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WinHSPF

Version 2.0

An Interactive Windows Interface to HSPF (WinHSPF)

User's Manual

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WinHSPF replaces the program NPSM developed for BASINS 1.0 and 2.0 by Tetratech, Inc. Many features of WinHSPF were inspired or influenced by that earlier product.

User Assistance and Technical Support

EPA's Office of Science and Technology (OST) provides assistance and technical support to users of WinHSPF. Technical support can be obtained at OST's Internet Home Page. WinHSPF users are encouraged to access OST's home page for information on new updates, answers to the most frequently asked questions, user tips, and additional documentation.

EPA OST's Internet home page address: http://www.epa.gov/ost/basins

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Abstract

Hydrologic and water quality modeling with the Hydrological Simulation Program-Fortran (HSPF) involves managing large volumes of data. Among that data are parameters describing watershed characteristics, which often are derived from Geographic Information Systems (GIS) layers such as subbasin boundaries and land uses. Other parameters specify simulation options within HSPF. All of these parameters are input to HSPF by means of a text file, known as the User Control Input (UCI) file, containing a series of tightly formatted records. The values on the records must be formatted precisely, and the records must themselves be arranged in a preordained order for HSPF to understand.

WinHSPF was designed as an interactive Windows interface to HSPF. WinHSPF assists the user in building UCI files from GIS data, especially data from the US Environmental Protection Agency's BASINS system. After the UCI file is built, WinHSPF is used to view, understand, and modify the model representation of a watershed. The Fortran program HSPF can be run from within WinHSPF. A given UCI file can be modified and saved by another name, thus creating model simulation scenarios. Within the BASINS system, WinHSPF is intended to be used in conjunction with the interactive program known as 'GENeration and analysis of model simulation SCeNarios', or GenScn. GenScn allows the user to analyze results of model simulation scenarios and compare scenarios.

Introduction

Purpose of Report

This manual assists both end users and system administrators with the interactive computer program WinHSPF. Following the introduction is a chapter entitled User's Guide. This chapter contains four sections. The first section is entitled User Interface. It provides guidance for navigating the graphical user interface. The next section includes an Overview of WinHSPF from a systems perspective. Included is information relating to the system hardware and software requirements, system architecture, and sample data provided. Following that section is a series of Tutorials designed to familiarize a user with getting around within WinHSPF. The last section of the User's Guide, Detailed Functions, provides more specifics about individual functions of modules of WinHSPF. This manual concludes with a list of references and an appendix containing descriptions of the four types of BASINS files used by WinHSPF.

Background

Use of the Hydrological Simulation Program-Fortran (HSPF) watershed model (Bicknell and others, 1997) traditionally involved using a text editor to build an input sequence to describe a watershed's physical and water management characteristics. For large, complex river basins, input sequences were often thousands of lines long when water quality was simulated in addition to the hydrology. The processes of building a new input sequence and making changes to an existing one were time consuming and complex. In addition, the physical abstraction of a watershed was not at all apparent from looking at the input sequence. It was difficult for a user to understand how the model representation of a watershed related to the watershed in the real world.

The development of WinHSPF came as a response to the need to make HSPF input sequences easier to build and modify. WinHSPF provides advanced interaction with the HSPF input sequence and graphical illustration of the model representation. WinHSPF was created for the US Environmental Protection Agency's BASINS system, although any HSPF user would benefit from its advanced input sequence modification functionality.

Capabilities and Uses

WinHSPF provides an interactive interface to HSPF in a Windows environment. WinHSPF may be used for creating a new HSPF input sequence or for modifying an existing HSPF input sequence. The program HSPF may be run from within WinHSPF. Input Sequences may be modified and saved under another name, thus creating simulation scenarios. WinHSPF also assists the user in building the necessary data sets and making the necessary modifications to the input sequence for hydrologic calibration using the United States Geological Survey's Expert System for the Calibration of HSPF (HSPEXP).

User’s Guide

This user’s guide provides:

- a description of how to use the forms and menus of the user interface;
- an overview of the system architecture, and sample data;
- a tutorial containing a set of lessons that shows the major features of WinHSPF; and
- a detailed description of the forms and menus for each major function in WinHSPF in (detailed functions).

User Interface

The majority of the user interface consists of standard Windows (95/98/NT/2000) components. All forms within the system are made up of varying numbers of menus, toolbars, buttons, lists, check boxes, radio buttons, command buttons, picture boxes, and text boxes. All mouse interaction is through the left mouse button. More detailed information on the objects that make up the forms may be found in the Windows on-line help. A few extensions to the Windows interface are used in WinHSPF, but these operate in a similar manner to Windows components.

Graphical User Interface Conventions

WinHSPF was developed for user interaction to take place through a graphical user interface (GUI). Screens are organized in a logical manner to minimize both user learning time and user mouse/keystroke effort. Information within WinHSPF is often organized in layers, with the most basic, important information being readily available and more detailed, less frequently used information being accessed through additional menus or buttons. Another way that information may be layered is through the use of overlaid tabs, with the most frequently used tabs on top of the stack.

WinHSPF was also designed to assist the user in keeping track of where they are in the system. This was done by labeling all of the sub forms with titles that indicate the task being performed. This labeling also confirms to the user that they got to the right place in the system after selecting a menu option or button. The label on the main form is updated to include the name of the project being run every time a project is opened.

Keyboard Shortcuts

To allow users the flexibility of not using a mouse, keyboard shortcuts have been provided to perform all of the functions throughout WinHSPF. Some controls, such as menus and buttons, may be activated by holding down the Alt key and then pressing the letter underlined in the control. Other controls may only be manipulated using keyboard shortcuts if the control has the "focus." Focus means that the control can receive keyboard or mouse input. Focus is indicated by a dashed line surrounding the control. When using the keyboard, the focus is changed from one control to the next by using the Tab key (a mouse sets the focus to the control on which it has clicked).

Menu titles may be activated by holding down the Alt key and then pressing the letter underlined in the desired menu title. Once a menu title has been activated (that is, pulled down), the desired menu item may be selected by pressing the underlined letter or by highlighting the item using the arrow keys and then pressing the Enter key. For example, to select the File:Open menu item, one would type ALT-FO.

Buttons may be activated in one of two ways. If a button caption has an underlined letter, holding down the Alt key and pressing the underlined letter will activate the button. A button may also be activated by setting the focus to the button and then pressing the Enter key.

In this picture, the **OK** button has a keyboard shortcut, indicated by the underline, so pressing Alt-O will activate the **OK** button as if it had been clicked with the mouse. The dashed line around the **Cancel** button indicates that button currently has focus, so pressing **Enter** will activate the **Cancel** button as if it had been clicked with the mouse. A button labeled **Cancel** can also be activated by pressing the **Esc** key.

Selection of list items is performed in different ways depending on the type of list. A scrollable list allows multiple items to be selected. To select items in a scrollable list, set the focus to the list, use the arrows to set the focus to the desired item, and then press the space bar to highlight the item. A drop-down list allows only one item from a list to be selected. To select the desired item from a drop-down list, set the focus to the list and use the arrow keys to highlight the desired item.

Selection of option buttons and check boxes may be made in two ways. If an option button or check box caption has an underlined letter, holding down the Alt key and pressing the underlined letter will select the item. Option buttons and check boxes may also be selected by setting the focus to them and using the arrow keys to highlight the desired item. For option buttons, this will automatically select the button. For check boxes, the space bar must be pressed to select the highlighted item.

If a form contains layered tabs of information, a tab may be moved to the front by holding down the Alt key and pressing the underlined letter in the caption of the desired tab.

Toolbars

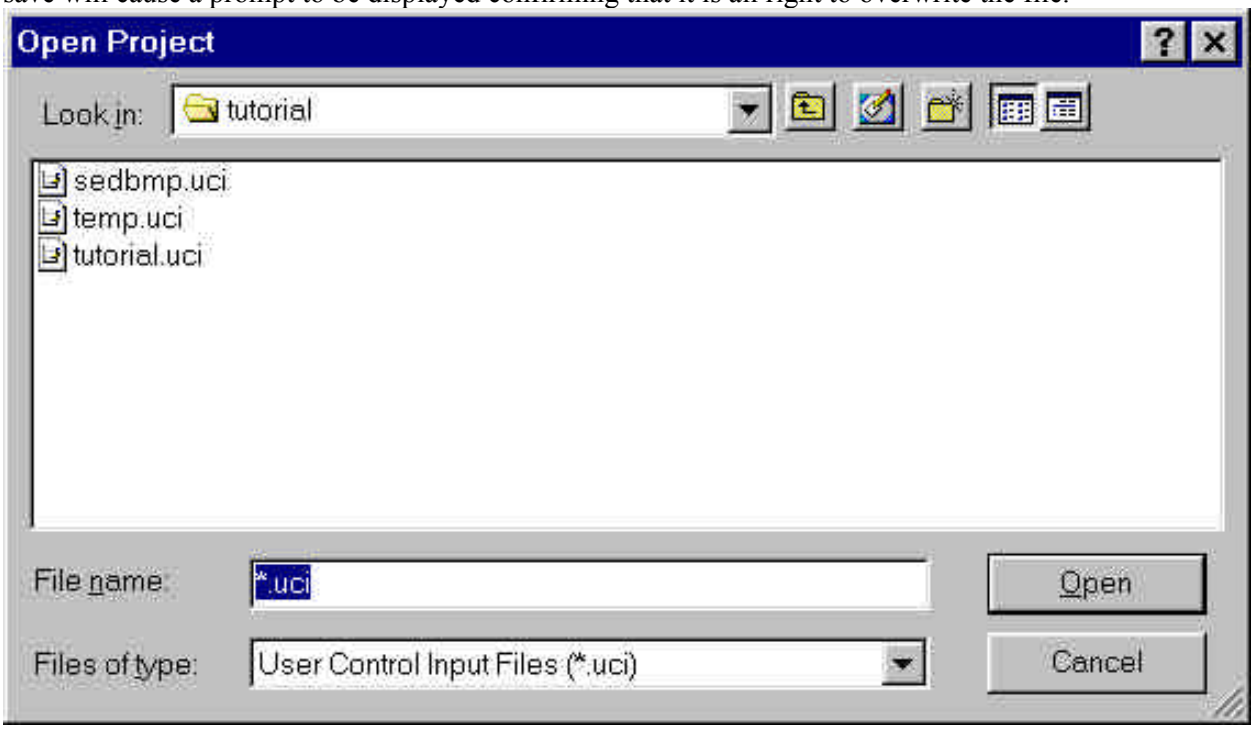
Toolbars are used in WinHSPF to provide quick access to the most frequently used functions. When applicable, the toolbars are located in close proximity to the control(s) with which their functions are associated. This allows a single click of a nearby button to perform a function, rather than moving to the top of the form to pull down a menu title and select a menu item. The toolbar buttons contain graphical images to assist the user in recalling what each button does. Additionally, toolbar buttons contain tooltips, which provide a text description of each button when the mouse pointer is held over the button for a brief moment.

Common Dialogs

Some interactions that are routinely performed in the Windows interface are handled using common dialogs. These are forms that have consistent interfaces for routine tasks. The user will then be familiar with the form each time one of these tasks are performed. Within WinHSPF, the tasks performed using common dialogs are retrieving or saving a file.

In WinHSPF, the user is frequently prompted for file names when saving or retrieving a file. The list at the top of the form (labeled either **Save in** or **Look in**) displays the current directory path. Use of the pull-down arrow on this list allows the user to move to any directory above the current one. Directories below the current one are displayed in the large middle box. The desired directory is selected by double clicking on it. The buttons to the right of the top list are used for (from left to right) moving up one directory level,

viewing the root desktop directory, creating a new directory (or folder), and specifying whether to display a standard or detailed list of the directories and files contained in the current directory. The middle box also displays any existing files of the file type specified. The file type specification is made in the list at the bottom of the form (labeled either **Save as type** or **Files of type**). The **File name** text box is used to enter the name of the file. Clicking on a file listed in the middle box will put the name of the file in the **File name** box. A file is selected either by double clicking a file name in the middle box or by filling in the **File name** box and clicking the **Save** button or the **Open** button. Selecting an existing file during a save will cause a prompt to be displayed confirming that it is all right to overwrite the file.



Help System

There are various levels of Help within WinHSPF and they may be accessed in different ways. The Help menu title on the main WinHSPF form has two menu items: About and Contents. The About item is used to display a summary of the version of WinHSPF being run. The Contents item is used to bring up a window that allows the user to move throughout the entire WinHSPF help file. The user may move through the help file by using the hierarchical structure or the index of help topics.

Context-sensitive access to the WinHSPF help file is provided through the F1 key. Pressing the F1 key from any form will display the relevant topic in the help file.

An additional level of help that pertains to HSPF is also available. This help information is available when editing a table of the HSPF UCI file. Help will be displayed that pertains to the model parameter being edited.

System Overview

This section includes information relating to the system hardware and software requirements, downloading the program and documentation, architecture, special files, and sample data.

System Requirements

WinHSPF requires a computer running Windows 95/98, Windows NT Version 4.0 or higher, or Windows 2000. The minimum platform configuration is a Pentium or equivalent processor running at 200 megahertz with 64 megabytes of memory, at least 100 megabytes of free disk space, and display resolution of at least 1024 x 768. For optimal performance, a Pentium II processor running at 400 megahertz or faster with at least 128 megabytes of memory, 100 megabytes of free disk space, and display resolution of 1280x1024 is recommended. A color printer is also recommended.

Obtaining WinHSPF

WinHSPF may be obtained through the internet by accessing the US Environmental Protection Agency's BASINS page. From this page follow the instructions for downloading the software and installing it on your machine. The manual, containing the same text and figures found in the help file, is included with the software.

Architecture

Object design was key in development of WinHSPF. An object was created to store all of the information that is normally contained within the UCI file. This UCI object is accessible throughout WinHSPF, and enables the software to easily access model parameter values. All of the data traditionally stored in the UCI file are now stored in the UCI object in memory. When the user accesses an existing UCI file, the UCI file is read and translated into the UCI object. WinHSPF then uses this UCI object throughout the program. When the UCI information is saved, the contents of the UCI object are translated back into the UCI file format.

The HSPF model code was compiled into a dynamic link library (dll) for access by WinHSPF. A small set of subroutines was developed to interface between the Visual Basic code and the existing HSPF Fortran routines. Similarly, the timeseries data objects within WinHSPF use some calls to the Watershed Data Management (WDM) Fortran library of subroutines for time-series management. This scheme allowed the well-tested and well-documented WDM code to be preserved.

BASINS Files

WinHSPF uses a series of files from BASINS for creating a new project. These files are intended to be produced using the BASINS GIS interface, but since they are text files, they may be built manually. Once a new project has been created, these files will no longer be needed by the project.

The following sections provide detailed descriptions of each of these files and their contents. For examples of these files, see BASINS File Samples within the Appendix. The following is a list of the files:

- Watershed File - *.wsd
- Reach File - *.rch
- Channel Geometry File - *.ptf
- Point Sources File - *.psr

Watershed File

The Watershed File has a .wsd extension. This file contains information related to the amount of each land use contributing to each reach. This file is written from BASINS and is used in creating a new WinHSPF project.

The Watershed File is a space-delimited ASCII file, with one or more spaces used to separate fields. Each record of the file contains the following information:

- LU Name (land use name, used as LSID in PERLND/IMPLND GEN-INFO table)
- Type (1=impervious/2=pervious, used to specify PERLND vs IMPLND)
- Watershed-id (used to connect each land use to a reach)
- Area (in acres, used as area factor in SCHEMATIC block)
- Slope (used as SLSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)
- Distance (in ft, used as LSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)

An example of the Watershed File is found in the Watershed File section of the Appendix.

The Slope and Distance fields are derived from the fields ‘Slo1’ and ‘Len1’, respectively, in the Subbasins shape file. These values are computed during watershed delineation.

Reach File

The Reach File has an .rch extension. This file contains information related to each reach and the connections between reaches. This file is used in creating a new WinHSPF project.

The Reach File is a space-delimited ASCII file. Each record of the file contains the following information:

- Rivrch (reach id)
- Pname (reach name, used as RCHID in RCHRES GEN-INFO table)
- Watershed-ID (used to connect each reach with associated land segments)
- HeadwaterFlag
- Exits (number of exits, used as NEXITS in RCHRES GEN-INFO table)
- Milept
- Stream/Reservoir Type (S-stream/R-reservoir, used to set LKFG in RCHRES GEN-INFO table)
- Segl (segment length in miles, used as LEN in RCHRES HYDR-PARM2 table)
- Delth (delta h in ft, used as DELTH in RCHRES HYDR-PARM2 table)
- Elev
- Ulcsm
- Urcsm
- Dscsm (downstream reach id, used to establish connectivity for SCHEMATIC block)
- Ccsm
- Mnflow
- Mnvelo
- Svtnflow
- Svtnvelo
- Pslope
- Pdepth
- Pwidth

- Pmile
- Ptemp
- Pph
- Pk1
- Pk2
- Pk3
- Pmann
- Psod
- Pbgdo
- Pbgnh3
- Pbgbod5
- Pbgbod
- Level

Many of the fields in this file are not used by WinHSPF. Those fields that are used by WinHSPF are noted above.

An example of the Reach File is found in the Reach File section of the Appendix.

Channel Geometry File

The Channel Geometry File has a .ptf extension. This file contains information related to the channel cross sections and lengths for each reach. This file is used in creating the FTABLES for a new WinHSPF project.

The Channel Geometry File is a space-delimited ASCII file. Each record of the file contains the following information:

- Reach Number
- Length (ft)
- Mean Depth (ft)
- Mean Width (ft)

- Mannings Roughness Coeff.
- Long. Slope
- Type of x-section
- Side slope of upper FP left
- Side slope of lower FP left
- Zero slope FP width left (ft)
- Side slope of channel left
- Side slope of channel right
- Zero slope FP width right (ft)
- Side slope lower FP right
- Side slope upper FP right
- Channel Depth (ft)
- Flood side slope change at depth
- Max. depth
- No. of exits
- Fraction of flow through exit 1
- Fraction of flow through exit 2
- Fraction of flow through exit 3
- Fraction of flow through exit 4
- Fraction of flow through exit 5

An example of the Channel Geometry File is found in the Channel Geometry File section of the Appendix.

Point Sources File

The Point Sources File has a .psr extension. This file contains information related to point source dischargers in the watershed, the pollutants output and the loading rates. This file is used in creating point source time-series data sets in the project WDM file.

The Point Sources File is a space-delimited ASCII file. The first record of the file contains an integer number of point source dischargers. Following this line is a blank line, followed by a header line. Then the next n lines, where n is the number of point source dischargers, contain the following information:

- Facility Name
- Npdes
- Cuseg
- Mi

The following line is blank, followed by a header line. The rest of the file consists of a series of records containing the following information:

- Ordinal Number
- Pollutant
- Load (lbs/hr)

An example of the Point Sources File is found in the Point Sources File section of the Appendix.

Sample Data

Sample data have been provided with the WinHSPF installation package for learning and demonstration purposes. No assumptions are to be made concerning the accuracy of the data, including the HSPF User Control Input (UCI) file that might be created from this test data.

Tutorial

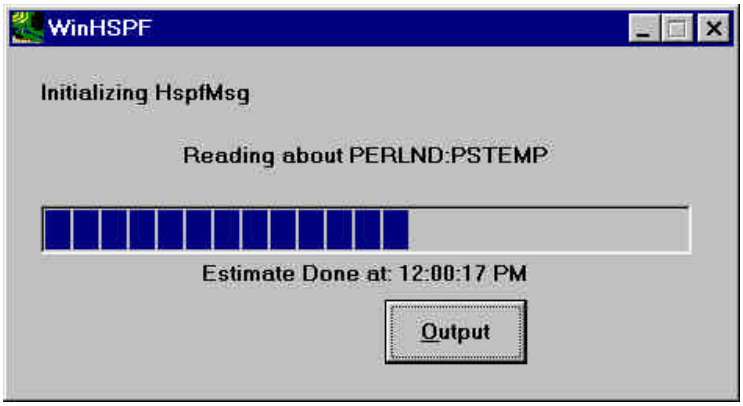
This section presents detailed examples illustrating the use of WinHSPF. The most effective way to use this section is by running WinHSPF and working through the lessons. This assumes that WinHSPF and its associated example data have been installed on your computer. For instructions on how to obtain and install WinHSPF, see the Obtaining WinHSPF section.

- Lesson 1 shows how to build a new UCI file from using the files output from the BASINS HSPF option.
- Lesson 2 shows how to open any existing UCI file in WinHSPF.
- Lesson 3 shows how to execute the HSPF Model and review the results.
- Lesson 4 shows how to specify timeseries to be output from the simulation.
- Lesson 5 shows how to change HSPF parameters and save the changes as a new scenario.
- Lesson 6 shows how to model a watershed management practice.
- Lesson 7 shows how to add point source data to a simulation from a variety of data sources.
- Lesson 8 shows how to modify the specified meteorological data contributing to each model segment.

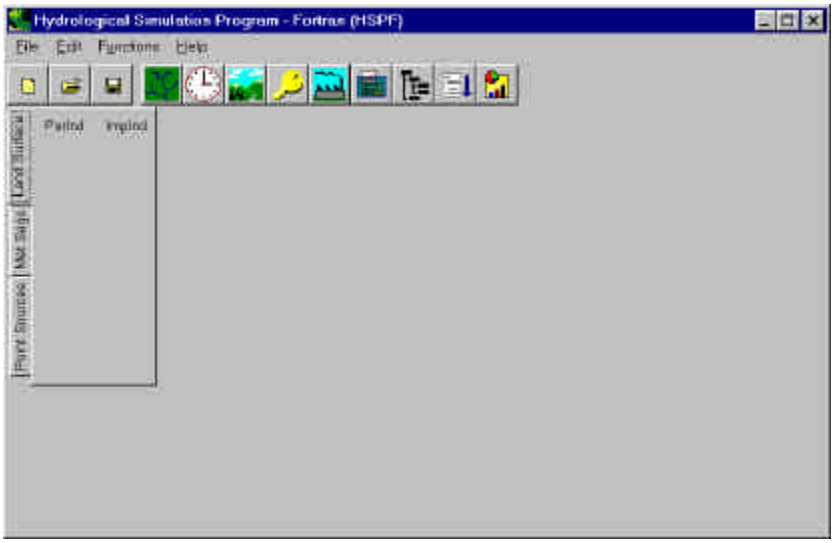
Lesson 1: Creating a New Project

Creating a new WinHSPF project means creating a new UCI file, since all WinHSPF project information is stored in the UCI file. When using WinHSPF from the BASINS system, the user will automatically enter WinHSPF at the **Create Project** window. When using WinHSPF apart from the BASINS system, the user will have to choose **Create** from the **File** menu or click on the icon on the toolbar to enter the **Create Project** window. Whichever way WinHSPF is started, the **Create Project** feature assumes that the user has created a set of intermediate files from BASINS (.wsd, .rch, .psr, and .ptf) that transfer data from the BASINS GIS interface to WinHSPF.

As WinHSPF starts, an initialization process begins, during which the contents of several files are read into memory, including the files 'HspfMsg.mdb' and 'starter.uci'. The progress will be visible in the status window.

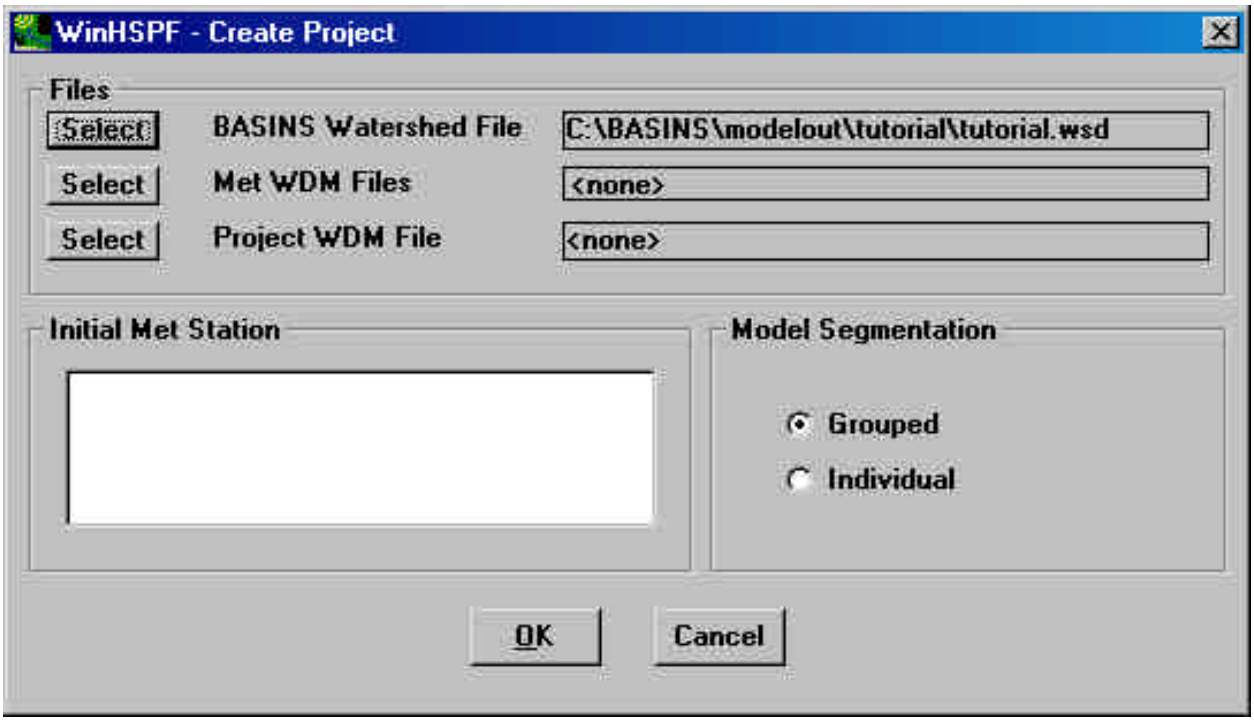


After initialization is complete, either one of two windows will appear, depending upon the way WinHSPF was started. If the user has started WinHSPF independently from BASINS, the **Hydrological Simulation Program - Fortran (HSPF)** window, the main WinHSPF window, appears.



The user should select the **File** menu and then choose the **Create** option. At this point the window entitled **WinHSPF - Create Project** will appear.

If coming from BASINS the user is immediately taken to the **WinHSPF - Create Project** window.



The **Create Project** window contains **Select** buttons for three types of files, a list for selecting a met station, and a set of radio buttons for choosing between two land surface segmentation options. The first type of file available for selection is the BASINS Watershed File. When coming from BASINS, the text box next to this name will already be filled in with the name of the '.wsd' file for the current BASINS project. The second type of files that can be selected are the Met WDM Files. Up to 3 met WDM files can be selected. These files generally reside in the 'met_data' folder, but actually any other WDM file could be referenced as a met WDM file. The third type of file is the Project WDM File. This file will contain the point source inputs to the model as well as any output time series from the HSPF simulation.

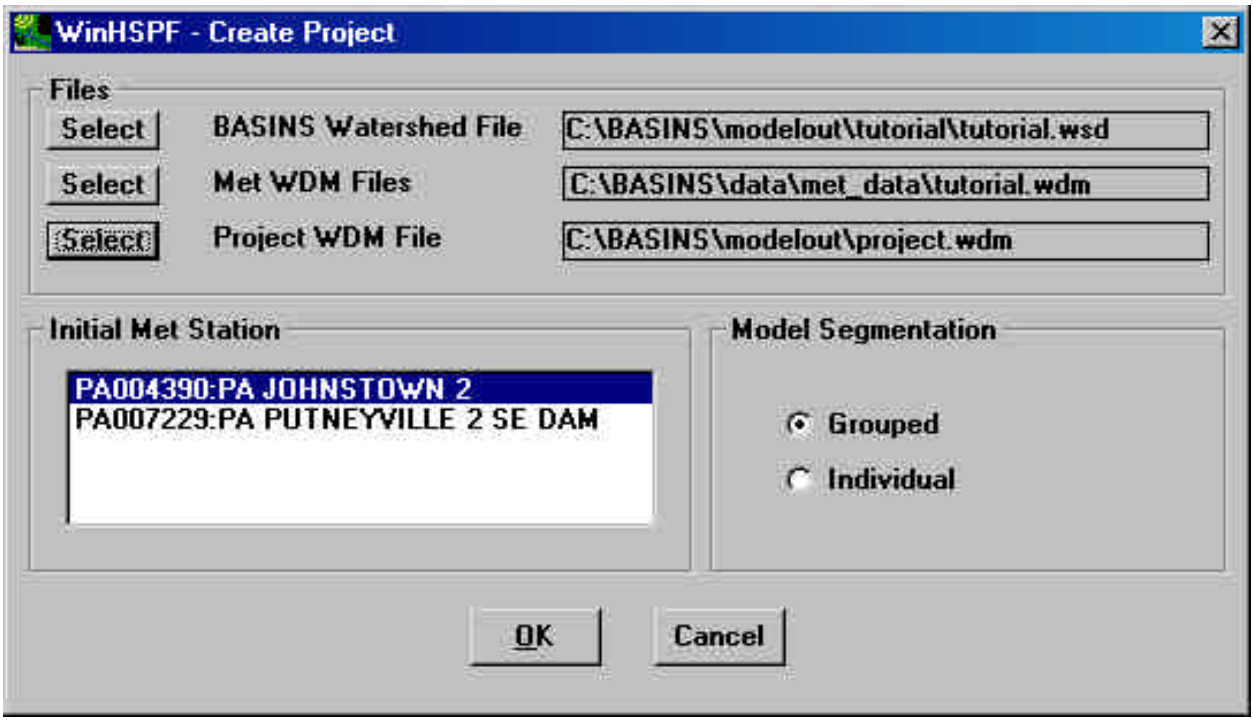
If the box next to **BASINS Watershed File** does not contain a file name, select tutorial.wsd from the 'tutorial' subdirectory. To do this, click the **Select** button next to the **BASINS Watershed File** text, and in the following file dialog, select the 'tutorial.wsd' file. Click the **Open** button, and the name of this file will appear in the **BASINS Watershed File** box in the **Create Project** window.

Next, select tutorial.wdm from the 'met_data' subdirectory as the Met WDM File. The file name will now appear in the box next to **Met WDM Files**. Then select project.wdm from the 'modelout' subdirectory as the **Project WDM File**. If this file does not already exist, type the name in the file name box and it will be created .

Once one or more met WDM files are specified, the **Initial Met Station** list will be populated with the identifier corresponding to met stations available for use in the new HSPF project. One item from this list should be selected in order to have some met data included in the HSPF simulation. (After the new

project has been created other met stations may be added through the WinHSPF interface.) Leave the first option in this list selected for this tutorial.

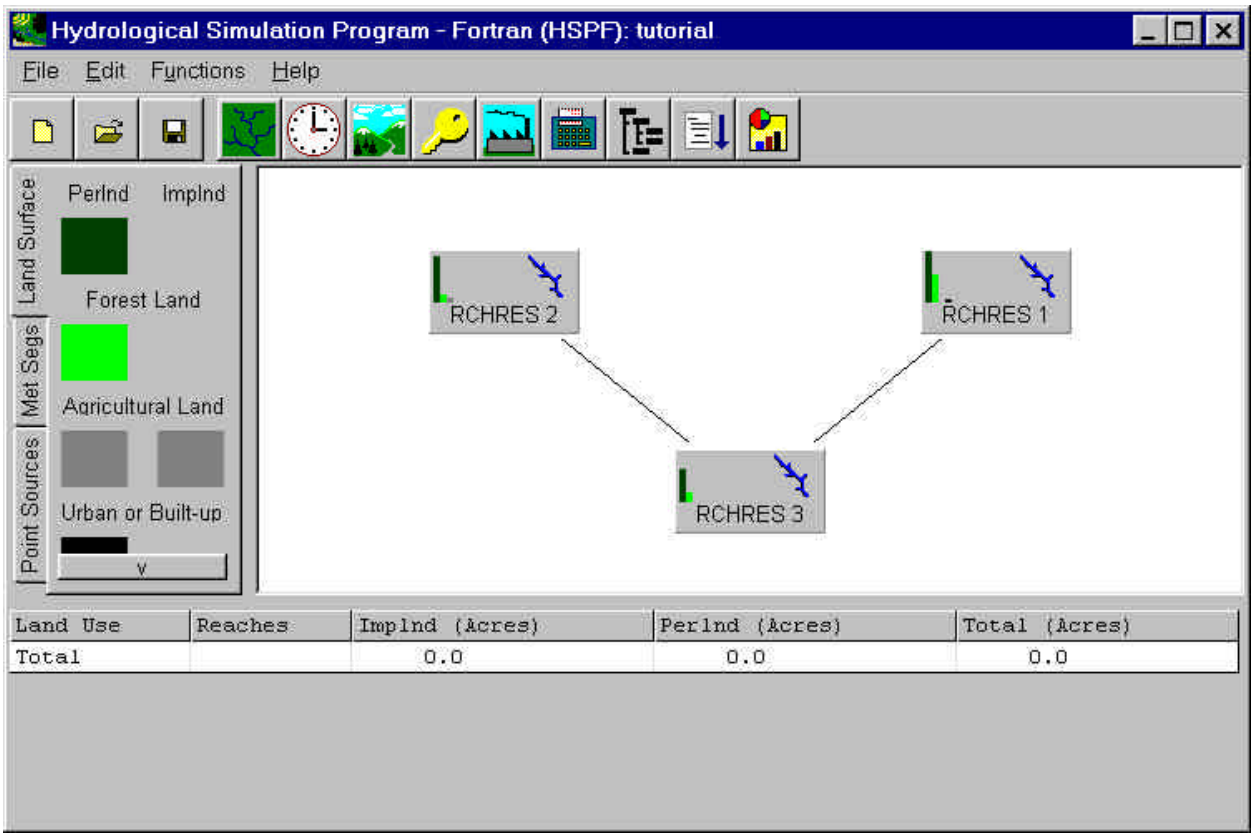
In the **Model Surface Segmentation** radio buttons, the **Grouped** option creates a single model segment (one PERLND/IMPLND per land use) for all collective subbasins, and the **Individual** creates a single model segment for each subbasin. For example, assume the watershed delineation contains three subbasins, and each subbasin contains a land use called 'Forest'. Using the Grouped option will result in one 'Forest' PERLND, say PERLND 101, contributing to each of the three delineated reaches. Using the Individual option, on the other hand, will result in three 'Forest' PERLNDs, say PERLND 101, PERLND 201, and PERLND 301, with each of these three PERLNDs contributing to one delineated reach. For this tutorial leave the selection set to **Grouped**.



Once the user has specified all of the information required in the **Create Project** window, click the **OK** button. Doing so will call the algorithms that build the new UCI file. The new UCI file is written to the BASINS project folder containing the .wsd file. Portions of the UCI file are created using the .rch, .psr, and .ptf files created when the **New HSPF Project** option was selected in the BASINS GIS interface.

Data sets are created in the project wdm file for the point sources included in the .psr file. The units of the data in these sets are lbs/hour for all constituents except flow, which is in cfs. For each point source data set, the scenario attribute is set to OBS-PT, and the location attribute is set to RCH plus the reach number. These attributes are used by the WinHSPF Point Sources tool to identify point source data sets.

Initial values for some parameters important to HSPF hydrology calibration are extracted from the 'starter.uci' and deposited into the new UCI file. After the UCI is created the main WinHSPF window appears. A schematic diagram of the watershed appears in the main WinHSPF window.

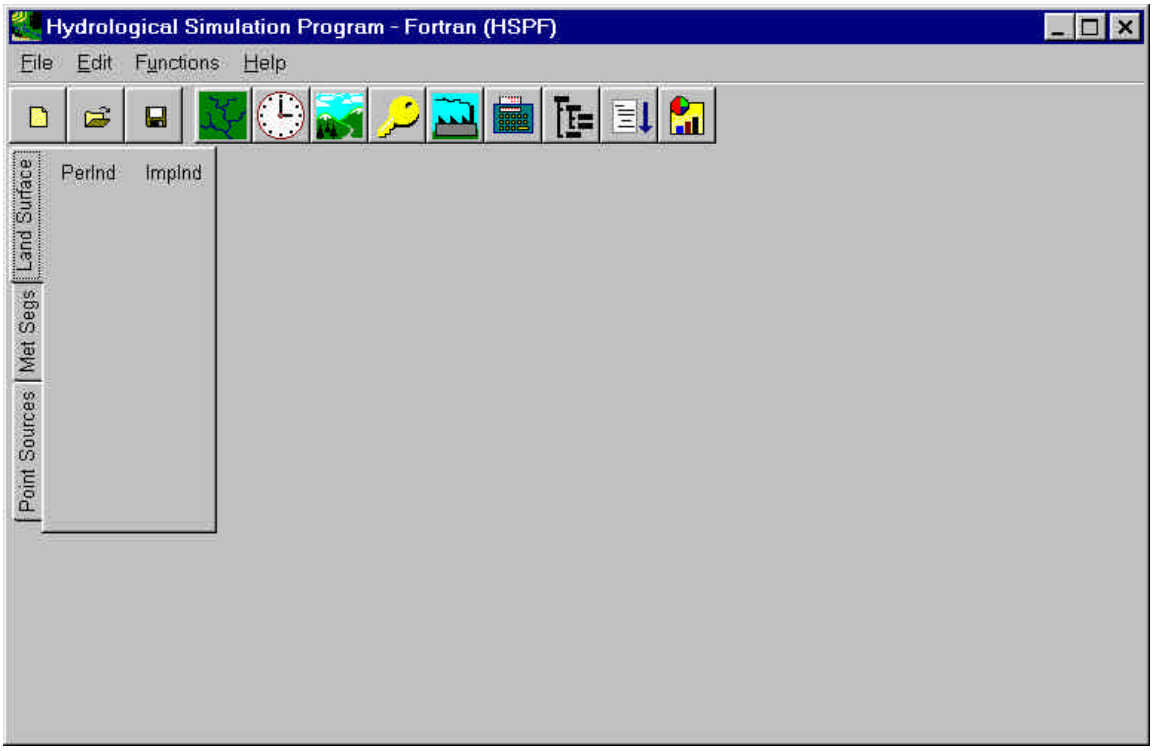


Once the UCI file creation process is complete, the set of files from the BASINS GIS interface (.wsd, .rch, .psr, and .ptf) are no longer used.

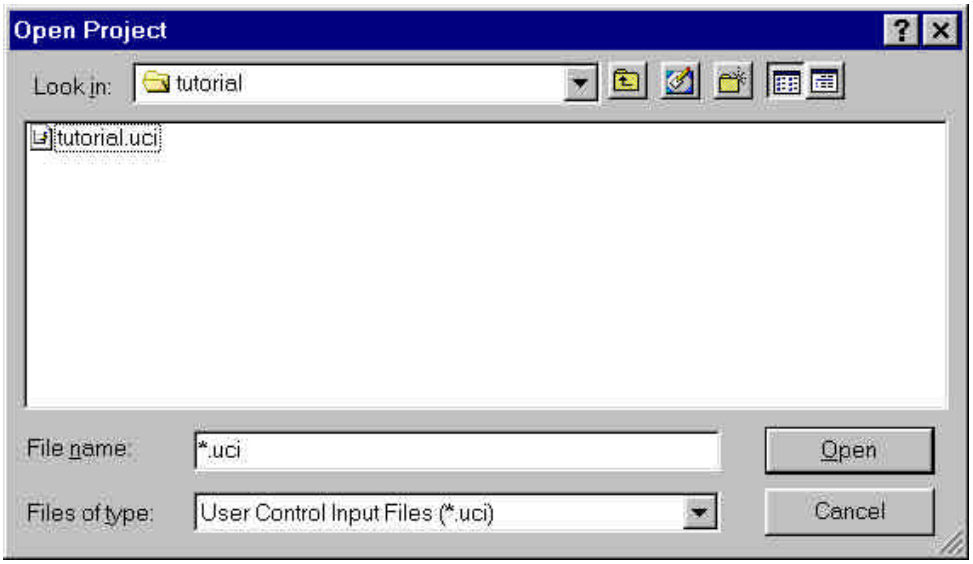
Lesson 2: Opening an Existing Project

Opening an existing WinHSPF project means opening an existing UCI file. Any valid UCI file may be opened by WinHSPF.

