Exercise 9b – Sediment Transport Calibration

BASINS/HSPF Application Steps

| Study Definition/Modeling Strategy | Timeseries Data Management | Parameter Development/Model Setup | Hydrologic Calibration/ Validation | **Water Quality Calibration/ Validation** | Scenario Analysis |
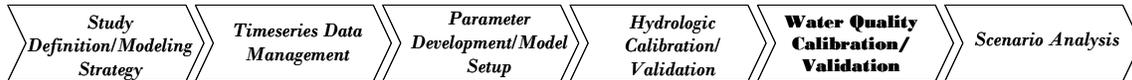
Questions addressed in this section:
1. How do I estimate in-stream sediment (silt and clay) transport parameters?
2. What procedures do I use in calibrating in-stream sediment transport?
3. How do I add a point source of sediment to my WinHSPF model?

In this exercise, we will use WinHSPF and GenScn to calibrate sediment transport in the Western Branch of the Patuxent River. In Exercise 8a, we estimated land use-specific target values for soil erosion from land segments and transport/delivery of sediment to the stream. In this exercise, we will apply (and add to) the information presented in the in-stream sediment lecture to 1) simulate and analyze shear stress in our reaches at various flow rates, 2) make preliminary estimates of key sediment parameters, 3) calibrate in-stream sediment concentrations, and 4) add a sediment point source to our model. In sediment modeling, a point source can represent either an actual point source, or a low background source of sediment (such as sediment eroded from small, un-modeled streams in the watershed[1]).

A. Estimating Shear Stress (TAU) for Reach 5

QUESTION ANSWERED:
1) How do I estimate in-stream sediment (silt and clay) transport parameters?

The simulation of transporting silt and clay (including scour, deposition, and advection) strongly depends on the computed shear stress (TAU) in a stream. Sheer stress is a function of hydraulics (i.e., flow velocity and channel geometry). For each reach, critical shear stress parameters for silt and clay can be estimated by examining the TAU time series. In this exercise, we will plot the *maximum* daily TAU time series to help us estimate the TAUCS (critical shear stress for scour) and TAUCD (critical shear stress for deposition) parameters for silt and clay.

1.   If WinHSPF isn't open, from the **Start** menu under **Programs**, select **BASINS** and then **WinHSPF**.

2.   Click [📂] (Open File).

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1 The in-stream scour algorithms are not designed to represent this phenomenon well.

3.   Navigate to *c:\Basins\modelout\sediment* and select *"sed_riv.uci"* and click OPEN.

      Note: This **.uci* file is identical to the one created in the previous exercise except
              that the sediment loads from each landuse have been calibrated. We are
   opening this **.uci* file to ensure that everybody has the same inputs.

4.   Click the "Output Manager" button, .

5.   Click the button beside "Other."

6.   Click ADD. The "WinHSPF – Add Output" window will open.

7.   In the "Operation" panel, select "RCHRES 5."

8.   In the "Group/Member" panel, select "HYDR:TAU."

      Note: Leave the "Base WDM DSN" field as "1000."

