:

1. From the analysis periods shortcut menu (see Figure 8.2, page 8-2), click **Delete**, the **Delete Analysis Periods** dialog box will open (see Figure 8.7, page 8-6).
2. From the **Existing** list select an analysis period, in the **Delete** box the name and description of the selected analysis period will appear.
3. Click **Delete**, a warning message will appear asking you if you really want to delete the selected analysis period. Click **Yes**, the warning message and the **Delete Analysis Periods** dialog box

(Figure 8.7) will close and the analysis period will no longer appear under the **Analysis Periods** column of the table (see Figure 8.5, page 8-4).

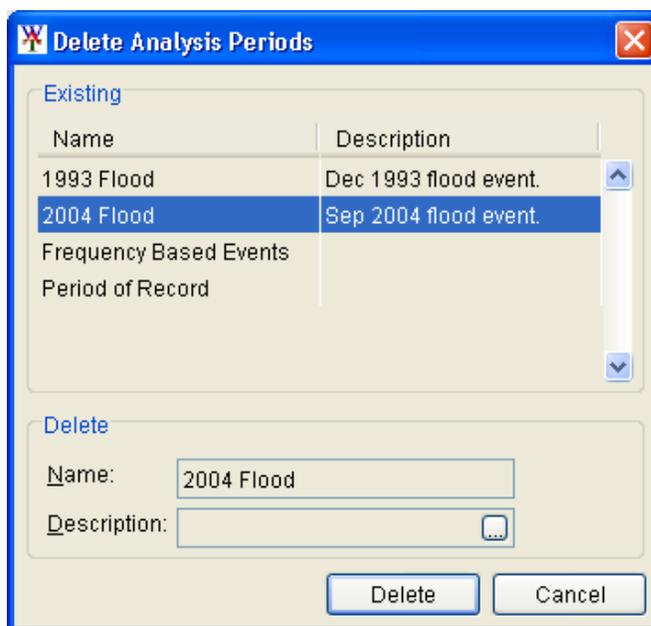


Figure 8.7 Delete Analysis Periods Dialog Box

Individual Analysis Period

The individual analysis period shortcut menu (Figure 8.8) is available from the **Alternative and Simulation Manager** (see Figure 8.5, page 8-4), by right-clicking on an analysis period name in the table. This

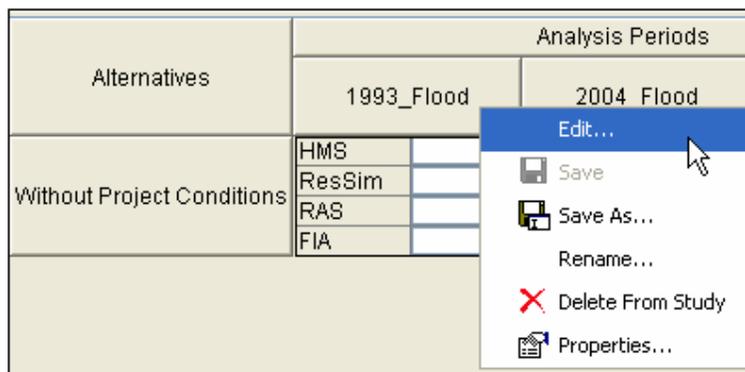


Figure 8.8 Individual Analysis Period Shortcut Menu

shortcut menu will allow you to edit, make a copy, rename, delete from the study, and view the properties of an analysis period. The following sections provide further details.

Editing an Analysis Period

To edit an analysis period:

1. From the individual analysis period shortcut menu (see Figure 8.8, page 8-6), click **Edit**. The **Analysis Period Editor** will open (Figure 8.9).

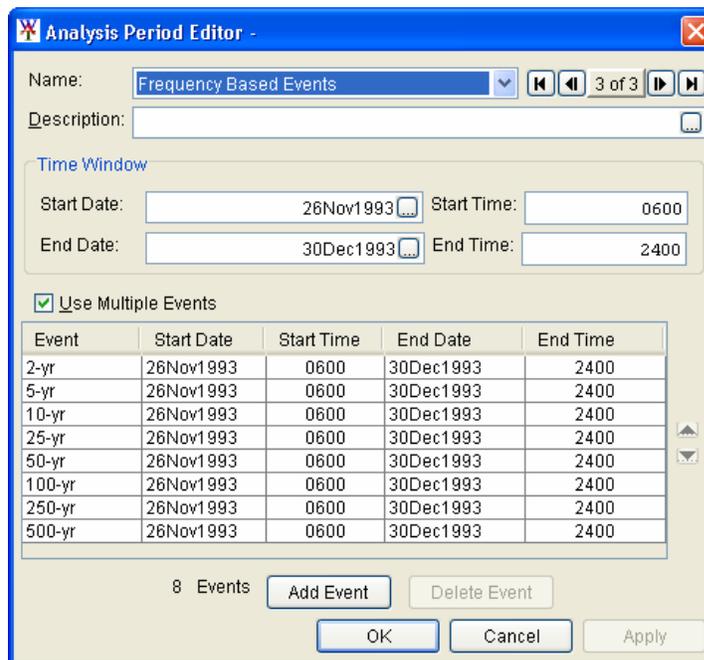


Figure 8.9 Analysis Period Editor

2. You can edit the name, description, and time window of the selected analysis period. Also, you can modify the events associated with the analysis period.
3. Click **OK**, the **Analysis Period Editor** will close (Figure 8.9), and the information you changed will appear on the **Alternative and Simulation Manager** (see Figure 8.5, page 8-4) in the table.

Making a Copy of an Analysis Period

To make a copy of an existing analysis period:

1. From the individual analysis period shortcut menu (see Figure 8.8, page 8-6), click **Save As**. The **Save Analysis Period As** dialog box will open (Figure 8.10). The information displayed in the dialog box represents the analysis period you have selected to make a copy of.

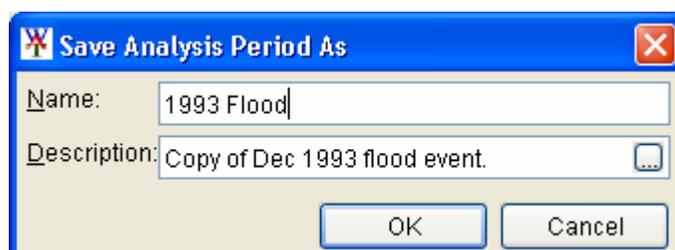


Figure 8.10 Save Analysis Period As Dialog Box

2. In the **Name** box, enter the name (required) of the new analysis period, and in the **Description** box, enter a description (optional, but recommended).
3. Click **OK**, the **Save Analysis Period As** dialog box (see Figure 8.10, page 8-7) will close. The new analysis period name will now appear in the table on the **Alternative and Simulation Manager**, under the **Analysis Periods** column header (see Figure 8.5, page 8-4).

Renaming an Analysis Period

To rename an analysis period:

*Another way to access the **Alternative and Simulation Manager**, from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**.*

1. From the individual analysis period shortcut menu (see Figure 8.8, page 8-6), click **Rename**. The **Rename Analysis Period** dialog box will open (Figure 8.11).

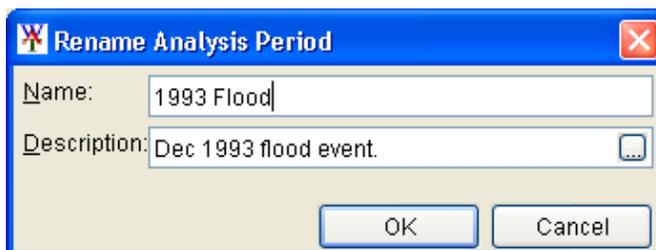


Figure 8.11 Rename Analysis Period Dialog Box

2. In the **Name** box, enter the new name, and enter a description in the **Description** box if needed (recommended).
3. Click **OK**, a warning message will appear asking you if you really want to rename the selected analysis period. Click **Yes**, the warning message and the **Rename Analysis Period** dialog box (Figure 8.11) will close, and in the **Alternative and Simulation Manager** (see Figure 8.5, page 8-4), on the table the name of the selected analysis period will be changed.

Deleting an Analysis Periods

To delete an analysis period, right-click on an analysis period in the table, from the shortcut menu (see Figure 8.8, page 8-6), click **Delete From Study**. A warning message will appear asking you if you really want to delete the selected analysis period. Click **Yes**, the analysis period will no longer appear on the table in the **Alternative and Simulation Manager** (see Figure 8.5, page 8-4).

Analysis Period Properties

The properties of an analysis period include the name and description for the Beta Version. For Version 1.0, properties will also include the event

names associated with an analysis period. To view the properties of an analysis period:

1. From the individual analysis period shortcut menu (see Figure 8.8, page 8-6), click **Properties**. The **Properties for AnalysisPeriodName** dialog box will open (Figure 8.12).

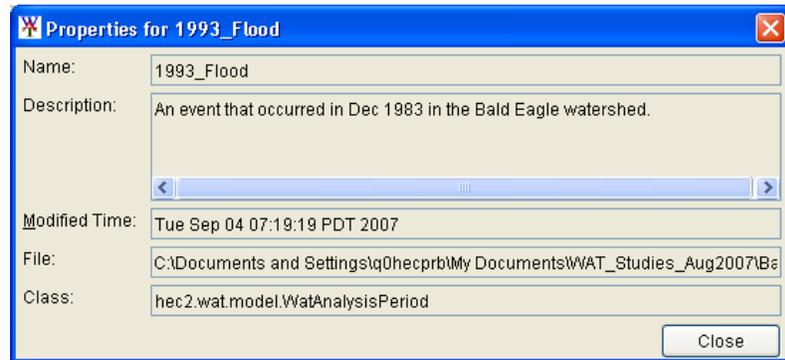


Figure 8.12 Properties for *AnalysisPeriodName* Dialog Box

2. For the Beta Version the properties for viewing are the name and description of the selected analysis period; the date and time the analysis period was last modified; the location of the analysis period file; and, the name of the file which contains information about the analysis.

8.2.2 Toolbar

From the toolbar of the **Alternative and Simulation Manager** (see Figure 6.2, page 6-2), you can create an analysis period. Click , the **Create New Analysis Period** dialog box will open (see Figure 8.3, page 8-3). The steps for creating an analysis period are the same as in the **Creating an Analysis Period**, under Section 8.2.1, page 8-3.

8.2.3 Menu Bar

From the **Menu Bar** of the **Alternative and Simulation Manager** (see Figure 8.5, page 8-4), you can create an analysis period, rename analysis periods, and delete analysis periods.

Creating an Analysis Period

To create an analysis period:

1. On the **File** menu, point to **Analysis Periods**, and then click **Create New**, the **Create New Analysis Period** dialog box will open (see Figure 8.3, page 8-3).

2. The steps for creating an analysis period are the same as in the **Creating an Analysis Period**, under Section 8.2.1, page 8-3.

Renaming Analysis Periods

If you want to rename an analysis period, but you just want to choose from a list of the developed analysis periods for a study:

1. On the **File** menu, point to **Analysis Periods**, and then click **Rename**, the **Rename Analysis Period** dialog box will open (see Figure 8.6, page 8-5).
2. The steps for renaming an analysis period are the same as in the **Renaming Analysis Periods**, under Section 8.2.1, page 8-4.

Deleting Analysis Periods

If you want to delete an analysis period, but you just want to choose from a list of the developed analysis periods for a study:

1. On the **File** menu, point to **Analysis Periods**, and then click **Delete**, the **Delete Analysis Periods** dialog box will open (see Figure 8.7, page 8-6).
2. The steps for deleting an analysis period are the same as in the **Deleting Analysis Periods**, under Section 8.2.1, page 8-5.

8.3 Study Pane

The user can also create, edit, rename, and delete analysis periods from the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-5). This section of the chapter describes how to perform these operations directly from the **Study Pane**.

8.3.1 Analysis Periods

Study Pane provides an overview of WAT alternatives, simulations and analysis periods.

The analysis periods shortcut menu (Figure 8.13) is available from the **Study Pane**, by right-clicking on the folder **Analysis Periods**. This shortcut menu will allow you to create, rename, and delete analysis periods.

The following sections provide further details.

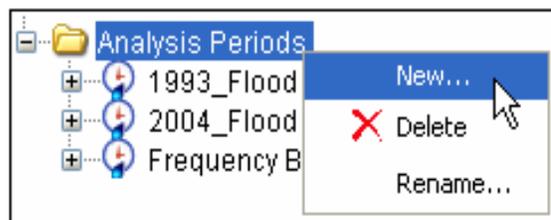


Figure 8.13 Analysis Periods Shortcut Menu

Creating an Analysis Period

To create an analysis period:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Analysis Periods** folder, from the analysis periods shortcut menu (Figure 8.13), click **New**. The **Create New Analysis Period** dialog box will open (see Figure 8.3, page 8-3).
2. The steps for creating an analysis period are the same as in the **Creating an Analysis Period**, under Section 8.2.1, page 8-3.

Deleting Analysis Periods

If you want to delete an analysis period, but you want to choose from a list of the developed analysis periods for a study:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Analysis Periods** folder, from the analysis periods shortcut menu (see Figure 8.13, page 8-11), click **Delete**. The **Delete Analysis Periods** dialog box will open (see Figure 8.7, page 8-6).
2. The steps for deleting an analysis period are the same as in the **Deleting Analysis Periods**, under Section 8.2.1, page 8-5.

Renaming Analysis Periods

If you want to rename an analysis period, but you just want to choose from a list of the developed analysis periods for a study:

1. From the **Study Tab**, on the **Study Pane**, right-click on the **Analysis Periods** folder, from the analysis period shortcut menu (see Figure 8.13, page 8-11), click **Rename**. The **Rename Analysis Period** dialog box will open (see Figure 8.6, page 8-5).
2. The steps for renaming an analysis period are the same as in the **Renaming Analysis Periods**, under Section 8.2.1, page 8-4.

8.3.2 Individual Analysis Period

The individual analysis period shortcut menu (see Figure 8.14, page 8-13) is available from the **Study Pane**, by right-clicking on an analysis period name under the **Analysis Periods** folder. This shortcut menu will allow you to edit, make a copy, rename, delete from the study, and view the properties of an analysis period. The following sections provide further details.

Editing an Analysis Period

To edit an analysis period:

1. From the **Study Tab**, on the **Study Pane**, from the **Analysis Periods** folder, right-click on an analysis period, from the individual analysis period shortcut menu (Figure 8.14), click **Edit**. The **Analysis Period Editor** will open (see Figure 8.9, page 8-7).
2. The steps for editing an analysis period are the same as in the **Editing an Analysis Period**, under Section 8.2.1, page 8-6.

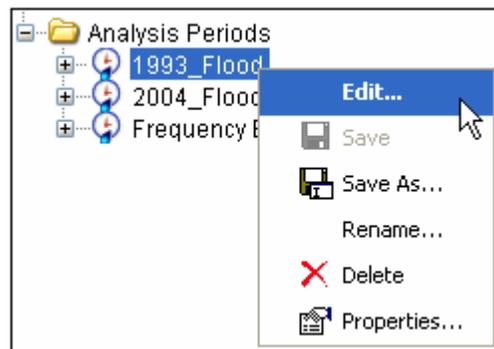


Figure 8.14 Individual Analysis Period Shortcut Menu

Saving an Analysis Period

To save an analysis period, from the **Study Tab**, from the **Study Pane**, from the **Analysis Periods** folder, right-click on an analysis period, from the individual analysis period shortcut menu (Figure 8.14), click **Save**. Any changes that have occurred to the selected analysis periods will be saved by the WAT.

Making a Copy of an Existing Analysis Period

To make a copy of an existing analysis period:

1. From the **Study Tab**, on the **Study Pane**, from the **Analysis Periods** folder, right-click on an analysis period, from the individual analysis period shortcut menu (Figure 8.14), click **Save As**. The Save Analysis Period As dialog box will open (see Figure 8.10, page 8-7)
2. The steps for making a copy of an existing analysis period are the same as in the **Making a Copy of an Analysis Period**, under Section 8.2.1, page 8-7.

Renaming an Analysis Period

1. From the **Study Tab**, on the **Study Pane**, from the **Analysis Periods** folder, right-click on an analysis period, from the individual analysis period shortcut menu (Figure 8.14), click

- Rename.** The **Rename Analysis Period** dialog box will open (see Figure 8.11, page 8-8).
2. The steps for renaming an analysis period are the same as in the **Renaming an Analysis Periods**, under Section 8.2.1, page 8-8.

Deleting an Analysis Period

1. From the **Study Tab**, on the **Study Pane**, from the **Analysis Periods** folder, right-click on an analysis period, from the individual analysis period shortcut menu (see Figure 8.14, page 8-12), click **Delete**.
2. The steps for deleting an analysis period are the same as in the **Deleting an Analysis Period**, under Section 8.2.1, page 8-8.

Analysis Period Properties

The properties of an analysis period include the name and description for the Beta Version. For Version 1.0, properties that will also include the event names associated with an analysis period. To view the properties of an analysis period:

1. From the individual analysis period shortcut menu (see Figure 8.14, page 8-12), click **Properties**. The **Properties for AnalysisPeriodName** dialog box will open (see Figure 8.12, page 8-9).
2. The steps for accessing analysis period properties are the same as in the **Analysis Period Properties**, under Section 8.2.1, page 8-9.

CHAPTER 9

Creating and Managing Simulations

9.1 Overview

Once you have defined alternatives and analysis periods, you are ready to create simulations. A **simulation** in HEC-WAT is a combination of an analysis period and event(s) and an alternative. After a simulation has been created, the models need to communicate with each other. In the WAT this is accomplished by linking (DSS mapping) the models through DSS. This chapter discusses how to establish program order, import models that have been built for the study, how to create, edit, and manage simulations, and how to link the models of a simulation.

9.2 Program Order

The WAT allows for a flexible set of programs, computation sequence, and data flow for individual simulations. You can establish several different program orders for a WAT study. The WAT has a default program order named **Default**, which consists of HMS, ResSim, RAS and FIA.

There are two ways to establish multiple program orders in the WAT; the recommended way is from the **Alternative and Simulation Manager** (Section 9.2.1). The second way is from the main window of the WAT (see Section 9.2.2, page 9-4); both of these methods are discussed in the following sections.

9.2.1 Alternative and Simulation Manager

In the WAT, the **Alternative and Simulation Manager** (see Figure 9.1, page 9-2) provides a convenient way to organize and develop the main components for a WAT study – alternatives, analysis period (events), and simulations. This section will focus on the organization and development of program orders. The **Alternative and Simulation Manager** has two areas where you can create program orders. These areas are the **Toolbar** (see page 9-2) and the **Menu Bar** (page 9-4). These areas and the ability to create program orders are described in the following sections.

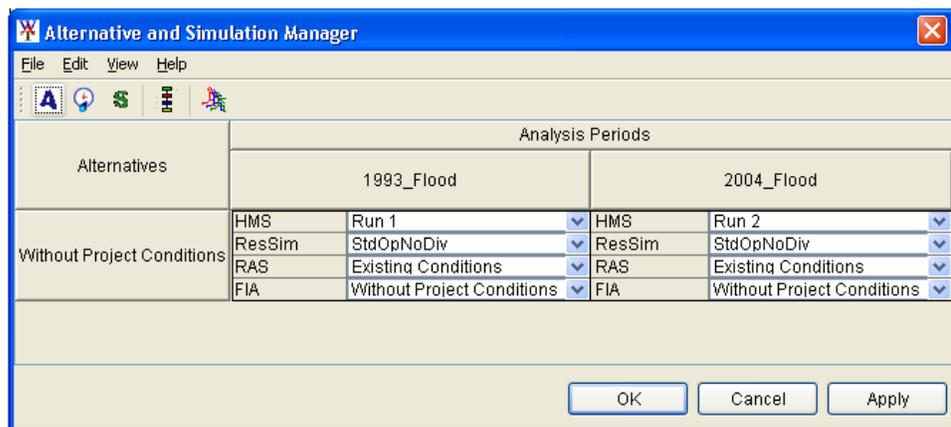


Figure 9.1 Alternative and Simulation Manager

To access the **Alternative and Simulation Manager**, from the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . Another way to access the **Alternative and Simulation Manager** is from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**. From either method the **Alternative and Simulation Manager** will open (Figure 9.1).

Toolbar

From the toolbar of the **Alternative and Simulation Manager** (Figure 9.1), you can create a program order. Click , the **Program Order** dialog box will open (Figure 9.2). The steps for creating a program order are detailed in the following section.

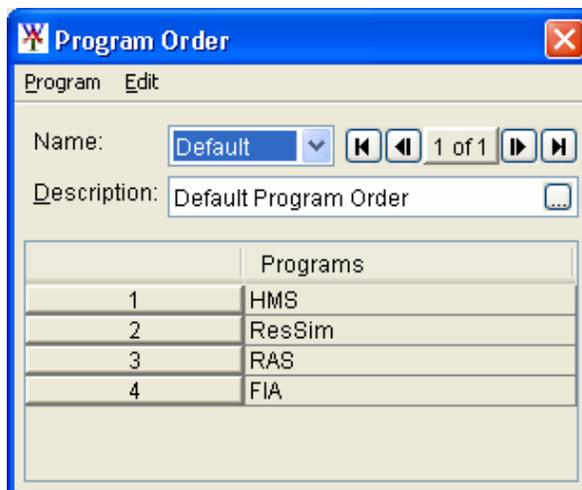


Figure 9.2 Program Order Dialog Box

Creating a Program Order

To create a program order:

1. By default, the **Default** program order is displayed in the Program Order dialog box (see Figure 9.2, page 9-2). To create a new program order, from **Program**, click **New**. The **New Program Order** dialog box will open (Figure 9.3).

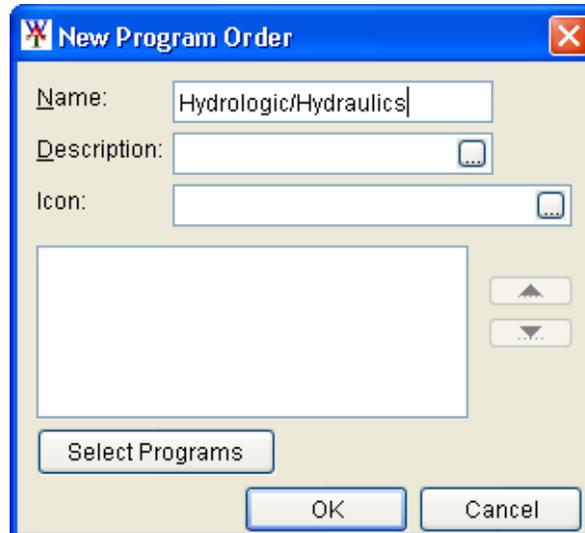


Figure 9.3 New Program Order Dialog Box

2. In the **Name** box enter a name for the program order. Optionally (but recommended), you can provide a description in the **Description** box, and if you have an icon, you can enter the location of the icon file in the **Icon** box.
3. To select the programs you want in your program order, click **Select Programs**, the **Selection Editor** will open (Figure 9.4). From the **Available** list select the programs you would like in your program order. Click **Add**, the name of the selected program will move to the **Selected** list and be removed from the **Available** list (Figure 9.4).

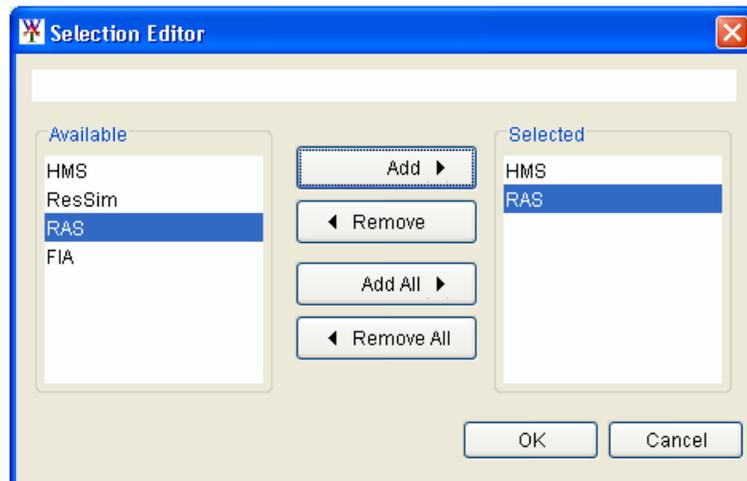


Figure 9.4 Selection Editor

4. Once you have selected all the programs, click **OK**, the **Selection Editor** will close (Figure 9.4). On the **New Program Order** dialog

- box (see Figure 9.3, page 9-3) the names of the selected programs will appear. Click **OK**, the **New Program Order** dialog box will close.
5. On the **Program Order** dialog box (see Figure 9.2, page 9-2) the name of the new program order will appear in the **Name** list, and the table will display the programs selected.

Menu Bar

From the **Menu Bar** of the **Alternative and Simulation Manager** (see Figure 9.1, page 9-2), you can create a program order. On the **File** menu, click **Program Order**, the **Program Order** dialog box will open (see Figure 9.2, page 9-2). The steps for creating a program order are the same as in the **Creating Program Order**, under Section 9.2.1, page 9-2.

9.2.2 WAT Main Window

From the WAT main window (see Chapter 3, Figure 3.1, page 3-2) there are two ways to establish multiple programs orders in the WAT. From the main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4) click . The second way is from the **Edit** menu, click **Program Order**; both of these methods will open the **Program Order** dialog box (see Figure 9.2, page 9-2). To create a program order, follow the same steps in **Creating a Program Order**, under Section 9.2.1, page 9-2.

9.3 Import Models

This section discusses how to import existing HEC models (HEC-HMS, HEC-ResSim, HEC-RAS, and HEC-FIA) into the WAT system, for use in developing WAT alternatives. In the Beta Version of HEC-WAT you can import ResSim, RAS and FIA models. The HMS model will have to be copied using system tools for the Beta release. The import of an HMS model should be available in Version 1.0 of the WAT.

9.3.1 HMS Model

To incorporate an HMS model into the WAT, you will need to copy files outside of the WAT. A WAT study has a directory structure (Chapter 4), which includes an *hms* directory. Once you have identified your HMS model for your particular WAT study, using system tools, copy all files and folders associated with your HMS model into the *hms* directory. The WAT will now find your *hms* model for that particular study.

9.3.2 ResSim Model

Before importing the ResSim model, you will have to tell the WAT through ResSim, what working directory the ResSim model is stored in. From the **Programs** toolbar, click **ResSim**, to specify the ResSim working directory perform the following steps:

1. From the ResSim main window, on the **Tools** menu, click **Options**, the **Options** dialog box will open (Figure 9.5). From the **Model Directories** tab, click **Add Location**.

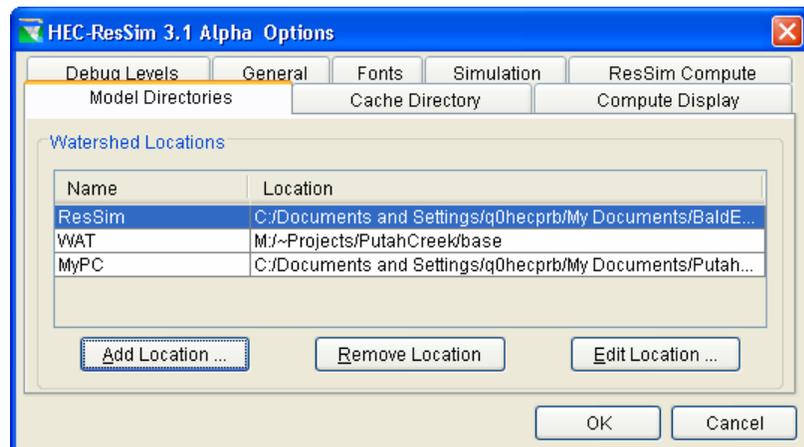


Figure 9.5 Options Dialog Box

2. The **Add Watershed Location** dialog box will open (Figure 9.6). In the **Name** box, enter a name (e.g. *ResSim*) that will simply reference the directory location. Enter a directory location (e.g., *C:/Documents and Settings/xxx/My Documents/ watershed*) that

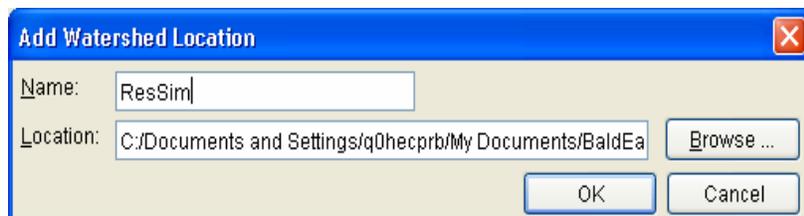


Figure 9.6 Add Watershed Location Dialog Box

3. specifies where ResSim should search for watersheds in the **Location** box. You must enter an existing directory name.
4. You can also browse to the directory that you want, from the **Add Watershed Location** dialog box (Figure 9.6), click **Browse**. A browser will open; you can then navigate to a directory on your computer or network. Select a directory, click **OK**, the browser will close and the name will appear in the **Location** box.
5. Click **OK**, the **Add Watershed Location** dialog box (Figure 9.6) will close, and the working directory you identified will now appear on the table in the **Options** dialog box.
6. Click **OK**, the **Options** dialog box (Figure 9.5) will close.

Now that you have finished that setup, you are ready to import a ResSim model into the WAT:

1. From the WAT main window, on the **File** menu, point to **Import**, click **ResSim**.
2. The **Import Alternative Wizard** will open (Figure 9.7).

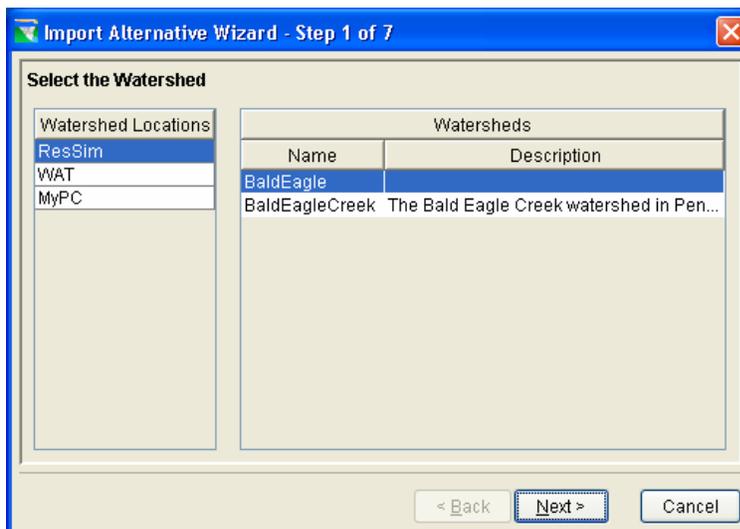


Figure 9.7 Import Alternative Wizard – Step 1 of 7

3. In the **Watershed Locations** box, select the name that identifies the directory where your ResSim model is stored. In the **Watersheds** box, the table will display the available ResSim models in that directory.
4. Select the ResSim watershed, click **Next**, the **Import Alternative Wizard** (Figure 9.8) will now ask you to select which ResSim alternative you want to import. From the **Available Alternatives** box, on the table select the alternative you want to import.

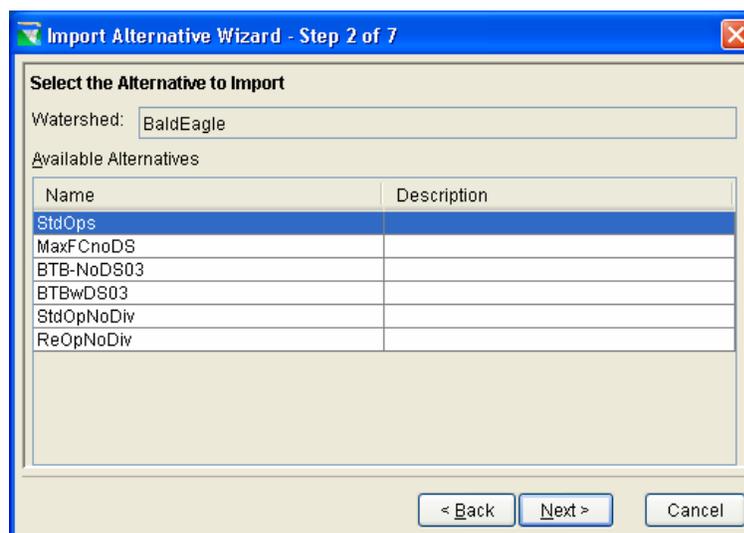


Figure 9.8 Import Alternative Wizard – Step 2 of 7

- Click **Next**, the **Import Alternative Wizard** (Figure 9.9) will now ask you if you want to give the ResSim alternative a new name or use the default name. We recommend you use the default name.

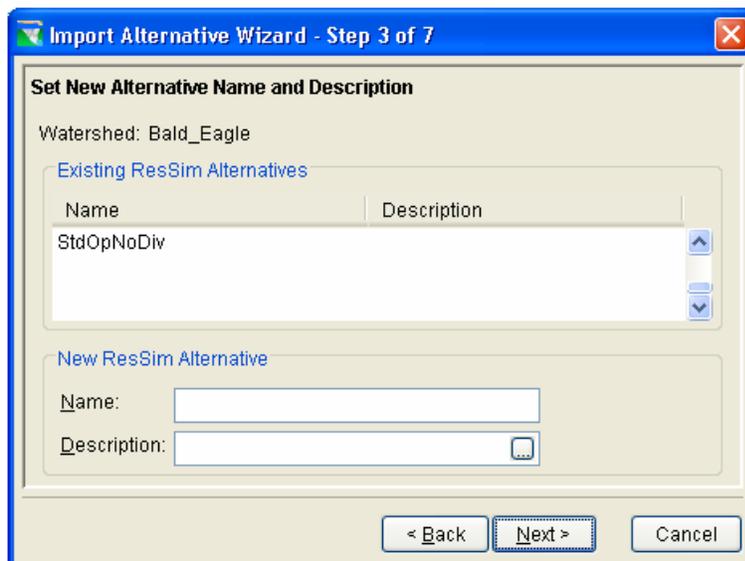


Figure 9.9 Import Alternative Wizard – Step 3 of 7

- Click **Next**, the **Import Alternative Wizard** (Figure 9.10) will now give you a chance to accept the default name of the ResSim network that is associated with the selected ResSim alternative, or change the name. We recommend you use the default name.

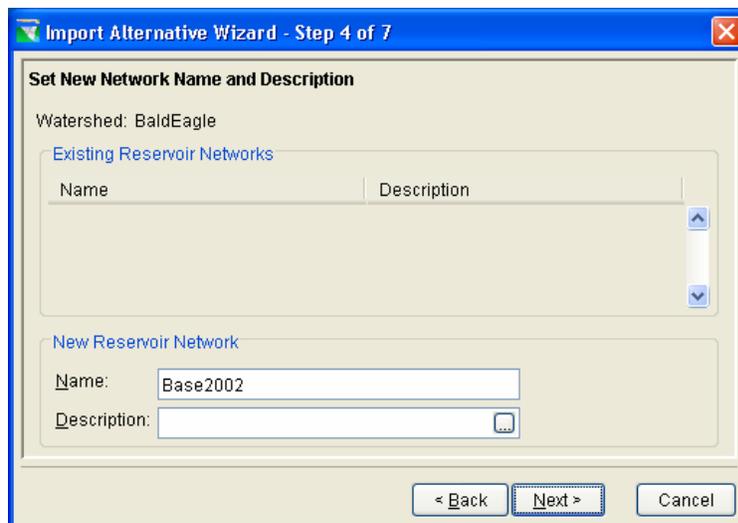


Figure 9.10 Import Alternative Wizard – Step 4 of 7

- Click **Next**, the **Import Alternative Wizard** (see Figure 9.11, page 9-8) will now ask you to assign stream names to the various elements of the selected ResSim network. This has to be done because the current version of ResSim does not store the stream names by name but by an ID, the WAT stores the stream names by name. If the elements are on different streams, in the **To Stream** column (see Figure 9.11, page 9-8), click a cell, a list of the

available stream names from the WAT will appear, select the appropriate stream name(s) from the list. The name of the selected stream will now appear in the **To Stream** column (Figure 9.11).

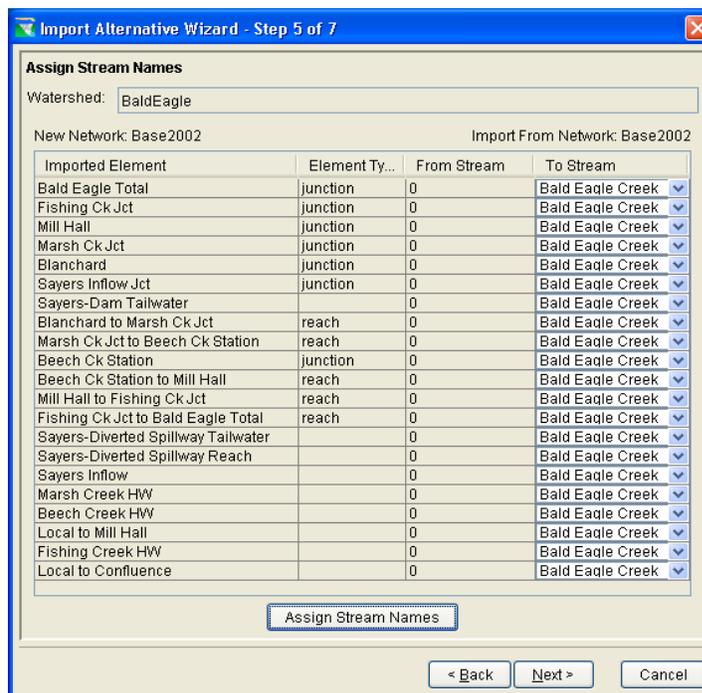


Figure 9.11 Import Alternative Wizard – Step 5 of 7

8. If all the elements are on the same stream name, click **Assign Stream Names**. The **Select Stream Name** dialog box will open (Figure 9.12), in the **To Stream** column, click a cell, a list of the available stream names from the WAT will appear, select the



Figure 9.12 Select Stream Name Dialog Box

appropriate stream name(s) from the list. Click **OK**, the **Select Stream Name** dialog box will close. On the **Alternative Import Wizard** (Figure 9.11) the **To Stream** column of table will display the selected stream name.

9. Click **Next**, the **Import Alternative Wizard** (see Figure 9.13, page 9-9) will now ask you to assign a common computation point to a ResSim junction name. This has to be done because the current version of ResSim does not store the common computation point names by name but by an ID, the WAT stores the common computation point names by name. Click on a cell in the

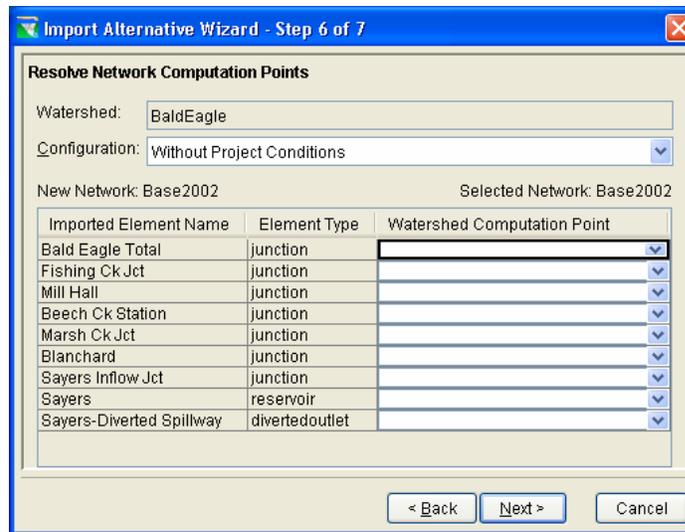


Figure 9.13 Import Alternative Wizard – Step 6 of 7

Watershed Computation Point column (Figure 9.13), a list of common computation point names will appear, select a name from the list for the selected ResSim junction name. Repeat this process for all elements listed in the table.

10. Click **Next**, in the Beta release of the WAT, the common computations point assignment does not seem to be working correctly, so **Assignment Warnings** will open (Figure 9.14), click **OK**.



Figure 9.14 Assignment Warnings

11. The **Import Alternative Wizard** (Figure 9.15) will now provide you with a summary of what you are about to import for your ResSim model in the WAT. After reviewing, click **Finish**. A warning will appear telling you that the import operation will create a new alternative and network with the chosen names. Click **Yes**, to continue with the import.

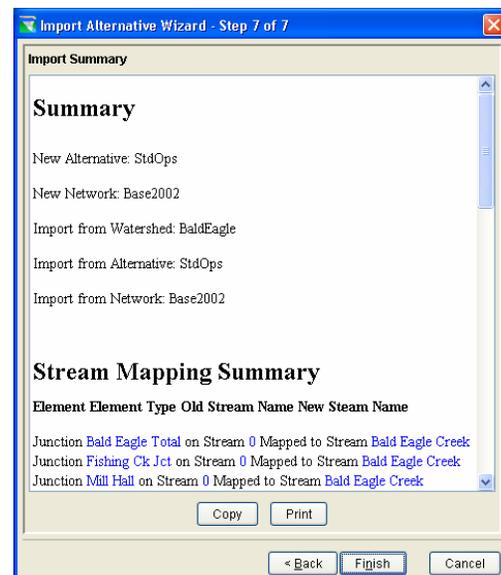


Figure 9.15 Import Alternative Wizard – Step 7 of 7

12. You have now completed the import of a ResSim alternative, if you want to have more ResSim

alternatives included in your ResSim model you will need to repeat these steps for each ResSim alternative.

9.3.3 RAS Model

To import a RAS model into the WAT:

1. From the WAT main window, on the **File** menu, point to **Import**, click **RAS**.
2. The **Select RAS project to import from** browser will open (Figure 9.16). From the browser select the directory that contains the RAS model files. The browser is looking for a RAS project file (*.prj). Select the project file; click **Open**, the **Select RAS project to import from** browser will close.

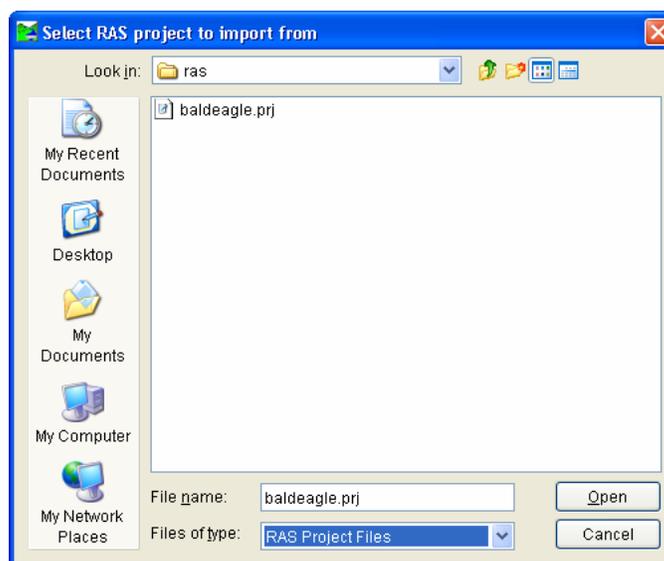


Figure 9.16 Select RAS project to import from Browser

3. The RAS files associated with the selected RAS project will be copied to the *ras* directory in the WAT. The WAT will now be able to recognize the RAS model.

9.3.4 FIA Model

To import an FIA model (Version 2.0) into the WAT:

1. From the WAT main window, on the **File** menu, point to **Import**, click **FIA**.
2. An **Alternative Import Wizard** will open (see Figure 9.17, page 9-11), browse to the FIA study that contains the FIA model needed for the WAT. The browser is looking for an FIA study file (*.prj). Select the project file, click **Next**.

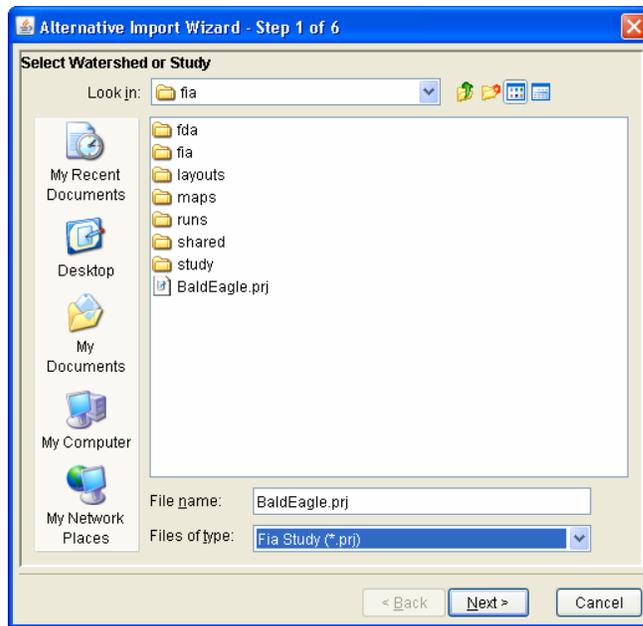


Figure 9.17 Alternative Import Wizard – Step 1 of 6

3. The **Alternative Import Wizard** (Figure 9.18) will now ask you to select which FIA alternative you wish to choose. From the **Available Alternatives** box (Figure 9.18), on the table select the alternative you want to import.
4. Click **Next**, the **Alternative Import Wizard** (Figure 9.19) will now ask you if you want to give the

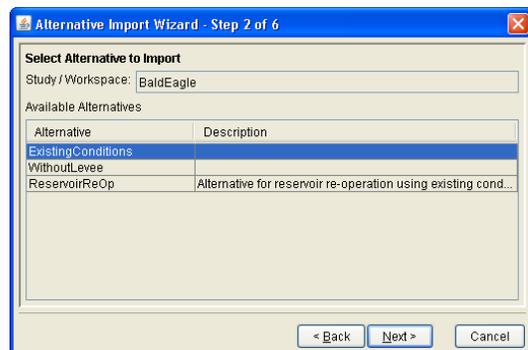


Figure 9.18 Alternative Import Wizard – Step 2 of 6

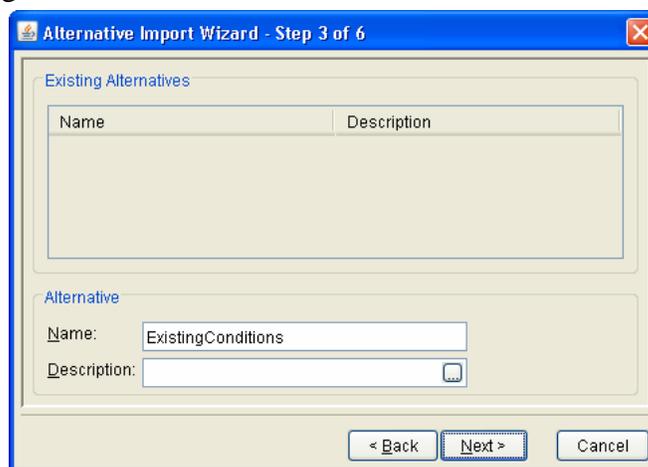


Figure 9.19 Alternative Import Wizard – Step 3 of 6

- FIA alternative a new name or use the default name. We recommend you use the default name.
- Click **Next**, the **Import Alternative Wizard** (Figure 9.20) will now give you a chance to accept the default name of the FIA impact area set that is associated with the selected FIA alternative, or change the name. We recommend you use the default name.

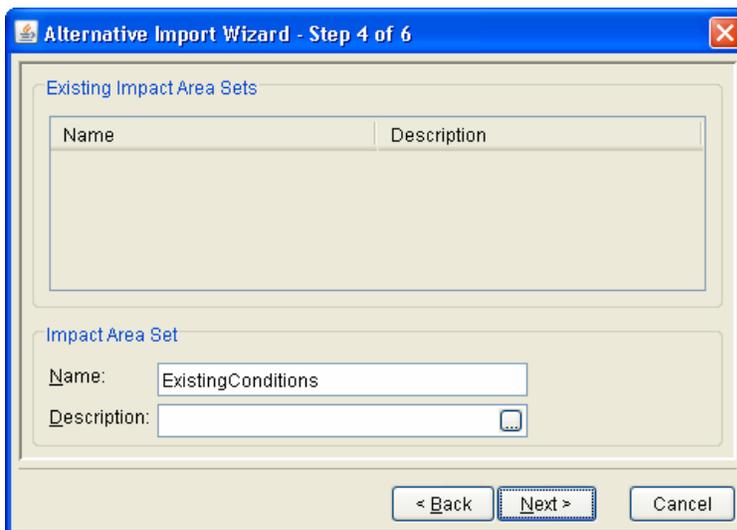


Figure 9.20 Alternative Import Wizard – Step 4 of 6

- Click **Next**, the **Import Alternative Wizard** (Figure 9.21) will now give you a chance to accept the default name of the FIA time series set that is associated with the selected FIA alternative, or change the name. We recommend you use the default name.

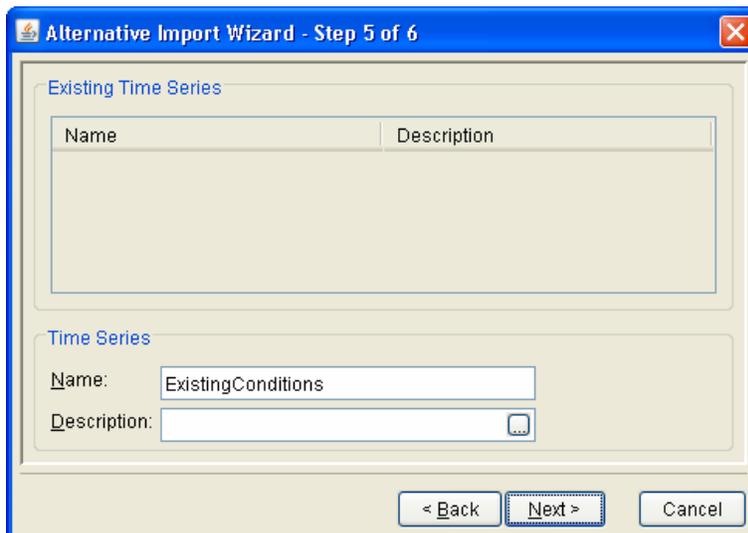


Figure 9.21 Alternative Import Wizard – Step 5 of 6

- The **Alternative Import Wizard** (see Figure 9.22, page 9-13) will now provide you with a summary of what you are about to import for your FIA model in the WAT. After reviewing, click **Finish**, you have now completed the import of an FIA alternative, if you want to



Figure 9.22 Alternative Import Wizard – Step 6 of 6

have more FIA alternatives included in your FIA model you will need to repeat these steps for each FIA alternative.

9.4 Simulations

A **simulation** in the WAT is a combination of an analysis period and event(s) and an alternative. The WAT provides two ways to organize and develop simulations; one way is from the **Alternative and Simulation Manager** (Section 9.4.1), and the other way is from the **Study Pane** (see Section 9.4.2, page 9-22).

9.4.1 Alternative and Simulation Manager

In the WAT, the **Alternative and Simulation Manager** (see Figure 9.23, page 9-14) provides a convenient way to organize and develop the main components for a WAT study – alternatives, analysis period (events), and simulations. This section will focus on the organization and development of simulations. The **Alternative and Simulation Manager** has three areas where you can access commands that will allow you to create, delete, and rename simulations. These areas are the **Table** (page 9-14), **Toolbar** (page 9-20) and **Menu Bar** (page 9-21). These areas and the available commands are described in the following sections.

To access the **Alternative and Simulation Manager**, from the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . Another way to access the **Alternative and**

Simulation Manager is from the WAT main window, on the **Edit** menu, click **Alternative and Simulation Manager**. From either method the **Alternative and Simulation Manager** will open (Figure 9.23).

A simulation in HEC-WAT is a combination of an analysis period and event(s) and an alternative

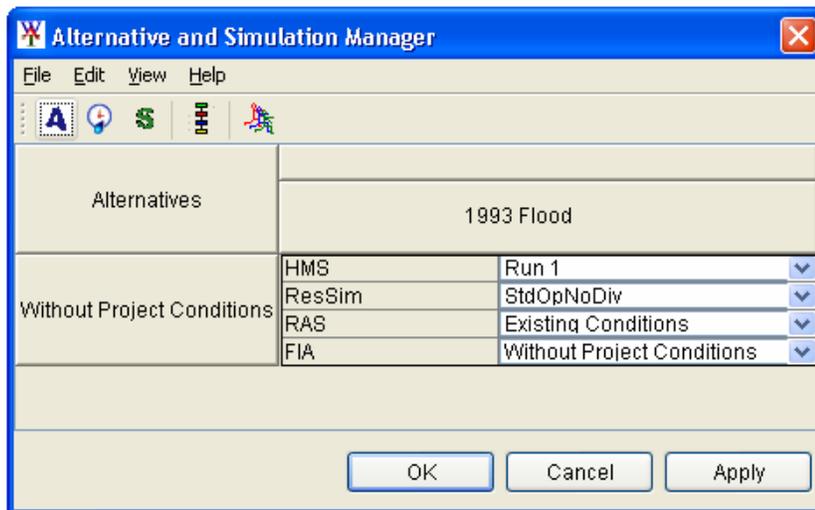


Figure 9.23 Alternative and Simulation Manager - Simulation

Table

The **Alternative and Simulation Manager** (Figure 9.23) table allows organization of a study's alternatives; a way to track the state of data sets needed for each model, create analysis periods, and create simulations. Since the focus of this section is simulations, the focus will only be on the available commands from the table to develop and organize simulations.

The individual simulation shortcut menu (Figure 9.24) is available from the **Alternative and Simulation Manager**, by right-clicking on a simulation in the table. This shortcut menu will allow you to view the

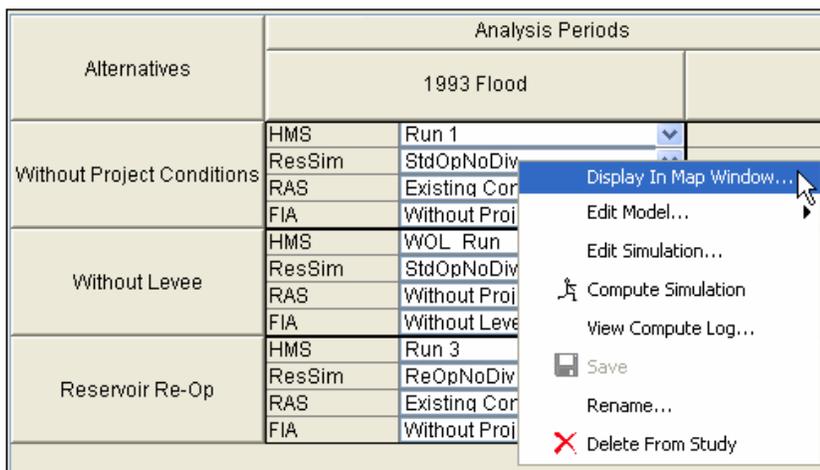


Figure 9.24 Individual Simulation Shortcut Menu

selected simulation in a map window; edit the model alternatives associated with the selected simulation; edit the name, description, and

DSS mapping identifier of the selected simulation; compute; view the log of the compute; rename; and, delete from the study the selected simulation. The following sections provide further details on how to create a simulation and the other commands available from the table.

Creating a Simulation

To create a simulation:

1. A simulation on the table is the cell where an analysis period and alternative intersect. In Figure 9.25, this intersection is the blue

Alternatives	Analysis Periods
	1993 Flood
Without Project Conditions	Create Simulation

Figure 9.25 Alternative and Simulation Manager – Table

cell. Right-click on the cell, from the shortcut menu, click **Create Simulation**. The **Create New Simulation** dialog box will open (Figure 9.26).

Figure 9.26 Create New Simulation Dialog Box

2. In the **Name** box a default name has been generated by the WAT. The default name for a simulation is the concatenation of the alternative name, analysis period name, and an event name. You can change this name, but it is recommended to use the default name. In the **Description** box, you can enter a description (optional, but recommended).
3. From the WAT the programs share data from a DSS file, the F-Part of the pathnames informs the programs what simulation the pathname belongs to. In the **F Part** box (Figure 9.26), a default name has been generated by the WAT. This default name is the

first ten characters of the alternative name, the first ten characters of the analysis period name, and the first ten characters of the event name. You can change this name, but it is recommended to use the default name.

4. Information is provided on what alternative and what analysis period are being used for this simulation. This information is displayed in the **Alternative** box and the **Analysis Period** box, respectively (see Figure 9.26, page 9-15).
5. From the **Program Order** list (see Figure 9.26, page 9-15) you can choose which program order is appropriate for this simulation. The default program order is: HEC-HMS, HEC-ResSim, HEC-RAS, and HEC-FIA. If the program order you want is not available, click **New**, the **New Program Order** dialog box will open (see Figure 9.3, page 9-3). You can then define a new program order, save, and then select from the **Program Order** list.
6. From the **Create News Simulation** dialog box (see Figure 9.26, page 9-15) click **OK**, the dialog box will close. On the **Alternative and Simulation Manager** (Figure 9.27), the cell that you right-clicked in now contains the programs in your program order, and

Alternatives	Analysis Periods	
	1993 Flood	
Without Project Conditions	HMS	▼
	ResSim	▼
	RAS	▼
	FIA	▼

Figure 9.27 Alternative and Simulation Manager – Simulation with no Model Alternatives

drop-down lists for each program so you can choose what model alternatives to use for the simulation.

7. For each program you now need to select the appropriate model alternative for the simulation. For example, in Figure 9.28, click the **RAS** list, the RAS model alternatives that you imported are

HMS	Run 1	▼
ResSim	StdOps	▼
RAS		▼
FIA		
	Existing Conditions	
	Unsteady-Existing Conditions from Dam to Mouth	
	Without Project Conditions	

Figure 9.28 Model Alternative Selection - RAS

listed, select one. That name is now displayed in the table of the **Alternative and Simulation Manager** (see Figure 9.23, page 9-14).

8. If you have more simulations to create, repeat steps 1-7 until you have defined all your simulations for the study. Once you are finished with defining simulations, your next step will be to compute the simulations (Chapter 10).

Viewing a Simulation

To view a simulation in a map window:

1. From the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Display in Map Window**.
2. If there is not a map window open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the simulation map window for the simulation will open in the **Desktop Pane**. From the simulation map window you can edit the stream alignment, view model alternative results, and edit model alternatives that are associated with a simulation.
3. If a map window is open in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), the **Select Map** dialog box (Figure 9.29) will open. You can choose whether to open the simulation map window in the current map window or in a new map window, click **OK**. The **Select Map** dialog box will close, and the simulation map window for the selected simulation will appear in the **Desktop Pane**.

