Exercise 4 – Introduction to WinHSPF and GenScn

BASINS/HSPF Application Steps

| Study Definition/M odeling Strategy | Parameter Development/Model Setup | Hydrologic Calibration/ Validation | Water Quality Calibration/ Validation | Scenario A nalysis | |
|---|---|--|---|--------------------|--|
|---|---|--|---|--------------------|--|

In this exercise, you will learn how to build and run a WinHSPF project. We will add three shape files (*outlets*, *streams*, and *subbasins*) to our BASINS project. These files are associated with the watershed delineation for the West Branch Patuxent River and are necessary to launch WinHSPF from BASINS. They can be created using the BASINS manual delineation tool or automatic delineation tool. Using these files, we will launch WinHSPF from the BASINS interface.

The WinHSPF interface includes many useful tools and user-input windows, many of which allow user-specified parameter adjustments. Because our goal during this exercise is to help you gain a basic understanding of WinHSPF and GenScn, we will leave most of the inputs as the default values. After we have explained each of the tools and some of the input tables, we will run our WinHSPF model for flow.

One of the most important aspects of modeling watersheds is hydrology calibration. In order to ascertain how well our model is simulating conditions in our watershed, we need to compare the model's output to observed data. In this exercise, we will download historical streamflow data, add it to our project's output file, and then use GenScn to plot the simulated streamflow on the same graph as the observed streamflow. In Exercises 5 and 6, we will learn how to calibrate our model's hydrology so that it more accurately predicts streamflow.

Questions addressed in this exercise:

- 1) How do I import Subbasins, Streams, and Outlets layers into my BASINS project?
- 2) How do I launch WinHSPF from BASINS?
- 3) What tools are available within WinHSPF?
- 4) How do I run my WinHSPF model?
- 5) How do I add gage data to my WinHSPF project file?
- 6) How do I use GenScn to view my simulation results?

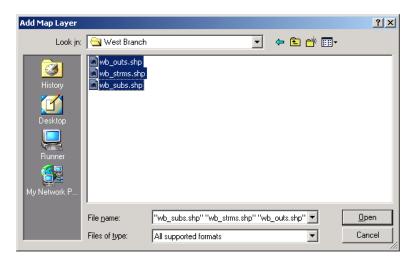
A. Importing delineation layers

QUESTION ANSWERED:

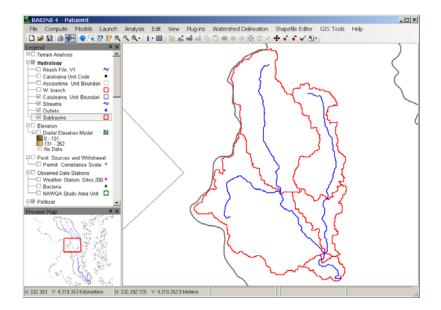
1) How do I import Subbasins, Streams, and Outlets layers into my BASINS project?

- 1. If BASINS isn't open, from the **Start** menu under **Programs**, select **BASINS** and then **BASINS 4**.
- 2. **Click** "*patuxent*" in the "Welcome to BASINS 4" window.

- 3. To avoid confusion, remove the *Streams*, *Subbasins*, and *Outlets* layers produced during the previous exercise by right-clicking on each layer and selecting "Remove Layer". Also remove the results of the automatic delineation from the map legend.
 - **Note:** Map layers representing *Streams* and *Subbasins* are required in order to launch WinHSPF from the BASINS interface. An *Outlets* layer is optional. These files can be created using the manual delineation tool or the automatic delineation tool. In this case these files were created by the automatic delineation tool. We will use these predefined map layers so that everybody will have the same model results.
- 4. Click (Add Layer tool).
- 5. Navigate to *c:\basins\predefined delineations\west branch* and select all three shapefiles in the folder.



- 6. Click OPEN. Three layers (Streams *wb_strms.shp*, Subbasins *wb_subs.shp*, and Outlets *wb_outs.shp*) will be added to the map.
- 7. Turn "off" all layers except *Streams*, *Subbasins*, *Outlets*, *State Boundaries*, and *Cataloging Unit Boundaries*.
- 8. Make sure the *Outlets* and *Streams* layers are displayed on top of the *Subbasins* layer. Your view should look like the following.



B. Launching WinHSPF from BASINS

QUESTION ANSWERED:

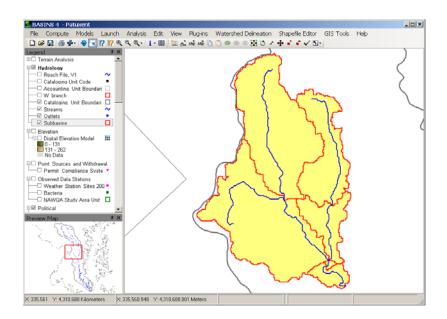
2) How do I launch WinHSPF from BASINS?

Now that we have added the new *Subbasins*, *Streams*, and *Outlets* layers, we will launch WinHSPF from the BASINS interface. When WinHSPF is launched from BASINS, an input file (*.uci*) is created. HSPF uses the information found in BASINS to estimate values for many parameter inputs. It should be noted that these values can be highly inaccurate and should be modified if more accurate information is available.

1. From the **Plug-ins** menu, make sure **Model Setup** (**HSPF/AQUATOX**) is checked (on).

| Plug-ins | | Shapefile Editor | GIS Tools | He | | |
|----------|-----------|---------------------|-----------|----|--|--|
| | Edit | Plug-ins | | | | |
| | Scripts | | | | | |
| | Ana | lysis | | • | | |
| ~ | BASINS 4 | | | | | |
| ~ | GIS Tools | | | | | |
| ~ | Man | ual Delineation | | | | |
| ~ | Mod | lel Setup (HSPF/AQU | JATOX) | | | |
| ~ | Shaj | pefile Editor | | | | |
| | Time | eseries | | ۲ | | |
| ~ | Wat | ershed Delineation | | | | |

- 2. Turn "on" and "activate" the *Subbasins* layer.
- 3. Click 🖾 (Select tool).
- 4. While holding down the CTRL key, click on all 6 subwatersheds.



- 5. From the **Models** menu, select **HSPF**. (Be patient for a moment.)
- 6. The following window will appear. Enter "WestPat" in the "HSPF project name:" box. Leave "USGS GIRAS Shapefile" in the "Land Use Type" box. Set *Subasins* to be the "Subbasins Layer", *Streams* to be the "Streams Layer", and *Outlets* to be the "Point Sources Layer". *Weather Station Sites 2006* will default to the "Met Stations Layer".

| BASINS HSPF | | <u>_ X</u> |
|-------------------------|---|--------------|
| General Land Use Str | eams Subbasins Point Sources Met Stations | |
| | | |
| HSPF Project Name: | WestPat | |
| | | _ |
| Land Use Type: | USGS GIRAS Shapefile | - |
| Subbasins Layer: | Subbasins | • |
| | | |
| Streams Layer: | Streams | |
| Point Sources Layer: | Outlets | |
| Met Stations Laver: | Weather Station Sites 2006 | - |
| | | |
| | | |
| Status | | |
| Update specifications i | f desired, then click OK to proceed. | |
| OK Open Exis | ting Cancel Help Ab | iout |

7. Click the **Land Use** tab. The "Land Use" tab is used to specify the land use classification scheme. This scheme includes information regarding the combined land use classifications that will be used in HSPF as well as the impervious percentages for each of the land use classifications.

| General Land Use Stre | aams Subbasins Point Sources Met Stat | ions |
|------------------------------------|---|--------|
| Classification File: | /BASINS/etc/giras.dbf | Change |
| Group Description | Impervious Percent | |
| Urban or Built-up Land | 50 | |
| Agricultural Land | 0 | |
| Range Land | 0 | |
| Forest Land | 0 | |
| Wetlands/Water | 0 | |
| Barren Land | 0 | |
| Status Update specifications if | desired, then click OK to proceed. | |
| OK Open Exist | | About |

- **Note:** The "impervious percent" values indicate how much of each land use category will be impervious to infiltration, such as paved area and rooftops. For example, a 30% impervious percentage indicates that the given land use category is 30% impervious and 70% pervious. The model uses this information to estimate runoff from each land use type.
- 8. The Streams, Subbasins, and Point Sources tabs are used to map fields from those map layers to variables used in building the HSPF model. These fields will default appropriately when using the output of a BASINS watershed delineation tool, so we will not have to change anything in these tabs for this example.
- 9. Click on the **Met Stations** tab. Because we specified *Weather Station Sites 2006* as the "Met Stations Layer", the "Met WDM File" will be set to the WDM file associated with the *Weather Station Sites 2006*, which is named 'met.wdm' and is located in the '\BASINS\data\02060006' folder.