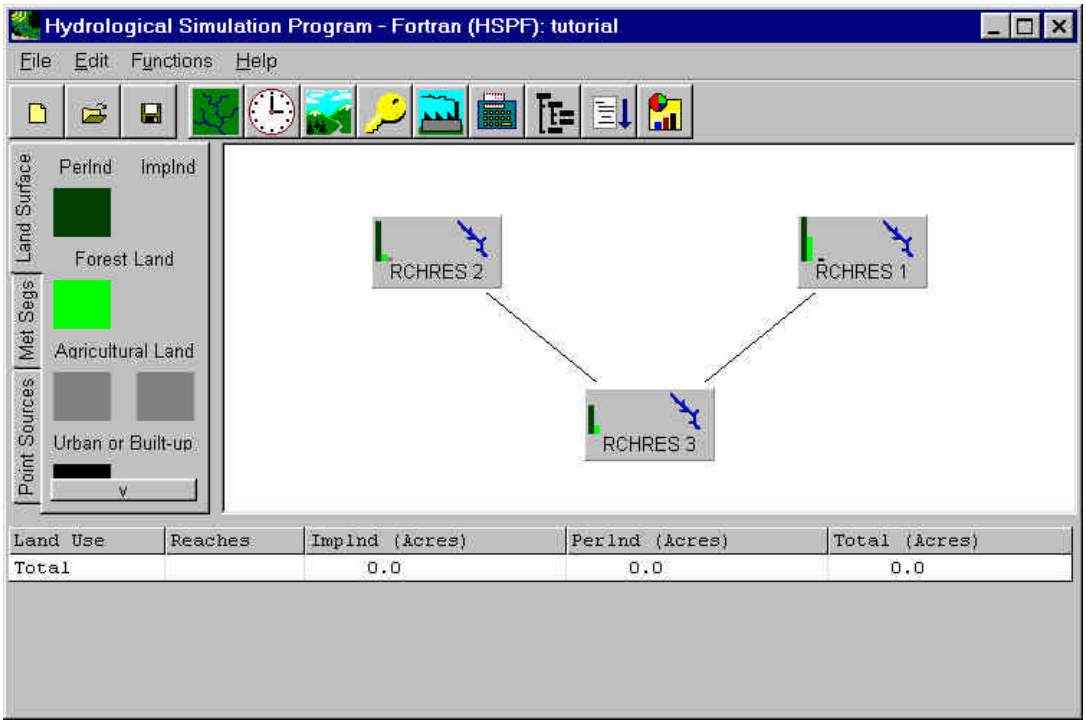
As WinHSPF starts, an initialization process begins, during which the contents of several files are read into memory, including the files 'HspfMsg.mdb' and 'starter.uci'. The progress will be visible in the status window. After initialization the main WinHSPF window appears, entitled **Hydrological Simulation Program - Fortran (HSPF)**.



To open an existing UCI file, choose **Open** from the **File** menu or click the icon on the toolbar. In the **Open Project** dialog select the tutorial.uci file from the 'tutorial' subdirectory then click the **Open** button.

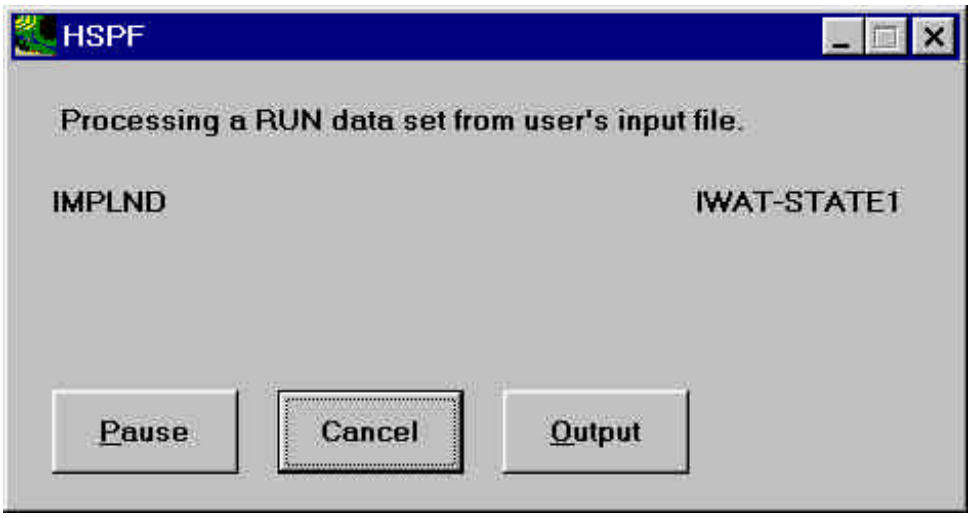


As a UCI file is opened, a status window will provide information related to the progress of reading and interpreting the UCI file. The status window will minimize after the UCI has been processed. A schematic diagram of the watershed will appear in the main WinHSPF window.

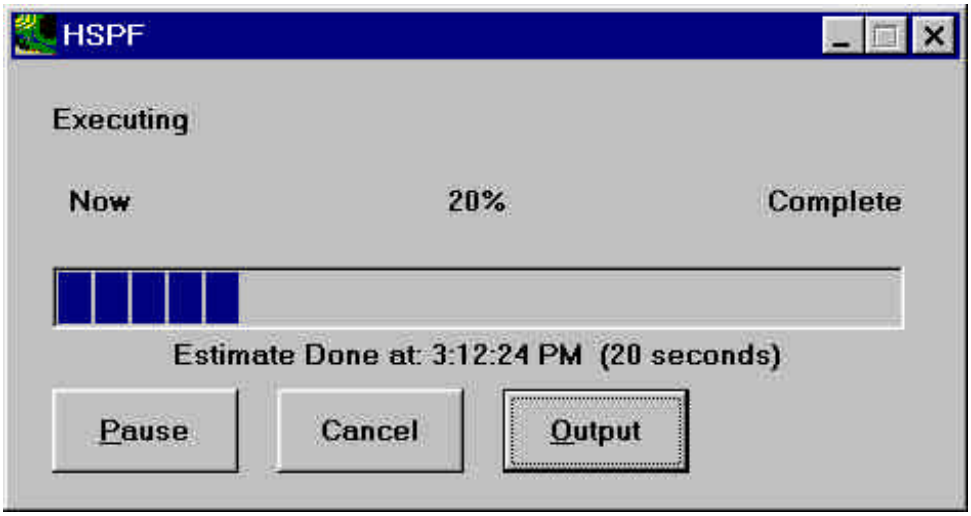


Lesson 3: Executing the HSPF Model

Once a project has been created or opened in WinHSPF, running the HSPF model is simple. From the **Hydrological Simulation Program - Fortran** window, either select the **Functions:Run** menu item or click the icon on the toolbar. Once the user clicks this button, HSPF begins reading and interpreting the UCI file.

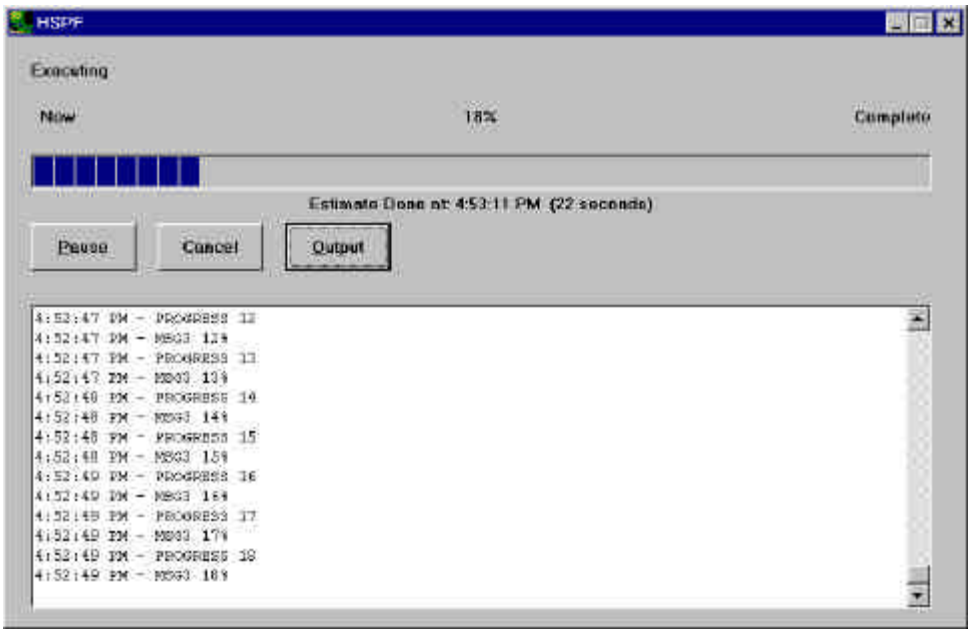


After this interpretation phase is complete, a status window will appear, showing the progress of the simulation.



Once the simulation is complete, the status window will disappear.

In case of error during the execution of HSPF, look at the contents of the status window. More detailed messages may be found by clicking the **Output** button in the status window.

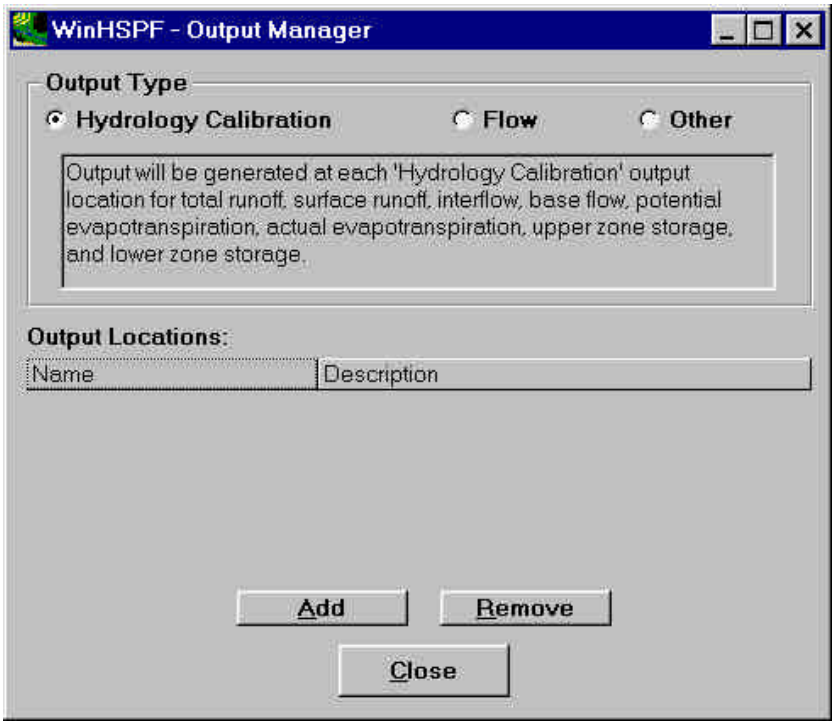


Also be sure to check for run interpreter error messages, which would be written to the HSPF echo file. For a project created with WinHSPF, the echo file should be in the same folder as the UCI file. The echo file name will consist of the base name of the project followed by a '.ech' extension.

Lesson 4: Specifying Output Timeseries

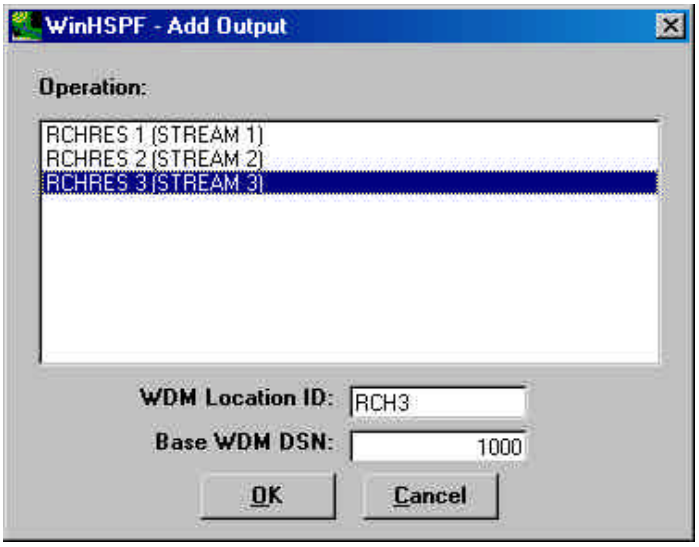
WinHSPF output timeseries are stored in data sets in the Project WDM File. Output data sets associated with one UCI file are tagged with a common attribute, so that WinHSPF can identify which data sets are associated with a particular UCI file. This WDM attribute is known as the scenario name; it is also used in GenScn to identify timeseries of a common scenario.

WinHSPF has two ways to specify output timeseries. The first way is through the Output Manager. The **Output Manager** is accessed either by choosing the **Functions:Output** menu option or by clicking the icon on the toolbar. The Output Manager window will appear containing a set of radio buttons and a list of output locations. The radio buttons are used to specify which of the three types of output to view. Clicking on one of the radio buttons produces a list of locations where that output has been specified.

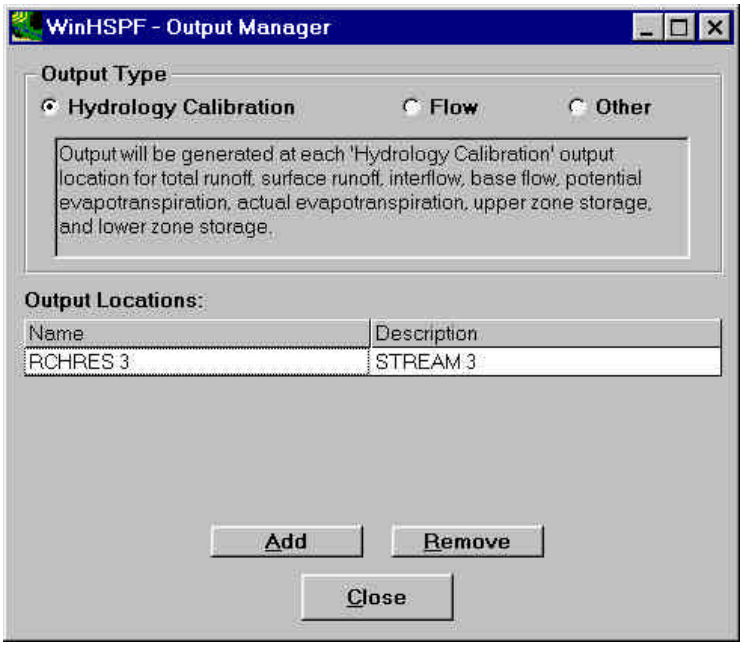


The first output type is Hydrology Calibration. This button will already be selected when entering the Output Manager. Underneath the radio buttons is a text box explaining which output timeseries will be generated during the HSPF model run. There are eight output timeseries required by the Expert System for HSPF Hydrology Calibration, known as HSPEXP. The list below the text box will be empty when running this tutorial, because by default no hydrology calibration locations are specified. Adding calibration locations to this list is accomplished by clicking on the **Add** button. Click this button. A window will be produced containing a list of available calibration locations, i.e. the reaches of the watershed, along with two text fields. Choose 'Rchres 3' from the list. The WDM Location ID will be used in GenScn for the user to specify locations for analysis. Enter 'RCH3' or up to eight characters of

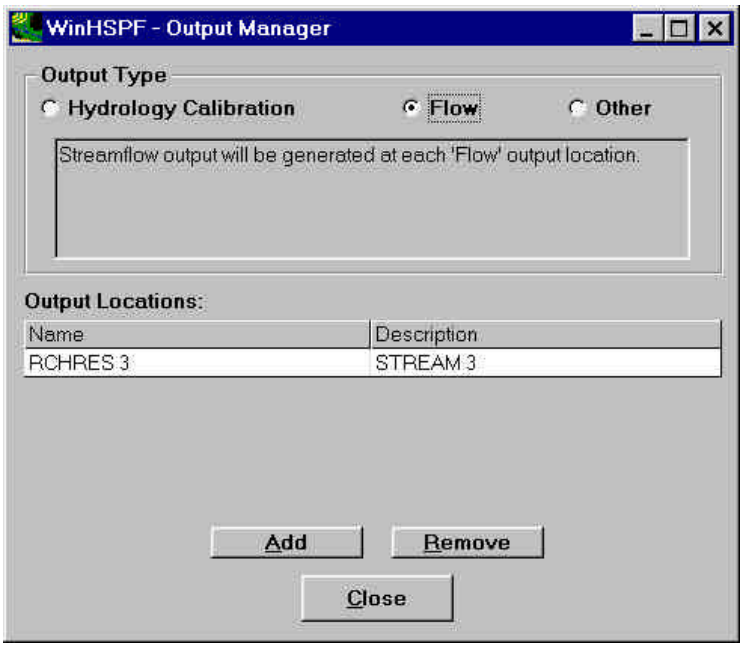
text to use as the location identifier. Use 1000 as the base data set number. The new data sets will be numbered as the available data sets following that number.



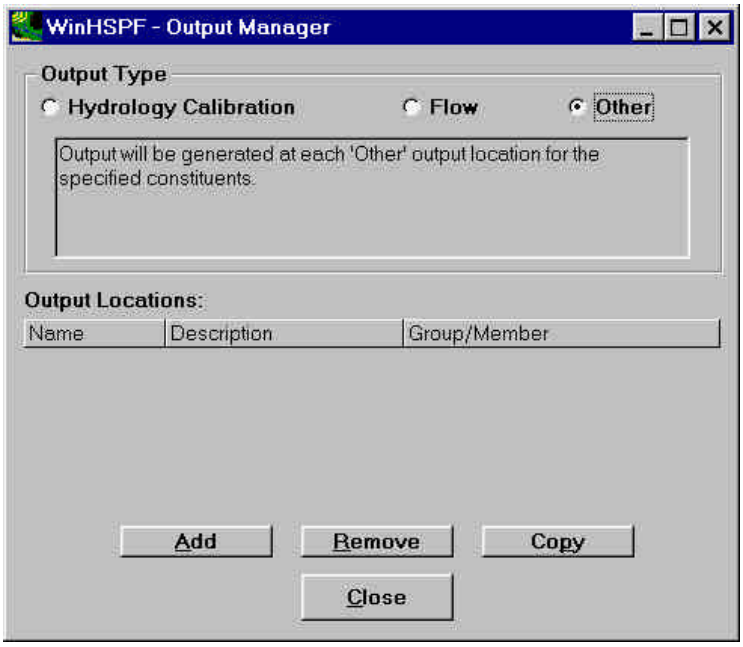
Click **OK** from this window, and you will be back in the **Output Manager** window. As you return to the **Output Manager** window, eight new time-series data sets are created in the project WDM file, as required by the Expert System for HSPF Hydrology Calibration, known as HSPEXP. The UCI in memory is modified to include the appropriate Copy operation as well as the appropriate External Targets, Schematic, and Mass-Link Blocks. The Output Manager window now shows an output hydrology calibration location at RCHRES 3.



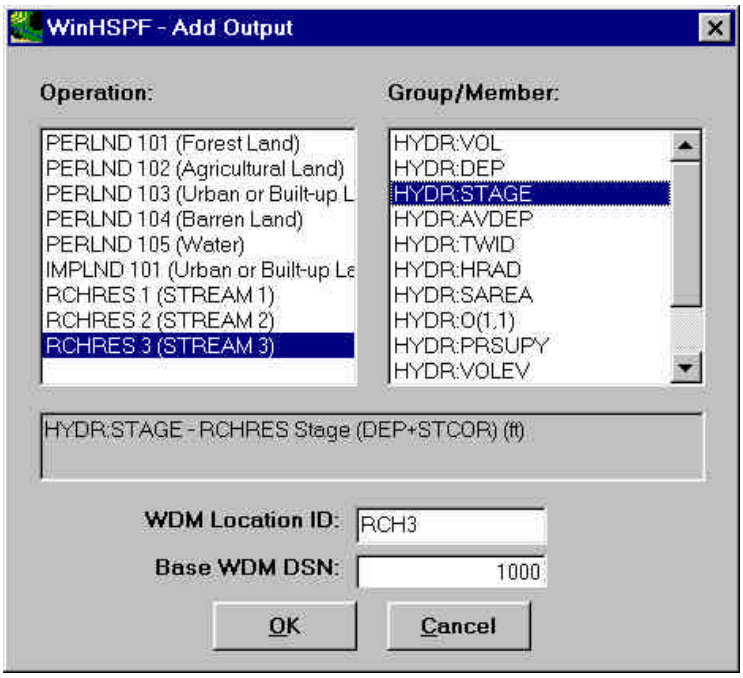
Click the **Flow** radio button and notice that be default Flow is specified for output at the outlet of the watershed, RCHRES 3. Flow output can be added by means similar to those used to add a calibration location.



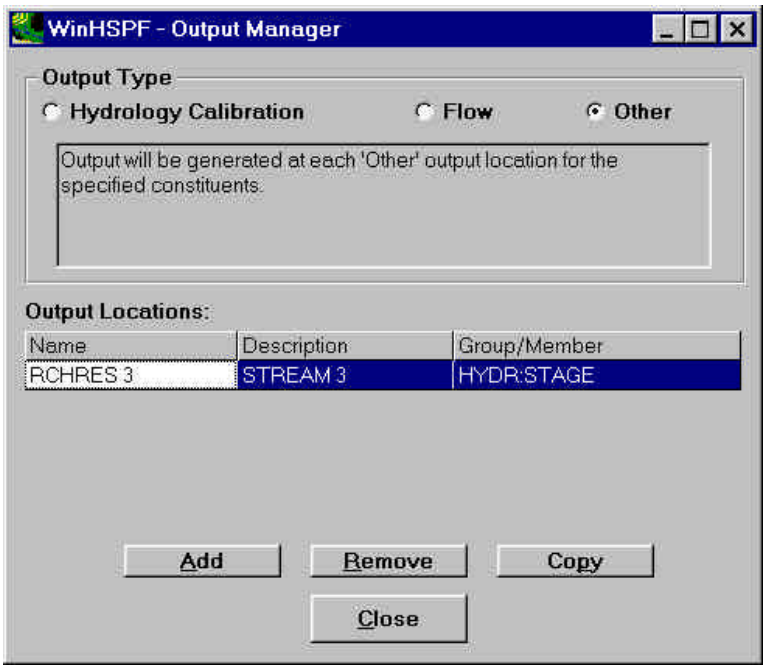
The **Other** radio button is used to add other outputs.



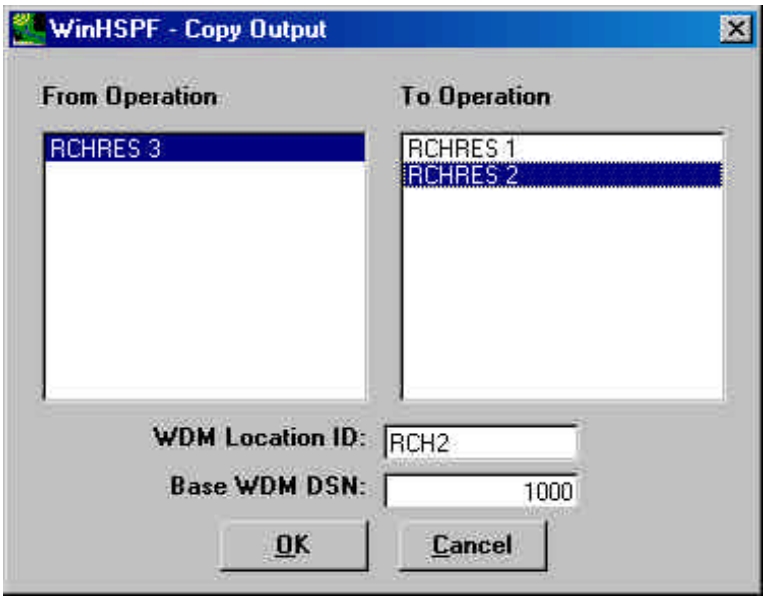
Click **Add** to add additional outputs from this simulation. A window will be produced containing a list of model segments.



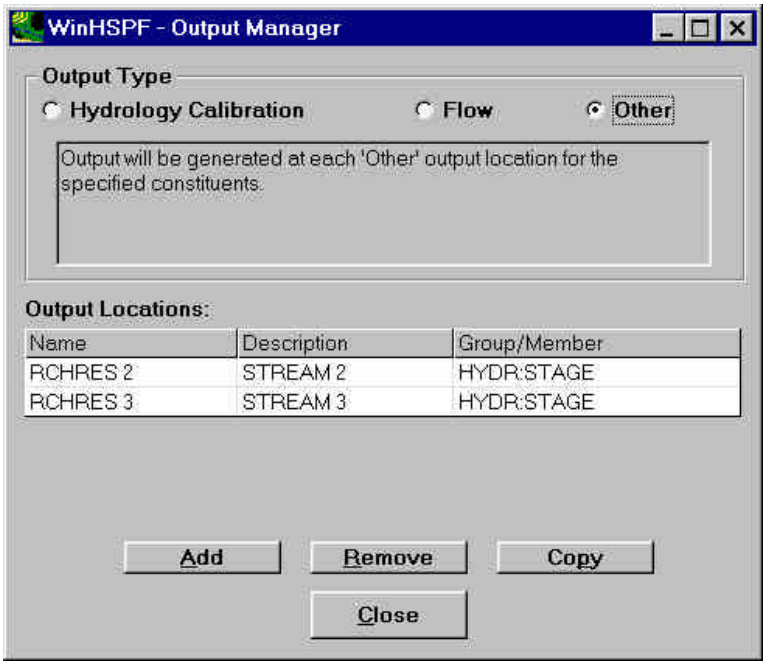
Choose 'RCHRES 3', and a list of Group and Members will appear. This list contains all valid Group and Member pairs that can be output from this operation given the current active sections of this operation. Choose 'Hydr:Stage' to output 'Stage' for this reach. The gray text box in the middle of the form displays the Operation and Group/Member selections. Click **OK** to add this output specification.



Notice that 'Stage' is now listed in the Output Manager. **Copy** is used to copy output specifications from one model segment to another. Click **Copy**, and a window will appear containing a list of operations with output specified.

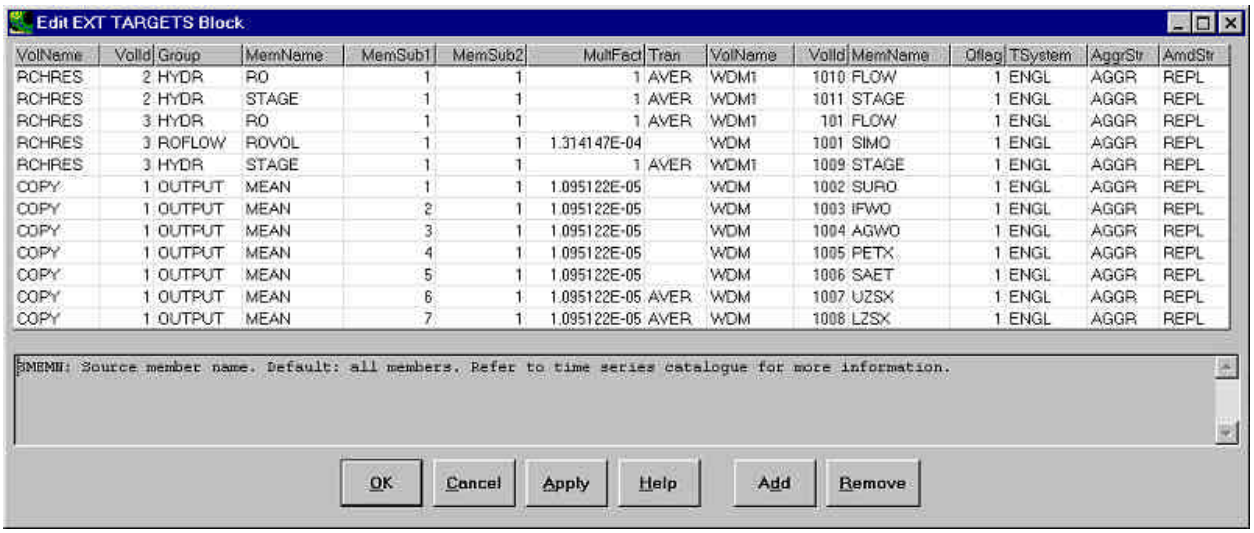


Choose 'RCHRES 3' as the 'From' operation, and then choose 'RCHRES 2' as the 'To' operation. Then click **OK**. Notice now in the Output Manager that 'Stage' is also specified for output from RCHRES 2.

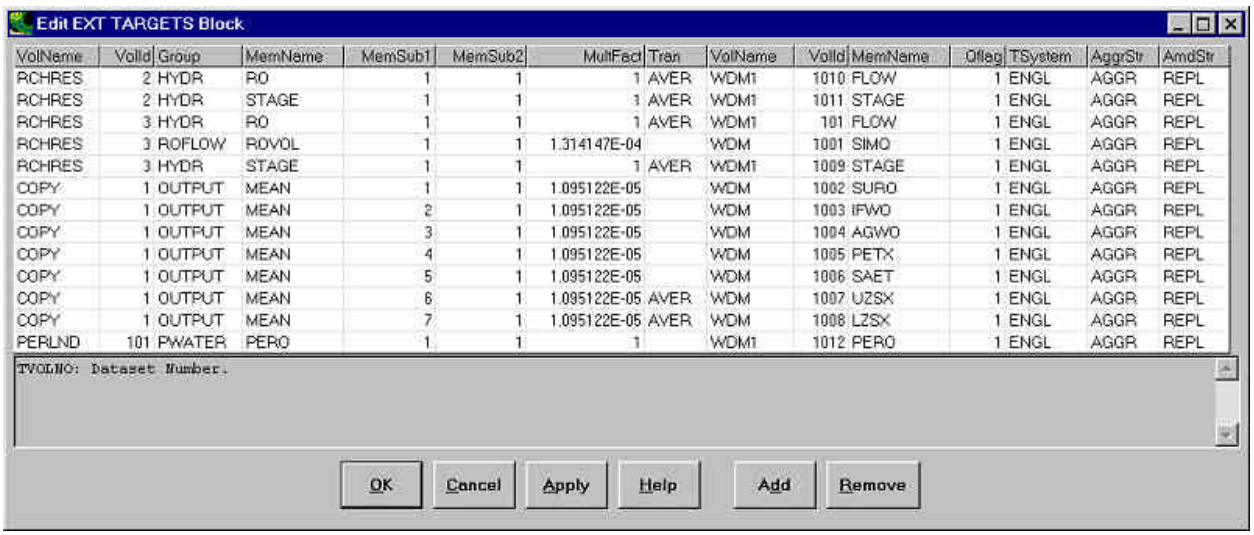


Click **Close** to return to the main WinHSPF window.

Another way to specify output timeseries is through editing the External Targets block. This functionality is accessed either by choosing the **Edit:EXT TARGETS** menu option or by choosing EXT TARGETS in the Input Data Editor. Click on the **Edit** menu, then select the **EXT TARGETS** option.



The **Edit External Targets** window contains a grid showing all External Targets entries. Each row contains the specifications for one output time series; each column of the grid represents a distinct specification. The gray text box in the middle of the form provides a description of the currently selected specification. To add a new entry, click on the **Add** button. A new record will appear in the list. Double click in the left-most column of the bottom row, and choose 'Perlnd'. Double click in the next column, and choose '101'. Proceed through the rest of the fields, adding values as shown in the image below. For this example, be sure to use a data set number that does not already exist in your WDM file.

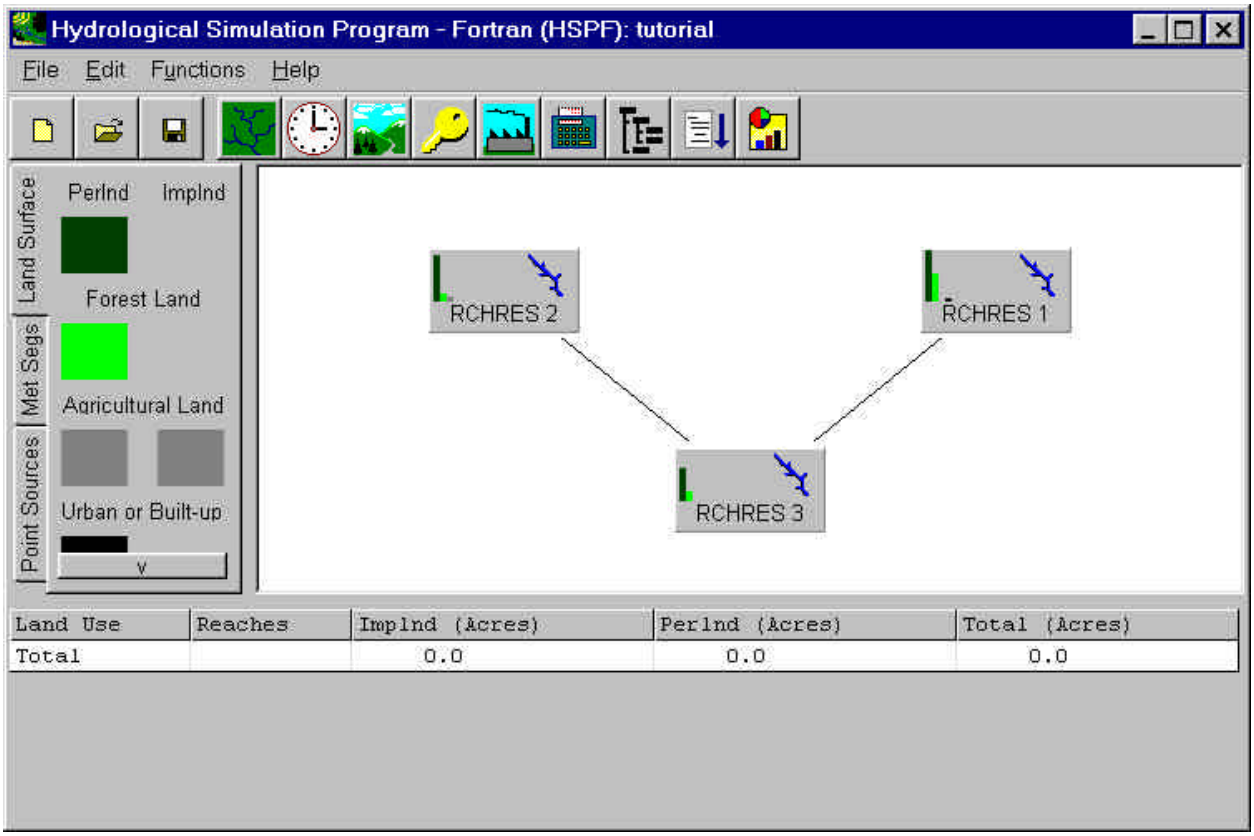


Once you have added values for each field, click the **Apply** button. The **Add Data Set** window will appear, which indicates that the data set number you have selected does not yet exist. The user may edit attribute values for this new data set if desired. Click the **OK** button to accept the values for this new data set.

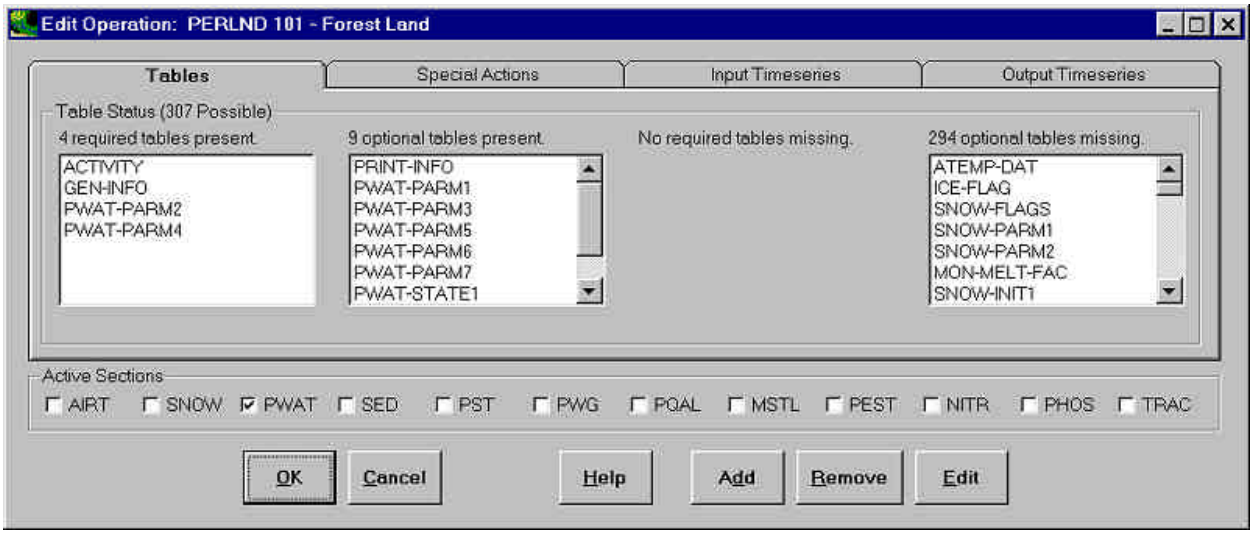
At this point you have added a new output timeseries. Click **OK** in the **Edit External Targets** window to return to the main WinHSPF window.

Lesson 5: Changing HSPF Parameters and Saving the Revised Project

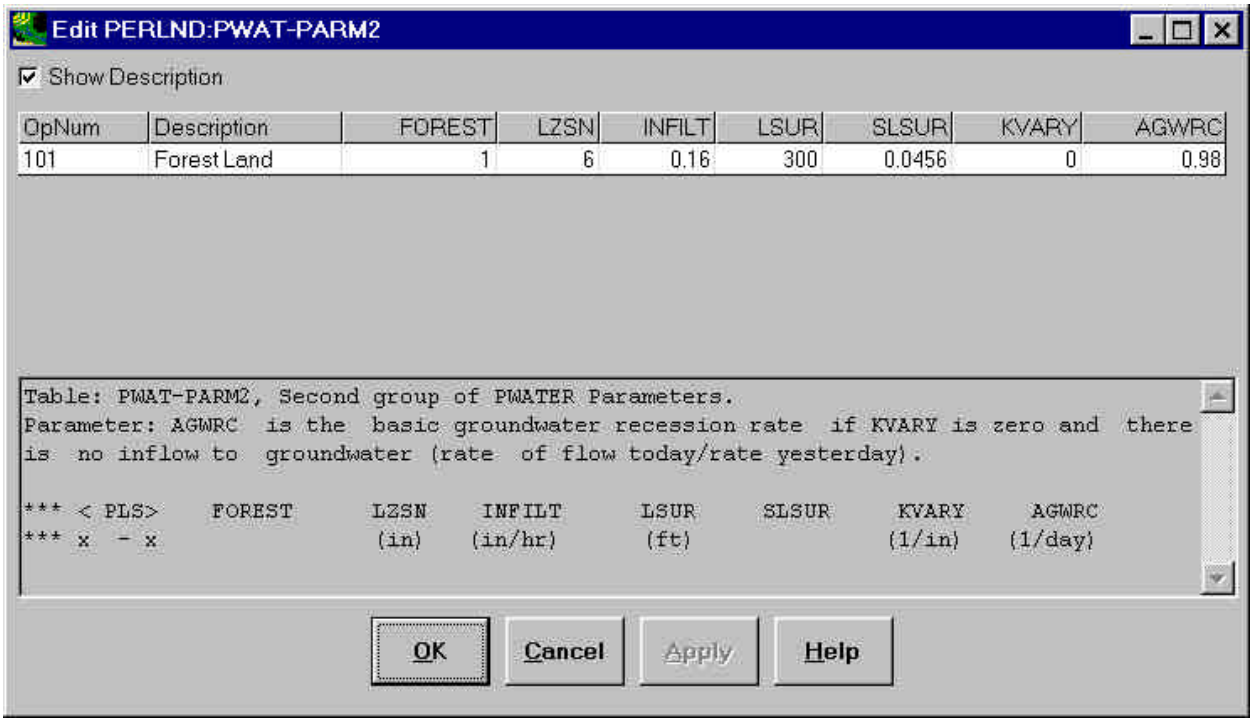
With a project active in WinHSPF, the user may wish to modify some HSPF parameters and save the changes. This situation occurs often during model calibration. This lesson demonstrates how to change HSPF parameters and save the changes.