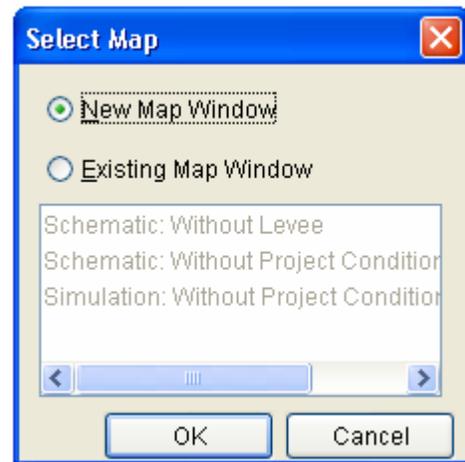


Figure 9.29 Select Map Dialog Box

Editing the Model Alternatives of a Simulation

To edit the model alternatives associated with a simulation:

1. From the individual simulation shortcut menu (see Figure 9.24, page 9-14), point to **Edit Model**, from the sub-menu (Figure 9.30) click on the model alternative you wish to edit.

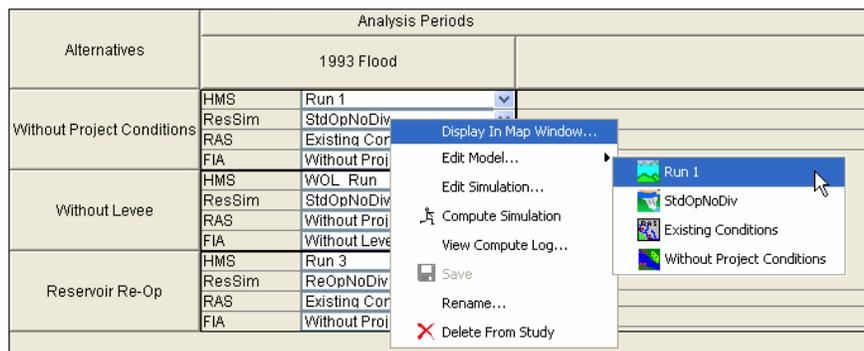


Figure 9.30 Editing a Model Alternative

2. The program associated with the model alternative that you selected will open. For example, in Figure 9.30 (page 9-17), if you select the model alternative **Run 1**, the **HMS** program will open.
3. You can now make changes to the selected model alternative, save, and close the program associated with the model alternative. For further details on the individual program editors, see Appendix I.

Editing a Simulation

To edit a simulation:

1. From the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Edit Simulation**. The **Simulation Editor** will open (Figure 9.31).

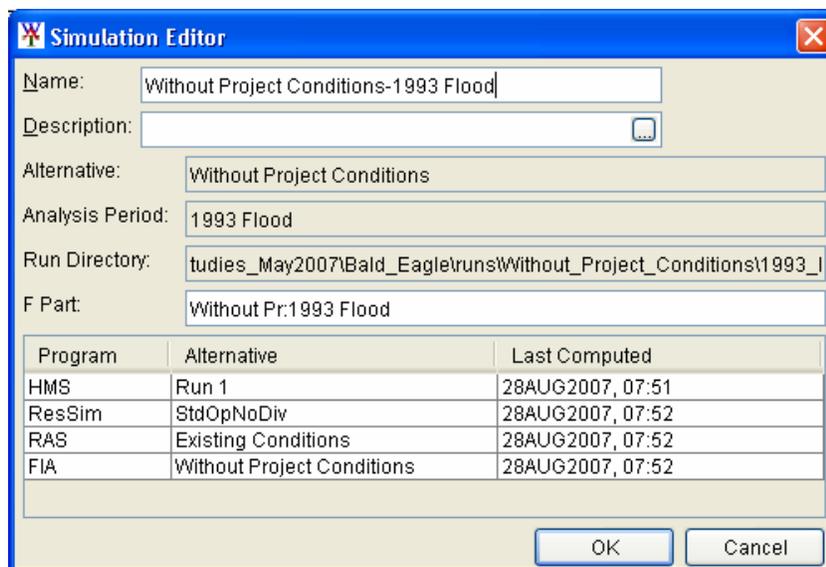


Figure 9.31 Simulation Editor

2. You can edit the name, description, and F-Part associated with a simulation. The editor also provides you with information on what WAT alternative and analysis period are associated with the simulation. The editor also provides information on what model alternatives are being computed for the simulation.
3. Click **OK**, the **Simulation Editor** will close (Figure 9.31) and the information you changed will be saved.

Computing a Simulation

To compute a simulation:

1. From the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Compute Simulation**. The **Compute Progress** dialog box will open (see Figure 9.32, page 9-19).

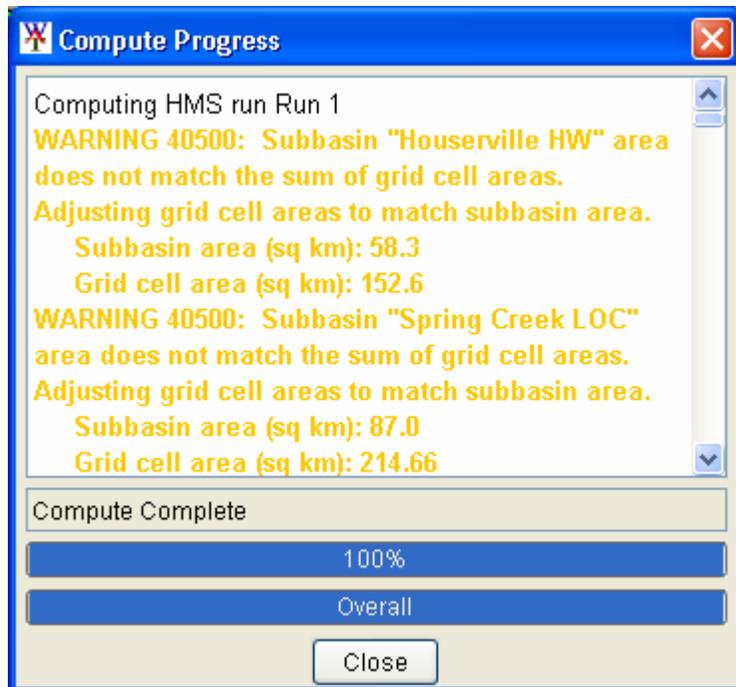


Figure 9.32 Compute Progress Dialog Box

2. From this dialog box you can see which model is computing for the simulation and information from each model is displayed in the **Compute Progress** dialog box (Figure 9.32).
3. When the compute is finished click **Close**, the **Compute Progress** dialog box will close.

Viewing the Compute Log of a Simulation

To view the compute log of a simulation, from the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **View Compute Log**. The *SimulationName.log* dialog box will open (Figure 9.33) in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). This contains information regarding the compute for the selected simulation. This information is provided by each individual program that was part of the compute.

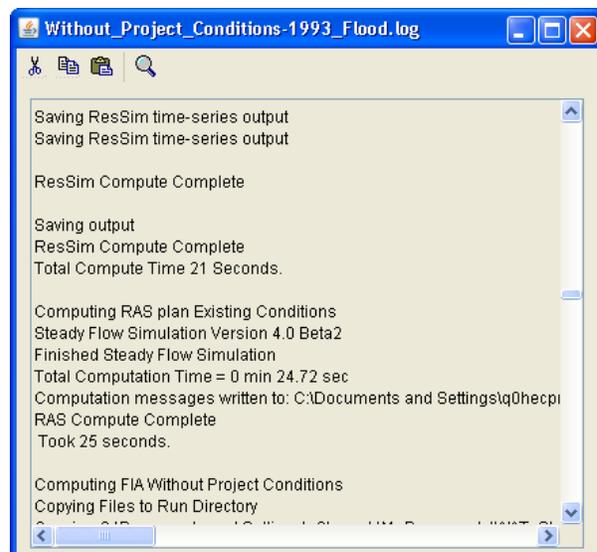


Figure 9.33 *SimulationName.log* Dialog Box

Saving a Simulation

To save a simulation, from the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Save**. Any changes that have occurred to the selected simulation will be saved by the WAT.

Renaming a Simulation

To rename a simulation:

1. From the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Rename**. The **Rename Simulation** dialog box will open (Figure 9.34).

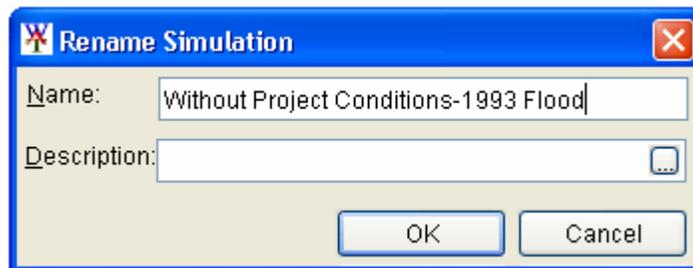


Figure 9.34 Rename Simulation Dialog Box

2. In the **Name** box, enter the new name, and enter a description in the **Description** box if needed (recommended).
3. Click **OK**, a warning message will appear asking you if you really want to rename the selected simulation. Click **Yes**, the warning message and the **Rename Simulation** dialog box will close.

Deleting a Simulation

To delete a simulation, right-click on a simulation in the table, from the individual simulation shortcut menu (see Figure 9.24, page 9-14), click **Delete From Study**. A warning message will appear asking you if you really want to delete the selected simulation. Click **Yes**, the intersection of the alternative and analysis period/event that the simulation was associated with will now be blank in table in the **Alternative and Simulation Manager** (see Figure 9.25, page 9-15).

Toolbar

From the toolbar of the **Alternative and Simulation Manager** (see Figure 9.23, page 9-14), you can create a simulation. Click , the **Create New Simulation** dialog box will open (see Figure 9.26, page 9-15). The steps for creating a simulation are the same as in the **Creating a Simulation**, under Section 9.4.1, page 9-15.

Menu Bar

From the **Menu Bar** of the **Alternative and Simulation Manager** (see Figure 9.24, page 9-14), you can create simulation, rename simulations, and delete simulations.

Creating a Simulation

To create a simulation:

1. On the **File** menu, point to **Simulation**, and then click **New**, the **Create New Simulation** dialog box will open (Figure 9.35).

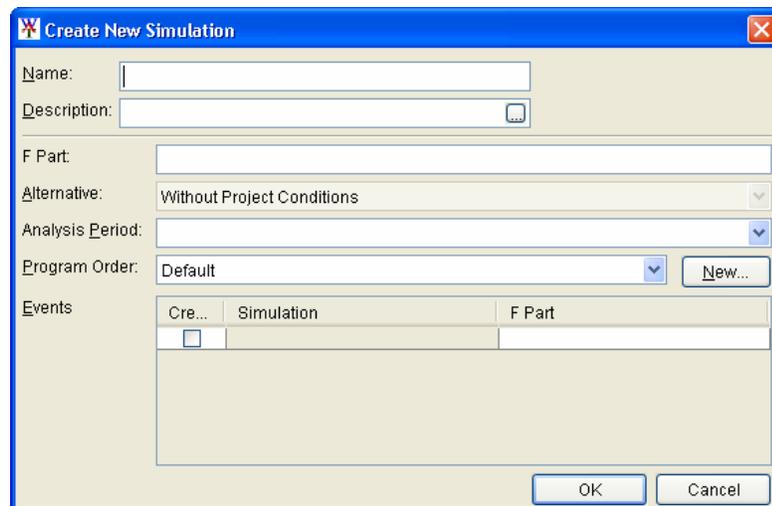


Figure 9.35 Create New Simulation Dialog Box

2. From the **Analysis Period** list, select an analysis period. Once an analysis period is selected, the name, F part are created and the dialog box changes. The dialog box is now similar to Figure 9.26 (page 9-15).
3. The steps for creating a simulation are the same as in the **Creating a Simulation**, under Section 9.4.1, page 9-15.

Renaming Simulations

If you want to rename a simulation, but you want to choose from a list of the developed simulations for a study:

1. On the **File** menu, point to **Simulation**, and then click **Rename**, the **Rename Simulation** dialog box will open (see Figure 9.36, page 9-22).
2. From the **Existing** list (see Figure 9.36, page 9-22) select a simulation, in the **Rename** box the name and description of the selected simulation will appear.

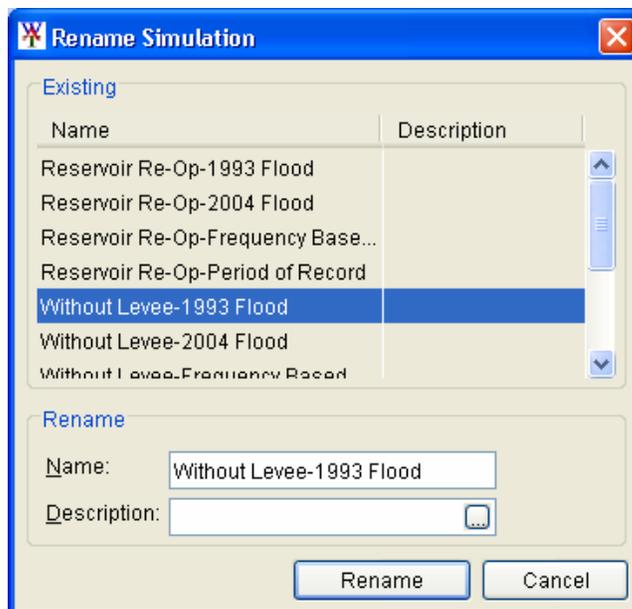


Figure 9.36 Rename Simulation Dialog Box

3. In the **Name** box (Figure 9.36), enter the new name, and enter a description in the **Description** box if needed (recommended).
4. Click **Rename**, a warning message will appear asking you if you really want to rename the selected simulation. Click **Yes**, the warning message and the **Rename Simulation** dialog box (Figure 9.36) will close.

Deleting Simulations

If you want to delete a simulation, but you want to choose from a list of the developed simulations for a study:

1. On the **File** menu, point to **Simulation**, and then click **Delete**, the **Delete Simulations** dialog box will open (see Figure 9.37, page 9-23).
2. From the **Existing** list select a simulation, in the **Delete** box the name and description of the selected simulation will appear.
3. Click **Delete**, a warning message will appear asking you if you really want to delete the selected simulation. Click **Yes**, the intersection of the alternative and analysis period/event that the simulation was associated with will now be blank in the table on the **Alternative and Simulation Manager** (see Figure 9.25, page 9-15).

9.4.2 Study Pane

The user can also create, edit, rename, and delete simulations from the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-5). This section of

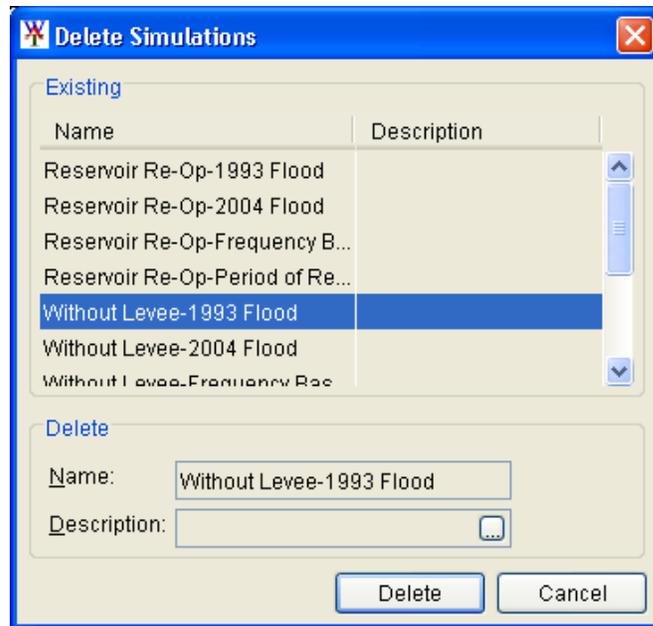


Figure 9.37 Delete Simulations Dialog Box

the chapter describes how to perform these operations directly from the **Study Pane**.

Simulations

The simulations shortcut menu (Figure 9.38) is available from the **Study Pane**, by right-clicking on the folder **Simulations**. This shortcut menu will allow you to create, rename, and delete simulations. The following sections provide further details.

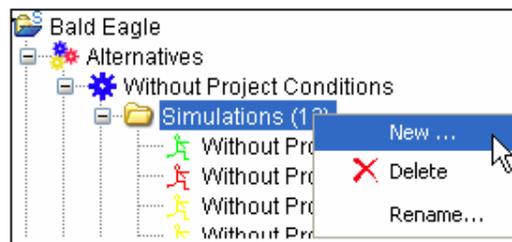


Figure 9.38 Simulations Shortcut Menu

Creating a Simulation

To create a simulation from the **Study Pane**:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the simulations shortcut menu (Figure 9.38), click **New** the **Create New Simulation** dialog box will open (see Figure 9.35, page 9-21).
2. The steps for creating a simulation are the same as in the **Creating a Simulation**, under Section 9.4.1, page 9-15.

Renaming Simulations

If you want to rename a simulation, but you want to choose from a list of the developed simulations for a study:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the simulations shortcut menu (see Figure 9.38, page 9-23), click **Rename**. The **Rename Simulation** dialog box will open (see Figure 9.36, page 9-22).
2. The steps for renaming a simulation are the same as in the **Renaming Simulations**, under Section 9.4.1, page 9-21.

Deleting Simulations

If you want to delete a simulation, but you want to choose from a list of the developed simulations for a study:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the simulations shortcut menu (see Figure 9.38, page 9-23), click **Delete**. The **Delete Simulations** dialog box will open (see Figure 9.37, page 9-23).
2. The steps for deleting a simulation are the same as in the **Deleting Simulations**, under Section 9.4.1, page 9-22.

Individual Simulations

The individual simulation shortcut menu (Figure 9.39) is available from the **Study Pane**, by right-clicking on a simulation name under the **Simulation** folder. This shortcut menu will allow you to view the selected

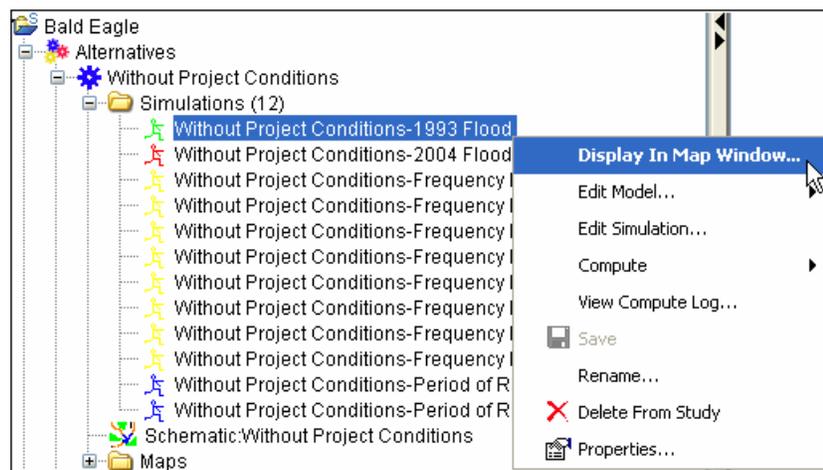


Figure 9.39 Individual Simulation Shortcut Menu

simulation in a map window; edit the model alternatives associated with the selected simulation; edit the name, description, and DSS mapping

identifier of the selected simulation; compute; view the log of the compute; rename; and, delete from the study the selected simulation.

Viewing a Simulation

To view a simulation in a map window:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the individual simulation shortcut menu (see Figure 9.40, page 9-25), click **Display in Map Window**.
2. The steps for viewing a simulation are the same as in the **Viewing a Simulation**, under Section 9.4.1, page 9-17.

Editing the Model Alternatives of a Simulation

To edit the model alternatives associated with a simulation:

1. From the individual simulation shortcut menu (see Figure 9.40, page 9-25), point to **Edit Model**, from the sub-menu (see Figure 9.30, page 9-17) click on the model alternative you wish to edit.
2. The steps for editing the model alternatives associated with a simulation are the same as in the **Editing the Model Alternatives of a Simulation**, under Section 9.4.1, page 9-17.

Editing a Simulation

To edit a simulation:

1. From the individual simulation shortcut menu (see Figure 9.40, page 9-25), click **Edit Simulation**. The **Simulation Editor** will open (see Figure 9.31, page 9-18).
2. The steps for editing a simulation are the same as in the **Editing a Simulation**, under Section 9.4.1, page 9-18.

Computing a Simulation

To compute a simulation:

1. From the individual simulation shortcut menu (see Figure 9.39, page 9-25), point to **Compute**, from the sub-menu (see Figure 9.40, page 9-26) you have two options for computing.
2. **All** will compute all of the programs associated with the program order (see Section 9.2, page 9-1) of the simulation. The first compute will compute all programs; any subsequent computes will

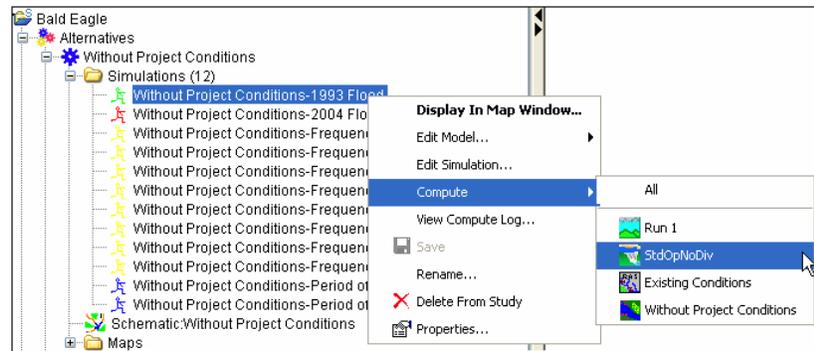


Figure 9.40 Computing Through a Particular WAT Program

- only compute the model that has changed. To force a recomputed hold down the **CTRL** key when clicking **All**.
3. The other option is to compute the simulation through a particular program alternative, stopping the compute process at that program. For example, in Figure 9.40, if you only wish to compute the simulation thru the ResSim alternative you would click *StdOpNoDiv*, the compute would proceed through **ResSim** and then stop. Once again, the first compute will compute through to the selected program alternative, to force a re-compute hold down the **CTRL** key when clicking the program alternative.
 4. With either option (step 2 or 3) the **Compute Progress** dialog box will open (see Figure 9.32, page 9-19). From this dialog box you can see which program alternative is computing for the simulation and information from each program alternative is displayed in the **Compute Progress** dialog box.
 5. If you want to stop the computation the selected simulation, from the **Compute Progress** dialog box (see Figure 9.32, page 9-19), click **Cancel**.
 6. Once the computation is finished, click **Close** and the **Compute Progress** dialog box will close (see Figure 9.32, page 9-19).

Viewing the Compute Log of a Simulation

To view the compute log of a simulation, from the individual simulation shortcut menu (see Figure 9.39, page 9-25), click **View Compute Log**. The *SimulationName.log* dialog box will open (see Figure 9.33, page 9-19) in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). This contains information regarding the compute for the selected simulation. This information is provided by each individual program that was part of the compute.

Saving a Simulation

To save a simulation, from the individual simulation shortcut menu (see Figure 9.39, page 9-25), click **Save**. Any changes that have occurred to the selected simulation will be saved by the WAT.

Renaming a Simulation

To rename a simulation from the **Study Pane**:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the individual simulation shortcut menu (see Figure 9.39, page 9-25), click **Rename**. The **Rename Simulation** dialog box will open (see Figure 9.34, page 9-20).
2. The steps for renaming a simulation are the same as in the **Renaming a Simulation**, under Section 9.4.1, page 9-20.

Deleting a Simulation

To delete a simulation, from the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the individual simulation shortcut menu (see Figure 9.39, page 9-25), click **Delete From Study**. A message will open asking you if you really want to delete the selected simulation. Click **Yes**, the warning message will close and the simulation will no longer appear under the **Simulations** folder.

Simulation Properties

The properties of a simulation include the name and description for the Beta Version. For Version 1.0 properties that will be displayed are: WAT alternative, analysis period, program order, and models and model alternatives. To view the properties of a simulation:

1. From the **Study Tab**, on the **Study Pane**, from the **Simulations** folder, right-click on a simulation, from the individual simulation shortcut menu (see Figure 9.39, page 9-25), click **Properties**.
2. The **Properties for SimulationName** dialog box will open (Figure 9.41).

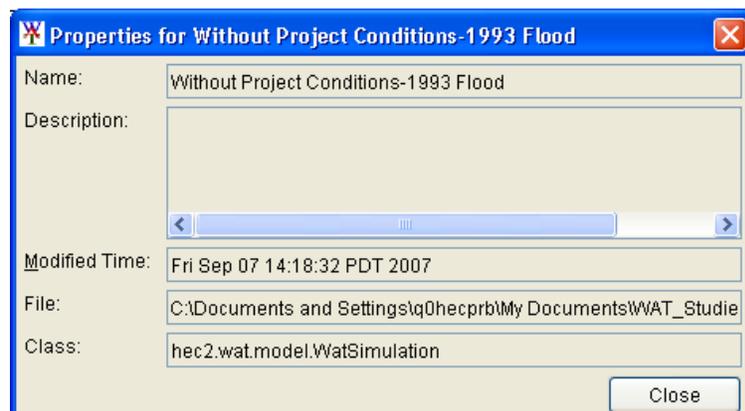


Figure 9.41 Properties for *SimulationName* Dialog Box

- For the Beta Version the properties for viewing are the name and description of the selected simulation; the date and time the simulation was last modified; the location of the simulation file; and, the name of the file which contains information about the simulation.

9.5 Model Linking

The next step is to have the models of a simulation communicate with each other. This is accomplished by linking (DSS mapping) the models thru DSS and using a simulation name. From the WAT, the **Model Linking Editor** (Figure 9.42) provides an easy way to link models including observed data, and provides a mechanism where the linking will have to be done once per alternative.

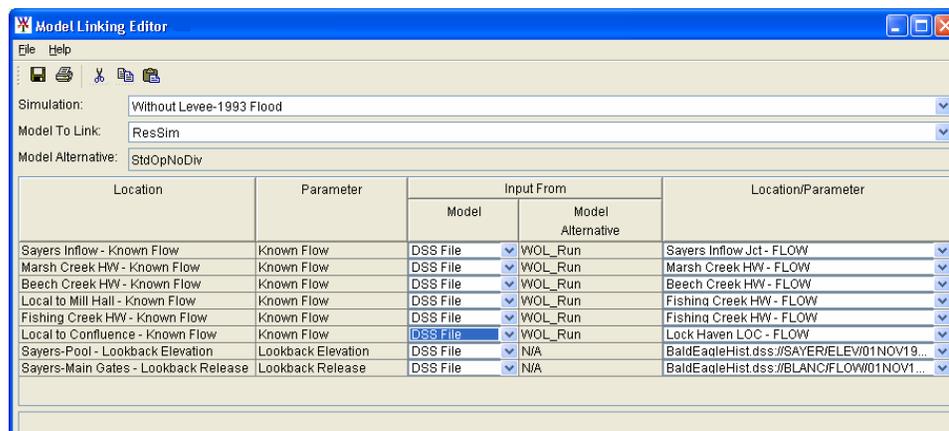


Figure 9.42 Model Linking Editor

To access the **Model Linking Editor**, from the WAT main window, from the WAT main window, from the **WAT Tools** toolbar, click , the **Modeling Linking Editor** will open (Figure 9.42). You can also access the **Model Linking Editor** from the WAT main window in another location. From the **Edit** menu, click **Model Linking Editor**, and the **Modeling Linking Editor** will open (Figure 9.42).

Another way to access the **Model Linking Editor** is from the **Alternative and Simulation Manager** (see Figure 9.23, page 9-14). From the **Edit** menu, click **Model Linking Editor**; the **Model Linking Editor** will open (Figure 9.42). Section 9.5.1 concentrates on accessing the **Model Linking Editor** from the **Alternative and Simulation Manager**, but the concepts are the same from wherever you access the **Model Linking Editor** in the WAT.

9.5.1 Model Linking Editor

To link models for a simulation:

1. From the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . The **Alternative and Simulation Manager** will open (see Figure 9.23, page 9-14).
2. On the **Edit** menu, click **Model Linking Editor**, the **Model Linking Editor** will open (see Figure 9.42, page 9-28).
3. The linking of models is done by simulation, so from the **Simulation** list you need to select a simulation.
4. Next, you need to select the model that you want to link, with the default program order that would be ResSim, since the first program is not linked. From the **Model To Link** list select the appropriate model.
5. Since a simulation knows what model alternative is being used for a specific model, once you make your model selection the **Model Alternative** box will display the correct model alternative. The table on the **Model Linking Editor** will fill in with information provided from the model alternative (see Figure 9.42, page 9-28).
6. If the model alternative has not been linked to a model in the program order, the WAT will default to what the previous linking was for that model alternative. You will need to select the model that ResSim will be receiving data from. From the **Model Linking Editor** (Figure 9.43), on the table, under the **Input From** header, in the **Model** column, for each location, from the **Model** list, select

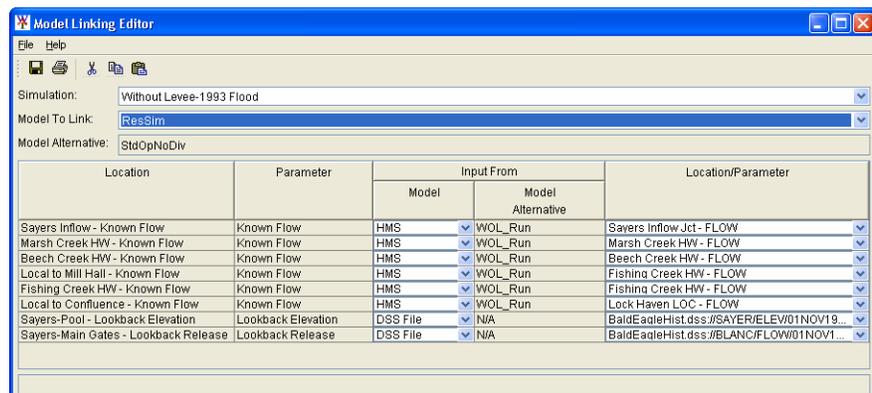


Figure 9.43 Model Linking Editor – ResSim Model Alternative Linked

- from the choices available. Based on the program order, the choices will include the available programs, the ability to link to a DSS file, and a user defined choice (available Version 1.0).
7. If your **Model to Link** (Figure 9.43) is ResSim, then from the **Model** list, select HMS. Once this selection is made, the **Model Alternative** column will fill in automatically with the correct model alternative; since this information is know by the simulation.

8. If you have selected a model, now you need to provide the location (common computation point) and parameter (e.g., FLOW, STAGE) information, the WAT has compiled a list of locations and parameters from the model alternative. From the **Location/Parameter** column, from the list select the appropriate location/parameter. You will need to repeat this step for all the locations in the table, once you are finished, the table will be complete (see Figure 9.43, page 9-29) and the linking for that one model will be finished for the selected simulation.
9. Before proceeding to the next model, from the toolbar click **Save**, or on the **File** menu, click **Save**.
10. Repeat Steps 5 thru 9 to complete the linking information for the rest of the programs set in the program order.
11. If you have chosen to link to a DSS file, from the **Model** list, click **DSS File**, a **Select Pathname** dialog box will open (Figure 9.44). From this dialog box, find the appropriate DSS file, and then select the correct pathname for the location in the table. Click **Set**

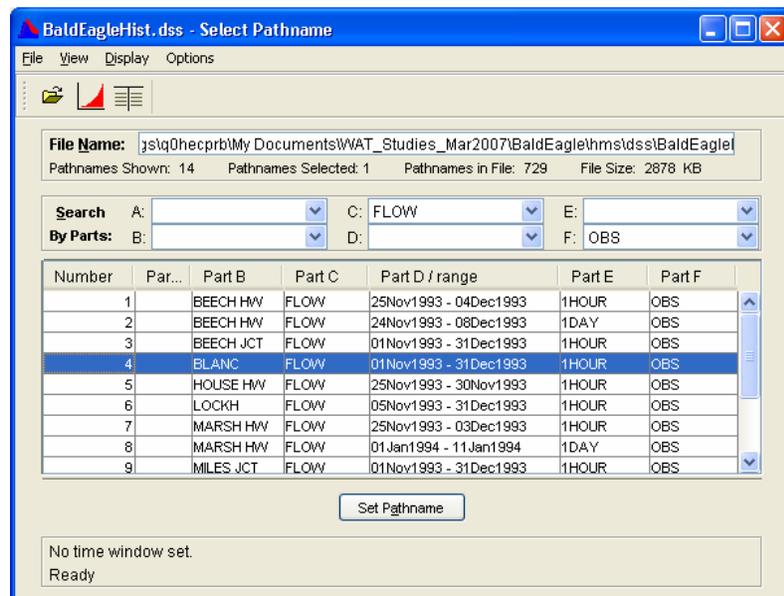


Figure 9.44 Select Pathname Dialog Box

Pathname, the **Select Pathname** dialog box will close and on the table on the **Model Linking Editor**, under the **Location/Parameter** column for that location, the DSS filename and the selected pathname will appear (see Figure 9.43, page 9-29).

Once you have completed the model linking step for all the programs for that simulation, you can then establish model linking for other simulations. After the model linking has been finished you are now ready to compute simulations.

CHAPTER 10

Computes and Alternative Analysis

10.1 Computing in HEC-WAT

Now that simulations have been defined, the linking of model alternatives has been completed for the simulations, and model alternatives have been imported into the WAT, you are now ready to compute. Once again the WAT provides you with several ways to compute simulations. You can compute a simulation individually, compute multiple simulations, or compute through a specific program. For example if you want to compute the simulation through the RAS model, the WAT would compute the **HMS**, **ResSim** and **RAS** model alternatives for the simulation (see Section 10.1.2, page 10-4). The following sections describe in detail how you would compute simulations in the WAT.

10.1.1 Compute Manager

The **Compute Manager** (Figure 10.1) provides you with information on the computes of simulations. The **Compute Manager** has a table which is color coded so you can easily tell which simulations need to be computed,

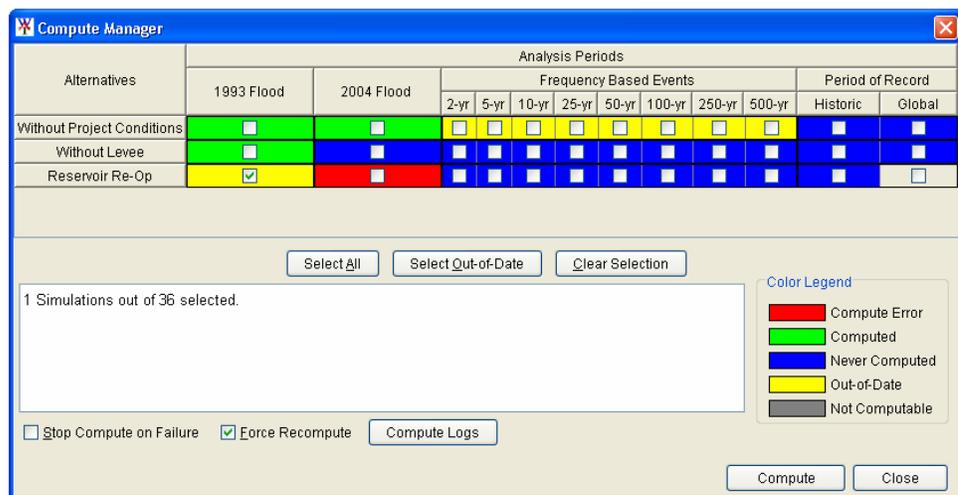


Figure 10.1 Compute Manager

which simulations have errors, which simulations have been computed, which simulations have had changes made and need to be re-computed,

and, which simulations that are not computable, because something is incomplete. Also, from the **Compute Manager** (see Figure 10.1, page 10-1) you can select individual simulations, multiple simulations, or all simulations for computation.

From the WAT you can access the **Compute Manager** from several different places. From the WAT main window, on the **Compute** menu, click **Compute Manager**, or, from the **Management Tools** toolbar, click , either way open the **Compute Manager** (see Figure 10.1, page 10-1).

Another way to access the Compute Manager is from the **Alternative and Simulation Manager** (Figure 10.2). From the **Toolbar**, click . The steps below assume you access the **Compute Manager** from the **Alternative and Simulation Manager**, but the concepts are the same from wherever you access the **Compute Manager** in the WAT.



Figure 10.2 Alternative and Simulation Manager

To compute simulations:

1. From the WAT main window, from the **Management Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click . The **Compute Manager** will open (see Figure 10.1, page 10-1).
2. To compute all simulations click **Select All** (Figure 10.3), a green checkmark will appear for all simulations in the table on the **Compute Manager** (see figure 10.1, page 10-1).

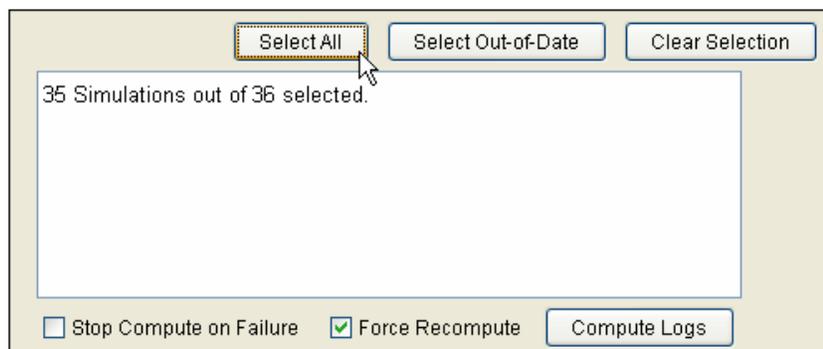


Figure 10.3 Compute Manager – Compute Commands for Simulations

3. To compute individual simulations, click on the cell in the table that represents an individual simulation.

4. To clear selecting simulations, click **Clear Selection** (see Figure 10.3, page 10-2), any green check marks will no longer display on the table.
5. To compute all simulations that are out-of-date, click **Select Out-of-Date**, the WAT will select all simulations that are out-of-date.
6. After selecting a single simulation or multiple simulations, click **Compute**. The **Compute Progress** dialog box will open (Figure 10.4). From this dialog box you can see which model is computing for the simulation and information from each model is displayed in the **Compute Progress** dialog box.

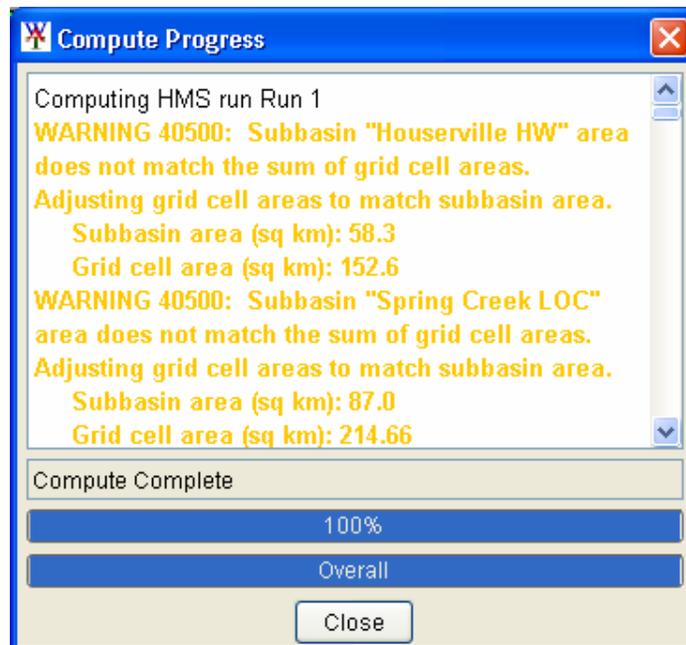


Figure 10.4 Compute Progress Dialog Box

7. If a simulation has been previously computed and only one model has changed, when you re-compute, the previous models that did not change will not be re-computed. If you want the whole simulation to re-compute, click **Force Recompute** (see Figure 10.3, page 10-2), the **Compute Progress** dialog box will open (Figure 10.4) and all models associated with the selected simulation will re-compute.
8. If you want to stop the current computation of a simulation, from the **Compute Progress** dialog box, click **Cancel**. Remember this only cancels the compute of the active simulation, if you have multiple simulations selected, the next simulation will start computing.
9. If during a compute that has multiple simulations, if one of the simulations fails, the WAT will compute the other simulations. If you want the WAT to stop when any simulation fails, click **Stop Compute on Failure**.
10. Once the computation is finished, click **Close** and the **Compute Progress** dialog box will close (Figure 10.4).

11. If you wish to view the logs of simulations that have computed, click **Compute Logs**. The **Select Log File** dialog box will open (Figure 10.5). From the **Existing** box, select the simulation you wish to view the log file of the last compute for that simulation, click **Open**.

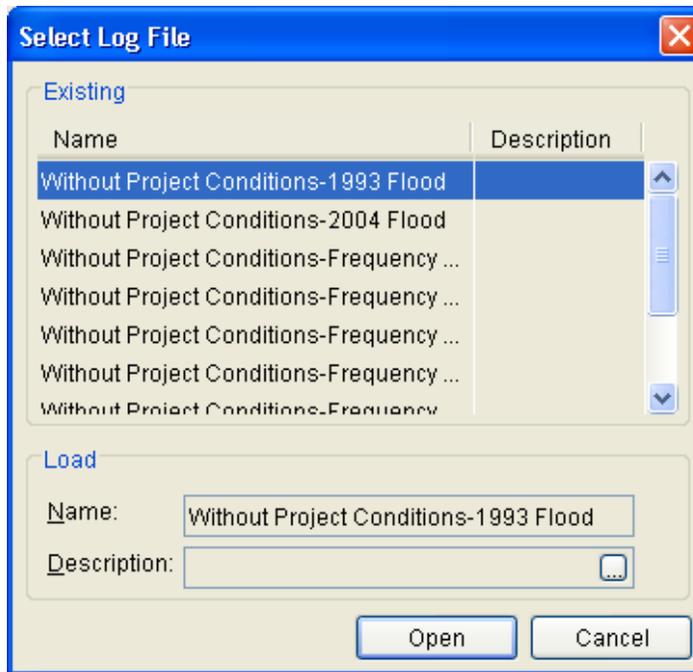


Figure 10.5 Select Log File Dialog Box

12. The **SimulationName.log** dialog box will open (Figure 10.6) in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). This contains information regarding the compute for the selected simulation. This information is provided by each individual program that was part of the compute.

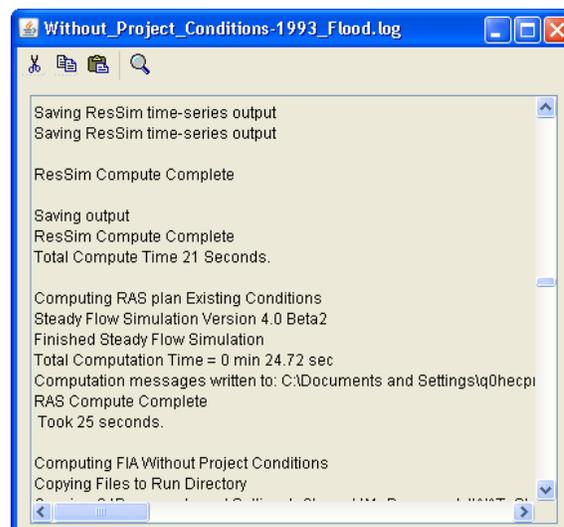


Figure 10.6 SimulationName.log Dialog Box

15. Once you have completed your computations, click **Close**, the **Compute Manager** will close (see Figure 10.1, page 10-1).

Now that you have successfully computed simulations, you can now setup comparing and reviewing results. Section 10.2 (page 10-7) reviews the WAT mechanism for comparing results.

10.1.2 Study Pane

From the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-6) of the WAT you can compute a simulation individually or compute a simulation through a specific program. For example if you want to compute the simulation through the RAS model, the WAT would compute the **HMS**, **ResSim** and **RAS** model alternatives for the simulation. The following two sections detail how to compute a simulation from the **Study Pane**.

Compute an Individual Simulation

To compute an individual simulation:

1. From the **Study Tab**, on the **Study Pane** (Figure 10.7), expand the **Alternatives** folder, expand the folder of the alternative you wish to compute simulations from (e.g., *Without Project Conditions*),

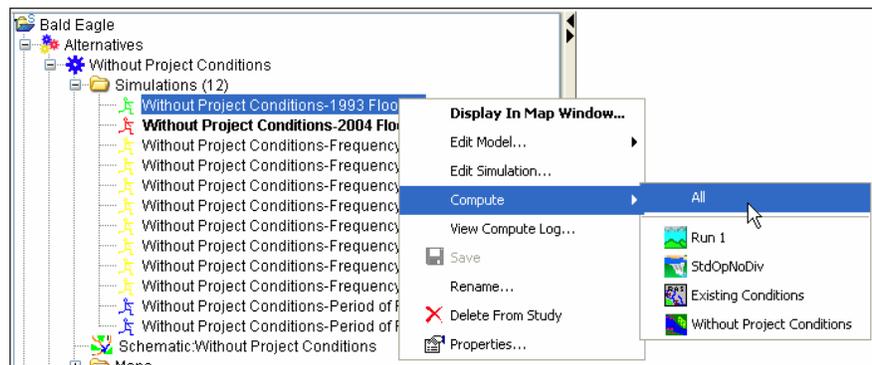


Figure 10.7 Study Pane – Simulation Shortcut Menu

- expand the **Simulations** folder. Right-click on the simulation you wish to compute, for example in Figure 10.7, right-click on *Without Project Conditions-1993 Flood*. From the shortcut menu, point to **Compute**, click **All**, the WAT will compute all of the programs associated with the program order (see Chapter 9, Section 9.2, page 9-1) of the simulation. The first compute will compute all programs; any subsequent computes will only compute the model that has changed. To force a re-compute hold down the **CTRL** key when clicking **All**.
2. The **Compute Progress** dialog box will open (see Figure 10.4, page 10-3). From this dialog box you can see which program alternative is computing for the simulation and information from each program alternative is displayed in the **Compute Progress** dialog box.
3. If you want to stop the computation the selected simulation, from the **Compute Progress** dialog box (see Figure 10.4, page 10-3), click **Cancel**.

4. Once the computation is finished, click **Close** and the **Compute Progress** dialog box will close (see Figure 10.4, page 10-3).
5. If you wish to view the log of the simulation that has computed, from the simulation shortcut menu (see Figure 10.7, page 10-5), click **View Compute Log**. The *SimulationName.log* dialog box will open (see Figure 10.6, page 10-4) in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). This contains information regarding the compute for the selected simulation. The information is provided by each individual program that was part of the compute.

Compute a Simulation through a Specific Program

To compute a simulation through a specific program:

1. From the **Study Tab**, on the **Study Pane** (see Figure 10.7, page 10-5), expand the **Alternatives** folder, expand the folder of the alternative you wish to compute simulations from (e.g., *Without Project Conditions*), expand the **Simulations** folder. Right-click on the simulation you wish to compute, for example in Figure 10.7, right-click on *Without Project Conditions-1993 Flood*. From the shortcut menu, point to **Compute**, select which program you want the simulation to compute through.
2. For example, in Figure 10.7 (page 10-5), if you only wish to compute the simulation thru the ResSim model alternative you would click *StdOpNoDiv*, the compute will proceed through **ResSim** and then stop. Once again, the first compute will compute through to the selected program alternative, to force a re-compute hold down the **CTRL** key when clicking the program alternative.
3. The **Compute Progress** dialog box will open (see Figure 10.4, page 10-3). From this dialog box you can see which program alternative is computing for the simulation and information from each program alternative is displayed in the **Compute Progress** dialog box.
4. If you want to stop the computation the selected simulation, from the **Compute Progress** dialog box (see Figure 10.4, page 10-3), click **Cancel**.
5. Once the computation is finished, click **Close** and the **Compute Progress** dialog box will close (see Figure 10.4, page 10-3).
6. If you wish to view the log of the simulation that has computed, from the simulation shortcut menu (see Figure 10.7, page 10-5), click **View Compute Log**. The *SimulationName.log* dialog box will open (see Figure 10.6, page 10-4) in the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7). This contains information regarding the compute for the selected simulation. The information is provided by each individual program that was part of the compute.

Now that you have successfully computed simulations, you can now setup comparing and reviewing results. Section 10.2 reviews the WAT mechanism for comparing results.

10.2 Alternative Analysis

How can you compare with-project and without-project losses? How are urban flood damages in a particular impact area reduced by each of three alternative projects? For the alternative that most reduces crop losses, are urban losses increased? What percentage of the projected flood damages is prevented if a given project is implemented? One of the basic objectives of the WAT is to view and compare alternative results from a single interface.

After the computations are completed, you will be able to view and compare alternative results directly from simulation map windows. The user will select the alternative(s) for comparison from the WAT, through the **Result Comparison Manager** (see Section 10.2.1). Once the selection(s) is made, you will then be able to select any hydrologic object or element (computation points, reservoirs, river reaches, impact areas, cross sections, storage areas etc.) on a simulation map window and a list of tabular or graphical output will be available. Selecting the table or graphic of choice, the WAT will then find that output from the appropriate program and display the result. The user could be oblivious to which model the results came from.

Rearranging the alternatives is important because the comparisons you make consider the first alternative to be the base alternative. The WAT uses whichever alternative you designated as primary as the base alternative. Most of the time, this will be your Without Project Condition alternative. After you arranged your alternatives for comparison, the WAT provides access to several graphs and reports from the individual models that will compare alternative results.

10.2.1 Result Comparison Manager

The **Result Comparison Manager** (see Figure 10.8, page 10-8) provides you with the capability to compare results easily from within the WAT. The **Result Comparison Manager** has a table which is color coded so you can easily tell which simulations need to be computed, which simulations have errors, which simulations have been computed, which simulations have had changes made and need to be re-computed, and, simulations that are not computable, because something is incomplete. Also, from the **Result Comparison Manager** you can select individual simulations, multiple simulations, or all simulations for comparison.

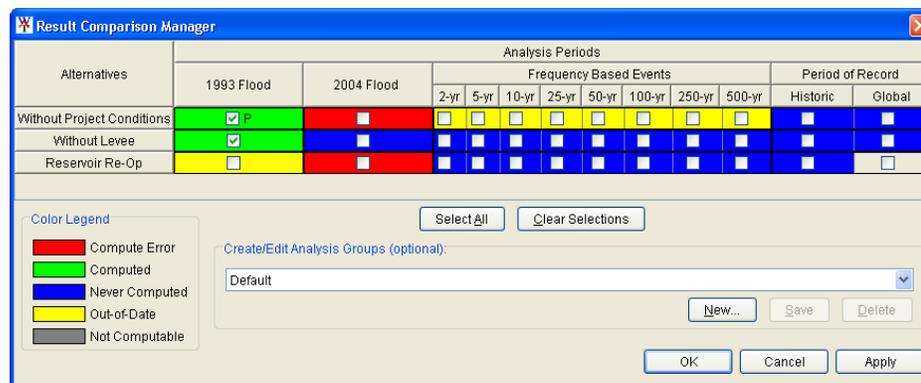


Figure 10.8 Result Comparison Manager

From the WAT you can access the **Result Comparison Manager** from the WAT main window, on the **Results** menu, click **Result Comparison Manager**, or, from the **Management Tools** toolbar, click , either way the **Result Comparison Manager** will open (Figure 10.8)

To setup comparing results:

1. From the WAT main window, from the **Management Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click , the **Result Comparison Manager** will open (Figure 10.8).
2. To compare all results, click **Select All**, a green checkmark will appear for all simulations.
3. To compare individual simulation results, click on the cell in the table that represents an individual simulation.
4. To clear selected simulations, click **Clear Selection**, green check marks will no longer display on the table.
5. When you select the first simulation, the alternative associated with that simulation will become the primary or base alternative in the available comparison graphs and reports. A "P" will appear in the cell of the selected simulation. For example, in Figure 10.8, the simulation for the *Without Project Conditions* alternative and *1993 Flood* analysis period will be the primary alternative in comparison graphs and reports.
6. In the WAT you can save your selections of alternatives to view in an analysis group. An **analysis group** is just a way to group alternative/analysis period sets together with a name. There is a default analysis group which is your selection without specifically saving an analysis group.
7. To save your selection to an analysis group, select the alternatives/analysis periods you wish to compare, in the **Create/Edit Analysis Groups** box (Figure 10.8), click **New**, the **Create New Analysis Group** dialog box will open (see Figure 10.9, page 10-9).
8. Enter an analysis group name in the **Name** box, and an optional description in the **Description** box, click **OK**. The **Create New**

Analysis Group dialog box (Figure 10.9) will close. From the list located in the **Create/Edit Analysis Groups** box, the new analysis group will appear.

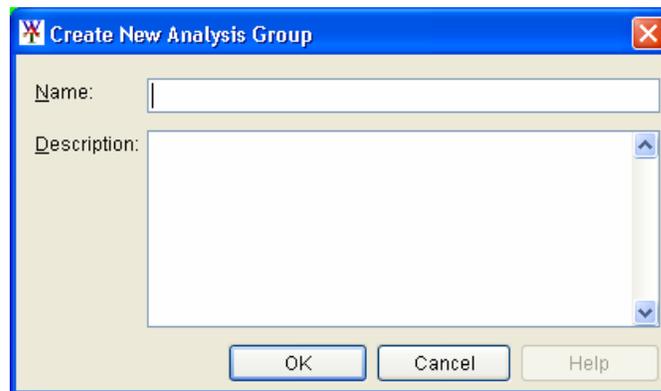


Figure 10.9 Create New Analysis Group Dialog Box

11. Once you have set up the alternative/analysis periods you want to compare, close the **Result Comparison Manager** (see Figure 10.8, page 10-8).

Now to complete your alternatives analysis, open a simulation map window, and from the schematic right-click on a model element, from that shortcut menu select a model graphic or report. When either a graphic or report opens, you should be able to view all the alternatives that were selected for that analysis group and proceed with your alternative analysis. Also, from the **Results** menu, you can select reports from the various models that will display comparison results.

10.2.2 Analysis Tab

The **Analysis Tab** (see Figure 10.10, page 10-10) provides a view for comparing results for the selected analysis group. You can select which alternatives to compare, which alternative will be the "base" alternative, and select analysis groups.

In the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-6) of the **Analysis Tab**, is a list of the simulations that are associated with the selected analysis group. From the list at the top of the **Study Pane** you can select which analysis group you wish to view in the simulation map window.

The simulation that is in bold is the base or primary alternative, and is usually listed first. However, by using the up and down arrows at the bottom of the **Study Pane**, you can re-arrange the order of the simulations. You can also turn-off simulations for viewing by clearing the selection by the name, and then graphics and reports will no longer display that simulation. Also from the **Analysis Tab**, you can create, delete and edit analysis groups.

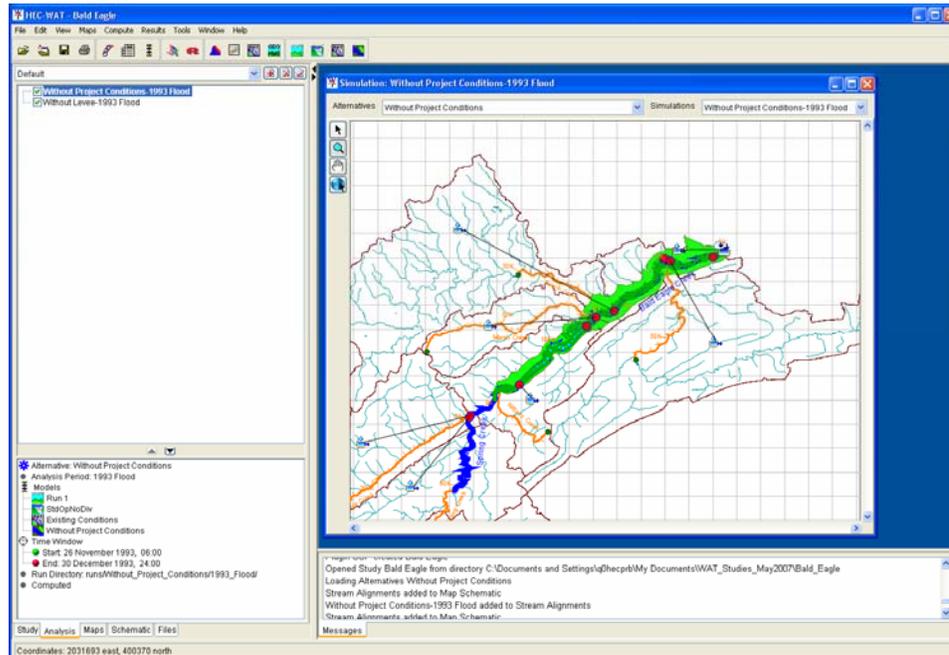


Figure 10.10 Analysis Tab

Creating an Analysis Group

To create an analysis group from the **Analysis Tab**:

1. From the **Analysis Tab** (Figure 10.10), on the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-6), click .
2. The **New Analysis Group** dialog box will open (10.11). Enter an analysis group name in the **Name** box, and an optional (but recommended) description in the **Description** box, click **OK**. The **New Analysis Group** dialog box will close.

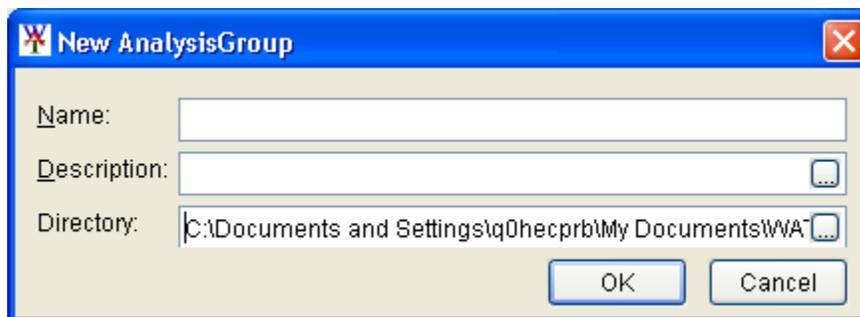


Figure 10.11 New Analysis Group Dialog Box

3. The name of the new analysis group will appear in the list at the top of the **Study Pane**. The **Study Pane** will be blank; you will need to edit the analysis group to add simulations to the analysis group.

Deleting an Analysis Group

To delete an analysis group from the **Analysis Tab**:

1. From the **Analysis Tab** (see Figure 10.10, page 10-10), on the **Study Pane**, from the list at the top of the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-6), select the analysis group you wish to delete.
2. Click , a warning message will appear asking you if you really want to delete the selected analysis group. Click **Yes**, the warning message will close, and the analysis group will be removed from the list and the study.