The list of the **Met Stations** tab will be populated with an identifier/description corresponding to each meteorological station available in the WDM file for use in the new HSPF project. One item from this list must be selected in order to have meteorological data included in the HSPF simulation. (In Exercise 5 we will learn how to set up a new HSPF project utilizing multiple met stations.) You should specify the meteorological station that best represents your watershed.

The 'Select' button may be used to select another meteorological data file. Any WDM file can be referenced as a met WDM file (as long as the file contains the necessary meteorological data).

| BASINS HSPF |
|--|
| General Land Use Streams Subbasins Point Sources Met Stations |
| Met WDM File |
| C:\BASINS\data\02060006\met\met.wdm Select |
| |
| MD180193:ANNAPOLIS POLICE BRKS (1951/4/1-2006/1/1) |
| MD180460:BALTIMORE SLEDDS POINT (1949/12/1-1957/3/1) *MD180465:BALTIMORE WASH INTL AP (1970/1/1-2007/1/1) |
| MD180483 BALTIMORE WASHINTLAP (1970/171-2007/171) |
| MD180475:BALTIMORE HAMILTON (1948/8/1-1960/12/1) |
| *MD180700:BELTSVILLE (1970/1/1-2007/1/1) |
| MD180701:BELTSVILLE PLANT STN 1 (1949/1/1-1961/1/1) |
| MD180702:BELTSVILLE PLANT STN 2 (1949/1/1-1961/1/1) |
| MD180703:BELTSVILLE PLANT STN 3 (1949/1/1-1957/7/1) |
| MD180704:BELTSVILLE PLANT STN 4 (1949/1/1-1961/1/1) MD180705:BELTSVILLE PLANT STN 5 (1949/1/1-1978/10/1) |
| MD180706:BELTSVILLE PLANT STN 5 (1949/1/1-1978/10/1) |
| MD180800:BETHESDA NATL INST HEALTH (1951/1/1-1960/9/1) |
| * Full Set Available |
| Status |
| Update specifications if desired, then click OK to proceed. |
| |
| OK Open Existing Cancel Help About |

10. Select "MD000465: BALT-WASHGTN INTL AP" as the Met Station to use in this HSPF project.

To determine which weather station to use, you may simply turn "on" and "activate" the *Weather Station Sites 2006* layer within BASINS, and then use the "Identify" tool to determine which station is closest (or most representative) of your watershed.

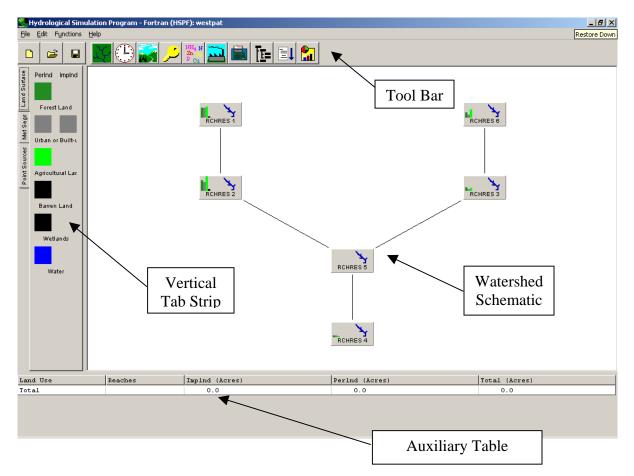
The "MD BELTSVILLE" station is actually closer to our watershed than the Baltimore-Washington Airport station is; however, the Beltsville station that is included in the BASINS database has some precipitation data gaps and therefore won't be used for this particular computer session.

The '*' next to the met station name indicates that this station has the full set of meteorologic constituents available. Stations without the '*' can be used as the meteorologic inputs for an HSPF hydrology simulation, but some met constituents will have to be specified from other locations to simulate full range of HSPF water quality modules.

11. Click OK.

Note: You will see some processing messages appear along with a status bar at the bottom of the main BASINS window. During this time the HSPF User Control Input (UCI) file will be created for the specified project.

After clicking OK, BASINS will create the HSPF User Control Input (UCI) file as specified. The UCI file will be assigned the HSPF project name indicated on the **General** tab, in a subfolder of the same name within the \BASINS\modelout folder. For example, for this HSPF project a UCI file by the name WestPat.uci will be created in the \BASINS\modelout\WestPat folder. A new WDM file called WestPat.wdm will also be created in this folder to be used for storing the point source inputs to the model as well as any output time series from the HSPF simulation. Once the UCI has been created, the main window of the HSPF interface (WinHSPF) will open. This window contains several menus, a tool bar, a vertical tab strip, a schematic of the watershed, and an auxiliary table. The vertical tab strip, watershed schematic, and auxiliary table will not be active until a project is active (until a *.uci* file is opened or a project is created). When WinHSPF is launched from BASINS, the corresponding *.uci* file will automatically be opened. The information in the tab strip, the auxiliary tables, and the watershed schematic are relevant to the open project.



C. BASINS WinHSPF Tools

QUESTION ANSWERED:

The buttons on the tool bar,

4) What tools are available within WinHSPF?



provide

links to the various tools with which the user can interact with the open project. The buttons to the left of the tool bar can be used for creating, opening, and saving projects. The "Run

HSPF" button, is used to perform the simulation (run HSPF). The other buttons on the tool bar are used to view and modify input values and parameters of the open project and to specify things such as the simulation period and constituents you would like modeled.

The vertical tab strip contains three tabs. The tabs, in conjunction with the figures in the

watershed schematic, display information about the project in the auxiliary table. These features can be used to specify whether to display information related to land surfaces, met segments, and point sources. If you highlight items in the tab strip and highlight a figure in the watershed schematic, related data will appear in the auxiliary table. For example, click the "Land Surface" tab and then click the "Forest Land" icon. Click the "RCHRES 2" figure in the watershed schematic. The auxiliary table will show the acres of forested area contributing to Reach 2.

Clicking the "Met Segs" tab indicates 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 (Duda et al., 2001).

The "Point Sources" tab is used to view the point sources that will contribute to the streams in WinHSPF. If you click on a point source, the stream segment to which it will contribute flow and/or constituents will become highlighted in the watershed schematic and data regarding the source will appear in the auxiliary table.

In order to become more familiar with the WinHSPF interface, we will click on each button in tool bar and view the various tools, options, and default input values.

WinHSPF Reach Editor

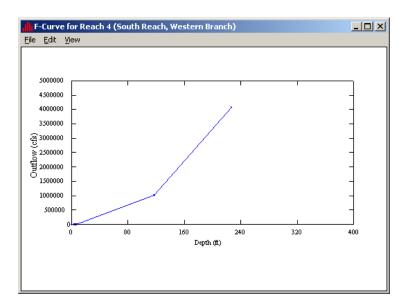
1. Click (Reach Properties Editor). This editor allows you to modify select properties of each reach. The following screen will appear:

| WinHSPF - Reach Editor | | | | | | | |
|------------------------|----------------------|-------------|--------------|--------------|---------|-----------|--|
| ID | Description | Length (mi) | Delta H (ft) | DownstreamID | N Exits | Lake Flag | |
| 1 | Western Branch Patux | 9.66 | 56 | 2 | 1 | 0 | |
| 2 | Southwest Branch Wes | 12.37 | 200 | 5 | 1 | 0 | |
| 3 | South Collington Bra | 3.96 | 3 | 5 | 1 | 0 | |
| 4 | South Reach, Western | 2.95 | 7 | 0 | 1 | 0 | |
| 5 | Western Branch Patux | 0.47 | 0 | 4 | 1 | 0 | |
| 6 | North Collington Bra | 8.16 | 102 | 3 | 1 | 0 | |