      Your screen should look like the following:
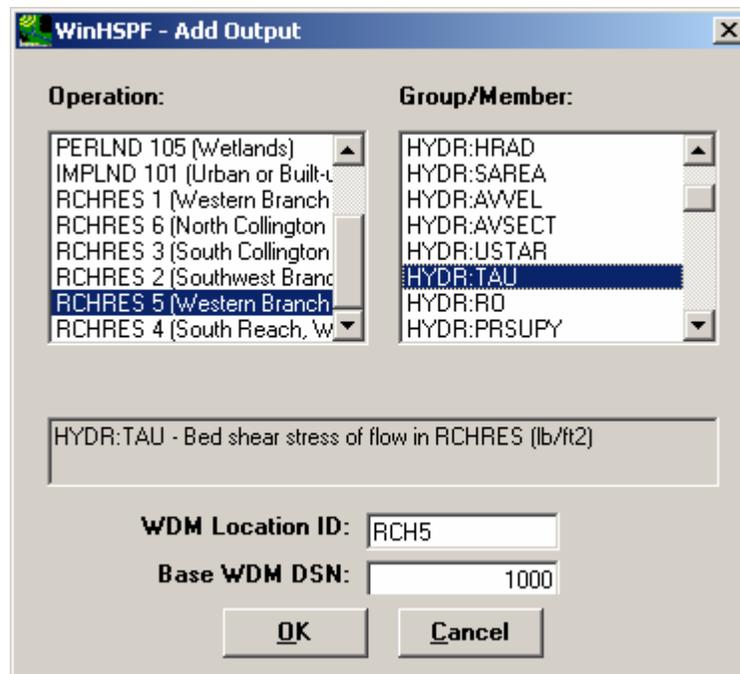
9.   Click OK.

10.   Click ADD.

11.   In the "Operations" box, select "RCHRES 5 (Western Branch)."

12.   In the "Group/Member" box, select "SEDTRN: SSED (4,1)." Your screen should
      look like the following:
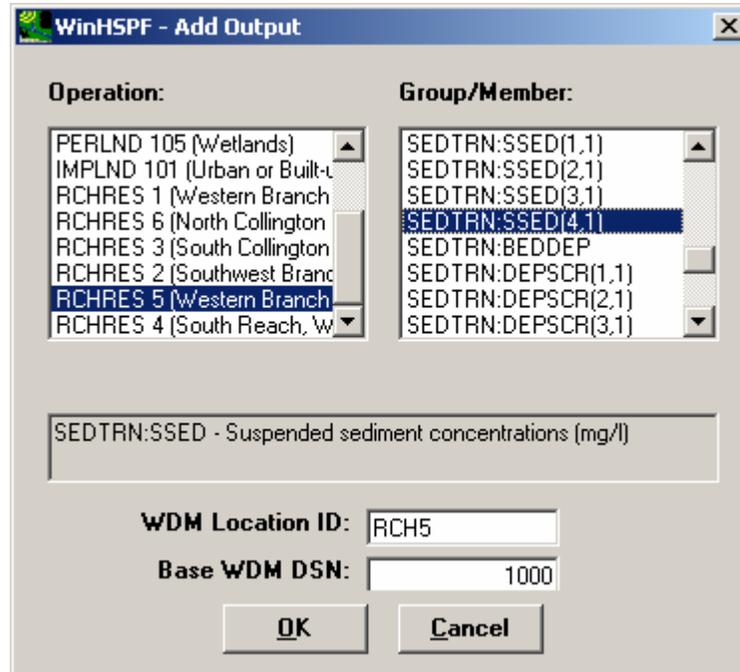
Note: SSED(4,1) is the total in-stream suspended sediment concentration. The numbers in parentheses after the parameter names in the Output Manager are subscripts that represent various parameters within a parameter group. In this case, they represent the following sediment components:

        (1,1) – Sand
        (2,1) – Silt
        (3,1) – Clay
   (4,1) – Total (sum of sand, silt and clay)

13.   Click OK.

14.   Click ADD.

15.   In the "Operations" box, select "RCHRES 5 (Western Branch)."

16.   In the "Group/Member" box, select "SEDTRN:DEPSCR (4,1)."

       Note: DEPSCR(4,1) corresponds to the total simulated sediment deposition (positive values) or total simulated sediment scour (negative values) (tons/interval).

17.   Click OK.

18.   Click CLOSE.

19.   Click the "Input Data Editor" button, .

20.   **Double click** EXT TARGETS.

21.   Change the value in the "Tran" column to "MAX" for RCHRES 5: HYDR, TAU.

       Note: This step specifies that the TAU time series output will be maximum values
                   of TAU (sheer stress) per day.