Editing an Analysis Group

To edit an analysis group from the **Analysis Tab**:

1. From the **Analysis Tab** (see Figure 10.10, page 10-10), on the **Study Pane**, from the list at the top of the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-6), select the analysis group you wish to edit.
2. Click , the **Selection Editor** will open (Figure 10.12). From the **Available** box, select the simulations you wish to add to the analysis group, click **Add**. The selected simulations will now

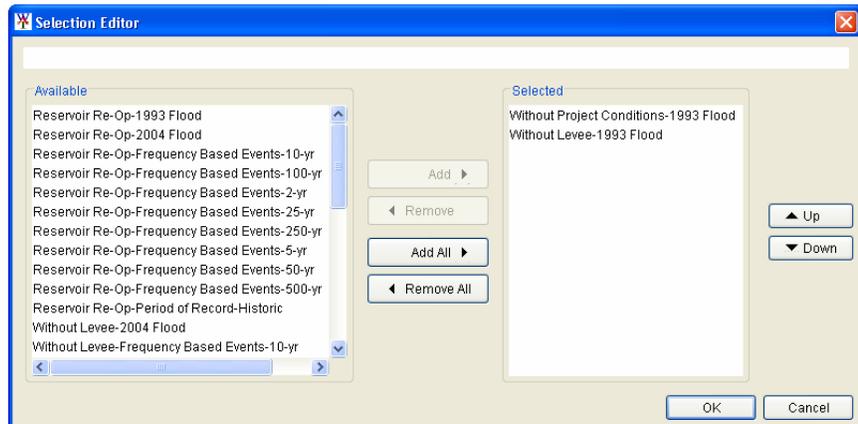


Figure 10.12 Selection Editor

appear in the **Selected** box. You can order the simulations in the **Available** box by selecting the simulation you wish to move up or down in the list, and clicking **Up** or **Down** to move the simulation in the list.

3. To remove simulations from an analysis group, from the **Selected** box, select the simulations you no longer want associated with the selected analysis group, click **Remove**. The selected simulations

will no longer appear in the **Selected** box (see Figure 10.12, page 10-12), and will appear now in the **Available** box.

- Once you have decided on the simulation for the selected analysis group, click **OK**. The **Selection Editor** will close, and the changes you have made to the analysis group will appear on the **Study Pane** of the **Analysis Tab**.

10.2.3 Viewing Results

Now that you have setup the alternatives that you would like to compare, from the map window containing the primary alternative you can select any hydrologic object or element and a list of tabular or graphical output will be available. The available output is from the programs executed in the selected simulations. More detail on available results from the WAT is discussed in Chapter 11. The following is an example of a report and graphical image that compares alternatives results.

To view the FIA Comparison Report:

- From the **Analysis Tab** (see Figure 10.10, page 10-10), on the **Desktop Pane** (see Chapter 3, Section 3.2.2, page 3-7), from the simulation map window, zoom in on a particular part of the schematic.
- After zooming in, right-click on a cross section, a shortcut menu will appear (Figure 10.13). The shortcut menu will list the model elements that it can find in the area where you right-clicked. For

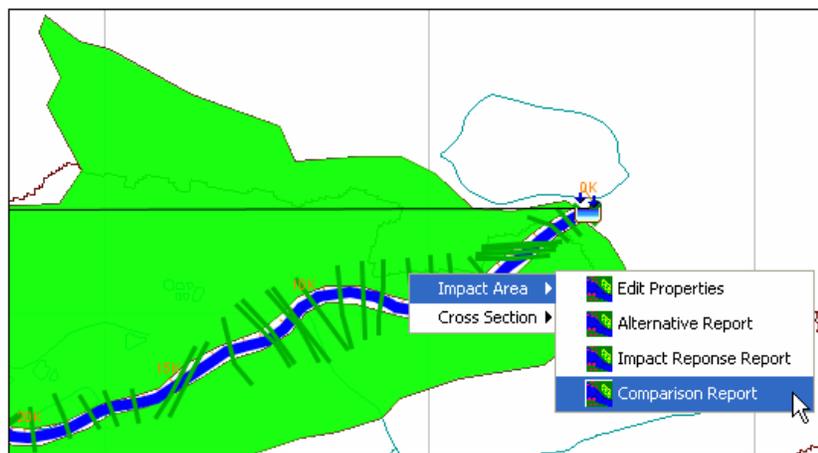


Figure 10.13 Model Results from Schematic - FIA

example, in Figure 10.13, you right-clicked on a cross section, but there is also an impact area within that area, so the shortcut menu lists impact area (FIA result) and cross section (RAS result).

- To view FIA results at an impact area, point to **Impact Area**, click on **Comparison Report**. The **Compare Alternatives Report – StudyName** dialog box will open (see Figure 10.14, page 10-13).

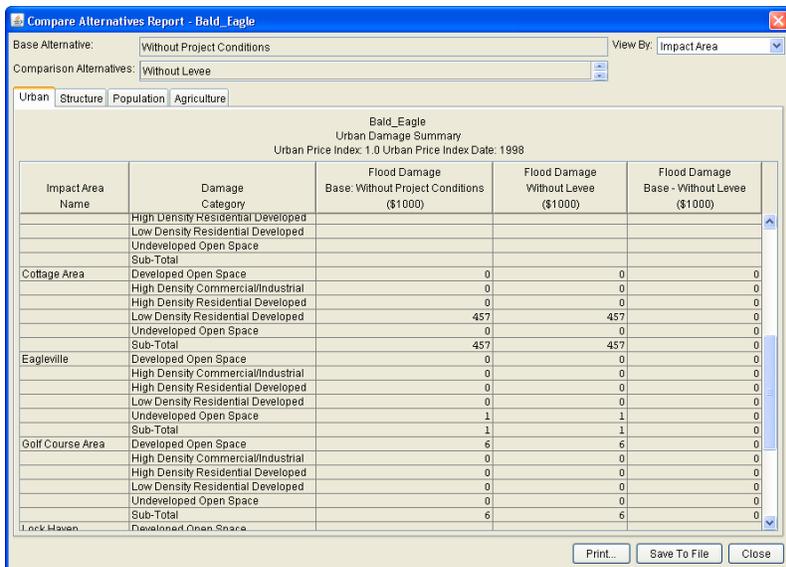


Figure 10.14 FIA Compare Alternatives Report – *StudyName* Dialog Box

This report is from FIA, and compares the damages for each alternative, and in the last column of the report is the difference in flood damage (benefit).

4. Click **Close**, the **Compare Alternatives Report – StudyName** dialog box (Figure 10.14) will close.
5. To view RAS results at a cross section, right-click on a cross section, a shortcut menu will appear (Figure 10.15). The shortcut menu will list the model elements that it can find in the area where

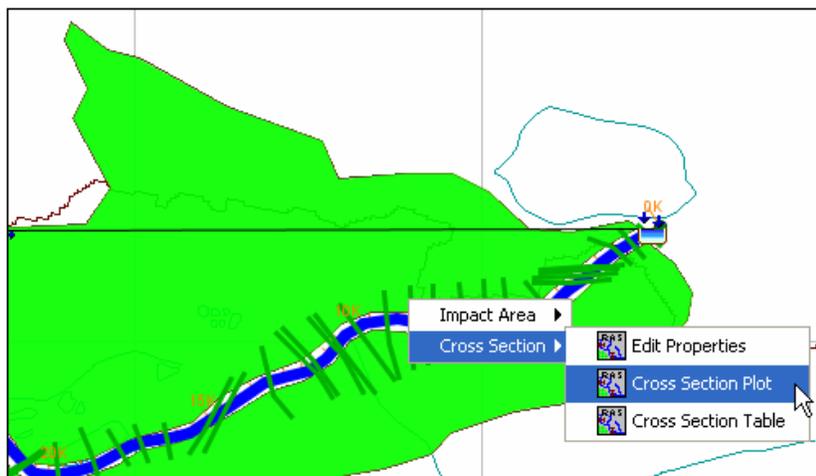


Figure 10.15 Model Results from Schematic - RAS

you right-clicked. To view RAS results, point to **Cross Section**, click on **Cross Section Plot**. The **Cross Section** dialog box will open (see Figure 10.16, page 10-13).

6. This plot is from RAS, and contains results for both alternatives that were selected for comparison. For further details on the information contained in this plot, please see the RAS User's Manual.

CHAPTER 11

Model Results

11.1 Overview

To view model results in HEC-WAT, you must have at least one simulation map window open. Results will display for the active simulation map window by model alternatives that are associated with the simulation. Results are available either interactively from the schematic (Section 11.2) or from the WAT main window (Section 11.3, page 11-10).

11.2 Schematic

From the active simulation map window you can access model results from the model elements that are available on the map window. If you hover over a model element, the tooltip that appears (Figure 11.1) will list what model information is available for that particular model element. For example, in Figure 11.1, at the junction there is possible information from ResSim, there must be a cross section in the area, and a reach element that is recognized by ResSim, HMS, and RAS.



Figure 11.1 ToolTip Information from Schematic (Simulation Map Window)

To access model results, right-click on a model element, you will get a shortcut menu (see Figure 11.2, page 11-2) that will provide access to the model results. The WAT searches for all available model results in the area that you right-clicked on, so the shortcut menu will usually have results for all model elements that were found in the area. Results can either be reports or graphical output that is available from the individual models. For example, in Figure 11.2 (page 11-2), right-clicking at a reach, the WAT provides results from ResSim, HMS, and RAS.



Figure 11.2 Model Result Shortcut Menus

11.2.1 HMS

Whether you are right-clicking on a subbasin element, junction element, reach element, or sink element, from the schematic there are three HMS model results you can view. The following section describes those results.

Graph

To view graphical results from HMS:

1. From the simulation map window, right-click on an HMS model element on the schematic, a shortcut menu will appear. For example, in Figure 11.3, you have right-clicked on a subbasin element, from the shortcut menu, point to **Subbasin**, click **Graph**.

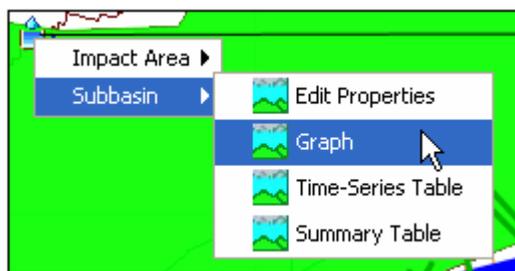


Figure 11.3 HMS Model Result Shortcut Menu

2. The **Graph for Subbasin "subbasin name"** dialog box will open (see Figure 11.4, page 11-3). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. The graphical output displayed is from the HMS model and is discussed in detail in the HMS User's Manual.
4. To close the **Graph for Subbasin "subbasin name"** dialog box (see Figure 11.4, page 11-3) click .

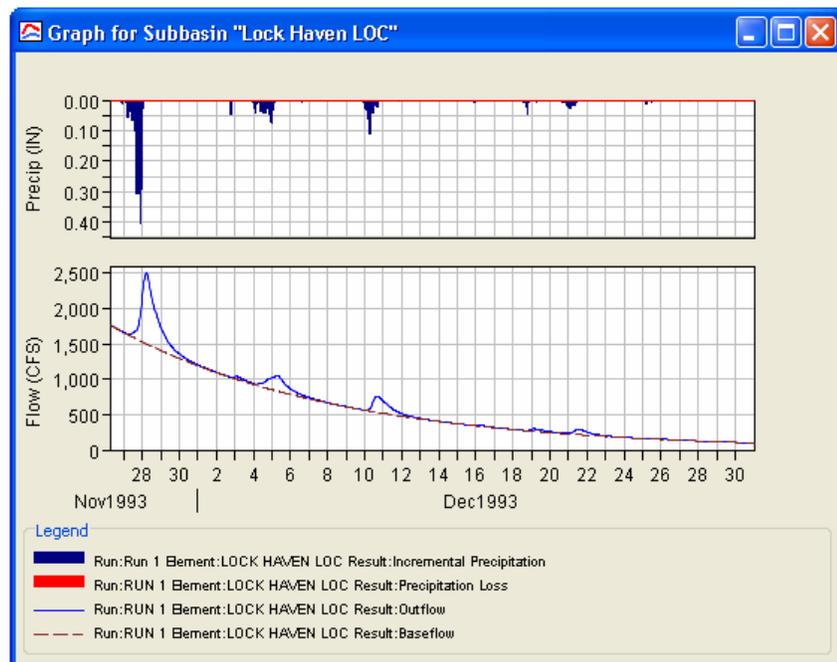


Figure 11.4 HMS – Graphical Results from Schematic

Time-Series Table

1. From the simulation map window, right-click on an HMS model element on the schematic, a shortcut menu will appear. For example, in Figure 11.3 (page 11-2), you have right-clicked on a subbasin element, from the shortcut menu, point to **Subbasin**, click **Time-Series Table**.

2. The **Time-Series Results for Subbasin "subbasin name"** dialog box will open (Figure 11.5). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

Date	Time	Precip (IN)	Loss (IN)	Excess (IN)	Direct Flow (CFS)	Baseflow (CFS)	Total Flow (CFS)
26Nov1993	06:00	0.00	0.00	0.00	0.0	1766.0	1766.0
26Nov1993	07:00	0.00	0.00	0.00	0.0	1759.9	1759.9
26Nov1993	08:00	0.00	0.00	0.00	0.0	1753.8	1753.8
26Nov1993	09:00	0.00	0.00	0.00	0.0	1747.7	1747.7
26Nov1993	10:00	0.00	0.00	0.00	0.0	1741.6	1741.6
26Nov1993	11:00	0.00	0.00	0.00	0.0	1735.6	1735.6
26Nov1993	12:00	0.00	0.00	0.00	0.0	1729.6	1729.6
26Nov1993	13:00	0.00	0.00	0.00	0.1	1723.6	1723.7
26Nov1993	14:00	0.00	0.00	0.00	0.4	1717.6	1718.0
26Nov1993	15:00	0.00	0.00	0.00	0.6	1711.6	1712.2
26Nov1993	16:00	0.00	0.00	0.00	0.7	1705.7	1706.4
26Nov1993	17:00	0.00	0.00	0.00	0.6	1699.8	1700.4
26Nov1993	18:00	0.00	0.00	0.00	0.7	1693.9	1694.6
26Nov1993	19:00	0.00	0.00	0.00	0.6	1688.0	1688.7
26Nov1993	20:00	0.00	0.00	0.00	0.6	1682.2	1682.8
26Nov1993	21:00	0.00	0.00	0.00	0.6	1676.3	1676.9
26Nov1993	22:00	0.01	0.00	0.01	0.6	1670.5	1671.1
26Nov1993	23:00	0.01	0.00	0.01	0.6	1664.7	1665.4
27Nov1993	00:00	0.00	0.00	0.00	1.2	1658.9	1660.1
27Nov1993	01:00	0.00	0.00	0.00	2.4	1653.2	1655.6

Figure 11.5 HMS Report – Time-Series Results from Schematic

3. The report displayed is from the HMS model and is discussed in detail in the HMS User's Manual.

- To close the **Time-Series Results for Subbasin "subbasin name"** dialog box (see Figure 11.5, page 11-3) click .

Summary Table

- From the simulation map window, right-click on an HMS model element on the schematic, a shortcut menu will appear. For example, in Figure 11.3 (page 11-2), you have right-clicked on a subbasin element, from the shortcut menu, point to **Subbasin**, click **Summary Table**.
- The **Summary Results for Subbasin "subbasin name"** dialog box will open (Figure 11.6). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

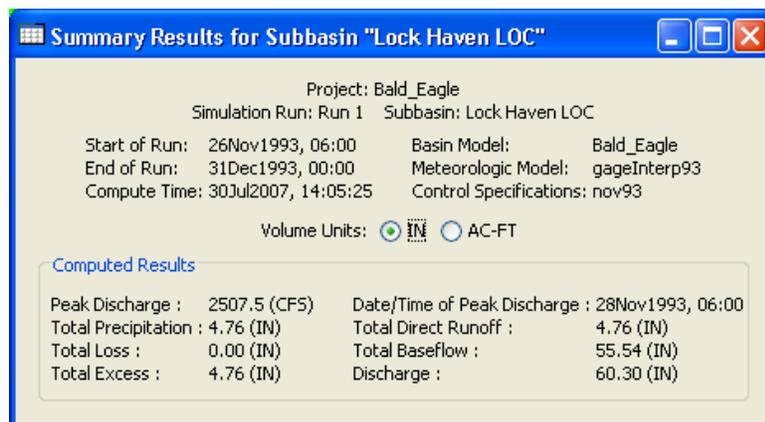


Figure 11.6 HMS Report – Graphical Results from Schematic

- The report displayed is from the HMS model and is discussed in detail in the HMS User's Manual.
- To close the **Summary Results for Subbasin "subbasin name"** dialog box (Figure 11.6) click .

11.2.2 ResSim

When right-clicking on a reservoir element, junction element, or reach element, from the schematic there are several ResSim model results you can view. The following sections describe those results.

Reservoir Element

Release Decision Report

The **Release Decision Report** provides the decision information that the ResSim model alternative reached. The report shows the rules that

governed these decisions. For further details on the Release Decision Report see the ResSim User's Manual.

To view the **Release Decision Report**:

- From the simulation map window, right-click on a reservoir on the schematic, a shortcut menu will appear (Figure 11.7). From the shortcut menu, point to **Reservoir**, click **Release Decision Report**.



Figure 11.7 ResSim Model Result for a Reservoir - Shortcut Menu

- The **Release Decision Report** will open (Figure 11.8).

Date-Time	Active Zone Elev (ft)	Net Inflow (cfs)	Sayers		
			Sayers Active Rule Flow (cfs)	-Dam Active Rule Flow (cfs)	-Dam Uncont Flow (cfs)
26Nov1993, 07:00	610.13	10,940.00	255.00	255.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 08:00	611.48	10,924.14	20.00	20.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 09:00	612.72	10,906.70	20.00	20.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 10:00	613.89	10,887.88	20.00	20.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 11:00	614.97	10,866.73	20.00	20.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 12:00	615.99	10,843.30	20.00	20.00	
	Conservation		MinRelease	MinRelease	
26Nov1993, 13:00	616.93	10,818.90	20.00	20.00	
	Conservation		MinRelease	MinRelease	

Figure 11.8 ResSim Report – Release Decision Report

- In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
- The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will display the decisions based on rules defined in ResSim.
- From the **File** menu, click **Close**, the **Release Decision Report** (Figure 11.8) will close.

Plot

1. From the simulation map window, right-click on a reservoir on the schematic, a shortcut menu will appear (see Figure 11.7, page 11-5). From the shortcut menu, point to **Reservoir**, click **Plot**.
2. A **Plot** dialog box will open (Figure 11.9).

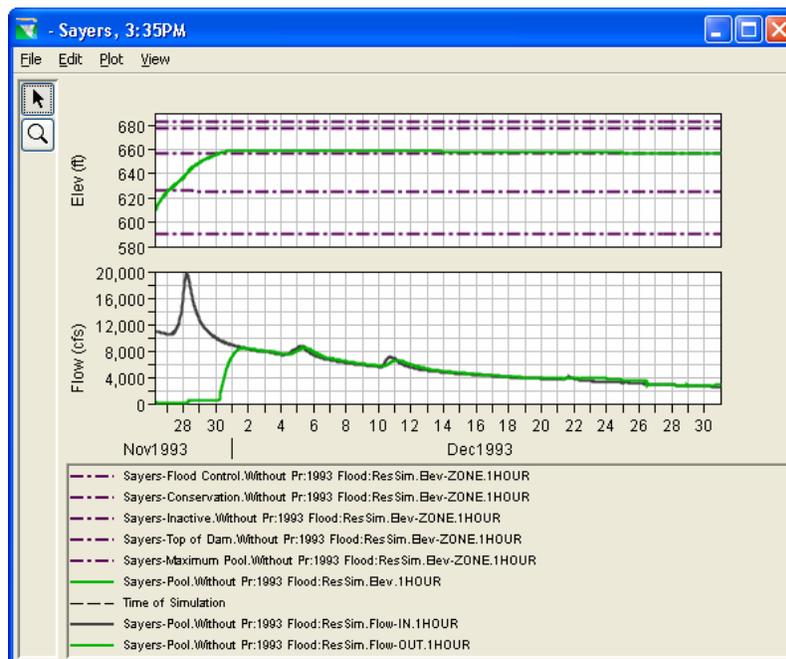


Figure 11.9 ResSim – Plot for a Reservoir

3. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
4. The plot displays graphically, the computed ResSim results for a reservoir.
5. From the **File** menu, click **Close**, the **Plot** dialog box (Figure 11.9) will close.

Plot Power

1. From the simulation map window, right-click on a reservoir on the schematic, a shortcut menu will appear (see Figure 11.7, page 11-5). From the shortcut menu, point to **Reservoir**, click **Plot Power**.
2. A **Power** dialog box will open (see Figure 11.10, page 11-7).
3. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
4. The plot displays graphically, the power and flow results for a reservoir from ResSim. The power results are shown in the upper

window (top viewport), while the flow results are shown in the lower plot window (bottom viewport).

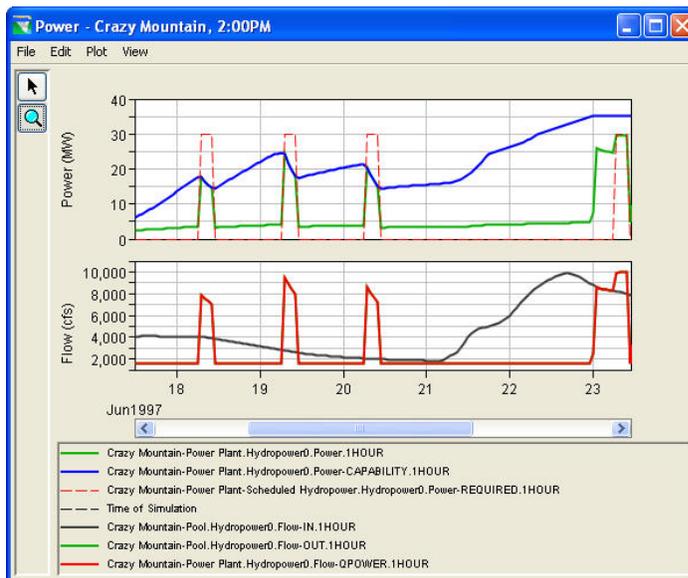


Figure 11.10 ResSim – Power Plot for a Reservoir

5. From the **File** menu, click **Close**, the **Power** dialog box (Figure 11.10) will close.

Plot Releases

1. From the simulation map window, right-click on a reservoir on the schematic, a shortcut menu will appear (see Figure 11.7, page 11-5). From the shortcut menu, point to **Reservoir**, click **Plot Releases**.
2. A **Plot** dialog box will open (Figure 11.11).

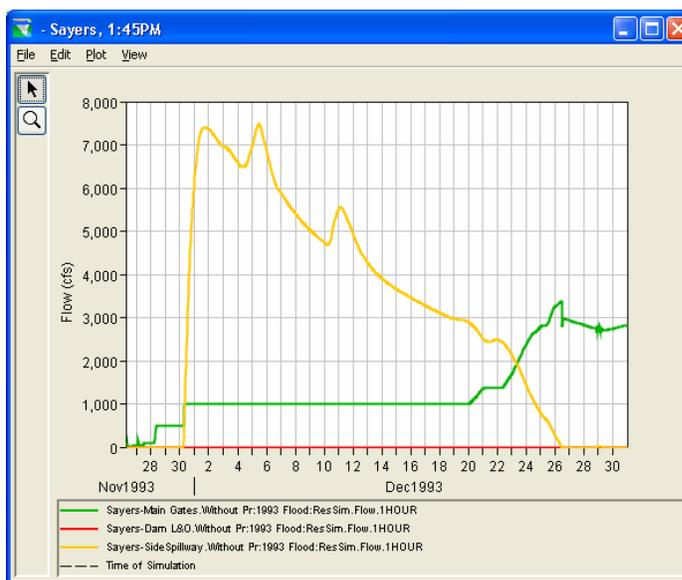


Figure 11.11 ResSim – Releases Plot for a Reservoir

1. From the simulation map window, right-click on a junction on the schematic, a shortcut menu will appear (Figure 11.13). From the shortcut menu, point to **Junction**, click **Plot**.
2. A **Plot** dialog box will open (Figure 11.14).
3. In the Beta version of the WAT, this dialog

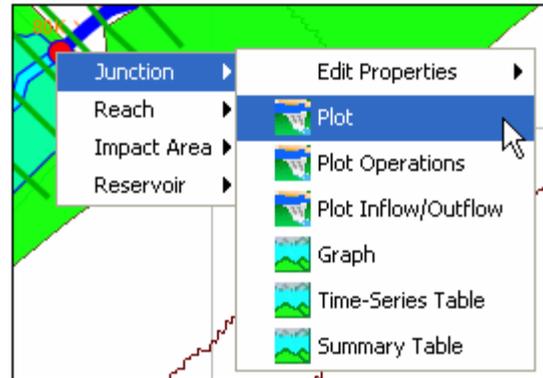


Figure 11.13 ResSim Model Result for a Junction - Shortcut Menu

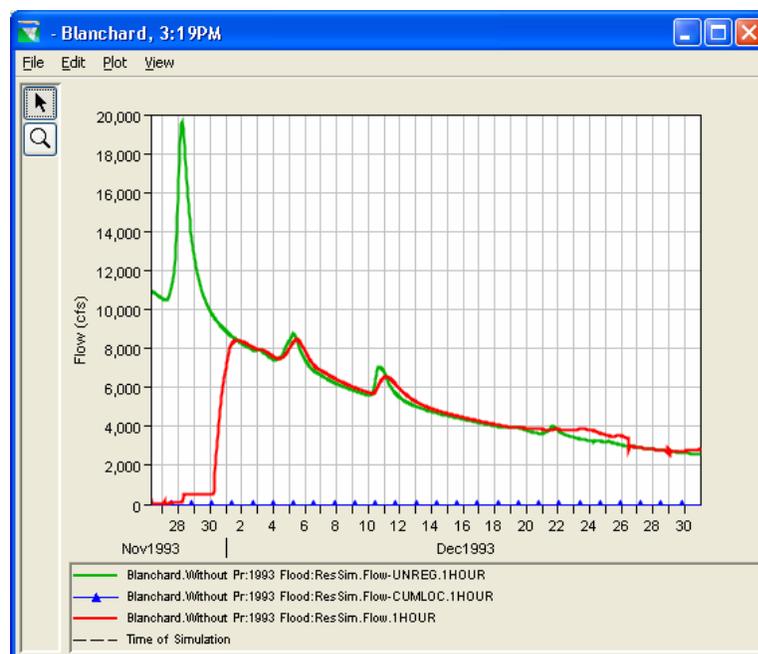


Figure 11.14 ResSim –Plot for a Junction

box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

4. The plot displays graphically, the computed ResSim results for a junction.
5. From the **File** menu, click **Close**, the **Plot** dialog box (see Figure 11.14, page 11-9) will close.

Plot Operations

1. From the simulation map window, right-click on a junction on the schematic, a shortcut menu will appear (Figure 11.13). From the shortcut menu, point to **Junction**, click **Plot Operations**.
2. A **Plot** dialog box will open (see Figure 11.15, page 11-10).

3. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
4. The plot displays graphically, the computed ResSim operation results for a junction.
5. From the **File** menu, click **Close**, the **Plot** dialog box (Figure 11.15) will close.

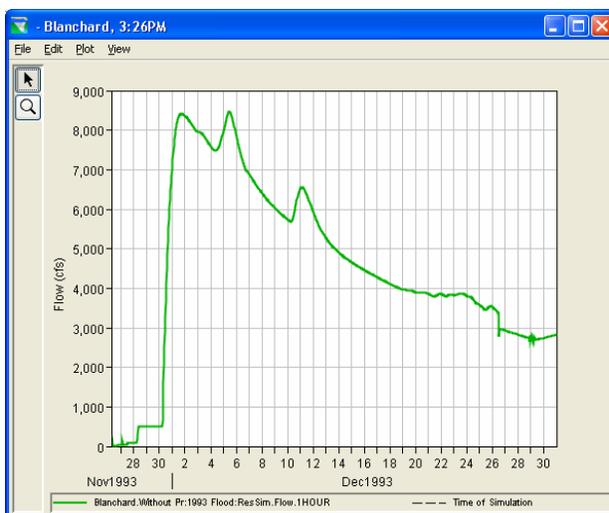


Figure 11.15 ResSim – Operations Plot for a Junction

Plot Inflow/Outflow

1. From the simulation map window, right-click on a junction on the schematic, a shortcut menu will appear (see Figure 11.13, page 11-9). From the shortcut menu, point to **Junction**, click **Plot Inflow/Outflow**.
2. A **Plot** dialog box will open (Figure 11.16).

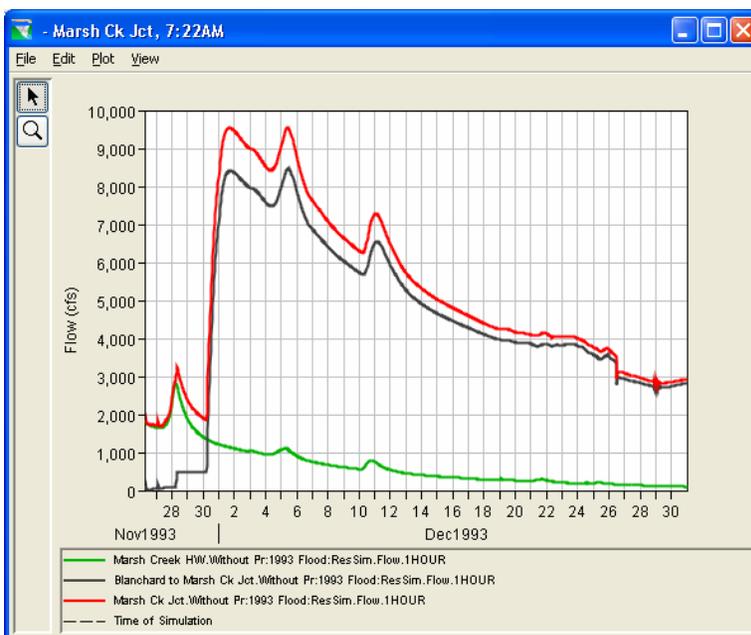


Figure 11.16 ResSim – Inflow/Outflow Plot for a Junction

3. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
4. The plot displays graphically, the computed ResSim inflow/outflow results for a junction.
5. From the **File** menu, click **Close**, the **Plot** dialog box (see Figure 11.16, page 11-10) will close.

Routing Reach Element

Plot

To view a plot from a routing reach:

1. From the simulation map window, right-click on a routing reach on the schematic, a shortcut menu will appear (Figure 11.17). From the shortcut menu, click **Plot**.
2. A **Plot** dialog box will open (Figure 11.18).
3. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
4. The plot displays graphically, the computed ResSim results for a routing reach.

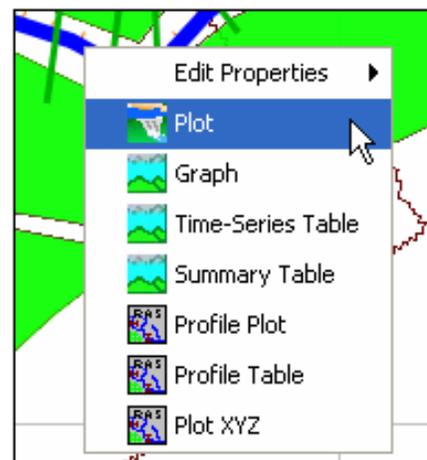


Figure 11.17 ResSim Model Result for a Routing Reach - Shortcut Menu

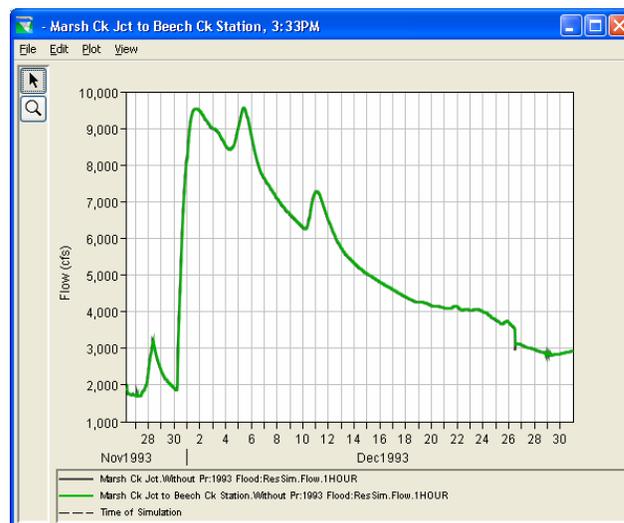


Figure 11.18 ResSim –Plot for a Routing Reach

- From the **File** menu, click **Close**, the **Plot** dialog box (see Figure 11.18, page 11-11) will close.

11.2.3 RAS

When right-clicking on a cross section element or a reach element, from the schematic there are several RAS model results you can view. The following section describes those results.

Cross Section Element

Cross Section Plot

To view a cross section graphically:

- From the simulation map window, right-click on a cross section on the schematic, a shortcut menu will appear (Figure 11.19). From the shortcut menu, point to **Cross Section**, click **Cross Section Plot**.

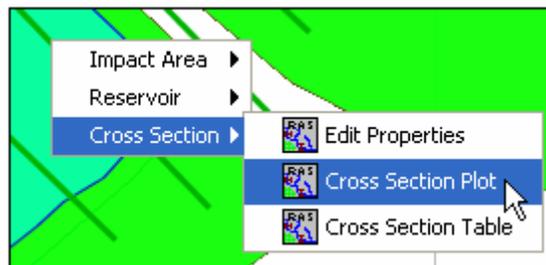


Figure 11.19 RAS Model Result for a Cross Section - Shortcut Menu

- A **Cross Section** dialog box will open (Figure 11.20).

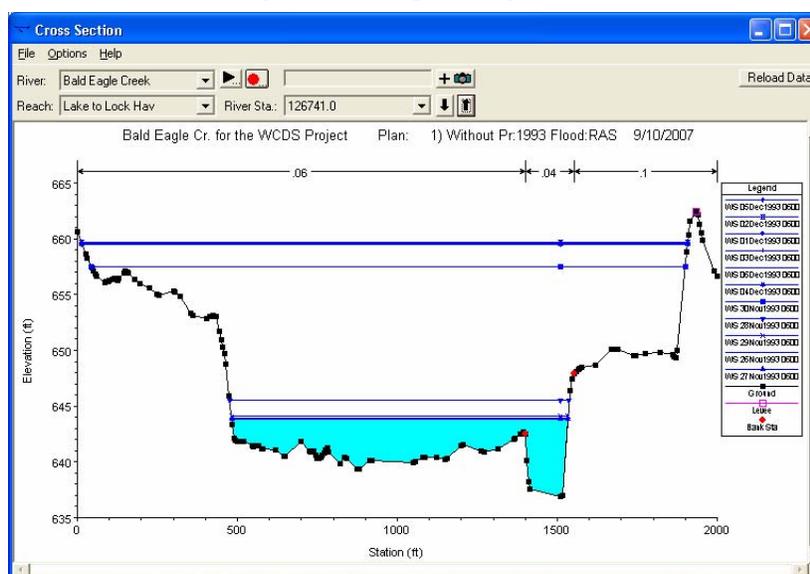


Figure 11.20 RAS – Cross Section Plot

- The plot displays graphically, a cross section computed by RAS. The cross section plot displays the water surface elevation for a

cross section on a reach in the river system. To view cross-sections from another reach, use the Reach list on the Cross Section dialog box (see Figure 11.20, page 11-12).

4. From the **File** menu, click **Exit**, the **Cross Section** dialog box (see Figure 11.20, page 11-12) will close.

Cross Section Table

To view the **Cross Section Table**:

1. From the simulation map window, right-click on a cross section on the schematic, a shortcut menu will appear (see Figure 11.19, page 11-12). From the shortcut menu, point to **Cross Section**, click **Cross Section Table**.
2. The **Cross Section Output** dialog box will open (Figure 11.21).

Plan: Without Pr:1993 Flood:RAS Bald Eagle Creek Lake to Lock Hav RS: 81849.41 Profile: 26Nov1993					
E.G. Elev (ft)	592.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.		0.040	
W.S. Elev (ft)	591.63	Reach Len. (ft)	1297.70	765.24	1223.73
Crit W.S. (ft)	591.63	Flow Area (sq ft)		37.23	
E.G. Slope (ft/ft)	0.022053	Area (sq ft)		37.23	
Q Total (cfs)	255.00	Flow (cfs)		255.00	
Top Width (ft)	25.81	Top Width (ft)		25.81	
Vel Total (ft/s)	6.85	Avg. Vel. (ft/s)		6.85	
Max Chl Dpth (ft)	1.63	Hydr. Depth (ft)		1.44	
Conv. Total (cfs)	1717.2	Conv. (cfs)		1717.2	
Length Wtd. (ft)	765.24	Wetted Per. (ft)		26.92	
Min Ch El (ft)	590.00	Shear (lb/sq ft)		1.90	
Alpha	1.00	Stream Power (lb/ft s)		13.04	
Frcn Loss (ft)		Cum Volume (acre-ft)	4669.06	5593.16	3821.24
C & E Loss (ft)		Cum SA (acres)	1241.40	439.69	737.49

Errors, Warnings, and Notes

Select Profile

Figure 11.21 RAS – Cross Section Output Dialog Box

3. The report displays detailed output for cross sections; any cross section can be displayed by selecting the appropriate river, reach and river station. Also, any of the computed profiles can be displayed by selecting the desired profile. Additionally, different plans can be also viewed.
4. From the **File** menu, click **Exit**, the **Cross Section Output** dialog box (Figure 11.21) will close.

Routing Reach Element

Profile Plot

To view a **Profile Plot**:

1. From the simulation map window, right-click on a routing reach on the schematic, a shortcut menu will appear (Figure 11.22). From the shortcut menu, point to **Reach**, click **Profile Plot**.
2. The **Profile Plot** dialog box will open (Figure 11.23).
3. The profile plot displays the water surface profile for the first reach in the river system. If there is

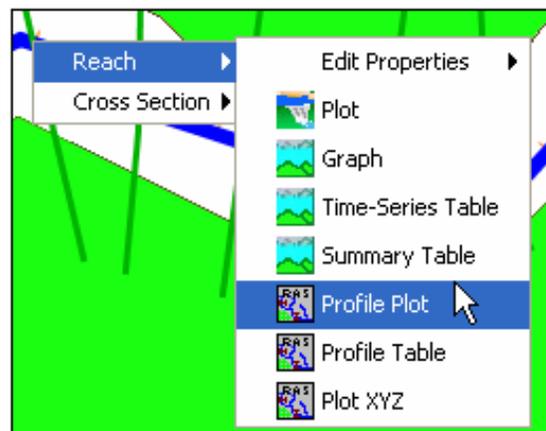


Figure 11.22 RAS Model Result for a Routing Reach - Shortcut Menu

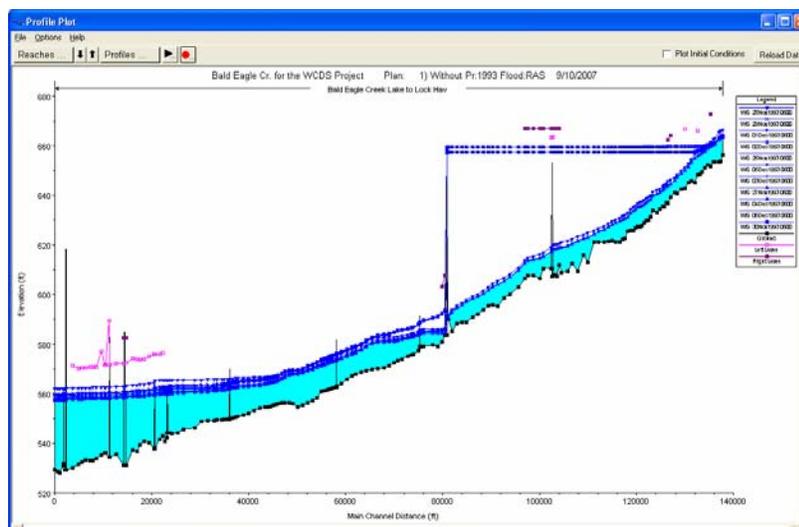


Figure 11.23 RAS – Profile Plot Dialog Box

more than one reach, additional reaches can be selected from the **Options** menu.

4. From the **File** menu, click **Exit**, the **Profile Plot** dialog box (Figure 11.23) will close.

Profile Table

To view the **Profile Output Table – Standard Table 1**:

1. From the simulation map window, right-click on a routing reach on the schematic, a shortcut menu will appear (see Figure 11.22, page 11-14). From the shortcut menu, point to **Reach**, click **Profile Table**.
2. The **Profile Output Table – Standard Table 1** dialog box will open (Figure 11.24).

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Lake to Lock Hav	138154.4	26Nov1993 0600	9182.00	656.30	664.36		664.75	0.001990	5.63	2041.42	368.46	0.39
Lake to Lock Hav	138154.4	27Nov1993 0600	8860.99	656.30	664.25		664.62	0.001981	5.55	1998.12	368.11	0.39
Lake to Lock Hav	138154.4	28Nov1993 0600	15951.09	656.30	666.41		667.01	0.002240	7.04	2801.28	374.66	0.44
Lake to Lock Hav	138154.4	29Nov1993 0600	9741.71	656.30	664.56		664.97	0.002007	5.75	2115.11	369.07	0.40
Lake to Lock Hav	138154.4	30Nov1993 0600	8186.28	656.30	664.00		664.35	0.001957	5.38	1905.90	367.35	0.39
Lake to Lock Hav	138154.4	01Dec1993 0600	7492.80	656.30	663.76		664.09	0.001893	5.17	1819.12	366.63	0.38
Lake to Lock Hav	138154.4	02Dec1993 0600	7041.34	656.30	663.58		663.89	0.001873	5.05	1753.07	366.08	0.37
Lake to Lock Hav	138154.4	03Dec1993 0600	6819.46	656.30	663.48		663.79	0.001870	4.99	1718.00	365.79	0.37
Lake to Lock Hav	138154.4	04Dec1993 0600	6517.96	656.30	663.35		663.65	0.001865	4.91	1669.34	365.39	0.37
Lake to Lock Hav	138154.4	05Dec1993 0600	7543.88	656.30	663.78		664.11	0.001891	5.18	1827.70	366.70	0.38
Lake to Lock Hav	138154.4	06Dec1993 0600	6225.55	656.30	663.22		663.51	0.001855	4.83	1623.00	365.01	0.37
Lake to Lock Hav	137690.8	26Nov1993 0600	9182.00	653.73	663.93		664.13	0.000961	4.50	3268.51	664.50	0.28
Lake to Lock Hav	137690.8	27Nov1993 0600	8860.99	653.73	663.81		664.00	0.000959	4.45	3187.92	661.88	0.28
Lake to Lock Hav	137690.8	28Nov1993 0600	15051.00	653.73	666.81		667.21	0.002240	7.04	4607.73	675.99	0.39

Figure 11.24 RAS – Profile Output Table – Standard Table 1 Dialog Box

3. The report displays a number of hydraulic variables for stream stations. You can change certain parameters for reporting, from the **Options** menu, you can choose which profiles and reaches to display, you can add a column to the report that includes the profile name, and you can choose which system units you wish to view the report in.
4. From the **File** menu, click **Exit**, the **Profile Output Table – Standard Table 1** dialog box (Figure 11.24) will close.

Plot XYZ

To view an **X-Y-Z Perspective Plot**:

1. From the simulation map window, right-click on a routing reach on the schematic, a shortcut menu will appear (see Figure 11.22, page 11-14). From the shortcut menu, point to **Reach**, click **Plot XYZ**.
2. The **X-Y-Z Perspective Plot** dialog box will open (see Figure 11.25, page 11-16).
3. The X-Y-Z plot is a pseudo three-dimensional plot of multiple cross sections within a reach. The user has the ability to select which reaches to be plotted, the range of the river stations, and which plans and profiles to be displayed. The plot can be rotated left and right, as well as up and down, in order to get different perspectives of the river system.
4. From the **File** menu, click **Exit**, the **X-Y-Z Plot** (see Figure 11.25, page 11-16) will close.

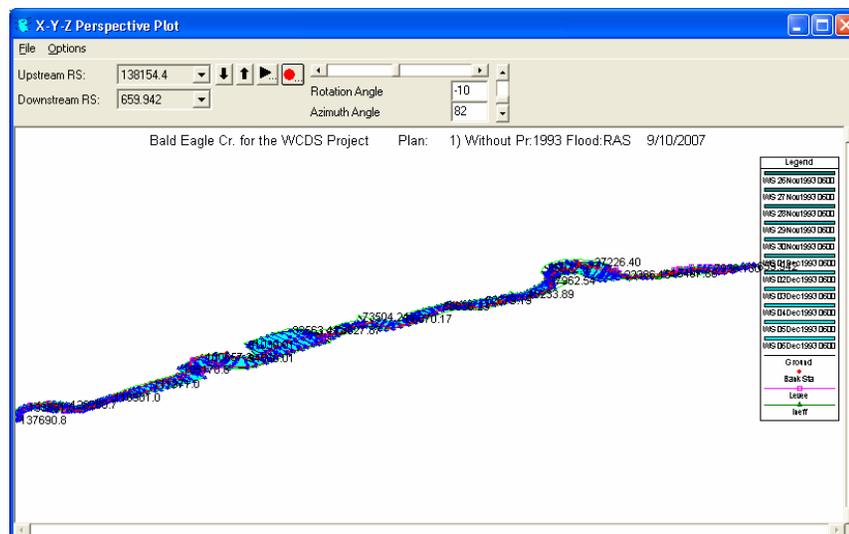


Figure 11.25 RAS – X-Y-Z Perspective Plot Dialog Box

11.2.4 FIA

When right-clicking on an impact area element, from the schematic there are several FIA model results you can view. The following section describes those results.

Impact Area Element

Alternative Report

To view the **Alternative Report**:

1. From the simulation map window, right-click on an impact area on the schematic, a shortcut menu will appear (Figure 11.26). From the shortcut menu, point to **Impact Area**, click **Alternative Report**.

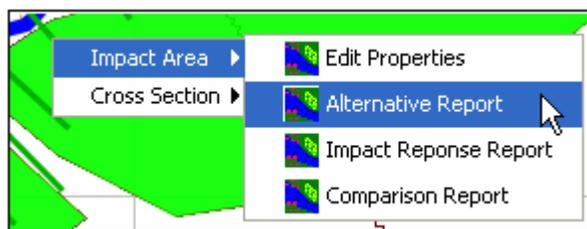


Figure 11.26 FIA Model Result for an Impact Area - Shortcut Menu

2. The **Alternative Report** will open (see Figure 11.27, page 11-17).
3. The report displays the name of the study, the name of the FIA model alternative, and the time window of the simulation. This report summarizes all the impacts by impact area for the study. There are separate reports for urban damages, structures impacted, agricultural damage, and report that summarizes all damage and impacts, including population impacted. You can view this report by different boundary categories. From the **View By** list, select the

boundary category you wish to view results by; the default is impact area.

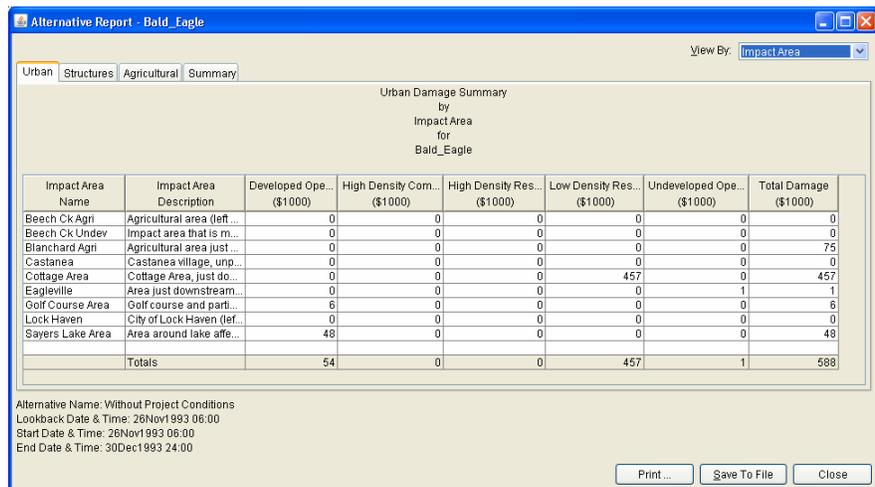


Figure 11.27 FIA – Alternative Report

4. Click **Close**, the **Alternative Report** (Figure 11.27) will close.

Impact Response Report

Using the hydrographs (time-series data) defined for the impact area; FIA continuously simulates conditions and evaluates damage during a flood event. As the program steps through a simulation, evaluating damage, it also searches through the rules in the **Impact Table** to identify the stage thresholds that may be exceeded. When it finds a threshold that is exceeded, it records the time and date. At the conclusion of the simulation, the results are displayed in the **Impact Response Report**.

To view the **Impact Response Report**:

1. From the simulation map window, right-click on an impact area on the schematic, a shortcut menu will appear (see Figure 11.26, page 11-16). From the shortcut menu, point to **Impact Area**, click **Impact Response Report**.
2. The **Impact Response Report** will open (see Figure 11.28, page 11-17).
3. This report summarizes, for each impact area, thresholds that were exceeded, along with the time and date of the exceedence. Also, this report will inform you of the actions you should take when those thresholds are exceeded. The columns of the report represent the various FIA model alternatives that have been evaluated. Also, from this report you can determine how various FIA model alternatives would affect an impact area during a flood event.
4. As illustrated in Figure 11.28 (page 11-18), the FIA model alternative, *Without Project Conditions* has been evaluated. For the impact area, *Lock Haven*, at *25Nov1993, 22:00*, *Flap gates of*

interior drains underwater was reached, and the following action is recommended – *Check drains to ensure operation*.

Impact Area	Stage (ft)	Impact	Action	Time
Without Project Conditions				
Cottage Area	556.00	Flood Warning Stage	Initiate reconnaissance an...	25Nov1993, 22:00
	558.00	Flood Stage	Full alert, warn of potential ...	25Nov1993, 22:00
	560.00	Damage to infrastrucur...	Close life lines & roads to ...	25Nov1993, 22:00
	561.00	Egress begins to be a pr...	Evacuate residences & per...	25Nov1993, 22:00
				Max Flood Stage - 30Dec93, 23:00 565.61 ft
Lock Haven	535.20	Zero stage reading		25Nov1993, 22:00
	540.10	Flap gates of interior dra...	Check drains to ensure op...	25Nov1993, 22:00
	543.20	Elevation of Grant Street ...		25Nov1993, 22:00
	545.00	Handrails at Summer B...	Remove handrails & close ...	25Nov1993, 22:00
	549.00	Grant Street Dam platfor...		25Nov1993, 22:00
	553.00	Flood Warning Stage	Begin levee patrol	25Nov1993, 22:00
	556.20	Flood Stage	River overtops bank	25Nov1993, 22:00
	556.30	Bath house floor elevation	Close bath house	25Nov1993, 22:00
	557.20		Prepare to close Closure S...	25Nov1993, 22:00

Figure 11.28 FIA – Impact Response Report

- Click **Close**, the **Impact Response Report** (Figure 11.28) will close.

Comparison Report

To view the **Comparison Report**:

- From the simulation map window, right-click on an impact area on the schematic, a shortcut menu will appear (see Figure 11.26, page 11-16). From the shortcut menu, point to **Impact Area**, click **Comparison Report**.
- The **Compare Alternatives Report** will open (Figure 11.29).

Impact Area Name	Damage Category	Flood Damage Base: Without Pr... (\$1000)	Flood Damage Without Levee (\$1000)	Flood Damage Base - Without Le... (\$1000)
	Low Density Resi...			
	Undeveloped Ope...			
	Sub-Total			
Cottage Area	Developed Open ...	0	0	0
	High Density Com...	0	0	0
	High Density Resi...	0	0	0
	Low Density Resi...	457	457	0
	Undeveloped Ope...	0	0	0
	Sub-Total	457	457	0
Eagleville	Developed Open ...	0	0	0
	High Density Com...	0	0	0
	High Density Resi...	0	0	0
	Low Density Resi...	0	0	0
	Undeveloped Ope...	1	1	0
	Sub-Total	1	1	0
Golf Course Area	Developed Open ...	6	6	0
	High Density Com...	0	0	0
	High Density Resi...	0	0	0
	Low Density Resi...	0	0	0
	Undeveloped Ope...	0	0	0
	Sub-Total	6	6	0
Lock Haven	Developed Open ...			

Figure 11.29 FIA – Comparison Report

- The report (see Figure 11.29, page 11-18) displays the name of the study, the title of the report, the name of the base FIA model alternative, and the names of the comparison alternatives. This report summarizes all the impacts by impact area for the selected simulation alternatives. There are separate reports for urban damages, structures impacted, population impacted, and agricultural damage. From the **View By** list, select the boundary category you wish to view results by; the default is impact area.
- Click **Close**, the **Compare Alternatives Report** (see Figure 11.29, page 11-18) will close.

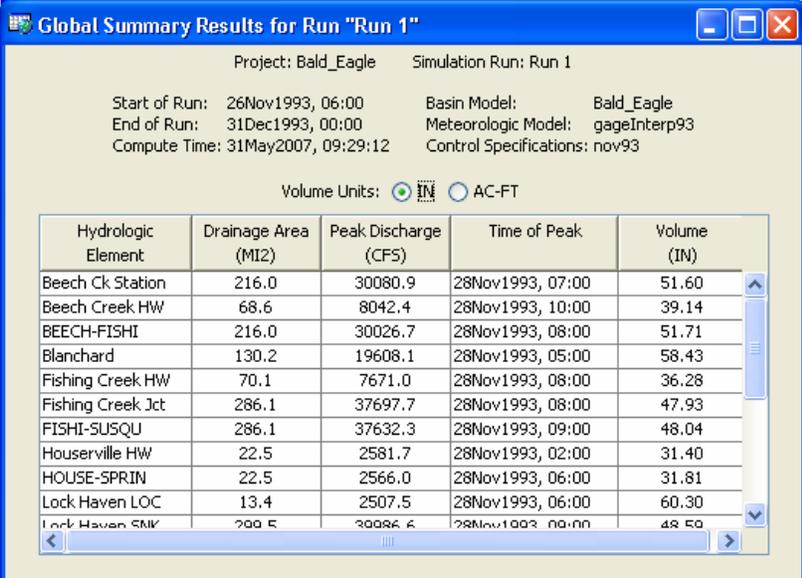
11.3 Results Menu

11.3.1 HMS Reports

Global Summary Table

To view the **Global Summary Table**:

- From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2.1, page 3-4), point to **HMS**, click **Global Summary Table**.
- The **Global Summary Results for Run "HMS Model Alternative Name"** dialog box will open (Figure 11.30).



Project: Bald_Eagle Simulation Run: Run 1

Start of Run: 26Nov1993, 06:00 Basin Model: Bald_Eagle
 End of Run: 31Dec1993, 00:00 Meteorologic Model: gageInterp93
 Compute Time: 31May2007, 09:29:12 Control Specifications: nov93

Volume Units: IN AC-FT

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Beech Ck Station	216.0	30080.9	28Nov1993, 07:00	51.60
Beech Creek HW	68.6	8042.4	28Nov1993, 10:00	39.14
BEECH-FISHI	216.0	30026.7	28Nov1993, 08:00	51.71
Blanchard	130.2	19608.1	28Nov1993, 05:00	58.43
Fishing Creek HW	70.1	7671.0	28Nov1993, 08:00	36.28
Fishing Creek Jct	286.1	37697.7	28Nov1993, 08:00	47.93
FISHI-SUSQU	286.1	37632.3	28Nov1993, 09:00	48.04
Houserville HW	22.5	2581.7	28Nov1993, 02:00	31.40
HOUSE-SPRIN	22.5	2566.0	28Nov1993, 06:00	31.81
Lock Haven LOC	13.4	2507.5	28Nov1993, 06:00	60.30
Lock Haven SNK	200.5	30084.6	28Nov1993, 08:00	48.50

Figure 11.30 HMS – Global Summary Table Dialog Box

- This report provides information about the HMS model alternative for the selected WAT simulation. This information includes the

- HMS project name, the HMS run name, the time window, the compute time, the HMS basin model name, the HMS meteorologic model name, the HMS control specifications name, volume units, and by hydrologic element various hydrologic parameters.
- To close the **Global Summary Results for Run "HMS Model Alternative Name"** dialog box (see Figure 11.30, page 11-19) click .

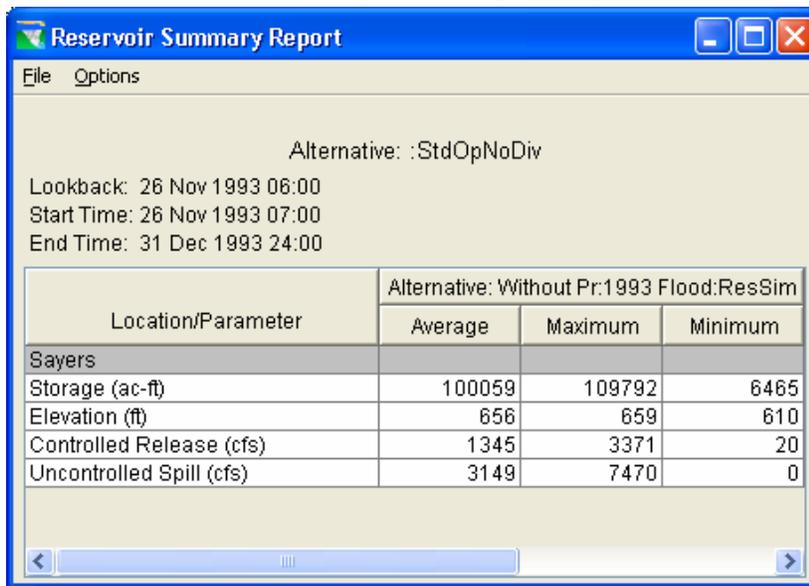
11.3.2 ResSim Reports

Reservoir Summary Report

This report summarizes the reservoirs for the active simulation. These results include the storage, elevation, controlled release, and uncontrolled spill parameters for each reservoir. Reported are the average, maximum, and minimum values for each parameter.

To view the **Reservoir Summary Report**:

- From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Reservoir Summary**.
- The **Reservoir Summary Report** will open (Figure 11.31).