- **Note:** The values in the "Reach Editor" table are automatically calculated when either the manual or automatic delineation tools are used to create the *Streams* layer. If neither of these tools is used, the user must make sure these fields and their corresponding values are included in the attributes of the *Streams* shapefile before launching WinHSPF.
- 2. Click FTABLES. The "Edit Ftable" window will open.

| FTable: 4-Sou | th Reach, Western | | | |
|---------------|-------------------|---------------------|------------------|---------------|
| Depth (ft) | Area (acres) | Volume (acre-ft) | Outflow1 (ft3/s) | NRows: |
| 0 | 35.57 | 0 | 0 | |
| 0.37 | 35.83 | 13.1 | 11.43 | NCols: |
| 3.67 | 38.19 | 135.35 | 527.69 | |
| 4.59 | 38.84 | 170.69 | 764.79 | Import From |
| 5.73 | 116.86 | 303.79 | 972.87 | Cross Section |
| 6.88 | 118.5 | 438.77 | 1777.1 | |
| 118.14 | 277.55 | 22470.36 | 685228.7 | Compute New |
| 229.4 | 436.6 | 62197.17 | 2737217 | compute New |
| | | | | F-Curve |
| | <u>0</u> K | <u>Cancel</u> Apply | Help | |

- **Note**: WinHSPF estimates the depth and width of individual reaches using some simple assumptions and the drainage area of a subbasin. These estimates are generally inaccurate, but they are better than nothing. It is best to gather data for your watershed's individual reaches and then use cross-sectional characteristics to populate the F-Tables by either estimating the stagedischarge relationship with an equation such as the Manning's Equation and then entering them manually or by using the "Import From Cross Section" tool. In this exercise, we will use the default F-tables.
- 3. Click F-Curve . A graph that shows the relationship between the depth (stage) and reach flow rates will appear.



4. From the **File** menu, select **Close**.

5. Click Import From Cross Section

| <u>D</u> r | ben <u>S</u> a | ve | | | |
|------------|---|-------|--|--|--|
| FTABLE | 3 | | | | |
| Variable | Description | Value | | | |
| L | Length (ft) | 0.01 | | | |
| Ym | Mean Depth (ft) | 0.01 | | | |
| Wm | Mean Width (ft) | 0.01 | | | |
| n S | Mannings Roughness Coefficient | 0.01 | | | |
| | Longitudinal Slope | 0.01 | | | |
| m32 | Side Slope of Upper Flood Plain Left | | | | |
| m22 | Side Slope of Lower Flood Plain Left | | | | |
| W12 | Zero Slope Flood Plain Width Left (ft) | 0.01 | | | |
| m12 | Side Slope of Channel Left | 0.01 | | | |
| m11 | Side Slope of Channel Right | 0.01 | | | |
| W11 | Zero Slope Flood Plain Width Right (ft) | 0.01 | | | |
| m21 | Side Slope Lower Flood Plain Right | 0.01 | | | |
| m31 | Side Slope Upper Flood Plain Right | 0.01 | | | |
| Yc | Channel Depth (ft) | 0.01 | | | |
| Ytt | Flood Side Slope Change at Depth (ft) | 0.01 | | | |
| Yt2 | Maximum Depth (ft) | 0.01 | | | |

- **Note:** Using this editor, you can modify the cross section characteristics or import a table that contains the cross-sectional data (*.*rtf* file).
- 6. Click CANCEL to exit the "Import From Cross-Section" window.
- 7. Click OK to exit the "Edit FTable" screen.
- 8. Click OK to exit the "Reach Editor" window.

WinHSPF Simulation Time Editor

A *.*wdm* file containing meteorological time series data was specified in the "Create Project" window. In the Simulation Time Editor, you should specify a simulation period (the default time period is for all dates included in your meteorological data file – this time period is usually very long (several decades). The period you specify must be within the time range of data included in your meteorological *.*wdm* file.

- 1. Click (Simulation Time and Meteorological Data).
- 2. Enter the dates shown below for the 'Start' and 'End' of the simulation.

| WinHSPF - Simulation Time and Meteorological Data 📃 🔲 🗙 | | | | | | |
|---|------|-------|-----|------|--------|--|
| | Year | Month | Day | Hour | Minute | |
| Start [| 1985 | 10 | 1 | 0 | 0 | |
| End [| 1989 | 4 | 30 | 24 | 0 | |

- **Note:** The Met Segments section of the Simulation Time and Meteorological Data window contains a grid with a list of the meteorological segments and the operations that they affect. New met segments may be added by clicking ADD button. Click EDIT to modify existing met segments. To edit a met segment, highlight the desired segment in the "Met Seg ID" column then click EDIT. The "Add Met Segment" and "Edit Met Segment" forms are almost identical, 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 therefore, may not be edited in the "Edit Met Segment" form (Duda et al., 2001). We will not add or edit any met segments at this time.
- 3. Click OK.

WinHSPF Landuse Editor

This tool allows you to edit the area of each land use contributing to each reach and is useful for best management practices and modeling various scenarios. This will be further explained in Exercise 14.

1. Click (Landuse Editor).

| Sources Available: | Add -> <- Remove Add All ->> <- Remove All | Selected: PERLND 101 PERLND 102 PERLND 103 PERLND 104 IMPLND 101 PERLND 106 PERLND 105 | Add -> RC RC RC RC RC RC | lected: HRES 1 HRES 4 HRES 2 HRES 5 HRES 3 |
|-----------------------|---|---|--------------------------------|---|
| Source ID | Source Description | Target ID | Target Description | Area (Acres) |
| PERLND 101 | Forest Land | RCHRES 1 | Western Branch, Patuxent River | 5785 |
| PERLND 102 | Urban or Built-up Land | RCHRES 1 | Western Branch, Patuxent River | 2830 |
| IMPLND 101 | Urban or Built-up Land | RCHRES 1 | Western Branch, Patuxent River | 2830 |
| PERLND 103 | Agricultural Land | RCHRES 1 | Western Branch, Patuxent River | 6255 |
| PERLND 104 | Barren Land | RCHRES 1 | Western Branch, Patuxent River | 382 |
| PERLND 101 | Forest Land | RCHRES 4 | North Collington Branch | 2774 |
| PERLND 102 | Urban or Built-up Land | RCHRES 4 | North Collington Branch | 641 |
| IMPLND 101 | Urban or Built-up Land | RCHRES 4 | North Collington Branch | 641 |
| PERLND 103 | Agricultural Land | RCHRES 4 | North Collington Branch | 4569 |
| PERLND 104 | Barren Land | RCHRES 4 | North Collington Branch | 164 |
| PERLND 106 | Water | RCHRES 4 | North Collington Branch | 21 |
| PERLND 103 | Agricultural Land | RCHRES 2 | South Collington Branch | 1483 |
| PERLND 101 | Forest Land | RCHRES 2 | South Collington Branch | 1873 |
| | | | <u>D</u> K <u>Cancel</u> | Total: 53581 |

Note: The "Sources - Available" box on the left represents the sources and land segments, and the "Targets - Available" box on the right represents the targets

and reaches. The table at the bottom of the window lists each "selected" land segment contributing to each "selected" reach. Reaches and land segments are represented in the table if the name of the operation is in the "Selected" box. Sources, land segments, and targets can be moved back and forth between the "Selected" and "Available" boxes. The contents of the grid will automatically be updated.

- **Note:** The values in the "Area" column may be edited. The text below the grid will indicate the original total area, the new total area, and the difference between these two. This information allows the user to feel confident that the change was interpreted as desired (Duda et al., 2001).
- 2. Click OK.