WinHSPF permits the user to change HSPF parameters in a variety of locations throughout the software. Double click on the **Forest Land** box in the **Land Surface** tab of the main WinHSPF window. If you selected the 'Grouped' model segmentation in Lesson 1, the **Edit Operation** window will appear for PERLND 101.

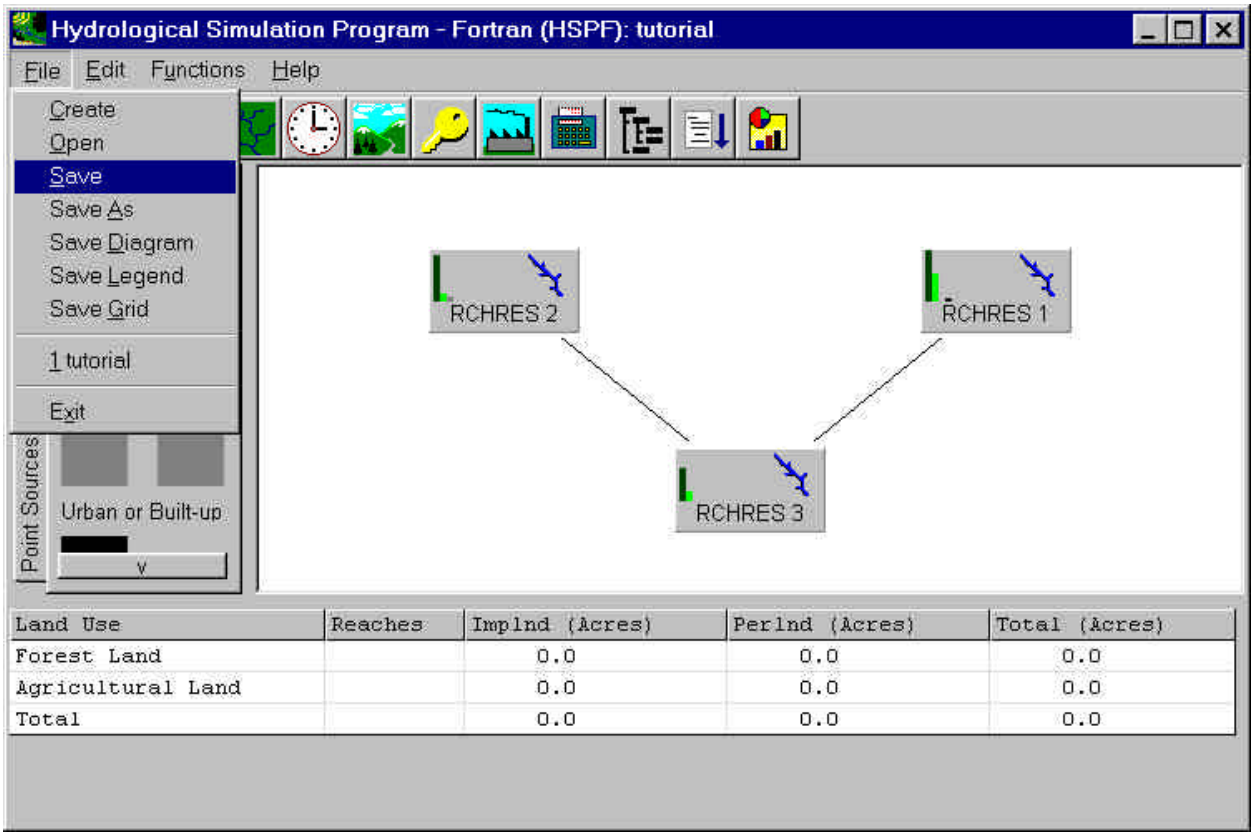


In the **Edit Operation** window, double click on **Pwat-Parm2**. A new window will appear for editing the values of the **Pwat-Parm2** table for this Perlnd operation.

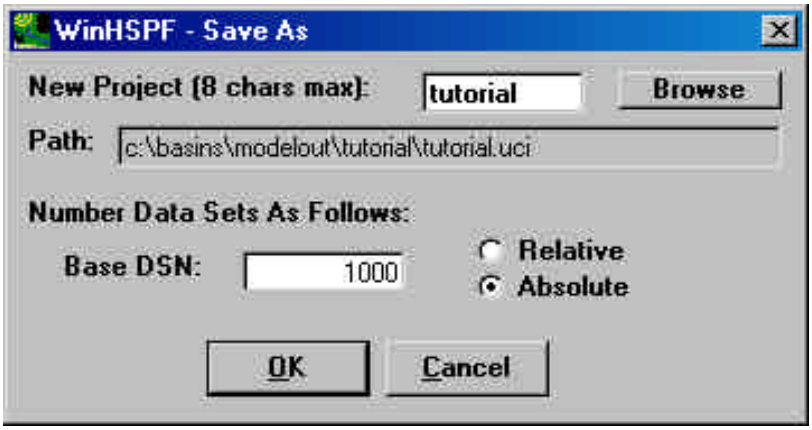


Click on the first row of the **LZSN** column. Edit the LZSN value, making it 13.1. After entering the number click the **OK** button. Click the **OK** button for the **Edit Operation** window as well.

At this point you have made a change to the UCI, but the file has not been saved. To save the changes, select the **File** menu and choose the **Save** option. This option will overwrite the previous version of the UCI with the revised version.



The user might prefer to save the changes to a new UCI file. To do so, choose the **Save As** option from the **File** menu. The **Save As** window will appear, in which the user may specify the name of the new project.



In addition to entering the name of the new UCI file, the user may also specify the other details about the new project. The **Browse** button is used to set the path name where the new UCI is to be stored. The other parameters pertain to the WDM data sets specified as outputs from this simulation.

When the UCI file is saved under a new name, WinHSPF scans the project WDM file to identify any WDM data sets associated with the previous UCI file name. For each data set identified, a new WDM

data set is built to contain the output from the new UCI file, and the External Targets block is modified to use these new data set numbers. The Base DSN field in conjunction with the Relative/Absolute radio buttons is used to specify the new data set numbers for the new project. A Base DSN of 1000 specified 'Absolute' means that the new data sets will be numbered using the first available data set numbers after 1000. A Base DSN of 1000 specified 'Relative' means that the new data sets will be numbered as the next available data set number after the current data set number plus 1000 (for example data set 101 will be numbered 1101).

Specify the name for the new UCI file, and click the **Save** button. WinHSPF will modify the project WDM file and the External Targets block of the new UCI file as described above. Once WinHSPF completes these modifications, the new UCI file is written to disk.

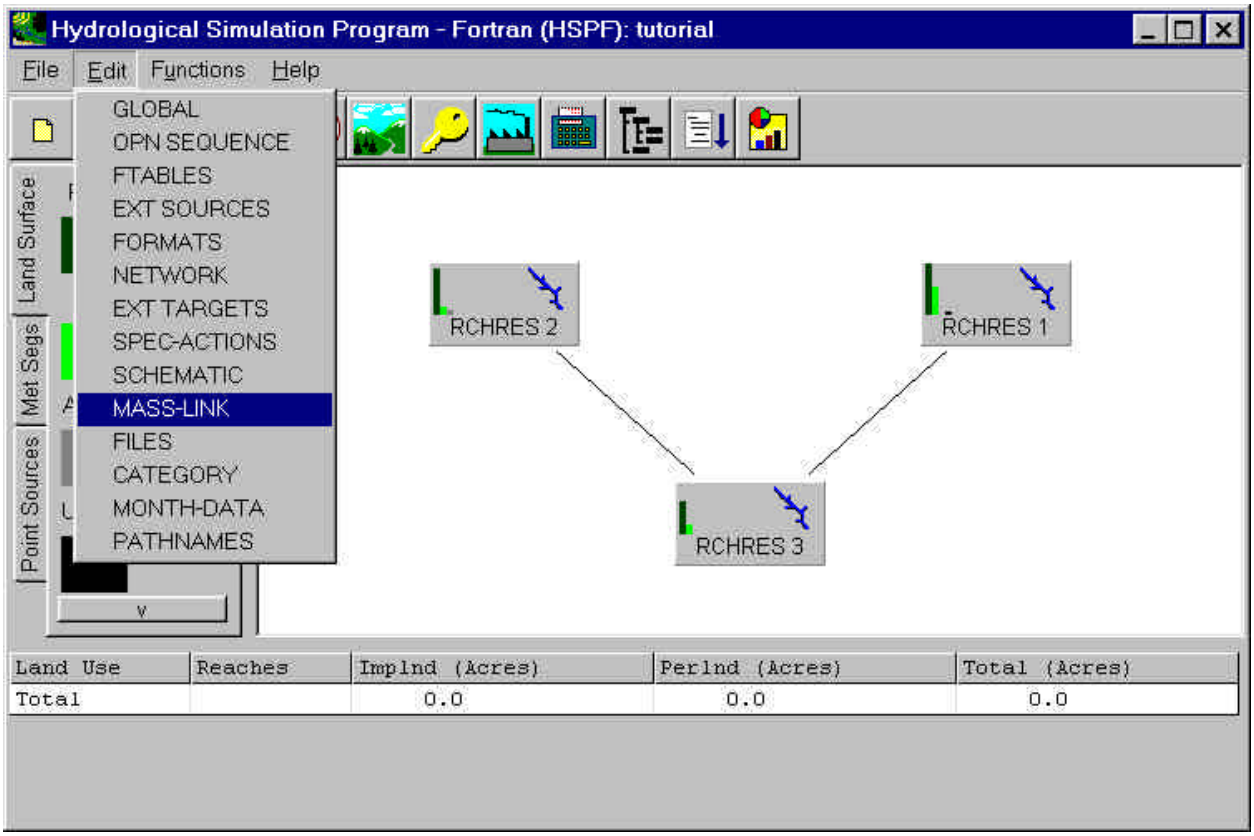
Lesson 6: Modeling a Watershed Management Practice

With a project active in WinHSPF, the user may wish to make significant changes in the HSPF input sequence and save this modified input sequence under a new WinHSPF project name. This situation might occur if the user is modeling a watershed management practice. This lesson demonstrates how to make changes to the project to model a sediment BMP and save the changes to a new WinHSPF project name. (An alternate way to add BMPs is through use of the BMP Editor. See the Best Management Practices Editor for more details.)

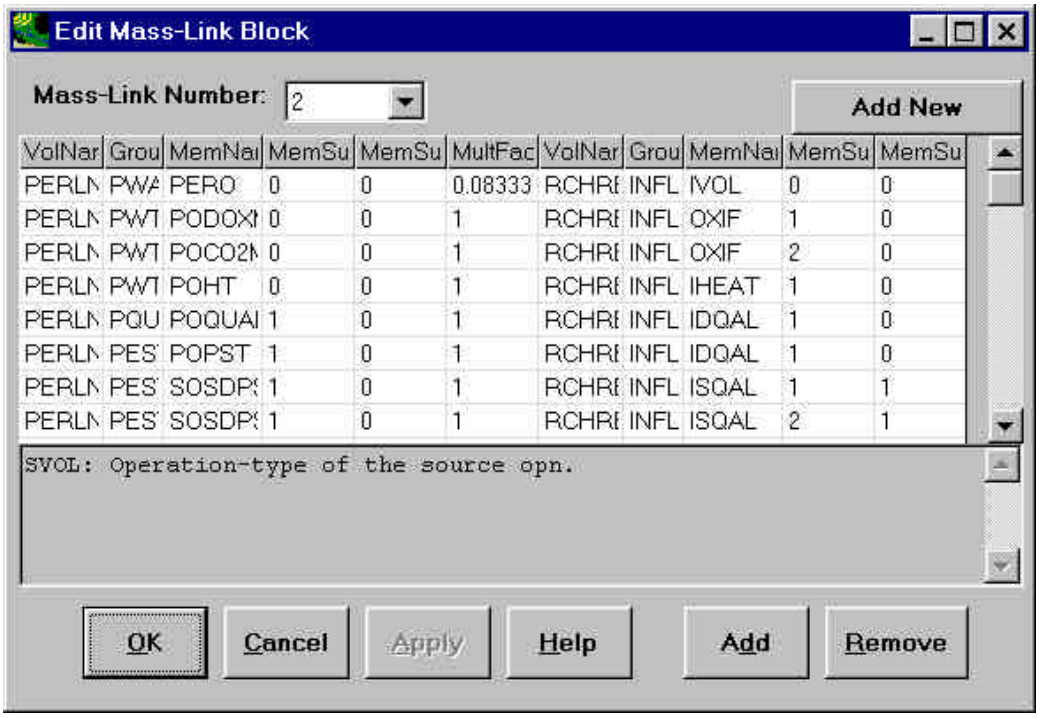
Watershed management practices can be modeled in HSPF using the BMPRAC operation. Adding a BMPRAC operation requires several steps, including adding the BMPRAC operation to the Operation Sequence block, adding the appropriate tables within the BMPRAC block, and adding the appropriate connections.

WinHSPF provides assistance in adding the BMPRAC operation and required BMPRAC tables, but the appropriate Mass-Links must already exist in the Mass-Link block. This tutorial assumes that the appropriate Mass-Links do not already exist.

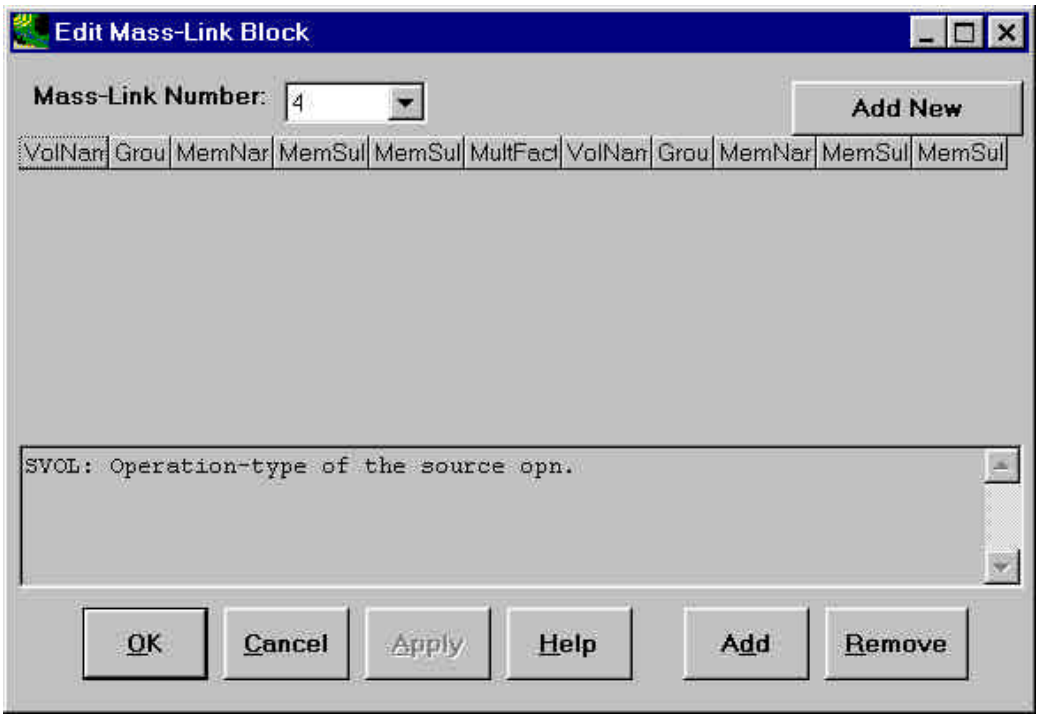
The user must first add the necessary Mass-Links. From the main WinHSPF window, click on the **Edit** menu, and select the **Mass-Link** option.



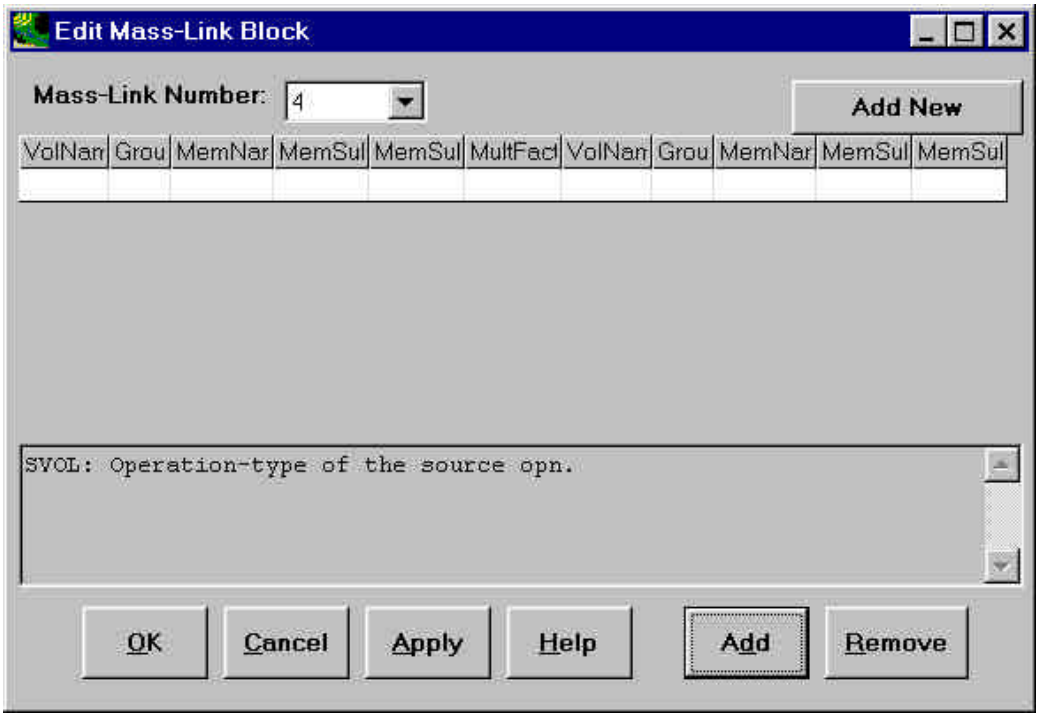
The **Edit Mass-Link Block** window will appear.



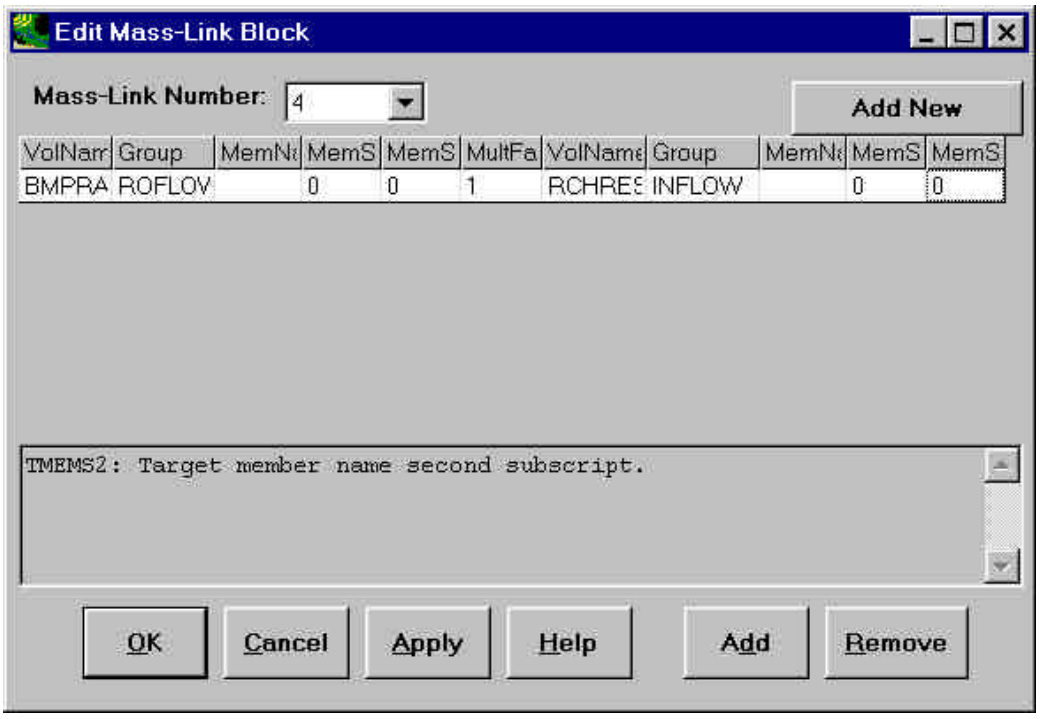
Click the **Add New** button in the top right corner to add a new Mass-Link. A new Mass-Link will appear with no records in it.



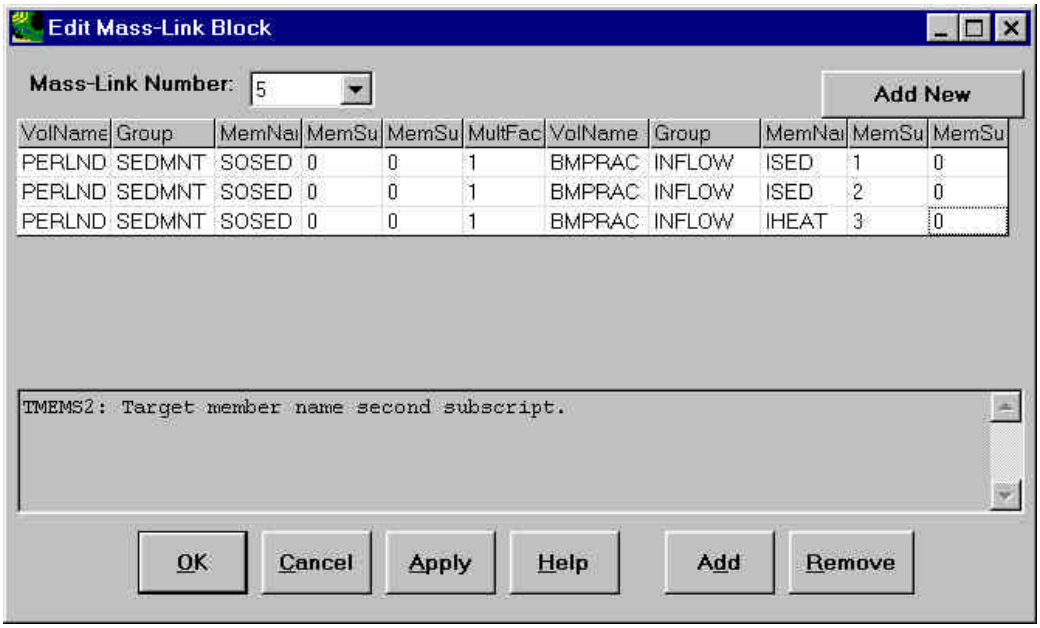
Click the **Add** button to add a record to this Mass-Link.



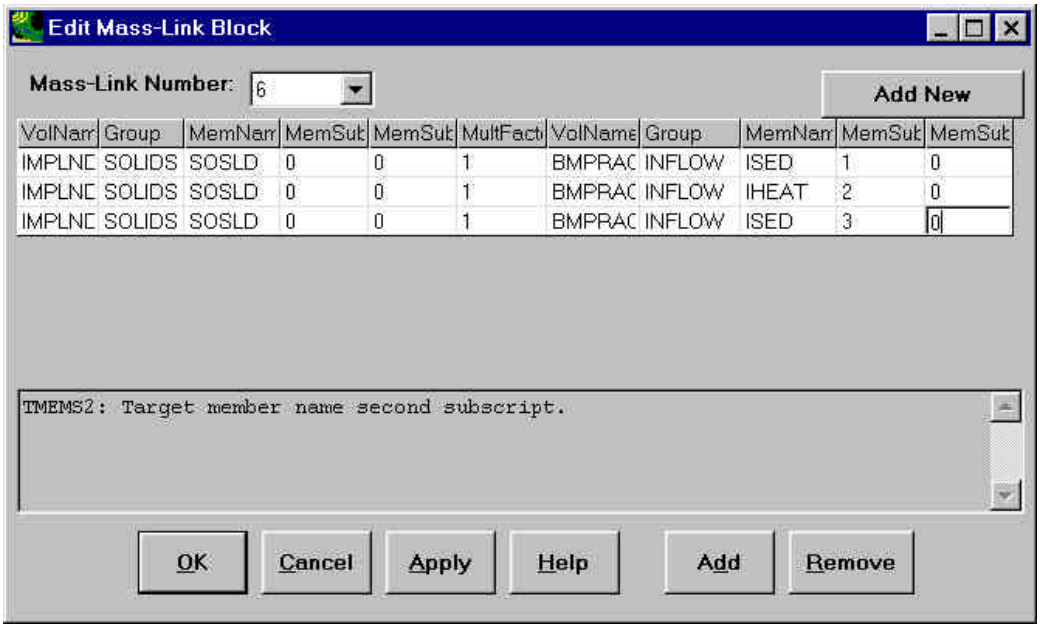
This new Mass-Link will be used for the BMPRAC to RCHRES connection. Double click in the left-most column and choose the BMPRAC operation. Click in the column to the right and enter '1' as the operation number. Proceed through the rest of the columns adding text as shown in the following image. When finished click the **Apply** button.



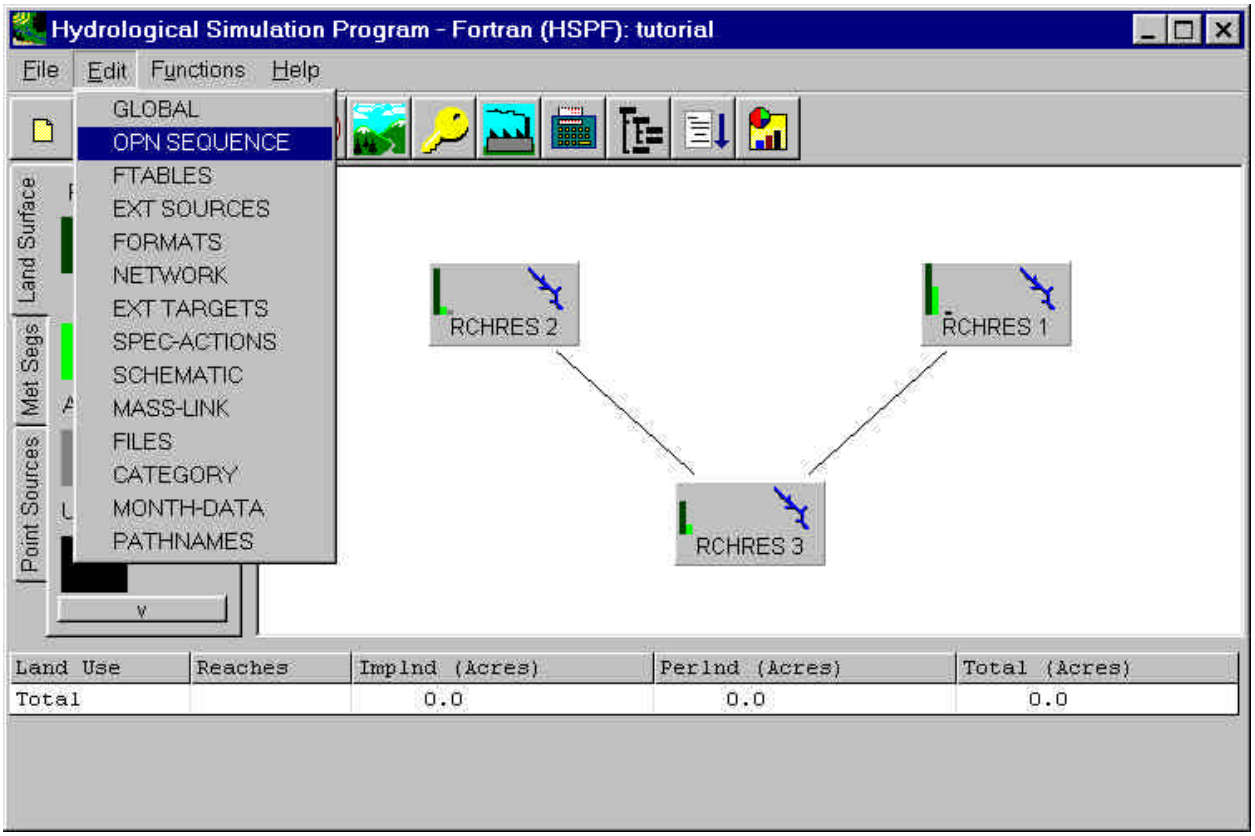
The same process is needed for the PERLND to BMPRAC connection. Click the **Add New** button to add a new Mass-Link. A new Mass-Link will appear with no records in it. Click the **Add** button three times to add three records to this Mass-Link. Proceed through the rows and columns adding text as shown in the following image. When finished click the **Apply** button.



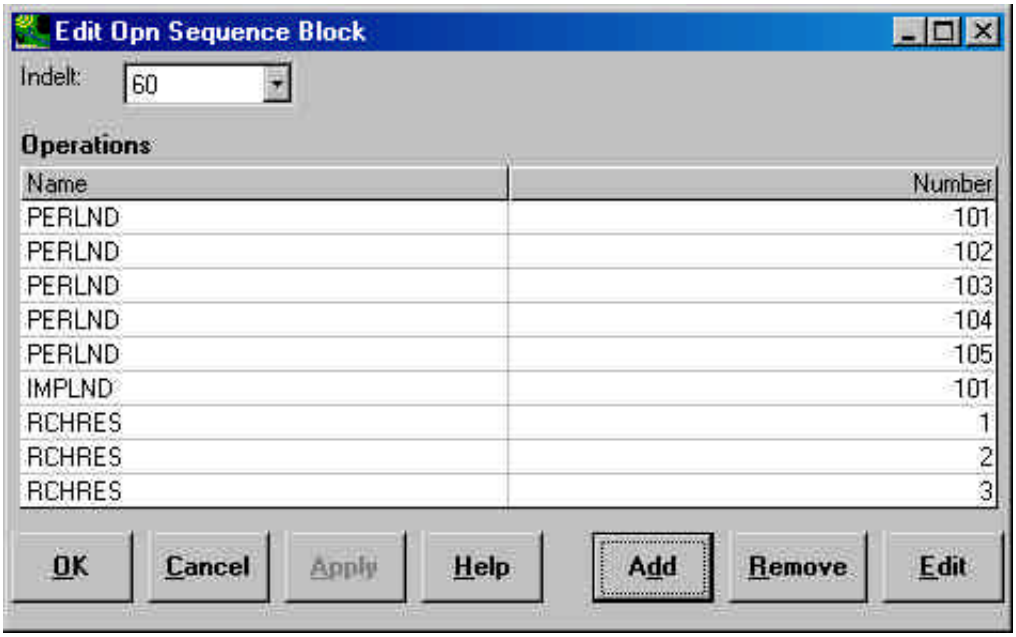
The same process is needed for the IMPLND to BMPRAC connection. Click the **Add New** button to add a new Mass-Link. A new Mass-Link will appear with no records in it. Click the **Add** button three times to add three records to this Mass-Link. Proceed through the rows and columns adding text as shown in the following image. When finished click the **OK** button to return to the main WinHSPF window.



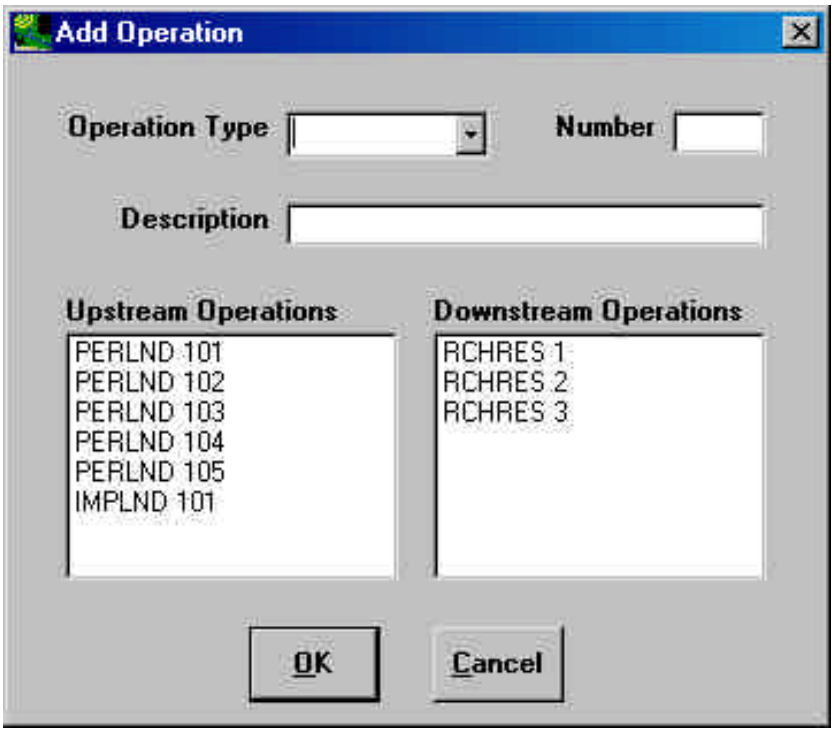
The Mass-Links have now been added, and the user may proceed to add the new operation. From the main WinHSPF window, click on the **Edit** menu, and select the **Opn Sequence** option.



The **Edit Opn Sequence Block** window will appear.

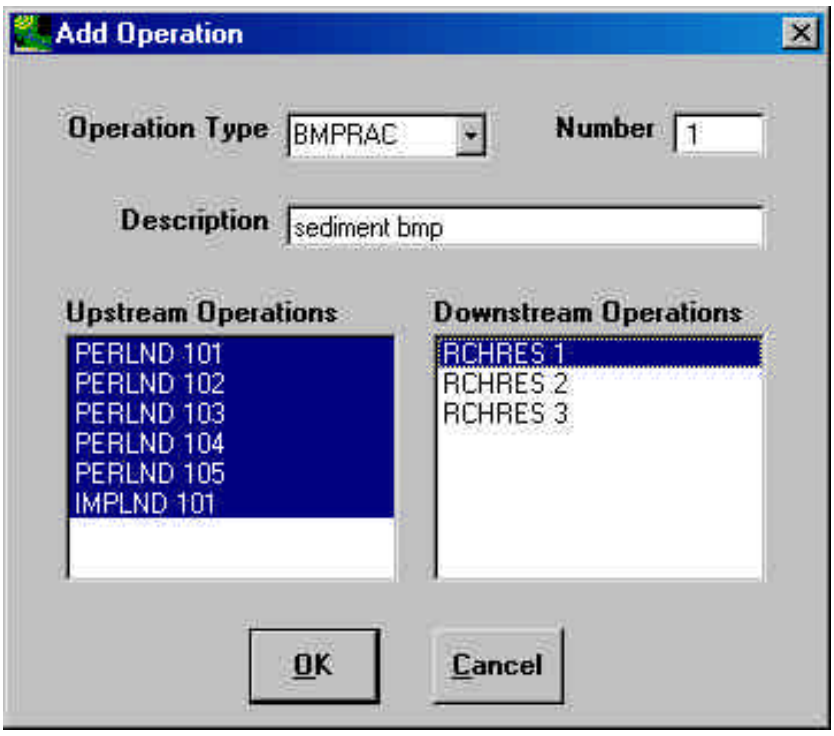


We will add the new BMPRAC operation upstream of RCHRES 1. Click on the row containing RCHRES 1. Then click the **Add** button.

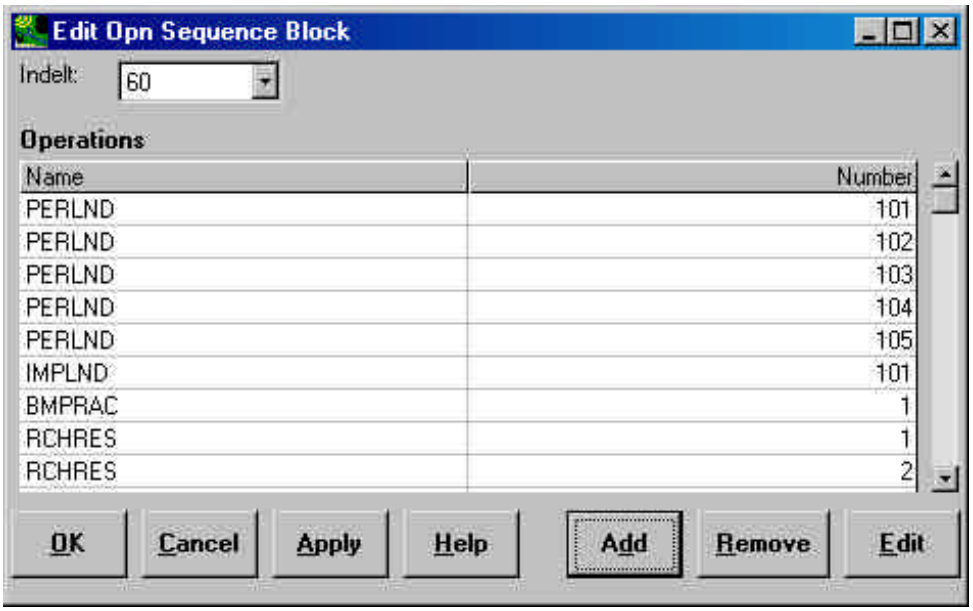


The **Add Operation** window will appear. Specify the parameters in this window as shown in the following image. Be sure to select 'BMPRAC' as the operation type, '1' as the number, type 'sediment

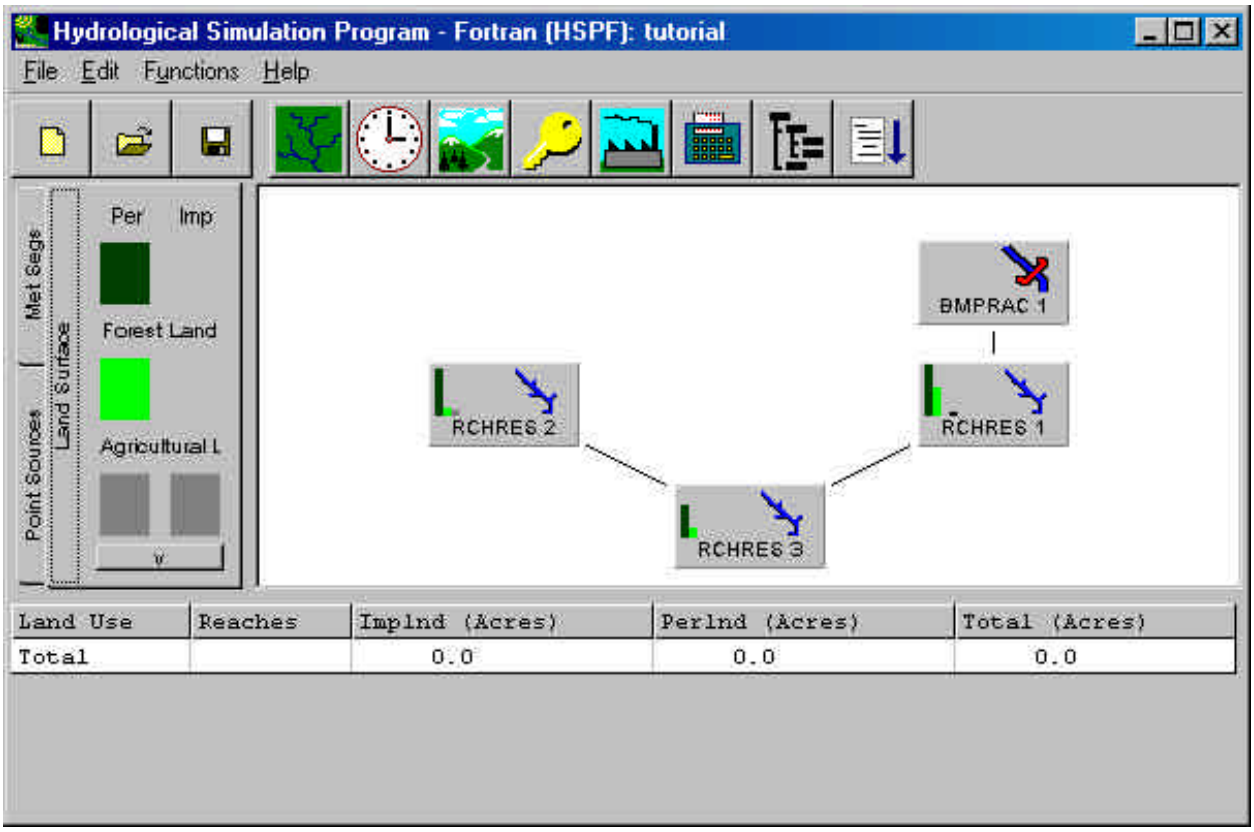
bmp' as the description, choose all upstream operations, and choose 'RCHRES 1' as the downstream operation. Then click the **OK** button.