Location/Parameter	Alternative: Without Pr:1993 Flood:ResSim		
	Average	Maximum	Minimum
Sayers			
Storage (ac-ft)	100059	109792	6465
Elevation (ft)	656	659	610
Controlled Release (cfs)	1345	3371	20
Uncontrolled Spill (cfs)	3149	7470	0

Figure 11.31 ResSim – Reservoir Summary Report

- The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will give you information regarding the average, maximum and minimum values for the reservoirs and certain parameters for the time window of the simulation.

- From the **File** menu, click **Close**, the **Reservoir Summary Report** (see Figure 11.31, page 11-20) will close.

Flow Summary Report

This report summarizes the flow at reservoirs and non-reservoir locations for the active simulation. These results include the regulated flow, unregulated flow, and cumulative local flow for each location. Reported are the average, maximum, and minimum values for each parameter.

To view the **Flow Summary Report**:

- From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Flow Summary**.
- The **Flow Summary Report** will open (Figure 11.32).

Location/Parameter	Alternative: Without Pr:1993 Flood:ResSim		
	Average	Maximum	Minimum
Bald Eagle Total			
Regulated Flow (cfs)	11811	28447	3932
Unregulated Flow (cfs)	13257	47423	3685
Cumulative Local Flow (cfs)	7328	28128	1120
Beech Ck Station			
Regulated Flow (cfs)	7221	13182	3247
Unregulated Flow (cfs)	8627	30081	2981
Cumulative Local Flow (cfs)	2729	10740	427
Beech Ck Station to Mill Hall			
Regulated Flow (cfs)	7230	13177	3247
Unregulated Flow (cfs)	8663	29863	2994
Cumulative Local Flow (cfs)	2745	10682	433
Blanchard			

Figure 11.32 ResSim – Flow Summary Report

- The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will give you information regarding the average, maximum, and minimum flow values for all locations and certain parameters.
- From the **File** menu, click **Close**, the **Flow Summary Report** (Figure 11.32) will close.

Power Summary Report

This report summarizes the hydropower information at a reservoir for the active simulation. These results include generation efficiency, power

head, hydraulic losses, energy generated per time step, power generated, plant factor, and flow power for each power plant. Reported are the average, maximum, and minimum values for each parameter. If the appropriate data (hydropower plant) has not been entered this report will be blank:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Power Summary**.
2. The **Power Summary Report** will open (Figure 11.33).

Location/Parameter	Average	Maximum	Minimum
Crazy Mountain-Controlled Outlet			
Generation Efficiency	0.9	0.9	0.9
Power Head (ft)	35.0	40.7	20.1
Hydraulic Losses (ft)	1.5	1.5	1.5
Energy Generated per Time Step (MWh)	13.7	31.7	0.0
Power Generated (MW)	13.8	31.7	2.4
Plant Factor	0.2	0.4	0.0
Flow Power (cfs)	4826.3	10591.8	1597.7

Figure 11.33 ResSim – Power Summary Report

3. The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will give you information regarding the average, maximum, and minimum hydropower values for all locations.
4. From the **File** menu, click **Close**, the **Power Summary Report** (Figure 11.33) will close.

Gate Summary Report

This report summarizes the gates defined for the reservoirs in the active simulation. Reported is the average, maximum, minimum value for the gate opening at each reservoir where a gate has been defined. To view the **Gate Summary Report** (if the appropriate data has not been entered this report will be blank):

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Gates Summary**.
2. The **Gate Summary Report** will open (see Figure 11.34, page 11-23).
3. The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will give you information regarding the average, maximum,

and minimum gate opening values for all locations and certain parameters.

Location/Parameter	Alternative: Without Pr:1993 Flood:ResSim		
	Average	Maximum	Minimum
Sayers-Main Gates			
Gate Opening (ft)	2.0	5.1	0.0

Figure 11.34 ResSim – Gate Summary Report

- From the **File** menu, click **Close**, the **Gate Summary Report** (Figure 11.34) will close.

Stage Summary Report

This report summarizes the stage at reservoirs and non-reservoir locations for the active simulation. These results include the regulated stage, unregulated stage, and cumulative local stage for each location. Reported are the average, maximum, and minimum values for each parameter. If the appropriate data has not been entered (rating curves) this report will be blank.

- From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Stage Summary**.
- The **Stage Summary Report** will open (Figure 11.35).

Location/Parameter	Average	Maximum	Minimum
River Pointe			
Regulated Stage (cfs)	9.7	11.0	9.2
Unregulated Stage (cfs)	9.9	11.0	9.3
Cumulative Local Stage (cfs)	9.5	10.5	9.0
Rockville			
Regulated Stage (cfs)	6.5	9.4	5.2
Unregulated Stage (cfs)	7.5	9.4	5.4
Cumulative Local Stage (cfs)	2.3	6.9	1.5

Figure 11.35 ResSim – Stage Summary Report

3. The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will give you information regarding the average, maximum, and minimum stage values for all locations and certain parameters.
4. From the **File** menu, click **Close**, the **Stage Summary Report** (see Figure 11.35, page 11-23) will close.

Release Decision Report

The **Release Decision Report** provides the decision information that the ResSim model alternative reached. The report shows the rules that governed these decisions.

To view the **Release Decision Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **ResSim**, click **Release Decision Report**.
2. The **Release Decision Report** will open (see Figure 11.8, page 11-5).
3. The report displays the ResSim model alternative name; in addition, the time window information for the simulation is displayed. This report will display the decisions based on rules defined in ResSim.
5. From the **File** menu, click **Close**, the **Release Decision Report** (see Figure 11.8, page 11-5) will close.

11.3.3 RAS Reports

Standard Table 1 Report

To view the **Standard Table 1 Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Summary Output Table**.
2. The **Profile Output Table - Standard Table 1** dialog box will open (see Figure 11.24, page 11-15).
3. The report displays a number of hydraulic variables for stream stations. You can change certain parameters for reporting, from the **Options** menu, you can choose which profiles and reaches to display, you can add a column to the report that includes the profile name, and you can choose which system units you wish to view the report in.
4. From the **File** menu, click **Exit**, the **Profile Output Table – Standard Table 1** dialog box (see Figure 11.24, page 11-15) will close.

Cross Section Output Report

To view the **Cross Section Output Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Detailed Output Table**.
2. The **Cross Section Output** dialog box will open (see Figure 11.21, page 11-13).
3. The report displays detailed output for cross sections; any cross section can be displayed by selecting the appropriate river, reach and river station. Also, any of the computed profiles can be displayed by selecting the desired profile. Additionally, different plans can be also viewed.
4. From the **File** menu, click **Exit**, the **Cross Section Output** dialog box (see Figure 11.21, page 11-13) will close.

Profile Plot

To view a **Profile Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Profile Plot**.
2. The **Profile Plot** dialog box will open (see Figure 11.23, page 11-14).
3. The profile plot displays the water surface profile for the first reach in the river system. If there is more than one reach, additional reaches can be selected from the **Options** menu.
4. From the **File** menu, click **Exit**, the **Profile Plot** dialog box (see Figure 11.23, page 11-14) will close.

Stage and Flow Hydrograph Plot

To view a **Stage and Flow Hydrograph Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Stage & Flow Hydrograph**.
2. The **Stage and Flow Hydrographs** dialog box will open (see Figure 11.36, page 11-26).
3. If the user has performed an unsteady flow analysis, then stage and flow hydrographs will be available for viewing, otherwise this dialog box will be blank. You can view just stage hydrographs, just flow hydrographs, or both. By default, the plot is at cross sections only, you can select from several other parameters.
4. From the **File** menu, click **Exit**, the **Stage and Flow Hydrographs** dialog box (Figure 11.36) will close.

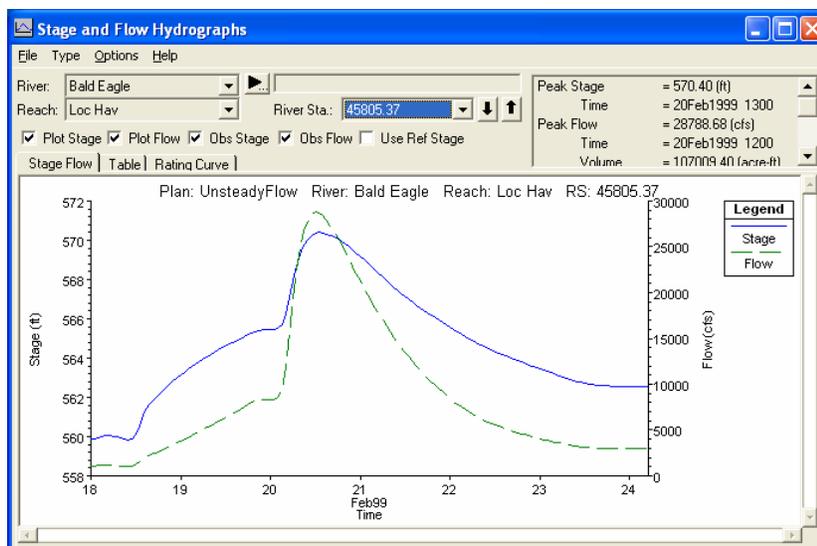


Figure 11.36 RAS – Stage and Flow Hydrographs Dialog Box

Rating Curve Plot

To view a **Rating Curve Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Rating Curve**.

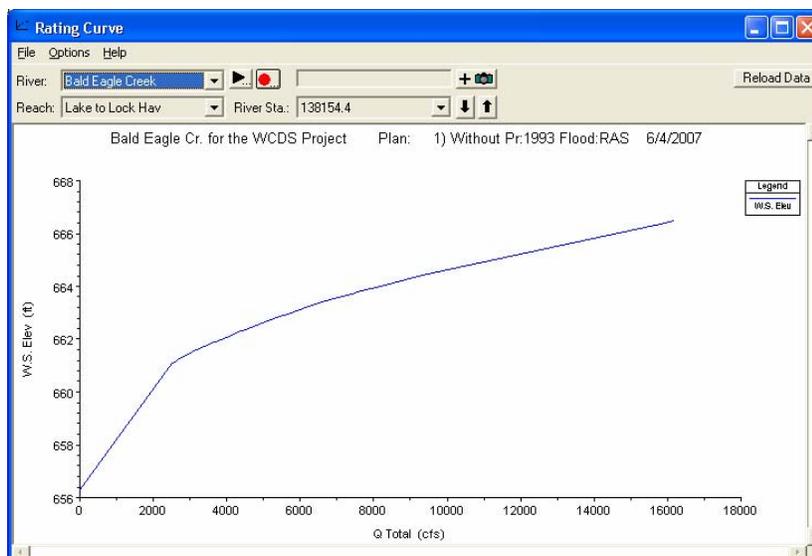


Figure 11.37 RAS – Rating Curve Dialog Box

2. The **Rating Curve** dialog box will open (Figure 11.37).
3. The rating curve is a plot of the water surface elevation versus flow rate for the profiles that were computed. A rating curve can be plotted at any cross-section by selecting the appropriate reach and river station.
4. From the **File** menu, click **Exit**, the **Rating Curve** dialog box (Figure 11.37) will close.

Cross Section Plot

To view a **Cross Section Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Cross Section Plot**.
2. The **Cross Section Plot** dialog box will open (see Figure 11.20, page 11-12).
3. The cross section plot displays the water surface elevation for a reach in the river system. If there is more than one reach, additional reaches can be selected.
4. From the **File** menu, click **Exit**, the **Cross Section** dialog box (see Figure 11.20, page 11-12) will close.

X-Y-Z Perspective Plot

To view an **X-Y-Z Perspective Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **X-Y-Z 3D Plot**.
2. The **X-Y-Z Perspective Plot** dialog box will open (see Figure 11.25, page 11-16).
3. The X-Y-Z plot is a pseudo three-dimensional plot of multiple cross sections within a reach. The user has the ability to select which reaches to be plotted, the range of the river stations, and which plans and profiles to be displayed. The plot can be rotated left and right, as well as up and down, in order to get different perspectives of the river system.
4. From the **File** menu, click **Exit**, the **X-Y-Z Plot** (see Figure 11.25, page 11-16) will close.

General Profile Plot

To view a **General Profile Plot**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **General Profile Plot**.
2. The **General Profile Plot - Velocities** dialog box will open (see Figure 11.38, page 11-28).
3. Any RAS parameters that are computed at a cross section can be displayed in a profile view. For example, in Figure 11.38 (page 11-28), velocity versus distance has been displayed. The user can plot several different variable types at one time (e.g., velocity and area versus distance), but the scaling may not be appropriate when this is done.

- From the **File** menu, click **Exit**, the **General Profile Plot - Velocities** dialog box (Figure 11.38) will close.

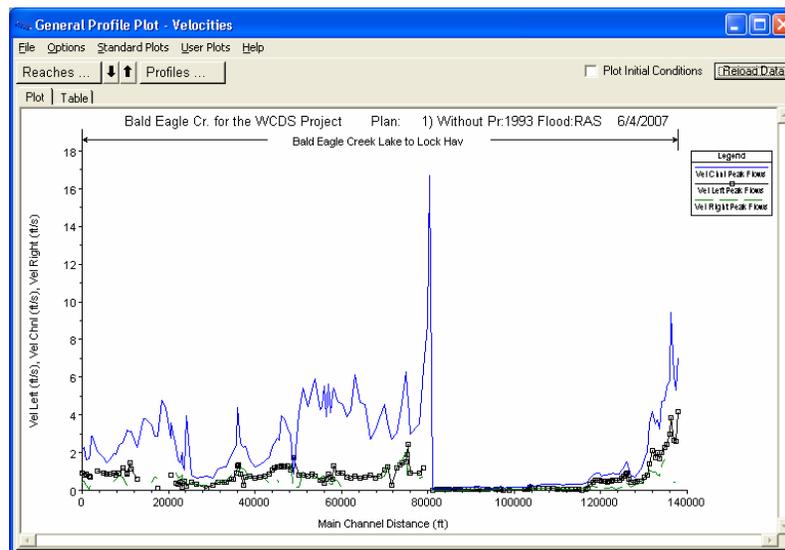


Figure 11.38 RAS – General Profile Plot Dialog Box

Hydraulic Property Tables Report

To view the **Hydraulic Properties Table**:

- From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **RAS**, click **Hydraulic Properties Table**.
- The **View Hydraulic Property Tables** dialog box will open (Figure 11.39).

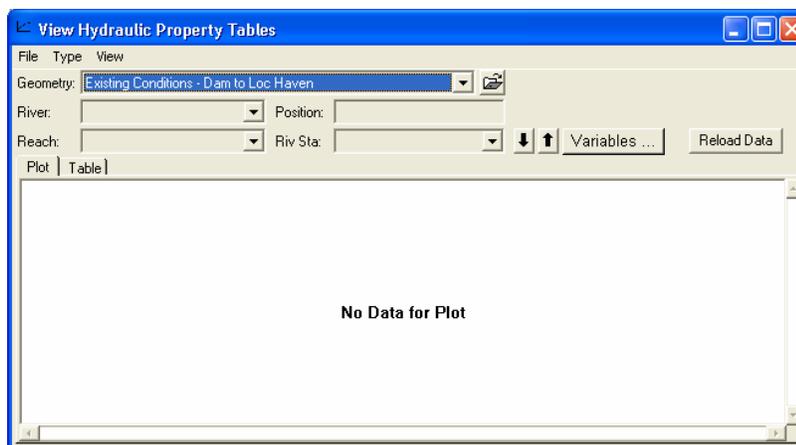


Figure 11.39 RAS – View Hydraulic Property Tables Dialog Box

- If the user has performed an unsteady flow analysis, the hydraulic property table will be available for viewing; otherwise this dialog box will be blank.
- From the **File** menu, click **Exit**, the **View Hydraulic Property Tables** dialog box (Figure 11.39) will close.

11.3.4 FIA Reports

Alternative Report

To view the **Alternative Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **FIA**, click **Alternative Report**.
2. The **Alternative Report** will open (see Figure 11.27, page 11-17).
3. The report displays the name of the study, the name of the FIA model alternative, and the time window of the simulation. This report summarizes all the impacts by impact area for the study. There are separate reports for urban damages, structures impacted, agricultural damage, and report that summarizes all damage and impacts, including population impacted. You can view this report by different boundary categories. From the **View By** list, select the boundary category you wish to view results by; the default is impact area.
4. Click **Close**, the **Alternative Report** (see Figure 11.27, page 11-17) will close.

Compare Alternatives Report

To view the **Comparison Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **FIA**, click **Comparison Report**.
2. The **Compare Alternatives Report** will open (see Figure 11.29, page 11-18).
3. The report displays the name of the study, the title of the report, the name of the base FIA model alternative, and the names of the comparison alternatives. This report summarizes all the impacts by impact area for the selected simulation alternatives. There are separate reports for urban damages, structures impacted, population impacted, and agricultural damage. From the **View By** list, select the boundary category you wish to view results by; the default is impact area.
4. Click **Close**, the **Compare Alternatives Report** (see Figure 11.29, page 11-18) will close.

Project Benefits Report

To view the **Project Benefits Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **FIA**, click **Project Benefits Report**.
2. The **Project Benefits Report** will open (Figure 11.40).

Impact Area	Damage Categories	With Project	Without Project	Total	Levee	Sayers	Corps Projects	Total	Levee	Sayers	Corps Projects
Beech Ck Agri	Total	0	4	4		4	4	100		100	100
Beech Ck Undev	Total	0	0	0		0	0	0		0	0
Blanchard Agri	Total	75	75	0		0	0	0		0	0
Castanea	Total	0	0	0		0	0	0		0	0
Cottage Area	Developed Open Space	0	0	0		0	0				
	High Density Commercial/Industrial	0	0	0		0	0				
	High Density Residential Developed	0	0	0		0	0				
	Low Density Residential Developed	457	602	145		145	145	24		24	24
	Undeveloped Open Space	0	0	0		0	0				
	Total	457	602	145		145	145	24		24	24
Eagleview	Developed Open Space	0	0	0		0	0				
	High Density Commercial/Industrial	0	0	0		0	0				
	High Density Residential Developed	0	0	0		0	0				
	Low Density Residential Developed	0	0	0		0	0				
	Undeveloped Open Space	1	2	0		0	0	24		24	24
	Total	1	2	0		0	0	24		24	24
Golf Course Area	Developed Open Space	6	19	13		13	13	70		70	70
	High Density Commercial/Industrial	0	67	67		67	67	100		100	100
	High Density Residential Developed	0	0	0		0	0				
	Low Density Residential Developed	0	3	3		3	3	100		100	100
	Undeveloped Open Space	0	0	0		0	0				
	Total	6	89	92		92	92	92		92	92
Lock Haven	Total	0	26597	26597	16284	10313	26597	100	61	39	100
Total		539	27369	26829	16284	10545	26829	98	59	39	98

Figure 11.40 FIA – Project Benefits Report

3. The report displays the title of the report and the name of the forecast alternative. This report displays the results from the computer project benefits option in FIA. There are three specific areas to the report.
 - Damage Suffered** - when FIA performs the computation for project benefits, it actually computes two sets of results. The without project which means no projects (levees and reservoirs) are included in calculations, and the other, with project which includes projects in the calculations.
 - Damage Prevented** - includes the differences between with and without project damages (**Total** column) and the distribution of the benefits among the projects. In addition, the amount of the benefits awarded to Corps' projects is displayed.
 - % Damage Prevented** - reports the damage reductions for the differences between with and without project damages (**Total** column), each type of project (levee, reservoir), and damage reductions awarded to Corps project) by a percentage. This percentage is simply calculated by dividing the **Damage Prevented** column by the **Without Project** column.
4. There are separate reports for urban damages, structures impacted, population impacted, and agricultural damage. You can view this report by different boundary categories. From the **View By** list, select the boundary category you wish to view results by; the default is impact area.
5. Click **Close**, the **Project Benefits Report** (Figure 11.40) will close.

Impact Response Report

Using the hydrographs (time-series data) defined for the impact area; FIA continuously simulates conditions and evaluates damage during a flood event. As the program steps through a simulation, evaluating damage, it also searches through the rules in the **Impact Table** to identify the stage thresholds that may be exceeded. When it finds a threshold that is exceeded, it records the time and date. At the conclusion of the simulation, the results are displayed in the **Impact Response Report**.

To view the **Impact Response Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **FIA**, click **Impact Response**.
2. The **Impact Response Report** will open (see Figure 11.28, page 11-18).
3. This report summarizes, for each impact area, thresholds that were exceeded, along with the time and date of the exceedence. Also, this report will inform you of the actions you should take when those thresholds are exceeded. The columns of the report represent the various FIA model alternatives that have been evaluated. Also, from this report you can determine how various FIA model alternatives would affect an impact area during a flood event.
4. As illustrated in Figure 11.28 (page 11-18), the FIA model alternative, *Without Project Conditions* has been evaluated. For the impact area, *Lock Haven*, at *25Nov1993, 22:00*, *Flap gates of interior drains underwater* was reached, and the following action is recommended – *Check drains to ensure operation*.
5. Click **Close**, the **Impact Response Report** (see Figure 11.28, page 11-18) will close.

Receding Response Report

Using the hydrographs (time-series data) defined for the impact area; FIA continuously simulates conditions and evaluates potential environmental and operational problems due to low flow. As the program steps through a simulation, evaluating damage, it also searches through the rules in the **Receding Table** to identify the stage thresholds that need to be maintained or exceeded. When it finds a threshold that is not met, it records the time and date. At the conclusion of the simulation, FIA will display the results in the **Receding Response Report**. This report summarizes, for each impact area, thresholds that were not met, along with the time and date of the threshold not being met. The columns of the report represent the various simulation alternatives that have been evaluated. Also, from this report you can determine how various simulation alternatives would affect an impact area during a low flow event.

To view the **Receding Response Report**:

1. From the WAT main window, on the **Results** menu (see Chapter 3, Section 3.2, page 3-3), point to **FIA**, click **Receding Response**.
2. The **Receding Response Report** will open (Figure 11.41).

Impact Area	Stage (ft)	Impact	Action	Time
Beech Ck Agri	575.00	Flood Stage	Minor agricultural flooding begins	Without Project Conditions
				26Nov93 12:00
	575.00	Flood Stage	Minor agricultural flooding begins	29Nov93 22:00
	575.00	Flood Stage	Minor agricultural flooding begins	13Dec93 19:00
				Min Stage - 30Dec93, 23:00 571.59 ft

Figure 11.41 FIA – Receding Response Report

3. This report summarizes, for each impact area, thresholds that were exceeded, along with the time and date of the exceedence. Also, this report will inform you of the actions you should take when those thresholds are exceeded. The columns of the report represent the FIA model alternative that is being evaluated for the active simulation. Also, from this report you can determine how various alternatives would affect an impact area during a flood event.
4. As illustrated in Figure 11.41, the FIA model alternative, *Without Project Conditions* have been evaluated. For the impact area, *Beech Ck Agri*, at *29Nov93 22:00*, *Flood Stage* was reached, and the following action is recommended – *Minor agricultural flooding begins*.
5. Click **Close**, the **Receding Response Report** (Figure 11.41) will close.

Appendix A

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Dunn, Christopher N., P.E., Apr 2006, *The Development of a Software Integration Tool for Watershed Studies – The Hydrologic Engineering Center's Watershed Analysis Tool (HEC-WAT)*, Interdisciplinary Solutions for Watershed Sustainability, Joint Eighth Federal Interagency Sedimentation Conference and Third Federal Interagency Hydrologic Modeling Conference, Federal Interagency Hydraulic Conference Proceedings, USGS, Office of Water Quality, Reston, VA 20192-5603. Proceedings of the Joint Federal Interagency Conference 2006, page 41.

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Appendix B

Plug-In Concepts

The HEC-WAT (Watershed Analysis Tool) uses a number of standalone programs, initially HMS, ResSim, RAS and FIA. These programs need to be incorporated into the WAT in a generic robust fashion. The "plug-in" allows the WAT to provide an integrated modeling experience without requiring special code to support individual models

B.1 Overview

The WAT by itself contains no software application specific logic, through the use of a "plug-in" the WAT will be able to incorporate a program seamlessly into its interface. Software applications incorporated into the WAT will be run as client/server architecture, with the WAT acting as the client and the software application as the server. There are numerous ways to implement the client/server architecture and the WAT "plug-in" design is not meant to preclude the use of any of them.

- The WAT provides the analysis framework.
- Software applications provide everything else.
- The WAT does not know about the software application code.
- New software applications can be added without any change to the WAT code.
- The "plug-in" provides integrated schematic elements, access to native software application editors and result displays, ability to launch software application computations.

There are two initial designs that are going to be used to incorporate the HEC software applications. The first design is used for the Java® based software applications, HMS, ResSim and FIA (Figure B.1).

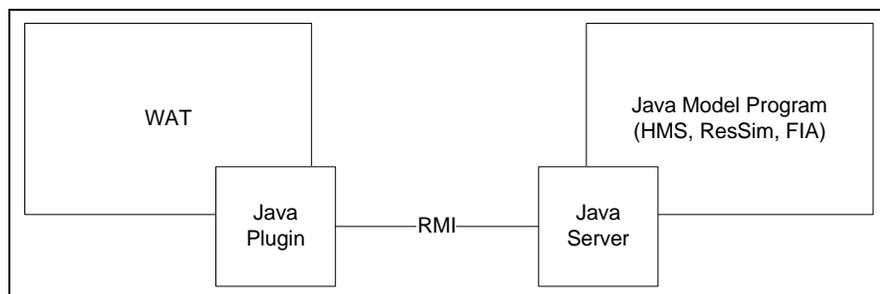


Figure B.1 Java Software Applications

The second design is used for RAS which is a Visual Basic program (Figure B.2).

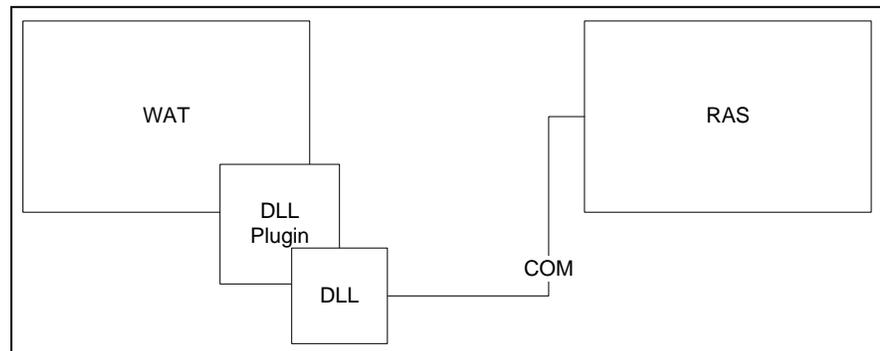


Figure B.2 Non-Java Software Applications

It is not intended that any of the application software contain WAT specific code when the application software is run outside of the WAT environment.

B.2 Loading

Plug-ins will be loaded using the framework's **Plug-in Manager**. The **Plug-in Manager** searches for jar files in the lib/ext directory. When it finds a jar file it checks the jar file's manifest file for the entry *MainClass*. If the *MainClass* entry is found, it loads that class through reflection and looks for a *public static void main(String[] args)* method. If the main method is found it invokes the method. When the plug-in's main method is called, the plug-in can then install itself into the application by registering with the appropriate factories.

The plug-in must register itself with the *hec2.wat.plugin.WatPluginManager* by calling *register(WatPlugin)* to be recognized by the WAT as a plug-in. It should also add its *hec2.model.PluginOrderItem* to the *hec2.model.PluginOrderItem* class by calling *addProgramOrderItem(ProgramOrderItem)*.

B.3 Interfaces

B.3.1 BasicWatPlugin

A plug-in must implement the interface *hec2.wat.client.BasicWatPlugin*. This interface defines the basic functionality that a plug-in must support, such as creating a project, opening a project, getting a list of model alternatives etc.

The *hec2.wat.client.BasicWatPlugin* interface consists of:

```

/**
 * create a new project for the program
 */
public boolean createProject(com.rma.model.Project project);
/**
 * open a project for the program
 */
public boolean openProject(com.rma.model.Project project);
/**
 * save the current project.
 */
public boolean saveProject();
/**
 * called when the WAT is shutting down or opening a new Study
 */
public boolean close(boolean watExiting);
/**
 * unique name of the plugin
 * @return
 */
public String getName();
/**
 * get the name of the project/watershed/etc opened by this plugin
 * @return
 */
public String getProjectName();
/**
 * get the name of the log file if there is one.
 * @return
 */
public String getLogfile();
/**
 * display the program to give the user full functionality to the program
 */
public boolean displayApplication();
/**
 * return the version of the application
 */
public String getVersion();
/**
 * add the MessageTaker msgTaker to the plugin. For adding messages to the
 * framework
 */
public void addMessageTaker(MessageTaker msgTaker);
/**
 * remove the MessageTaker msgTaker from the plugin
 */
public void removeMessageTaker(MessageTaker msgTaker);
/**
 * get the directory that this plugin is storing its base data in
 * @return the plugin's working directory
 */
public String getDirectory();

```

Table B.1
BasicWatPlugin Methods

createProject()	Create a new project. The current WAT project is passed in so that the plug-in can get any information it needs, like the name, directory, unit system etc.
openProject()	Open an existing project. The current WAT project is passed in so that the plug-in can use its information in determining which project to open if there is more than one.
close()	Close the plug-in application's project. If <i>watExisting</i> is true the application should shut down.
getName()	Get the name of the plug-in.

getProjectName()	Return the name of the plug-in application's project name.
getLogFile()	Return the log file for the plug-in application if it has one.
displayApplication()	Display the plug-in applications main window.
getVerion()	Get the application's version number.

B.3.2 WatPlugin

Plug-ins that is to be inserted into a WAT Simulation compute must implement the *hec2.wat.plugin.WatPlugin* which extends *hec2.wat.plugin.BasicWatPlugin* and defines methods used by the Simulation process.

The *hec2.wat.plugin.WatPlugin* interface consists of:

```

/**
 * get the ProgramOrderItem for the plugin. The ProgramOrderItem is used to
 * determine where the plug goes in the Program execution order
 */
public ProgramOrderItem getProgramOrderItem();

/**
 * compute the specified ModelAlternative
 */
public boolean compute(hec2.wat.model.ModelAlternative modelAlt);

/**
 * get the list of ModelAlternatives that this program has. The schematic
 * isn't used initially
 */
public List getModelAlternatives(Condition schematic);

/**
 * add the ComputeProgressListener's to the Plugin
 * @param progressListeners List of ComputeProgressListener
 */
public void addComputeListeners(List<ComputeProgressListener> progressListeners);
public void setComputeListeners(List<ComputeProgressListener> progressListeners);
/**
 * called when the user cancels the compute
 * @return true if the compute was canceled
 */
public boolean cancelCompute();

/**
 * display the program with the Alternative represented by malt loaded
 */
public boolean displayApplication(ModelAlternative malt)
/**
 * check to see if the data represented by the Alternative malt is out of date.
 */
public boolean needToCompute(ModelAlternative malt, HecTime lastComputeTime)
/**
 * import data from the plugin's application into the WAT
 */
public void importData();
/**
 * return whether the plugin is capable of importing it's data into the WAT
 */
public boolean canImport()
/**
 * get the DataLocations for the ModelAlternative modelAlt
 */
public List getDataLocations(ModelAlternative modelAlt, int direction)
/**
 * set the DataLocations for the ModelAlternative modelAlt
 */
public boolean setDataLocations(ModelAlternative modelAlt, List dataLocations)

```

Table B.2
WatPlugin Methods

getProgramOrderItem()	Return the plug-in's <i>ProgramOrderItem</i> .
compute()	Compute the specified <i>ModelAlternative</i> .
getModelAlternatives()	Return a list of <i>ModelAlternatives</i> that the plug-in application's project knows about. For RAS this is a Plan, for ResSim it's an Alternative.
addComputeListeners()	Add the <i>com.rma.model.ComputeListeners</i> to the plug-in applications compute process. There is usually an interface class that needs to take the application's compute information and translate the method calls to call the corresponding methods in the <i>ComputeListener</i> .
cancelCompute()	Cancel the current compute.
displayApplication()	Load the alternative specified by malt and display the plug-in application.
importData()	Display the plug-in applications import data window, if it has one.
needToCompute()	Check to see if the data represented by the alternative malt is out of date.
importData()	Import data from the plugin's application into the WAT.
canImport()	The <i>DataLocations</i> for the <i>ModelAlternative modelAlt</i>
getDataLocations()	Get the <i>DataLocations</i> for the <i>ModelAlternative modelAlt</i>
setDataLocations()	Set the <i>DataLocations</i> for the <i>ModelAlternative modelAlt</i>

B.3.3 DisplayableWatPlugin

Plug-ins that also need able to display information on the map schematic should implement the interface, *hec2.wat.client.DisplayableWatPlugin*. The *DisplayableWatPlugin* interface defines additional functionality that a plug-in must support to be displayed on a map schematic. These are things like returning a list of elements to display, displaying an editor for an item, displaying output for one or more elements, etc.

The *hec2.wat.client.DisplayableWatPlugin* interface extends *hec2.wat.client.WatPlugin* and adds the following methods:

```
/**
 * get the list of GraphicElements to draw on the map for the
 * ModelAlternative modelAlt
 */
public List getGraphicElements(hec2.wat.model.ModelAlternative modelAlt);
/**
 * get the list of output reports for the ModelAlternative modelAlt
 */
public List getOutputReports(hec2.wat.model.ModelAlternative modelAlt);
/**
```

```

    * display the editor for the selected GraphicElement element
    */
public boolean displayEditor(hec2.wat.map.GraphicElement element);
/**
 * display the output (plot/table) for the selected OutputElements
 */
public boolean displayOutput(hec2.wat.model.OutputElement element);
/**
 * get the EditActions to put in the Edit Menu for the ModelAlternative
 * @param modelAlt the ModelAlternative, can be null
 * @return a List of EditActions
 */
public List getEditActions(ModelAlternative modelAlt);
/**
 * display the editor for the specified ModelAlternative
 */
public void editAlternative(ModelAlternative modelAlt);
/**
 * get the List of EditActions that are always available in the WAT frame's Edit
menu
 */
public List getGlobalEditAction();
/**
 * perform the edit action. The Action is fromt the List of Actions returned by
 * getEditActions()
 */
public void editAction(String action, ModelAlternative modelAlt)
/**
 * called when a Map Layer is added to the WAT project to tell the plugin to add
the
 * Map Layer to its project
 */
public void addMap(String mapPath)
/**
 * called when a Map Layer is removed from the WAT project to tell the plugin to
remove
 * the Map Layer from it's project.
 */
public void removeMap(String mapPath)

```

Table B.3
Displayable WatPlugin Methods

getGraphicElements()	Returns the list of <i>GraphicElements</i> for the specified <i>ModelAlternative</i> . The <i>GraphicElement</i> should have any <i>OutputElements</i> that it wants displayed in its popup menu added to it with <i>addOutputAction(OutputElement)</i> .
getOutputReports()	Returns the list of <i>OutputElements</i> that should be added to the WAT's main window, Results menu.
displayEditor()	Displays the editor associated with the <i>GraphicElement</i> .
displayOutput()	Displays the report/table/plot etc for the <i>OutputElement</i> specified. The <i>OutputElement</i> passed in is a copy of the <i>OutputElement</i> originally returned from the plug-in.
getEditActions()	Returns the list of <i>EditActions</i> that should be displayed on the WAT's main window, Edit menu.
editAlternative()	Display the editor for the <i>ModelAlternative</i> .
getGlobalEditAction()	Get the list of <i>EditActions</i> that are always available in the WAT's main window, Edit menu
editAction()	Perform the edit action. The action is from the list of actions returned by <i>getEditActions()</i> .

addMap()	Called when a Map Layer is added to the WAT project to tell the plug-in to add the Map Layer to its project.
removeMap()	Called when a Map Layer is removed from the WAT project to tell the plug-in to remove the Map Layer from its project.

The four HEC application software packages will all be *DisplayableWatPlugins*, since they all have graphics elements.

An additional interface *hec2.wat.plugin.ClientServerPlugin* is used by the plug-in panel for client/server plug-ins, it consists of the following methods:

```
/**
 * return whether the server is alive
 * @return the server alive state
 */
public boolean isServerAlive();
/**
 * start the plugin's server
 * @return true if the server was started successfully
 */
public boolean startServer();
```

B.3.4 Java Program Plug-In

The three application software that are Java based, HMS, ResSim, FIA, will all share a common client side plug-in and RMI interface for the server side. Only on the server side is unique to each program, the client needs to only implement a couple of methods. Since the server-side component of the plug-ins will all be implemented using the same RMI interface, the client side can be based on the same base class, with the only difference being the server that they launch.

B.4 Map Drawing

B.4.1 Graphic Elements

Every plug-in that displays graphic elements on the screen will need to return a list of those elements to the WAT. The WAT *Glyph* that draws these elements will attempt to combine like elements from the various models into a single image on the screen. If two reaches exist on the same segment of a stream, the WAT will only draw a single reach. Elements can reference their location either by stream name and stream station or by X-Y coordinates, with the stream name/stream station being the preferred method. The WAT *Glyph* will have the ability to draw a limited number of elements directly. For plug-ins that need additional elements that are

not built into the WAT *Glyph*, the WAT *Glyph* will have those graphic elements draw themselves on the map. No drawing optimizations will be attempted on these unknown element types.

Element types that have optimized drawing:

ReservoirElement
 ReachElement
 JunctionElement
 DiversionElement
 XSectionElement
 PoolElement
 ImpactAreaElement
 SubBasinElement
 LeveeElement

Additional elements that are drawn:

PointElement
 PolygonElement
 LineElement

All elements of a specific type, from the optimized set, are drawn using the same drawing properties. Therefore, all *ReservoirElements*, no matter which application software they come from, are all drawn the same (Figure B.3).

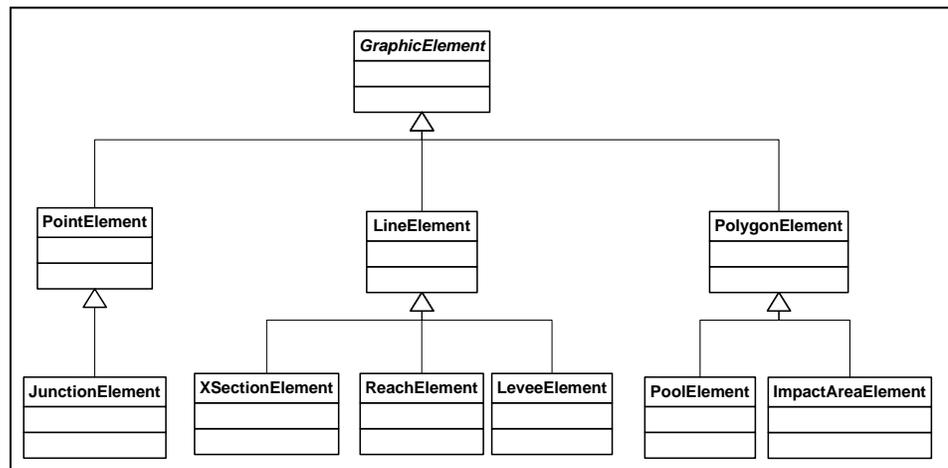


Figure B.3 Graphic Elements

Graphic elements also have a drawing hierarchy number; the lowest number will be the element that actually gets drawn on the map panel. In the case of reservoirs, where ResSim, HMS and RAS can all have reservoirs, the ResSim reservoir is the most detailed so it should be one drawn (assuming there is a reservoir for each model at the location). So

the ResSim *ReservoirElement* should have a lower number than the HMS or RAS *ReservoirElements*.

Reaches are treated a bit special. The WAT *MapGlyph* figures out the longest reach on a stream and creates a new dummy reach. This dummy reach then holds a list of all the plug-in reaches. When a right-click or tooltip is called for, the WAT *MapGlyph* figures out which plug-in reaches are located at that stream station.

GraphicElements will also contain information used by the plug-in to display the editor for that element as well as information for creating the plot and tabulate popup menus. This will keep the WAT from having to constantly contacting the model program to determine what functionality that element has.

B.5 Compute

B.5.1 Passing Information to the Plug-In

The call to *compute()* is passed with a single argument of the *hec.wat.model.ModelAlternative*. The *ModelAlternative* will have the necessary information for the plug-in to perform the compute.

This information consists of:

- DSS Filename for both input and output of DSS data
- F-Part for DSS pathnames
- Run time window
- Simulation name
- The base compute directory. The plug-in is expected to compute in a subdirectory under this directory.
- Compute Progress Listeners, these listeners allow the plug-in to return compute status back to the WAT.

B.5.2 DSS F-Part

The DSS F-Part will consist of the *<Simulation Name>:<Event Name>:<Model>* where:

<Simulation Name> is the first 10 character in the name of the simulation.

<Event Name> is the first 10 characters in the name of the event.

<Model> is the name of the plug-in.

B.5.3 F-Part Replacement

To ensure that upstream models can feed downstream models data through the simulation's DSS file F-Part replacement will have to occur during the compute. The plug-in will be told what its output F-Part will be at compute time. The program should then look through its input time series pathnames and if it finds a pathname matching a WAT F-Part pathname it should replace the simulation *name:event* name part of the pathname with the current simulation *name:event* name and replace the DSS file.

Appendix C

Tools

The HEC-WAT has several tools available for the user to make use of in manipulating DSS data, doing a statistical analysis, setting options for the WAT, customizing the WAT menus and toolbars, view the WAT execution, and check memory usage. The following sections describe these tools, with Appendix G covering the use of HEC-DSSVue.

C.1 HEC-SSP

The Statistical Software Package, HEC-SSP, is used to perform statistical analyses of hydrologic data (Figure C.1). The current version is limited to frequency analysis based on Bulletin 17B, "Guidelines for Determining

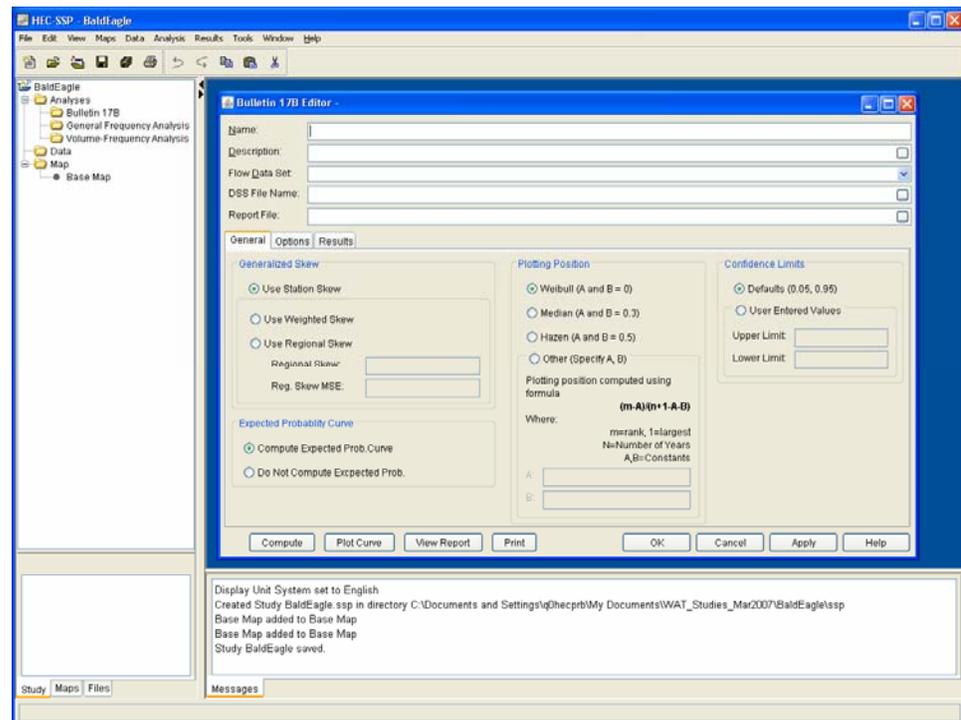


Figure C.1 HEC-SSP Main Window

Flood flow Frequency" by the Interagency Advisory Committee on Water Data. From the WAT a frequency analysis would be performed at stream gages to create frequency curves that could be used by other software in the WAT program sequence. See the HEC-SSP User's Manual (CPD-86) for further details.

To perform a frequency analysis:

1. From the WAT main window, from the **WAT Tools** toolbar (see Chapter 3, Section 3.2.1, page 3-4), click **HEC-SSP**, the HEC-SSP main window will open (Figure C.1).
2. Another way to access HEC-SSP from the WAT main window, on the **Tools** menu, click **HEC-SSP**.
3. Either way in the **Desktop** pane, the **Bulletin 17B Editor** is open (Figure C.2).

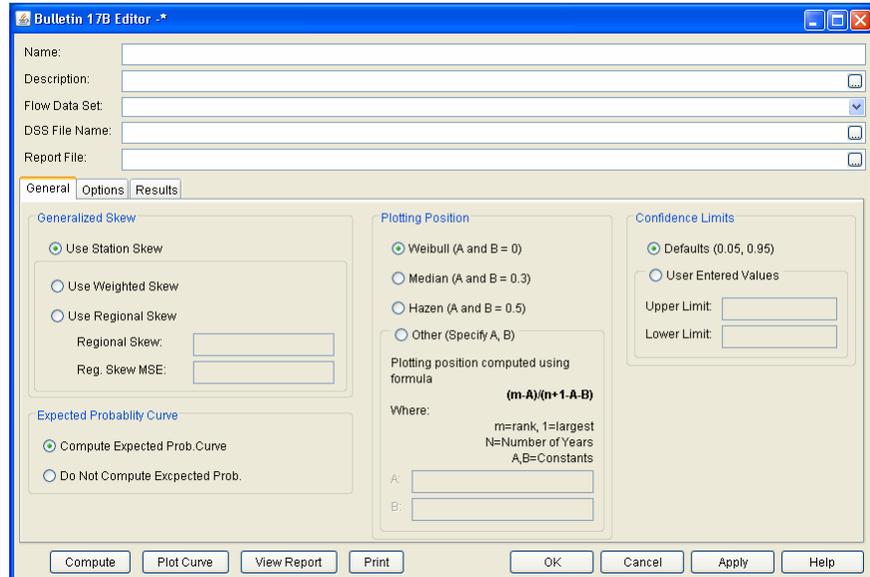


Figure C.2 Bulletin 17B Editor

4. You must enter a name for the frequency analysis, select a flow data set; select a name for the output DSS file, and enter a name for the report file.
5. The **General** tab (Figure C.2) is where you will set the general settings for a frequency analysis. This includes: generalized skew, expected probability curve (frequency curve), plotting positions, and confidence limits.
6. The **Options** tab (see Figure C.3, page C-3) provides a place for the user to enter optional data like low outlier threshold, historic period data, and user-specified frequency outliers.
7. The last tab is the **Results** tab (see Figure C.4, page C-3), which is populated after the user clicks **Compute**. This tab contains the computed flow frequency curve, the expected probability adjusted curve, general statistics about the data, and information on the events. Also, you can view data graphically and in a report form from this tab.
8. Data is stored to a DSS file, which is where the programs would retrieve the data.

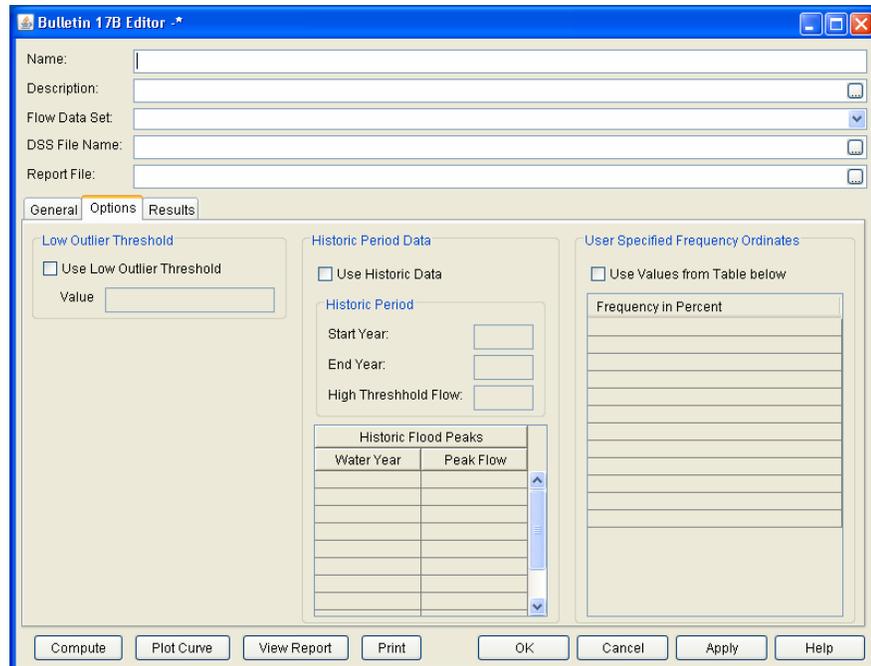


Figure C.3 Bulletin 17B Editor – Options Tab

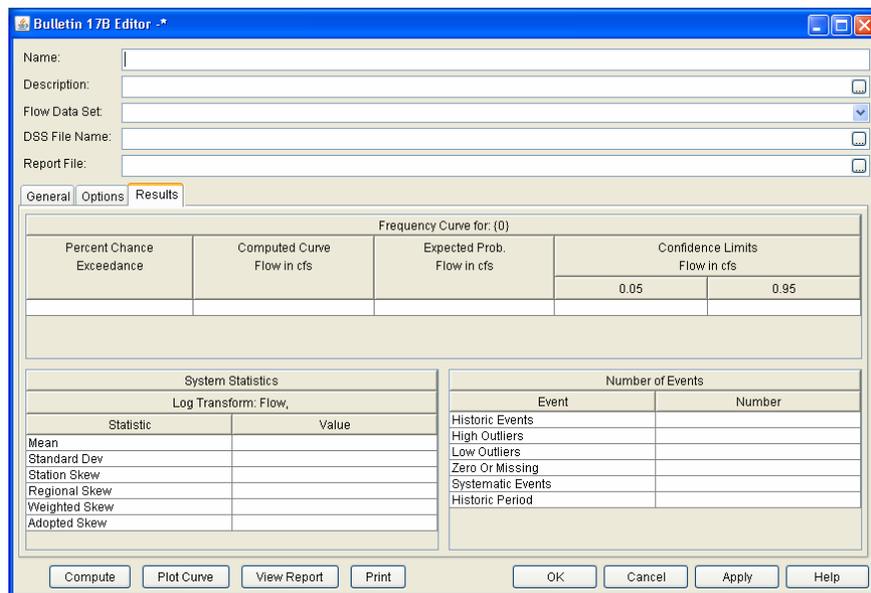


Figure C.4 Bulletin 17B Editor – Results Tab

C.2 HEC-GeoRAS

HEC-GeoRAS is a set of ArcGIS® tools specifically designed to process geospatial data for use with HEC-RAS. This set of procedures, tools, and utilities will give a user the ability to prepare GIS data for import to RAS and generate GIS data from RAS output with limited GIS experience. Users must have experience modeling with RAS and have a thorough

understanding of river hydraulics to properly create and interpret GIS data sets. For further details see the GeoRAS User's Manual (CPD-83).

C.3 HEC-GeoHMS

HEC-GeoHMS is a geospatial hydrology tool kit for engineers and hydrologists with limited GIS experience. The program allows users to visualize spatial information, document watershed characteristics, perform spatial analysis, delineate subbasin and streams, construct inputs to hydrologic models, and assist with report preparation. The GeoHMS interface allows a user to expediently create hydrologic inputs that can be used directly with HEC-HMS. For further details see the GeoHMS User's Manual (CPD-77).

C.4 HEC-WAT Options Dialog Box

The WAT allows you to configure several options for the interface. You can specify loading the last study, show startup screen and other general options; view and add system properties, view the threads being used by the WAT, configure the colors of the messages that are displayed in the table on the **Compute Manager**, configure the colors for the state of simulations on the **Compute Manager** and the **Results Comparison Manager**, and find information and review log files for the plug-ins.

C.4.1 General Tab

From this worksheet, you can set whether the last study you had open will be loaded on startup of the WAT, display a dialog box that will allow you to open or create a study, automatically save the study on exiting the WAT, restore the layout, synchronize the Study Tree to the open Map Window, and set an interval to for saving the study.

To set the automatic reload of the last study:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **General** tab (see Figure C.5, page C-5).
3. If you wish to have the last study automatically loaded the next time you start the WAT, click **Load Last Study at startup** to set.
4. Once you have the automatic study loaded set, click **OK**. The **Options** dialog box will close.

To display the **Startup** dialog box:

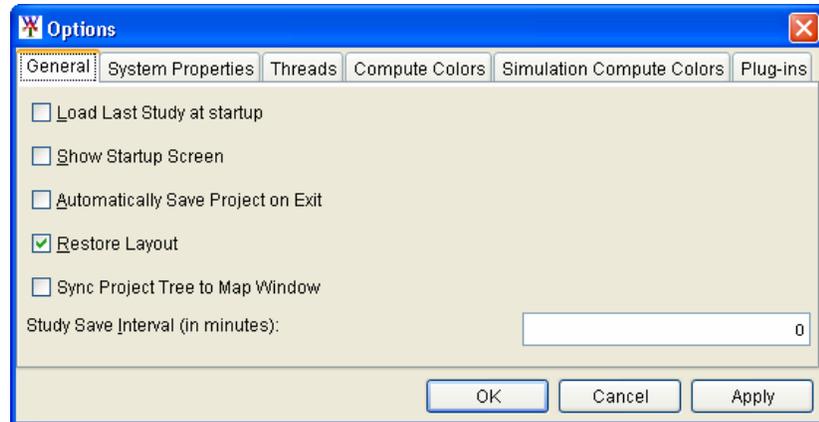


Figure C.5 Options Dialog Box

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open (Figure C.5), click the **General** tab.
3. If you wish to have the **Startup** dialog box open the next time you start the WAT, click **Show Startup Screen** to set. For this option to work properly you can not have the **Load Last Study at startup** option selected (Figure C.5).
4. Once you have the automatic study loaded set, click **OK**. The **Options** dialog box will close (Figure C.5). The next time you bring up the WAT, the **Startup** dialog box will display (Figure C.6). This allows you a convenient way to open or create a study.

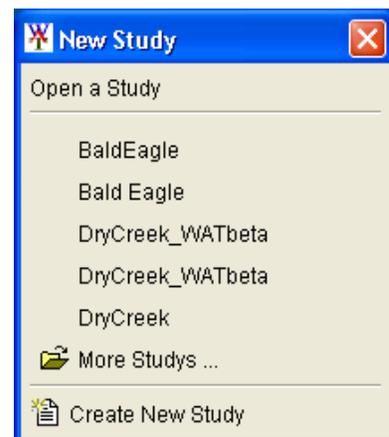


Figure C.6 Startup Dialog Box

C.4.2 System Properties Tab

System properties allow you to view system properties, and if you have the correct user access, you can edit some or all of the system properties. The recommendation is that you only use this information for debugging purposes and viewing. Editing must be done with extreme caution as any changes you make can directly affect the WAT functionality.

To view system properties:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **System Properties** tab (see Figure C.7, page C-6).

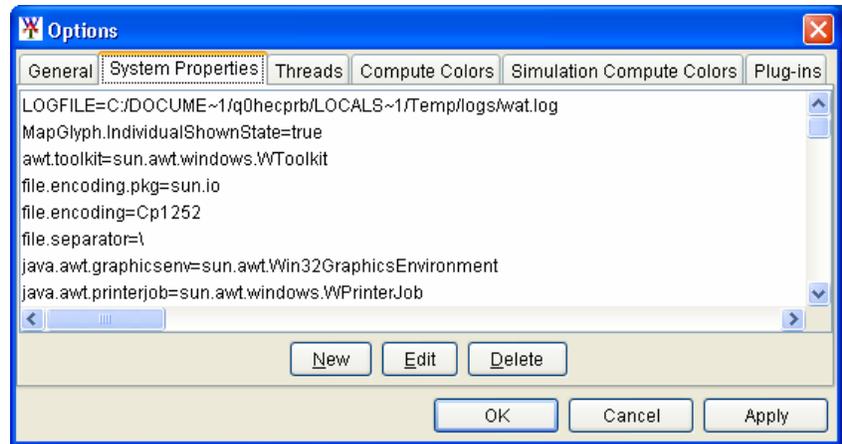


Figure C.7 Options Dialog Box – System Properties Tab

3. The **Server Properties Worksheet** will give you information regarding the WAT system properties that have been set.
4. Click **OK**, the **Options** dialog box will close.

To add a system property:

1. If you have the correct user access levels then the **New** command will be available and you can add system properties.
2. Click **New**, the **New System Property** dialog box (Figure C.8) will open.

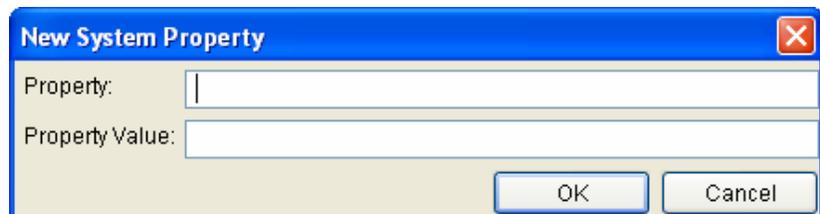


Figure C.8 New System Property Dialog Box

3. In the **Property** box (Figure C.8), enter the name of the new system property. For the parameters of the new system property, will enter the parameters in the **Property Value** box.
4. Click **OK**, the **New System Property** dialog box closes, and the new system property will appear on the **System Properties** worksheet (Figure C.7).

To edit a system property:

1. If you have the correct user access levels then the **Edit** command will be available and you can edit system properties.
2. From the **System Properties** worksheet (Figure C.75), select a system property from the available list, click **Edit**, the **Edit System Property** dialog box (see Figure C.9, page C-7) will open.
3. In the **Property** and **Property Value** boxes, from the selection you made, edit the items, as you need to.

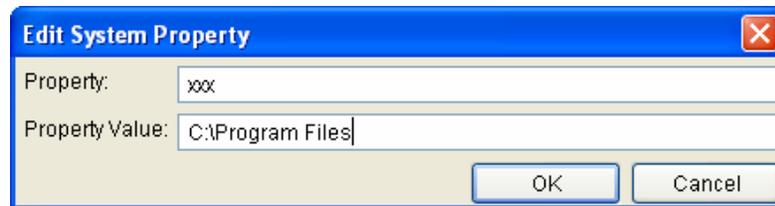


Figure C.9 Edit System Property Dialog Box

4. Click **OK**, the **Edit System Property** dialog box closes, and the changed system property will appear on the **System Properties** worksheet (see Figure C.7, page C-6).