22.   Change the value in the column "Tran" to "SUM" for RCHRES 5: SEDTRN,
       DEPSCR.

23.   Click APPLY.

24.   Click OK.

25.   Click CLOSE.

26.   Click the "Run HSPF" button, ▣↓.

27.   Click SAVE/RUN.

28.   Click the "View Output through GenScn" button, 📊.

29.   Click the "HSPF Output" tab and check the box beside *c:\basins\modelout\
       sed_riv.wdm.*

30.   Click OK.

31.   In the "Scenarios" frame, select "Observed" and "Sed_Riv."

32.   In the "Constituents" frame, select "SEDIMENT" and "SSED4."

       Note: The SSED time series corresponds to *simulated* total suspended sediment
                  concentrations (sand, silt, and clay) (mg/L). The SEDIMENT time series
                  contains the *observed* total suspended sediment data (mg/L).

33.   In the "Time Series" frame, click the "Add to Time Series List" button, ✚.

34.   In the "Dates" frame, change the dates to the following:
               Start: 1987/6/1
               End: 1987/12/31

35.   Select the "SEDIMENT" and "SSED" time series and click 📊 (Generate Graphs)
       in the "Analysis" frame.

36.   In the "Graph" window, make sure "Standard" is checked. Click GENERATE.

37.   **Double click** on the "SSED, SEDIMENT" axis.

38.   Make sure the "Axes" tab is selected. In the "Left Y-axis" frame, change the "Max" to "200."

39.   Click APPLY.

40.   Click OK. Your plot should look like the following:
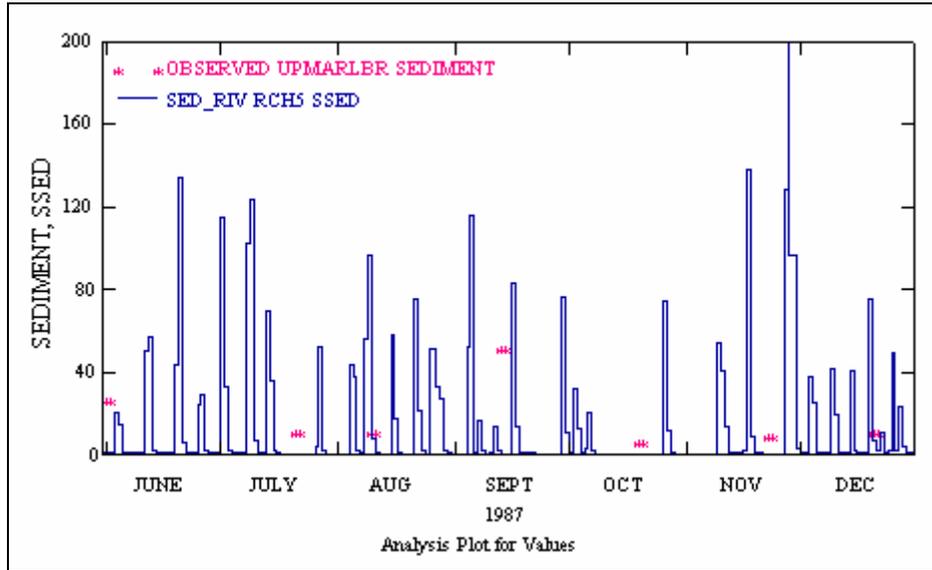
> **Note:** Because there are very few observed data points, it is difficult to determine how well we are estimating sediment erosion and transport. Look at the SSED values. After we adjust some key calibration parameters in the next section, we will plot the results and compare the new SSED plot with the one above. This will help us ascertain the effects of adjusting the parameter values and determine whether to further adjust the parameters.

41.   Close the SSED/SEDIMENT plot.

42.   In the "Constituents" frame, click "TAU."

43.   In the "Time Series" frame, click ⊞ (Add to Time Series List). The TAU time series should appear in the "Time Series" list.

44.   In the "Dates" frame, change the start and end dates to the following:

45.   Select the "TAU" time series and click 📊 (Generate Graphs) in the "Analysis"

frame.