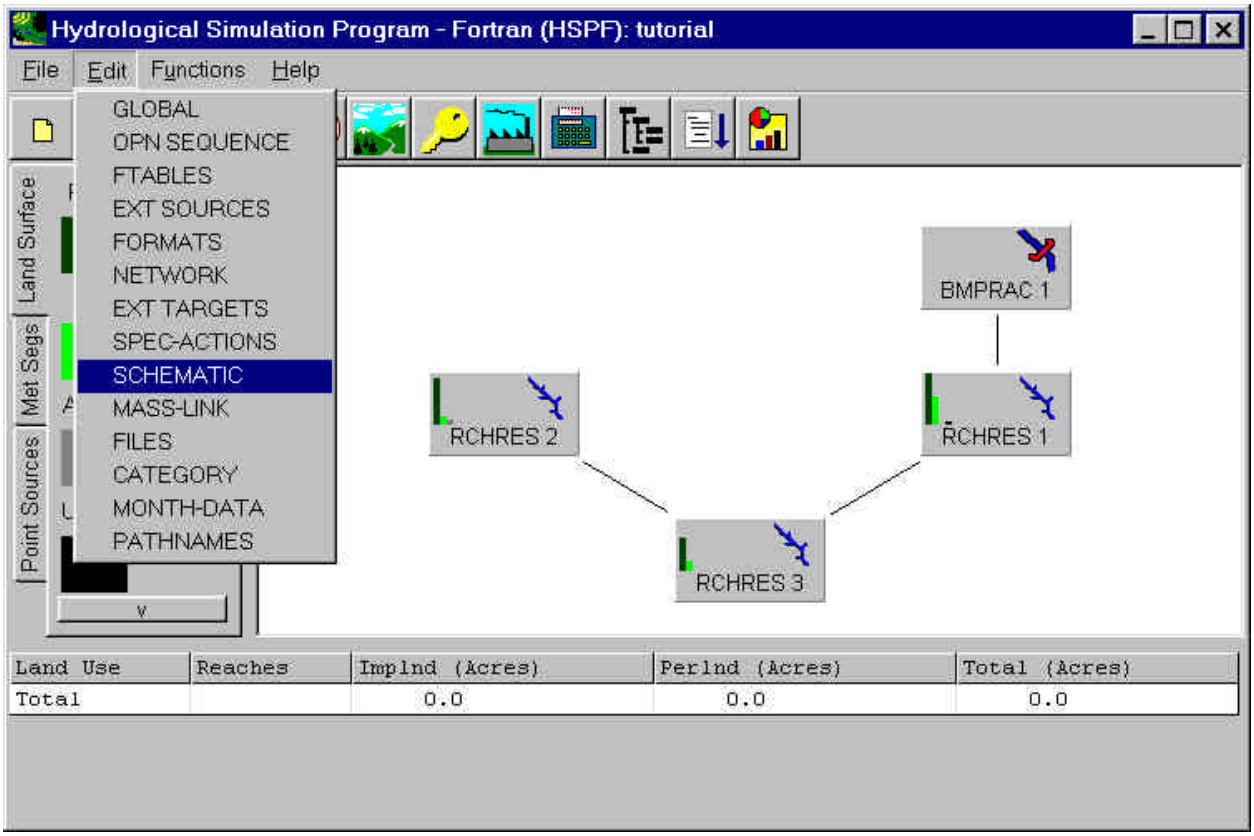
The new BMPRAC operation will appear in the **Edit Opn Sequence Block** window. Click **OK** to return the main WINHSPF window.



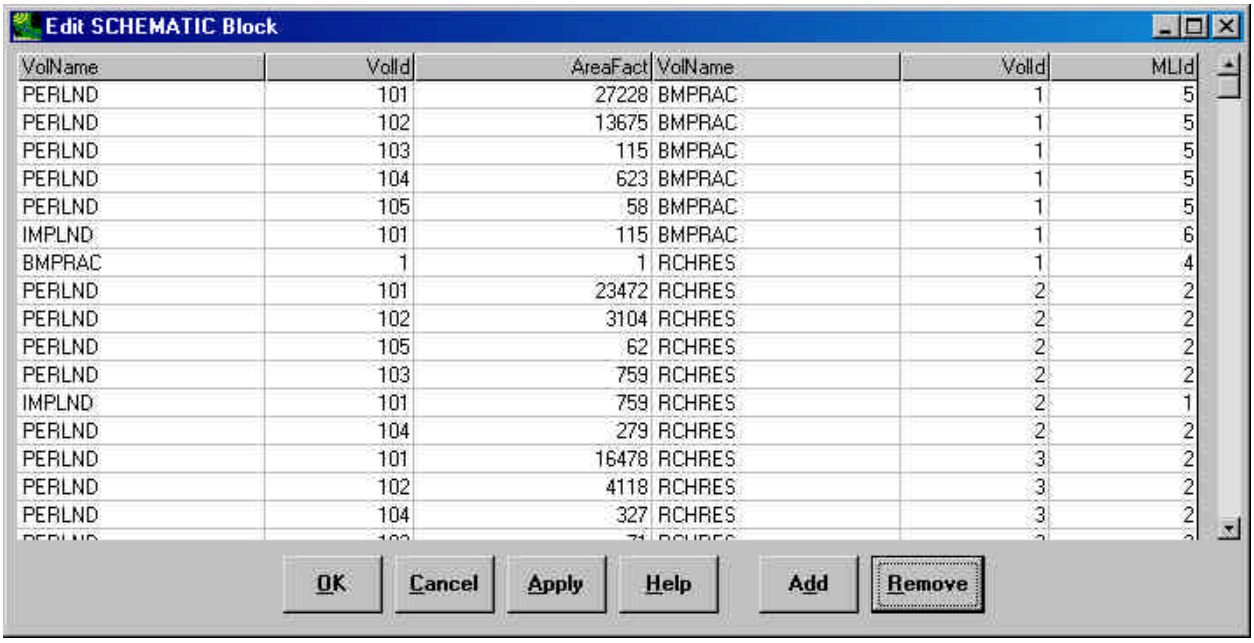
The watershed schematic in the main window now contains the new BMPRAC operation.



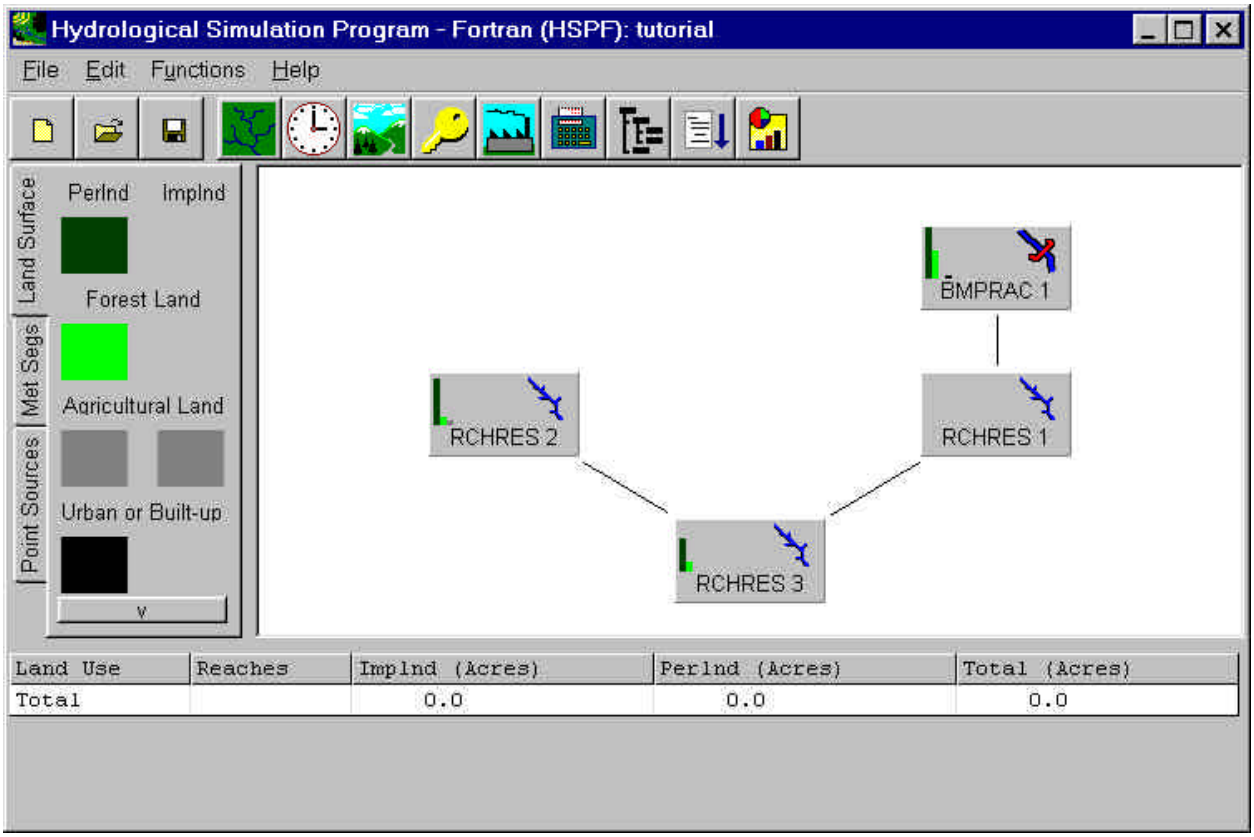
The new BMPRAC operation does not have any land area contributing to it yet. Click on the **Edit** menu, and select the **Schematic** option.



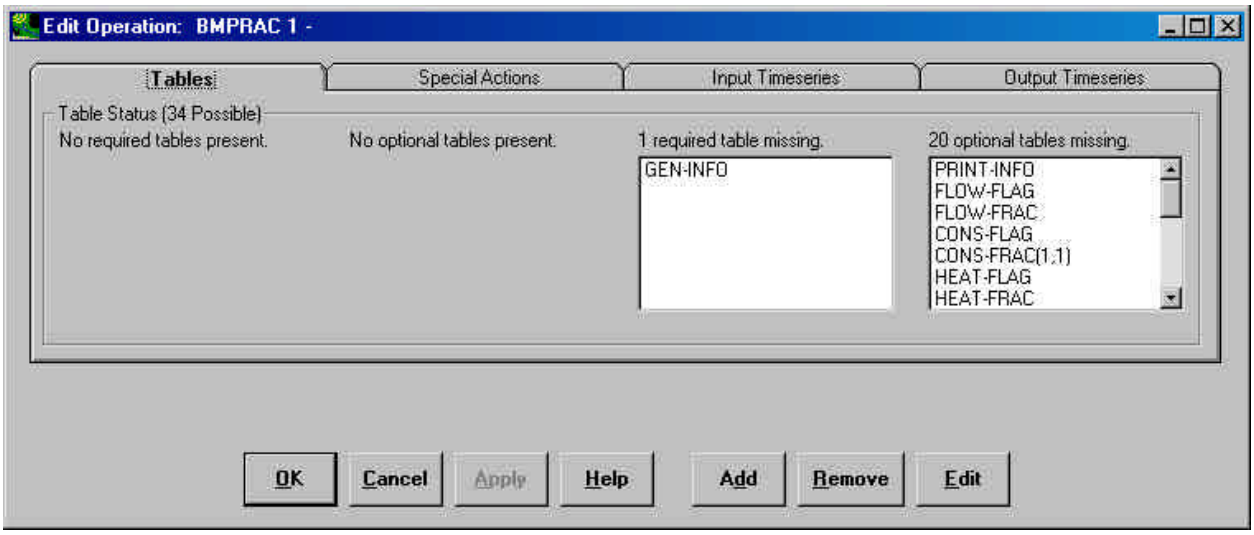
The **Edit Schematic Block** window will appear. Notice the number of acres of PERLND 101 contributing to RCHRES 1. Enter this number of acres in the **AreaFact** column of the PERLND 101 to BMPRAC 1 row. Then click on the PERLND 101 to RCHRES 1 record, and click on the **Remove** button to remove this record from the Schematic block. Proceed through the rest of the records contributing to BMPRAC 1, so that the Schematic block appears as follows. Then click the **OK** button to return to the main WinHSPF window.



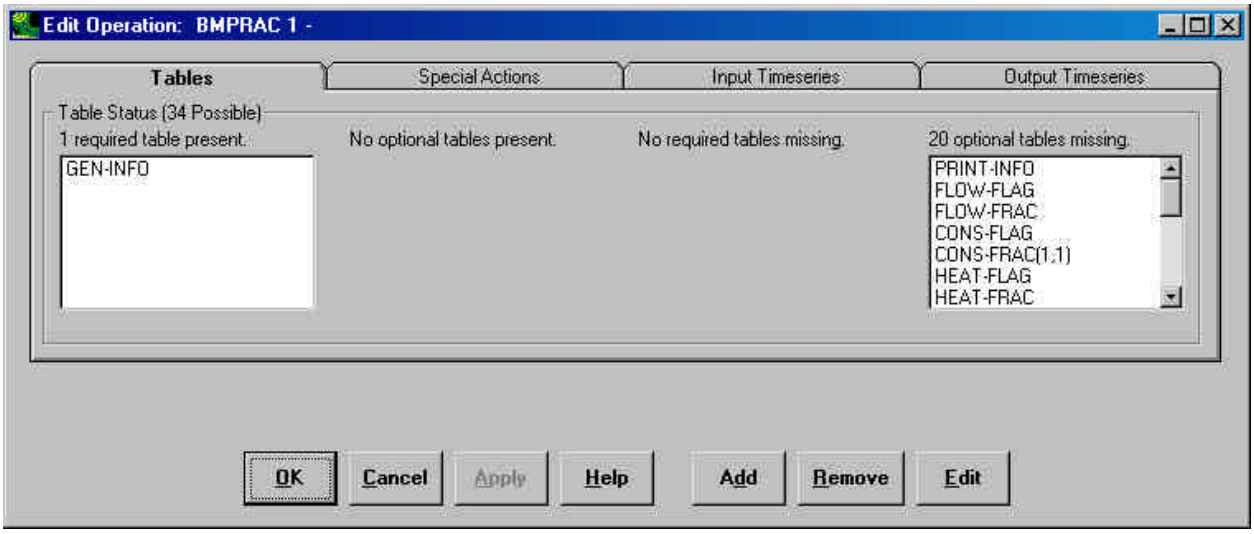
Notice in the watershed schematic that land area now contributes to BMPRAC 1.



The last step in adding the new management practice is to add the necessary tables to the BMPRAC block. Double-click on the BMPRAC 1 box in the watershed schematic. The **Edit Operation** window will appear for BMPRAC 1.

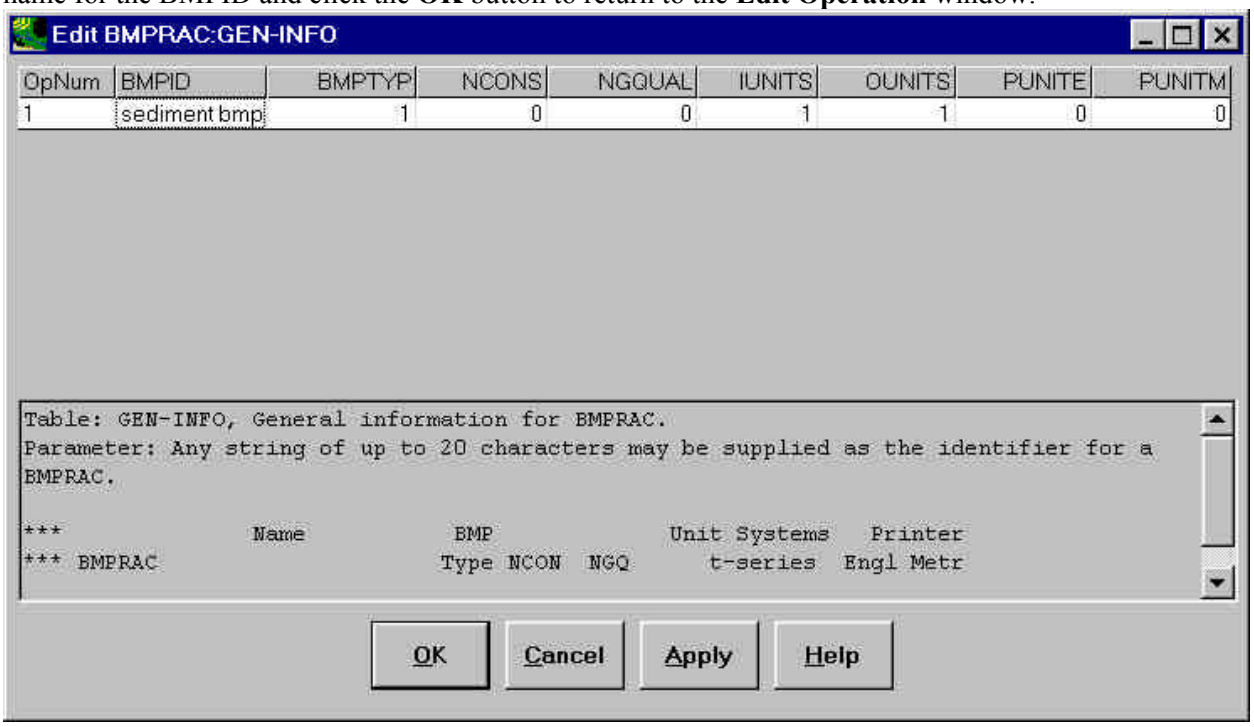


Notice that the required table 'GEN-INFO' is missing. Select the name 'GEN-INFO' and then click the **Add** button to add this table. The name 'GEN-INFO' will move to the list of tables that are present.

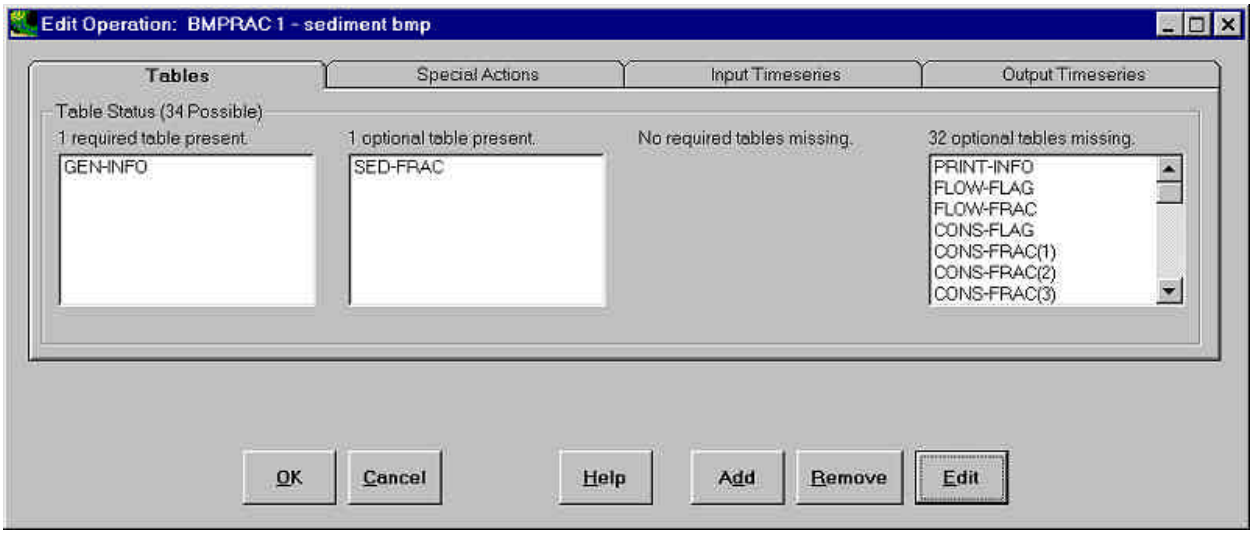


Select the name 'GEN-INFO' and then click the **Edit** button to edit this table. The **Edit BMPRAC:GEN-INFO** window will appear. The default values for this table are acceptable. Type in a

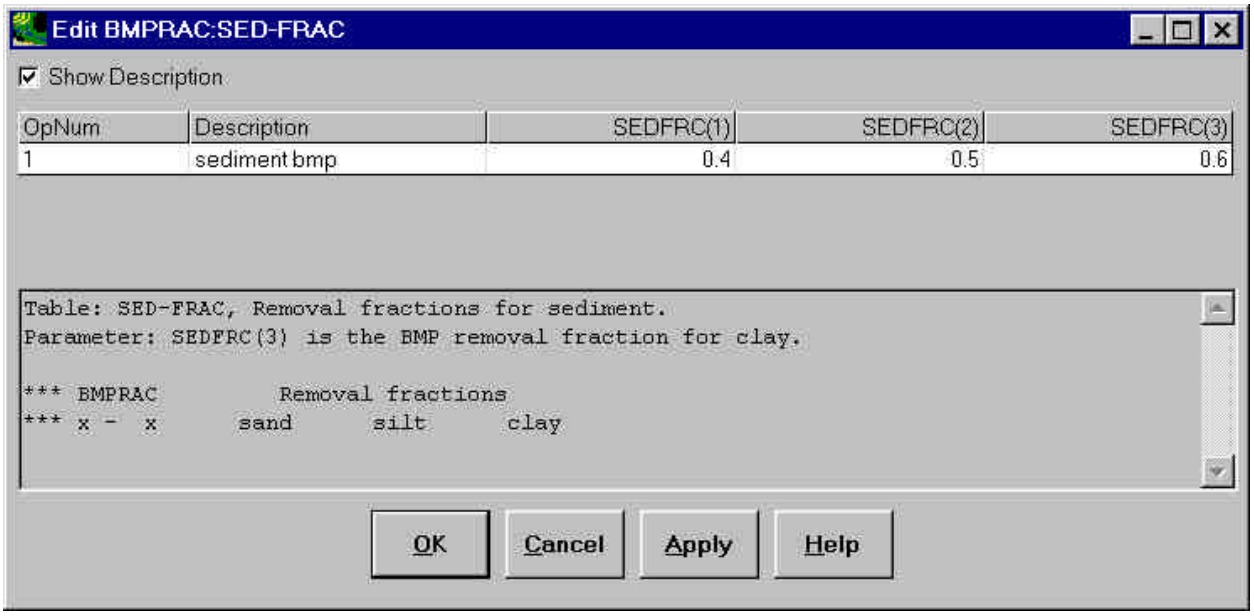
name for the BMPID and click the **OK** button to return to the **Edit Operation** window.



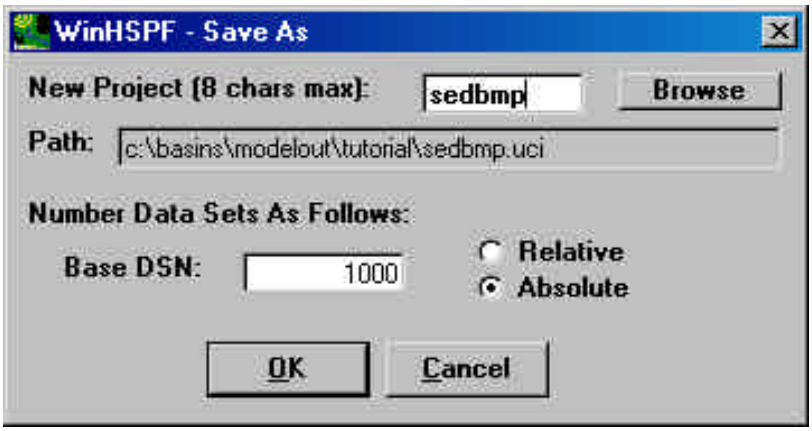
Select the name 'SED-FRAC' and then click the **Add** button to add this table. The name 'SED-FRAC' will move to the list of optional tables present.



Select the name 'SED-FRAC' and then click the **Edit** button to edit this table. The **Edit BMPRAC:SED-FRAC** window will appear. Enter 0.4 for SEDFRAC 1, 0.5 for SEDFRAC 2, and 0.6 for SEDFRAC 3. These numbers represent the removal fractions for sand, silt, and clay, respectively. Click the **OK** button to return to the **Edit Operation** window.



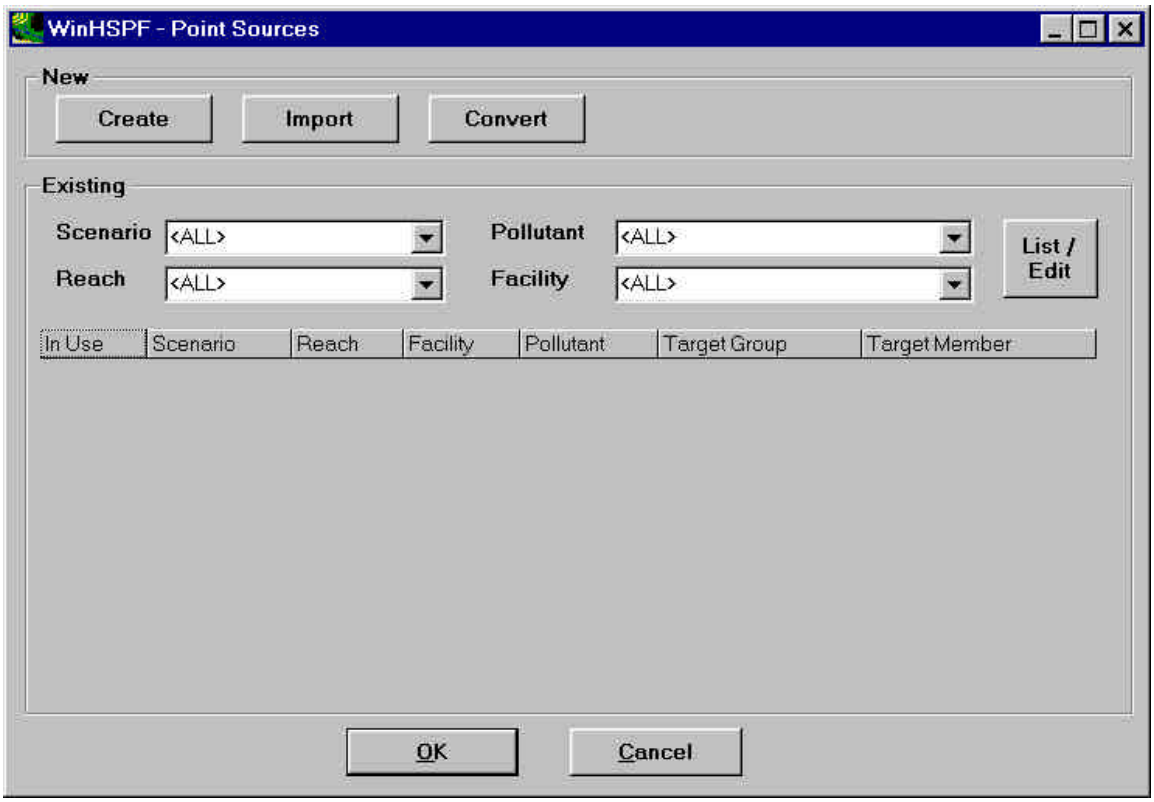
From the **Edit Operation** window, click the **OK** button to return to the main WinHSPF window. We have now completed the process of adding a watershed management practice. To save the project with the new BMP, click on the **File** menu, and select the **Save As** option. Enter the name of the new sediment BMP UCI file, and click the **OK** button.



Lesson 7: Adding Point Source Data

With a project active in WinHSPF, the user may wish to add point source data to the project WDM file. The user may also wish to edit point source data. This lesson demonstrates how to add point source data on the project WDM file, and how to edit existing point sources.

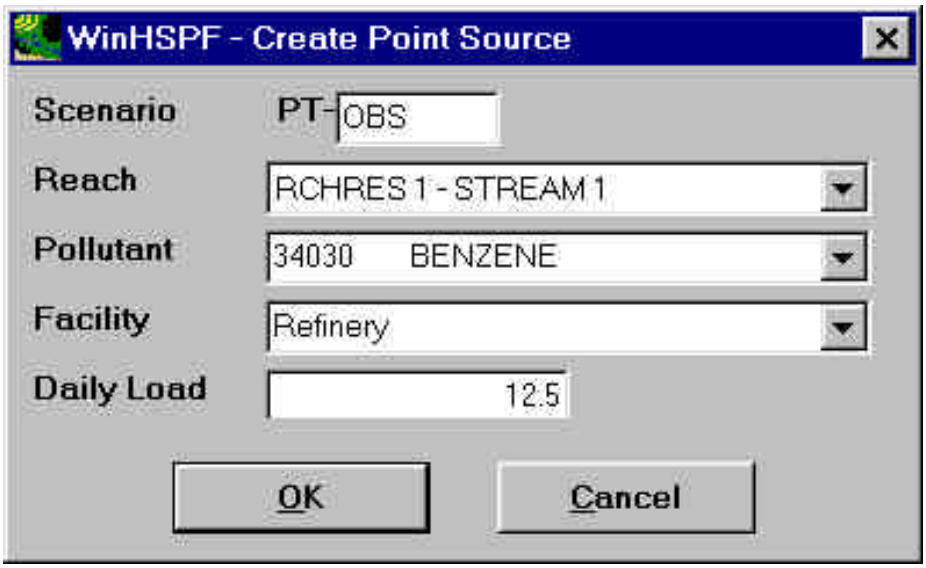
Upon creation of a new project, point source data is written to the project WDM file for all point sources and constituents specified in the BASINS point sources file. Click on the button on the toolbar and the following window will appear:



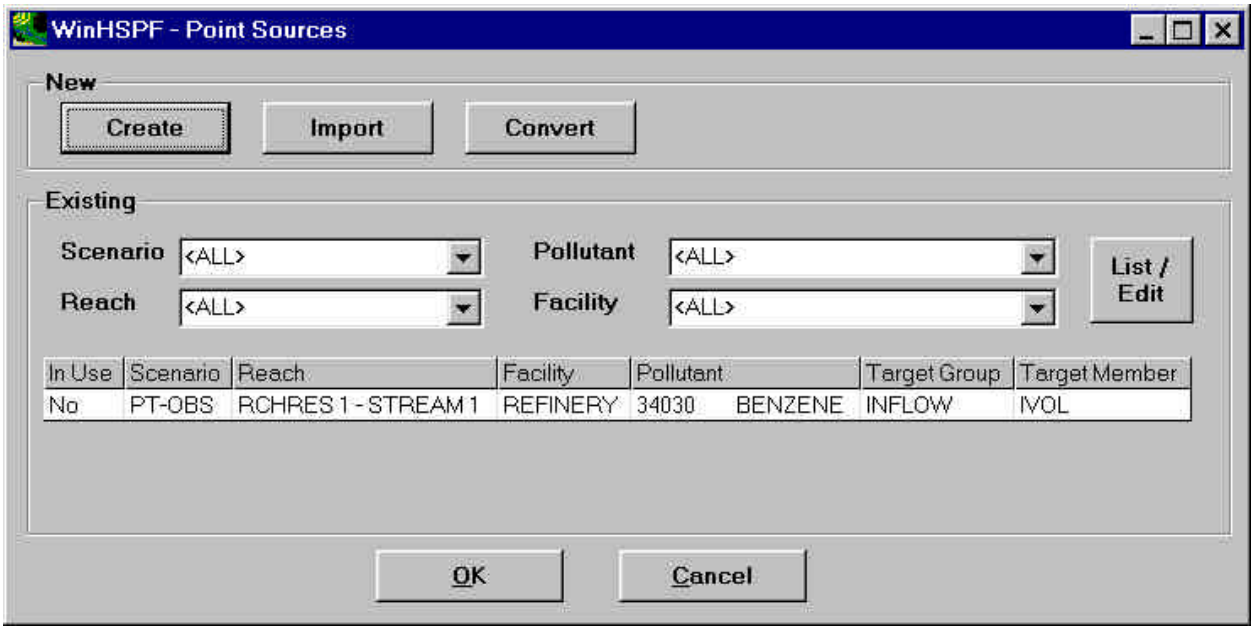
The absence of a grid on the bottom portion of the window indicates that there are currently no point source data for the project. The three buttons at the top of the window provide ways to add such data to the project WDM file.

- **Create** - allows the user to manually create a point source data set
- **Import** - allows the user to import a MUTSIN point source data file
- **Convert** - converts any MUTSIN point source files referenced in the HSPF input sequence to WDM data sets

Click on the **Create** button and enter the following information. Values for the **Scenario** and **Daily Load** fields must be typed in while the other 3 fields are selected from drop-down lists.

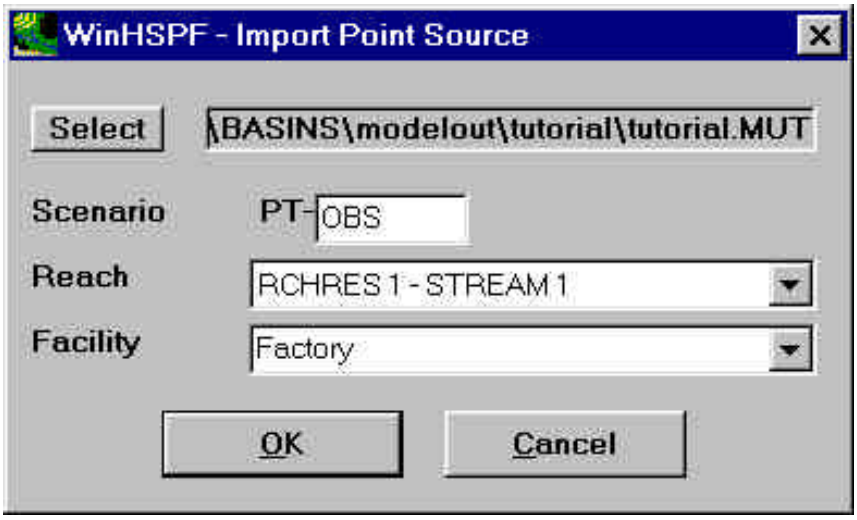


Once the values have been entered, click the **OK** button to create the new point source in the project WDM file and return to the main **Point Sources** window. The new point source data set is now displayed in the grid.

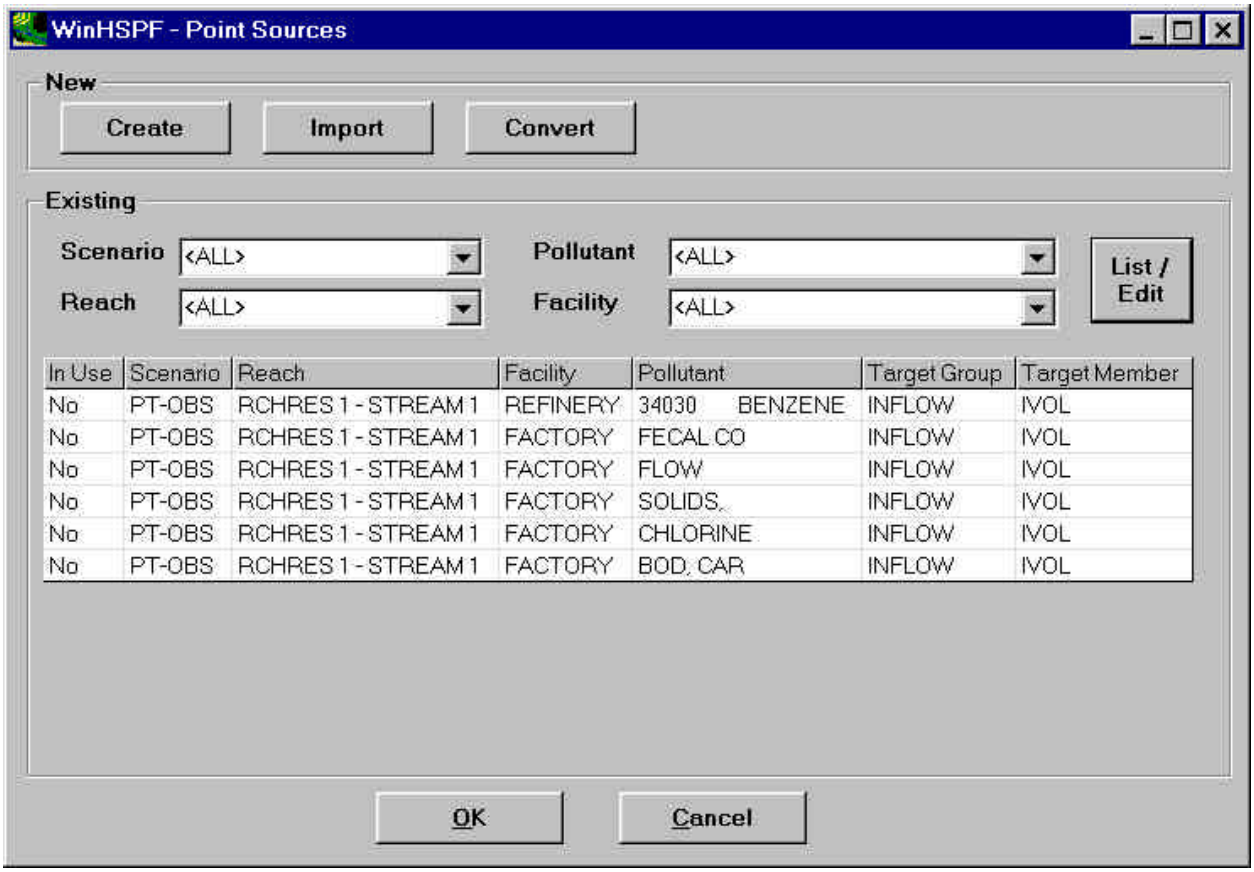


Now click on the **Import** button and enter the following information. Select tutorial.MUT from the '\BASINS\data\tutorial\HSPF' subdirectory, type in the extension of the **Scenario** name, and select the

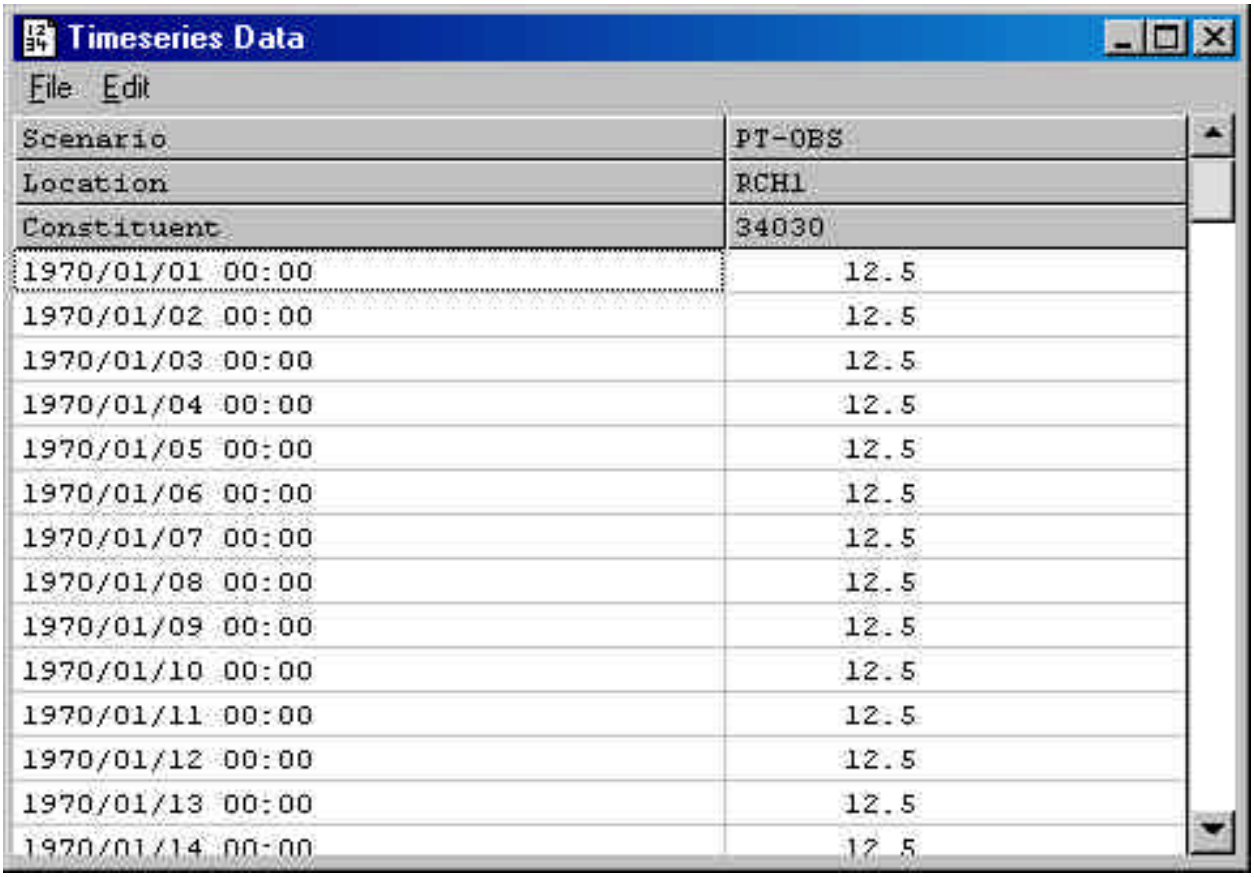
Reach from its drop-down list box. The **Facility** field is automatically filled in with text from the import file.