To delete a system property:

1. If you have the correct user access levels then the **Delete** command will be available and you can delete system properties.
2. From the **System Properties** worksheet (see Figure C.7, page C-6), select the system property you wish to delete. To select, click on the system property, it will now be highlighted in blue.
3. Click **Delete**, a **Confirm** message (Figure C.10) will open. If you want to delete the selected system property, click **Yes**. The **Confirm** message will close and the selected system property will be removed from the **System Properties** worksheet (see Figure C.7, page C-6).

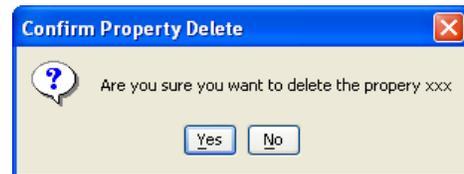


Figure C.10 Confirm Message

C.4.3 Threads Tab

A thread is a single sequential flow of control within software. Within Java you have the ability to have multiple threads in a piece of software all running at the same time and performing different tasks. The WAT is a multi-threaded program, and the **Options** dialog box provides you a view of the threads being used by the WAT.

To view threads:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **Threads** tab (see Figure C.11, page C-8).
3. The **Threads Worksheet** will give you information regarding the threads that are actively being used by the WAT. To provide an up-to-date list of the active threads, click **Refresh**.
4. Click **OK**, the **Options** dialog box will close.

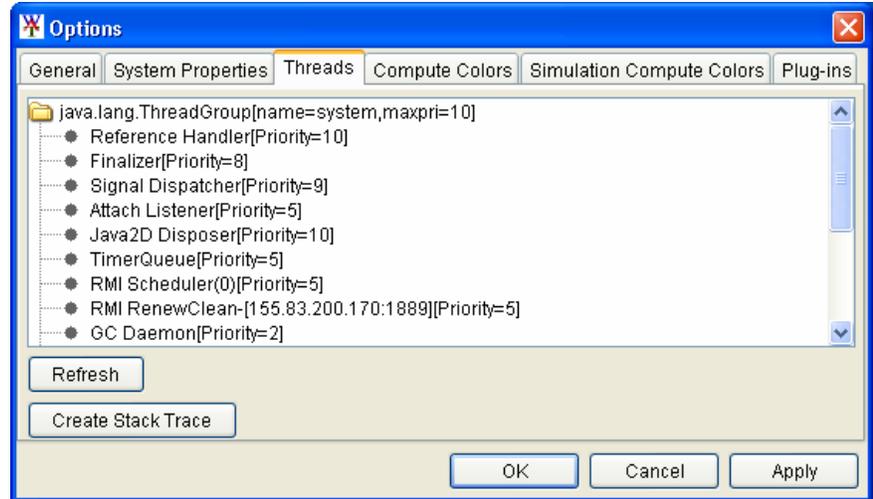


Figure C.11 Options Dialog Box – Threads Tab

C.4.4 Compute Colors Tab

During a compute, from the **Compute Manager** and the **Compute Progress** dialog box, messages are written. There are three different types of messages, each with its own default color. From the **Options** dialog box you can change the default color for each message type.

To set the colors for messages displayed during a compute:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **Compute Colors** tab (Figure C.12).

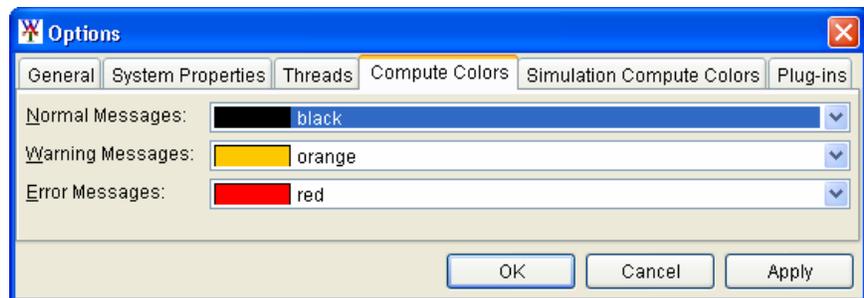


Figure C.12 Options Dialog Box – Compute Colors Tab

3. The **Compute Colors Worksheet** displays the default colors for **Normal Messages**, **Warning Messages**, and **Error Messages**. To change the color, from the color list associated with each message type, click on a new color.
4. Click **OK**, the **Options** dialog box will close. The new color will appear in the **Compute Manager** and the **Compute Progress** dialog box, the next time a compute is executed.

C.4.5 Simulation Compute Colors Tab

Simulations are color coded in the WAT, so the user can at a glance see what simulations need to be computed, which ones had errors, which ones successfully computed, which ones are out-of-date, and what simulations are not computable. Each category has its own default color, which appears in the **Study** pane, the **Compute Manager**, and the **Result Comparison Manager**. From the **Options** dialog box you can change the default color for each simulation compute category.

To set the colors for simulations:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **Simulation Compute Colors** tab (Figure C.13).

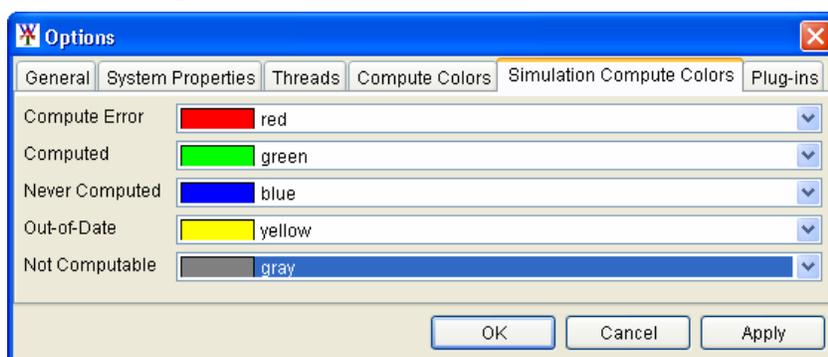


Figure C.13 Options Dialog Box – Simulation Compute Colors Tab

3. The **Simulation Compute Colors Worksheet** displays the default colors for **Compute Error**, **Computed**, **Never Computed**, **Out-of-Date**, and **Not Computable**. To change the color, from the color list associated with each simulation compute category, click on a new color.
4. Click **OK**, the **Options** dialog box will close (Figure C.13). The new color will appear in the Study Pane, **Compute Manager** and the **Result Comparison Manager**, the next time a simulation is computed.

C.4.6 WAT Plug-Ins Tab

This worksheet provides information on the plug-ins that are currently being used in the WAT for the four basic programs in the default program order, plus the plug-in for the HEC-SSP tool (see Section C.1). The information includes the plug-in name, the version of the software the plug-in represents, the name of the project, whether the plug-in is written in a client/server mode or not, status of the server side, and a log file associated with the plug-in. The log file is very important when debugging issues related to the individual programs in the WAT. The

only program that does not have a log file for the Beta version is HEC-RAS. The following steps can be followed for any of the software plug-ins.

To access the HMS server log file:

1. On the **Tools** menu, click **Options**.
2. The **Options** dialog box will open, click the **Plug-ins** tab (Figure C.14).

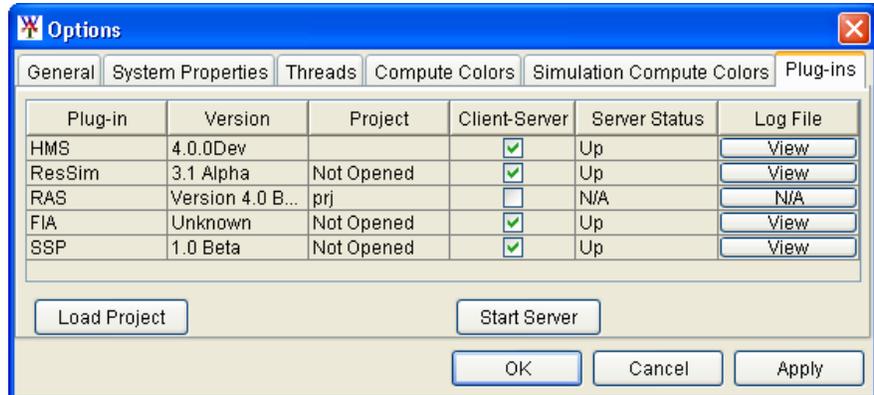


Figure C.14 Options Dialog Box – Plug-ins Tab

3. To view the log file for the HMS server, on the table, in the **HMS** row, click **View**. The **hmsserver.log** will open (Figure C.15).

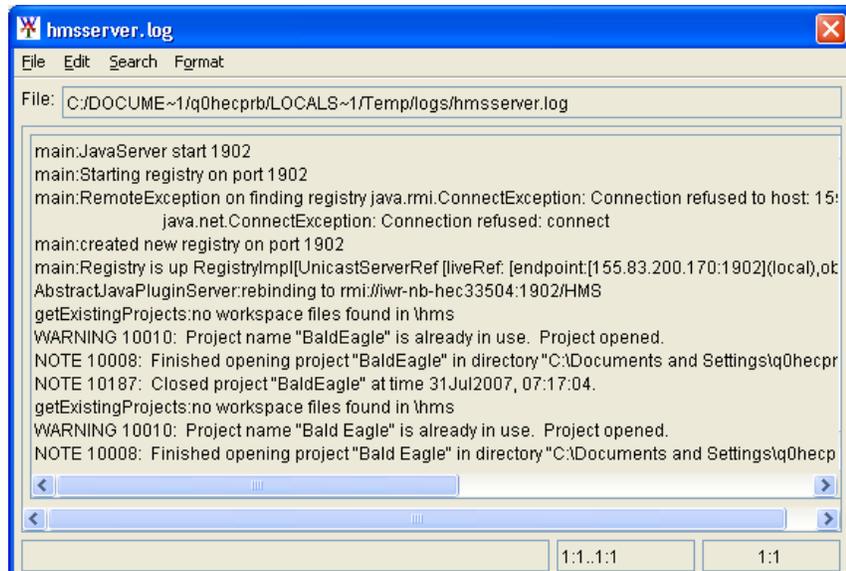


Figure C.15 hmsserver.log

4. Review the **hmsserver.log** for any information that can help you debug any issues with the HMS program. From the **File** menu, click **Close**, the **hmsserver.log** will close.
5. Click **OK**, the **Options** dialog box will close (Figure C.14).

C.5 Customize HEC-WAT Menus and Toolbars

This item allows the user to customize the menu items in the WAT, and turn on and off the WAT toolbars.

To customize menu items:

1. On the **Tools** menu, click **Customize**.
2. The **Customize** dialog box will open; click the **Commands** tab (Figure C.16).
3. From the **Categories** box, select the menu you wish to customize. From the **Commands** box, click on the command you wish to remove and click **Remove**. The command will no longer appear in the Commands box.
4. Click **OK**, the **Customize** dialog box will close. The command you removed from the menu will no longer appear in the WAT.

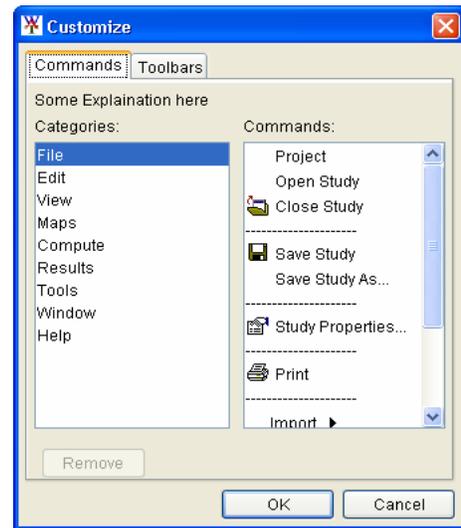


Figure C.16 Customize Dialog Box

C.6 HEC-WAT Output

To review the progress of the WAT, on the **Tools** menu, click **Console Output**, the **Console Window** will open (Figure C.17). From this dialog box you can view the progress of the WAT, help in debugging issues with

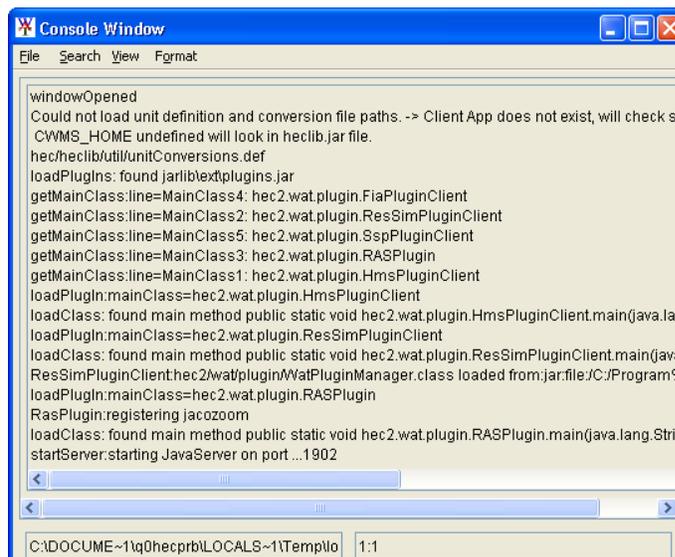


Figure C.17 Console Window

the WAT, search for certain items, format the dialog box, and print the contents of the dialog box. From the **File** menu, click **Close**, the **Console Window** will close.

C.7 HEC-WAT Memory Usage

To review the memory being used by the WAT, on the **Tools** menu, click **Memory Monitor**, the **Memory Monitor** dialog box will open (Figure C.18). From this dialog box you can view the memory usage of the WAT. Click the X to close the **Memory Monitor** dialog box.

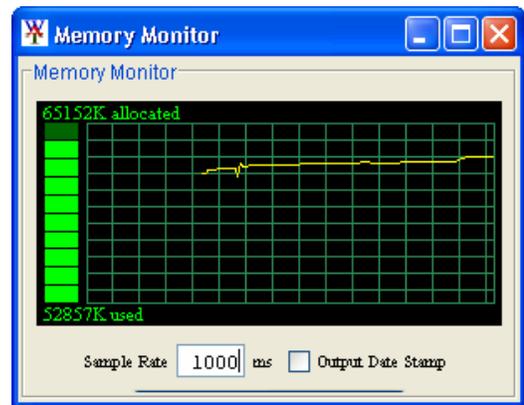


Figure C.18 Memory Monitor Dialog Box

Appendix D

Setting Up the Coordinate System

To maintain a geographic reference (also called a geo-reference), HEC-WAT uses a user-selected **coordinate system**, called the World Coordinate System (WCS). This superimposes a grid on layer features to establish x- and y-coordinates in WCS for each point on the layer. The x-coordinate is referred to as "easting" and the y-coordinate is referred to as "northing" following customary use in surveying and mapping. The user can select the extent of this grid, the dimensions of the cells of the grid, the units of measurement of the grid, and even the location of the origin of the grid. This appendix focuses on how to setup and edit different coordinate systems.

D.1 Geographic Referencing

To maintain a geographic reference, you must specify a coordinate system for each watershed. To establish the grid size and coordinate system:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (Figure D.1). By default, the **Map Extents** tab is selected.

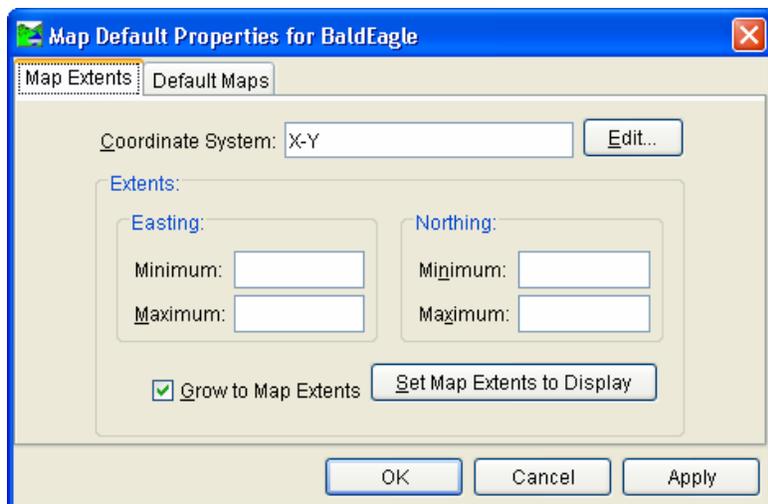


Figure D.1 Map Default Properties for StudyName Dialog Box

2. The information in the **Map Extents** tab includes:
 - **Coordinate System.** This box identifies the established coordinate system for a study. To edit the coordinate system,

click **Edit**, and the **Map Coordinate Information** dialog box (Figure D.2) will open. Remember that all layers must exist in one unified coordinate system.



Figure D.2 Map Coordinate Information Dialog Box

- **Extents – Easting Minimum, Maximum, Northing Minimum, and Maximum.** These values indicate the location of the left, right, bottom and top borders (respectively) of the grid in the map window.
- **Grow to Map Extents.** When selected, the WAT automatically sets the geographic extents to define the smallest rectangle that encompasses all the objects in the study.
- **Set Map Extents to Display.** This will set the limits of the map window. If you zoom in on an area, and click **Set Map Display to Display**, the extents on the **Default Map Properties**, the **Map Default Properties for StudyName** dialog box (see Figure D.1, page D-1) will change to the zoomed area.

Note that the geographic extents of your layers must be selected carefully to ensure that the entire study is included. Further, the extents you specify and the coordinate system you use must be consistent for all the layers. Therefore, you may need to use GIS tools to transform the layers from one coordinate system to another before using them with the WAT. The WAT has no coordinate system transformation tools.

D.2 Coordinate System Types

A **coordinate system** is a method of representing points in a space of given dimensions by coordinates. There are several different types of coordinate systems; two of interest to the WAT is the geographic coordinate system, which is based on latitude and longitude coordinates, and the project coordinate system that represents the projection of a geographic coordinate system on a plane.

The coordinate systems available in The WAT are shown in Table D.1. This table also shows the units and spheroid type for each coordinate system. A **spheroid** (ellipsoid) is the shape of the earth that used in the calculations that transform positions on the curved surface of the earth to positions on a flat map. It is part of the horizontal datum, which approximates the curved surface of the earth over part of the globe.

Table D.1
Coordinate System Available in the WAT

Coordinate Systems	Units	Spheroid
X-Y	U.S. feet	N/A
Geographic	radians	WGS 72
Universal Transverse Mercator	meters	GRS 1980(NAD83)
State Plane Coordinates	meters	GRS 1980(NAD83)
Albers Equal-Area Conic	Degrees of Arc	Sphere of Radius 6370997 meters
Lambert Conformal Conic	International Feet	
Transverse Mercator	U.S. feet	Clarke 1866(NAD27)
Albers Equal-Area Conic (SHG)	meters	GRS 1980(NAD83)
Polar Sterographic (HRAP)	meters	Sphere of Radius 6371200 meters

D.2.1 X-Y Coordinate System

The X-Y coordinate system is also known as the World Coordinate System (WCS). This superimposes a grid on layer features to establish x- and y-coordinates for each point on the layer. The origin point (0,0) can be located anywhere, but every object is located in relation to the origin point. For the X-Y, coordinate system there is not a specification for spheroid.

To set parameters for the X-Y Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (see Figure D.2, page D-2) will open.
3. From the **System** list, select X-Y.
4. From the **Units** list, select the units for the X-Y coordinate system.
5. Click **OK**, the **Map Coordinate Information** dialog box (see Figure D.2, page D-2) will close, and you will be returned to the **Map Default Properties for StudyName** dialog box (see Figure D.1, page D-1). In the **Coordinate System** box, X-Y should be displayed.

D.2.2 Geographic Coordinate System

For the geographic coordinate system, there you will specify units and a spheroid type. To set parameters for the Geographic Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.3) will open.

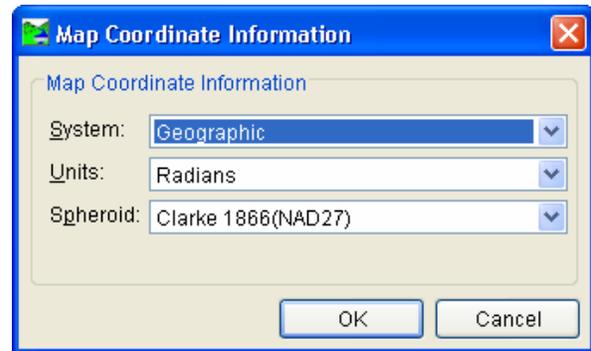


Figure D.3 Geographic Coordinate System

3. From the **System** list, select *Geographic*.
4. From the **Units** list, select the units for the *Geographic* coordinate system. The only units available should be **Radians**, **Seconds of Arc**, and **Degrees of Arc**.
5. From the **Spheroid** list, select a spheroid type for the *Geographic* coordinate system.
6. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Geographic* should be displayed.

D.2.3 Universal Transverse Mercator Coordinate System

The Universal Transverse Mercator (UTM) coordinate system is a projection coordinate system. UTM is used to define horizontal positions throughout the world by dividing the surface of the Earth into six-degree zones, with a central meridian in the center of each zone.

To set parameters for the Universal Transverse Mercator Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (see Figure D.4, page D-5) will open.

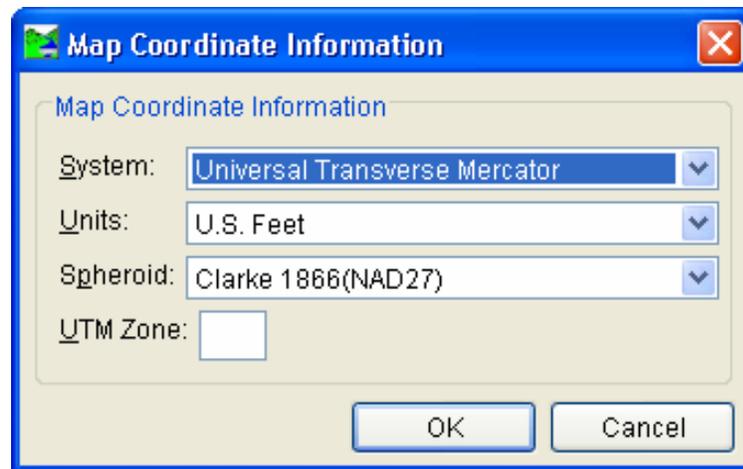


Figure D.4 Universal Transverse Mercator Coordinate System

3. From the **System** list, select **Universal Transverse Mercator**.
4. From the **Units** list, select the units for the *Universal Transverse Mercator* coordinate system.
5. From the **Spheroid** list, select a spheroid type for the *Universal Transverse Mercator* coordinate system.
6. In the **UTM Zone** box, enter the UTM zone number.
7. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Universal Transverse Mercator* should be displayed.

D.2.4 State Plane Coordinate System

The State Plane Coordinate System (SPCS) was established in the 1930's and now covers all fifty states. Zones were established for each state using either the Lambert Conformal or Traverse Mercator projections. Units are generally in feet (NAD27) or meters (NAD83).

To set parameters for the State Plane Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (see Figure D.5, page D-6) will open.
3. From the **System** list, select **State Plane Coordinates**.
4. From the **Units** list, select the units for the State Plane coordinate system.
5. From the **Spheroid** list, select a spheroid type for the State Plane coordinate system. There should only be two choices: **Clarke 1866(NAD27)** and **GRS 1980(NAD83)**.

6. In the **Zone** box, enter the zone for the state. These codes are FIPS codes.
7. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *State Plane Coordinates* should be displayed.



Figure D.5 State Plane Coordinate System

D.2.5 Albers Equal-Area Conic Coordinate System

The Albers Equal-Area Conic projection was established for mapping large countries like the United States. The projection is an equivalent projection, where areas are proportional and directions are true in limited areas.

To set parameters for the Albers Equal-Area Conic Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.6) will open.

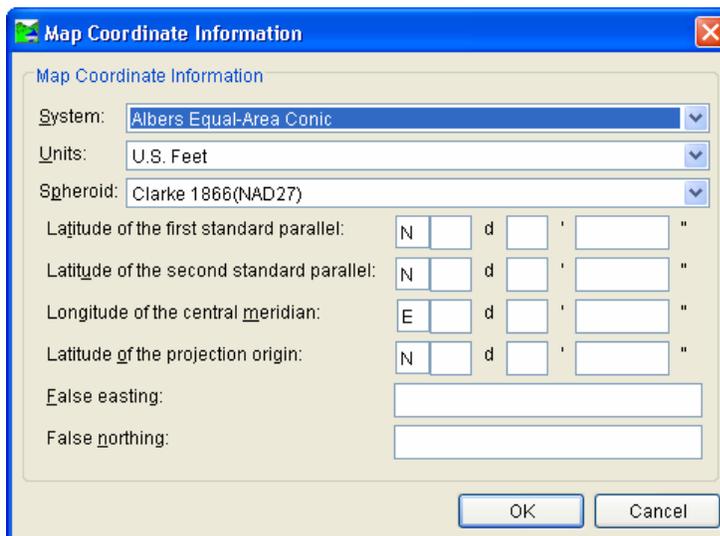


Figure D.6 Albers Equal-Area Conic Coordinate System

3. From the **System** list, select **Albers Equal-Area Conic**.
4. From the **Units** list, select the units for the Albers Equal-Area Conic coordinate system.
5. From the **Spheroid** list, select a spheroid type for the Albers Equal-Area Conic coordinate system.
6. The remaining items to be entered are the angular parameters that are required to fine-tune the projection. When specifying latitudes you will enter N or S, and for longitudes, you will enter E or W. Use the SPACEBAR to toggle between the entries.
7. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Albers Equal-Area Conic* should be displayed.

D.2.6 Lambert Conformal Conic Coordinate System

The Lambert Conformal Conic projection is used extensively for mapping areas of the world with predominantly east-west orientation. Similar to the Albers Equal-Conic projection, however the projection is not done in an equal-area.

To set parameters for the Lambert Conformal Conic Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.7) will open.

The screenshot shows the 'Map Coordinate Information' dialog box. The 'System' dropdown is set to 'Lambert Conformal Conic', 'Units' is 'U.S. Feet', and 'Spheroid' is 'Clarke 1866(NAD27)'. Below these are input fields for angular parameters: 'Latitude of the first standard parallel', 'Latitude of the second standard parallel', 'Longitude of the central meridian', and 'Latitude of the projection origin'. Each of these fields has a dropdown for direction (N or S for latitude, E or W for longitude) and a numeric input field. At the bottom are 'False easting' and 'False northing' text boxes, and 'OK' and 'Cancel' buttons.

Figure D.7 Lambert Conformal Conic Coordinate System

3. From the **System** list, select **Lambert Conformal Conic**.
4. From the **Units** list, select the units for the Lambert Conformal Conic coordinate system.
5. From the **Spheroid** list, select a spheroid type for the Lambert Conformal Conic coordinate system.
6. When specifying latitudes you will enter **N** or **S**, and for longitudes, you will enter **E** or **W**. Use the **SPACEBAR** to toggle between the entries.
7. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Lambert Conformal Conic* should be displayed.

D.2.7 Transverse Mercator Coordinate System

The Transverse Mercator projection is where a sphere is projected onto a cylinder tangent to a central meridian. Similar to the Lambert Conformal Conic project, but used to portray large areas in a north-south orientation. Many national grid systems are based on the Transverse Mercator projection.

To set parameters for the Transverse Mercator Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.8) will open.

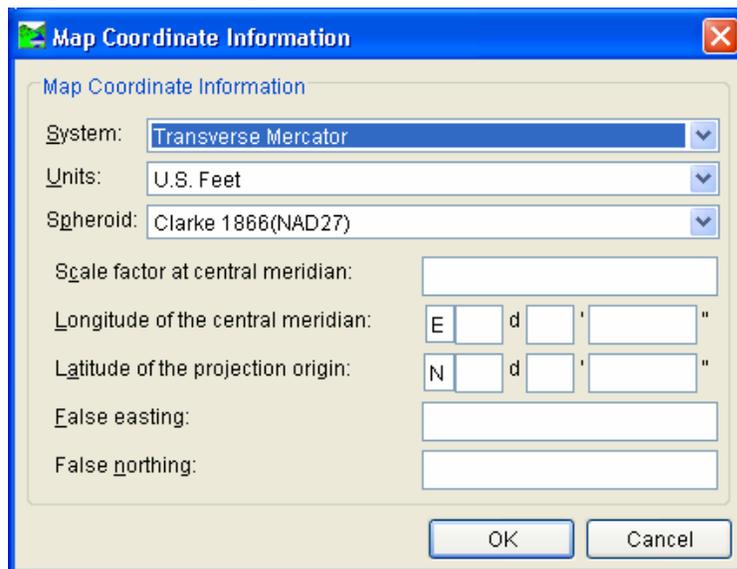


Figure D.8 Transverse Mercator Coordinate System

3. From the **System** list, select **Transverse Mercator**.
4. From the **Units** list, select the units for the Transverse Mercator coordinate system.
5. From the **Spheroid** list, select a spheroid type for the Transverse Mercator coordinate system.
6. Enter a scaling factor for central meridian, in the **Scale factor at central meridian** box.
7. When specifying latitudes you will enter **N** or **S**, and for longitudes, you will enter **E** or **W**. Use the **SPACEBAR** to toggle between the entries.
8. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Transverse Mercator* should be displayed.

D.2.8 Albers Equal-Area Conic (SHG) Coordinate System

This is the SHG version of the Albers Equal-Area Conic coordinate system. The parameters are set to match USACE map coordinates for SHG, so do not change any parameter settings.

To view the parameters for the Albers Equal-Area Conic (SHG) Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.9) will open.

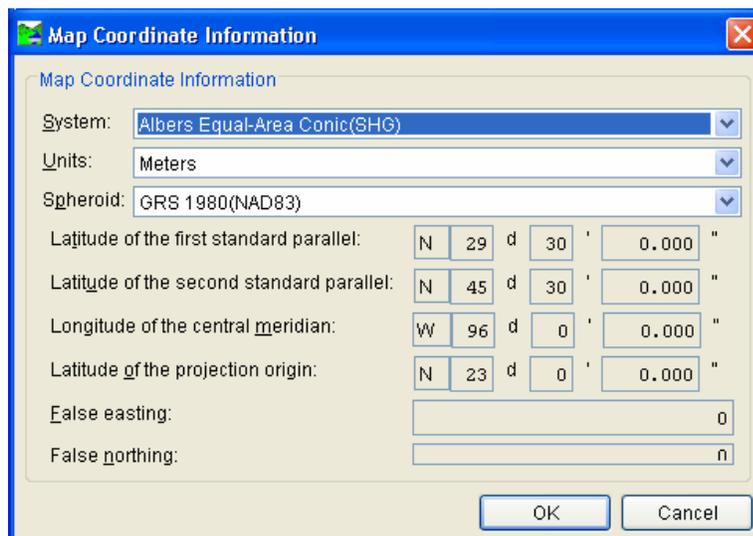


Figure D.9 Albers Equal-Area Conic (SHG) Coordinate System

3. From the **System** list, select **Albers Equal-Area Conic (SHG)**.
4. From the **Units** list, select the units for the Albers Equal-Area Conic (SHG) coordinate system.
5. From the **Spheroid** list, select a spheroid type for the Albers Equal-Area Conic (SHG) coordinate system.
6. The remaining parameters are informational and are not editable.
7. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Albers Equal-Area Conic (SHG)* should be displayed.

D.2.9 Polar Sterographic (HRAP) Coordinate System

The Polar Sterographic (HRAP) is used for navigation in polar regions. The parameters are set to match NWS map coordinates used for radar grids, so do not change any parameter settings.

To view the parameters for the Polar Sterographic (HRAP) Coordinate System:

1. On the **Maps** menu, click **Default Map Properties**, the **Map Default Properties for StudyName** dialog box will open (see Figure D.1, page D-1). By default, the **Map Extents** tab is selected.
2. The **Coordinate System** box contains the default coordinate system for the maps, click **Edit**, the **Map Coordinate Information** dialog box (Figure D.10) will open.

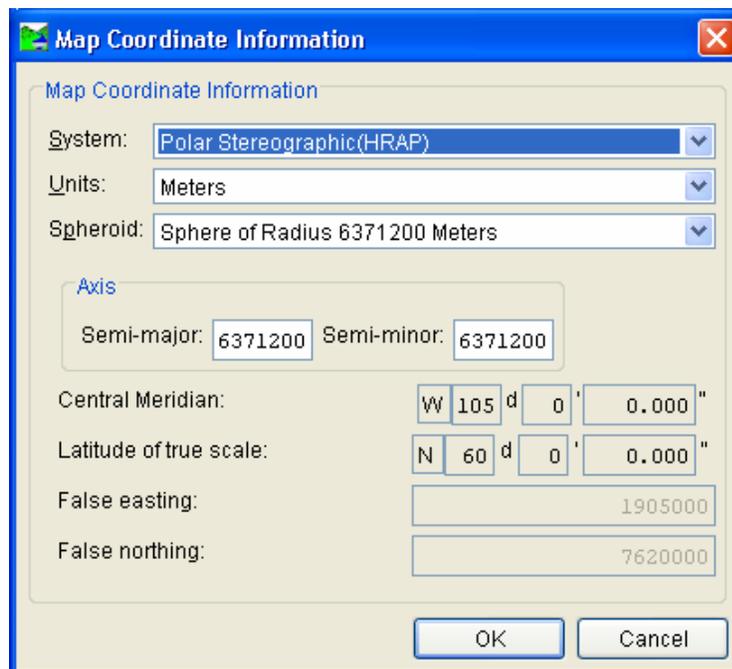


Figure D.10 Polar Sterographic (HRAP) Coordinate System

3. From the **System** list, select **Polar Sterographic (HRAP)**.
4. From the **Units** list, select the units for the Polar Sterographic (HRAP) coordinate system.
5. From the **Spheroid** list, select a spheroid type for the Polar Sterographic (HRAP) coordinate system.
6. From the **Axis** box you can edit the axes information for either the **Semi-major** or the **Semi-minor** axes.
7. The remaining parameters are informational and are not editable.
8. Click **OK**, the **Map Coordinate Information** dialog box will close, and you will be returned to the **Map Default Properties for StudyName** dialog box. In the **Coordinate System** box, *Polar Sterographic (HRAP)* should be displayed.

Appendix E

Using Map Editors

There are seven map layers supported by HEC-WAT, the different map layers are described in Chapter 5, Section 5.2.1 (page 5-1) of this manual. In the WAT you can configure several options for each type of map layer, except for AutoCAD® DXF files; additional customization is in development for future versions of the software.

You will access the map layer editors, from the **Maps Tab**, which provides a view of the active map window in the **Desktop Pane**. From the **Content Pane**, either double-click on a map layer name, or right-click, and from the shortcut menu click **Properties**. An editor specific to the type of map layer you selected will open.

E.1 Arc Shapefiles (.shp)

This layer type is the native data structure for the ArcView® GIS program. Shapefiles store nontopological geometry and attribute information for the spatial features of a data set. There are three kinds of shapefiles: line, polygon, and point.

To edit a line or polygon Arc Shapefile:

1. From the **Maps Tab**, from the **Content Pane**, right-click on an Arc Shapefile that you know is either a line or a polygon shapefile, from the shortcut menu click **Properties** or double-click on the Arc Shapefile filename.
2. The **Shapefile Display Options** dialog box (see Figure E.1, page E-2) will open.
3. Across the top of the dialog box, is displayed the location and name of the shapefile.
4. From the list, you can select the field from the shapefile to be used for associating colors and what labels can be displayed. In Figure E.1 (page E-2), you have chosen *Stream_ID*, which displays the name of the individual streams in the shapefile.
5. By default, the shapefile will display lines and areas (polygons). To turn off either one of these options clear **Draw Line** or **Draw Areas**. Click **OK**, the **Shapefile Display Options** dialog box will close. From the **Layer Selector** dialog box, click **Apply**. If you

- have cleared **Draw Areas**, then the areas (polygons) will now no longer appear in the display area.
6. If you wish to display labels associated with the shapefile, click **Draw Labels**. Click **OK**, the **Shapefile Display Options** dialog box will close. From the **Layer Selector** dialog box, click **Apply**, the labels for the selected field will appear in the display area.
 7. To change the colors of line or polygons, from the table, in the **Color** column, click on the color square. A **Color Chooser** (Figure E.2) will open.
 8. The properties of the **Color Chooser** are discussed in detail in Appendix F. From the color palette, select a color, click **OK**. The **Color Chooser** will close and the selected color will now appear in the color square for the selected field.

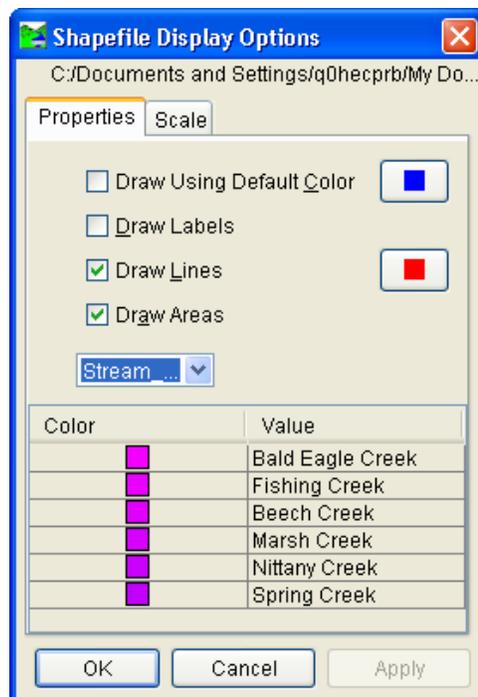


Figure E.1 Shapefile Display Options Dialog Box

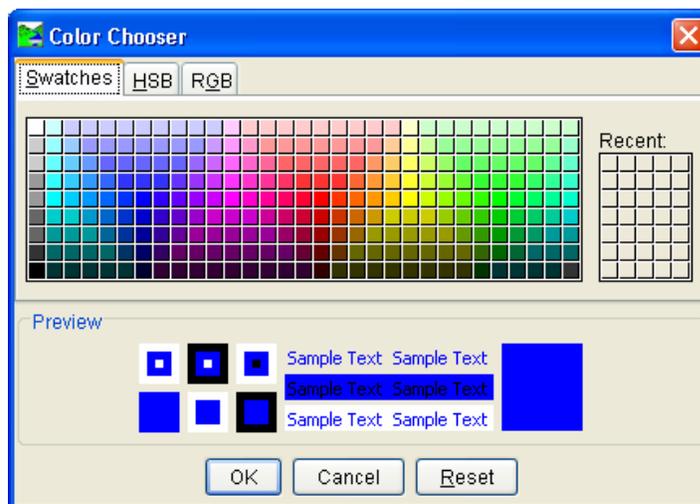


Figure E.2 Color Chooser

9. Click **OK**, the **Shapefile Display Options** dialog box will close. From the **Layer Selector** dialog box, click **Apply**, the color for the selected field will appear in the display area.
10. If you wish to save any changes, from the **File** menu, choose **Save Watershed**. Changes are saved to a file with the extension *.gdr*. For example, in Figure E.1, the shapefile name is *stream.shp*, if you have made changes and saved, a file *stream.gdr* will be created.

To edit a point Arc Shapefile:

1. From the **Layer Tree**, right-click on an Arc Shapefile that you know is a point shapefile. From the shortcut menu, click **Properties**, or double-click on the Arc Shapefile name.
2. The **Color Chooser** (see Figure E.2, page E-2) will open.
3. The properties of the **Color Chooser** are discussed in detail in Appendix F. From the color palette, select a color, click **OK**. The **Color Chooser** will close.
4. From the **Layer Selector** dialog box, click **Apply**, the color for the points will appear in the display area.
5. In the Beta Version of the WAT, any of the above changes are not saved and the procedures described may not always behave correctly in the Beta Version.

E.2 USGS Digital Line Graph (.dlg)

This layer type is a vector representation of the data. When the WAT interacts with a *dlg* file it automatically creates a *dlgbin* file for use.

To edit a USGS Digital Line Graph file:

1. From the **Maps Tab**, from the **Content Pane**, right-click on a USGS Digital Line Graph file. From the shortcut menu, click **Properties**, or double-click on the USGS Digital Line Graph filename.
2. The **USGS Digital Line Graph Editor** (Figure E.3) will open.

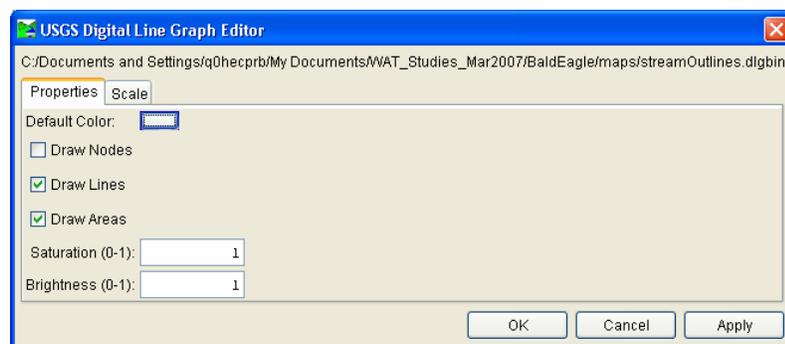


Figure E.3 USGS Digital Line Graph Editor

3. Across the top of the dialog box, is displayed the location and name of the USGS Digital Line Graph file.
4. To change the color of the lines of the *dlg* file, click the color box. The **Color Chooser** (see Figure E.2, page E-2) will open.
5. The properties of the **Color Chooser** are discussed in detail in Appendix F. From the color palette, select a color, click **OK**. The

- Color Chooser** will close and the selected color will now appear in the color box.
- From the **Layer Selector** dialog box, click **Apply**, the color for the lines will appear in the display area.
 - You can control the appearance of nodes, line, and areas by selecting and clearing **Draw Nodes**, **Draw Lines**, and **Draw Areas**, respectively.
 - You can also control the saturation and brightness level of the color you have selected by entering values in the **Saturation** or **Brightness** boxes. Values entered for saturation or brightness must be between zero (0) and one (1).
 - If you wish to save any changes, from the **File** menu, choose **Save Study**. The color for a USGS digital line graph file is stored in the watershed file (*.wksp).

E.3 Elevation Options Dialog Box

For the other map layer formats – USGS DEM, ASCII NetTin, and ArcInfo® DEM; they all have the same editor, the **Elevation Options** dialog box.

To edit an ASCII NetTin file:

- From the **Maps Tab**, from the **Content Pane**, right-click on an ASCII NetTin file. From the shortcut menu, click **Properties**, or double-click on the ASCII NetTin name.
- The **Elevation Options** dialog box (Figure E.4) will open.
- Across the top of the dialog box, is displayed the name of the ASCII NetTin file.
- From the list box, there are available color contour schemes – **Aspect Shading**, **Grayscale**, **Linear**, **Precipitation**, **Red-Green-Blue**, and **Terrain** (default).
- The **Draw Edges** check box is specifically for ASCII NetTin files. If selected, the edges of the triangles the make up an ASCII NetTin file will be drawn.
- You can set the contour tic interval, by entering a

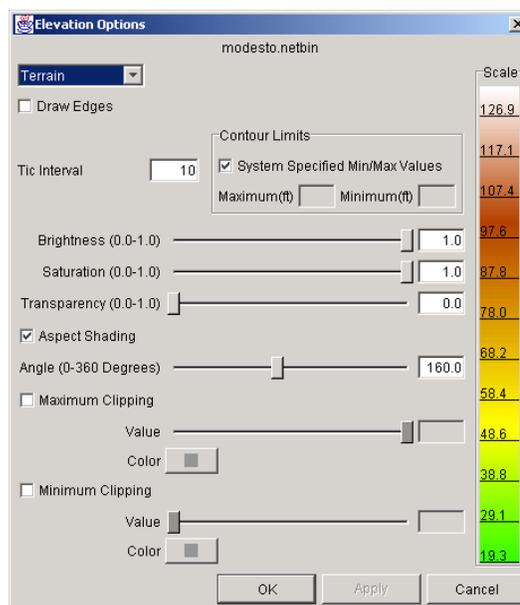


Figure E.4 Elevation Options Dialog Box

value in the **Tic Interval** box. The program sets the maximum and minimum limits of the contours automatically. You can set your own maximum and minimum limits. Clear **System Specified Min/Max Values**, the **Maximum** and **Minimum** boxes are now available for you to enter values.

7. You can control the brightness (amount of white), saturation (amount of black), and transparency (level of opacity or alpha) for the colors. You can adjust the values by using the **Brightness**, **Saturation**, and **Transparency** slider bars or boxes.
8. By default the **Aspect Shading** option is on, aspect shading is where you make the map layer appear in relief by placing an imaginary light source above the map and shading the contours. You can adjust the angle of the light source by using the **Angle** slider bar or the box. If you do not want aspect shading, clear **Aspect Shading**.
9. Clipping provides you a way to highlight an area based on your color choices and values. For maximum clipping, you would fill the contour with the clip color from the maximum value of the map to the value entered for **Maximum Clipping**. An example of where you might use maximum clipping would be smog levels, cloud cover, or snow level at a particular elevation. By default, maximum clipping is turned off, to select click the **Maximum Clipping** check box. Then choose a color by clicking the **Color** box and either enter a maximum clipping value by using the slider bar or enter a value in the box.
10. Minimum clipping will fill the contour with the clip color from the minimum value of the map to the value entered for **Minimum Clipping**. An example of where you might use minimum clipping would be to see where a water level would be if it flooded to a particular elevation. By default, minimum clipping is turned off, to select click the **Minimum Clipping** check box. Then choose a color by clicking the **Color** box and either enter a minimum clipping value by using the slider bar or enter a value in the box.
11. In the Beta Version, any of the above changes are not saved and the procedures described may not always behave correctly in the Beta Version of the WAT.

Appendix F

Using the Color Chooser

The **Color Chooser** (Figure F.1) affords great flexibility when you need to select default colors for map layers, labels, and background colors in your watershed display. The **Color Chooser** has three tabs: **Swatches**, **HSB**, and **RGB**, offering three methods for choosing a color. For each method, the preview area allows you to see your choice before applying changes.

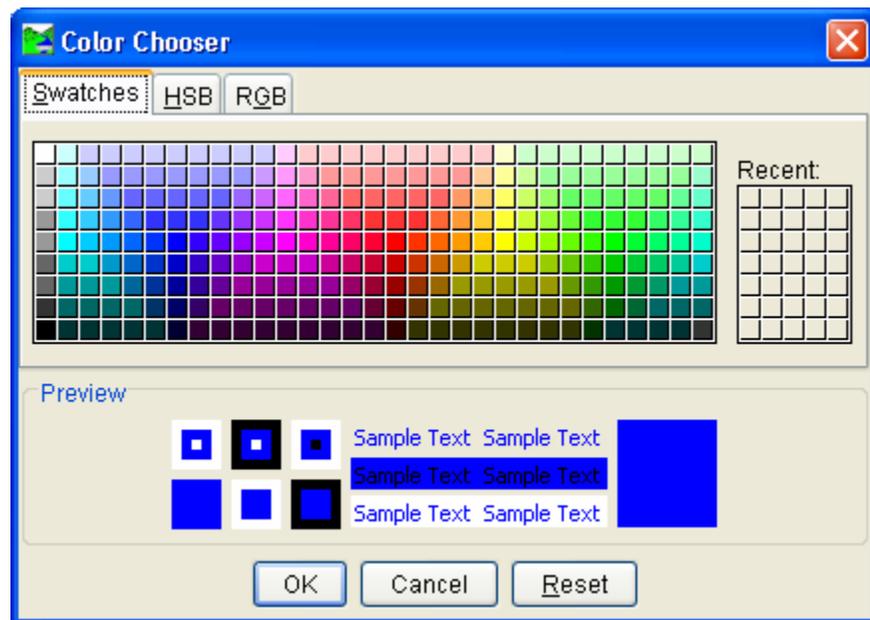


Figure F.1 Color Chooser – Swatches Worksheet

F.1 Swatches Worksheet

The **Swatches** worksheet provides a palette of pre-defined colors. From the palette, select a color. Once you have selected a color, the **Recent** box displays that color, as also does the **Preview** box. Click **OK**, the **Color Chooser** will close. Depending on where you accessed the **Color Chooser**, you will have to click either **Apply** or **OK** for the color change to appear in the map window.

For example, for a USGS Digital Line Graph, you would have accessed the **Color Chooser** from the **USGS Digital Line Graph Editor** (see Appendix E, Section E.2, page E-3). Once you have selected the color

from the **Color Chooser** and closed, then you need to click **OK** or **Apply** from the **USGS Digital Line Graph Editor** for the color change to appear in the map window.

F.2 HSB Worksheet

HSB is the Hue, Saturation, and Brightness color model, which allows you to set the hue, saturation, and brightness of the colors you wish to produce. From the **Color Chooser**, select the **HSB** tab; the **HSB Worksheet** (Figure F.2) becomes available.

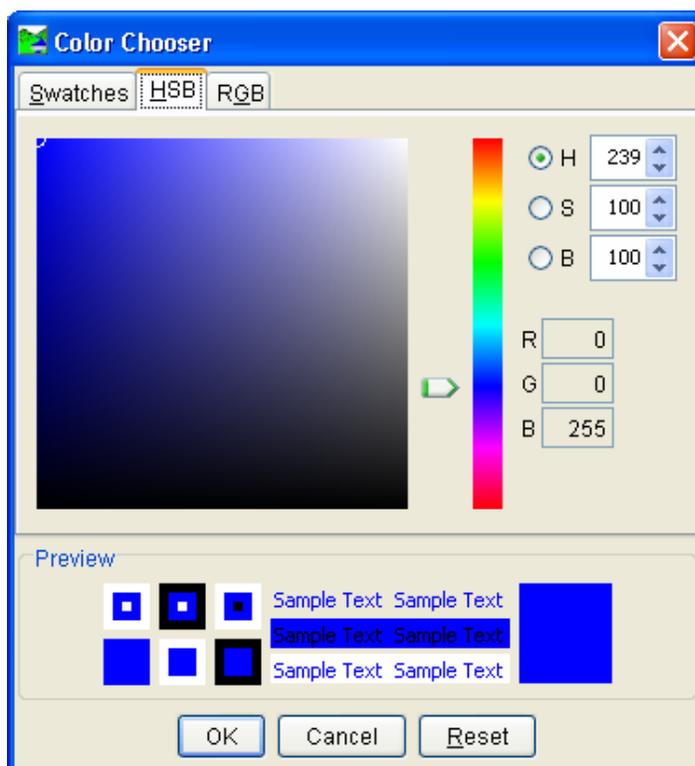


Figure F.2 Color Chooser – HSB Worksheet

There are several ways to adjust the hue, saturation, and brightness of the colors. The slider bar in conjunction with the **H**, **S**, and **B** options will change the color, if you select *red* with the **H** option selected, then when you switch to the **S** and **B** options, you will be changing the saturation and brightness of *red*. Another way to affect the colors is in the **H**, **S**, and **B** boxes you can directly enter a value for hue, saturation, and brightness. The following rules apply to the values you can enter for each box:

H Box: Hue is measured in a circle from zero (0) to 359 degrees.
 0 = red, 60 = yellow, 120 = green, 180 = cyan
 240 = blue, 300 = magenta

S Box: Saturation is the amount of black, measured from zero (0) to one hundred (100) percent.

B Box: Brightness is the amount of white, measured from zero (0) to one hundred (100) percent.

A finally way to set a color on the HSB worksheet, is from the color palette, click and drag the little white circle. This will automatically change the hue, saturation, and brightness values, along with the red, green and blue color values. The red, green, and blue values in the **R**, **G**, and **B** boxes are not editable, and informational only.

Click **OK**, the **Color Chooser** will close. Depending on where you accessed the **Color Chooser**, you will have to click either **Apply** or **OK** for the color change to appear in the display area.

F.3 RGB Worksheet

RGB is the Red, Green, and Blue color model, which allows you to set the red, green, and blue values of the colors you wish to produce. From the **Color Chooser**, select the **RGB** tab; the **RBB Worksheet** (Figure F.3) becomes available.

There are two ways to adjust the red, green, and blue value of colors. There is a slider bar for **Red**, **Green**, and **Blue**. As you change the slider bar for each one, in the **Preview** box, the color you are producing is shown. Another way to affect colors is in the **Red**, **Green**, and **Blue** boxes you can directly enter a value. Click **OK**, the **Color Chooser** will close. Depending on where you accessed the **Color Chooser**, you will have to click either **Apply** or **OK** for the color change to appear in the map window.

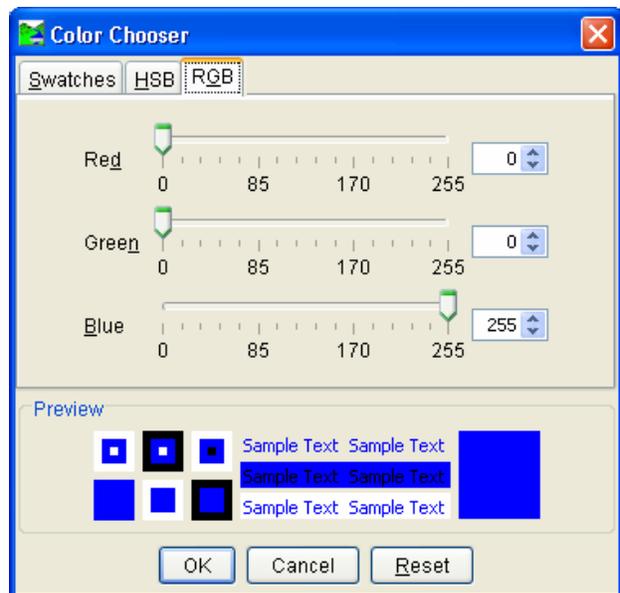


Figure F.3 Color Chooser – RGB Worksheet

Appendix G

Using HEC-DSSVue

HEC-DSSVue (Hydrologic Engineering Center Data Storage System Visual Utility Engine) is a graphical user interface program for viewing, editing, and manipulating data in HEC-DSS database files. With DSSVue, data may be plotted, tabulated, edited, and manipulated with over fifty mathematical functions. Along with these functions, DSSVue provides several utility functions, such as entering data sets into a database, renaming data set names, copying data sets to other DSS database files, and deleting data sets.

For HEC-WAT, you will use DSSVue mainly as a viewing tool for DSS data. This appendix will review some of the general functions in DSSVue. For further detail, see the HEC-DSSVue User's Manual.

G.1 HEC Data Storage System Concepts

HEC-DSS is a database system that was designed to efficiently store and retrieve scientific data that is typically sequential. Such data types include, but are not limited to, time series data, curve data, spatial-oriented gridded data, textual data (such as this manual), and others. The system was designed to make it easy for users and application programs to retrieve and store data.

The data are arranged into blocks. For example, one year of daily-interval data is stored in a single **record** in the DSS. Each record is given a unique name called a pathname. The pathname is formulated in a way that makes it easy to group related data together. Software from HEC has the ability to read from and write to DSS. This capability facilitates data exchange among applications. For example, you could use ResSim to generate the time series input for FIA.

G.2 Overview of HEC-DSSVue in the WAT

On the **Tools** menu, click **HecDssVue**, the **DSSVue** main window opens. The main window and the different components are illustrated in Figure G.1 (page G-2).

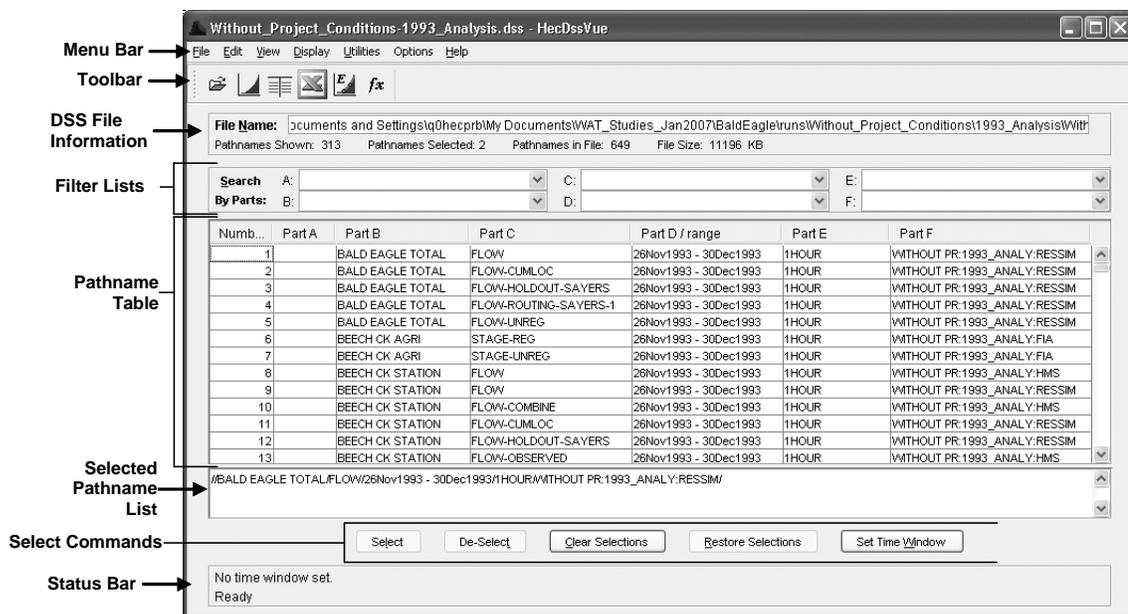


Figure G.1 DSSVue Main Window

The **Menu Bar** contains the menus for the main window of DSSVue. The following list is a description of the available menus.

- File** This menu is used for DSS file management and contains the following command: **New, Open, Release DSS File, Print Catalog Preview, Print Catalog, and Close.**
- Edit** This menu provides editing functions and contains the following commands: **Tabular Edit, Graphical Edit, Edit In MS Excel and Select All.**
- View** This menu provides options for viewing DSS pathnames. Available commands are: **Pathname List, Pathname Parts, Condensed Catalog, No Pathnames, Search pathnames by string, Search pathnames by parts, Refresh Catalog, and Time Window.**
- Display** After you have selected a pathname, this menu gives you the ability to display the data for that pathname. Available commands are: **Plot, Plot Data Options, Tabulate, Tabulate with MS Excel, and Supplemental Information.**
- Utilities** This menu provides options for manipulating data stored in the pathnames, entering data, renaming, copying, and duplicating records, merging of DSS files, performing maintenance on a DSS file, and viewing the status of a DSS file. Available commands are: **Math Functions,**

Compare, Manual Data Entry, Import, Export, Copy Records, Rename Records, Duplicate Records, Delete Record, Undelete, Merge Files, Squeeze, Script Editor, and Script Selector.