WinHSPF Control Cards Editor

- 1. Click (Control Cards).
- 2. Click DESCRIPTIONS when the following window appears.

| Control Window Selection | × | | | | | |
|--|---|--|--|--|--|--|
| Choose a format for editing control cards. | | | | | | |
| Tables <u>D</u> escriptions | | | | | | |

- **Note:** This screen allows you to choose which parameters you would like to model in WinHSPF. Each tab (PERLND, IMPLND, and RCHRES) contains a list of corresponding modules and parameters. You can specify which parameters and modules you want to model by checking the boxes beside the parameters. For example, if you wanted to model the accumulation and melting of snow and ice, you would check the box beside "Snow." When you turn "on" (check the box beside) a module through this editor, other sections might turn on automatically because there are rules in the model's coding that require certain modules as prerequisites to others. These operating rules are based on the guidelines in *BASINS Technical Note 3: the NPSM/HSPF Simulation Module Matrix.* Following these operating rules, all required and recommended prerequisite sections are turned on when appropriate (Duda et al., 2001).
- 3. The "Pervious Land" tab will be displayed. Make sure that "PWATER" (water budget pervious) is selected.

| 2 | WinHSPF - Control Cards | | | | | | |
|---|--|-------------------------------|----------------------------|--|--|--|--|
| | Pervious Land | Impervious Land | <u>B</u> eaches/Reservoirs | | | | |
| | ATEMP - Air Temperature Elevation Difference SNOW - Accumulation and Melting of Snow and Ice | | | | | | |
| | VWATER - Water Budget Pervious | | | | | | |
| | SEDMNT - Production and Removal of Sediment PSTEMP - Soil Temperatures | | | | | | |
| | PWTGAS - Water Temp | perature and Dissolved Gas Co | oncentrations | | | | |

4. Click the "Impervious Land" tab.

| WinHSPF - (| Control Cards | | _ 🗆 × |
|-------------|---|---|----------------------------|
| Per | vious Land | Impervious Land | <u>R</u> eaches/Reservoirs |
| SNOV | V - Accumulation a ER - Water Budge OS - Accumulation AS - Water Tempe | e Elevation Difference nd Melting of Snow and I t Impervious and Removal of Solids rature and Dissolved Gas ients Using Simple Relatio | Concentrations |

- 5. Make sure that "IWATER" (water budget impervious) is selected.
- 6. Click the "Reaches/Reservoirs" tab.

| 2 | WinHSPF - Control Cards | × |
|---|---|---|
| | | |
| Í | Pervious Land Impervious Land Reaches/Reservoirs | 1 |
| | | |
| | V HYDR - Hydraulic Behavior | |
| | ADCALC - Advection of Fully Entrained Constituents | |
| | CONS - Conservative Constituents | |
| | HTRCH - Heat Exchange and Water Temperature | |
| | SEDTRN - Behavior of Inorganic Sediment | |
| | 🔲 GQUAL - Generalized Quality Constituents | |
| | OXRX - Primary DO and BOD Balances | |
| | NUTRX - Primary Inorganic Nitrogen and Phosphorus Balances | |
| | PLANK - Plankton Populations and Associated Reactions | |
| | PHCARB - pH, Carbon Dioxide, Total Inorganic Carbon, and Alkalinity | |
| | | |

7. Note that "HYDR" (hydraulic behavior) is selected, and select "ADCALC."

- **Note:** Notice that PWATER is selected in the Pervious Land tab, IWATER is selected in the Impervious Land tab, and HYDR is selected in the Reaches/Reservoir tab. These three selections indicate that we will be modeling overland flow in pervious and impervious land segments and it will then be routed into the stream reach.
- 8. Click OK.

Pollutant Selection

1. Click (Pollutant Selection). In this window, we can specify which water quality constituents we would like to model using HSPF. We will not change anything in this screen since we are not modeling water quality in this session.

| 💐 WinHSPF - Pollutant Selection | | | -OX |
|--|-----------------------|-----------|-----|
| Available: | | Selected: | |
| F.COLIFORM NH3+NH4 NO3 ORTHO P BOD METALS SEDIMENT DO | Add -> <- Remove | | |
| | <u>O</u> K <u>C</u> a | ncel | |

2. Click OK.

Point Source Editor

This tool is used to view and manage point sources in the simulation. We will add the PCS point source that contributes to Reach 4.

1. Click (Point Sources). The "Point Sources" window will open.

| WinHSPF - Point Sources | | | | <u>_ ×</u> |
|-------------------------|------------|-------------|----------|--------------|
| Available: | | | In Use: | |
| WESTERN BRANCH_WWTP (0 | Ad | d -> | | |
| | <- Re | emove | | |
| | Add / | All ->> | | |
| | <<- Rei | nove All | | |
| , | | | , | |
| Show Details Add N | New | Create | Scenario | |
| | <u>]</u> K | <u>C</u> ar | ncel | |

2. In the "Available" box, select "WESTERN BRANCH WWTP (OBS)" and click "Add->." The record will now be in the "In Use" box.

| WinHSPF - Point Sources | | 👯 WinHSPF - Point So | |
|---------------------------------------|---|----------------------|---|
| Available: WESTERN BRANCH, WWTP (0 | Add -> <pre> Add All ->> </pre> <pre> </pre> | Available: | Add -> C - Remove Add All ->> C - Remove All |
| Show Details Add I | Vew Create Scenario | 🗖 Show Details | Add New Create Scenario |
| <u> </u> | <u><u>C</u>ancel</u> | | <u>OK</u> <u>C</u> ancel |

3. Click in the box next to "Show Details." The Point Sources editor will expand.

| WinH5 Availal | PF - Point So ble: | DUFCES | _ | Add -> - Remove add All ->> Remove All | | In Use: WESTER | N BRANCH_ | (0 |
|------------------|--------------------------|----------------|------------|---|-------------|-------------------|-----------|---------------|
| | • Details s of WESTEI | Add | | | ate | Scenario | | |
| In Use | Reach | | | Pollutant | Targ | get Member | MemSub1 🔺 | 1 . II |
| No | RCHRES 4 - | South Reach, W | /estern | OXYGEN, | IVO | L | 0 | |
| No | RCHRES 4 - | South Reach, W | /estern | BOD, 5-D | IVO | L | 0 | 111 |
| No | RCHRES 4 - | South Reach, W | /estern | SOLIDS, | IVO | L | 0 | 222 |
| No | RCHRES 4 - | South Reach, W | /estern | NITROGEN | IVO | L | 0 | |
| No | RCHRES 4 - | South Reach, W | /estern | NITROGEN | IVO | L | 0 | |
| No | RCHRES 4 - | South Reach, W | /estern | NITROGEN | IVO | L | 0 | |
| No | | South Reach, W | /estern | | IVO | | 0 🗸 | 1 |
| ₹ | DOUDEO 4 | с и в – н с. | | DUCCDUCD | 15.200 | | ₽ | 1 |
| | | | <u>o</u> k | | <u>C</u> an | cel | | |

4. The list under "Details of WESTERN BRANCH_WWTP(OBS)" shows the pollutants included in the PCS file. The model will not simulate a constituent unless its corresponding "In Use" box is set to "Yes." Scroll down until you see "FLOW" in the "Pollutant" column. Double click the corresponding "In Use" box and select "Yes."

| No RCHRES 4 - South Reach, Western NITROGEN IVOL 0 No RCHRES 4 - South Reach, Western NITROGEN IVOL 0 No RCHRES 4 - South Reach, Western NITRITE IVOL 0 No RCHRES 4 - South Reach, Western NITRITE IVOL 0 No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 No RCHRES 4 - South Reach, Western CHLORINE IVOL 0 No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | | Reach | Pollutant | Target Member | MemSub1 🔺 | |
|--|-----|---------------------------------|-----------|---------------|-----------|-------------|
| No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 No RCHRES 4 - South Reach, Western CHLORINE IVOL 0 No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | No | RCHRES 4 - South Reach, Western | NITROGEN | IVOL | 0 | |
| No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 No RCHRES 4 - South Reach, Western CHLORINE IVOL 0 No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | No | RCHRES 4 - South Reach, Western | NITROGEN | IVOL | 0 | _ 11 |
| No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 No RCHRES 4 - South Reach, Western CHLORINE IVOL 0 No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | No | RCHRES 4 - South Reach, Western | NITRITE | IVOL | 0 | 22 |
| No RCHRES 4 - South Reach, Western CHLURINE IVUL U No RCHRES 4 - South Reach, Western PHOSPHOR IVOL 0 Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | No | RCHRES 4 - South Reach, Western | PHOSPHOR | IVOL | 0 | |
| Yes RCHRES 4 - South Reach, Western FLOW IVOL 0 | No | RCHRES 4 - South Reach, Western | CHLORINE | IVOL | 0 | |
| | No | RCHRES 4 - South Reach, Western | PHOSPHOR | IVOL | 0 | |
| | Yes | RCHRES 4 - South Reach, Western | FLOW | IVOL | 0 | |
| | • | | | | | |

5. Click OK.

Note: If you want to use point source data other than that provided by BASINS, click ADD NEW. The following window will appear.

| WinHSPF - Add Point Source |
|--------------------------------|
| Simple Create |
| Import MUTSIN Format |
| Convert All MUTSINs in Project |
| Advanced Generation |
| Advanced Generation |

The following gives explanations for the buttons on the "Add Point Source" window.