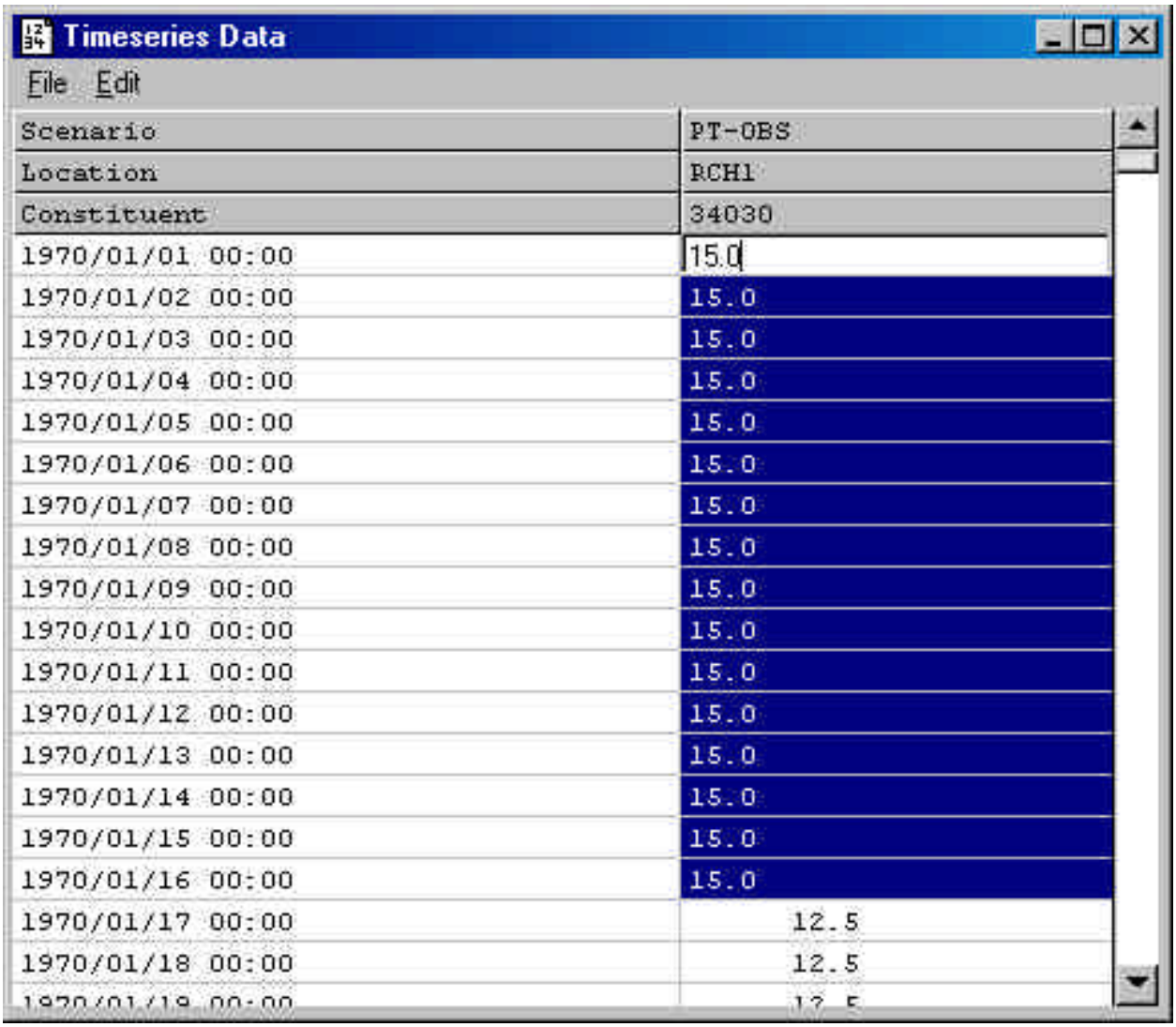
Once the values have been entered, click the **OK** button to import the new point sources into the project WDM file and return to the main **Point Sources** window.



Select a field in the first row containing the information associated with Benzene, then click on the **List/Edit** button. The following form appears:

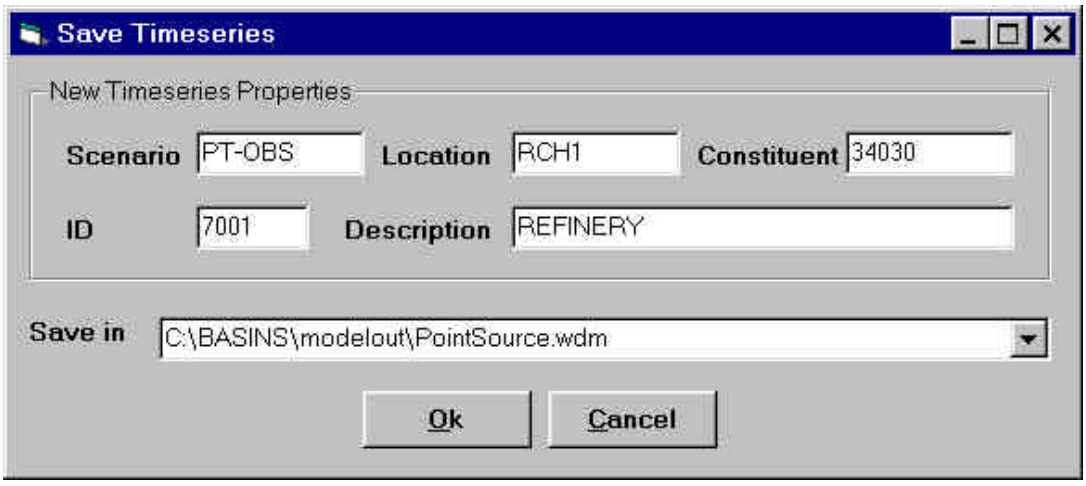


Highlight the value fields for 1970/01/01 to 1970/01/16 then type in the value 15.

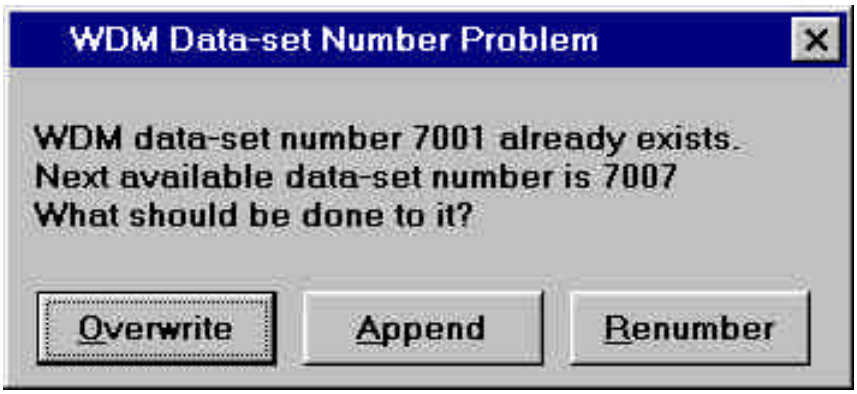


Click on the X in the top right corner of the window and the following message box will prompt you to save the changes to the data set.

Click on the 'No' button. From the 'File' menu, choose 'Save Changed', and the following dialogue box appears:



Click on the **OK** button without editing any values and the following message box appears:



A final message box appears confirming that the edits were successfully saved to the project WDM file then the interface returns to the **Point Sources** window. Click on the **OK** button to return to the main WinHSPF form from there. Six new point source data sets have been added to the project WDM file.

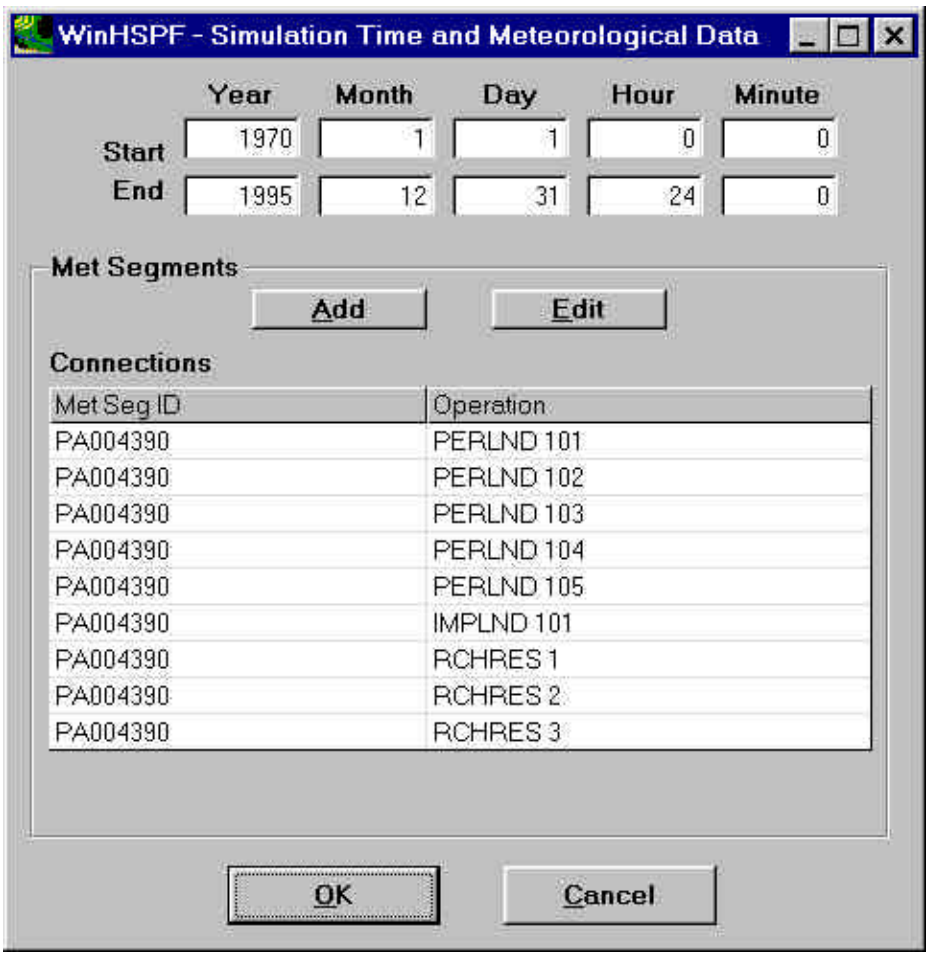
See the Point Sources section of the online help for more detailed information about adding point source data to the project.

Lesson 8: Modifying Meteorological Data

With a project active in WinHSPF, the user may wish to alter the time span simulated during the HSPF run or edit the composition of the meteorological segments contributing to the HSPF operations. Both of these tasks can be accomplished via the **Simulation Time and Meteorological Data** form. This lesson demonstrates how to:

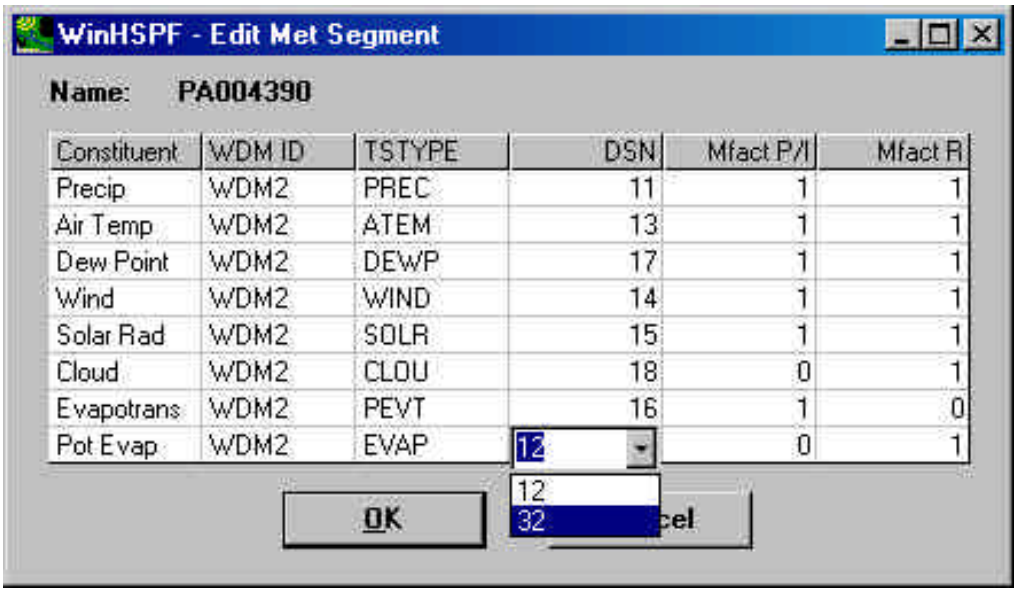
- modify the time span of the HSPF simulation run
- create additional met segments
- edit which met segments contribute to which operations

While running the tutorial project distributed with WinHSPF, click on the icon on the toolbar. The following window appears:

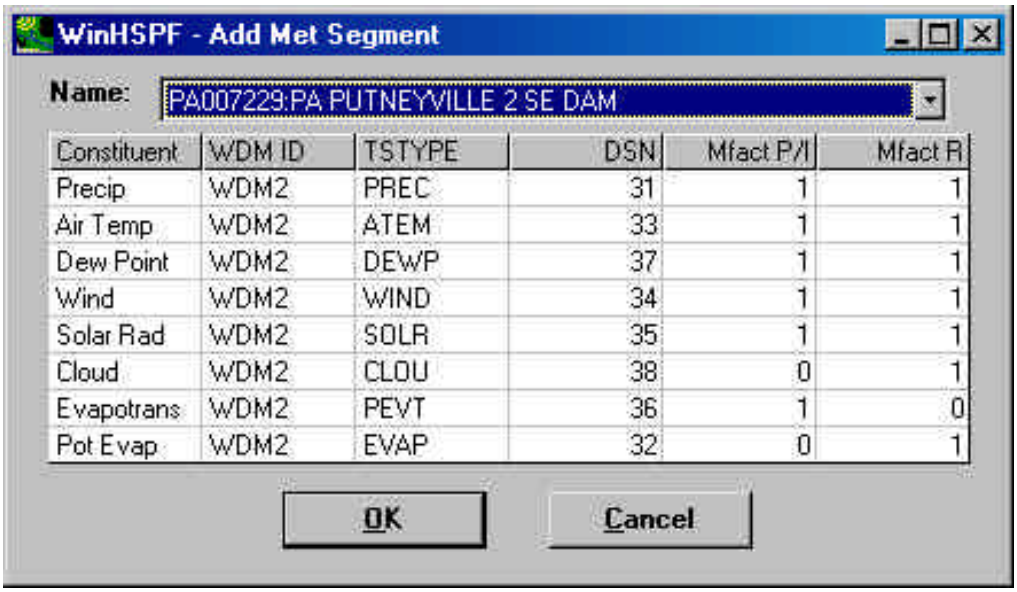


Click on the Start Year and enter a value of 1975. Now click on the the End Year and enter a value of 1980. The HSPF simulation will now only encompass this six-year span.

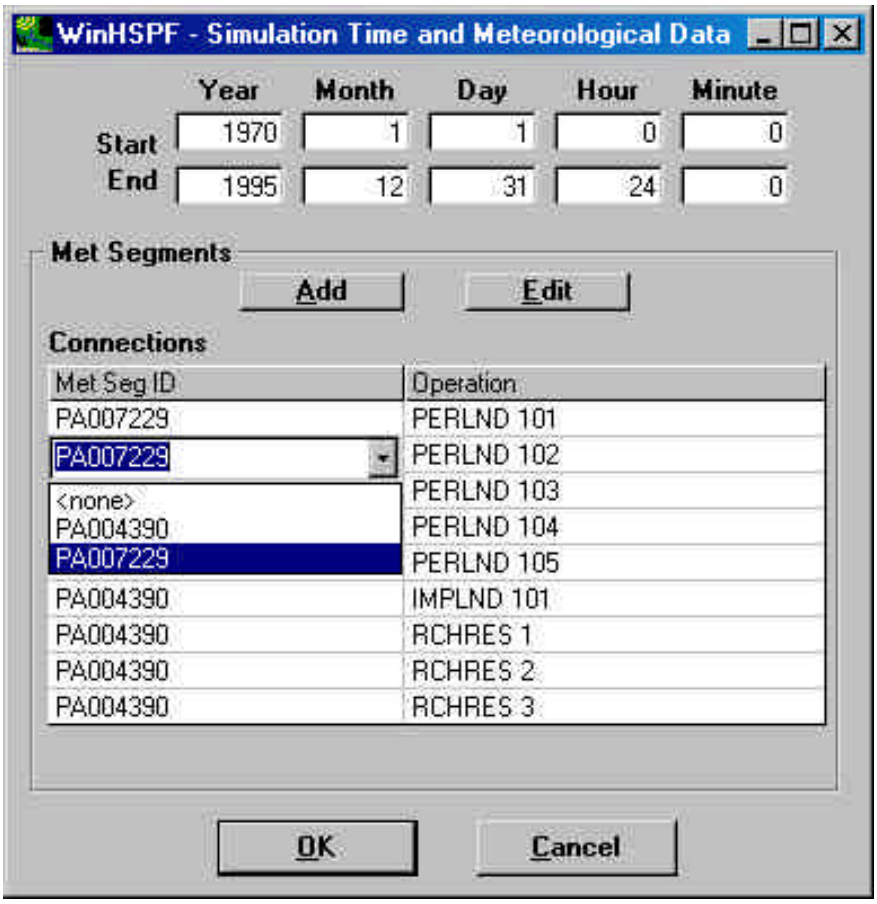
Now modify the met segments contributing to the operations. Double-click any field in the Met Seg ID column. The drop-down list contains only one met segment, indicating that there is only one such segment available for application to the corresponding operation. With a Met Seg ID still selected, click on the **Edit** button at the top left of the **Met Segments** frame. The **Edit Met Segment** form appears. Notice that the user may change the way this Met Segment is defined by changing the values in this grid, such as changing the Evap DSN.



Click on the **Cancel** button and return to the **Simulation Time and Meteorological Data** form. Now click on the **Add** button at the top right of the **Met Segments** frame and the **Add Met Segment** form appears. In the drop down list at the top of the window, choose the second item.



Notice that the user may customize this new Met Segment by editing the fields in this grid. Click on the **OK** button when the selections are complete and return to the **Simulation Time and Meteorological Data** form. Now double-click on the first two rows in the Met Seg ID column and select the recently created met segment PA007229.



When the selections are complete, click the **OK** button and return to the main form. The newly created met segment PA007229 will now affect the PERLND 101 and PERLND 102 operations during a HSPF simulation run.

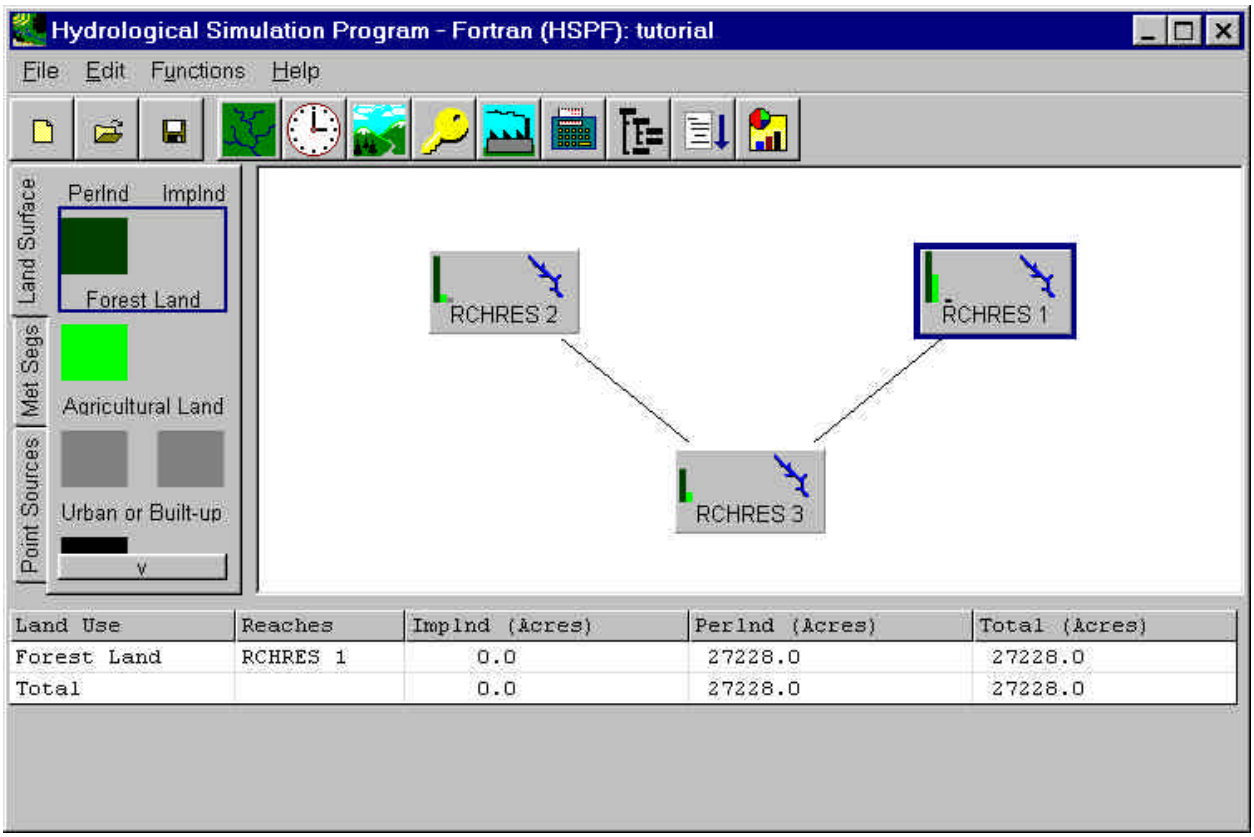
Detailed Functions

Main WinHSPF Window

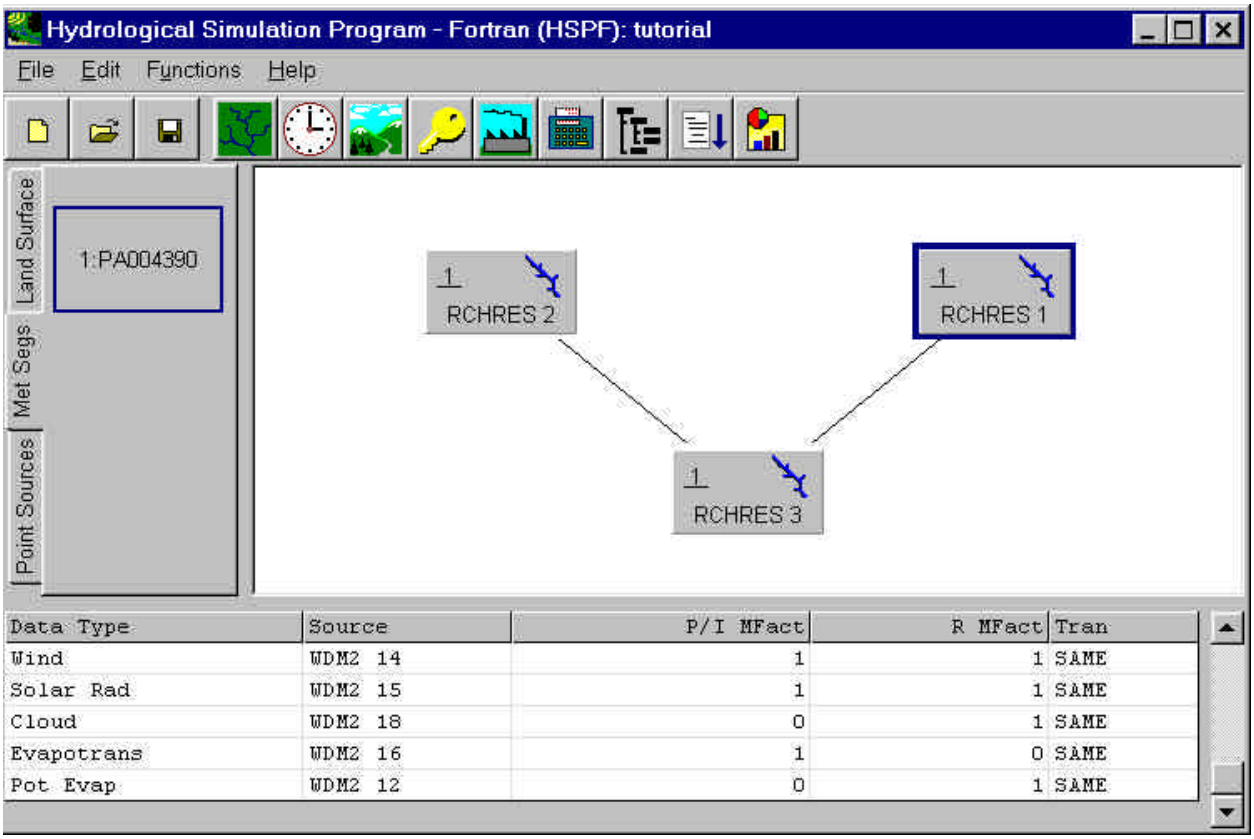
The main window of WinHSPF contains a menu, a tool bar, a vertical tab strip, a schematic of the watershed, and an auxiliary table. The tab strip, watershed schematic, and auxiliary table are not active until a project is active (i.e. a UCI file is opened). The information on the tab strip as well as the auxiliary table pertain to the open project, that is the project represented by the watershed schematic.

The buttons on the tool bar represent various ways of interacting with the open project. The left most buttons can be used for creating, opening, and saving a project. The right most button on the tool bar is used to perform the simulation, i.e. run HSPF. The other buttons on the tool bar are used to view and/or modify the contents of various portions of the open project.

The tab strip contains three tabs. The tabs work in conjunction with the figures in the watershed schematic to display information about the project in the auxiliary table. The tabs are used to specify whether to display information related to land surfaces, met segments, or point sources. Highlighting some items in the tab strip in conjunction with highlighting some figures in the watershed schematic results in some related data being summarized in the auxiliary table. For example, from the **Land Surface** tab, click on the 'Forest Land' surface and the 'Rchres 1' figure. The auxiliary table will show the acres of Forested area contributing to Rchres 1.



Clicking on the **Met Segs** tab shows which met segments are associated with each reach. The auxiliary table will show information for the selected met segment contributing to the selected reach. Information in the auxiliary table includes the constituent name, WDM data set number, associated multiplication factor for the PERLND/IMPLND segments, associated multiplication factor for the RCHRES segments, and the transformation function used to adjust the time dimension of the data units as necessary.

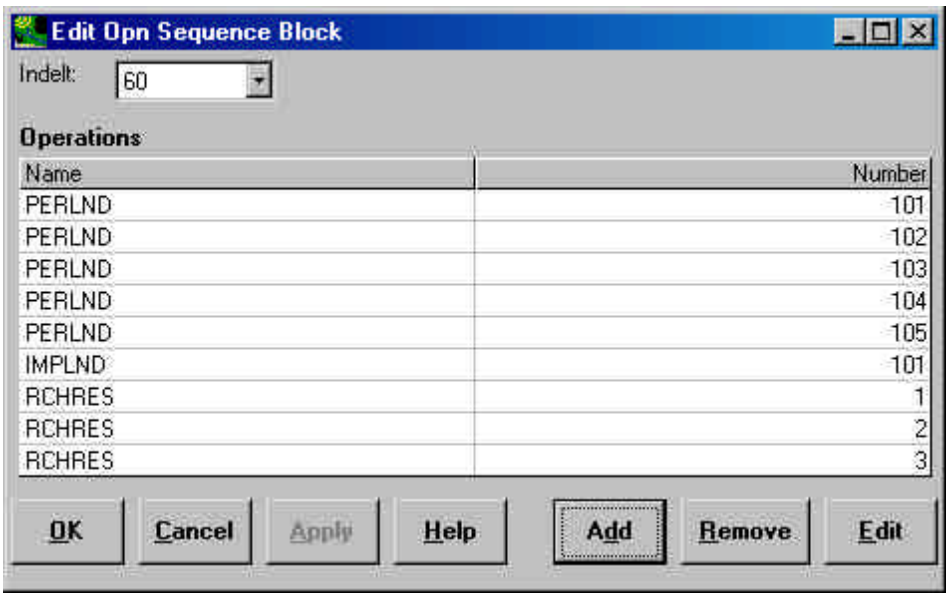


Data Type	Source	P/I MFact	R MFact	Tran
Wind	WDM2 14	1	1	SAME
Solar Rad	WDM2 15	1	1	SAME
Cloud	WDM2 18	0	1	SAME
Evapotrans	WDM2 16	1	0	SAME
Pot Evap	WDM2 12	0	1	SAME

Similarly, clicking on the **Point Sources** tab shows the point sources that are associated with each reach. The auxiliary table will show information for the selected point source and reach combination.

Edit Operation

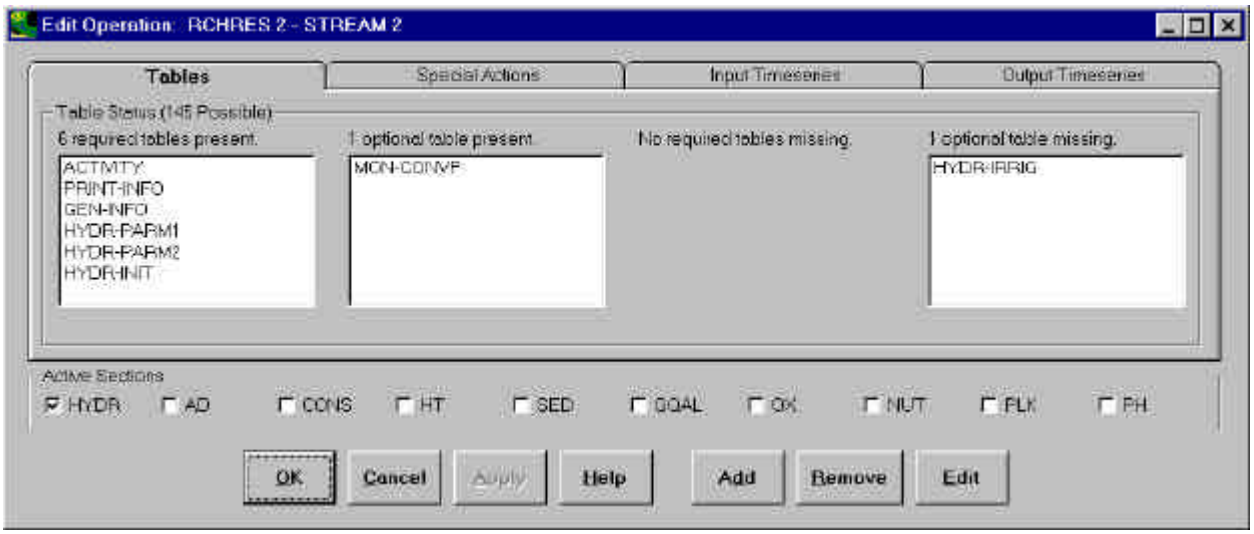
The **Edit Operation** window provides a powerful interface to an HSPF operation. There are two ways to produce this window. One is to select the **OPN SEQUENCE** option from the **Edit** menu, which displays the **Edit Opn Sequence Block** window. Select the desired operation from the Name column then click on the **Edit** button.



The other way to produce the **Edit Operation** window is to double-click on a figure in the watershed schematic or on an item on the **Land Surface** tab of the main form. If the model segmentation is 'Individual', the individual land segments can be accessed by selecting OPN SEQUENCE from the Edit menu.

The **Edit Operation** window contains a tab strip, a frame containing a row of check boxes, and a series of command buttons. All of the information in the **Edit Operation** window pertains to the current operation, which is referenced in the window name. The tab strip contains tabs for tables, special actions, input timeseries, and output timeseries. Active sections are turned on or off for this operation through use of the row of check boxes. Each of the active sections corresponds to a module within the HSPF model. The user may incorporate these modules into the simulation run by checking the box next to the appropriate section.