- Options** This menu provides options for manipulating the DSS catalog, merging of DSS files, viewing the status of a DSS file, and viewing the output log. Available commands are: **Condensed Disk Catalog, Abbreviated Disk Catalog, Full Disk Catalog, Status, View Output Log, and Program Options.**
- Help** Displays current version information about DSSVue.

The **Toolbar** (see Figure G.1, page G-2) contains buttons that provide you with the capability to open a DSS file, plot the data, and tabulate the data. These buttons provide a shortcut to the respective commands in the **Display** menu.



Open File Button – opens an **Open File Browser**, which allows you to select a DSS file.



Plot Button – plots the data of the selected pathname(s).



Tabulate Button – displays the data of the selected pathname(s) in a tabular form.

The **DSS File Information** (see Figure G.1, page G-2) box displays the filename of the DSS file, and statistics about the pathnames in the DSS file and the size of the DSS file.

The **Filter Lists** (see Figure G.1, page G-2) are used to sort DSS pathnames by parts. There is a filter list for each individual part, A through F. The **Pathname Table** displays the filtered pathnames contained in the DSS file. The pathnames are displayed by the individual parts. The **Selected Pathname List** displays the pathnames that you have selected from the **Pathname Table**.

The **Select Commands** (see Figure G.1, page G-2) are available after you have selected the pathnames you wish to view or manipulate. Available commands are **Select, De-Select, Clear Selections, Restore Selections, and Set Time Window**. These commands will be detailed later in this appendix.

When you have entered time window information, the **Status Bar** (see Figure G.1, page G-2) will display the time window information. A time

window is where you give a specific time frame for viewing or manipulating data.

G.3 Opening a DSS File

There are several ways to open a DSS file from DSSVue. One way is to type in the location and filename of the DSS file in the **File Name** box of the **DSSVue** main window (see Figure G.1, page G-2). After you have entered the correct information, press **ENTER**, the **Pathname Table** will display the pathnames of the selected DSS file, and the **DSS File Information** (see Figure G.1, page G-2) box will display statistics about the DSS file.

Another way to open a DSS file is from the **File** menu, choose **Open**; or, click the **Open File** button from the **Toolbar**. Either method opens an

Open HEC-DSS File (Figure G.2) browser. The browser defaults to the WAT working directory, which is viewable in the **Folder** box of the browser. If you are in the **Simulation Module** and you have opened a simulation, the browser will default to the simulation directory.

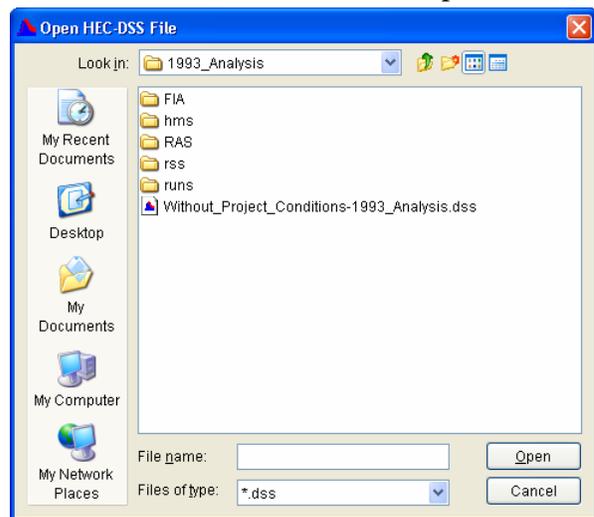


Figure G.2 Open HEC-DSS File Browser

Locate the DSS file you wish to open, click **OK**.

The **Open HEC-DSS File**

browser will close, and the DSSVue main window will display the name of the DSS file and all of the pathnames associated with that DSS file will appear in the **Pathname Table** (see Figure G.1, page G-2).

G.4 Set Time Window

To view the data for a certain block of time, you can set a time window:

1. On the **View** menu, click **Time Window**, the **Set Time Window** dialog box (see Figure G.3, page G-5) will open.
2. To enter a start date and time, click **Specific Time Window**. In the **Start Date** box type a date in the format **ddmmmyyyy** (i.e., **26Nov1993**), and in the **Start Time** box type a time in the format **hhmm** (i.e., **0630**).

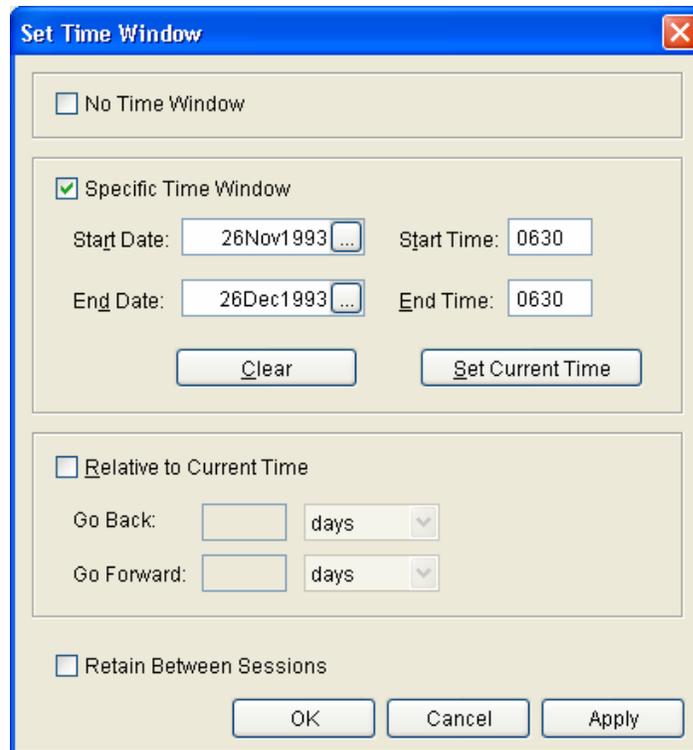


Figure G.3 Set Time Window Dialog Box

3. To enter an ending date and time, in the **End Date** box type a date in the format ddmmmyyyy (i.e., *26Dec1993*), and in the **End Time** box type a time in the format hhmm (i.e., *0630*).
4. To clear the time window boxes, click **Clear**.
5. If you want to use the current date and time, click **Set Current Time**. All time window boxes will be filled, you will probably need to edit the ending data and time.
6. Click **OK**, the **Set Time Window** dialog box will close, the time window will be set, and the time window will be displayed in the **Status Bar** of the **DSSVue** main window (see Figure G.1, page G-2).

G.5 DSS Pathnames

Data is stored in blocks, or records, within a file, and each record is identified by a unique name called a **pathname**. Each time that data is stored or retrieved from the file, its pathname must be given. The pathname is the key to the data's location in the database. A pathname is analyzed by DSS to determine an index number. This index determines where the data set is stored within the database. The design ensures that very few disk accesses are made to retrieve or store data sets. One data set is not directly related to another, so there is no need to update other areas of the database when a new data set is stored.

DSS references records (data sets) by a pathname. The pathname of a DSS record can be three hundred and ninety-one (391) characters or less, and is, by convention, separated into **six parts**. The parts can be sixty-four (64) characters or less and are delimited by slashes in the pathname. The pathname parts are designated **A** through **F**. Table G.1 provides an example naming convention for regular-interval time series:

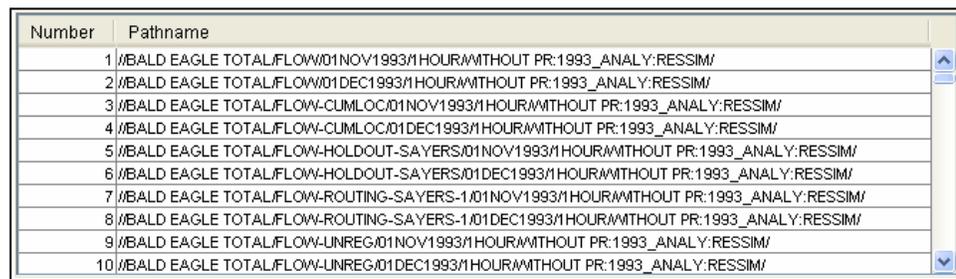
Table G.1
DSS Pathname Parts

A	project, river, or basin name
B	location identifier
C	data parameter (e.g., FLOW, PRECIP)
D	starting block data; format ddmmyyyy
E	time interval
F	additional user-defined descriptive information

G.5.1 Viewing of DSS Pathnames

The display of pathnames in the **Pathname Table** shows all of the pathnames by the different parts (see Figure G.1, page G-2). You can change this display from the **View** menu; available commands are **Pathname List**, **Pathname Parts**, **Condensed Catalog**, and **No Pathnames**.

The **Pathname List** command (Figure G.4) displays the pathnames in the **Pathname Table**, while **No Pathnames** displays nothing. The **Pathname Parts** command is the same as the **Condensed Catalog** command, except for the D part. On the **Condensed Catalog**, the D part displays the date span for each pathname.



Number	Pathname
1	/BALD EAGLE TOTAL/FLOW/01NOV1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
2	/BALD EAGLE TOTAL/FLOW/01DEC1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
3	/BALD EAGLE TOTAL/FLOW-CUMLOC/01NOV1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
4	/BALD EAGLE TOTAL/FLOW-CUMLOC/01DEC1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
5	/BALD EAGLE TOTAL/FLOW-HOLDOUT-SAYERS/01NOV1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
6	/BALD EAGLE TOTAL/FLOW-HOLDOUT-SAYERS/01DEC1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
7	/BALD EAGLE TOTAL/FLOW-ROUTING-SAYERS-1/01NOV1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
8	/BALD EAGLE TOTAL/FLOW-ROUTING-SAYERS-1/01DEC1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
9	/BALD EAGLE TOTAL/FLOW-UNREG/01NOV1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/
10	/BALD EAGLE TOTAL/FLOW-UNREG/01DEC1993/1HOUR/WTHOUT PR:1993_ANALY:RESSIM/

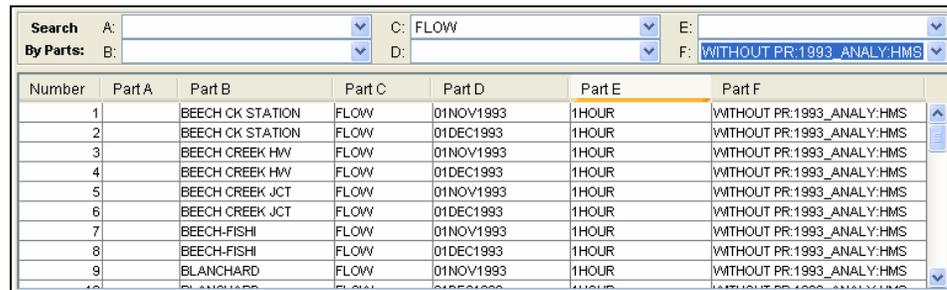
Figure G.4 Pathname List Display

G.5.2 Sorting DSS Pathnames by Parts

Another way to affect the display of the pathnames is through sorting by pathname parts. Sorting the DSS pathnames by parts is the command **Search pathnames by part** (default). However, another way to sort the

pathnames is available from the **View** menu, choose **Search pathnames by string**. The details for this method are described in the HEC-DSSVue User's Manual.

To sort by pathname parts, from the **Filter Lists** (Figure G.5) decide which pathname parts will be used to sort the pathname list. There is a **Filter List** for each individual pathname part. An example is shown in



Number	Part A	Part B	Part C	Part D	Part E	Part F
1		BEECH CK STATION	FLOW	01NOV1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
2		BEECH CK STATION	FLOW	01DEC1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
3		BEECH CREEK HW	FLOW	01NOV1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
4		BEECH CREEK HW	FLOW	01DEC1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
5		BEECH CREEK JCT	FLOW	01NOV1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
6		BEECH CREEK JCT	FLOW	01DEC1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
7		BEECH-FISHI	FLOW	01NOV1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
8		BEECH-FISHI	FLOW	01DEC1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
9		BLANCHARD	FLOW	01NOV1993	1HOUR	WITHOUT PR:1993_ANALY:HMS
10		BLANCHARD	FLOW	01DEC1993	1HOUR	WITHOUT PR:1993_ANALY:HMS

Figure G.5 Sorting Pathnames

Figure G.5 where filters are used to see all of the FLOW records that are observed data. From the **Filter C** list, select *FLOW*, and from the **Filter F** list, select *OBS*. The **Pathname Table** will now display only the pathnames that fit the criteria you stated in the **Filter Lists**.

G.5.3 Selecting Pathnames

Once you have the appropriate list of pathnames in the **Pathname Table**, you can select which pathnames you want to view or manipulate. To select a pathname, double-click on a pathname in the **Pathname Table** and the selected pathname will appear in the **Selected Pathname List** (see Figure G.1, page G-2). You can also click on a pathname in the **Pathname Table**, and then click **Select**.

To select multiple pathnames, in the **Pathname Table**, click on a pathname the pathname will be highlighted. Find the next pathname you would want to include in a group, hold down the **SHIFT** key and click. The block of pathnames will be highlighted, click **Select**, and all the pathnames within that block will be added to the **Selected Pathname List**.

Another way to select multiple pathnames is from the **Pathname Table**, click and drag across the pathnames you want, release the mouse button and the block of pathnames will be highlighted. Click **Select**, and all of the pathnames within that block will be added to the **Selected Pathname List**.

You can select individual pathnames to be in a group for selection. From the **Pathname Table**, select a pathname which will be highlighted, to select another not in a contiguous group, hold down the **CTRL** key and

select the next pathname which will be highlighted. Continue to do this until you have selected all of the pathnames you want, release the **CTRL** key and click **Select**. All the pathnames you have selected will be added to the **Selected Pathname List**.

You can select all of the pathnames displayed in the **Pathname Table**. From the **Edit** menu, choose **Select All**. All of the pathnames will now appear in the **Selected Pathname List**.

G.5.4 Clearing Selected Pathnames

To clear a pathname from the **Selected Pathname List** (see Figure G.1, page G-2), select a pathname and click **De-Select**. The pathname will be cleared from the **Selected Pathname List**. To clear all pathnames from the **Selected Pathname List**, click **Clear Selections**, and the **Selected Pathname Box** will be empty.

You can also clear groups of pathnames by using the same concepts described in selecting pathnames (see Section G.5.3, page G-7) by using the **SHIFT** and **CTRL** keys. Once pathnames have been cleared from the **Selected Pathname Box**, the pathnames can be restored to the **Selected Pathname Box** by clicking **Restore Selections**.

G.6 Visualizing Data

After you have selected a pathname or multiple pathnames, you can visualize the data associated with the pathname. You can do this through a graphical means – plots, or through a tabular form – tabulate. Further details on plots and tables are discussed in the HEC-DSSVue User's Manual.

G.6.1 Plots

To view a plot of the pathnames in the **Selected Pathname List** (see Figure G.1, page G-2), you can either click the **Plot** button from the **Toolbar**, or from the **View** menu, choose **Plot**. Either way will open the **Plot Window** (see Figure G.6, page G-9).

The parameters for the plots are labeled and color-coded, date ranges are specified along one axis, and the units of measure are specified along the other axis. You can resize the **Plot Window** by grabbing the corner of the window and dragging it to the desired size.

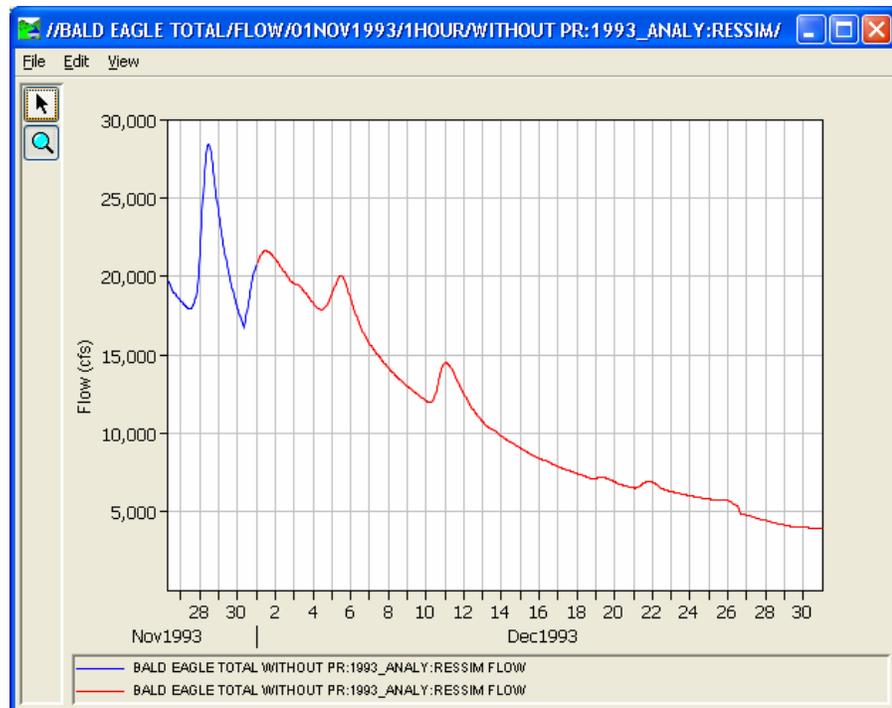


Figure G.6 Plot Window

You can also zoom in on areas of the plot. Click the **Zoom Tool**,  find the area on the plot you wish to zoom in on, click and drag over the area. The plot will refresh, the area within the zoom rectangle will fill the plot window. To zoom out, with the **Zoom Tool** selected, right-click anywhere on the plot area.

G.6.2 Tables

To view a table of the pathnames in the **Selected Pathname List** (see Figure G.1, page G-2), you will either click the **Tabulate** button from the **Toolbar**, or from the **View** menu, choose **Tabulate**. Either way will open the **Tabulate Window** (see Figure G.7, page G-10).

The **Tabulate Window** displays the ordinate (starting from the start date/time), the date and time stamp, and the values for the selected data sets. From the **Tabulate Window**, you have several options for displaying the tabular data (e.g., displaying commas in the number formatting, setting the precision of decimal places for your data).

G.7 DSS Records

HEC-DSS uses a block of sequential data as the basic unit of storage. Each block contains a series of values of a single variable over a time span appropriate for most applications. The basic concept underlying DSS is

Ordinate	Date / Time	BALD EAGLE TOTAL FLOW WITHOUT PR:1993_ANALY:RESSIM	
96	30 Nov 93 05:00	17,187	
97	30 Nov 93 06:00	17,042	
98	30 Nov 93 07:00	16,900	
99	30 Nov 93 08:00	16,783	
100	30 Nov 93 09:00	16,809	
101	30 Nov 93 10:00	17,100	
102	30 Nov 93 11:00	17,458	
103	30 Nov 93 12:00	17,798	
104	30 Nov 93 13:00	18,108	
105	30 Nov 93 14:00	18,394	
106	30 Nov 93 15:00	18,680	
107	30 Nov 93 16:00	18,977	
108	30 Nov 93 17:00	19,271	
109	30 Nov 93 18:00	19,550	
110	30 Nov 93 19:00	19,806	
111	30 Nov 93 20:00	20,037	
112	30 Nov 93 21:00	20,242	
113	30 Nov 93 22:00	20,424	
114	30 Nov 93 23:00	20,583	
115	30 Nov 93 24:00	20,721	
116	01 Dec 93 01:00		20,840
117	01 Dec 93 02:00		20,943
118	01 Dec 93 03:00		21,040
119	01 Dec 93 04:00		21,153
120	01 Dec 93 05:00		21,268
121	01 Dec 93 06:00		21,372
122	01 Dec 93 07:00		21,457
123	01 Dec 93 08:00		21,523
124	01 Dec 93 09:00		21,570

Figure G.7 Tabulate Window

the organization of data into records of continuous, applications-related elements, as opposed to individually addressable data items. This approach is more efficient for scientific applications than that of a conventional database system because it avoids the processing and storage overhead required for assembling an equivalent record from a conventional system. Data is stored in blocks, or records, within a file, and each record is identified by a pathname.

G.7.1 Renaming Records

To change the pathname parts of a pathname:

1. You must have selected one or more pathnames (see Section G.5.3, page G-7) for this command to be available.
2. On the **Utilities** menu, click **Rename Records**. The **Rename Records to:** dialog box (Figure G.8) will open.

Rename Records to:

Enter new pathname parts:

A: B: BALD EAGLE TOTAL C: FLOW

D: E: 1HOOR F: WITHOUT PR:1993_ANALY:RESSIM

OK Cancel

Figure G.8 Rename Records to: Dialog Box

3. Each of the boxes (**A - F**) represents the different pathname parts. You cannot rename the **D** and **E** parts. For parts **A**, **B**, **C**, and **F** you can change the parts by typing the new information in the appropriate box.
4. Click **OK**, the **Rename Records to:** dialog box will close, a message will appear informing you of the number of records renamed. The selected pathname will no longer be displayed in the **Selected Pathname Box** (see Figure G.1, page G-2) and the pathname will display in the **Pathname Table** (see Figure G.1, page G-2) with the new pathname parts.

G.7.2 Duplicating Records

Duplicating a record allows you to make a copy of a record, but with a pathname part that has been changed. To duplicate records:

1. You must have selected one or more pathnames (see Section G.5.3, page G-7) for this command to be available.
2. On the **Utilities** menu, click **Duplicate Records**. The **New pathname parts for duplicate records:** dialog box (similar to Figure G.8, page G-10) will open.
3. Each of the boxes (**A - F**) represents the different pathname parts. You cannot rename the **D** and **E** parts. For parts **A**, **B**, **C**, and **F** you can change the parts by typing the new information in the appropriate box.
4. Click **OK**, the **New pathname parts for duplicate records:** dialog box will close, a message will appear informing you of the number of records that were duplicated. A new pathname will be displayed in the **Pathname Table** (see Figure G.1, page G-2).

G.7.3 Deleting Records

To delete records:

1. You must have selected one or more pathnames (see Section G.5.3, page G-7) for this command to be available.
2. On the **Utilities** menu, click **Delete Records**, a warning message dialog box appears asking you if you really want to delete the listed pathnames. These should be the same pathnames displayed in the **Selected Pathname List** (see Figure G.1, page G-2).
3. Click **Yes**, the warning message dialog box will close. A message will appear informing you of the number of records deleted.
4. The deleted records no longer appear in the **Pathname Table** (see Figure G.1, page G-2).

G.7.4 Editing Data Associated with Records

You can edit the data associated with a pathname, if you have the appropriate permissions, on the **Edit** menu, click **Tabular Edit**, **Graphical Edit**, or, **Edit in MS Excel**. You can edit data directly, enter new time-series data or paired data, or use math functions to manipulate the data. All of these features are detailed in the HEC-DSSVue User's Manual.

Appendix H

Glossary

This glossary is a collection of definitions from throughout this user's manual, plus definitions of other pertinent terms.

Acre: A unit of area in English units used in calculation of agricultural crop damage.

Activity: Linked with features and may involve changes to operations or institutional actions.

Alternative: A system of structural and/or nonstructural measures, strategies, or programs formulated to alleviate problems or take advantage of specific opportunities associated with water and related land resources in the planning area. An alternative in the WAT is a way to group a schematic with different operations and model parameters. The WAT creates a base alternative (*Without Project Conditions*) by default.

Analysis Period: Defines the time window and events that could be associated with an alternative. Analysis periods are for determining damage and project performance information for specific time periods, such as the base year or the most likely future year. The analysis year results for a plan are also used to perform equivalent annual damage computations. The analysis years are used for all study evaluations. An analysis year represents a static time period or year that the H&H and economic data represent. Base year is the first year of the plan operation. The "most likely future year" condition is a development projection for a specific future year; say twenty years out from the base year. It usually is based on the projections of local future development plans.

Arc Shapefile: This layer type is the native data structure for the ArcView® GIS program. Shapefiles store non-topological geometry and attribute information for the spatial features of a data set. Usually there are three files: *.dbf, *.shp, and *.shx. The *shp* file contains the

shapes (point, polylines, or polygons) that are displayed in the layer. Each shape has a record in the dbf file containing descriptive data called “attributes.” The .shx file contains an index that links each shape to its record in the .dbf file.

ArcInfo® DEM: This is an ASCII file format representation of a grid generated by ArcInfo®. The file consists of keywords followed by values defining the number of columns, number of rows, lower left corner, cell size, no data value, and each cell value.

ASCII NetTin: This is an ASCII file format used to represent a triangulated irregular network (TIN). The TIN data are stored in a simple format that defines the nodes, edges, and triangles contain in the TIN. This format is common for transferring TIN data between software.

AutoCAD® DXF: A Drawing Interchange File (dxf) is created by a Computer-Aided Design (CAD) package, AutoCAD®. This format is a tagged data representation of an AutoCad® drawing file. **Tagged data** is where each data element is preceded by a group code. A **group code** is an integer indicating the type of data element. The file created is a vector-based graphic. The DXF format is commonly used for data export from other CAD and GIS programs.

CAP: Continuing Authorities Program; is a group of legislative authorities that give the Corps of Engineers the authority to plan, design, and construct certain types of water resource and ecosystem restoration projects without additional and specific congressional authorization. The following are the most commonly used CAP authorities: Small Flood control Projects (authorized by Section 205 of the 1948 Flood control Act); Emergency Streambank Protection Projects (authorized by Section 14 of the 1946 Flood control Act), Aquatic Ecosystem Restoration (authorized by Section 206 of the 1996 Water Resources Development Act); and, Project Modifications of the Improvement of the Environment (authorized by Section 1135 of the 1986 Water Resources Development Act).

Channel Modification: Physical alternation of the channel through re-sizing, re-configuration, or re-vegetation, etc.

Channel Modification Tool: Tool to create, delete, rename, and edit channel modifications. A channel modification has to be created on the stream alignment.

Common Computation Point: Locations where one model transfers data to another model, a location where results are needed for model development or alternative analysis, or locations where input boundary conditions are to be defined.

Common Computation Point Tool: Tool to create, delete, rename, and edit common computation points. See Chapter 7 (Section 7.14.2, page 7-40) for more detail on creating, deleting, renaming, and editing computation points.

Compute: Capability within the WAT that allows the user to perform the calculations made available through the WAT. These calculations could be for one or more of the models in an order chosen by the Project Delivery Team (PDT).

Also, a menu where you can compute individual simulations; compute multiple simulations; compute by individual program; and, view the compute log for the active simulation.

Content Pane: Area of the WAT framework that provides details on the selected WAT component in the **Study Pane**.

Desktop Pane: Area of the WAT framework where the different Map Windows available from the WAT will display.

Diversion: Removal and redirection of water from its normal course for various reasons, water supply, flood control, or environmental, etc.

Diversion Tool: Tool to create, delete, rename, and edit diversions. A diversion has to be started on the stream alignment.

DXF: See *AutoCAD® DXF*.

Easting: The X-coordinate of a location in the user-selected World Coordinate System (WCS).

Ecosystem Restoration Measure: Physical modifications or other actions that improve the value and function of an ecosystem (e.g., channel improvements, removal of drainage structures or levees).

- Edit:** A menu where the program order can be set; manipulate alternatives and simulations; link individual model alternatives; and, access the individual program editors.
- Event:** A rainfall and/or flow episode. Normally the event is the time period over which the model will retrieve data and produce results. An occurrence of precipitation/snowmelt that leads to some sort of hydrologic response normally associated with a specific time period. The event can be historical or represent the upper limit of a precipitation runoff response.
- File:** A menu used for study management, printing the active map, and, importing and exporting model alternatives.
- FIA:** Flood Impact Analysis, see *HEC-FIA*.
- Feature:** A physical element that generally requires site construction.
- Flood Damage Reduction Measure :** Can be a physical modification (**structural measures**) designed to reduce the frequency of damaging levels of flood inundation (i.e., reservoirs, levees, channelization measures, walls, etc.); or, it can be an activity (**non-structural measure**) that reduces flood damage without significantly altering the nature or extent of flooding (e.g., flood proofing, relocation of structures, raising structures).
- Floodwall:** A levee/floodwall is man made barrier built along a stream to provide protection from flooding. A levee/floodwall can reduce flood damage by preventing flood stages from reaching a potential damage area.
- GIS:** Geographic Information System
- Group Code:** In a DXF file an integer indicating the type of data element, see *AutoCAD® DXF*.
- GUI:** Graphical User Interface, designed to make the program easy and efficient to enter data, review output, and make comparisons.
- Hectare:** A unit of area in SI units used in calculation of agricultural crop damage.
- HEC-DSS:** The HEC database management system, HEC Data Storage System, stores data in a convenient manner for inventory, retrieval, and archiving for water resource applications.

- HEC-DSSVue:** The HEC software package, HEC Data Storage System Visual Utility Engine, which provides a graphical user interface for viewing, editing, and manipulating data in HEC-DSS files.
- HEC-FIA:** The HEC software package, HEC Flood Impact Analysis. This software package provides the capability to estimate the impacts and damage associated with flood events and the benefits attributed to flood control projects.
- HEC-HMS:** The HEC software package, HEC Hydrologic Modeling System. This software package is designed to simulate the precipitation-runoff processes of dendritic watershed systems and provides the capability to simulate the hydrologic response in a watershed.
- HEC-RAS:** The HEC software package, HEC River Analysis System. This software package is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels, that allow the user the capability to perform one-dimensional steady and unsteady flow river hydraulics calculations, sediment transport-mobile bed modeling, and water temperature analysis.
- HEC-ResSim:** The HEC software package, HEC Reservoir System Simulation. This software package provides the capability to simulate the operation of a reservoir or reservoir system for an observed, synthetic or predicted flow event using a defined operation scheme.
- HEC-SSP:** The HEC software package, HEC Statistical Software Package. This software package allows the user to perform statistical analyses of hydrologic data.
- HEC-WAT:** The HEC software package, HEC Watershed Analysis Tools. This software package will provide an interface that will streamline the analytical process using the tools commonly applied by multi-disciplinary teams at Corps offices.
- Help:** A menu that provides access to WAT help and displays current information about the WAT.
- Impact Area:** Is any distinct portion of a study area that is affected by rising or falling stage in a stream, river, lake, or reservoir. The boundaries of an impact area are defined by a closed polygon, and you characterize the effects of rising or

falling stage by describing the property and population at risk in the area bounded by the polygon.

Impact Area Tool: Tool is used to create, edit, delete, and rename, impact areas. See Chapter 7 (Section 7.15, page 7-42) for more detail on creating, deleting, renaming, and editing impact areas.

JRE: Java Runtime Environment (JRE)

Layer: Layers are maps that can be placed as background images behind the workspace. They are optional but do provide significant information. Layers can be many types (*.dlg, *.shp (ARC/INFO® or Arc Shapefile), *.dxf (AutoCAD®), *.dem).

Levee : A levee/floodwall is a man made barrier built along a stream to provide protection from flooding. A levee/floodwall can reduce flood damage by preventing flood stages from reaching a potential damage area.

Levee Tool: Tool to create, delete, rename, and edit levees. See Chapter 7 (Section 7.13.2, page 7-32) for more details on creating, deleting, renaming, and editing levees.

Map Windows: A way to graphically display the major components of a WAT study (stream alignments, schematics, alternatives, simulations). From these map windows you can create, edit, delete, open model editors, or view results.

Maps: A menu where you can setup map layers and map windows. You can set spatial properties; zoom the active map window out to its full extents, add map layers, remove map layers, open a new map window, adjust the active map windows properties, save the contents of the active map window as a graphic file, import a stream alignment from an ArcView® shapefile, import impact areas from an ArcView® shapefile, export a stream alignment to an ArcView® shapefile, and, export impact areas to an ArcView® shapefile.

Measure: Measures for the WAT include structural/non-structural measures (**flood damage reduction**), and/or ecosystem measures. **Structural measures** are physical modifications designed to reduce the frequency of damaging levels of flood inundation, and include dams with reservoirs, levees, channelization measures, walls, diversion channels, pumps, bridge modifications, and ice-control structures. **Non-structural measures** are activities that reduce flood damage without significantly altering the nature or extent of flooding

(e.g., flood proofing, relocation of structures, raising structures). **Ecosystem restoration measures** are physical modifications or other actions that improve the value and function of an ecosystem (e.g., channel improvements, removal of drainage structures or levees).

Message Pane: Area of the WAT framework that contains messages that the WAT program is providing for informational purposes. The information in the **Message Pane** is a record for the WAT program activity, recording the opening of the study, opening map windows, accessing DSS, and many other WAT activities.

NED: National Economic Development; usually referring to the NED plan which is the plan the Corps is required to compute and report. It is the plan that provides the greatest economic benefits. If a plan is recommended, most likely it is the NED plan.

NexGen: Next Generation Software Development Project

Northing: The Y-coordinate of a location in the user-selected World Coordinate System (WCS).

Panes: Viewing areas of the WAT main window that allow you to view WAT study data.

Pan Tool: Tool to move the display area while you are zoomed in.

PDT: Project Delivery Team

Plan: A set of one or more flood damage reduction or ecosystem restoration measures or actions designed to operate over a period of time (project life). The plan is inclusive of the entire study area although it may have a flood damage reduction measure for a single damage reach.

Plug-In: Provides the ability to access model parameters and view results of a model from the WAT

PM: Project Manager

Pointer/Selector Tool: Allows the user to select components for editing and viewing (plots) data or results.

Project: A man-made structure for the purpose of reducing flood damage or for ecosystem restoration.

R&U: Risk and Uncertainty

- Raster Image:** Generally defined as a rectangular array of sampled values (pixels). Each pixel has one or more number associated with it, generally specifying a color the pixel should be display in. The raster image formats supported by the WAT are JPEG format (*.jpg) and Graphics Interchange Format (*.gif). For The WAT to access these file types an *.img (ASCII text) file must be created by the user outside of the WAT. The file needs to contain the following lines, which need to match the easting and northing parameters stated in the **Map Default Properties for StudyName** dialog box (see Chapter 5, Section 5.2.5, page 5-6).
- Rating Curve:** A graphical relationship that yields the stage for a given discharge at a specific location on a stream or river.
- Reservoir:** The impoundment created behind dams, or behind navigation locks and dams. For the WAT a reservoir also includes the dam built on a stream to store water for uses such as navigation, tribal resources, flood damage reduction, fish and wildlife habitat considerations, hydroelectric power generation, recreation use, water quality, water supply, erosion and sedimentation control, and sustaining hydrologic function on lakes and rivers. The releases from a reservoir can reduce flood damage by reducing flood stages.
- Reservoir Tool:** Tool to create, delete, rename, and edit reservoirs. See Chapter 7 (Section 7.13.1, page 7-27) for more detail on creating, deleting, renaming, and editing reservoirs.
- Results:** A menu from which you can select simulations for comparison; and, view results from the individual WAT programs.
- Risk:** The probability an area will be flooded, resulting in undesirable consequences.
- Risk Analysis:** An approach to evaluation and decision making that explicitly, and to the extent practical, analytically, incorporates considerations of risk and uncertainty in a flood damage reduction study.
- Run:** Capability within the WAT that allows the PDT to select the models they want to execute for a given event or events.
- Schematic:** In the WAT, a physical representation of the study and it includes: common computation points, impact areas, stream

alignment, and flood damage reduction and environmental measures that will be modeled.

Simulation: A combination of an analysis period and event(s) associated with an alternative.

Stage: The vertical distance in feet (meters) above or below a local or national datum (N.G.V.D. for elevations).

Stage Hydrograph: A graphical relationship of stage as a function of time for a certain location.

Status Bar: Displays the coordinates of the pointer on a map window. Outside of a map window it reflects the status of the program.

Stream Alignment: Represents the stream system in the watershed. The alignment indicates where confluences and bifurcations occur and provides a sense of distance and scale. In the WAT, stream alignments are composed of a series of stream elements.

Stream Alignment Properties: Properties of a stream alignment that include: line width, color of line, font style, etc.

Stream Alignment Tool: Tool is used to create, delete, and edit the stream elements that make up the stream alignments. See Chapter 7 (Section 7.12, page 7-11) for more detail on creating, deleting, renaming, and editing a stream alignment.

Stream Element: Segment of the stream alignment that is composed of vertex points, with the beginning and ending vertex points being stream nodes. Typically begins or ends at a confluence, bifurcation, or at the boundary of the river system.

Streamgage Records: Records of the stream elevation or stage taken at a streamgage location.

Stream Node: The beginning and ending point for each stream element. Stream nodes are also created where stream elements meet. Also, a stream node can be used to establish stationing for a stream element.

Stream Node Tool: Tool is used to create, delete, and edit stream nodes on the stream alignment. See Chapter 7 (Section

7.12.7, page 7-19) for more detail on creating, deleting, renaming, and editing a stream alignment.

Stream Stationing: Watershed adopted stations along a stream normally denoted as miles (kilometers) above the mouth of a stream.

Study: The basic component of the WAT. The WAT study defines the watershed or geographic area to be evaluated. The study includes alternative analyses which is the investigation of with and without-project conditions involving hydrology, hydraulics, economics, plan formulation and evaluation. In the WAT it also includes all of the necessary information to complete an analysis of a specific geographical area.

Study Pane: Area of the WAT framework that provides an overview of WAT alternatives, simulations, and analysis periods that have been defined for a study.

System Units: This value is used as a label for data entry forms and output reports. Choices are *English* or *Metric*, with the default being *English*.

Tabs: Provides different views of the available data in a WAT study. The user can perform certain operations for a study from the tabs.

Toolbar: Provides quick access to the most frequently used options from the WAT menu bar.

Tools: A menu that provides access to DSS data (HEC-DSSVue); provides access to the Statistical Software Package (HEC-SSP); allows creating and editing of scripts; allows you to view general information about the study; provides options for the WAT startup and system properties; customize menus and toolbars; view WAT program activity; and, monitor memory usage..

Top of Levee: Stage at the top of the levee, floodwall or tidal barrier.

Uncertainty: A measure of imprecision of knowledge of parameters and functions used to describe the hydraulic, hydrologic, geotechnical, and economic aspects of a project plan.

USGS DEM: The USGS Geological Survey publishes the file format USGS DEM (Digital Elevation Map). A raster file format, DEM files usually contain terrain elevations, but the file format can be used for representing any surface. The format, published by the USGS, allows internal documentation of coordinate system, date of publication,

etc. These values are referenced horizontally either to a Universal Transverse Mecator (UTM) projection or to a geographic coordinate system.

USGS Digital Line Graph: USGS Digital Line Graphs (DLG) are created from two sources using manual and automated digitizing methods. The two sources are aerial photographs or cartographic sources. DLG files are vector representations of the data. When the WAT interacts with a *dlg* file it automatically creates a *dlgbin* file for use.

Vertex Point: A point with known coordinates on a stream element in the stream alignment.

View: A menu that allows you to setup the WAT main window; you can select toolbars and panes; set display unit for plotting and tabulating; and manage layouts for the WAT main window.

WAT: Watershed Analysis Tool, *see HEC-WAT*.

Watershed: The total area of land that drains to a common stream system.

Window: A menu where you can control the appearance of the map windows in the **Desktop Pane** of the WAT main window.

With Project Conditions: The economic, performance, and other conditions associated with implementing a flood damage reduction plan. It is compared to the without-project condition. It includes the base-year and static future analysis year periods to determine the equivalent values.

Without Project Conditions: Base alternative in the WAT for evaluating the benefits and performance of potential flood damage reduction plans and represents the conditions of the study if no actions are taken. The without project conditions includes the base year conditions and the most likely future year conditions.

World Coordinate System: To maintain a geographic reference (also called a geo-reference), the WAT uses a user-selected and customizable coordinate system, called the World Coordinate System (WCS). This superimposes a grid on layer features to establish x- and y-coordinates in WCS for each point on the layer. The x-coordinate is referred to as "easting" and the y-coordinate is referred to as "northing". Possible choices for the WCS include but are not limited to

State Plane Coordinates and Universal Transverse Mercator (UTM) coordinates.

Zoom Tool: Tool that allows zooming in and out of map windows. See Chapter 7 (Section 7.3, page 7-3) for more detail on how this tool works in the WAT.

APPENDIX I

Editing Model Data

I.1 Overview

The HEC-WAT provides an interface that streamlines and integrates a study using software commonly used within the corps. This software is directly accessible from within the WAT, which allows the user to edit individual model data directly from the individual software pieces. This flexibility is accomplished through the use of a "plug-in" (see Appendix B) that is built for each piece of software. The plug-in allows the WAT and the individual software to communicate without any specific code being needed by the WAT or the individual software.

From the WAT you have several options on editing model data. You can execute the software that edits the model data by clicking the appropriate software button from the **Programs Toolbar** (see Chapter 3, Section 3.2.1, page 3-4) of the WAT main window. Also from the WAT main window, from the **Study Tab**, on the **Study Pane** (see Chapter 3, Section 3.2.2, page 3-5), right-click on a simulation, from the shortcut menu, point to **Edit Model**, and then click on the model alternative you want to edit, the software associated with that model alternative will open.

This appendix will focus on accessing specific editors from the available software, from within the WAT. These editors can be accessed interactively from the schematic (Section I.2) or from the WAT main window (see Section I.3, page I-10)

I.2 Schematic

From the active simulation map window you can access model specific editors from the model elements that are available on the map window. If you hover over a model element, the tooltip that appears (see Figure I.1, page I-2) will list what model information is available for that particular model element. For example, in Figure 11.1 (page I-2, at the junction there is possible information from ResSim, there must be a cross section in the area, and a reach element that is recognized by ResSim, HMS, and RAS.



Figure I.1 ToolTip Information from Schematic (Simulation Map Window)

To access model specific editors, right-click on a model element, you will get a shortcut menu (Figure I.2) that will provide access to the model editors. The WAT searches for all available model elements in the area

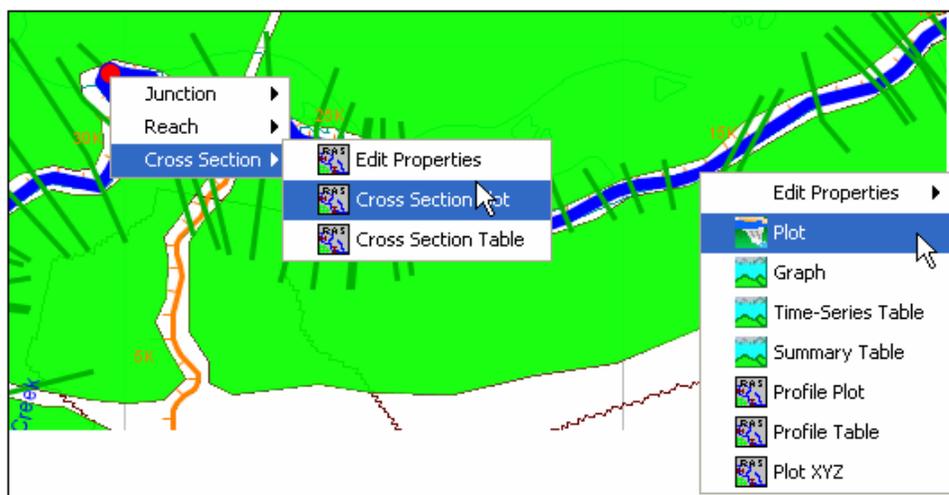


Figure I.2 Model Element Shortcut Menus

that you have right-clicked on, so the shortcut menu will usually display all the model elements that were found in the area. For example, in Figure I.2, right-clicking at a cross section, the WAT has found three model elements in the area of that cross section. To access the editor specific for the cross section, from the shortcut menu, point to **Cross Section**, click **Edit Properties**, the **Cross Section Data Editor** from RAS will open.

The following sections will cover the available model editors in the Beta version of the WAT.

I.2.1 HMS

Whether you are right-clicking on a subbasin element, junction element, reach element, or sink element, from the schematic there are various HMS model editors you can access. The following section describes those editors.

Subbasin Element

To edit HMS model data at a subbasin:

1. From the simulation map window, right-click on an HMS subbasin model element on the schematic, a shortcut menu will appear (Figure I.3). From the shortcut menu, point to **Subbasin**, click **Edit Properties**.

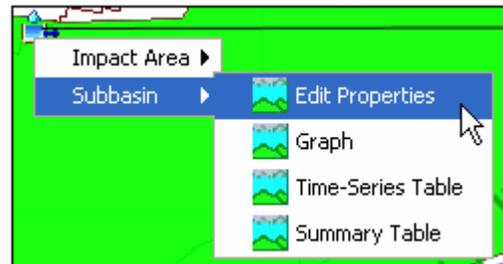


Figure I.3 Subbasin Element Shortcut Menu

2. The HMS editor for subbasins will open (Figure I.4). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time.

Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

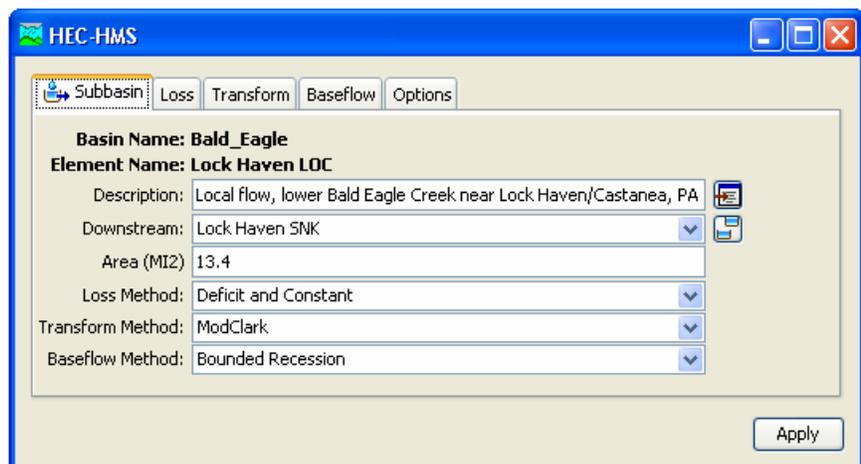


Figure I.4 HMS Editor - Subbasin

3. This editor allows you to change parameters that are specific to a subbasin. For further detail on this editor, reference the HMS User's Manual.
4. To close the HMS editor for subbasins (Figure I.4) click .

Routing Reach Element

1. From the simulation map window, right-click on an HMS routing reach model element on the schematic, a shortcut menu will appear (see Figure I.5, page I-4). From the shortcut menu, point to **Reach**, click **HMS**.
2. The HMS editor for a routing reach will open (see Figure I.6, page I-4). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box

- to the front, then after that the dialog box will open in front of the WAT.
- This editor allows you to change parameters that are specific to a subbasin. For further detail on this editor, reference the HMS User's Manual.
 - To close the HMS editor for routing reaches (Figure I.6) click .

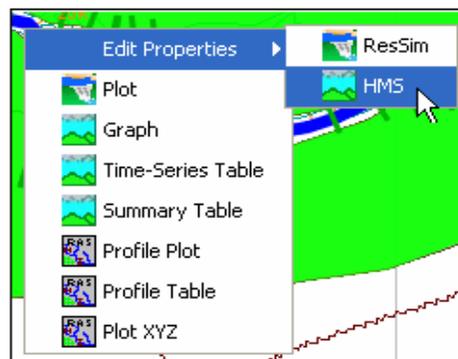


Figure I.5 Routing Reach Element Shortcut Menu

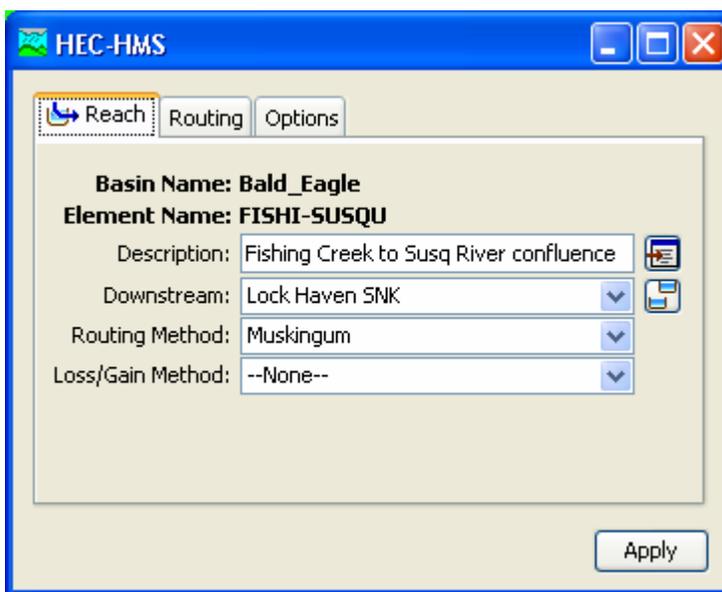


Figure I.6 HMS Editor – Routing Reaches

Junction Element

- From the simulation map window, right-click on an HMS junction model element on the schematic, a shortcut menu will appear (Figure I.7). From the shortcut menu click **Edit Properties**.
- The HMS editor for a junction will open (see Figure I.8, page I-5). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
- This editor allows you to change parameters that are specific to a junction. For further detail on this editor, reference the HMS User's Manual.



Figure I.7 Junction Element Shortcut Menu

- To close the HMS editor for junctions (Figure I.8) click .



Figure I.8 HMS Editor - Junction

I.2.2 ResSim

Whether you are right-clicking on a reservoir element, junction element, or reach element, from the schematic there are various ResSim model editors you can access. The following section describes those editors.

Reservoir Element

To edit ResSim model data at a reservoir:

- From the simulation map window, right-click on a reservoir model element on the schematic, a shortcut menu will appear (Figure I.9). From the shortcut menu, point to **Reservoir**, click **Edit Properties**.

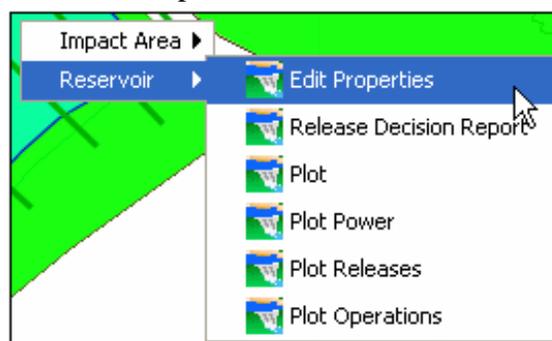


Figure I.9 Reservoir Element Shortcut Menu

- The ResSim **Reservoir Editor** will open (see Figure I.10, page I-6). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

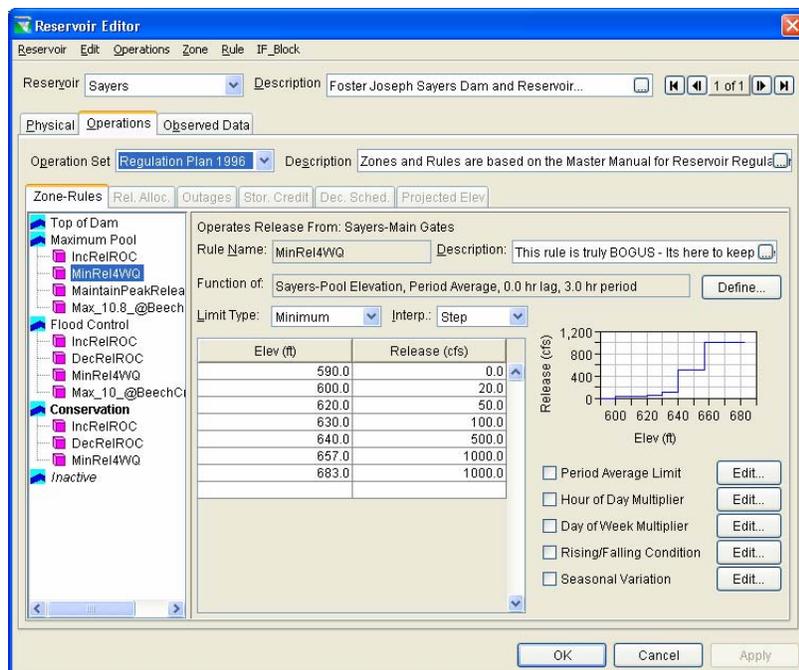


Figure I.10 ResSim – Reservoir Editor

3. This editor allows you to change physical data requirements for the reservoir, change the operation sets for a reservoir, and specify observed data if needed. For further detail on this editor, reference the ResSim User's Manual.
4. Click **OK**, the **Reservoir Editor** (Figure I.10) will close.

Junction Element

To edit ResSim model data at a junction:

1. From the simulation map window, right-click on a junction model element on the schematic, a shortcut menu will appear (Figure I.11). From the shortcut menu, point to **Junction**, point to **Edit Properties**, click **ResSim**.

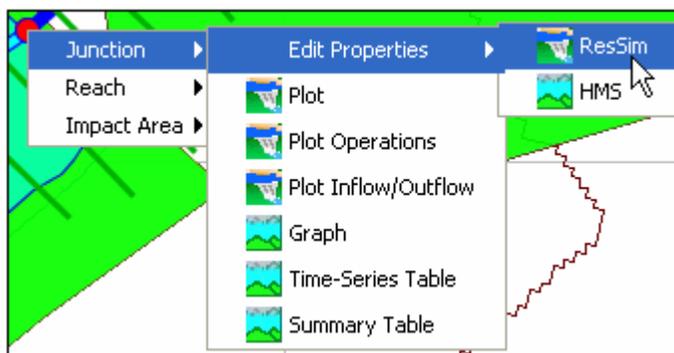


Figure I.11 Junction Element Shortcut Menu

- The ResSim **Junction Editor** will open (Figure I.12). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

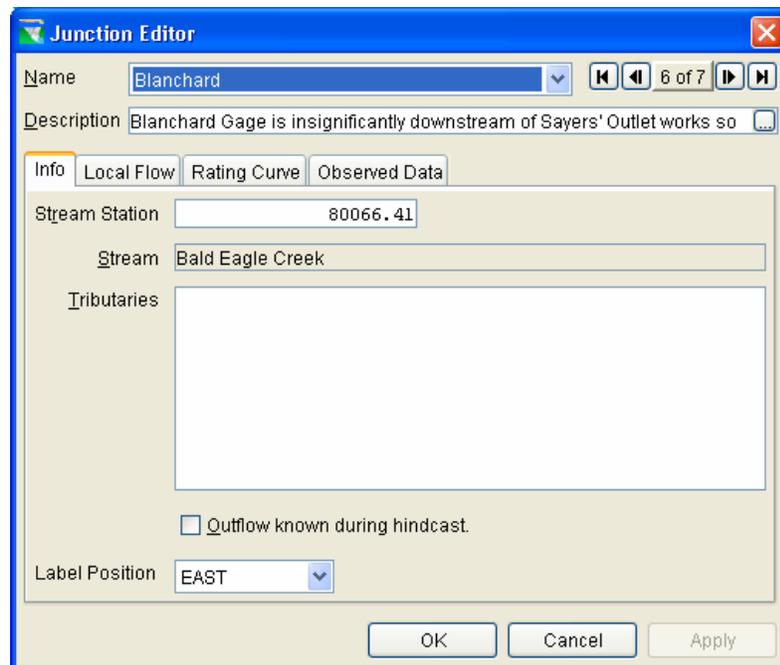


Figure I.12 ResSim – Junction Editor

- This editor allows you to change information about a ResSim junction, add local flow and a rating curve, and if needed add information about observed data. For further detail on this editor, reference the ResSim User's Manual.
- Click **OK**, the **Junction Editor** (Figure I.12) will close.

Routing Reach Element

To edit ResSim model data at a routing reach:

- From the simulation map window, right-click on a routing reach model element on the schematic, a shortcut menu will appear (Figure I.13). From the shortcut menu, point to **Reach**, point to **Edit Properties**, click **ResSim**.

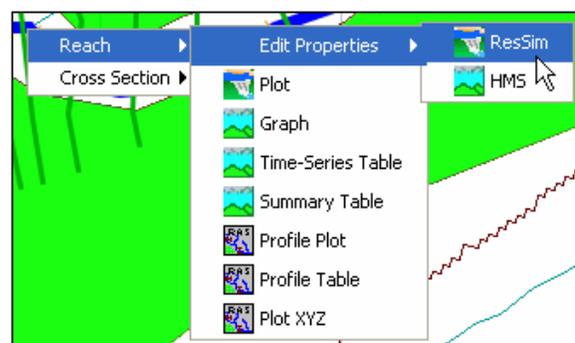


Figure I.13 Reach Element Shortcut Menu

- The ResSim **Reach Editor** will open (Figure I.14). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

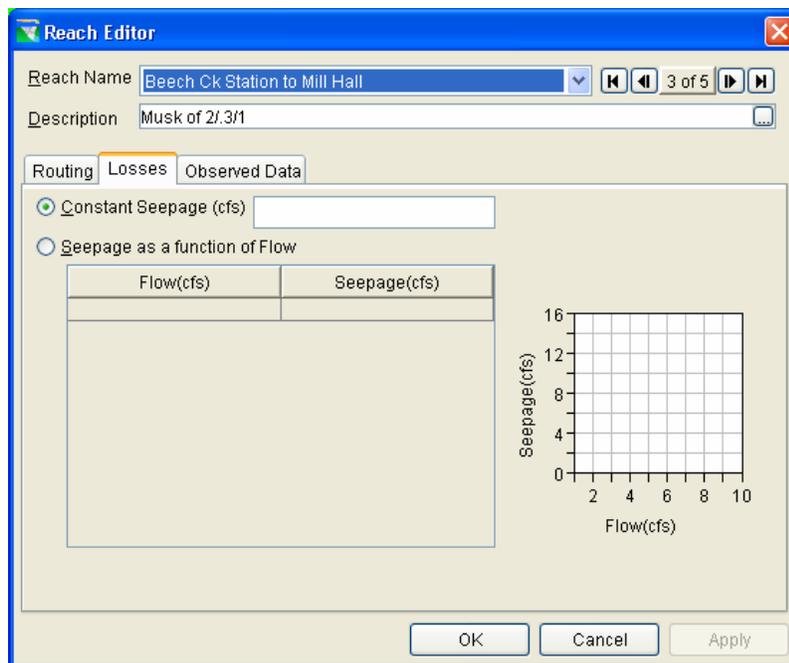


Figure I.14 ResSim – Reach Editor

- This editor allows you to change information about a ResSim reach, add/change routing information, edit information about losses for the reach, and if needed add information about observed data. For further detail on this editor, reference the ResSim User's Manual.
- Click **OK**, the **Reach Editor** (Figure I.14) will close.

I.2.3 RAS – Cross Section Data Editor

To edit RAS model data at a cross section:

- From the simulation map window, right-click on a cross section model element on the schematic, a shortcut menu will appear (Figure I.15). From the shortcut menu, point to **Cross Section**, click **Edit Properties**.