Simple Create: This tool allows you to add point source data by specifying a scenario name, a reach to which to add the point source, the pollutant(s), a facility name, and a daily load.

Import MUTSIN Format: This allows you to select a Mutsin file that contains the point source information. The user must specify a scenario name, a reach to which to add the point source, the pollutant(s), and a facility name.

Convert All MUTSINs in Project: This tool scans the HSPF input sequence (the UCI file) and converts any found Mutsin files to WDM data sets in the project WDM file.

Advanced Operation: This tool allows you to modify the time series in your point source data file.

Note: You might want to edit values in one of the point source data sets. You can do so by highlighting a field in the row associated with the desired data set and

then clicking the "List/Edit Selected Point Sources" button, $\begin{bmatrix} 111\\222 \end{bmatrix}$. Also, you can view the results graphically by clicking the "Graph Selected Point

111

Selected Point Sources" button,

WinHSPF Data Editor

1. Click (Data Editor). The following window will appear.

| WinHSPF - Input Data Editor | -OX |
|-----------------------------|-----|
| GLOBAL | |
| - OPN SEQUENCE | |
| - FTABLES | |
| - EXT SOURCES | |
| - FORMATS | |
| - NETWORK | |
| EXT TARGETS | |
| - SPEC-ACTIONS | |
| SCHEMATIC | |
| MASS-LINK | |
| - FILES | |
| - CATEGORY | |
| - MONTH-DATA | |
| - PATHNAMES | |
| B PERLND | |
| B IMPLND | |
| B RCHRES | |
| Lie-COPY | |
| Close | |

- **Note:** The "Input Data Editor" window contains a tree diagram of all the possible blocks and tables of HSPF. The tree diagram is navigated by clicking on an item name. **Double clicking** on an item name reveals the sub-items within that item if any exist.
- 3. Click \blacksquare next to "PWATER."
- 4. **Double click** "PWAT-PARM2."

| OpNum | Description | FOREST | LZSN | INFILT | LSUR | SLSUR | KVARY | AGWRC |
|-------------------|---|-----------------------------|---------|---------------------|------|----------|-------------------|-------|
| 101 | Urban or Built-up Land | 0 | 6 | 0.16 | 350 | 0.013207 | 0 | 0.98 |
| 102 | Agricultural Land | 0 | 6 | 0.16 | 350 | 0.013207 | 0 | 0.98 |
| 103 | Forest Land | 1 | 6.5 | 0.16 | 350 | 0.013207 | 0 | 0.98 |
| 104 | Barren Land | 0 | 6 | 0.16 | 350 | 0.013207 | 0 | 0.98 |
| 105 | Wetlands/Water | 1 | 6.5 | 0.16 | 350 | 0.013647 | 0 | 0.98 |
| Table: | PWAT-PARM2, Second grou | • | | | | | | - |
| Table: Paramet | | .c groundwat | er rece | ssion ra | | | zero and | there |
| Table: Paramet | PWAT-PARM2, Second grou er: AGWRC is the basi inflow to groundwater | .c groundwat (rate of f. | er rece | ssion ra ay/rate | | | zero and AGWRC | |

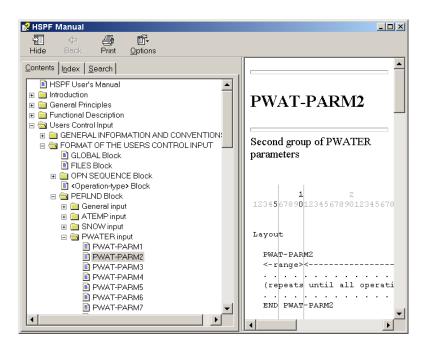
Note: This editor is used to modify site-specific and calibration parameters varied in

model calibration. Notice that as you click in each column corresponding with a parameter, the definition of that parameter is displayed in the text box below the table.

5. Click **HELP**.

| 🛃 HSPF Manual | |
|------------------------------|---|
| 1 (* 🎒 🗗 | |
| Hide Back Print Options | 1 |
| Contents Index Search | A |
| | |
| B PWATER input PWAT-PARM | |
| PWAT-PARM | PWAT-PARM2 |
| PWAT-PARM | |
| PWAT-PARM | I — |
| PWAT-PARM | |
| PWAT-PARM | Second group of PWATER parameters |
| PWAT-PARM | |
| | |
| MON-UZSN | 1 2 3 4 |
| | 123456789012345678901234567890123456789012345 |
| MON-INTERF | |
| MON-LZETP4 | |
| PWAT-STATI | Layout |
| IRRIG-PARM | |
| IRRIG-PARM | PWAT-PARM2 |
| CROP-DATE: | <-range> <pwatpar:< th=""></pwatpar:<> |
| CROP-STAGE | (repeats until all operations of this type |
| CROP-SEASF | |
| SOIL-DATA | END PWAT-PARM2 |
| SOIL-DATA2 | |
| SUIL-DATA3 | Example |
| | |

- **Note:** Notice that the HSPF Manual opens to the page corresponding to the table PWAT-PARM2. This page of the manual provides additional details about the individual parameters in the PWAT-PARM2 table, including definitions and limits.
- 6. Scroll up to the top of the "Contents" at the left side of the manual.



- **Note:** The tree diagram in the "Contents" shows the general format of the HSPF manual. The "Functional Description" section contains detailed explanations of the algorithms and scientific basis of HSPF, while the "Users Control Input" section contains operational details.
- 7. Scroll down in the "Contents." Within the "User Control Input" section, open the 'Catalog for PERLND module' folder, and click on the 'Group PWATER' page.

| 💕 HSPF Manual | | | | | | _ 0 | × |
|---|--------|--------|-----------------|------|----------|----------|---|
| 1 + 4 fr | | | | | | | |
| Hide Back Print <u>O</u> ptions | | | | | | | |
| Contents Index Search | | | | | | | • |
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| 🗉 🖻 BMPRAC Block | | - 51 | X 7 A 77 | ED | | - | |
| 🗉 📄 REPORT Block | Groi | up Pv | WAT: | ĿК | | | |
| FTABLES Block | | - | | | | | |
| | | | | | | | |
| Image: TABLES for the RCHRES AF | | | | | | | |
| | | | | | | | |
| ⊞ | | Mambay | :> | | | Units | |
| ☐ Gatalog for PERLND module ⓐ Group EXTNL | < | | | | | xternal) | |
| Group ATEMP | Name | | lues | | (e | xternal) | |
| Group SNOW | Name | | 2 | | T | | |
| Group PWATER | | 1 | 2 | d | Engl | M∈ | |
| Group SEDMNT | | | | | | | |
| Group PSTEMP | | | | | , | · · | |
| 🖹 Group PWTGAS | Time s | series | comput | ed b | y mod | ule sect | |
| Group PQUAL | | | | | | | |
| Group MSTLAY | PERS | 1 | 1 | * | in | mr | |
| Group PEST | CEPS | 1 | 1 | * | in | mn | |
| Group NITR | SURS | 1 | 1 | * | in | mr | |
| Group PHOS | UZS | 1 | 1 | * | in | mr | |
| E Catalog for IMPLND module | IFWS | 1 | 1 | * | in | mr | |
| | LZS | 1 | 1 | * | in | mr | ▼ |
| | | | | | | ► | |

Note: This page is known as the "Time Series Catalog" for PWATER. The "Time Series Catalog" lists all time series computed by each HSPF module, including the units of the output. It also lists the possible input time series for each

module. The list of input time series indicates either prerequisite sections that must be turned on or time series that must be supplied externally (such as through the input WDM file) for a particular module section.

- 8. Browse the HSPF Manual as much as you wish. When you are finished, close the manual by clicking the '**X**' in the top right corner.
- 9. Toggle to WinHSPF. Click OK or CANCEL in the "Edit PERLND:PWAT-PARM2" window.
- 10. Click CLOSE.