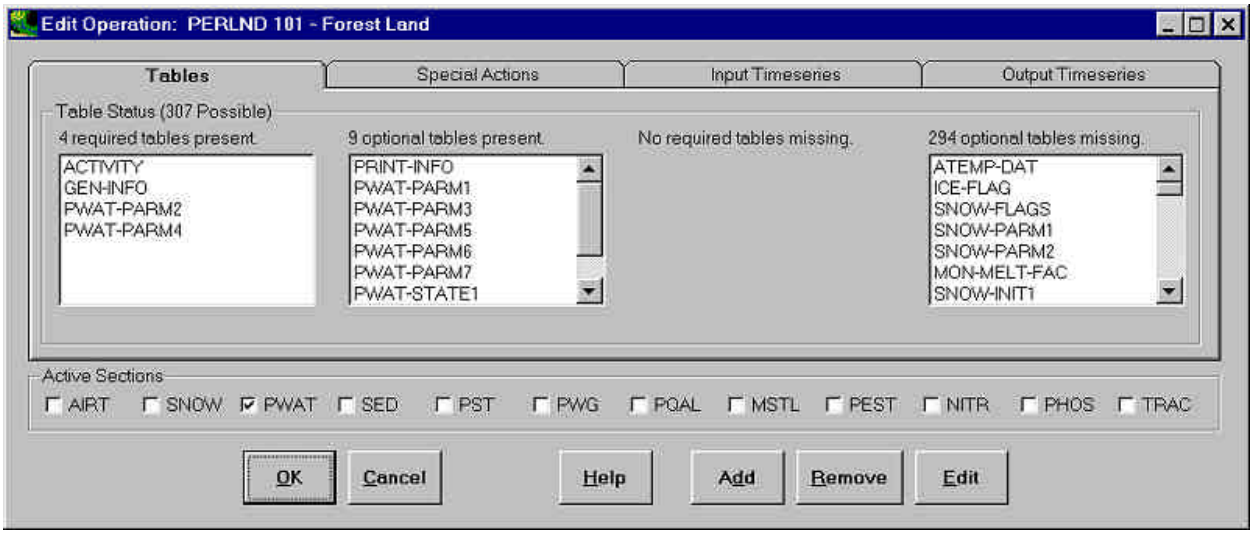
If a RCHRES operation is selected, the **Edit Operation** window will appear as follows:



The ten **Active Sections** are:

- HYDR - simulate hydraulic behavior
- AD - prepare to simulate advection of fully entrained constituents
- CONS - simulate conservative constituents
- HT - simulate heat exchange and water temperature
- SED - simulate behavior of inorganic sediment
- GQAL - simulate behavior of generalized quality constituent
- OX - simulate primary DO and BOD balances
- NUT - simulate primary inorganic nitrogen and phosphorus balances
- PLK - simulate zooplankton populations and associated reactions
- PH - simulate pH, carbon dioxide, total inorganic carbon, and Alkalinity

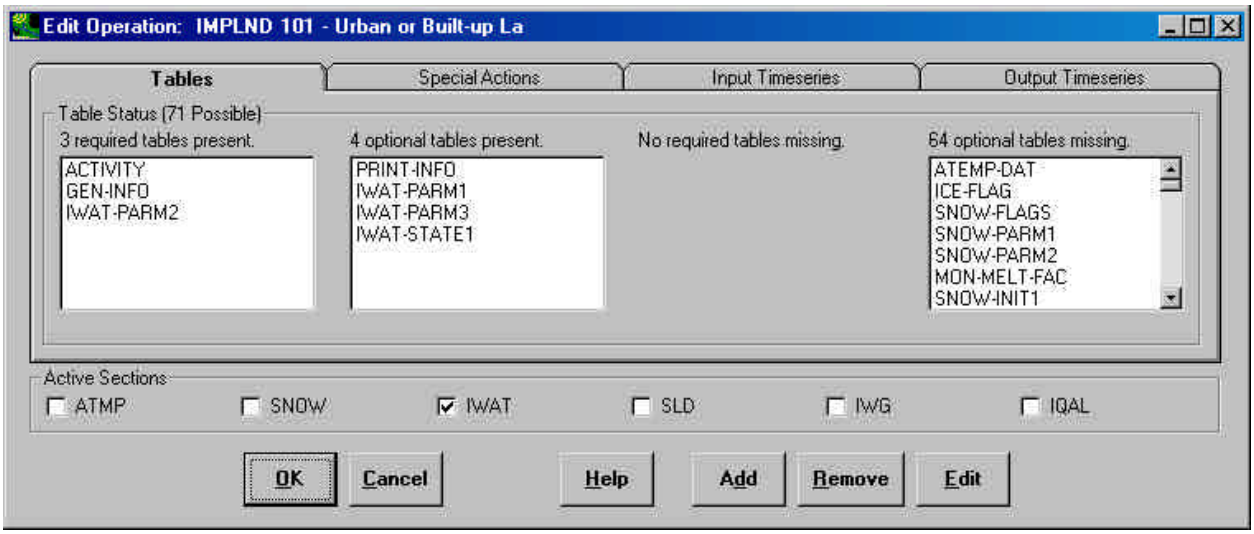
If a PERLND operation is selected, the **Edit Operation** window will appear as follows:



The twelve **Active Sections** are:

- AIRT - temperature correction for elevation difference
- SNOW - simulate accumulation and melting of snow and ice
- PWAT - simulate water budget for a pervious land segment
- SED - simulate production and removal of sediment
- PST - estimate soil temperatures
- PWG - estimate water temperature and dissolved gas concentrations
- PQAL - simulate water quality constituents
- MSTL - estimate moisture content of soil layers and fractional fluxes
- PEST - simulate pesticide behavior in detail
- NITR - simulate nitrogen behavior in detail
- PHOS - simulate phosphorus behavior in detail
- TRAC - simulate movement of a tracer

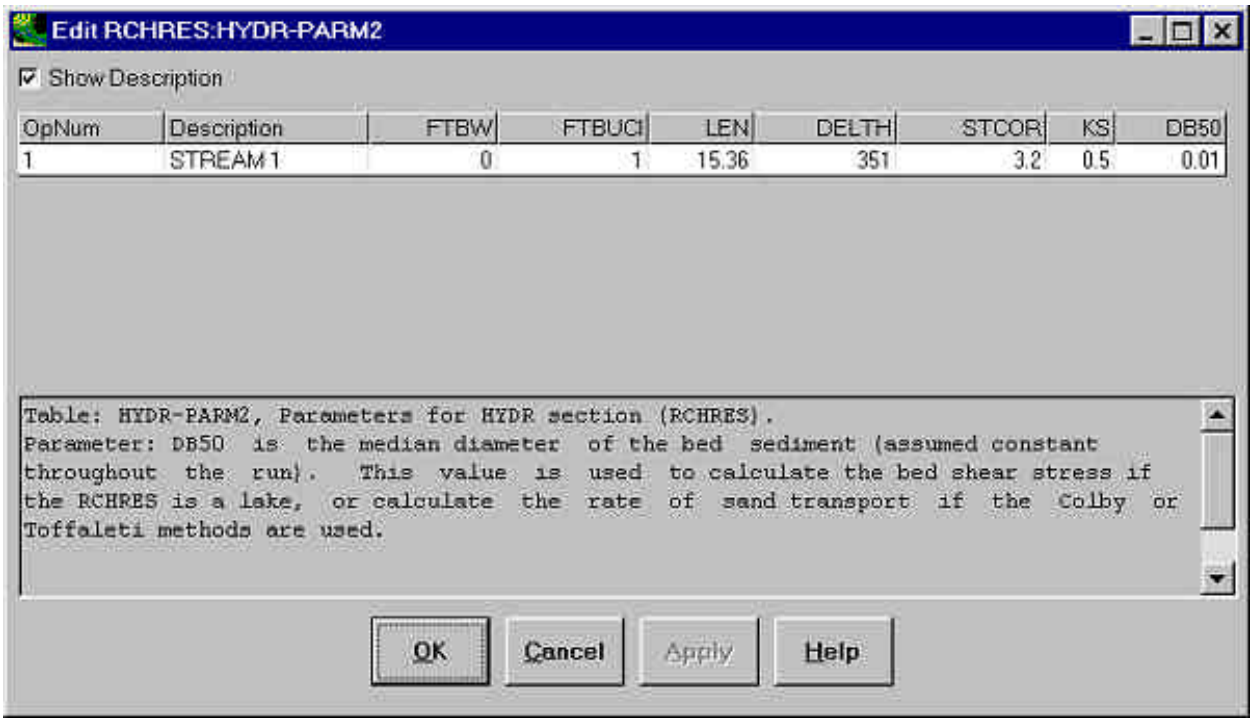
If an IMPLND operation is selected, the **Edit Operation** window will appear as follows:



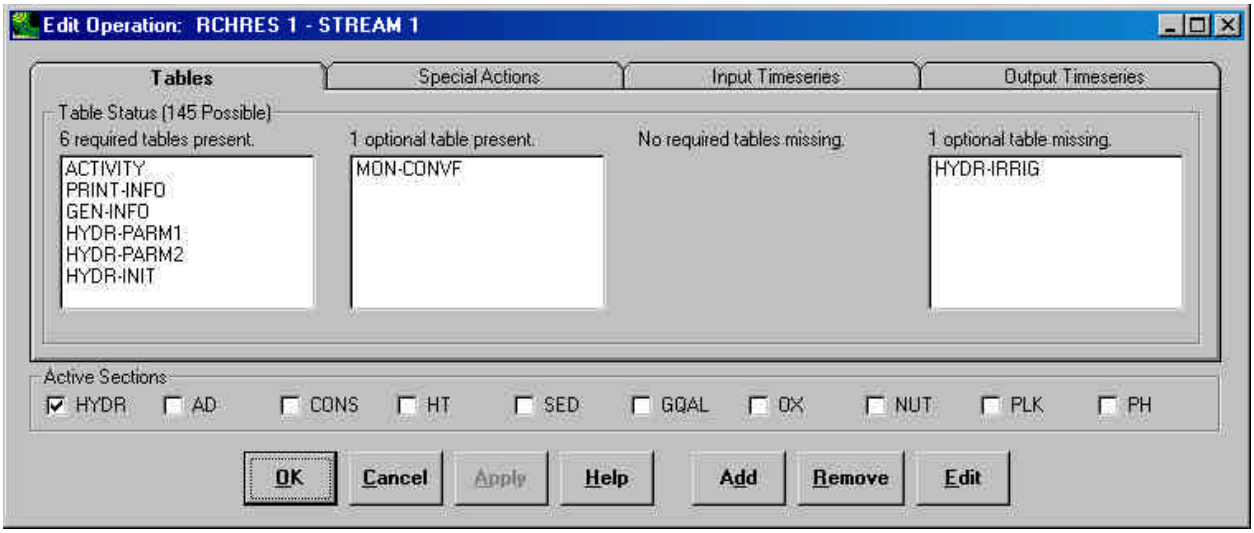
The six **Active Sections** are:

- ATMP - temperature correction for elevation difference
- SNOW - simulate accumulation and melting of snow and ice
- IWAT - simulate water budget for an impervious land segment
- SLD - simulate accumulation and removal of solids
- IWG - estimate water temperature and dissolved gas concentrations
- IQAL - simulate washoff of quality constituents

As active sections are turned on or off, the lists in the **Tables** tab change to reflect the tables applicable to the active sections. The four lists in the **Tables** tab show the required tables that are present, the optional tables that are present, the required tables that are missing, and the optional tables that are missing. The user may add a table by selecting the table name in the list and clicking the **Add** button. The user may remove a table by selecting the table name and clicking the **Remove** button. Similarly, the user may edit a table by selecting the table name and clicking the **Edit** button, or by double-clicking the table name. The resulting **Edit Table** window allows the user to edit the table parameters in a grid.



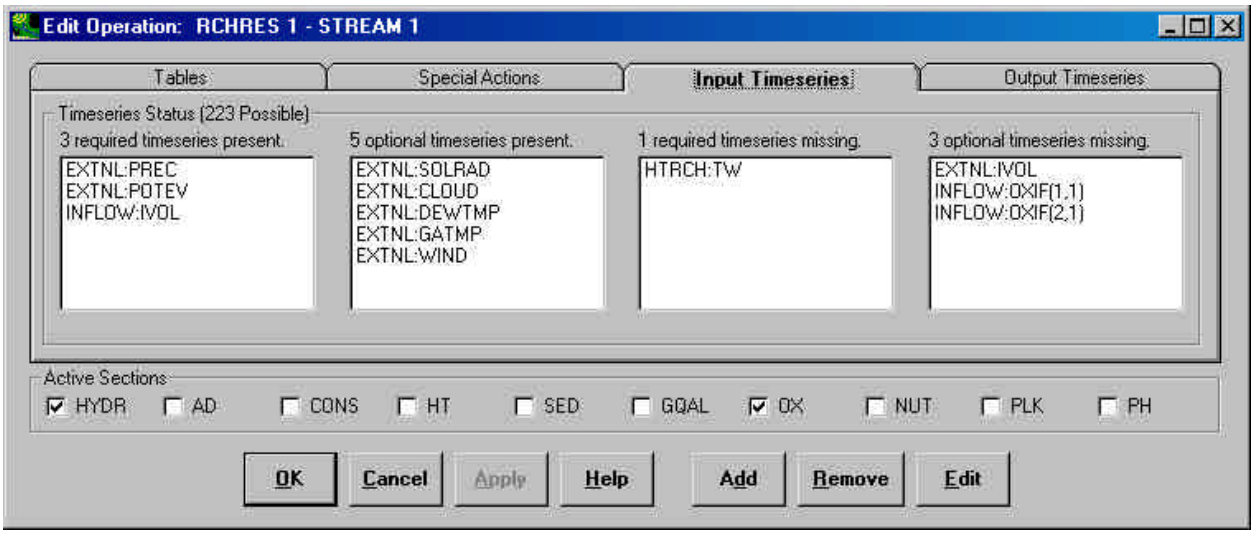
From this window a user may view and modify which sections of HSPF are active, view and modify the tables present for this operation, and view a summary of input and output timeseries used by this operation. Clicking on a table name allows the user to edit that table. Within this window is encapsulated important HSPF operating logic to assist the user in building a simulation. For example, the information in this window may alert a user to required tables or timeseries that are missing.



The **Tables** tab is useful for the user to identify which tables are required or missing for the current set of active sections, as well as providing a way to add, remove, and edit tables.

The **Input Timeseries** tab is similar to the **Tables** tab, except that the four lists pertain to Input Timeseries instead of Tables. Input Timeseries are not added and removed using this window as tables are, but the contents of the lists show the user which timeseries are being used in the simulation and which are missing. This functionality is especially useful when adding active sections to a simulation, and might help a user identify problems in a run resulting from required timeseries that are missing.

For example, a user might have only the 'Hydr' section on, and then turn on the 'Ox' section. The information in the **Input Timeseries** tab shows that the required timeseries "HTRCH:TW' is missing. This information would alert the user that the section 'Htrch' should be turned on, or that the timeseries 'HTRCH:TW' should be input as an external source.



The **Output Timeseries** tab is very similar to the **Input Timeseries** tab, except that output timeseries are listed.

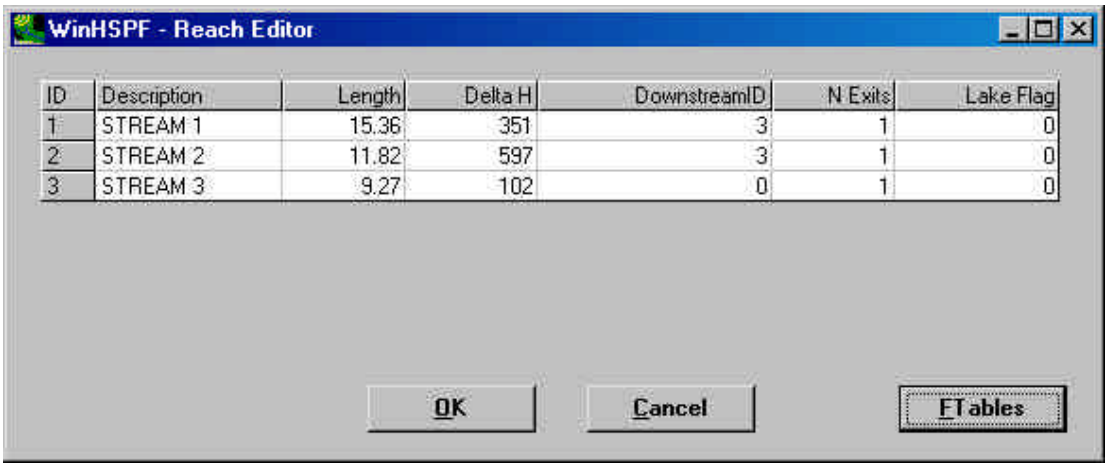
The **Special Actions** tab is not yet implemented. When completed, this tab will allow the user to edit the Special Actions specific to this operation. Until this option is completed, the Special Actions can be modified by editing the UCI file in a text editor.

Reach Editor

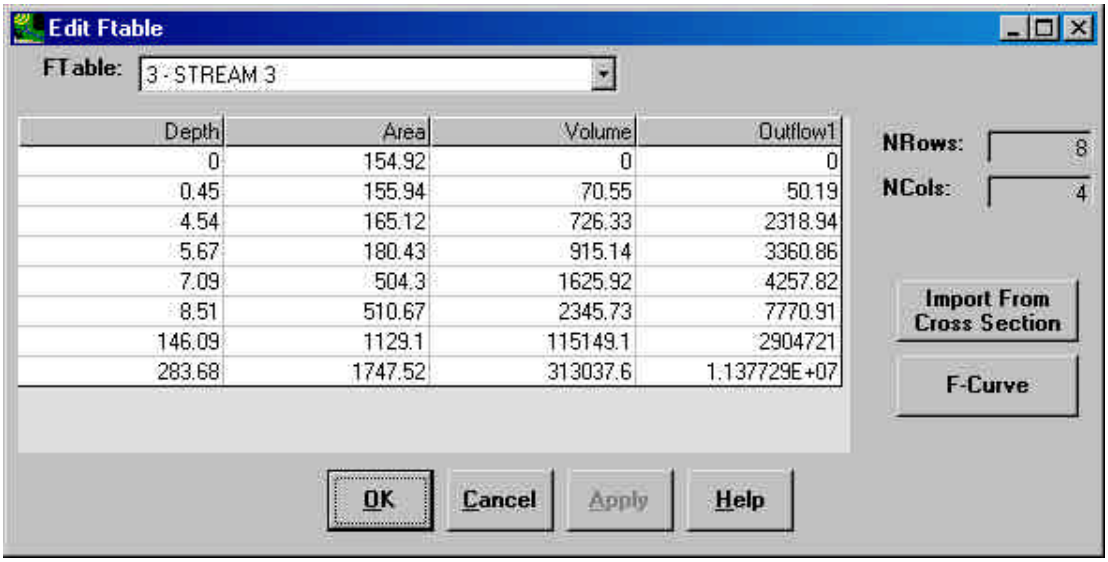
The Reach Editor allows the user to edit select properties of each reach. Clicking the button on the toolbar produces a window containing a grid of values for each reach. Values include:

- ID - RCHRES number as recognized by HSPF
- Description - descriptive name of reach
- Length - length of reach
- Delta H - change in elevation across length of reach
- DownstreamID - RCHRES number of downstream reach
- Nexits - number of outlets from reach
- Lake Flag - value is 1 if rchres is a lake

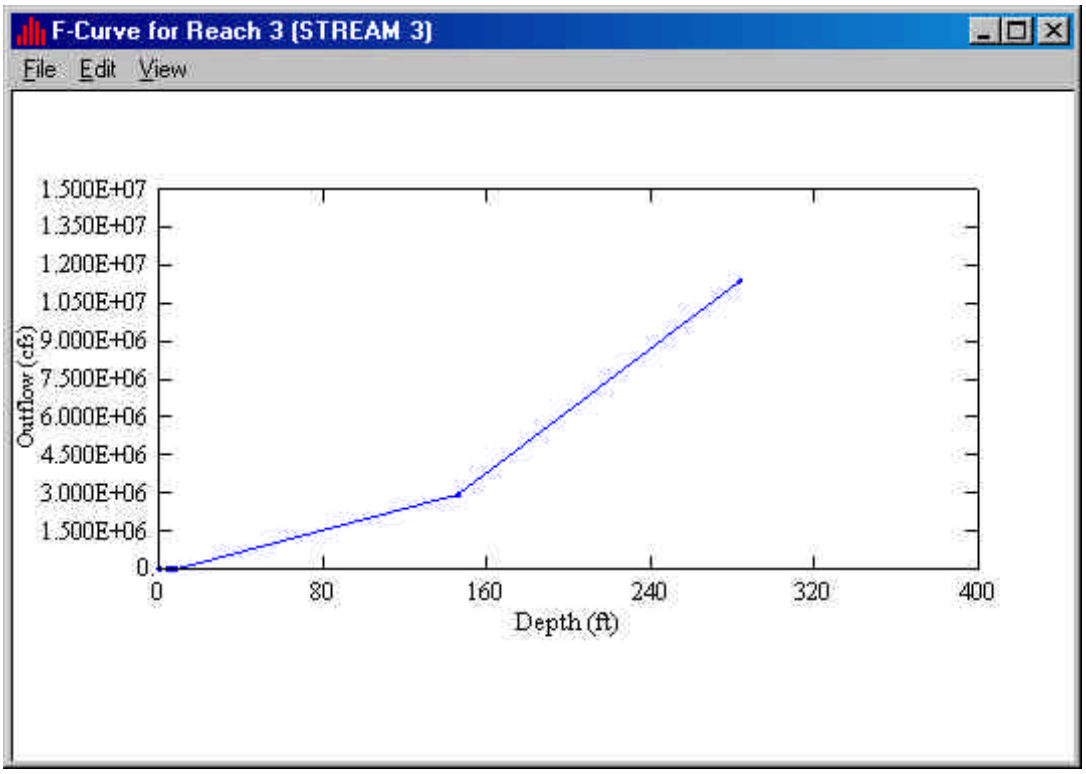
These values may be edited, and the **OK** button may be clicked to save the changes and return to the main WinHSPF window. The **Cancel** button may be used to return to the main window without saving changes.



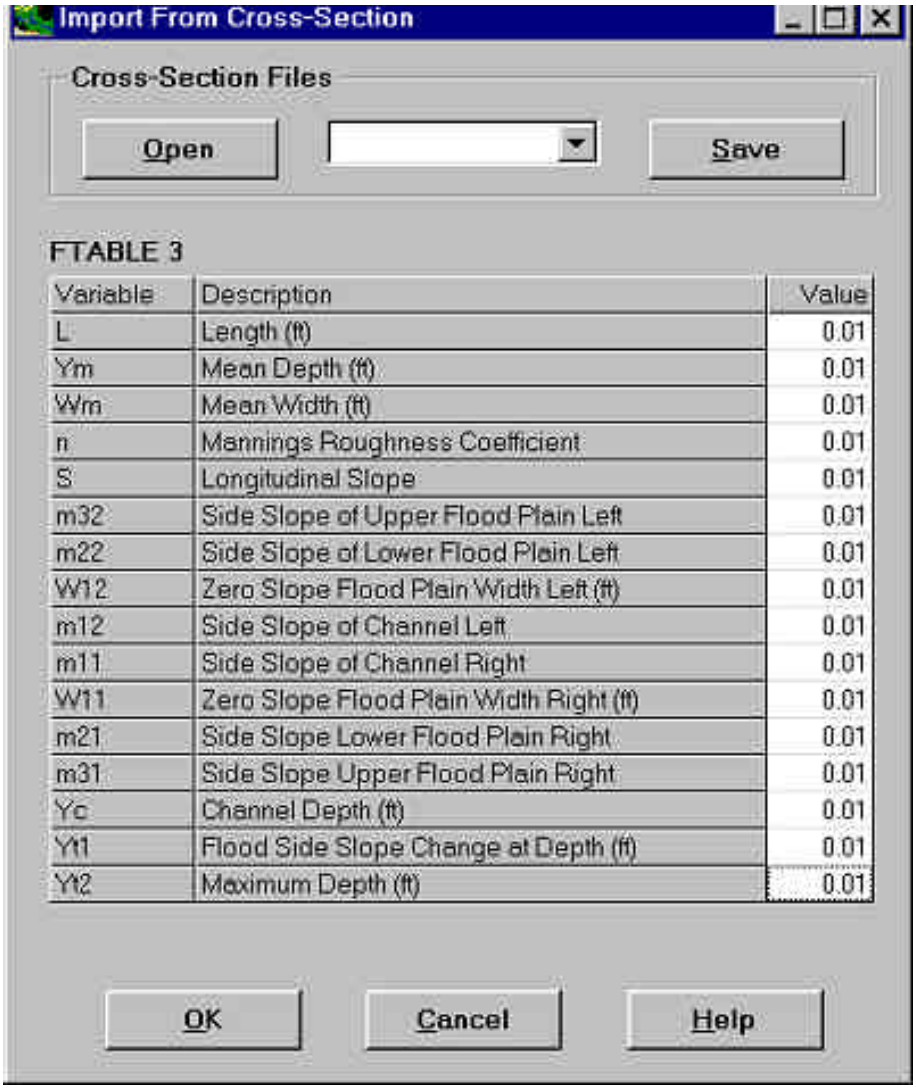
Clicking the **FTables** button produces a window from which the user may view and edit the values of each FTable. The drop down list at the top of the window is used to select the desired FTable.



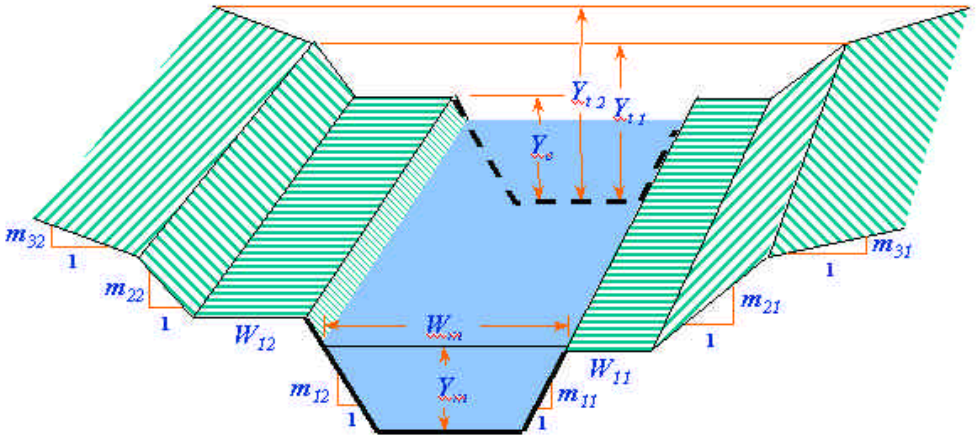
The **FCurve** button produces a graph of the FTable. The features of the graph may be edited by using the menus on the graph.



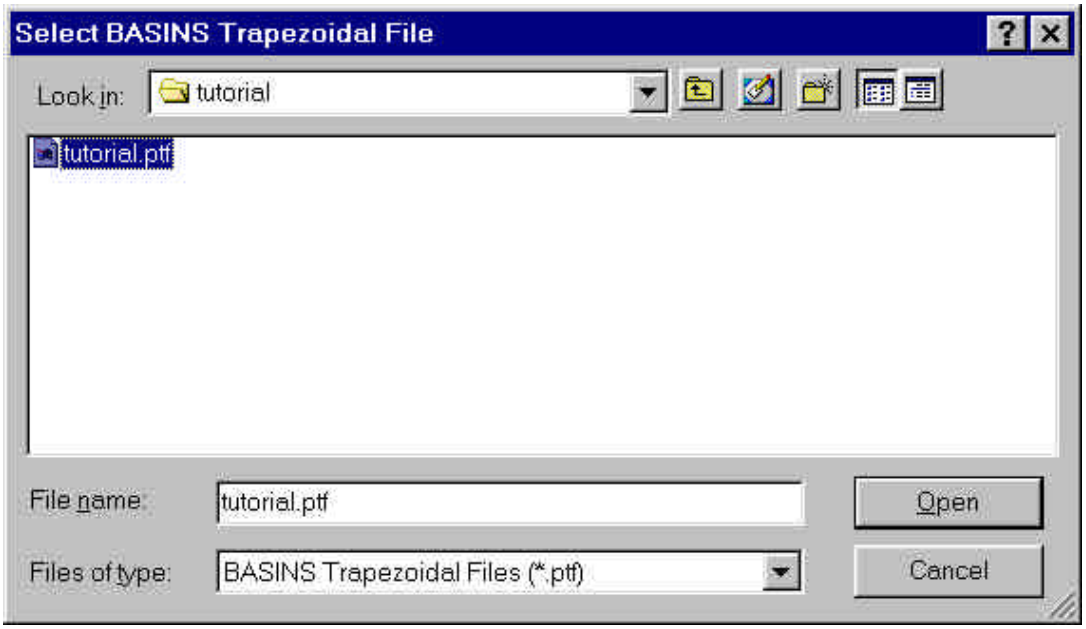
The **Import From Cross Section** button produces a window from which the user may enter cross section data for an FTable. Clicking **OK** in this form results in a new FTable being calculated for the selected reach.



The variables in the Import From Cross-Section frame are defined in following diagram.

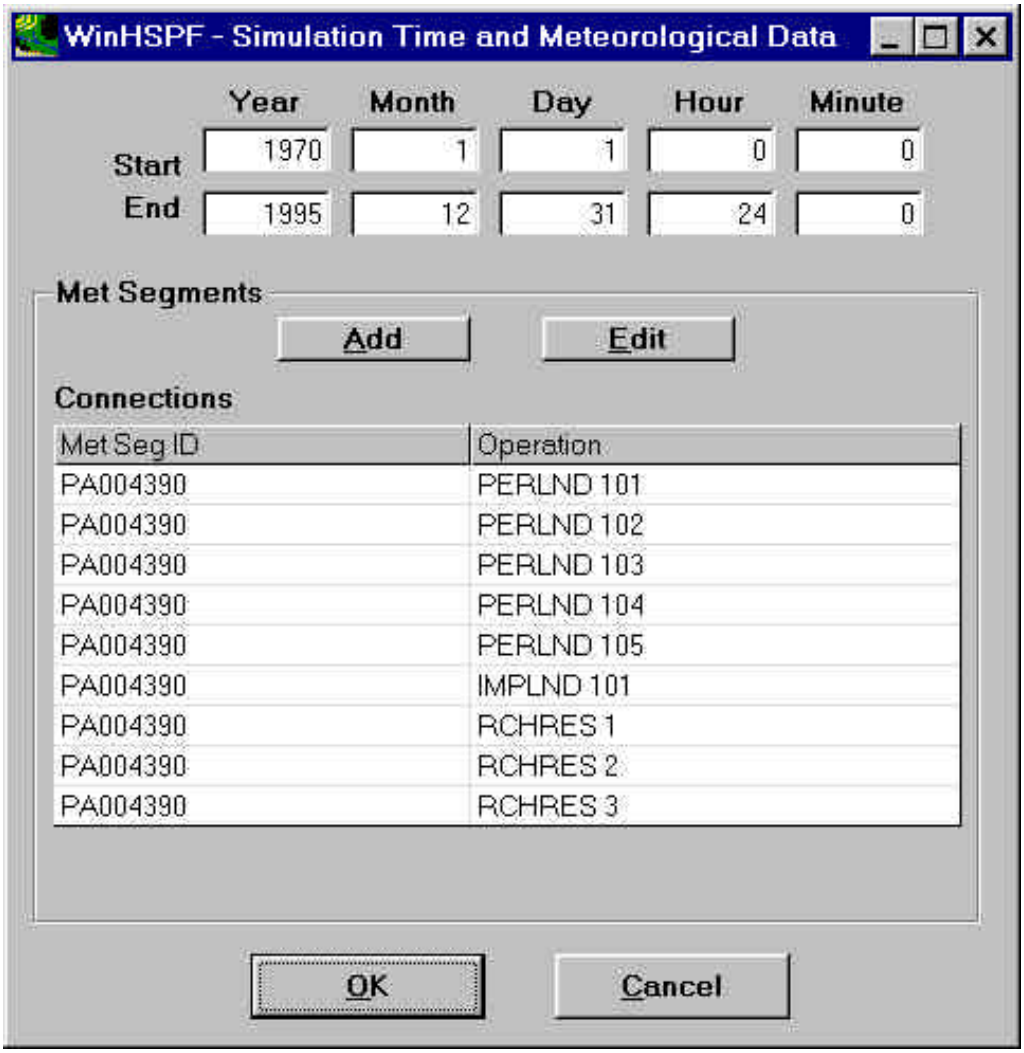


Cross-sectional data can be stored as BASINS Trapezoidal files (*.rtf). Click the Open button on the Import From Cross-Section frame to open an existing *.rtf file or the Save button to create a new *.rtf file.



Simulation Time

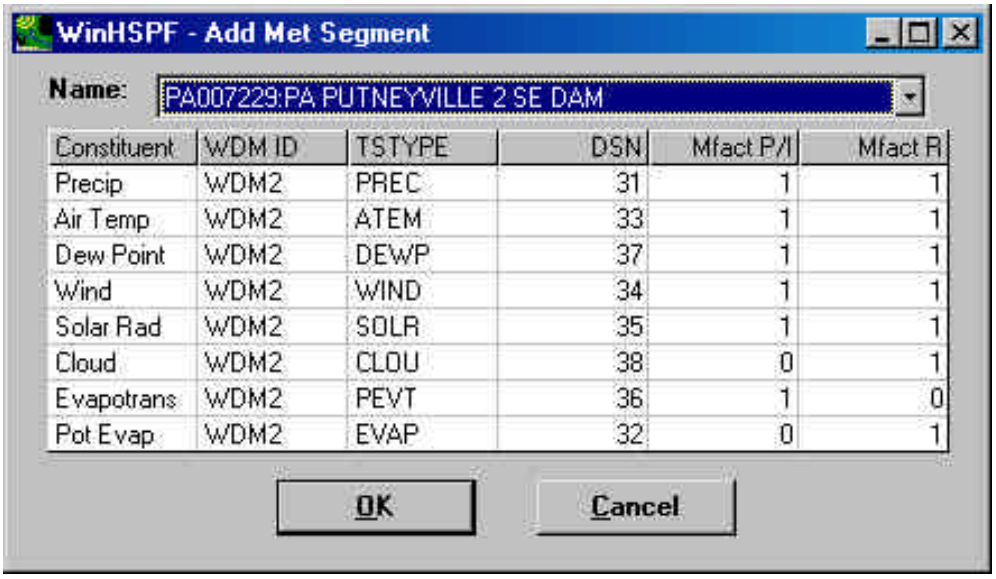
The **Simulation Time** button on the toolbar produces the **Simulation Time and Meteorological Data** form, which allows the user to edit the simulation starting and ending dates and times, as well as the met segments used in this HSPF project.

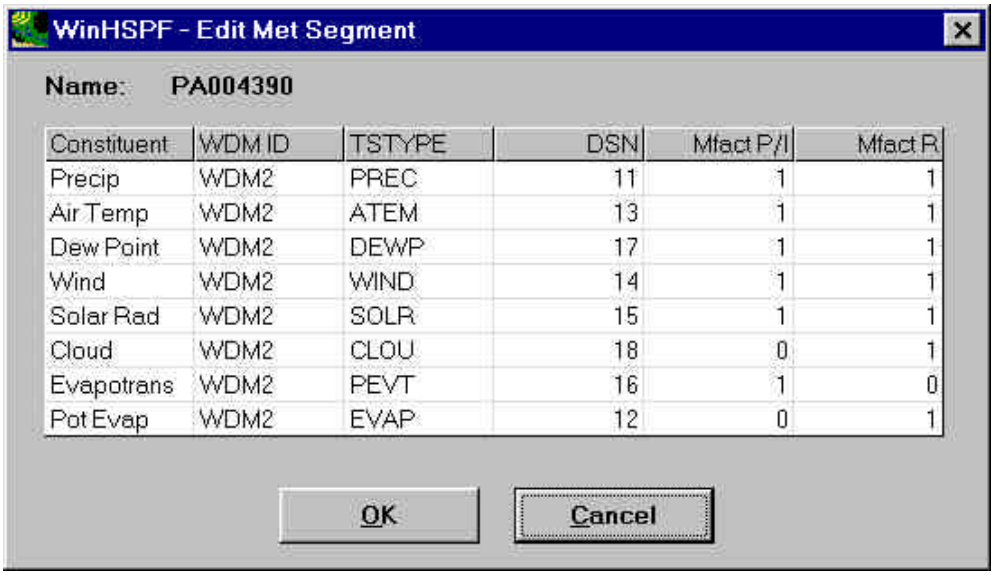


To edit the dates and times, simply click on the field for the year, month, day, hour, or minute and type in a value.

The Met Segments section of the Simulation Time and Meteorological Data form contains grid with a list of the meteorological segments and the operations which they affect. New met segments may be added by clicking on the **Add** button. Existing met segments may be modified by clicking on the **Edit** button. To edit a met segment, highlight the desired segment in the Met Seg ID Column then click on the **Edit** button. The **Add Met Segment** and **Edit Met Segment** forms are virtually identical in appearance, except that the Met Segment name in the 'Add Met Segment' form may be chosen from a drop-down list.

The precipitation data set defines the met segment and thus may not be edited in the **Edit Met Segment** form.





The eight constituents listed in the first column of the grid constitute a full set of data for a met segment. The next three columns contain drop-down listboxes with all available selections for each column. These columns should be filled out left to right because each successive field is dependent on the previous. The WDM ID column lists the WDM files used by this project (there may be up to 4). The TSTYPE column lists the types of time series available for the selected WDM file. The DSN column lists the data set numbers of the time series available for the selected WDM file and time series type. A real number should be typed in for the final 2 columns, which contain multiplication factors to be applied to the PERLND/IMPLND operations and to the RCHRES operations.

Values may be entered in the grid one at a time or they may be copied from an existing grid en masse. To copy values from one grid to another:

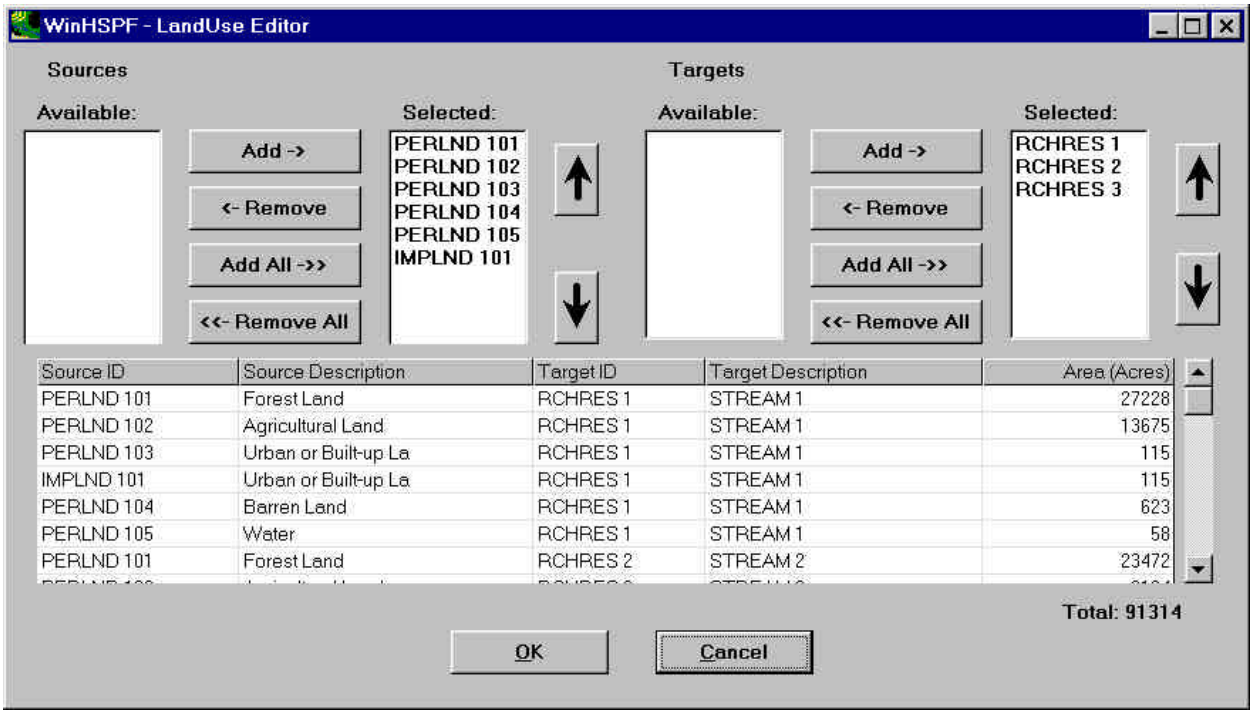
- bring up a full grid using the **Edit** button
- highlight the block of values to be copied
- type ‘ctrl-c’ to copy
- bring up an empty grid using the **Add** button or another full grid using the **Edit** button
- highlight the complete portion of the second grid where the values are to be pasted
- type ‘ctrl-v’ to paste

Once the desired changes have been made via the **Simulation Time and Meteorological Data** form, the **OK** button may be clicked to save the changes and return to the main WinHSPF window. The **Cancel** button may be used to return to the main window without saving changes.

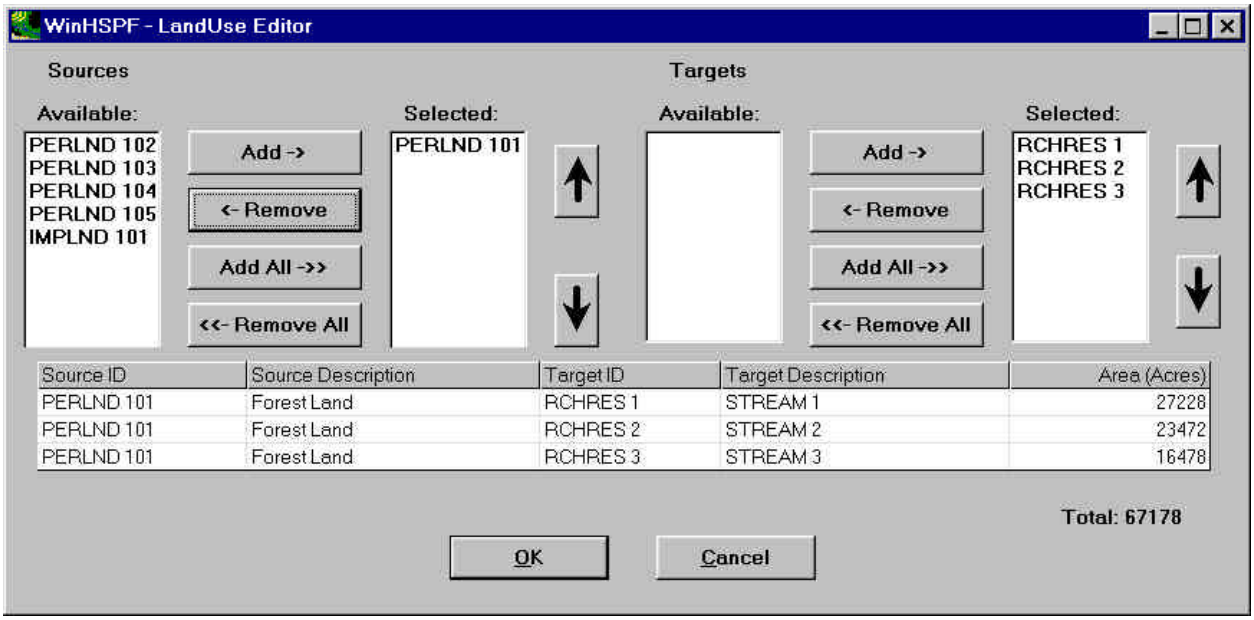
Land Use Editor

The Land Use Editor allows the user to edit the amount of each land use contributing to each reach. Clicking the button on the toolbar produces a window containing two list boxes, under which is a grid displaying area values connecting source operations to target operations. The grid contains five columns:

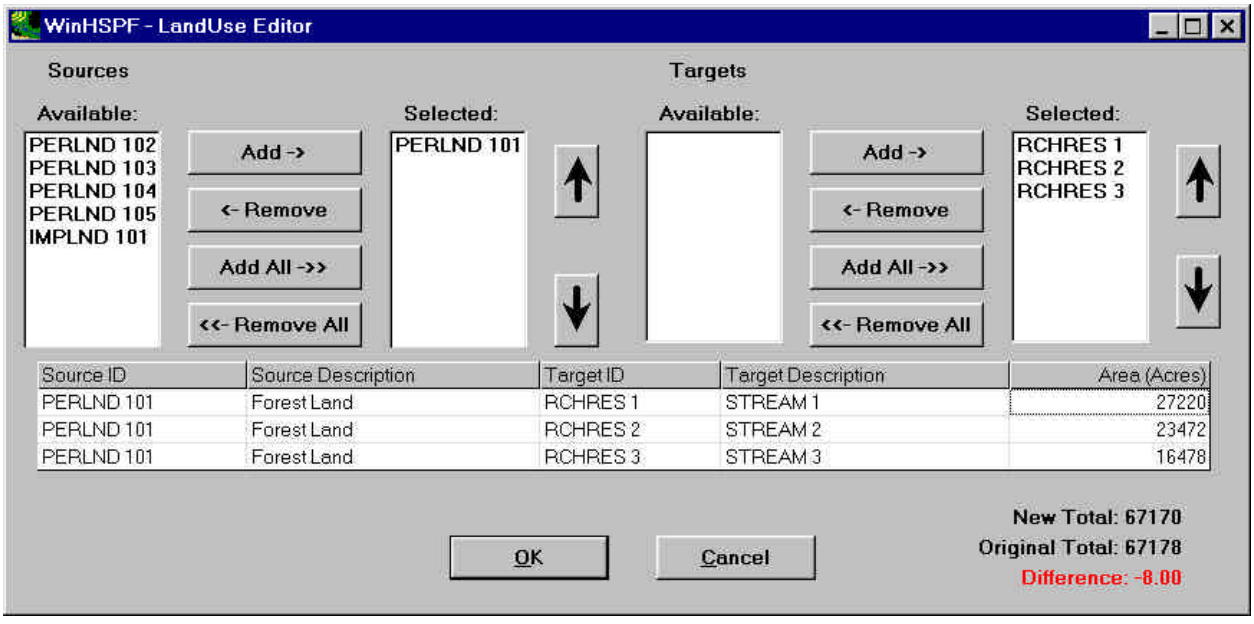
- SourceID - name of contributing source as recognized by HSPF
- Source Description - description of contributing source
- TargetID - name of target/reach as recognized by HSPF
- Target Description - description of target/reach
- Area - acreage of source contributing to target/reach



The list box on the left represents the sources or land segments, and the list box on the right represents the targets or reaches. The grid contains a row for each selected land segment contributing to each selected reach. Reaches and land segments are represented in the grid if the name of the operation is in the **Selected** portion of the list box. Operations can be moved back and forth between the **Selected** and **Available** portions of the list, and the contents of the grid automatically will change accordingly.