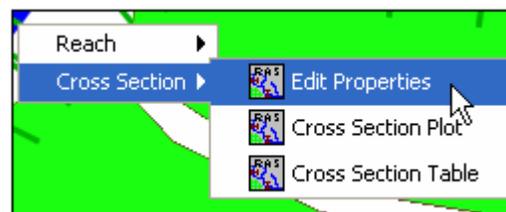


Figure I.15 Cross Section Element Shortcut Menu

- The RAS **Cross Section Data Editor** will open (see Figure I.16, page I-9). In the Beta version of the WAT, this dialog box might

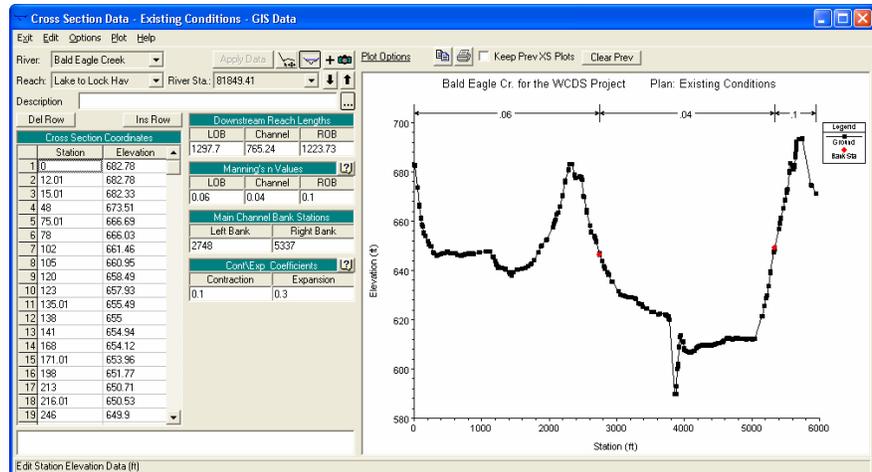


Figure I.16 RAS – Cross Section Data Editor

open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

3. This editor allows you to change information about a RAS cross section, add/change Manning's n values, edit cross section coordinates, and edit other information regarding a cross section. For further detail on this editor, reference the RAS User's Manual.
4. From the **Exit** menu, click **Exit Cross Section Editor**, the **Cross Section Data Editor** (Figure I.16) will close.

I.2.4 FIA – Impact Area Editor

To edit FIA model data at an impact area:

1. From the simulation map window, right-click on an impact area model element on the schematic, a shortcut menu will appear (Figure I.17). From the shortcut menu click **Edit Properties**. The **FIA Impact Area Editor** will open (see Figure I.18, page I-10).



Figure I.17 Impact Area Element Shortcut Menu

2. In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to change information about an FIA impact area, add/change general information about an impact area, edit information about damage functions and crop information, and edit

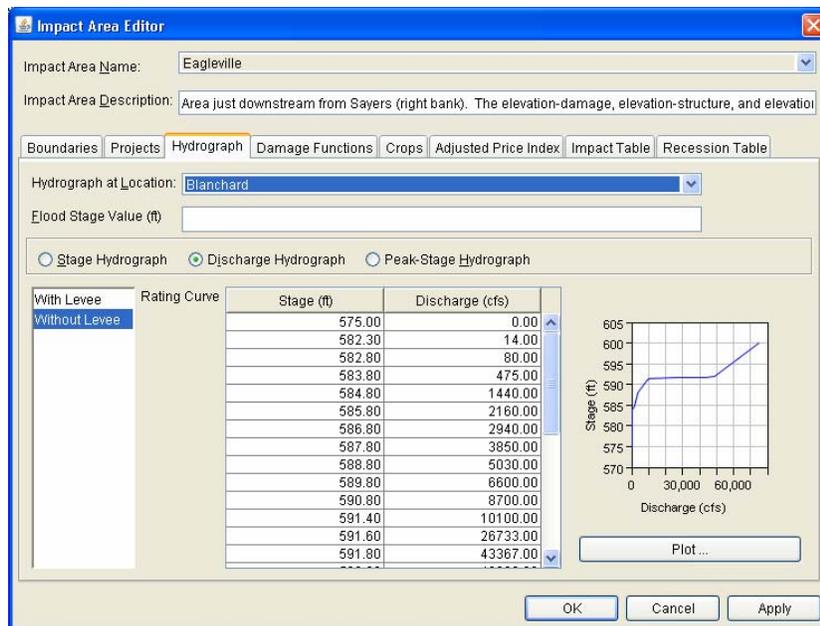


Figure I.18 FIA – Impact Area Editor

impact response information regarding the impact area. For further detail on this editor, reference the FIA User's Manual.

4. Click **OK**, the **Impact Area Editor** (Figure I.18) will close.

I.3 WAT Main Window

From the menu bar of the main WAT window, click **Edit** (Figure I.19), from this menu you can access various editors that are specific to the software included in the program order for the study. For example, in

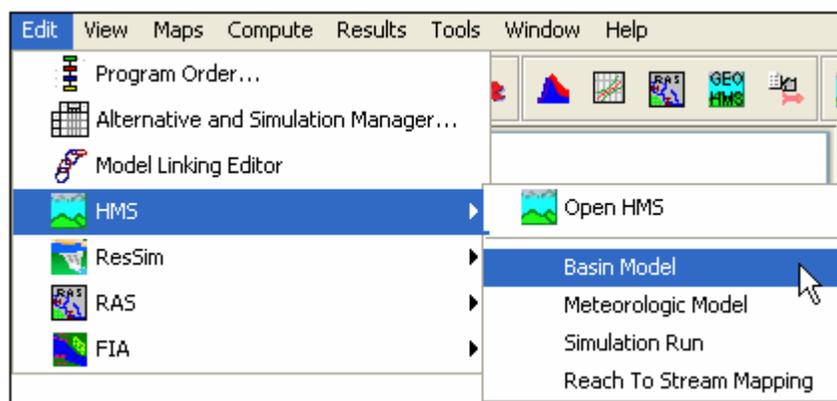


Figure I.19 Edit Menu – Access to HMS Model Editors

Figure I.19, point to **HMS**, the available commands allow you to execute the HMS program, or access several specific editors from the HMS program like the **Basin Model Editor**. The following sections provide an overview of the available editors. For more detail you will need to visit the user's manuals associated with each piece of software.

I.3.1 HMS

Basin Model

To edit HMS model data for a basin:

1. From the WAT main window, from the **Edit** menu (see Figure I.19, page I-10), point to **HMS**, click **Basin Model**.
2. The **HMS Basin Model Editor** will open (Figure I.20). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

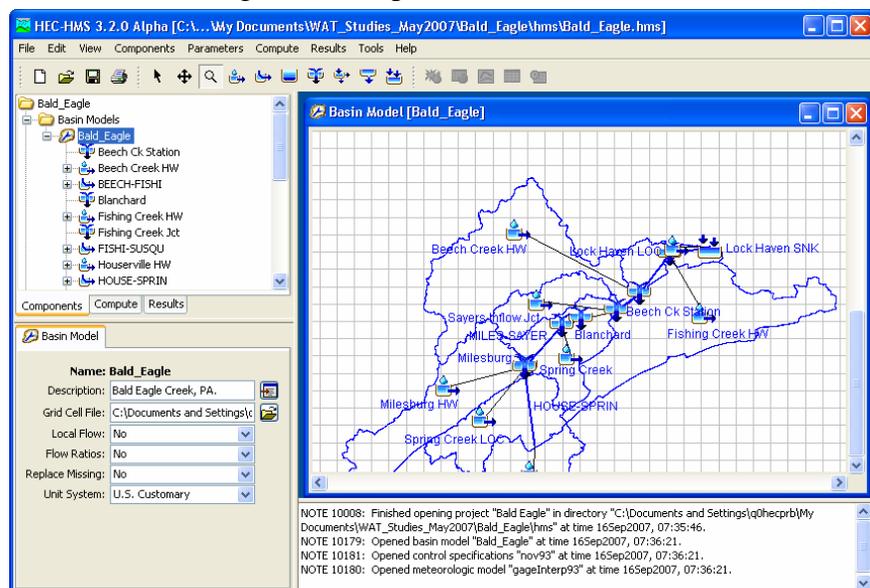


Figure I.20 HMS – Basin Model Editor

3. This editor allows you to change parameters that are specific to HMS basin. For further detail on this editor, reference the HMS User's Manual.
4. From the **File** menu, click **Exit**, the **HMS Basin Model Editor** (Figure 11.20) will close.

Meteorologic Model

To edit the HMS meteorologic model for a study:

1. From the WAT main window, from the **Edit** menu (see Figure I.19, page I-10), point to **HMS**, click **Meteorologic Model**.
2. The **HMS Meteorologic Model Editor** will open (see Figure I.21, page I-12). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog

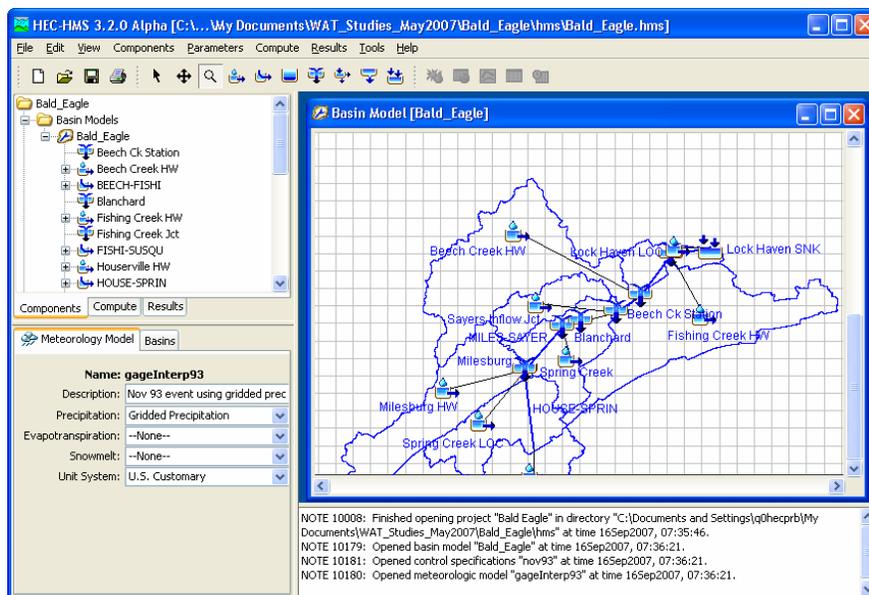


Figure I.21 HMS – Meteorologic Model Editor

- box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to edit parameters that have been defined for the meteorologic model. For further detail on this editor, reference the HMS User's Manual.
 4. From the **File** menu, click **Exit**, the **HMS Meteorologic Model Editor** (Figure 11.21) will close.

Simulation Run

To edit the defined parameters for an HMS simulation:

1. From the WAT main window, from the **Edit** menu (see Figure I.19, page I-10), point to **HMS**, click **Simulation Run**.
2. The **HMS Simulation Run Editor** will open (see Figure I.22, page I-13). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to edit parameters that have been defined for an HMS simulation run. For further detail on this editor, reference the HMS User's Manual.
4. From the **File** menu, click **Exit**, the **HMS Simulation Run Editor** (see Figure 11.22, page I-13) will close.

Reach to Stream Mapping

To edit the geographic location of HMS reaches:

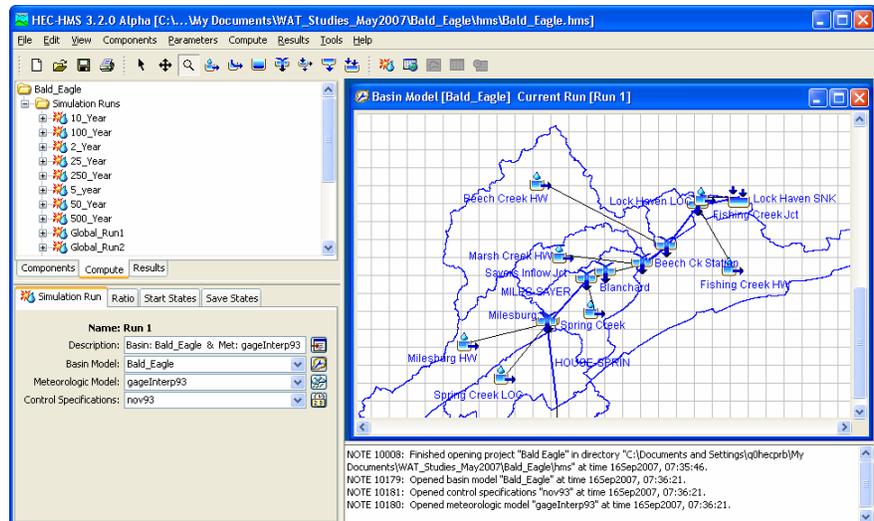


Figure I.22 HMS – Simulation Run Editor

1. From the WAT main window, from the **Edit** menu (see Figure I.19, page I-10), point to **HMS**, click **Reach To Stream Mapping**.
2. The **HMS Reach to Editor** will open (Figure I.23). This editor is not from HMS, but from the WAT. Since the current version of

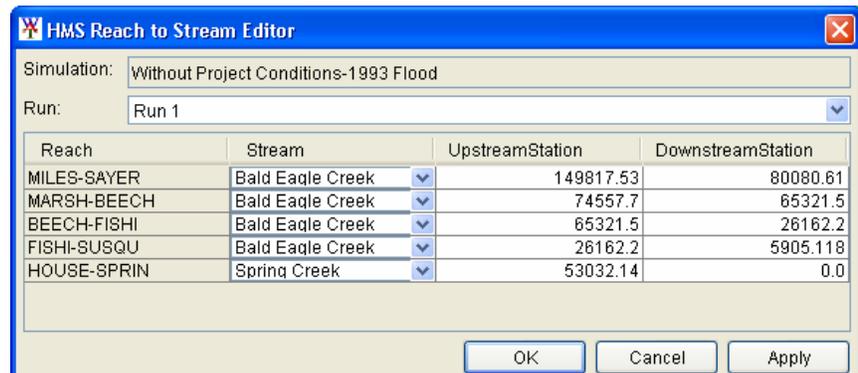


Figure I.23 HMS Reach to Stream Editor

HMS does not know about the coordinate system that the WAT has for a study, this editor allows you to enter information that will give the HMS model elements the correct geographic location on the schematic.

3. Click **OK**, the **HMS Reach to Stream Editor** (Figure 11.23) will close.

I.3.2 ResSim

Time Step Information

To edit time step and lookback duration for ResSim model alternatives:

1. From the WAT main window, from the **Edit** menu (Figure I.24), point to **ResSim**, click **TimeStep Information**.

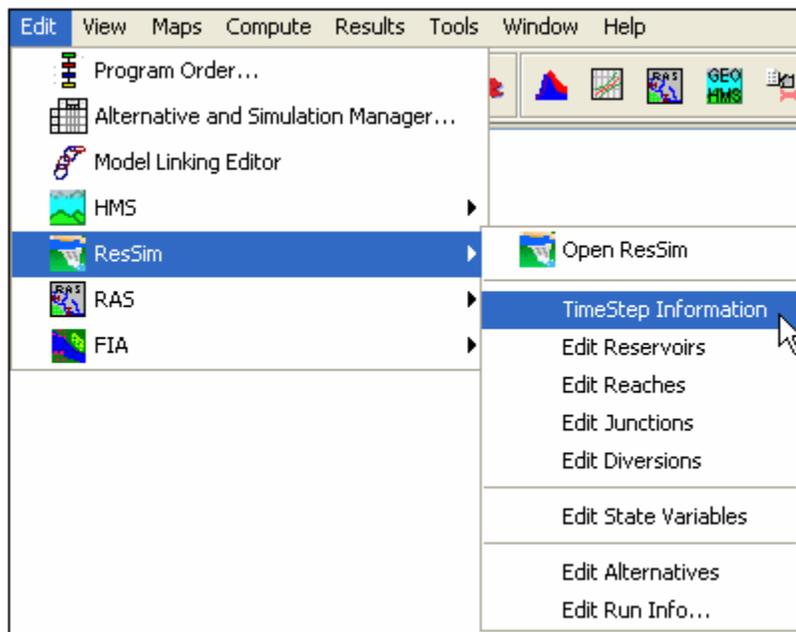


Figure I.24 Edit Menu – Access to ResSim Model Editors

2. The **TimeStep Information** dialog box will open (Figure I.25). This editor is not from ResSim, but from the WAT. The **TimeStep Information** dialog box allows you to adjust the time step and lookback duration for ResSim model alternatives if necessary.

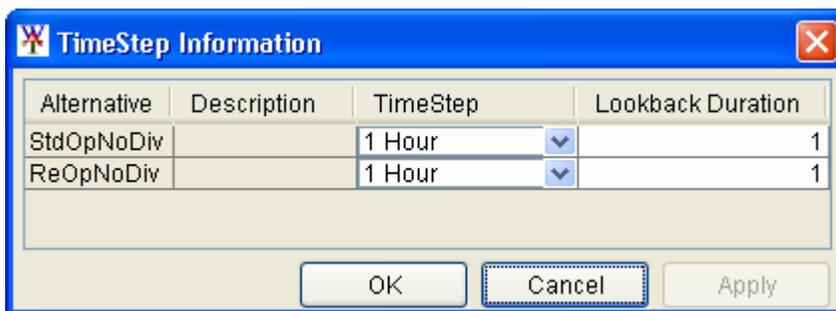


Figure I.25 TimeStep Information Dialog Box

3. Click **OK**, the **TimeStep Information** dialog box (Figure 11.25) will close.

Reservoir Editor

To edit ResSim model data at a reservoir:

1. From the WAT main window, from the **Edit** menu (Figure I.24), point to **ResSim**, click **Edit Reservoirs**.
2. The ResSim **Reservoir Editor** will open (see Figure I.10, page I-6). This editor allows you to change physical data requirements for the reservoir, change the operation sets for a reservoir, and specify

- observed data if needed. For further detail on this editor, reference the ResSim User's Manual.
3. Click **OK**, the **Reservoir Editor** (Figure I.10) will close.

Reach Editor

To edit ResSim model data at a reach:

1. From the WAT main window, from the **Edit** menu (see Figure I.24, page I-14), point to **ResSim**, click **Edit Reaches**.
2. The ResSim **Reach Editor** will open (see Figure I.14, page I-8). This editor allows you to change information about a ResSim reach, add/change routing information, edit information about losses for the reach, and if needed add information about observed data. For further detail on this editor, reference the ResSim User's Manual.
3. Click **OK**, the **Reach Editor** (see Figure I.14, page I-8) will close.

ResSim Editor

To edit ResSim simulation information:

1. From the WAT main window, from the **Edit** menu (see Figure I.24, page I-14), point to **ResSim**, click **Edit Run Info**.
2. The **ResSim Editor** will open (Figure I.26). This editor allows you to edit options that will affect the way ResSim will compute. Also, from this editor you can also access all of the individual ResSim editors. For further detail on this editor, reference the ResSim User's Manual.

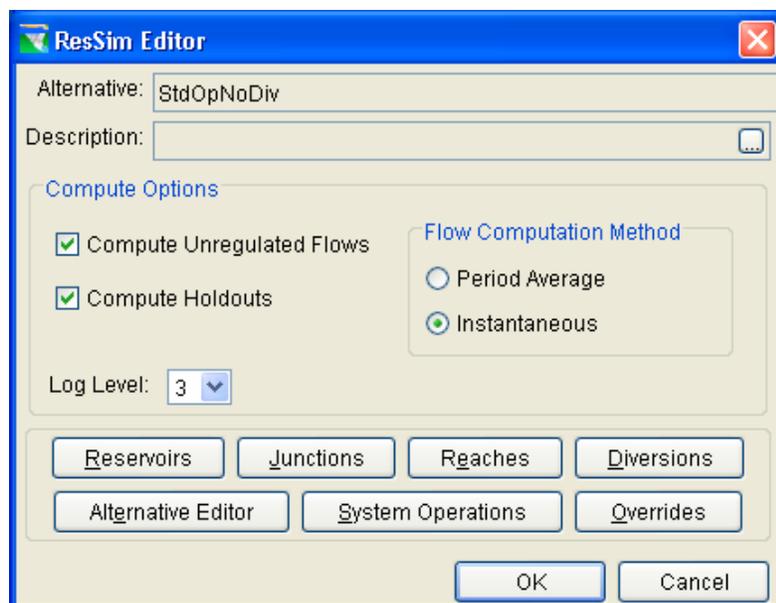


Figure I.26 ResSim Editor

3. Click **OK**, the **ResSim Editor** (Figure I.26) will close.

I.3.3 RAS

Geometric Data

To edit geometric data associated with a RAS model alternative:

1. From the WAT main window, from the **Edit** menu (Figure I.27), point to **RAS**, click **Geometric Data**.

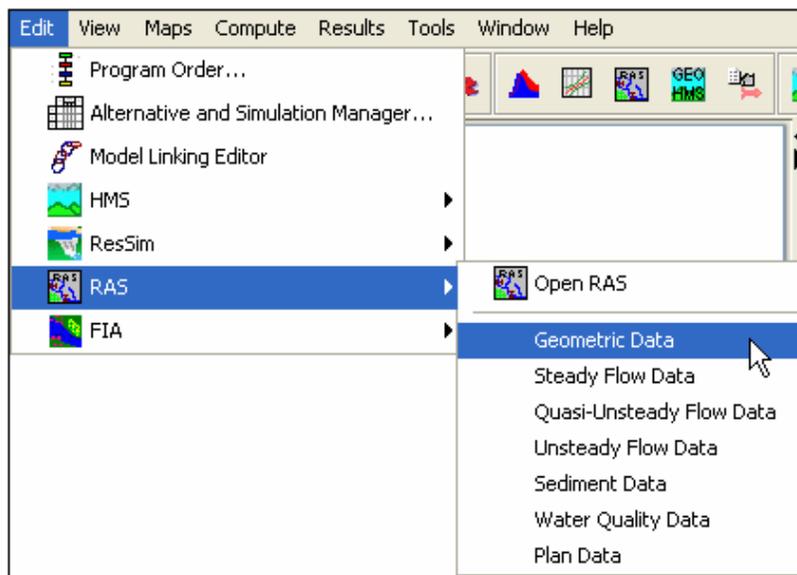


Figure I.27 Edit Menu – Access to RAS Model Editors

2. The RAS **Geometric Data Editor** will open (Figure I.28). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

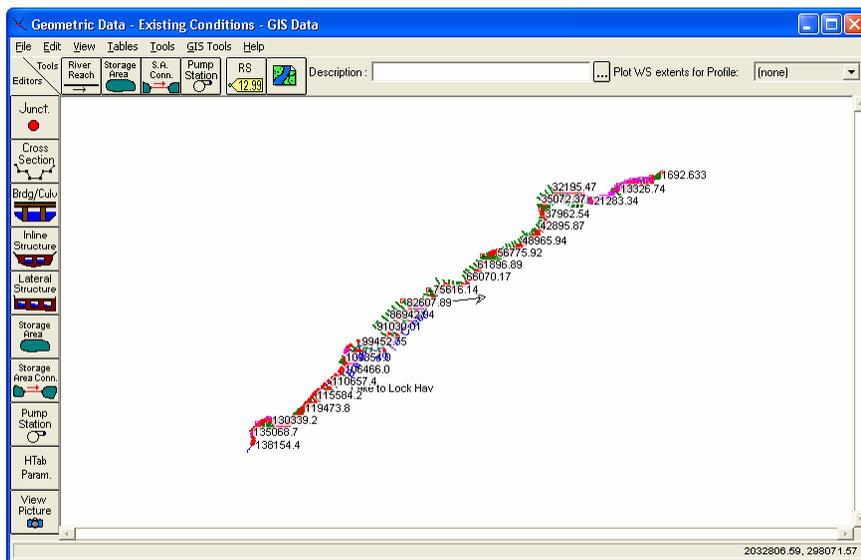


Figure I.28 RAS – Geometric Data Editor

3. This editor allows you to edit parameters that have been defined for the geometric data for a RAS model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit Geometry Data Editor**, the RAS **Geometric Data Editor** (see Figure I.28, page I-17) will close.

Steady Flow Data

To edit steady flow data associated with a RAS steady flow model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Steady Flow Data**.
2. The RAS **Steady Flow Data Editor** will open (Figure I.29). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

Flow Change Location			Profile Names and Flow Rates										
River	Reach	R/S	20Aug2001 0600	21Aug2001 0600	22Aug2001 0600	23Aug2001 0600	24Aug2001 0600	25Aug2001 0600	26Aug2001 0600	27Aug2001 0600	28Aug2001 0600	29Aug2001 0600	Peak Flow
1	Bald Eagle Creek, Lake to Lock Hwy	138154.4	257.02	244.69	233.19	222.42	201.06	204.6	194.52	185.79	177.77	170.31	257.017
2	Bald Eagle Creek, Lake to Lock Hwy	62607.25	305.82	290.08	275	260.91	250.66	239.47	225.01	213.48	203.17	193.65	305.8156
3	Bald Eagle Creek, Lake to Lock Hwy	91543.41	151.8	229.95	191.8	191.8	172.5	238.47	226.01	213.48	203.17	193.65	229.9501
4	Bald Eagle Creek, Lake to Lock Hwy	76002.98	208.6	323.84	193.12	189.82	210.99	272.23	254.74	240.73	228.22	216.7	328.9191
5	Bald Eagle Creek, Lake to Lock Hwy	67226.78	208.6	324	193.26	189.95	211.27	273.12	255.38	241.28	228.72	217.16	328.9172
6	Bald Eagle Creek, Lake to Lock Hwy	60279.11	345.99	459.69	317.22	304.24	324.86	372.28	345.68	329.93	304.15	285.59	459.5024
7	Bald Eagle Creek, Lake to Lock Hwy	27226.42	345.99	459.94	318.34	305.28	326.19	376.68	347.71	325.21	305.67	287.82	463.4029
8	Bald Eagle Creek, Lake to Lock Hwy	25960.71	522.67	621.56	467.04	442.08	467.29	498.33	456.94	424.46	396.32	370.98	629.1241
9	Bald Eagle Creek, Lake to Lock Hwy	959342	971.47	667.64	509.43	481.67	555.93	533.11	498.13	452.96	422.48	395.03	674.917

Figure I.29 RAS – Steady Flow Data Editor

3. This editor allows you to edit parameters that have been defined for the steady flow data for a RAS model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit Flow Data Editor**, the RAS **Steady Flow Data Editor** (Figure I.29) will close.

Quasi-Unsteady Flow Data

To edit quasi-unsteady flow data associated with a RAS unsteady flow model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Quasi-Unsteady Flow Data**.
2. The RAS **Quasi Unsteady Flow Editor** will open (see Figure I.30, page I-18). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

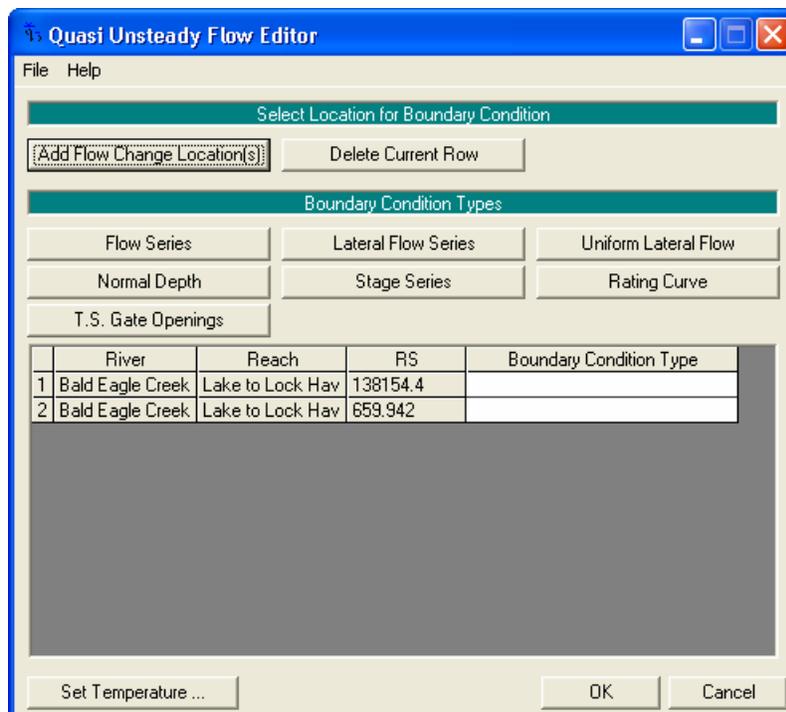


Figure I.30 RAS – Quasi Unsteady Flow Editor

3. This editor allows you to edit parameters that have been defined for the quasi-unsteady flow data for a RAS unsteady flow model alternative. For further detail on this editor, reference the RAS User's Manual.
4. Click **OK**, the RAS **Quasi- Unsteady Flow Editor** (Figure I.30) will close.

Unsteady Flow Data

To edit unsteady flow data associated with a RAS unsteady flow model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Unsteady Flow Data**.
2. The RAS **Unsteady Flow Editor** will open (see Figure I.31, page I-19). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to edit parameters that have been defined for the unsteady flow data for a RAS unsteady flow model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit**, the RAS **Unsteady Flow Editor** (see Figure I.31, page I-19) will close.

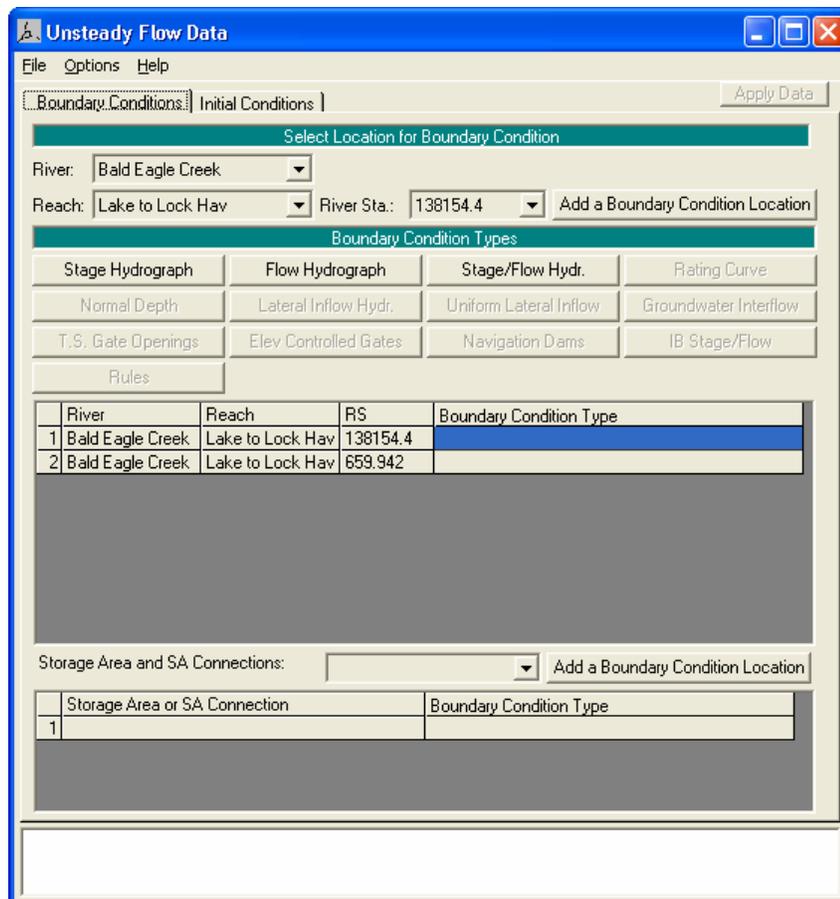


Figure I.31 RAS – Unsteady Flow Data Editor

Sediment Data

To edit sediment data associated with a RAS model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Sediment Data**.
2. The RAS **Sediment Data Editor** will open (see Figure I.32, page I-20). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to edit parameters that have been defined for the sediment data for a RAS model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit**, the RAS **Sediment Data Editor** (see Figure I.32, page I-20) will close.

Water Quality Data

To edit water Quality data associated with a RAS model alternative:

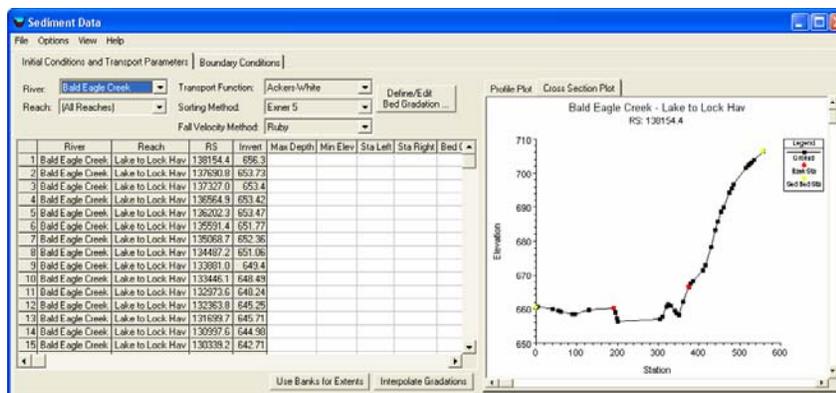


Figure I.32 RAS – Sediment Data Editor

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Water Quality Data**.
2. The RAS **Water Quality Data Editor** will open (Figure I.33). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

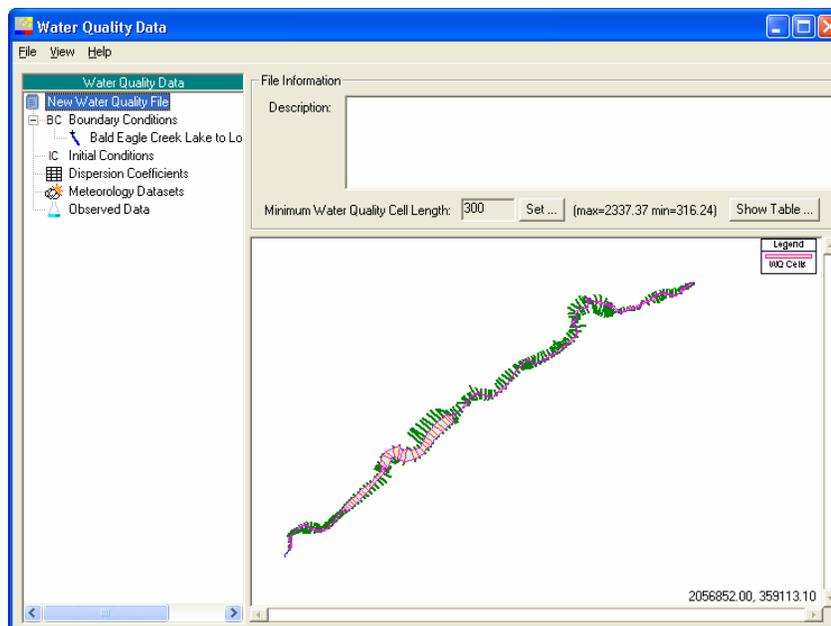


Figure I.33 RAS – Water Quality Data Editor

3. This editor allows you to edit parameters that have been defined for the water quality data for a RAS model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit**, the RAS **Water Quality Data Editor** (Figure I.33) will close.

Plan Data

To edit plan data associated with a RAS model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.27, page I-16), point to **RAS**, click **Plan Data**.
2. The **RAS Steady Flow Analysis Editor** will open (Figure I.34). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

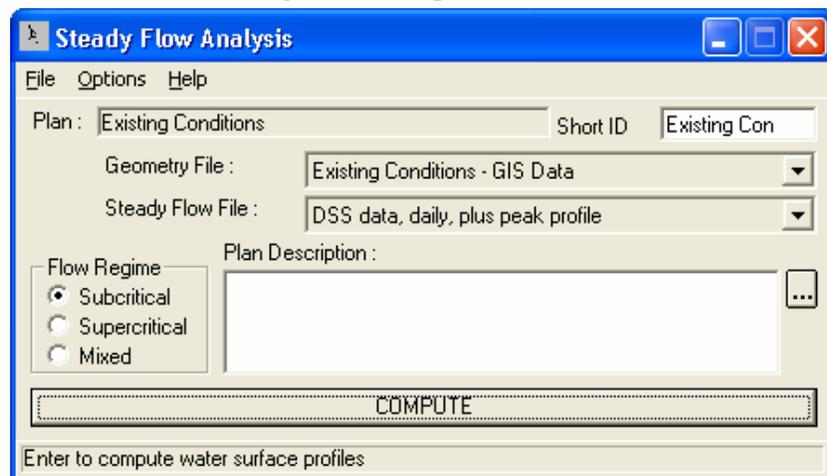


Figure I.34 RAS – Steady Flow Editor

3. This editor allows you to edit parameters that have been defined for the plan data for a RAS model alternative. For further detail on this editor, reference the RAS User's Manual.
4. From the **File** menu, click **Exit**, the **RAS Steady Flow Editor** (Figure I.34) will close.

I.3.4 FIA

Global Data Editor

To edit the global data associated with an FIA model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.35, page I-22), point to **FIA**, click **Global Data**.
2. The **FIA Global Data Editor** will open (see Figure I.36, page I-22). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.
3. This editor allows you to edit the global data that has been defined for an FIA model alternative. For further detail on this editor, reference the FIA User's Manual.

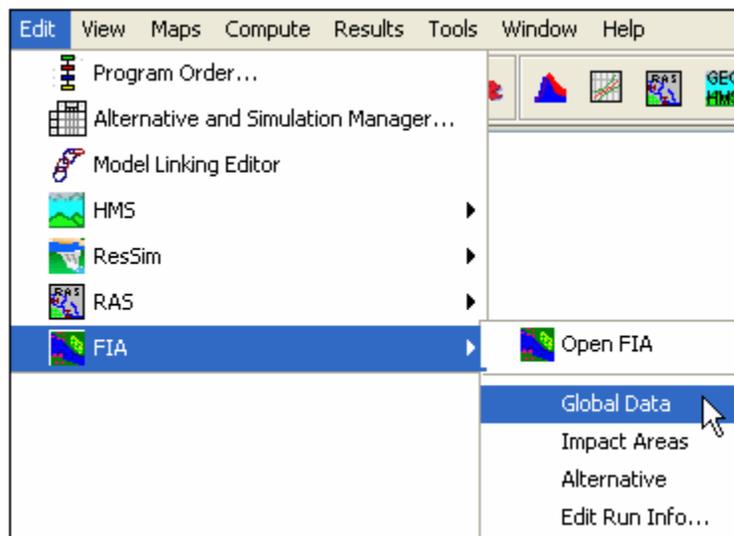


Figure I.35 Edit Menu – Access to FIA Model Editors

4. Click **OK**, the FIA **Global Data Editor** (Figure I.36) will close.

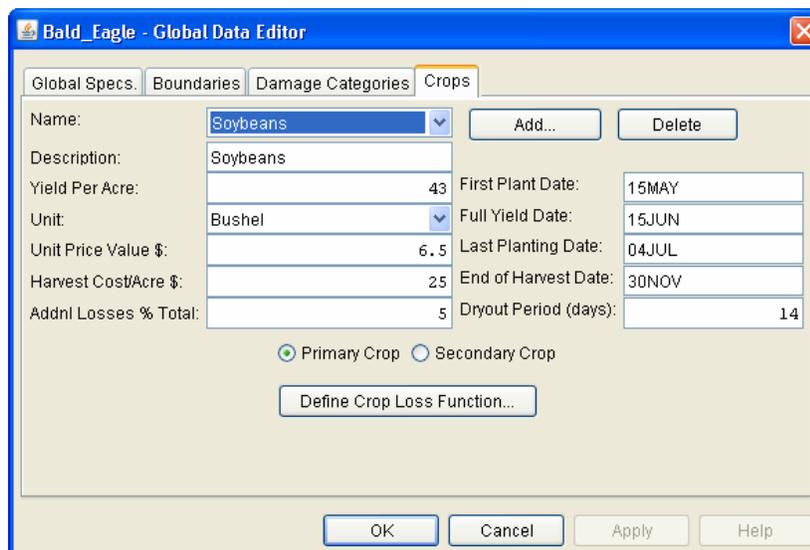


Figure I.36 FIA – Global Data Editor

Impact Area Editor

To edit impact area data associated with an FIA model alternative:

1. From the WAT main window, from the **Edit** menu (Figure I.35), point to **FIA**, click **Global Data**.
2. The FIA **Impact Area Editor** will open (see Figure I.18, page I-10). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

3. This editor allows you to change information about an FIA impact area, add/change general information about an impact area, edit information about damage functions and crop information, and edit impact response information regarding the impact area. For further detail on this editor, reference the FIA User's Manual.
4. Click **OK**, the **Impact Area Editor** (see Figure I.18, page I-10) will close.

Alternative Editor

To edit data associated with an FIA model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.35, page I-22), point to **FIA**, click **Alternative**.
2. The FIA **Alternative Editor** will open (Figure I.37). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

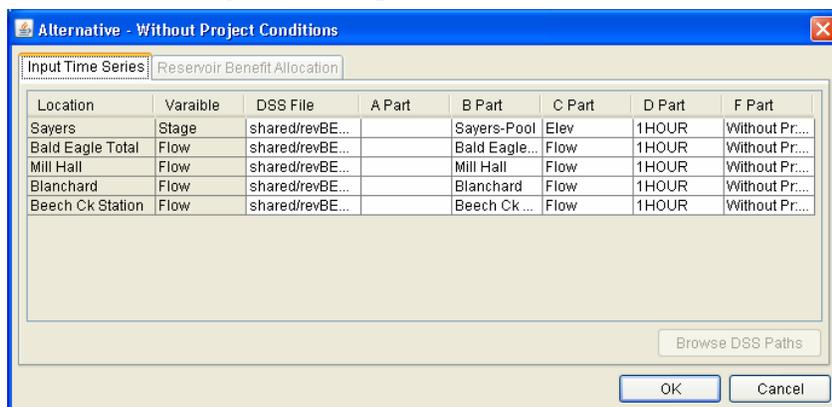


Figure I.37 FIA – Alternative Editor

3. This editor allows you to change information about an FIA model alternative. For further detail on this editor, reference the FIA User's Manual.
4. Click **OK**, the **Alternative Editor** (Figure I.37) will close.

Compute Project Benefits

To set the compute project benefits for an FIA model alternative:

1. From the WAT main window, from the **Edit** menu (see Figure I.35, page I-22), point to **FIA**, click **Edit Run Info**.
2. The FIA **Compute Project Benefits** dialog box will open (see Figure I.38, page I-24). In the Beta version of the WAT, this dialog box might open behind the WAT for the first time. Once you bring the dialog box to the front, then after that the dialog box will open in front of the WAT.

3. This dialog allows you to compute project benefits for an FIA model alternative. For further detail on this editor, reference the FIA User's Manual.
4. Click **OK**, the **Compute Project Benefits** dialog box (Figure I.38) will close.

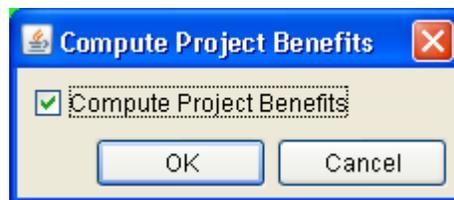


Figure I.38 FIA – Compute Project Benefits Dialog Box

APPENDIX J

Plots

Plots are highly customizable and offer an array of information that will assist you with reviewing your data in HEC-WAT. This appendix covers some of the capabilities of plots within the WAT. For more detail, see the HEC-DSSVue User's Manual (Chapter 5).

J.1 Plot Window

The **Plot** window provides tools that facilitate the viewing of WAT data. The main window and the different components for the **Plot** window are illustrated in Figure J.1. The **Title Bar** contains the name of the location that the data represents. For example, in Figure J.1, the plot is illustrating the raw and revised data for stage and flow at a location called *Beech Creek Sta.*

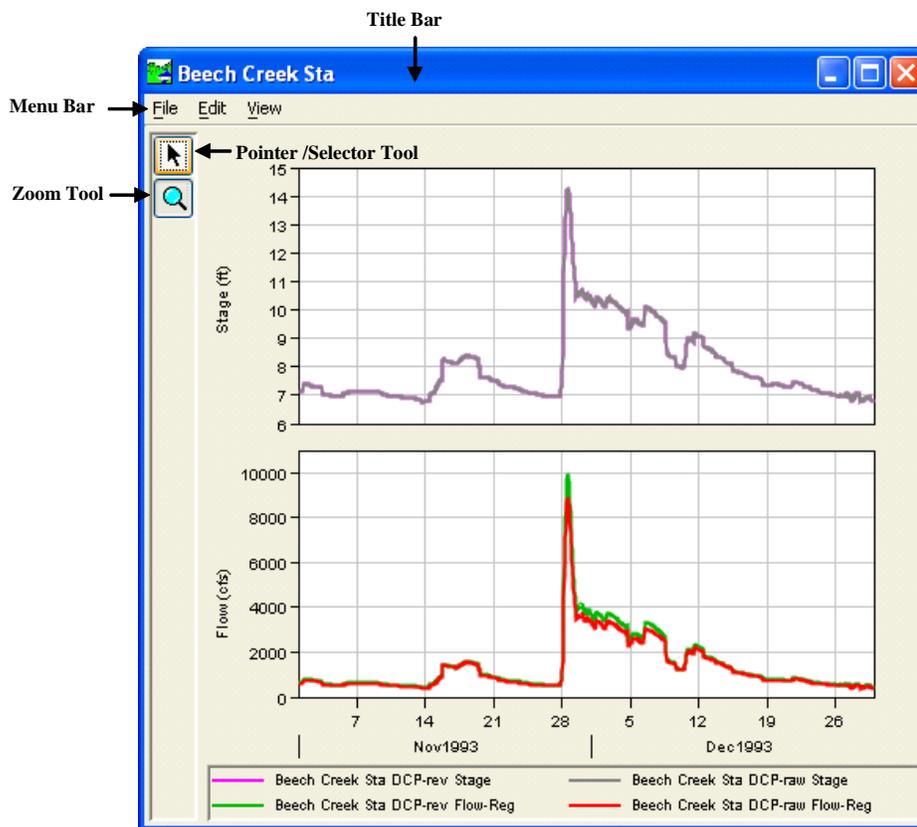


Figure J.1 Plot Window

J.1.1 Menu Bar

Following is an overview of the **Menu Bar** (see Figure J.1, page J-1) for the **Plot** window. The commands available from the menus will facilitate the viewing and customizing of plots.

- File** From this menu you can view the plotted data in a tabular format, save the plot as a graphics file, save a template, use a template, copy the plot to the clipboard, and print the plot. Available commands are: **Tabulate, Save As, Save Template, Apply Template, Copy to Clipboard, Print, Page Setup, Print Preview, Print Multiple, and Close.**
- Plot** From this menu you can customize the layout of an individual plot, and save a plot type. Available commands are: **Select Variables, Open Plot Type and Save Plot Type.**
- Edit** From this menu you can customize the plot. Available commands are: **Plot Properties, Configure Plot Layout, Default Line Styles, and Default Plot Properties.**
- View** From this menu you can have the plot window always on top of your desktop, and you can choose to use line styles. Available commands are: **Always On Top, Use Line Styles, and Zoom to all.**

J.1.2 Tools

The **Tools** appear in a toolbar on the left side of the **Plot** window (see Figure J.1, page J-1). The tools change the appearance of the mouse, as well as the functionality of the mouse:

Pointer/Selector Tool

With the **Pointer/Selector Tool**, you can access shortcut menus that allow you to customize features of your plots using the plot editing tools.

Zoom Tool

The **Zoom Tool** allows you to view data closely at a specific time. To zoom in, hold the mouse button down and outline the area you want to enlarge. To zoom out, click the right mouse button (right-click). The zoom out is done by a factor of two and positions the clicked location at the center of the display area.

J.2 Customizing Plots

J.2.1 Overview

From the **Plot** window several editors allow you to configure default properties for all plots as well as customize individual plots. Figure J.2 shows the features plot area that can be configured.

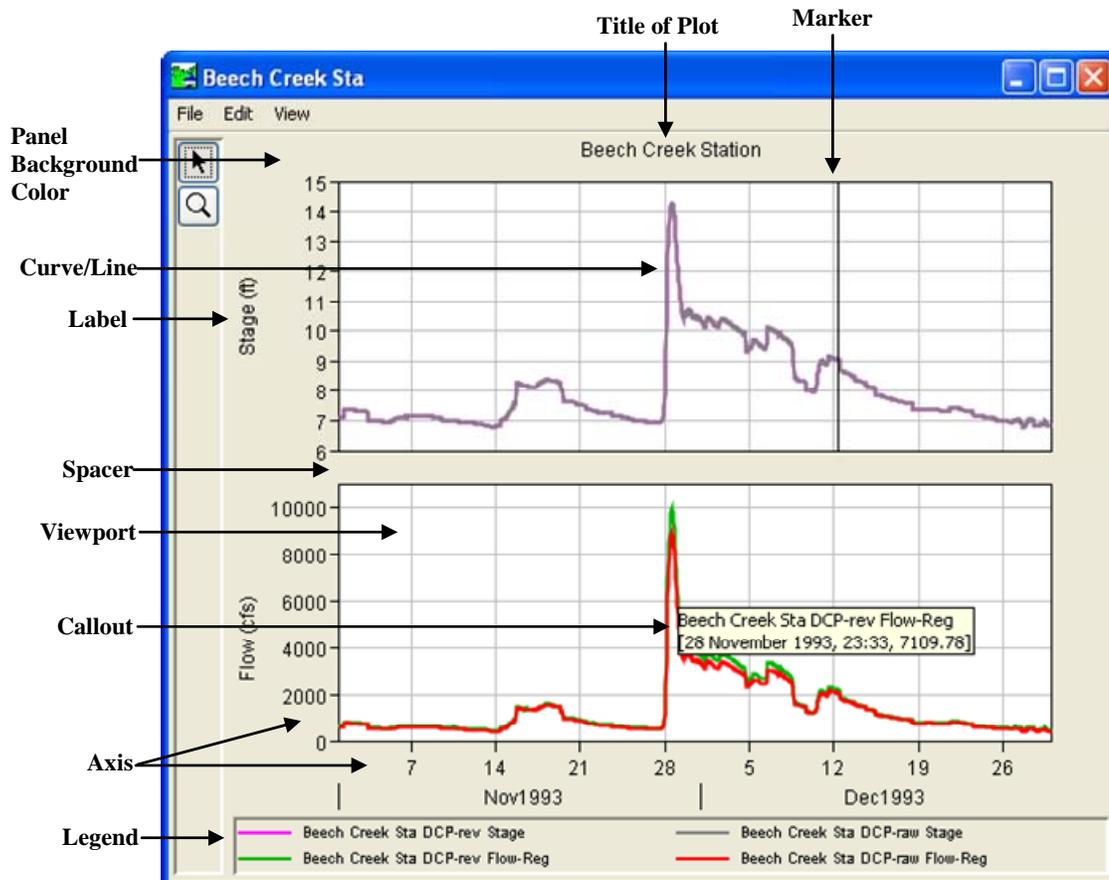


Figure J.2 Elements of the Plot Window

- Title** You can add a title to all plots or to individual plots.
- Marker** You can add markers on the X- and Y-axes and customize the appearance of these markers.
- Panel Background Color** You can specify the background color of the plot window (light grey is the default) for all plots only.
- Curve/Line Properties** You can choose the line and point styles, add labels, and specify symbols to indicate quality.
- Label** You can add borders and backgrounds to axis and legend labels.

- Spacer** You can specify the distance between viewports, between a viewport and the legend, and the width of side margins.
- Viewport** You can customize the border around the viewport, the background color and pattern, and the appearance of gridlines. You can also specify the number, size, and content of viewports.
- Callout** You can add descriptive callouts at specific points along a line.
- Axis** You can specify either a linear or log axis type, specify the axis scale, and customize tic marks.
- Legend** You can add titles to the plot legend and specify whether the legend appears below or to the right of the plot.

J.2.2 All Plots

You can customize all the plots for an entire watershed. From the **Plot** window (see Figure J.1, page J-1), from the **Edit** menu, there are two commands - **Default Line Styles** and **Default Plot Properties**. These commands will allow you to customize all new plot windows that will be accessed for a watershed.

Default Line Style Options

The **Default Line Style Options** dialog box (Figure J.3) is specifically for adjusting the curves (lines) in all of your plots. It allows you to add curve (line) types, change the color and fill of the curves (lines), and add labels for the curves (lines) for all plots. For more detailed information on **Default Line Style Options** dialog box, refer to the HEC-DSSVue User's Manual (Chapter 5).

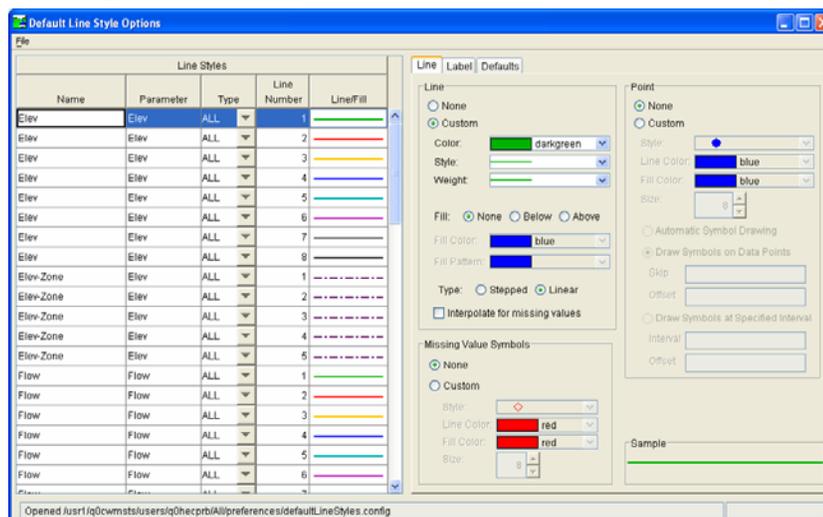


Figure J.3 Default Line Style Options Dialog Box

From the **Line** tab (see Figure J.3, page J-4) you can set the color, style, and weight for your curves (lines) in all plots. If the curves have points, you can also set the style, color, and fill color for the points on your curves in all plots.

From the **Default Line Style Options** dialog box (see Figure J.3, page J-4) you can also add labels to the curves and adjust the position of the label (**Label** tab) for all plots. You can manually adjust the maximum and minimum values for your X-axis, set viewport weight, and reverse the X-axis (**Defaults** tab) for certain curve types such as Precip.

Default Plot Properties

The **Default Plot Properties** dialog box (Figure J.4) allows you to configure allows you to set all of the other properties of your plots. The worksheets for this dialog box allow you to make adjustment to the viewport, add a title for all plots, adjust grids, labels, axes, marker lines, and legend, change the color of the panel background, change the layout of the legend, and adjust the size of the spacer.

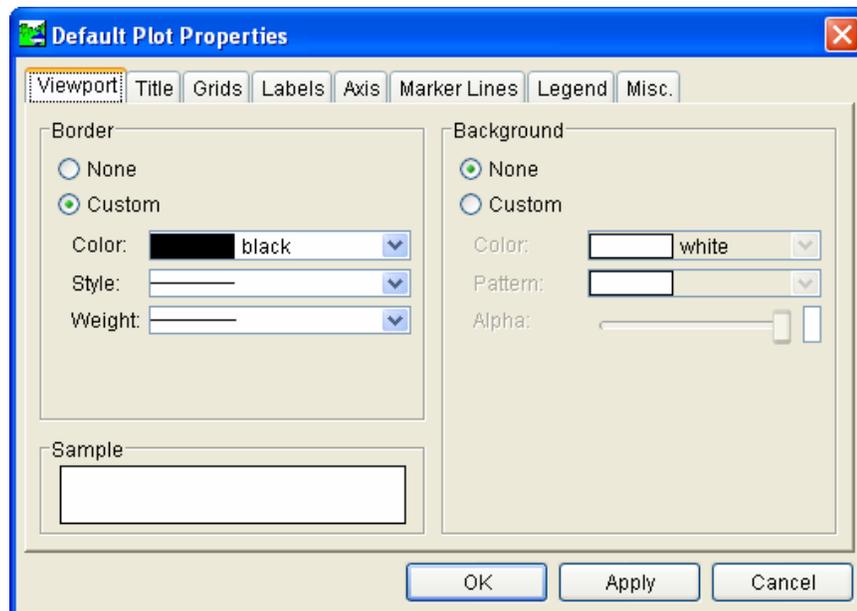


Figure J.4 **Default Plot Properties Dialog Box**

To add a title for all plots:

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **Edit** menu, click **Default Plot Properties**.
3. The **Default Plot Properties** dialog box will open (Figure J.4).
4. Click the **Title** tab; the **Default Plot Properties** dialog box will now display the **Title** worksheet (see Figure J.5, page J-6).

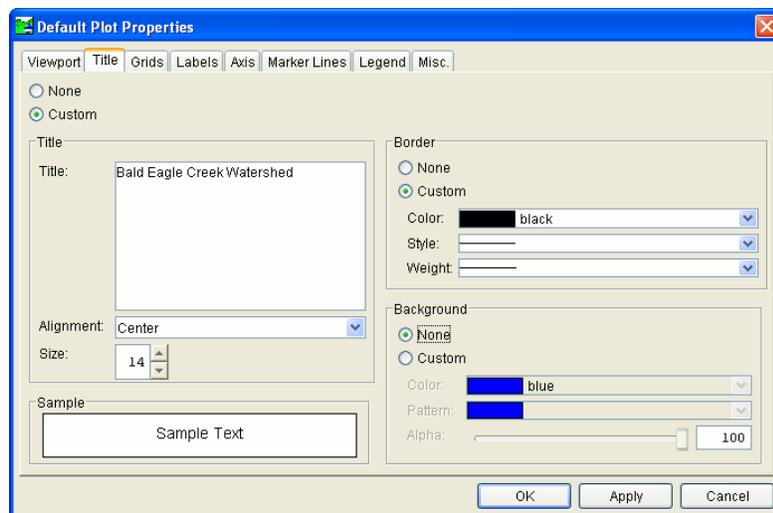


Figure J.5 Default Plot Properties Dialog Box – Title

5. To add a title, click **Custom**. In the **Title** box enter a title that will appear on all of the plots in the watershed. You can align the title, adjust the font size, add a border with color, and add a color background to the title.
6. Click **Apply**, the title will now appear on all plots.
7. Click **OK**, the **Default Plot Properties** dialog box will close, and all plots will display the title you entered.