WinHSPF Output Manager

- 1. Click (Output Manager). The Output Manager allows you to select what will be written as the output time series. For each output type, you can choose one or more locations for which output will be generated.
 - **Note:** 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. Under the buttons is a box explaining which output time series will be generated during the HSPF model run.

You can add calibration locations to this list by clicking ADD. A window will appear that lists all available calibration locations (i.e., the reaches of the watershed) along with two text fields. The user must choose one of the calibration locations, and then enter an eight-character identifier for that location. This identifier is used as the location ID attribute in the WDM timeseries data sets that will be created. The user may also enter a "base data set" number for the data sets to be created. The new data sets will be numbered consecutively as the available data sets following the base number. In this section, we are modeling only flow, so we will only specify output locations for "Flow."

2. Click the radio button beside "Flow."

| 🐫 WinHSPF - Output Ma | anager | |
|---|--|------|
| Output Type O Hydrology Ca O Flow | alibration C AQUATUX C Linkage C Other | |
| Streamflow output will I | be generated at each 'Flow' output local | ion. |
| | | |
| | | |
| | | |
| Output Locations: | | |
| Output Locations: Name | Description | |

- **Note:** Notice that "RCHRES 4" is the only stream listed in the output locations. We would like to look at the flow in "RCHRES 5" because there is a flow gage located on Reach 5.
- 3. Highlight "South Reach, Western" in the "Description" text box and click REMOVE.
- 4. Click YES when the following message appears.

| 🗶 Delete Query | | × |
|------------------------------|-----------------|-------------------|
| Do you want to permanently d | elete the outpu | t WDM timeseries? |
| Yes | <u>N</u> o | J |

- 5. Click ADD.
- 6. Highlight "RCHRES 5 (Western Branch Patux)."

| 2 | WinHSPF - Add Output | × |
|---|---|---|
| | Operation: | |
| | RCHRES 1 (Western Branch Patux) RCHRES 6 (North Collington Bra) RCHRES 3 (South Collington Bra) | |
| | RCHRES 2 (Southwest Branch Wes) RCHRES 5 (Western Branch Patux) | |
| | RCHRES 4 (South Reach, Western) | |

- 7. Click OK. Notice that "RCHRES 5" is now listed as an output location. This means that we will be able to view the simulated flow data for Reach 5.
- 8. Click CLOSE to exit the "Output Manager."

D. Running WinHSPF

In this section, we will run our WinHSPF model for the West Branch of the Patuxent River.

QUESTION ANSWERED:

- 4) How do I run my WinHSPF model?
- 1. Click (Run).
- 2. If the following message appears and asks if you want to save changes that have been made, click **SAVE/RUN**. Your *.uci* file will be saved and the model simulation run will begin.



- **Note:** A screen will appear, indicating that the input file is being processed and run. When this disappears, the model run is complete.
- **Note:** We would like to compare the simulated flow for Reach 5 (recall that we specified RCHRES 5 as a "Flow" output location) with observed flow in Reach 5. Before we do this, we need to add the gage data to the current project.
- 3. Close the WinHSPF window.

IMPORTANT NOTE: IF YOU DO NOT CLOSE THE WINHSPF WINDOW, YOU WILL NOT BE ABLE TO COMPLETE SECTION E.

E. Adding Gage Data to the Project

QUESTION ANSWERED:

5) How do I add gage data to my WinHSPF project file?

In this section, we will download the USGS gage data for Reach 5 and add it to the *WestPat* project *.*wdm* file. If you are unable to connect to the internet, please skip to step 18.

- 1. Within BASINS, from the **File** menu, select **Download Data**.
- 2. Check the box next to "Daily Discharge" within the "USGS Stations from NWIS"

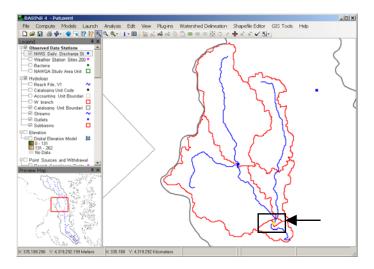
| Download Data | | | | |
|-----------------------|------------------------|-------------------|----------------------|----------|
| Region to Download | Hydrologic Unit 02 | 060006 | | |
| BASINS | , | | | |
| DEM Shape | 🔲 GIRAS Land Us | e 🗆 NED | Census | 🗖 303(d) |
| 🗖 DEM Grid | 🗖 Legacy STORE | т 🗆 NHD | 🗆 Meteorolog | ic 🗀 |
| National Hydrograp | hy Dataset Plus | | | |
| 🗖 All | | Catchments | 3 | |
| Elevation Grid | | 🗆 Hydrograpi | hy | |
| Flow Direction Gr | id | 🗆 Hydrologic | Units | |
| Flow Accumulation | in Grid | 🗆 Streamgag | e Events | |
| Station Locations fro | m US Geological Surv | ov National Wat | or Information Syste | |
| Daily Discharge | Water Quality | - | | |
| Data Values from U | S Geological Survey N | ational Water Inf | ormation System | |
| | ust be selected on the | | - | |
| National Land Cove | | 1 | | |
| Land Cover | Impervious | Canopy | 1992 Land (| |
| Land Cover | Impervious | Canopy | 1 1332 Lanu (| JUVEI |
| EPA STORET Wate | | | | |
| Stations | Results | | | |
| | | | | |
| Merge | Clip to Region | | Cancel | Download |

frame. Your window should look like the following.

3. Click DOWNLOAD. After a few moments, the following window will appear.

| Download Complete |
|---|
| Downloaded 1 Layer: Layer Name: NWIS Daily Discharge Stations Layer Filename: C:\BASINS\data\02060006\NWIS\NWIS_Stations_discharge.shp Layer Type: Point Shapefile Extents: (315609.626482551, 4256683.81416807 369531.648995571, 4353632.90420751) |
| ОК |

4. On the map, notice the new layer called "NWIS Daily Discharge Stations". With this layer active, select the USGS daily discharge site at the downstream end of RCH 5, as shown on the map below. Note that you may want to move the Observed Data Stations to the top of the legend and change the point size/color to make the stations more visible.



The selected station is USGS discharge site "01594526" with a station name of "Western Branch at Upper Marlboro, MD". You could use the identify tool to be sure that you have selected the desired station.

Now that we have identified the station for which we would like to download the daily discharge data, we will use the Data Download tool to download the actual discharge data.

- 5. From the **File** menu, select **Download Data**.
- 6. Check the box next to "Daily Discharge" within the "USGS Data from NWIS" frame. Your window should look like the following.

| Download Data | | | | × |
|------------------------|-----------------------|---------------------|--------------------|--------|
| Region to Download | Hydrologic Unit 020 | 60006 | | • |
| DEM Shape | GIRAS Land Use | e 🗆 NED | 🗆 Census 🗖 303(d) | |
| DEM Grid | C Legacy STORET | r 🗖 NHD | T Meteorologic | |
| -National Hydrograph | y Dataset Plus | | | |
| | | Catchments | | |
| Elevation Grid | | E Hydrography | | |
| Flow Direction Grid | k | 🗆 Hydrologic U | nits | |
| Flow Accumulation | n Grid | 🗖 Streamgage I | Events | |
| Station Locations from | n US Geological Surve | ey National Water | Information System | |
| 🗖 Daily Discharge | 🗌 Water Quality | 🗆 Measuremen | ts 🔲 Ground Water | |
| Data Values from US | Geological Survey Na | ational Water Infor | mation System | |
| 🗹 Daily Discharge | 🗖 Water Quality | E Measuremen | ts | |
| National Land Cover | Data 2001 | | | |
| Land Cover | Impervious | Canopy | 1992 Land Cover | |
| EPA STORET Water | Quality | | | |
| Stations | Results | | | |
| ☐ Merge | Clip to Region | | Cancel Downlos | id /// |

7. Click DOWNLOAD. After a few moments, the following window will appear.



- 8. Click OK.
 - **Note:** In order to compare the simulated data to the observed data, we need to add the gage data to a WDM file. Therefore, in the following steps we will add the gage data to the project WDM file (*WestPat*) that was created when we built our HSPF project.
- 9. The following window will appear.