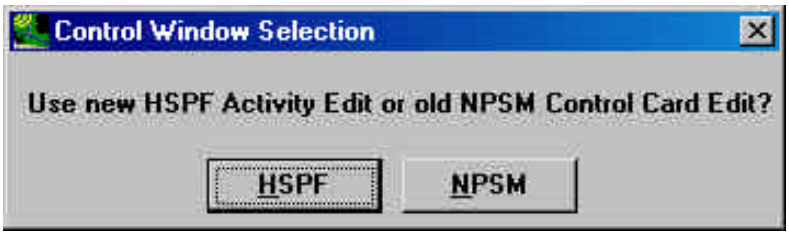
The area values may be edited, and text below the grid will indicate the original total area, the new total area, and the difference between these two. This information provides the user with some information that allows the user to feel confident that the change was interpreted as desired.



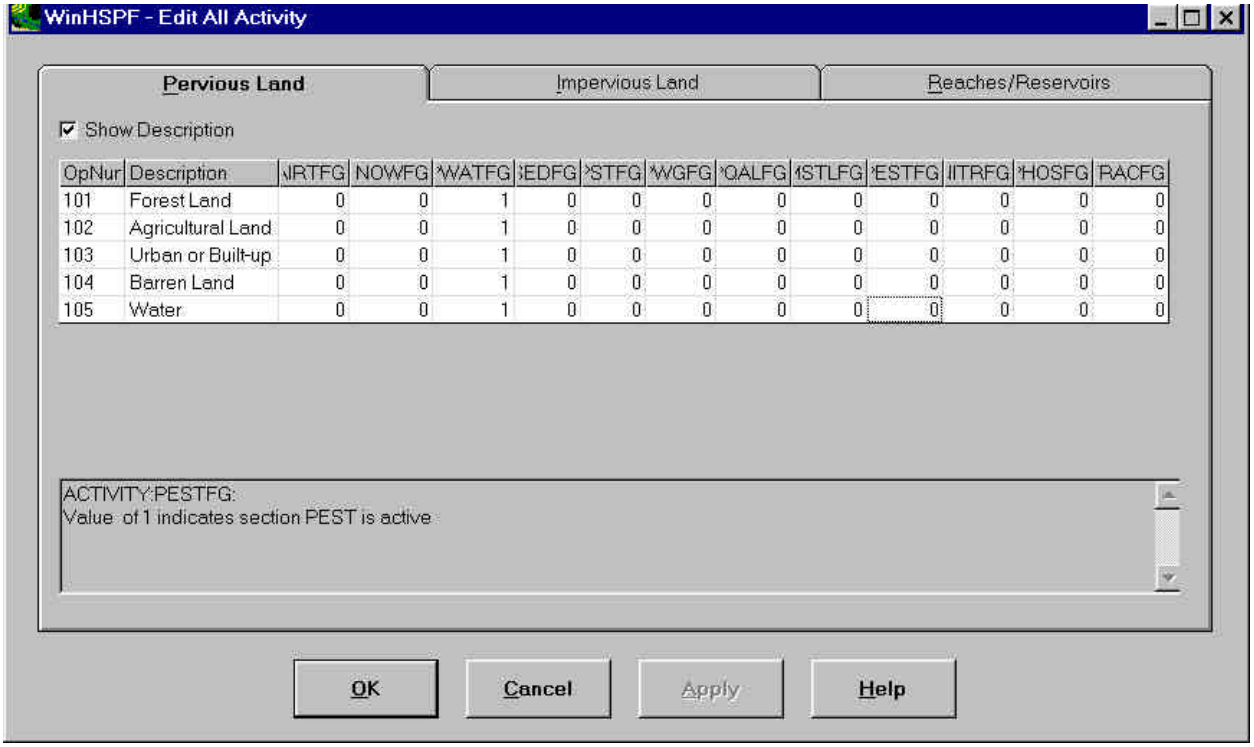
Once the values have been edited, the **OK** button may be clicked to save the changes and return to the main WinHSPF window. The **Cancel** button may be used to return to the main window without saving changes.

Control Cards

The Control Card Editor is accessed by choosing the **Control** option from the **Functions** menu or by clicking on the **Control Card** button on the toolbar. The **Control Window Selection** window will appear, prompting the user to choose between the HSPF Activity Edit window or the old NPSM Control Card Editor. Both schemes are available so that the user may have a choice of means.



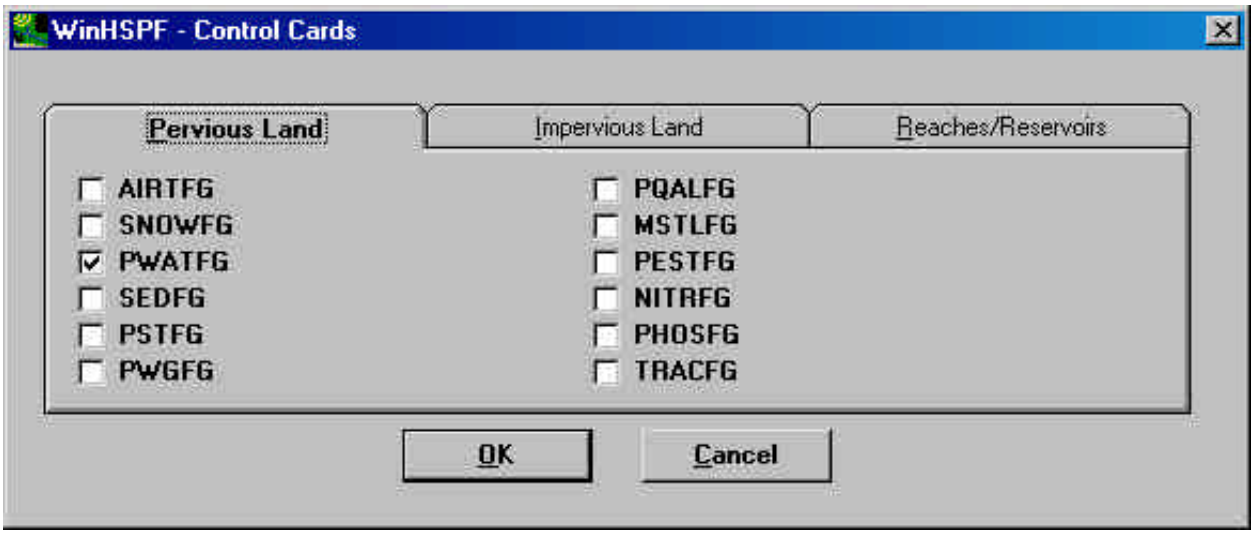
If the user chooses the **HSPF Activity** option, a window will be displayed containing a tab strip. On each of the three tabs are the Activity tables for the PERLND, IMPLND, and RCHRES blocks. Changes may be made to the entries in these tables, and then the user may click **OK** to exit and save the changes or **Cancel** to exit without saving the changes.



If the user chooses the **NPSM** option, a window will be displayed containing a tab strip, similar to the **HSPF Activity** edit window. The three tabs represent the PERLND, IMPLND, and RCHRES operations, but these tabs contain a series of check boxes. With this window the user may turn on or off a section for all operations of that type.

When the user turns a section on through this editor, other sections might turn on automatically. This section contains some operating rules that understand some sections to be prerequisite to running other sections. These operating rules are based on *BASINS Technical Note 3: the NPSM/HSPF Simulation Module Matrix*. Following these operating rules, all required and recommended prerequisite sections are turned on.

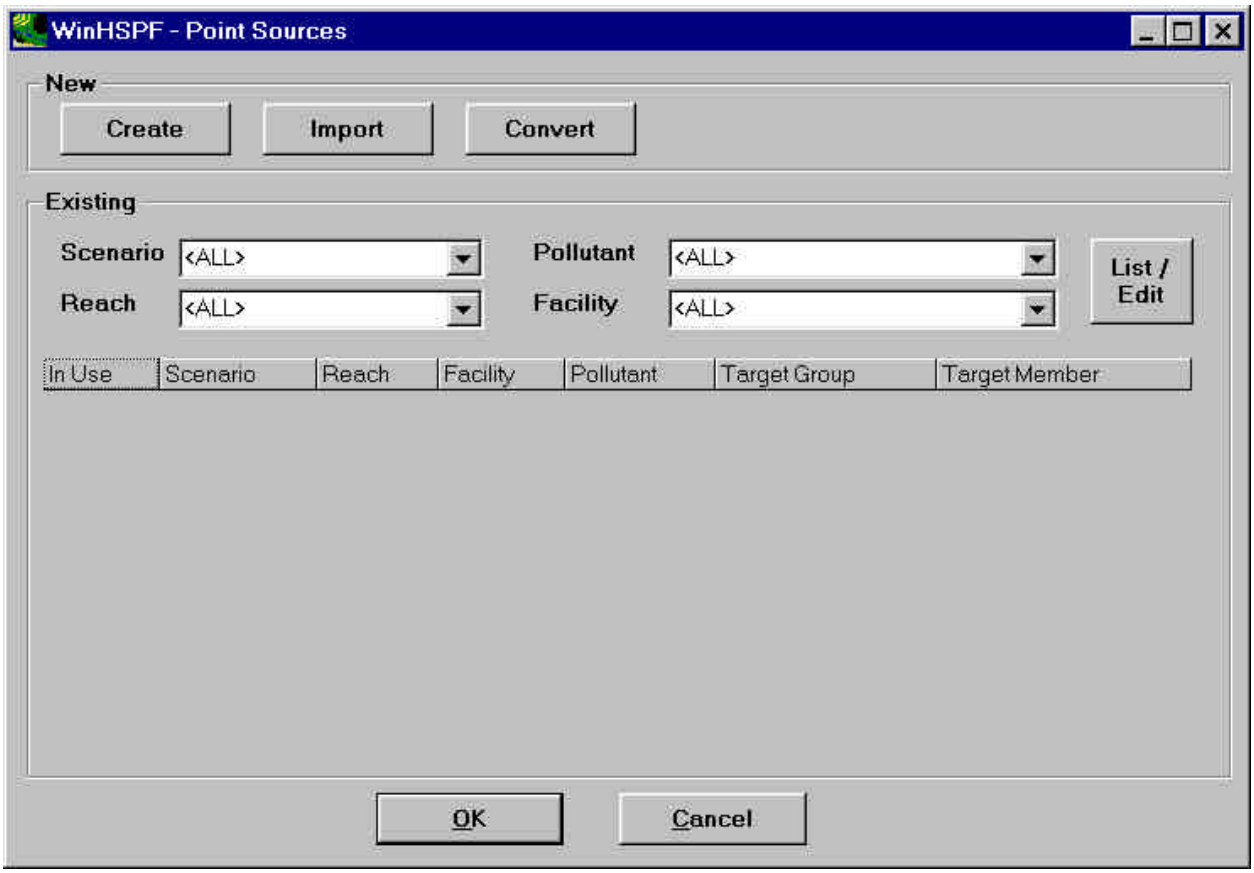
Then the user may click **OK** to exit and save the changes or **Cancel** to exit without saving the changes.



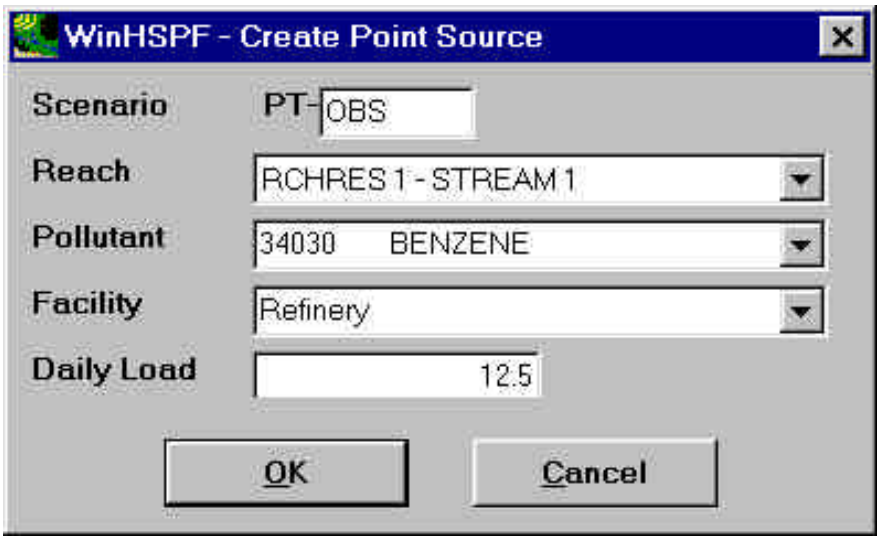
When making sections active, often tables that are not yet present become required by HSPF. If the user has turned some sections on and clicked OK, this editor will give the user the option to automatically add the tables required by the active sections.

Point Sources

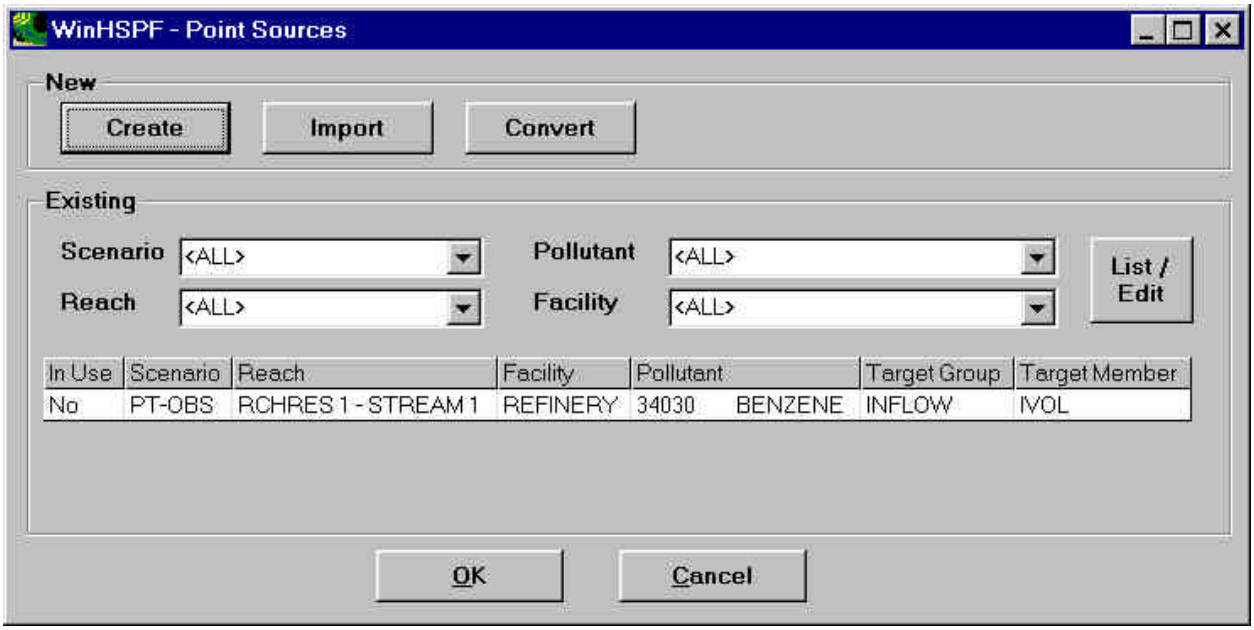
The **Point Sources** window is accessed either by selecting the **Point** option from the **Functions** menu or by clicking on the button on the toolbar. This window is used to view and manage the point sources that may be included in the simulation. When a new project is created, point source data is written to the project WDM file for all point sources and constituents specified in the BASINS point sources file. All of these point source data sets are available through the Point Sources window.



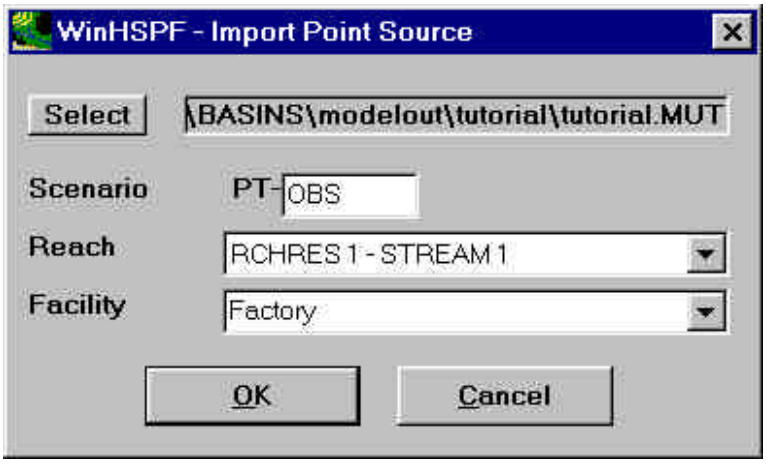
The **New** frame at the top of the window offers three methods for obtaining new point source data. Clicking on the **Create** button displays the **Create Point Source** window. The user types in the extension of the **Scenario** name, selects the **Reach** from its drop-down list box, either types in or selects the **Pollutant** and **Facility** from their respective combo boxes, and types in the **Daily Load**.



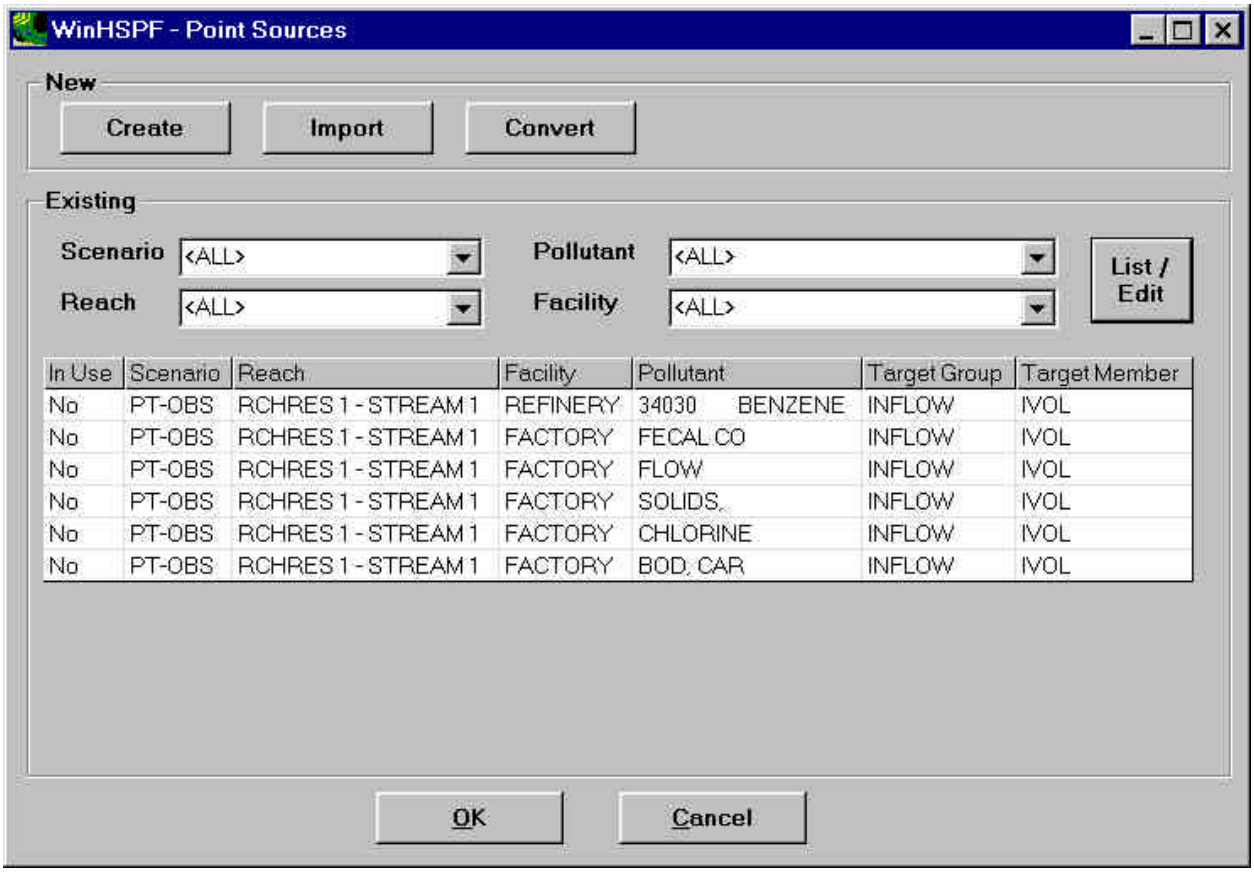
Once the values have been entered, click the **OK** button to create the new point source in the project WDM file and return to the main **Point Sources** window. The **Cancel** button may be used to return to this window without creating a new point source.



Clicking on the **Import** button displays the **Import Point Source** window. Clicking on the **Select** button allows the user to browse for the MUTSIN (*.mut) file to be imported. MUTSIN files are point source data files created by BASINS versions earlier than 3.0. The user then types in the extension of the **Scenario** name and selects the **Reach** from its drop-down list box. The **Facility** field will automatically be filled in with text from the import file.

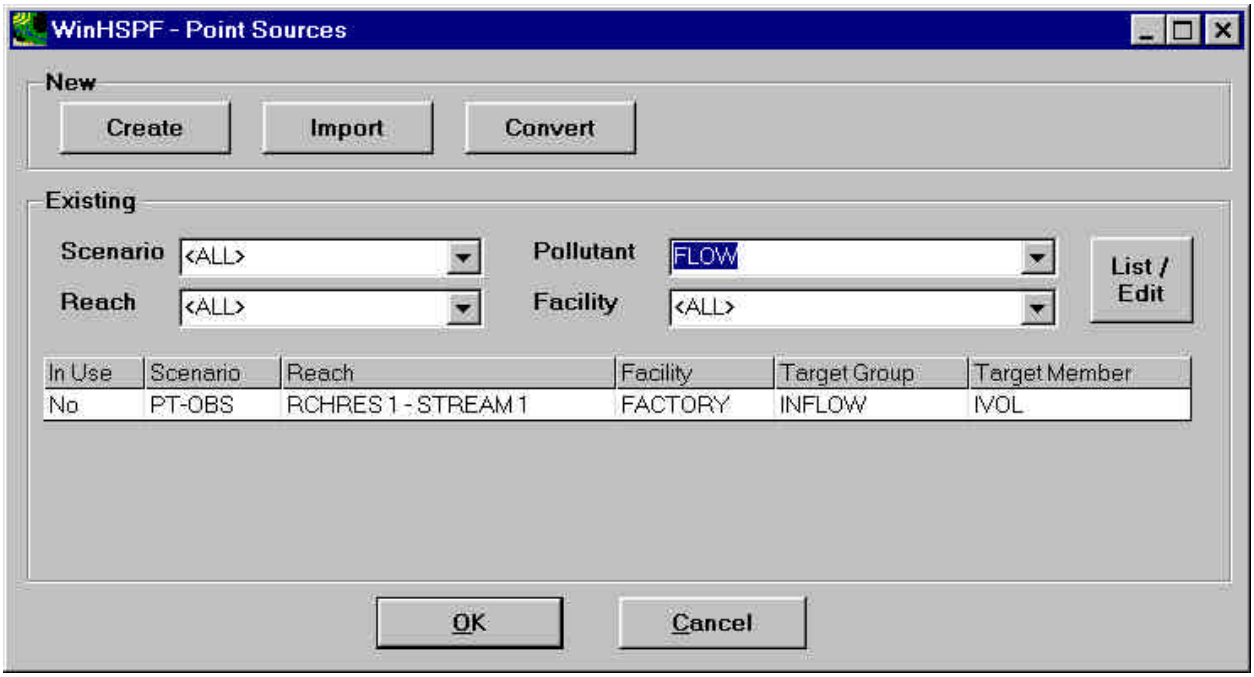


Once the values have been entered, click the **OK** button to import the new point sources into the project WDM file and return to the main **Point Sources** window. The **Cancel** button may be used to return to this window without importing a point source.



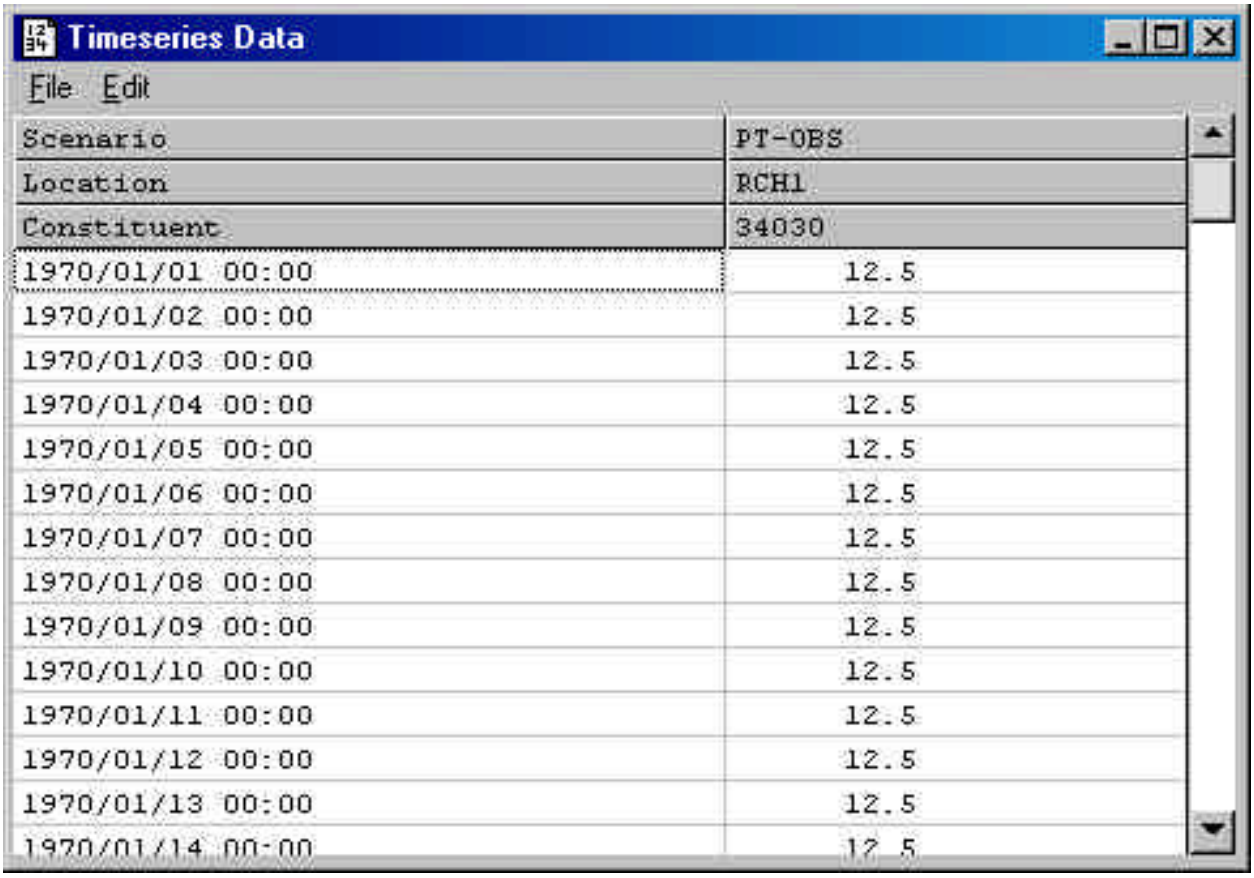
Clicking on the **Convert** button scans the HSPF input sequence (the UCI file) and, if this sequence refers to any MUTSIN files, all such files are converted to WDM data sets in the project WDM file.

The **Existing** frame at the bottom of the **Point Sources** window contains a grid displaying the point sources in the project WDM file. The number of point sources displayed in the grid can be restricted by making selections from the **Scenario**, **Reach**, **Pollutant**, and **Facility** drop-down list boxes. For example, if "FLOW" is selected from the **Pollutant** list box then the grid will display only the point sources that have "FLOW" as the **Pollutant**.



The 'In Use' column is used to specify if that point source is in use in the current simulation. When the user sets a point source to 'In Use', that point source is added to the External Sources block. WinHSPF will add the appropriate units conversion in the multiplication factor, provided that the daily data in the WDM data set is in the standard BASINS units (lbs/day all constituents except flow, which is in cfs) and that the time step of the run is in hours. Thus the multiplication factor for flow will convert cfs to acre-feet/hour.

The user may wish to edit values in one of the point source data sets. This may be done by highlighting a field in the row associated with the desired data set then clicking on the **List/Edit** button. The following form will appear:



Values may be edited by clicking on the desired field and entering a new date or value.

See Lesson 7 of the online tutorial to follow an example of creating, adding, and editing point source data.

Special Note: A user may wish to add point source data sets from formats other than the MUTSIN files included in BASINS. This may be accomplished using the program WDMUtil. When adding a new point source data set, be sure to use the units specified above. In addition, certain conventions should be followed in the WDM attribute naming so that WinHSPF Point Sources tool recognizes these data sets as candidate point source inputs. The details of these conventions follow:

- The scenario id attribute (IDSCEN) must begin with the three characters "PT-". These names will appear in the Point Sources 'Scenario' list.
- The constituent id attribute (IDCONS) must consist of a four-character abbreviation for the pollutant, or the standard five-digit parameter code. These names will appear in the Point Sources 'Pollutant' list.
- The time series type attribute (TSTYPE) must consist of a four-character abbreviation for the pollutant. If the constituent is flow, this attribute must be "FLOW".
- The location id attribute (IDLOCN) must consist of the three characters "RCH" followed by the RCHRES id number of the reach on which this point source resides, such as "RCH9" for a point

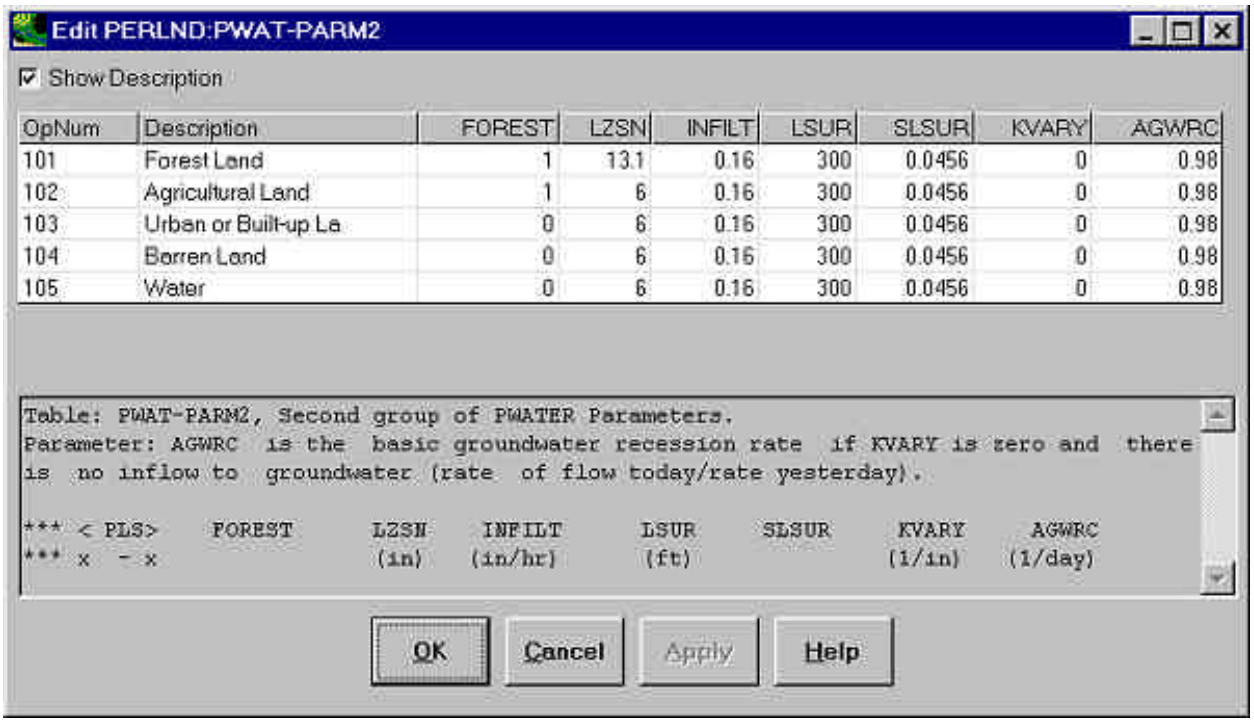
source on RCHRES 9 or “RCH10” for a point source on RCHRES 10. These names will appear in the Point Sources ‘Reach’ list.

- The station name attribute (STANAM) will appear as the facility name in WinHSPF. This attribute is optional, but the user might wish to add the facility name for consistency.

Input Data Editor

The Input Data Editor is accessed either by choosing the **Edit** option from the **Functions** menu or by clicking on the **Input Data Editor** button on the toolbar. The **Input Data Editor** window contains a tree diagram of the blocks and tables of HSPF. The tree diagram is navigated by clicking on an item name. Double-clicking on an item name reveals the subitems within that item, if any exist.

Double-clicking on a block or table name produces another window containing a grid for editing the parameters of that block or table.

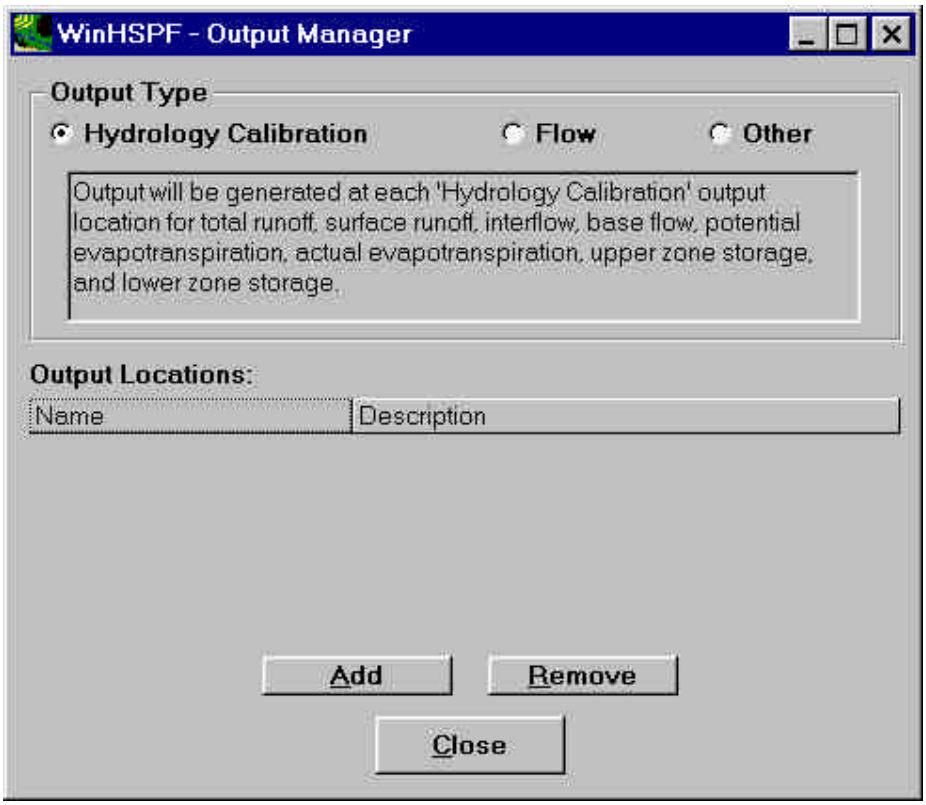


Note that the grid columns may be sorted by clicking on the column heading. The blocks of HSPF may also be accessed for editing using the **Edit** menu.

If the user has selected the name of a table that does not yet exist from the tree diagram, a message will appear asking if the user would like to add that table. The input data editor will also automatically add tables that become required through the changes made to the HSPF tables.

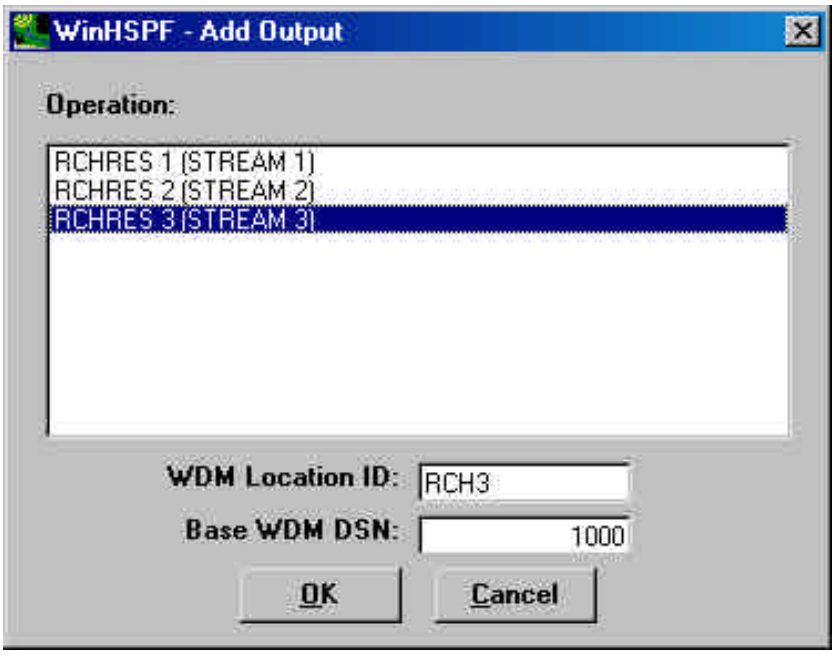
Output Manager

The **Output Manager** is accessed either by choosing the **Functions:Output** menu option or by clicking the icon on the toolbar. The Output Manager window will appear containing a set of radio buttons and a list of output locations. The radio buttons are used to specify which of the three types of output to view. Clicking on one of the radio buttons produces a list of locations where that output has been specified.