To change the panel background color for all plots:

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **Edit** menu, click **Default Plot Properties**.
3. The **Default Plot Properties** dialog box will open (see Figure J.4, page J-5).
4. Click the **Misc** tab; the **Default Plot Properties** dialog box will now display the **Misc** worksheet (see Figure J.6, Page J-7).
5. To change the panel background color of the plot, from the **Panel Background Color** list, select a color.
6. Click **Apply**, to view the change, you must close the **Default Plot Properties** dialog box, close the **Plot** window, and then reopen the **Plot** window.
7. Click **OK**, the **Default Plot Properties** dialog box will close, and all plots will display the title you entered.

J.2.3 Individual Plots

To customize individual plots that you are displaying (see Figure J.1, J-1) you can either use two dialog boxes, or using shortcut menus to make changes through individual editors. The two dialog boxes are available from the **Edit** menu; there are two commands – **Plot Properties** and **Configure Plot Layout**.

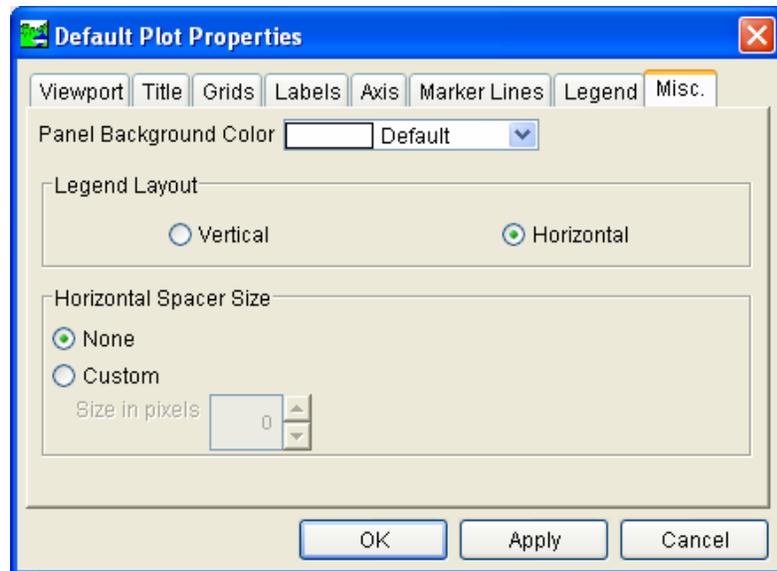


Figure J.6 Default Plot Properties Dialog Box – Misc

Individual Plot Properties

The **Plot Properties** dialog box (Figure J.7) allows you to configure multiple display properties of an individual plot. This includes the border and background patterns of the viewport; add a title to the plot; adjust the gridlines of the plot; edit the titles, tic marks, and scale of an

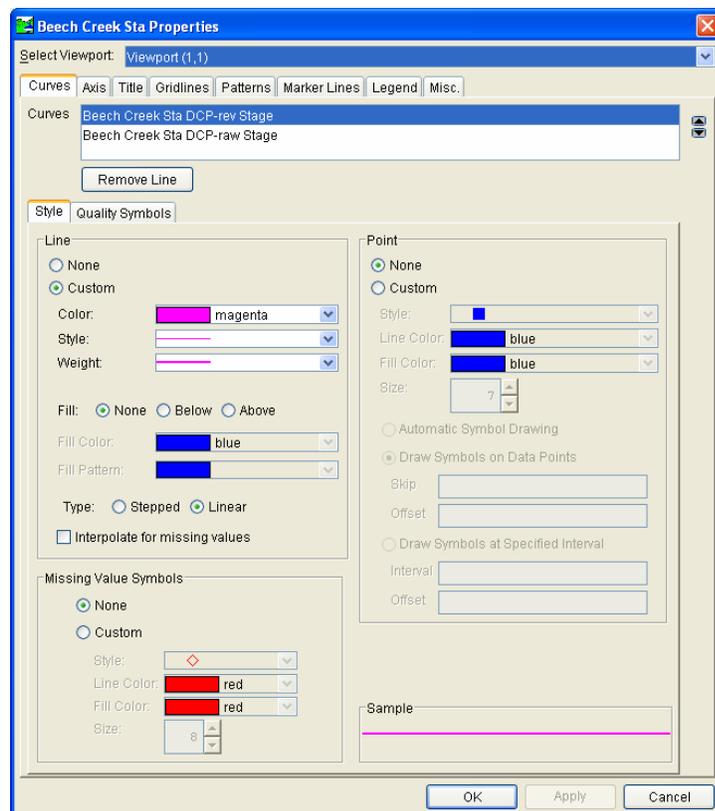


Figure J.7 Individual Plot Properties Dialog Box

axis; adjust the style, add points, and add quality symbols for curves; adjust the color, add labels, and position of marker lines; add a title, icon, and move the legend; change the color of the panel background; adjust the layout of the legend; and, the size of the spacer.

To change the gridlines of an individual plot:

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **Edit** menu, click **Plot Properties**.
3. The **Plot Properties** dialog box will open (see Figure J.7, page J-7).
4. The **Title Bar** displays the name of the location that data is being plotted.
5. If your plot has multiple viewports, the **Select Viewport** list displays the viewport where you're editing is taking place.
6. Click the **Gridlines** tab; the **Plot Properties** dialog box will now display the **Gridlines** worksheet (Figure J.8).

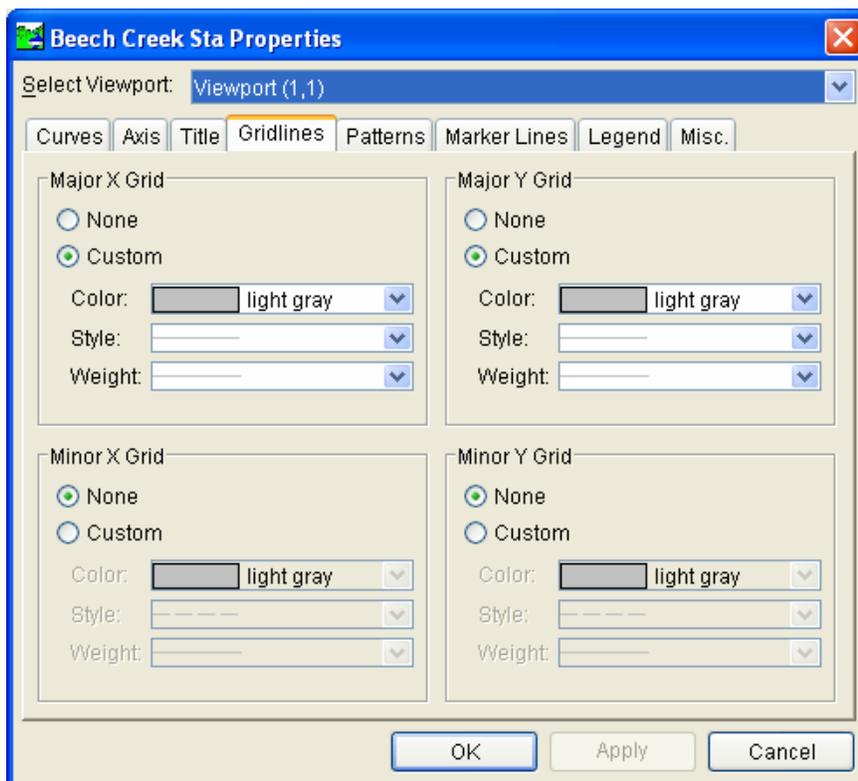


Figure J.8 Individual Plot Properties Dialog Box – Gridlines

7. To change the color and style of the X-axis gridlines, from the **Major X Grid** box, click **Custom**. From the **Color** list select the color you want. You can also change the style of the grid from the **Style** list. You can also change the Y-axis from the **Major Y Grid** box. By default the minor gridlines for each axis is set to off, but by clicking **Custom** in each box you can turn the minor gridlines on for your plot.

8. Click **Apply**, the color changes and style changes you made will now be reflect on the gridlines of your plot.
9. Click **OK**, the **Plot Properties** dialog box (see Figure J.8, page J-8) will close.

Configure Plot Layout

The **Configure Plot** dialog box (Figure J.9) allows you to customize the layout of an individual plot. You can add and remove axes, arrange the order of viewports, add and remove viewports, and set the weight of viewports. The plot components are displayed in a tree structure.

To add a viewport to an individual plot:

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **Edit** menu, click **Configure Plot Layout**.
3. The **Configure Plot** dialog box will open (Figure J.9).

4. From **Edit** menu, click **Add Viewport**. A new viewport will be added to the bottom of the tree.

5. You now need to add data from one of the other viewports to your new viewport. If you do not add data, the viewport will not be saved. Select a curve from one of the existing viewports, using the down move arrow, move the curve to the new viewport.

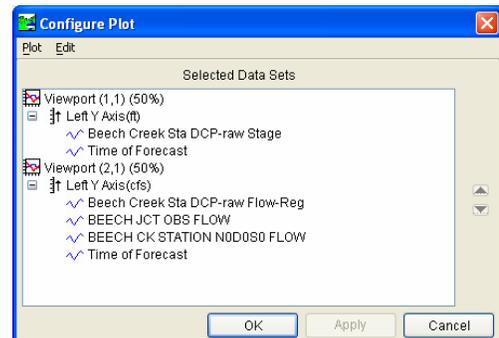


Figure J.9 **Configure Plot Dialog Box**

6. For example (Figure J.10), from Viewport (2,1), select **BEECH JCT OBS FLOW**. The down move arrow on the right-side of the **Configure Plot** dialog box becomes active. Click the down move arrow, the selected curve moves to the new viewport (Viewport (3,1)).

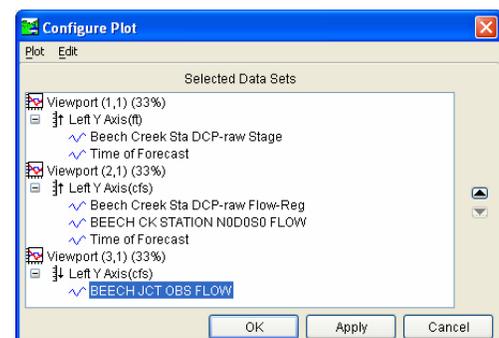


Figure J.10 **Added Viewport with Data**

7. Click **Apply**, the plot will now have an additional viewport that displays the curve that was moved.
8. Click **OK**, the **Configure Plot Editor** (Figure J.10) will close, and your plot will display the changes that were made.

Shortcut Menus

When you want to edit a specific property of a plot without using the **Individual Plot Properties** dialog box (see Figure J.7, page J-8), you can use individual plot property dialog boxes instead. To access these dialog boxes, select the **Pointer/Selector** tool, right-click on the element of the plot that (see in Figure J.2, page J-3) you want to edit, from the shortcut menu that appears, click **Edit Properties**.

Edit Title Properties

To add a title to an individual plot:

1. Right-click on the **Plot** window where the title is displayed or would be displayed (Figure J.11).

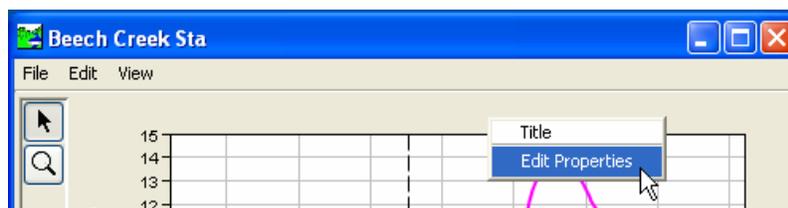


Figure J.11 Plot Title Shortcut Menu

2. From the shortcut menu, click **Edit Properties**.
3. The **Edit Title Properties** dialog box will open (Figure J.12).

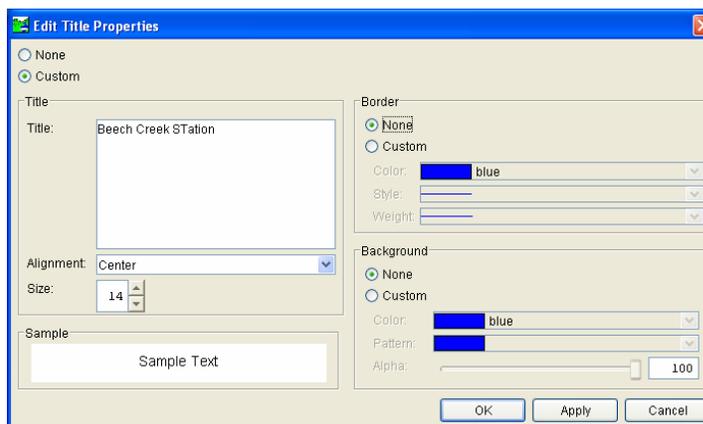


Figure J.12 Edit Title Properties Dialog Box

4. Click **Custom**, in the **Title** box, enter the title for the individual plot. From this dialog box you can also set the alignment, the size of the font, and add a border and background colors to the title.
5. Click **Apply**, the title will now be displayed on the plot.
6. Click **OK**, the **Edit Title Properties** dialog box (Figure J.12) will close.

Edit Marker Lines Properties

To edit the maker lines of an individual plot:

1. Right-click on the **Plot** window where the marker line is displayed (Figure J.13).

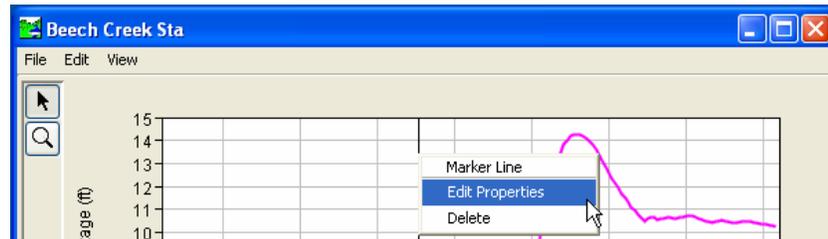


Figure J.13 Marker Line Shortcut Menu

2. From the shortcut menu, click **Edit Properties**.

3. The **Edit Marker Line Properties** dialog box will open (Figure J.14).

4. To change the style of the marker line, you need to work from the **Style** worksheet. This worksheet should be the default. You can change the color, style, and weight of the marker line. You can also add fill if you wish.

5. If you want to add a label to the marker line, click the **Label/Value** tab. From the **Label/Value** worksheet, you can add a label, the alignment of the label, and the placement of the label along the marker line.

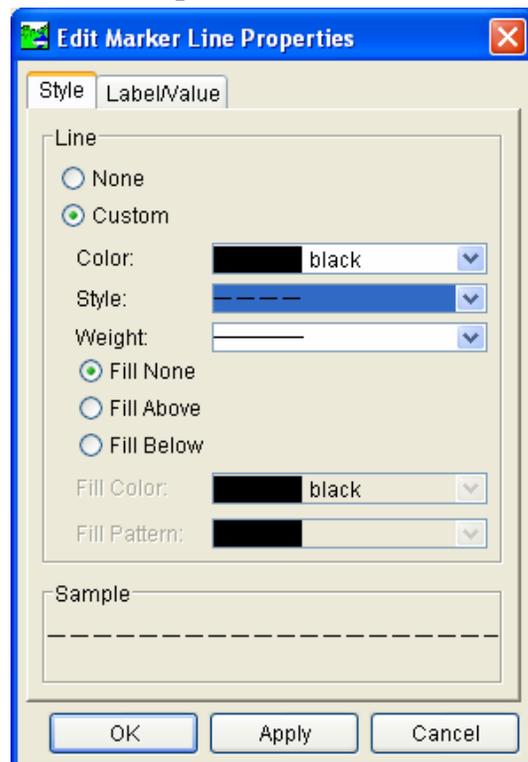


Figure J.14 Edit Marker Line Properties Dialog Box

6. If your plot has more than one viewport, you will have to set marker line properties for each viewport.
7. Click **Apply**, the changes to the marker line will now be displayed on the plot.
8. Click **OK**, the **Edit Marker Line Properties** dialog box (see Figure J.14, page J-11) will close.

Edit Curve Properties

To edit the curves of an individual plot:

1. Right-click on the **Plot** window where a curve is displayed (Figure J.15).

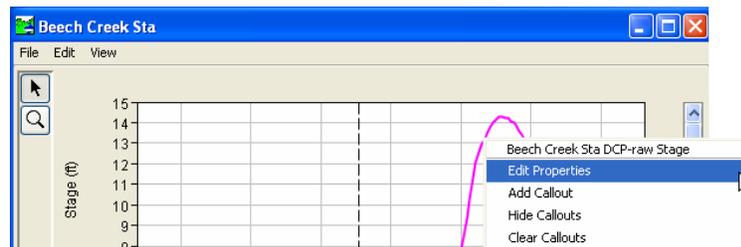


Figure J.15 Curve Shortcut Menu

2. From the shortcut menu, click **Edit Properties**.
3. The **Edit Curve Properties** dialog box will open (Figure J.16).

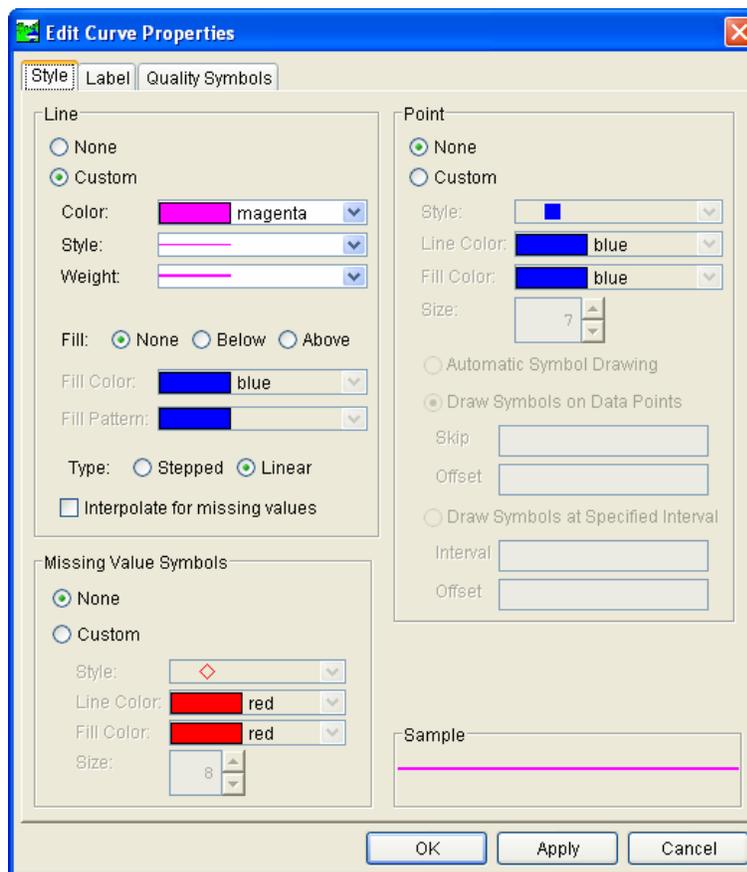


Figure J.16 Edit Curve Properties Dialog Box

4. To change the style of the curve, you need to work from the **Style** worksheet. This worksheet should be the default. You can change the color, style, and weight of the curve. You can also add fill if you wish.

5. The data that creates the curves in your plots could have quality attached to it. This means the data has been checked to see if what CWMS received is correct. If you want you can have the curves display their quality. Click **Quality Symbols** tab, from the worksheet you can set the symbol and color for each type of quality that is provided by CWMS.
6. If your plot has more than one curve, you will need to edit properties for each curve individually.
7. If your plot has more than one viewport, you will have to set curve properties for each viewport.
8. Click **Apply**, the changes to the marker line will now be displayed on the plot.
9. Click **OK**, the **Edit Curve Properties** dialog box (see Figure J.16, page J-12) will close.

To add a callout to a curve of an individual plot:

1. Right-click on the **Plot** window where a curve is displayed (see Figure J.15, page J-12).
2. From the shortcut menu, click **Add Callout**.
3. The **Add Callout** dialog box will open (Figure J.17).
4. Enter the callout you want in the **Callout Text** box.
4. Click **Apply**, the changes to the marker line will now be displayed on the plot.
5. Click **OK**, the new callout will now be displayed on the plot and the **Add Callout** dialog box (Figure J.17) will close.

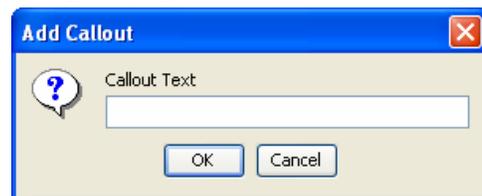


Figure J.17 Add Callout Dialog Box

Edit Axis Title Properties

To edit the appearance of axis titles for an individual plot:

1. Right-click on the **Plot** window where the axis titles are displayed (Figure J.18).

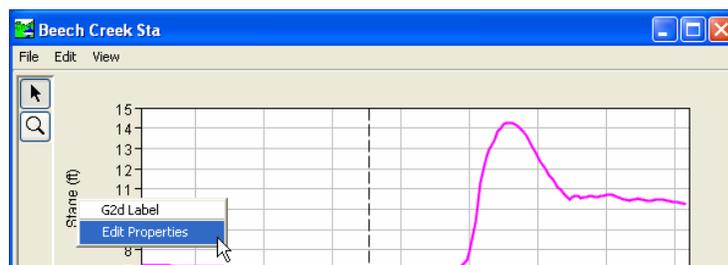


Figure J.18 Axis Title Shortcut Menu

- From the shortcut menu, click **Edit Properties**.
- The **Edit Label Properties** dialog box will open (Figure J.19).

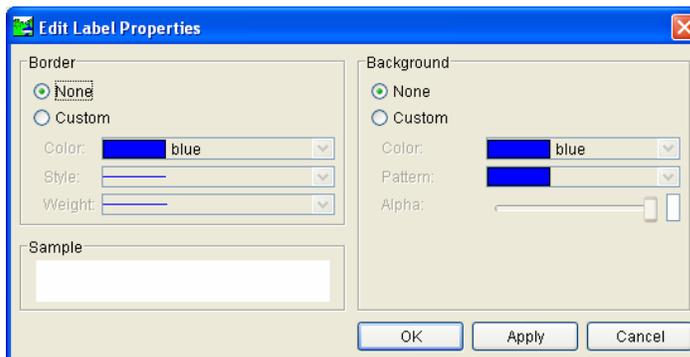


Figure J.19 Edit Label Properties Dialog Box

- To give an axis title a border, in the **Border** box, click **Custom**. You can set the color, style, and weight of the border around the axis title.
- To give an axis title a background color, in the **Background** box, click **Custom**. You can set the color and the pattern of the background for the axis title.
- Click **Apply**, the axis title will now be displayed with whatever changes you made.
- Click **OK**, the **Edit Label Properties** dialog box (Figure J.19) will close.

Edit Spacer Properties

To edit the spacer properties for an individual plot:

- Right-click on the **Plot** window where the spacer is (Figure J.20) located on the plot. Spacers are between viewports, on either side of each viewport, and the top of the plot.

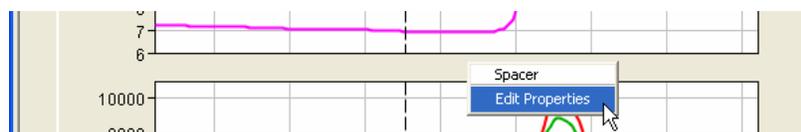


Figure J.20 Spacer Shortcut Menu

- From the shortcut menu, click **Edit Properties**.
- The **Edit Spacer Properties** dialog box will open (Figure J.21).
- Enter the size of the spacer in pixels in the **Size in Pixels** box.



Figure J.21 Edit Spacer Properties Dialog Box

- Click **Apply**, the changes you made to the spacer will appear on the plot.
- Click **OK**, the **Edit Spacer Properties** dialog box (see Figure J.21, page J-14) will close.

Edit Viewport Properties

To edit the viewports of an individual plot:

- Right-click on the **Plot** window where a viewport is displayed (Figure J.22).

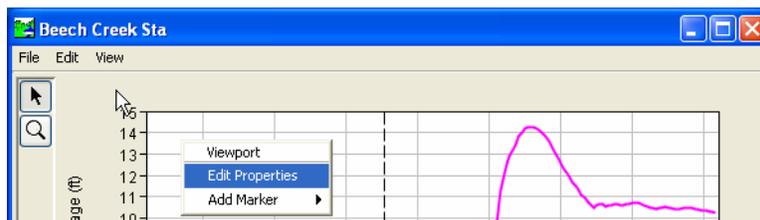


Figure J.22 Viewport Shortcut Menu

- From the shortcut menu, click **Edit Properties**.
- The **Edit Viewport Properties** dialog box will open (Figure J.23).

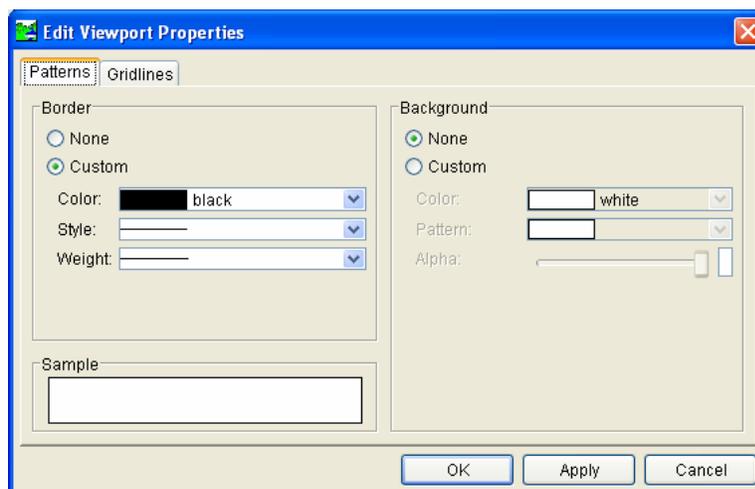


Figure J.23 Edit Viewport Properties Dialog Box

- To change the border or give a background color to a viewport, you need to work from the **Patterns** worksheet. This worksheet should be the default. Click **Custom**, from the **Border** box you can change the color, style, and weight of the viewport border.
- Still on the **Patterns** worksheet, click **Custom**, from the **Background** box you can select a color and pattern for the background of the viewport.
- If you want to change the gridlines of the viewport, click the **Gridlines** tab. The **Gridlines** worksheet is available (similar to Figure J.8, page J-8). To change the color and style of the X-axis gridlines, from the **Major X Grid** box, click **Custom**. From the **Color** list select the color you want. You can also change the style

of the grid from the **Style** list. You can also change the Y-axis from the **Major Y Grid** box. By default the minor gridlines for each axis is set to off, but by clicking Custom in each box you can turn the minor gridlines on for your plot.

7. If your plot has more than one viewport, you will have to set curve properties for each viewport.
8. Click **Apply**, the changes to the viewport will now be displayed on the plot.
9. Click **OK**, the **Edit Viewport Properties** dialog box (see Figure J.23, page J-15) will close.

Edit Axis Tics Properties

To edit the X-axis scale of an individual plot:

1. Right-click on the **Plot** window where the X-axis is displayed (Figure J.24).

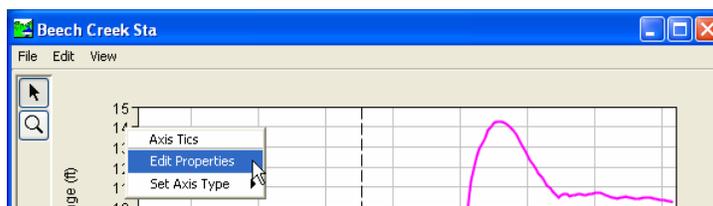


Figure J.24 Axis Tics Shortcut Menu

2. From the shortcut menu, click **Edit Properties**.
3. The **Edit Axis Properties** dialog box will open (Figure J.25).
4. To change the scale of the X-axis, you need to work from the **Scale** worksheet. This worksheet should be the default. The worksheet displays the default settings for the X-axis scale.
5. Still on the **Scale** worksheet, click the **Maximum** checkbox. You can enter a new maximum value for the X-axis.

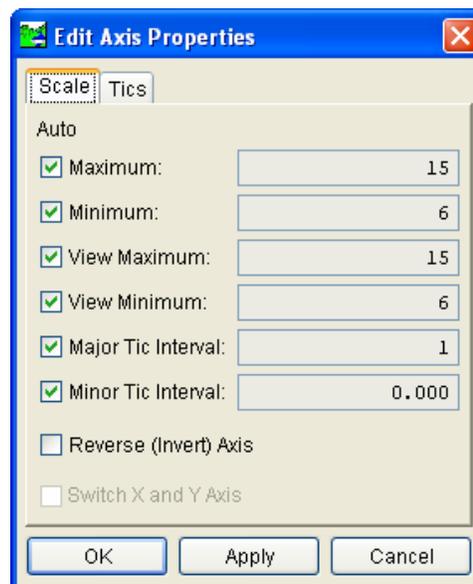


Figure J.25 **Edit Axis Tics Properties Dialog Box**

6. If you want to change the tic marks of the X-axis, click the **Tics** tab. By default major tic marks are selected with tic mark labels with a default color of black. You can add minor tics marks, do minor tic marks only, and change the color of the tic mark and tic mark label.

7. If your plot has more than one viewport, you will have to set axis ticks properties for each viewport.
8. Click **Apply**, the changes to the X-axis will now be displayed on the plot.
9. Click **OK**, the **Edit Axis Properties** dialog box (see Figure J.25, page J-16) will close.

Edit Legend Panel Properties

To edit the legend panel of an individual plot:

1. Right-click on the **Plot** window where the legend panel is displayed (Figure J.26).



Figure J.26 Legend Panel Shortcut Menu

2. From the shortcut menu, click **Edit Properties**.
3. The **Edit Legend Properties** dialog box will open (Figure J.27).

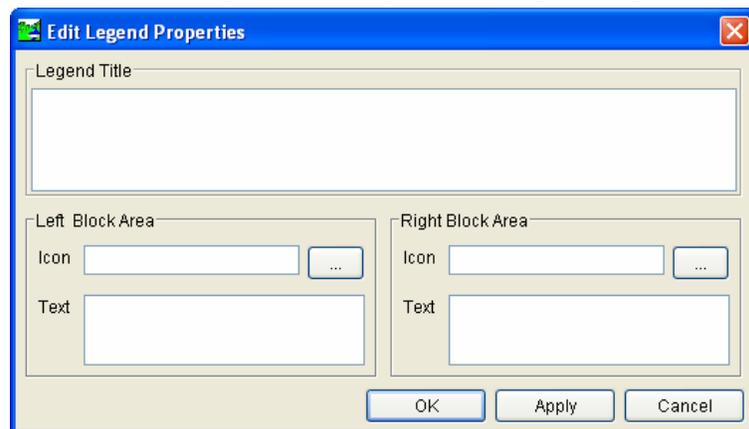


Figure J.27 Edit Legend Properties Dialog Box

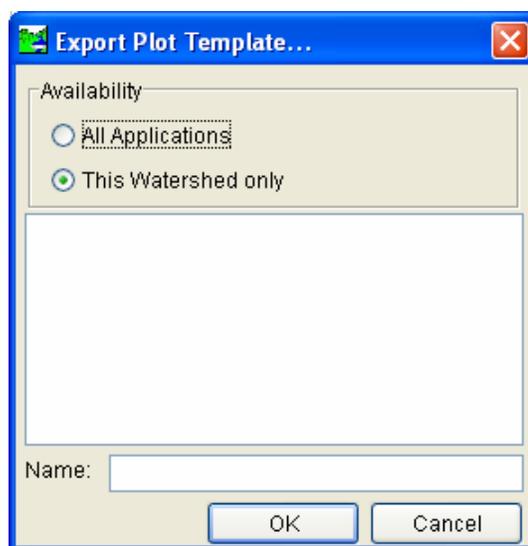
4. You can give the legend panel a title by entering information in the **Legend Title** box.
5. You can also add an icon and information to the left and right areas of the legend block. For example, if you want a description to display on the left side of the legend panel, in the **Left Block Area** group, in the **Text** box, enter the description information.
6. To add an icon, you need to enter the path and filename of icon to be displayed in the Icon box for either the left or right sides of the legend panel.
8. Click **Apply**, the changes to the legend panel will now be displayed on the plot.
9. Click **OK**, the **Edit Legend Properties** dialog box (see Figure J.27, page J-17) will close.

J.2.4 Exporting and Importing Templates

After you have customized a plot, you can save its settings as a template for use in other plots. Generally, you would use templates when scripting plots. For example, every day you generate a plot of flow, stage, and precipitation via a script, and then apply a template that has all of the correct formatting, such as viewport placement, size, line colors, and fills.

To create a template from a plot:

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **File** menu, click **Save Template**.
3. The **Export Plot Template...** dialog box will open (Figure J.28).
4. Specify whether you want the template to be available for **All Applications** or **This Watershed only**. Then enter a name for the template in the **Name** box.
5. Click **OK**, the **Save Template** dialog box will close, and the template will be saved.



To apply (import) a template you have created to another plot currently open:

Figure J.28 **Export Plot Template... Dialog Box**

1. Open a **Plot** window (see Figure J.1, page J-1).
2. From the **File** menu, click **Apply Template**.
3. The **Import Plot Template** dialog box opens, which is very similar to the dialog box in Figure J.28.
3. Specify whether you want the template to be available for **All Applications** or **This Watershed only**.
4. A list of available templates will display. Choose the template you want by clicking on its name.
5. When you select a template, its name will display in the **Name** box.
6. Click **OK** to apply the template to the current plot and close the dialog box.

APPENDIX K

Printing and Copying Data

Plots and tables in HEC-WAT offer detailed views of data and model results that you can print or copy and paste into other applications. In addition, you can print reports generated by the individual models.

K.1 Plots

Plots provide a graphical representation of your data. From the **Plot Window** (Figure K.1) you can view the plot, as well as print, save as a graphics file, copy the contents of the **Plot Window** to the clipboard, and save the properties of the plot to a template to be used by other plots. Following is an overview of the menu bar of the **Plot Window**. The commands available from the menus are:

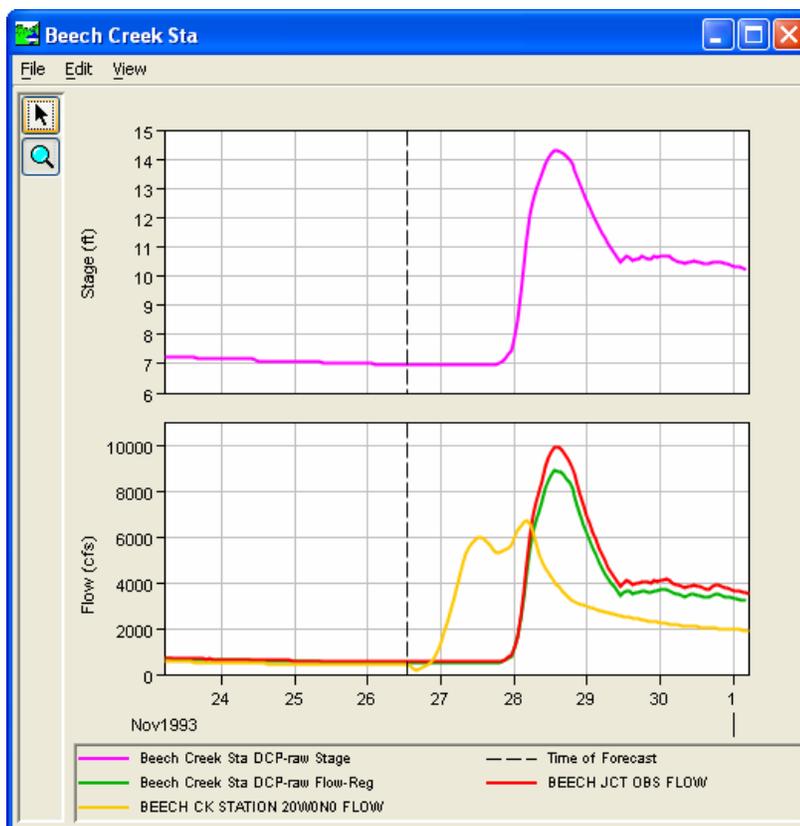


Figure K.1 Plot Window

- File** From this menu you can view the plotted data in a tabular format, save the plot as a graphics file, save a template, use a template, copy the plot to the clipboard, and print the plot. Available commands are: **Tabulate, Save As, Save Template, Apply Template, Copy to Clipboard, Print, Page Setup, Print Preview, Print Multiple,** and **Close.**
- Plot** From this menu you can customize the layout of an individual plot, and save a plot type. Available commands are: **Select Variables, Open Plot Type** and **Save Plot Type.**
- Edit** From this menu you can customize the plot. Available commands are: **Plot Properties, Configure Plot Layout, Default Line Styles,** and **Default Plot Properties.**
- View** From this menu you can have the plot window always on top of your desktop, and you can choose to use line styles. Available commands are: **Always On Top, Use Line Styles,** and **Zoom to all.**

The **Tools** appear in a toolbar on the left side of the **Plot** window (see Figure K.1, page K-1). The tools change the appearance of the mouse, as well as the functionality of the mouse:

 **Pointer/Selector Tool**

With the **Pointer/Selector Tool**, you can access shortcut menus that allow you to customize features of your plots using the plot editing tools.

 **Zoom Tool**

The **Zoom Tool** allows you to view data closely at a specific time. To zoom in, hold the mouse button down and outline the area you want to enlarge. To zoom out, click the right mouse button (right-click). The zoom out is done by a factor of two and positions the clicked location at the center of the display area.

K.1.1 Save As

The **Save As** command will allow you to save your plot to a graphics file. CWMS has four possible formats: Windows Metafile (*.wmf), Postscript (*.ps), JPEG (*.jpg, *.jpeg), and Portable Network Graphics (*.png).

To create a graphics file:

1. On the **File** menu, click **Save As**, the **Save** browser will open (Figure K.2).

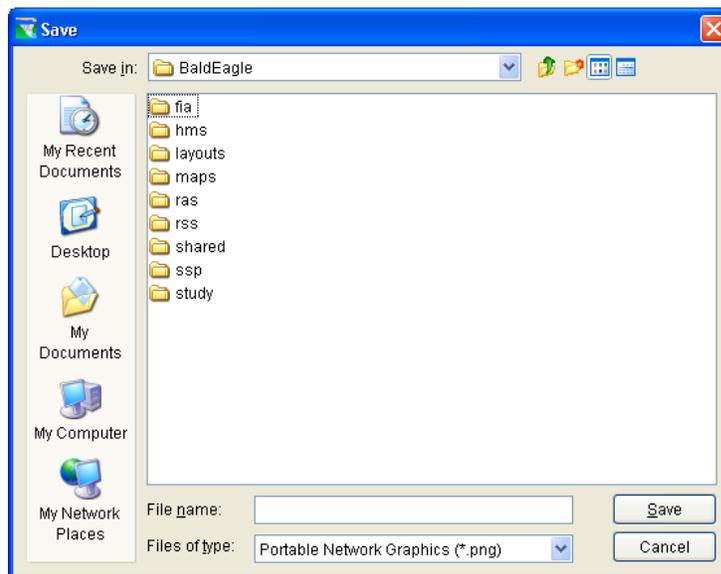


Figure K.2 **Save Browser**

2. Find the location where you want to save the graphics file.
3. Enter a name for the file in the **File name** box.
4. From the **Files of type** list, select the type of graphics file you wish to create.
5. Click **Save**, a file with the appropriate extension will be created in the selected location. The file will contain the contents of the **Plot Window** (see Figure K.1, page K-1).

K.1.2 Copy to Clipboard

The **Copy to Clipboard** command will copy the contents of the **Plot Window** to the clipboard. Once the copy is complete, you can paste the plot as an image into other applications.

K.1.3 Print Commands

The **Plot Window** (see Figure K.1, page K-1) provides the user with several different commands to setup the printing process and to print.

Print

The **Print** command opens a standard system **Print** dialog box (see Figure K.3, page K-4). From the dialog box you can select the printer, choose to

print to a file, and the number of copies to print. Click **OK**, the **Print** dialog box will close and the plot will print to the selected printer.

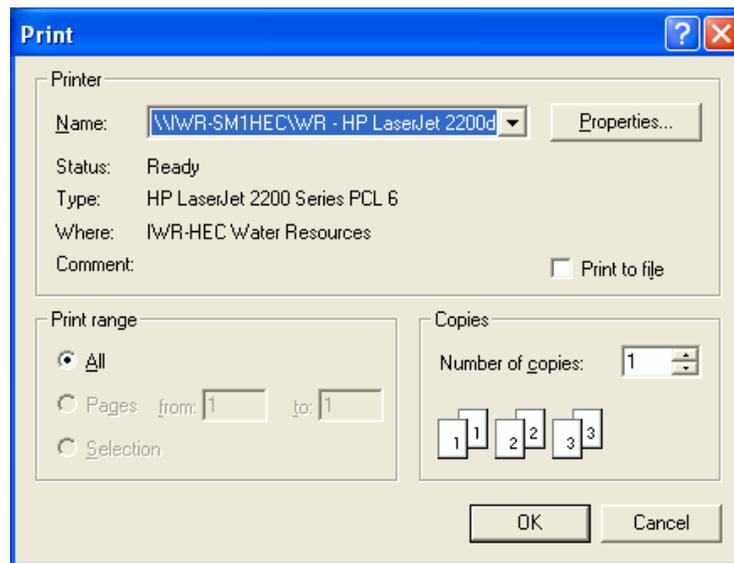


Figure K.3 Print Dialog Box

Page Setup

The **Page Setup** command opens the **Page Setup** dialog box (Figure K.4). When using this dialog box, you can setup the format of the printed page. Following is a list of the available options:

Orientation

By default, the page will be printed in **Portrait**. In addition, you can choose to print in **Landscape** or **Reversed** (does not work in the Beta version of the WAT).

Margins

The default margin settings are displayed in the **Margins** area of the **Page Setup** dialog box. If you want to

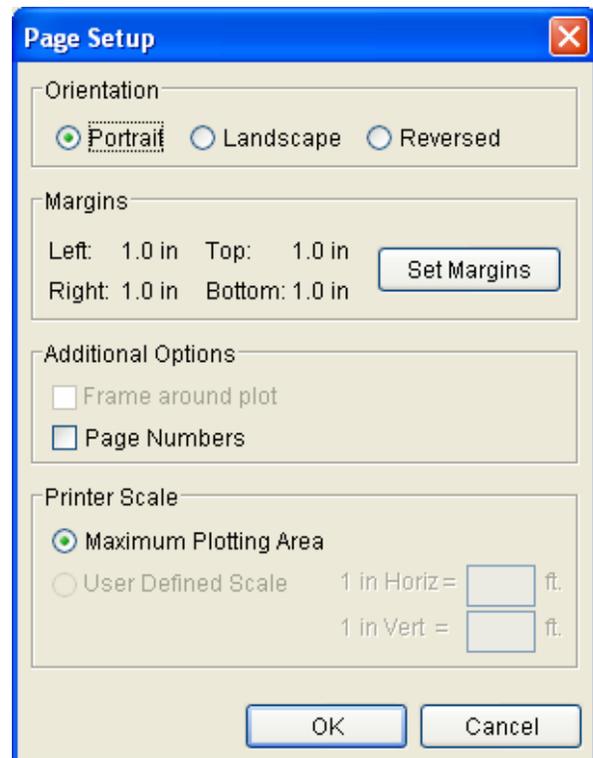


Figure K.4 Page Setup Dialog Box

set the margins, click **Set Margins**, the **Printer Margins** dialog box (Figure K.5) will open. From this dialog box, you can adjust the top, left, bottom, and right margins.

Additional Options

If you would like page numbers included on your printed page, select the **Page Numbers** check box (see Figure K.4, page K-4).

The **Frame around plot** option is not available in the Beta version of the WAT.

Printer Scale

The default option is **Maximum Plotting Area**, and in the Beta version of the WAT, is the only available option.

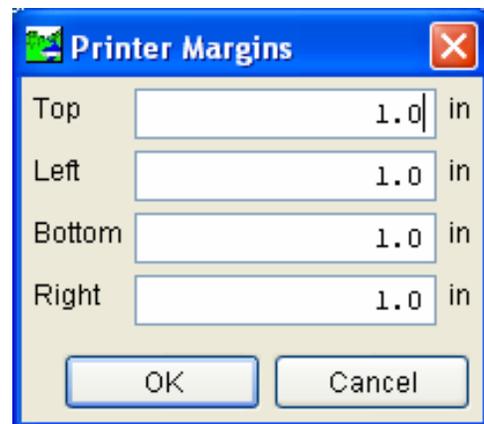


Figure K.5 Printer Margins Dialog Box

Print Preview

The **Print Preview** command opens the **Preview** dialog box (Figure K.6). From this dialog box, you can view the plot, adjust the scaling of the plot, and print the plot. The **Print** command automatically prints the plot to the default system printer.

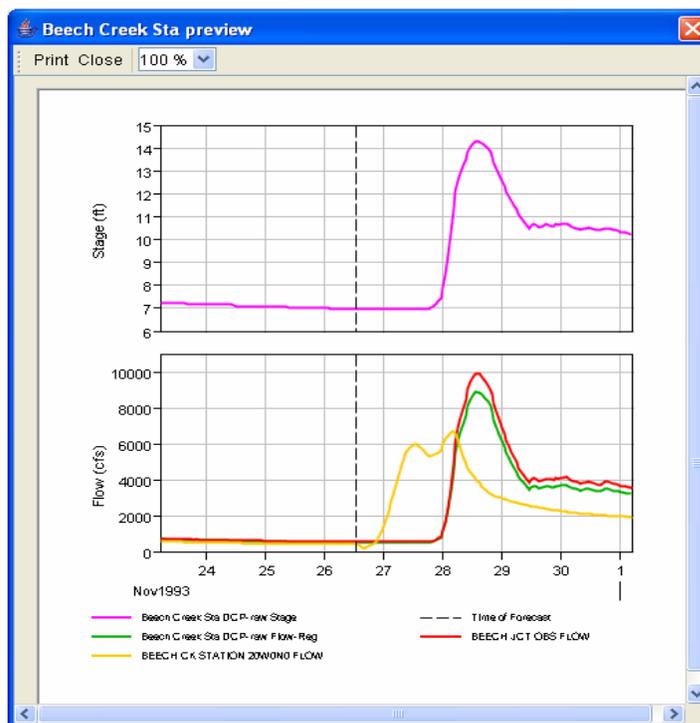


Figure K.6 Preview Dialog Box

Print Multiple

The **Print Multiple** command opens the **Print Multiple** dialog box (Figure K.7). To be able to print multiples plots you must have opened multiple individual plot windows. The open plots are listed in the

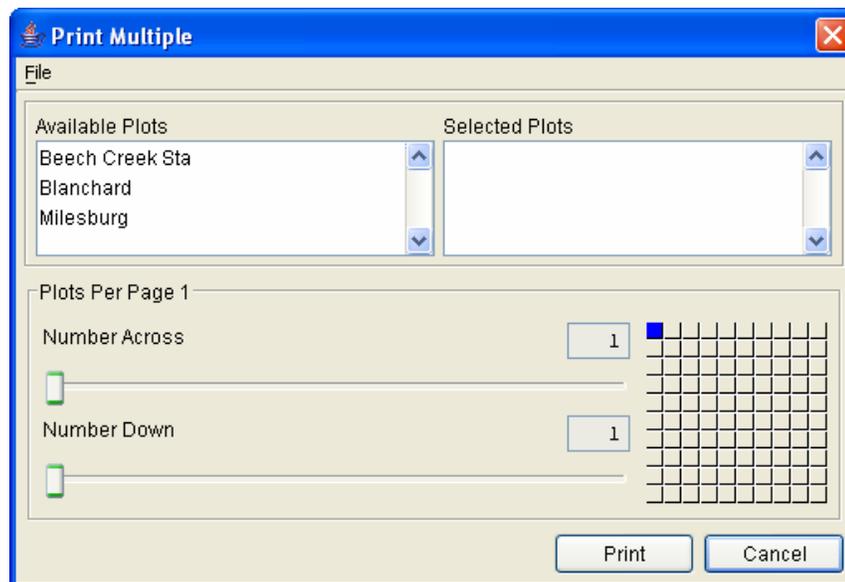


Figure K.7 **Print Multiple Dialog Box**

Available Plots list of the **Print Multiple** dialog box. To select plots to be printed on one page, double-click on a plot name in the **Available Plots** list. The plot name will move to the **Selected Plots** list. You can adjust the way the plots are arranged on a page, horizontally or vertically. Use the **Number Across** or **Number Down** sliders. The grid to the right of the sliders reflects your choices. From the **File** menu, the **Page Setup** and **Print Preview** commands are available.

K.2 Tables

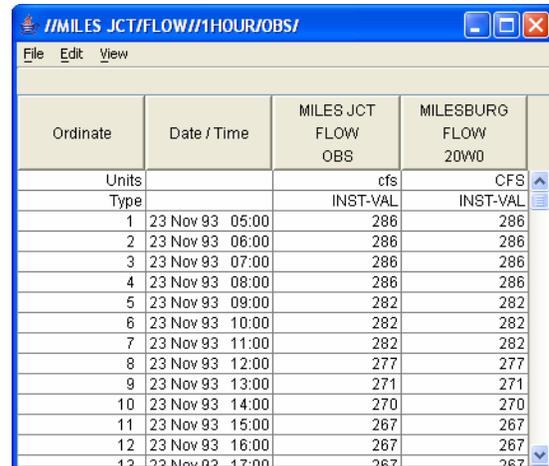
Tables provide a tabular format of your data. From the **Tabulate Window** (see Figure K.8, page K-7) you can view the data, as well as print the table, copy the selected contents of the **Tabulate Window** to the clipboard, adjust the display of the data, and save the data to an ASCII file. Following is an overview of the menu bar of the **Tabulate Window**. The commands available from the menus are:

- File** From this menu, you can print the data in a tabular format and view a plot of the data. Available commands are: **Print**, **Print Preview**, **Export**, **Plot**, and **Close**.
- Edit** From this menu, select data to be copied to the clipboard. Available commands are: **Copy**, **Select All**, **Find**, and **Compare data sets**.

View From this menu, you can control the appearance of the data displayed in the **Tabulate Window**.

Available commands are: **Commas, Date and Time Separately, Date with 4 Digit Years, Show Decimal Places**

(auto, 1 - 6), and **Show Missing As** (blank, -901.00, M, -M-).



Ordinate	Date / Time	MILES JCT FLOW OBS	MILESBURG FLOW 20W0
Units		cfs	CFS
Type		INST-VAL	INST-VAL
1	23 Nov 93 05:00	286	286
2	23 Nov 93 06:00	286	286
3	23 Nov 93 07:00	286	286
4	23 Nov 93 08:00	286	286
5	23 Nov 93 09:00	282	282
6	23 Nov 93 10:00	282	282
7	23 Nov 93 11:00	282	282
8	23 Nov 93 12:00	277	277
9	23 Nov 93 13:00	271	271
10	23 Nov 93 14:00	270	270
11	23 Nov 93 15:00	267	267
12	23 Nov 93 16:00	267	267
13	23 Nov 93 17:00	267	267

Figure K.8 **Tabulate Window**

K.2.1 Copying to the Clipboard

To copy data from the **Tabulate Window** (Figure K.8) to the clipboard, there are several ways. To use the **Copy** command from the **Edit** menu, you must first select the cells in the table you wish to copy to the clipboard. If you want the whole table, from the **Edit** menu choose **Select All**. If there is, only a certain area you wish to copy to the clipboard, from the table click and drag over the cells you wish to copy, your selection will be highlighted. With either method, then from the **Edit** menu choose **Copy**. The contents will then be copied to the clipboard you can paste the data into other applications. In addition, if you right-click on the table, a shortcut menu will appear which will also allow you to copy data to the clipboard.

K.2.2 Displaying Data

By default, data is displayed with commas and two decimal places. If you want to change the way the data is displayed, from the **View** menu there are several options. If you do not want commas displayed, from the **View** menu, click **Commas**.

For time series data the date and time are displayed in the following default format: ddmmmyy hhmm. You can change the way the date and time are displayed. From the **View** menu, click **Date and Time Separately**; the date and time are now displayed in two separate columns in the table. Another way is from the **View** menu, click **Date with 4 Digit Years**; the date and time now displays a four-digit year instead of a two-digit year.

Numbers by default are displayed with two decimal places. If you want to see more or less number of decimal places, from the **View** menu, point to **Decimal Places**, and click on the number (0 thru 6) of decimal places you would like displayed.

K.2.3 ASCII File

You can save the table of data to an ASCII file, right-click on the table. From the shortcut menu, click **Export**, the **Table Export Options** dialog box will open (Figure K.9). From this dialog box, you can set certain options for the ASCII file.

You can set the delimiter for the file from the **Field Delimiter** list. The hardwired choices are **TAB** (default), **SPACE**, **COMMA**, and **COLON**. You also make choices on whether the file contains fixed width columns, strings are set in quotes, whether to include column headers in the file, include gridlines in the file, and whether to include the a title in the file.

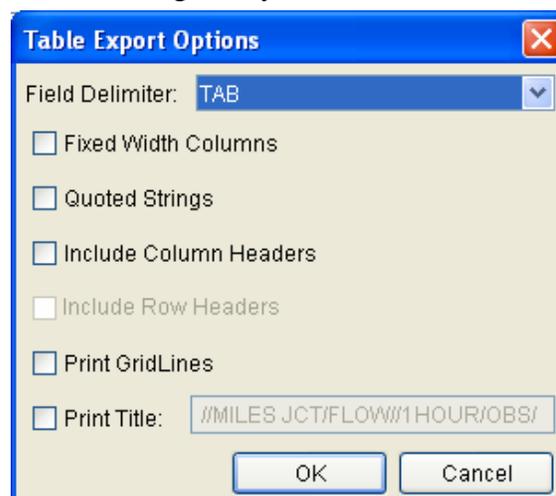


Figure K.9 Table Export Options Dialog Box

When you have all of your options set, click **OK**. A **Save** browser will open. Find the location where you want the file saved, and provide a filename. Click **Save**, the file will be created without an extension, since this is an ASCII file, you might want to give the file an extension of .txt.

K.2.4 Printing

The **Print** command opens the **Properties** dialog box will open (see Figure K.10, page K-9). From this dialog box, you can set up the format of the table for output.

From the **Page Worksheet** (see Figure K.10, page K-9), you can set the orientation; fit the table to a page, and whether to include the entire table or only a selection. In addition, you also choose to print the table in ASCII, add headers, add background color to headers (non-ASCII option), and add gridlines.

If you want to add header or foot information to the table report, click the **Header/Footer** tab (Figure K.10). From the **Header/Footer Worksheet** enter header or footer information.

The title of the table report defaults to the pathname tag associated with the data. If you want to change this title, click the **Table Title** tab. From the **Table Title Worksheet** enter or change the title, and decide if you want the title to print on each page of the report. When you have everything set, click **Print**, a standard system **Print** dialog box will open.

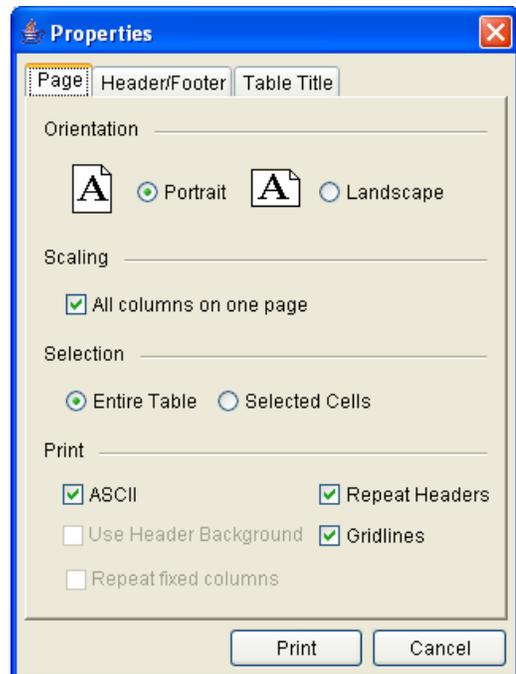


Figure K.10 Properties Dialog Box

To preview you table report, right-click on the table, from the shortcut menu click **Print Preview**. A dialog box similar to the **Properties** dialog box (Figure K.10) will open. Setup your options for the table report; click **Preview**, and the **Print Preview** dialog box (Figure K.11) will open. From this dialog box, you can view the table report, adjust the scaling of the report, and print the report. The **Print** command automatically prints the report to the default system printer.

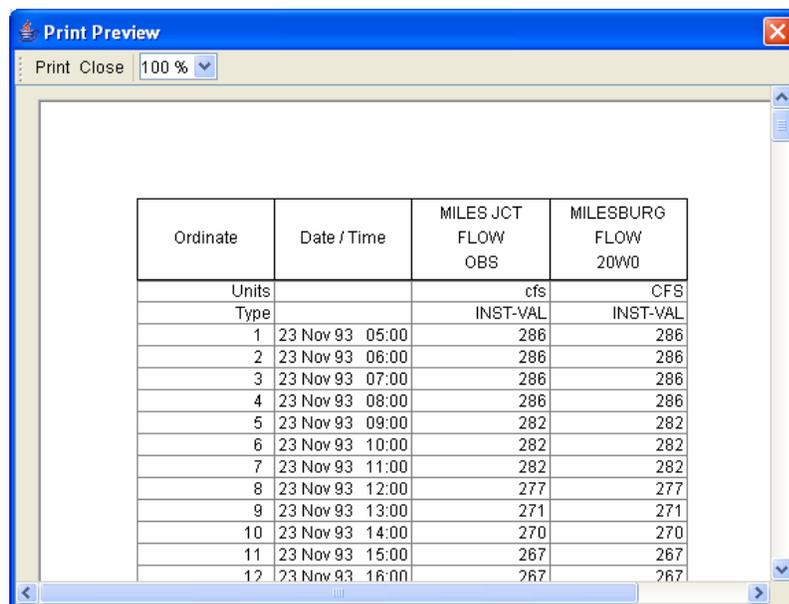


Figure K.11 Print Preview Dialog Box

K.3 Printing Reports from HEC-WAT

The printing of reports from the BETA version of the WAT are handled by the individual programs. In future version of the WAT, there could be WAT specific reports that will be printed.

Appendix L

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By using this program you voluntarily accept these terms and conditions. If you do not agree to these terms and conditions, uninstall the program and return any program materials to HEC (If you downloaded the program

and do not have disk media, please delete all copies, and cease using the program.)

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