46.   In the "Graph" window, make sure that "Standard" is checked and click
       GENERATE. The following graph will appear:
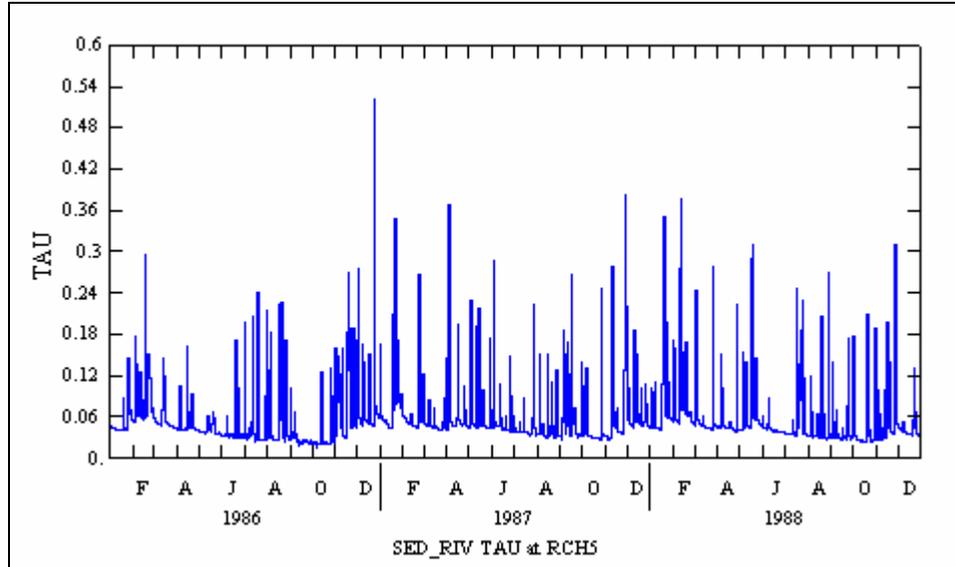
We need to estimate values for TAUCD and TAUCS for silt and clay. These are important
in-stream calibration parameters. Before proceeding, read the following explanations:

> **TAUCD** - *The critical bed shear stress for deposition. Above this stress, there will be no deposition;
>   as the stress drops below this value to zero, deposition will gradually increase to the value implied
>   by the fall velocity in still water.*

> **TAUCS** - *The critical bed shear stress for scour. Below this value, there will be no scour; above it,
>   scour will steadily increase.*

Note: In general, TAUCD should be less than or equal to TAUCS.

Scour will occur when there are large storms and high flows in the reach. Look at the
"TAU" graph below. (This graph is the same as that created in Step 22).   We will choose a
value of "0.12" for silt TAUCS so that scour will occur only periodically (as shown by the
top line). If we were to choose a smaller value, the model would probably simulate too much
scour (removal of sediment from the bottom of the reach channel). Deposition will occur
when the shear stress[2] is low. Look at the following plot again; we will choose a value of
"0.07" for silt's TAUCD. Since silt is heavier than clay, we will choose slightly higher
values for clay that will result in similar proportions of clay and silt scour and deposition.

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2 Shear stress is a function of the bottom slope of the reach, the unit weight of water, and the hydraulic radius.