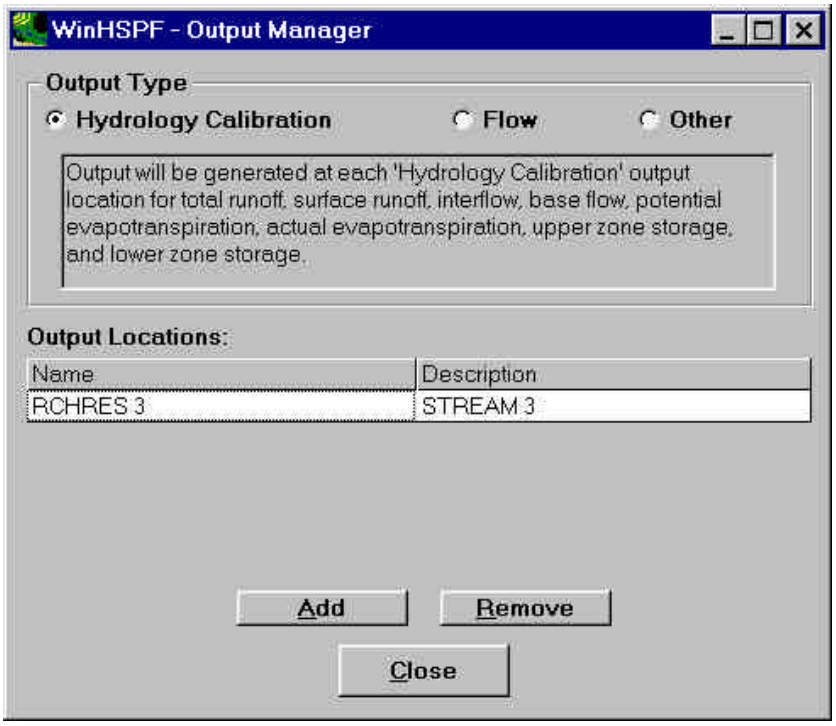


The first output type is Hydrology Calibration. This button will already be selected when entering the Output Manager. With this button selected, the list below the radio buttons displays the HSPF calibration locations within the current HSPF project. Underneath the radio buttons is a text box explaining which output timeseries will be generated during the HSPF model run.

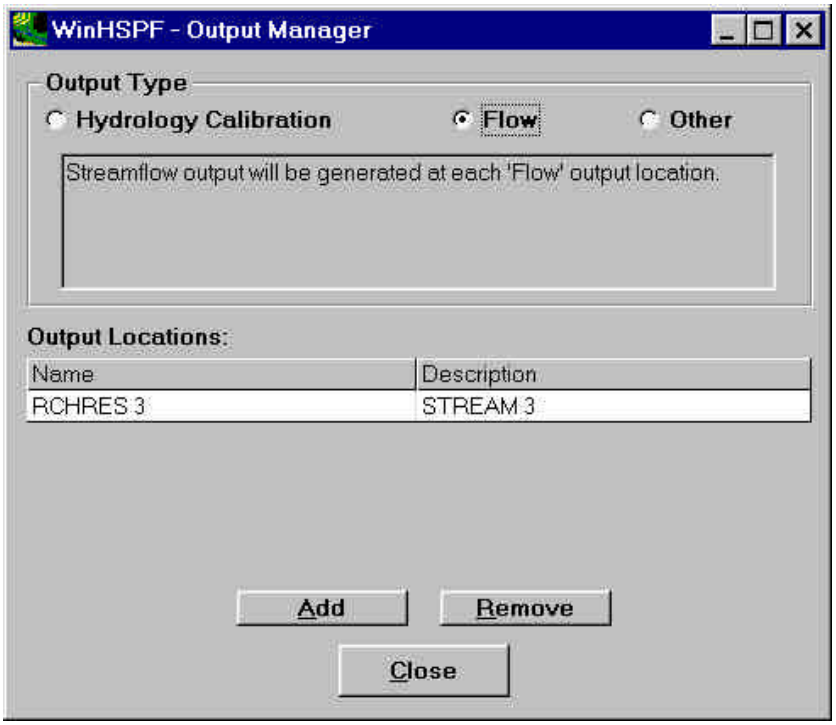
Adding calibration locations to this list is accomplished by clicking on the **Add** button. Clicking on this button produces another window. This window contains a list of available calibration locations, i.e. the reaches of the watershed, along with two text fields. The user must choose one of the calibration locations, then enter an eight character identifier for that location. This identifier is used as the location id attribute on the WDM time-series data sets that will be created. The user is also asked to enter a base data set number for the data sets to be created. The new data sets will be numbered as the available data sets following that number.



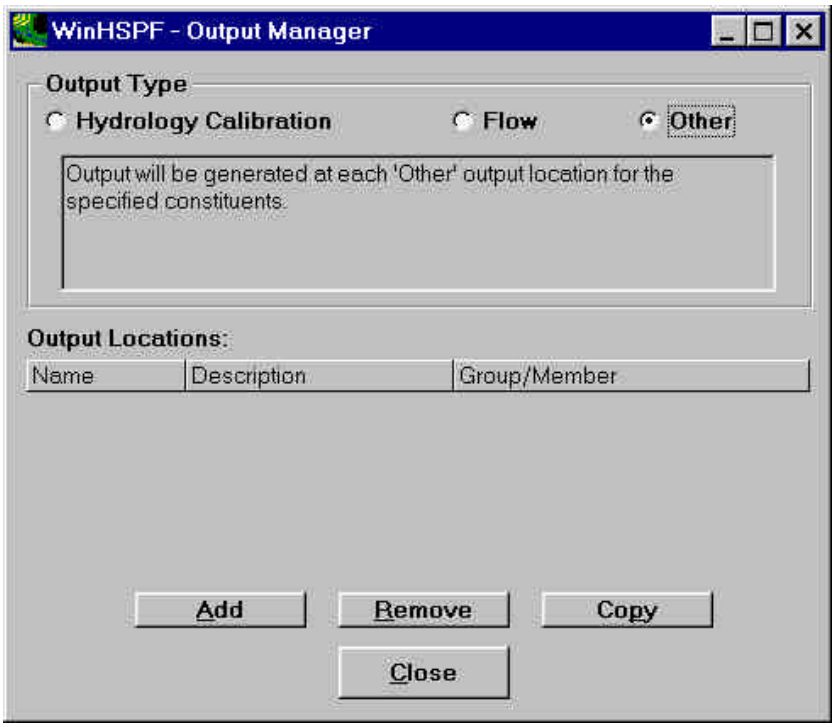
Clicking **OK** from this window brings the user back to the **Output Manager** window. As the user returns to the **Output Manager** window, eight new time-series data sets are created in the project WDM file, as required by the program HSPEXP. The UCI in memory is modified to include the appropriate Copy operation as well as the appropriate External Targets, Schematic, and Mass-Link Blocks.



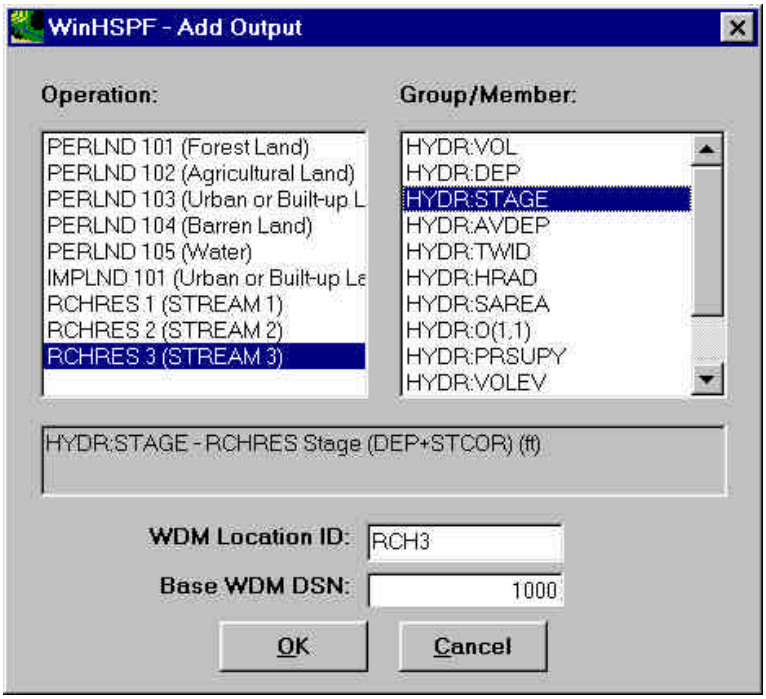
Clicking the **Flow** radio button produces a list of locations at which Flow is output. Flow output can be added by means similar to those used to add a calibration location.



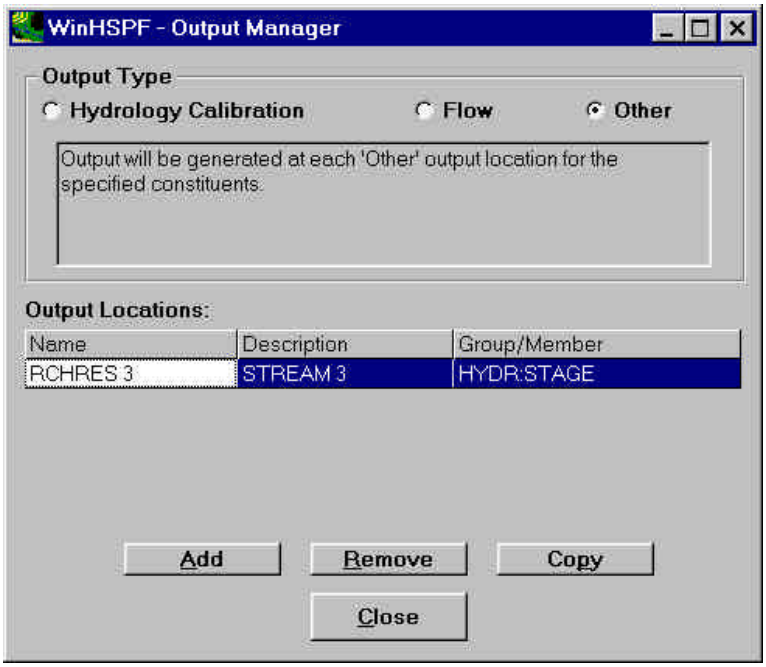
The **Other** radio button is used to view a list of other outputs.



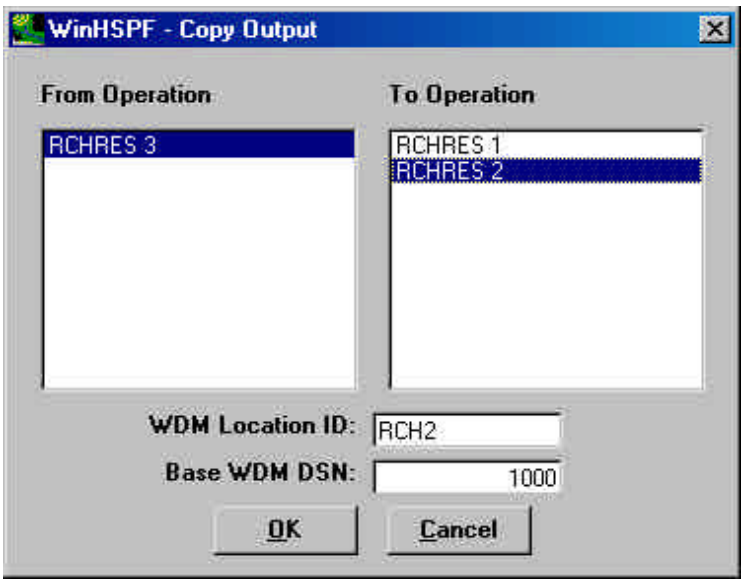
With the **Other** radio button selected, the **Add** button may be used to add additional outputs from this simulation. When the **Add** button is clicked, a window is produced containing a list of model segments.



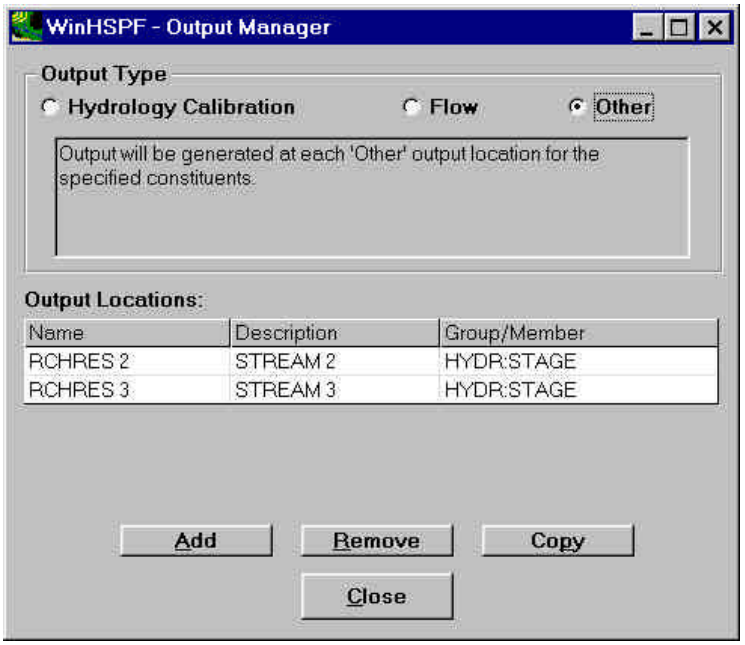
Choosing one of the model segments causes a list of Group and Members to appear. This list contains all valid Group and Member pairs that can be output from this operation given the current active sections of this operation. When the user chooses one Group/Member pair and then clicks **OK**, this output specification is added.



Copy is used to copy output specifications from one model segment to another. When **Copy** is clicked, a window appears containing a list of operations with output specified.



Choosing one operation from the 'From' list and one operation from the 'To' list specifies that all output specifications from the one operation will be copied to the other.

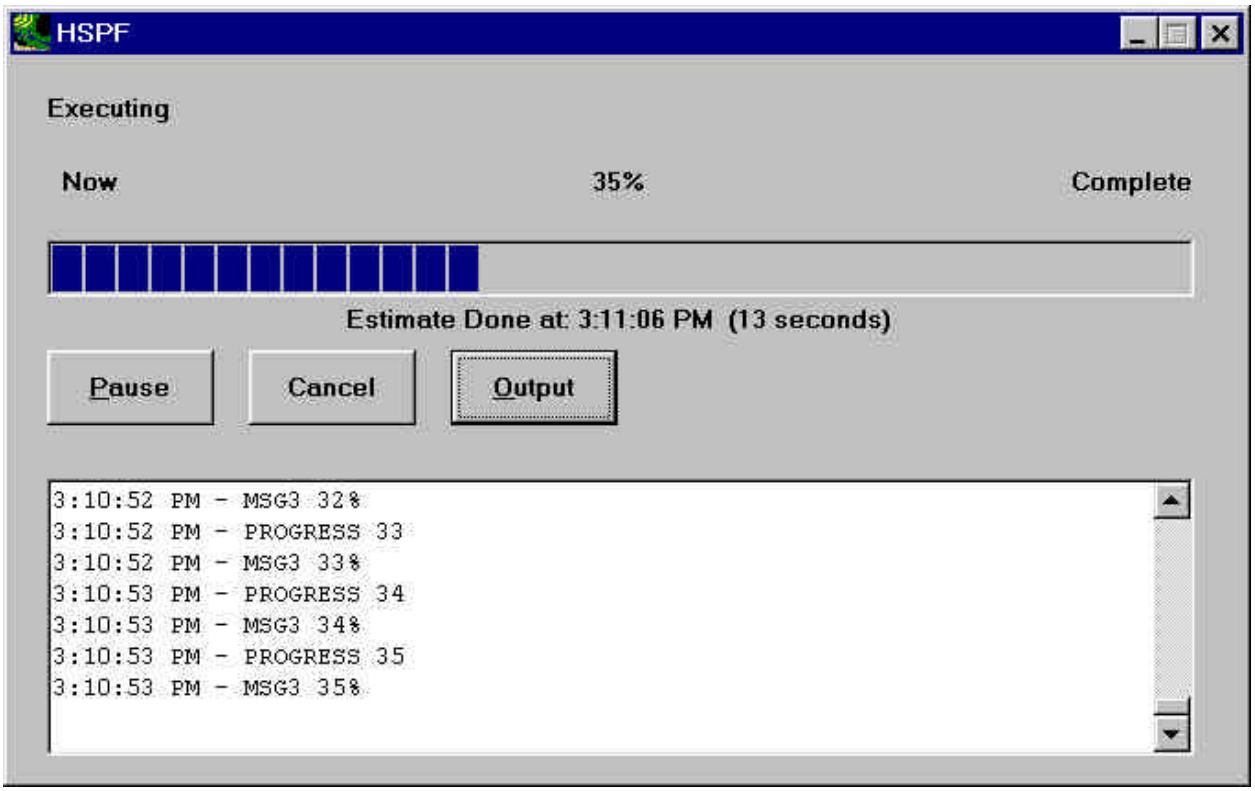


The **Remove** button is used to remove an output specification from the list.

Another option for managing output specifications is by using the **Edit:Ext Targets** menu option. Through the External Targets block editor, the user may add, delete, or modify external targets entries. In adding entries, WinHSPF automatically creates new WDM data sets as specified by the user.

Run HSPF

The **Run HSPF** button on the toolbar is used to perform the HSPF simulation, i.e. run hspf. Clicking this button produces a status window that keeps the user updated as to the state of the run. This window disappears when the run is complete. The **Output** button enlarges the window to display a log of all messages sent to the status window during the HSPF execution.



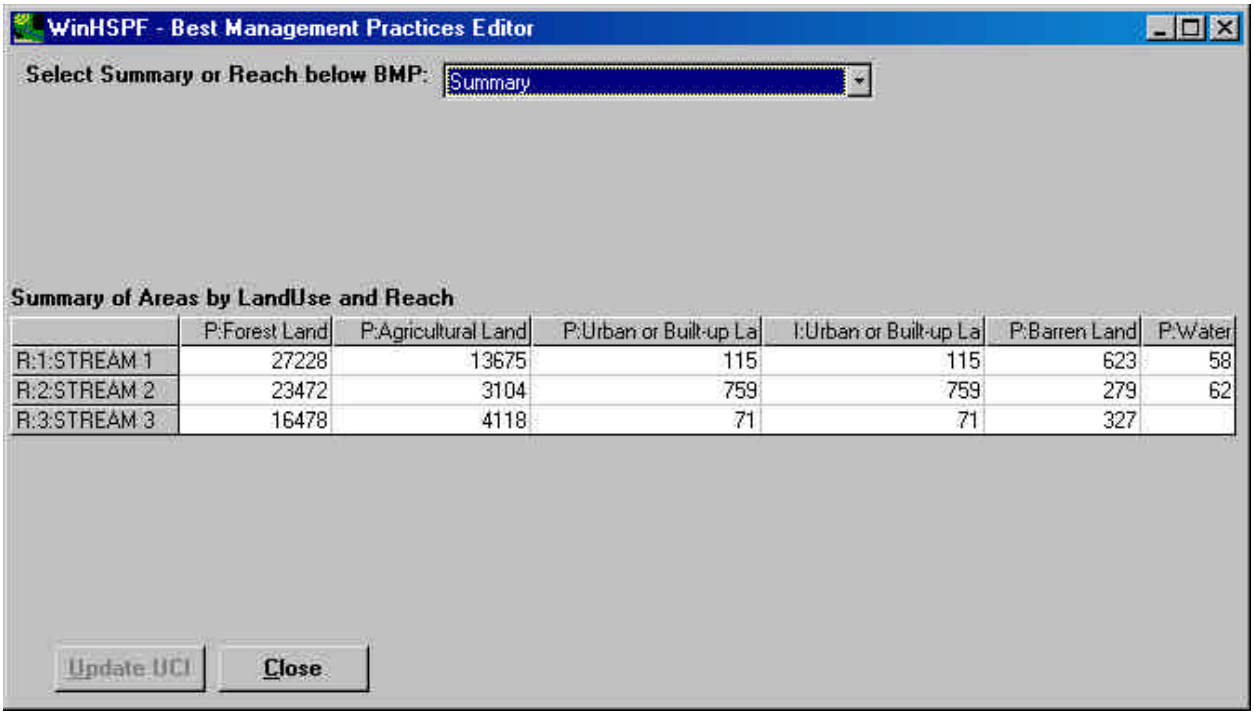
View Output

The **View Output** button on the toolbar is used to start the program GenScn for viewing timeseries output. GenScn is documented seperately.

Best Management Practices Editor

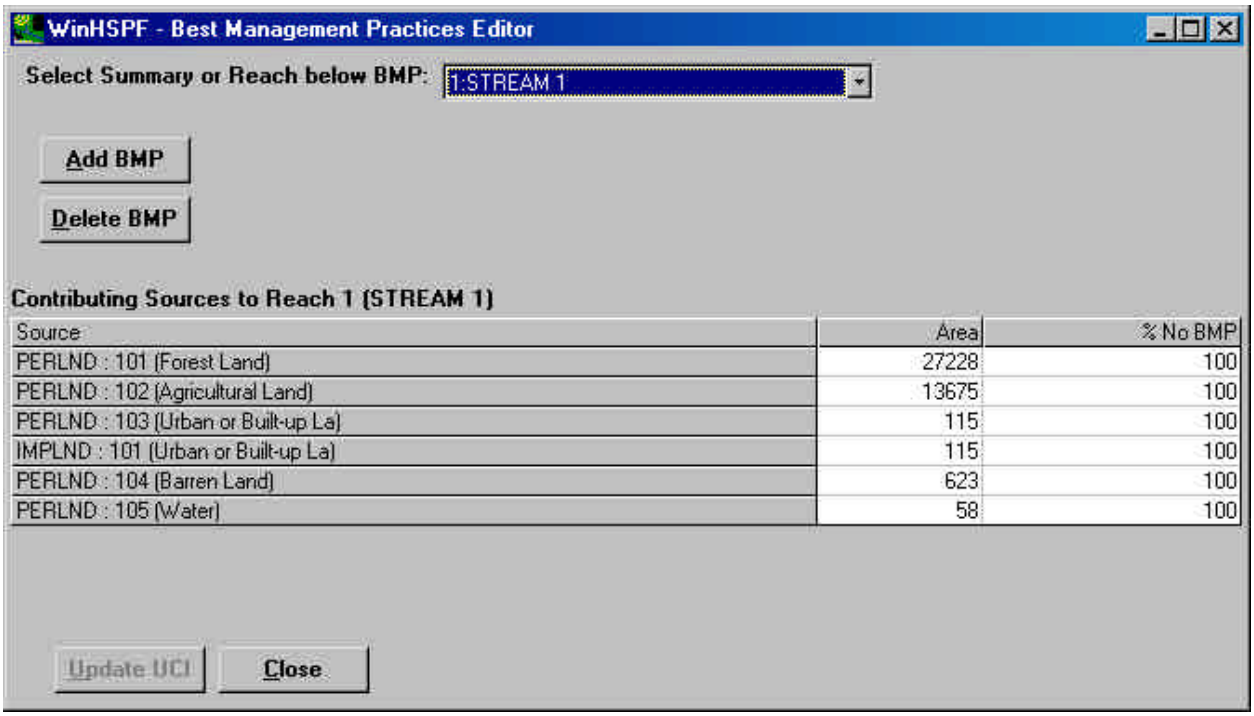
The Best Management Practices Editor is an advanced feature for assisting users in adding BMPs to a simulation. This feature may be used as an alternative to the method outlined in Lesson 6: Modeling a Watershed Management Practice. The BMP Editor is accessed by choosing the BMP option from the Functions menu.

The BMP window appears with a summary table illustrating the areas of each land use contributing to each reach. This table is provided as a convenience for the user, but areas in this table are not editable.



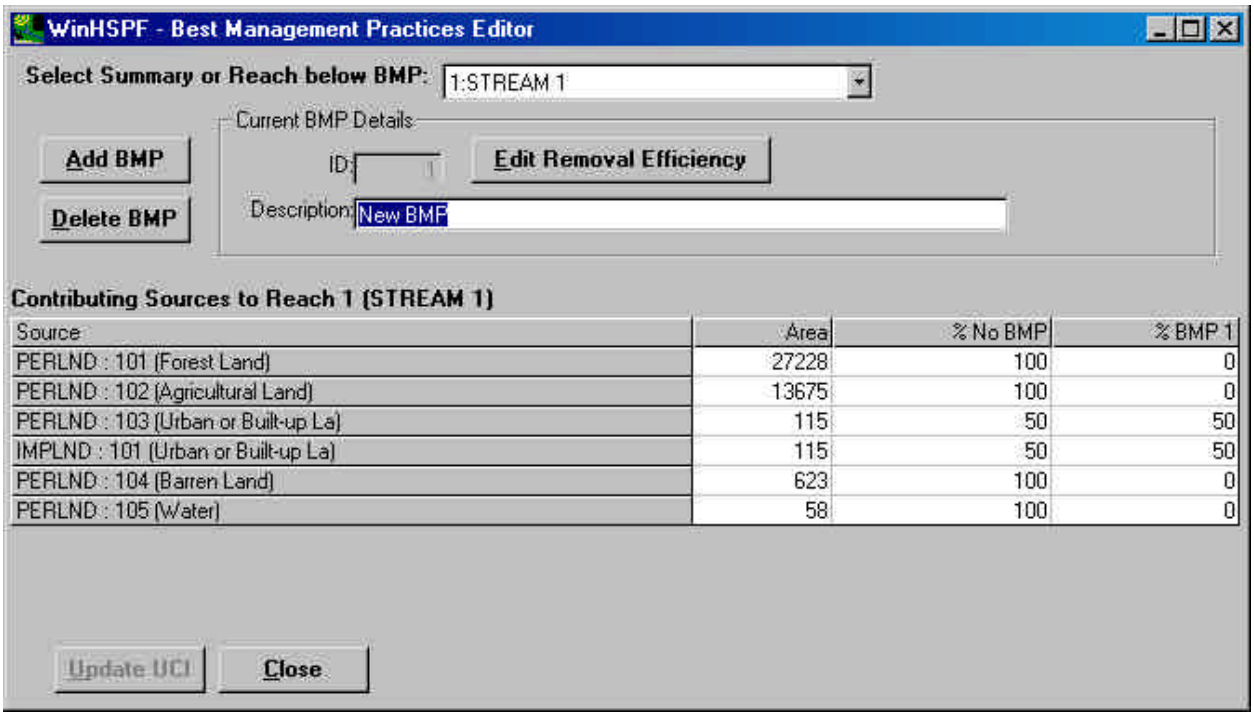
	P:Forest Land	P:Agricultural Land	P:Urban or Built-up La	I:Urban or Built-up La	P:Barren Land	P:Water
R:1:STREAM 1	27228	13675	115	115	623	58
R:2:STREAM 2	23472	3104	759	759	279	62
R:3:STREAM 3	16478	4118	71	71	327	

When a reach is selected from the list at the top of the BMP window, the table changes to show the percentage of land area from each land segment under each BMP, as well as the area not under any BMP.

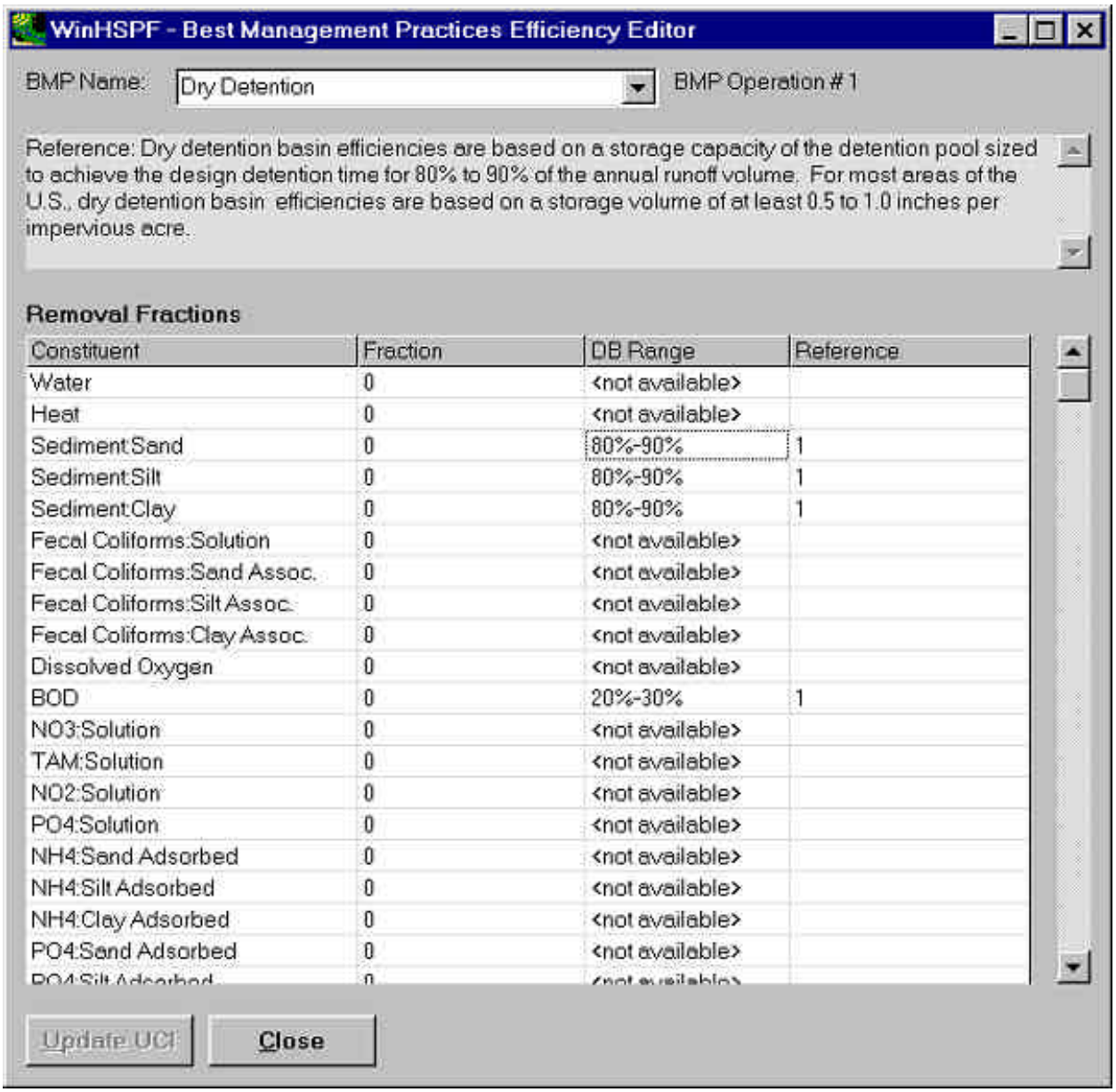


If any BMPs exist for this reach, the percentages in this table can be modified by editing the grid. The 'Add' button adds a BMP for the active reach, and the 'Delete' button removes a BMP for the active reach. When any change has been made, the 'Update UCI' button becomes available. Clicking this button makes the corresponding change in the UCI in memory. The change is not actually made in the UCI file on disk until the user chooses 'save' or 'save as' in the main WinHSPF window.

With a cell selected in a BMP column of the grid (if one has been added), the 'Edit Removal Efficiency' button may be clicked to edit the removal efficiencies for that BMP.



A database of commonly used BMPs is accessable from the BMP Editor for consultation in choosing appropriate removal rates. Clicking a cell of the 'DB Range' column produces a reference or other comments pertaining to that particular BMP in the text box above the grid.



The values of the 'Fraction' column may be edited to reflect the removal rates for the BMP. Once complete, the **Update UCI** button may be clicked to record the changes. The **Close** button returns the user to the main BMP Editor window.

Special Note: The BMP Editor adds connections to the Mass-Link and Schematic Blocks of the UCI file. If a Mass-Link already exists containing BMP to RCHRES connections, that Mass-Link will be used for a new BMP added through this editor. If such a Mass-Link does not exist, WinHSPF will automatically build that Mass-Link, pulling default values from the PERLND/IMPLND to RCHRES Mass-Link. When using the BMP Editor, care should be taken to make sure that the Mass-Link connections used by default are appropriate for the current simulation.

References

Bicknell, B.R., Imhoff, J.C., Kittle, J.L., Jr., Donigian, A.S., Jr. and Johanson, R.C., 1997, Hydrological Simulation Program -- FORTRAN, User's manual for version 11: U.S. Environmental Protection Agency, EPA/600/R-97/080, National Exposure Research Laboratory, Athens, Ga., 755 p.

Flynn, K.M., Hummel, P.R., Lumb, A.M., and Kittle, J.L., Jr., 1995, User's manual for ANNIE, version 2, a computer program for interactive hydrologic data management: U.S. Geological Survey-Water-Resources Investigations Report 95-4085, 211 p.

Lumb, A.M., Kittle, J.L., Jr., and Flynn, K.M., 1990, Users manual for ANNIE, A computer program for interactive hydrologic analyses and data management: U.S Geological Survey Water-Resources Investigations Report 89-4080, 236 p.

Lumb, A.M., McCammon, R.B., and Kittle, J.L., Jr., 1994. Users manual for an expert system (HSPEXP) for calibration of the hydrological simulation program - FORTRAN: U.S. Geological Survey Water-Resources Investigations Report 94-4168, 102 p.

Appendix

BASINS File Samples

This section provides examples of the files from BASINS used to create a new project in WinHSPF. These files are intended to be produced using the BASINS GIS interface, but since they are text files, they may be built manually using a text editor. For complete descriptions of the contents of these files, see BASINS Files within the System Overview section.

- Watershed File - *.wsd
- Reach File - *.rch
- Channel Geometry File - *.ptf
- Point Sources File - *.psr

Watershed File Sample

The following is an example of the Watershed File. Definitions of the fields in the Watershed File are found in the Watershed File section of the User's Guide.

```
"LU Name","Type (1=Impervious, 2=Pervious)","Watershd-
ID","Area","Slope","Distance"
"Forest Land"  2       1        27228  0.045574  8781.03
"Agricultural Land"  2       1        13675  0.045574  8781.03
"Urban or Built-up Land"  2       1        115  0.045574  8781.03
"Urban or Built-up Land"  1       1        115  0.045574  8781.03
"Barren Land"  2       1        623  0.045574  8781.03
"Water"  2       1        58  0.045574  8781.03
"Forest Land"  2       2        23472  0.062112  8023.88
"Agricultural Land"  2       2        3104  0.062112  8023.88
"Water"  2       2        62  0.062112  8023.88
"Urban or Built-up Land"  2       2        759  0.062112  8023.88
"Urban or Built-up Land"  1       2        759  0.062112  8023.88
"Barren Land"  2       2        279  0.062112  8023.88
"Forest Land"  2       3        16478  0.085153  5861.96
"Agricultural Land"  2       3        4118  0.085153  5861.96
"Barren Land"  2       3        327  0.085153  5861.96
"Urban or Built-up Land"  2       3        71  0.085153  5861.96
"Urban or Built-up Land"  1       3        71  0.085153  5861.96
```

Reach File Sample

The following is an example of the Reach File. Definitions of the fields in the Reach File are found in the Reach File section of the User's Guide.

```
"Rivrch","Pname","Watershed-ID","HeadwaterFlag","Exits","Milept","Stream/Resevoir
Type","Segl","Delth","Elev","Ulcsm","Urcsm","Dscsm","Ccsm","Mnflow","Mnvelo","Svtnflow","Svtnvelo
```

```
",”Pslope”,”Pdepth”,”Pwidth”,”Pmile”,”Ptemp”,”Pph”,”Pk1”,”Pk2”,”Pk3”,”Pmann”,”Psod”,”Pbgdo”,”Pbgn
h3”,”Pbgbod5”,”Pbgbod”,Level
1 “STREAM 1” 1 1 1 0 S 15.36 350.96 1573 -9999 -9999 3 2 0 0 0 0 0.012356 3.32133 91.9856 0 0 0 0
0 0 0 0 0 0 0 0 0
2 “STREAM 2” 2 1 1 0 S 11.82 596.96 1696 -9999 -9999 3 1 0 0 0 0 0.009563 2.84606 72.9574 0 0 0 0
0 0 0 0 0 0 0 0 0
3 “STREAM 3” 3 0 1 0 S 9.27 101.68 1350 1 2 -9999 -9999 0 0 0 0 0.002077 4.53886 146.945 0 0 0 0
0 0 0 0 0 0 0 0 0
```

Channel Geometry File Sample

The following is an example of the Channel Geometry File. Definitions of the fields in the Channel Geometry File are found in the Channel Geometry File section of the User's Guide.

```
“Reach Number”,”Length(ft)”,”Mean Depth(ft)”,”Mean Width (ft)”,”Mannings Roughness Coeff.”,”Long.
Slope”,”Type of x-section”,”Side slope of upper FP left”,”Side slope of lower FP left”,”Zero
slope FP width left(ft)”,”Side slope of channel left”,”Side slope of channel right”,”Zero slope
FP width right(ft)”,”Side slope lower FP right”,”Side slope upper FP right”,”Channel
Depth(ft)”,”Flood side slope change at depth”,”Max. depth”,”No. of exits”,”Fraction of flow
through exit 1”,”Fraction of flow through exit 2”,”Fraction of flow through exit 3”,”Fraction of
flow through exit 4”,”Fraction of flow through exit 5”
1 81095 3.32133 91.98563 0.05 0.01236 Trapezoidal 0.5 0.5 91.9856 1 1 91.9856 0.5 0.5 4.15166
6.22749 207.583 1 1 0 0 0 0
2 62424 2.84606 72.95737 0.05 0.00956 Trapezoidal 0.5 0.5 72.9574 1 1 72.9574 0.5 0.5 3.55757
5.33636 177.879 1 1 0 0 0 0
3 48949 4.53886 146.94531 0.05 0.00208 Trapezoidal 0.5 0.5 146.945 1 1 146.945 0.5 0.5 5.67358
8.51037 283.679 1 1 0 0 0 0
```

Point Sources File Sample

The following is an example of the Point Sources File. Definitions of the fields in the Point Sources File are found in the Point Sources File section of the User's Guide.

```
3

“Facility Name” “Npdes” “Cuseg” “Mi”
“PORTAGE AREA SEW AUTH” PA0032611 8 2.48
“GPU/GENCO-HOMER CITY GENERATING STATION” PA0005037 11 0.35
“SPECIALTY TIRES OF AMERICA” PA0004057 5 9.92

“Ordinal Number” “Pollutant” “Load (lbs/hr)”
0 “SOLIDS, TOTAL SUSPENDED” 10802.539600
0 “CHLORINE, TOTAL RESIDUAL” 93.583019
0 “BOD, CARBONACEOUS 05 DAY, 20C” 68728.332200
0 “CBODU (20 deg C), calculated” 46966.193090
1 “OXYGEN, DISSOLVED (DO)” 4947.152820
1 “SOLIDS, TOTAL SUSPENDED” 314407.965953
1 “OIL AND GREASE FREON EXTR-GRAV METH” 37838.656042
1 “ARSENIC, TOTAL (AS AS)” 288.154903
1 “CADMIUM, TOTAL (AS CD)” 9.639183
1 “IRON, DISSOLVED (AS FE)” 114.001343
1 “MANGANESE, TOTAL (AS MN)” 499.115311
1 “THALLIUM, TOTAL (AS TL)” 2.264882
1 “ALUMINUM, TOTAL (AS AL)” 84.361993
1 “CHLORINE, TOTAL RESIDUAL” 1695.200409
1 “BOD, CARBONACEOUS 05 DAY, 20C” 3015.365281
1 “CBODU (20 deg C), calculated” 2060.580020
2 “OIL AND GREASE FREON EXTR-GRAV METH” 3384.743450
0 Flow 0.0438100
1 Flow 0.0000000
2 Flow 0.0000000
```