| 🃒 Dat | a Sour | ces | | | |
|-------|-------------------|--------------------|----------|--|--|
| File | Edit | View | Analysis | Help | |
| ⊟-US | C:\BAS GS RD | в | | 3\met\met.wdm (209) \NWIS\NWIS_discharge_01594528.rdb (1) | |
| | INS\dat series | SGS RD ta\02060 | | IWIS_discharge_01594526.rdb | |

- 10. Click on the line representing the USGS RDB gage data at 01594526.
- 11. In the **Data Sources** window, from the **View** menu choose **Display**.
- 12. You will see that there is 1 dataset selected. Click **Save to File**.

| 2 | C:\BASINS\data\02060006\ 💻 🗖 | × |
|---|-----------------------------------|---|
| | 1 dataset | |
| Ş | Select what to do with this data: | |
| | Save to file | |
| | Discard | |
| | Add/Remove Datasets | |
| Γ | Display | |
| | List | |
| | Graph | |
| | Data Tree | |
| | Seasonal Attributes | |
| | Frequency Grid | |
| | | _ |

- 13. You will be prompted for which file to use. Double-click "Browse for new or existing file".
- 14. Navigate to *BASINS\modelout\WestPat*, select the file *WestPat.wdm*, and click **OPEN**.
- 15. The following window will appear. Click **SAVE**.

| | dited here before s tains 12 datasets nu | | 11 | | |
|----|---|----------|----------|-------------|-----------|
| ID | New DSN | Scenario | Location | Constituent | History 1 |
| | 7,012 | OBSERVED | 01594526 | FLOW | |
| | | | | Cancel | Save |

16. The gage data you specified has now been added to your *WestPat.wdm* file. Click **OK**.

| Saved Data 🔀 |
|--|
| Saved 1 of 1 dataset in C:\BASINS\modelout\WestPat\WestPat.wdm (file now contains 13 datasets) |
| ОК |

17. Close the Display and Data Sources window so that only the BASINS map is open.

If for some reason you were unable to download the data through the **Data Download** tool, the downloaded data has been provided for you. You may import this data into the *w_branch.wdm* file using WDMUtil by going through the following steps. If you were able to import the data successfully, you may skip steps 18 through 35 below and continue with Section F.

- 18. From the Start menu under Programs, select BASINS and then WDMUtil.
- 19. From the **File** menu, select **Open**.
- 20. Navigate to c:\basins\modelout\WestPat and click on "WestPat.wdm."
- 21. Click OPEN. The WDM will open:

| File Tools Scena Scenarios 0 of 2 4 PT-OBS WESTPAT | | | Constituer Locatior 0 of 2 RCH4 RCH5 | | es Help | Constituer 0 of 8 BOD, 5-D CHLORIN FLOW NITRITE NITRIGE OXYGEN, | All None |
|--|----------|----------|--|----------------------|------------|--|-----------------------|
| - Time Series + 🌾 🛨 | 12 of 12 | availabl | le time s | eries in list (🎕 | 0 not on ¥ | /DM file); 1 | selected. All None |
| Type File | DSN Sc | cenario | Location | Constituent | Start | End | Nval Station Na 🔨 |
| WDM w_branch | 1001 W | ESTPAT | RCH5 | FLOW | 1985/10/1 | 1989/4/30 | 1308 |
| WDM w_branch | 7001 P1 | F-OBS | RCH4 | OXYGEN, | 1970/1/1 | 1995/12/31 | 9496 WESTERI |
| WDM w_branch | 7002 P1 | F-OBS | RCH4 | BOD, 5-D | 1970/1/1 | 1995/12/31 | 9496 WESTERI |
| WDM w_branch | 7003 P1 | F-OBS | RCH4 | SOLIDS, | 1970/1/1 | 1995/12/31 | 9496 WESTERI |
| WDM w_branch | 7004 P1 | F-OBS | RCH4 | NITROGEN | 1970/1/1 | 1995/12/31 | 9496 WESTERI |
| WDM w_branch | 7005 P1 | F-OBS | RCH4 | NITROGEN | 1970/1/1 | 1995/12/31 | 9496 WESTERI |
| < | | | | | | | > |
| Dates Reset Start Current 1985 | 10 1 | End | | TStep,Units | | Tools | 1 |
| Common 1985 | 10 1 | to 1989 | 4 30 | Native | - | × 2 | X 📥 🎽 |

- 22. From the **File** menu, select **Import**.
- 23. Navigate to *c:\basins\extra training files* and select "*discharge.txt*." Click OPEN.
- 24. Click OK if the following message box appears.

| No Scripts Found Yet |
|---|
| Use the Find button to locate scripts. Look for the Scripts directory where this program is installed. |
| OK] |

- 25. The "Script Selection" window will open. Click FIND.
- 26. Navigate to *c:\basins\models\hspf\WDMUtil\scripts* and select "UsgsDvWeb_MDY_2001.WS."
- 27. Click OPEN.
- 28. Under script file, select the record that corresponds to "USGS Daily Web Values (mm/dd/yyyy) 2001 Format." It will turn blue.

| Script Selection for importing C:\BASINS\Extra | a Training Files\discharge.txt | _ 🗆 × |
|--|--|----------------|
| Description | Script File | Run |
| Blank Script | | |
| "Hourly Precip, On-Line Format, NCDC TD-3240" | C:\BASINS\models\HSPF\WDMUtil\scripts\HPCP_NC | Edit |
| "USGS Daily Web Values (mm/dd/yyyy) - 2001 Format" | C:\BASINS\models\HSPF\WDMUtil\scripts\UsgsDvWi | |
| | | <u>F</u> ind |
| | | Forget |
| | | <u>D</u> ebug |
| | | <u>C</u> ancel |
| | | |

29. Click RUN.

The "Script Selection" window will disappear and a run window will open, indicating that the discharge data is being processed and added to the current WDM project.

| 🧮 Readin | g C:\BASINS\modelout\discharge.txt | _ 🗆 X |
|----------|--|-------|
| USGS[1 | 0133895(11/06/1990(12) | |
| 0 | 36% | 100 |
| | | |
| | Estimate Done at: 5:17:32 PM (5 seconds) | |
| | | |

When this process is complete, a new record will appear in the time series list. It will be highlighted (yellow).

| Time Series - 13 of 13 available time series in list (1 not on WDM file); 0 selected. | | | | | | | | | |
|---|---------------------|------|----------|----------|-------------|-----------|------------|------|----------|
| | | | | | | | | | |
| Туре | File | DSN | Scenario | Location | Constituent | Start | End | Nval | 5. |
| WDM | w_branch | 7008 | PT-OBS | RCH4 | PHOSPHOR | 1970/1/1 | 1995/12/31 | 9496 | V |
| WDM | w_branch | 7009 | PT-OBS | RCH4 | CHLORINE | 1970/1/1 | 1995/12/31 | 9496 | V |
| WDM | w_branch | 7010 | PT-OBS | RCH4 | PHOSPHOR | 1970/1/1 | 1995/12/31 | 9496 | V |
| WDM | w_branch | 7011 | PT-OBS | RCH4 | FLOW | 1970/1/1 | 1995/12/31 | 9496 | V |
| In-Memory | <in memory=""></in> | 1 | OBSERVED | 01594526 | FLOW | 1985/10/1 | 1995/12/31 | 3744 | <u>v</u> |

30. Click the new time series. It will turn blue when selected.



- In the "Tools" frame, click (Write Time Series to WDM). 31.
- In the Output DSN text box, type "27." Leave other fields as they are. 32.

| Specify Output Data-set Number(s); Select/Enter Scenario, Location, Constituent as needed; Click Write button to store data on WDM file. | | | | | | | |
|--|---------------------|----------------|-------------|--|--|--|--|
| Use common period for all data sets, as defined on main form Use full period for each data set | | | | | | | |
| DSN/ID | Output DSN Scenario | Location | Constituent | | | | |
| 1 | OBSERVED | 01594526 | FLOW | | | | |
| | <u>W</u> rite | <u>C</u> ancel | | | | | |

- 33. Click WRITE.
- 34. Click OK when you are told that the file was stored successfully.
- 35. From the File menu, select Exit.

F. Viewing WinHSPF Output in GenScn

QUESTION ANSWERED:

6) How do I use GenScn to view my simulation results?

In this section, we will view the results of the simulation using the GenScn postprocessor. GenScn was designed to manage large volumes of input, output, and calibration data used by and produced in models such as SWAT and WinHSPF. This software has many different applications; however, in this exercise we will focus on those necessary for viewing the output from WinHSPF and corresponding gage data.

- 1. From the Start menu under Programs, select BASINS and then WinHSPF.
- From the **File** menu, select **Open** or click the "Open Existing Project" button, 2.
- 3. Navigate to c:\basins\modelout\Westpat\ and select "WestPat.uci." Click **OPEN**.



4.

Click (View Output button).

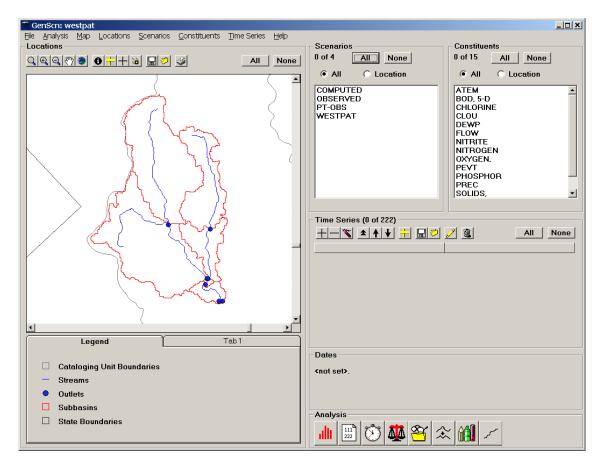
Note: The "GenScn Initialization from BASINS" window will appear. This form has six different tabs because many types of files can be viewed within the GenScn interface.

| 🕷 GenScn Initialization from BA | ASINS _ 🗆 🗶 |
|---------------------------------|--|
| Overview Met Data | PLTGEN SWAT Output HSPF Output Obs WQ Data |
| BASINS <u>P</u> roject | ALL |
| Project <u>T</u> ype | HSPF |
| Map File Name | C:\BASINS\modelout\westpat\westpat.mag <u>Browse</u> |
| Load Existing | <u>Q</u> K <u>C</u> ancel |

Note: The "Overview" tab shows information about the GenScn project that is being created from the BASINS interface.

5. When used from BASINS, by default the appropriate settings will be selected. Click OK.

The GenScn window will open. This window has six sections: Locations, Scenarios, Constituents, Time Series, Dates, and Analysis.



Recall that we want to look at a graph that includes both the model's flow simulation values and observed flow values for the same reach in order to ascertain how well we are simulating flow in Reach 5. We will graph both times series in the following steps.

- 3. In the "Scenarios" frame, select "WESTPAT" and "OBSERVED."
- 4. In the "Constituents" frame, select "FLOW."

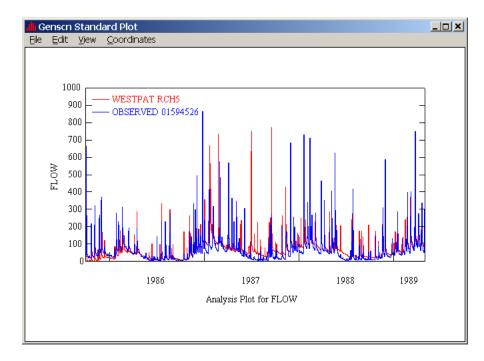
| - Scenarios | Constituents |
|------------------|------------------|
| 2 of 3 All None | 1 of 8 All None |
| • All O Location | • All C Location |
| OBSERVED | BOD, 5-D |
| PT-OBS | CHLORINE |
| WESTPAT | FLOW . |
| | NITRITE |
| | NITROGEN |
| | OXYGEN, |
| | PHOSPHOR |
| | SOLIDS, |
| | |

- 5. In the "Time Series" frame, click (Add to Time Series List). All time series for flow within the "WESTPAT" and "OBSERVED" scenarios will be listed in the Time Series section.
- 6. In the "Time Series" frame, highlight the record that corresponds to the scenario name "WESTPAT." Press SHIFT and highlight the "OBSERVED" time series.

| Γ | Time Series (2 of 93) | | | | | | | |
|---|-----------------------|----------|-------|----------|----------|-------------|-----------|-------|
| | +- | - 🌾 💈 | t † | ↓ | | 1 | All | None |
| | Туре | File | DSN | Scenario | Location | Constituent | Start | SJDay |
| | WDM | w_branch | 1 | OBSERVED | 01594526 | FLOW | 1985/10/1 | 46339 |
| | WDM | w_branch | 1001 | WESTPAT | RCH5 | FLOW | 1970/1/1 | 40587 |

- 7. In the "Analysis" frame, click (Generate Graphs).
- 8. Make sure the "Standard" box is checked.

| 📕 Graph | | | | |
|--|--|--|--|--|
| Select desired plots, then press Generate. | | | | |
| ✓ Standard | | | | |
| 🔲 <u>R</u> esidual (TS2 - TS1 vs. time) | | | | |
| <u>Cumulative Difference vs. time</u> | | | | |
| 🔲 Bar Chart | | | | |
| <u>Flow/Duration</u> | | | | |
| Difference (TS2 - TS1) vs. TS1 | | | | |
| 🔲 Scatter (TS2 vs. TS1) 📙 45 deg/regress lines | | | | |
| C Current Period C Storms | | | | |
| <u>G</u> enerate Cancel | | | | |



9. Click GENERATE. The plot window will open:

- 10. After looking at the graph, exit the GenScn Standard Plot. Click CANCEL to exit the "Graph" window.
- 11. Zoom in on smaller time periods by changing the start and end dates in the "Dates" frame. Repeat steps (6-9) to look at the graph of this time period.
- 12. Exit any open graphs and close GenScn. You don't need to save any changes.

Special Note about HSPF Errors in WinHSPF:

From time to time changes made to the User Control Input (*.*uci*) file through WinHSPF (or a text editor) are interpreted as errors the next time the *.*uci* is opened in WinHSPF. This condition is indicated by a message similar to the following when opening a *.*uci* file in WinHSPF:

| HSPF Problem | × | | | |
|---|----------------|--|--|--|
| Error interpreting UCI | File 'basewq'. | | | |
| See the file 'basewq.ech' for more details. | | | | |
| ····· | | | | |
| <u>C</u> ontinue | View Errors | | | |

Details of the error encountered are written to the file known as the "Echo" file which is named with the same base name as the *.*uci* file only with a *.*ech* extension (e.g., *w_branch.uci* will have an "Echo" file named *w_branch.ech*). Clicking the "View Errors"

button will provide a view of the *.*ech* file at the point of the first error. HSPF error messages are enclosed in asterisks as shown below:

| WinHSPF Error View of basewq.ech | <u>_ ×</u> |
|--|--------------|
| COPY 100 END INGRP END OPN SEQUENCE | |
| *********** | ***** |
| * <u> </u> | * |
| * ERROR/WARNING ID: 211 23 | * |
| * The text ' PERxND 191' is not recognized as a heading, | ÷ |
| * operation-type or delimiter, and thus will be ignored. Is it | * |
| <pre>* misspelled or placed in the wrong fields? *</pre> | * |
| ***** | ***** |
| FINISHED PROCESSING OPN SEQUENCE BLOCK | |
| PROCESSING FTABLES BLOCK | |
| USERS CONTROL INPUT IS: FTABLES | |
| FTABLE 680 | |
| • | ► |
| < | ind |

The *.*ech* file may also be opened in any text editor (such as Wordpad). Searching for the text 'Error' will take the focus to the portion of the file containing error messages. Once the error messages are found, the cause of the problems can be identified and resolved.

It should also be noted that it is also possible to encounter errors by HSPF during simulation that prevent the model from running to completion. If the simulation does not appear to run to completion (for example the output time series plots do not contain data for the full span of the run), the *.*ech* file should be examined for error messages. The *.*ech* files are generally located in the same directory as your *.*uci* file.

Reference:

Duda, P., J. Kittle, Jr., M. Gray, P. Hummel, R. Dusenbury. WinHSPF Version 2.0: An Interactive Windows Interface to HSPF (WinHSPF), User's Manual. Washington, D.C.: U.S. Environmental Protection Agency, 2001.