SED_RIV TAU at RCH5
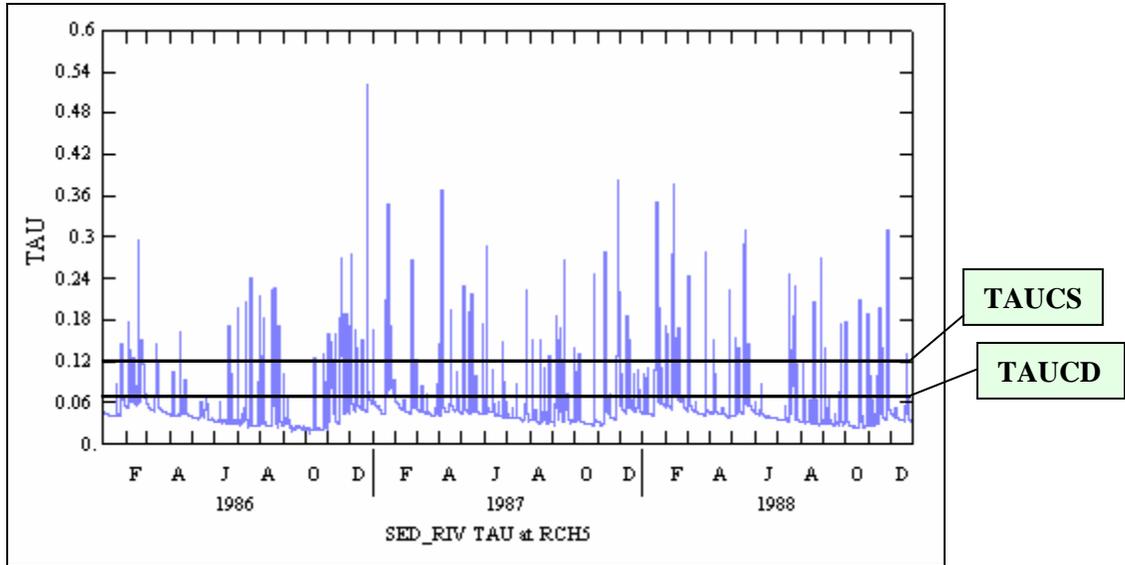
47.   Close GenScn and return to WinHSPF.

48.   Click the "Input Data Editor" button, [icon].

49.   **Double click** RCHRES → SEDTRN → SILT-CLAY-PM.

50.   Make sure the "Occurrence" is "1."

   Note: Recall that we defined two occurrences earlier: one for silt, and one for clay.
        "Occurrence 1" is associated with silt, and "Occurrence 2" is associated with
        clay. We will enter parameter values for both occurrences.

   Note: We estimated the value of TAUCD and TAUCS for Reach 5 above. The
        values for TAUCD and TAUCS for the other reaches were approximated
        following similar steps as those taken for Reach 5.

51.   Change the values in the "TAUCD" column to the following:

Reach (OpNum)	TAUCD
1	0.05
2	0.09
3	0.07
4	0.07

5	0.07
6	0.07

52.   Change the value in the "TAUCS" column to the following:

Reach (OpNum)	TAUCS
1	0.09
2	0.17
3	0.1
4	0.12
5	0.12
6	0.11

53.   Click APPLY.

54.   In the "Occurrence" menu, select "2."

55.   Change the values in the "TAUCD" column to the following:

Reach (OpNum)	TAUCD
1	0.06
2	0.1
3	0.08
4	0.08
5	0.08
6	0.08

56.   Change the values in the "TAUCS" column to the following:

Reach (OpNum)	TAUCS
1	0.1
2	0.18
3	0.11
4	0.13
5	0.13
6	0.12

57.   Click APPLY.

58.   Click OK to exit the SILT-CLAY-PM table.

59.   Click CLOSE.

B. Review Initial Sediment Simulation Results and Begin Calibration

QUESTION ANSWERED:
2) What procedures do I use in calibrating in-stream sediment transport?

We will use WinHSPF and GenScn to calibrate our sediment model. The programs can be used to adjust sediment input parameters, run the model, and examine results using graphical plots and statistical tests. Sediment calibration is a cyclical process of running the model and then comparing the simulation results with observed values. Because there are very few observed sediment data to compare with simulation results, our calibration will be limited to ensuring the results are reasonable and internally consistent.

In GenScn you should review several time series and plots relevant to RCHRES 5. Before doing this, we need to specify the constituents we would like to see output for.

1.   Click the "Run HSPF" button, .

2.   Click SAVE/RUN.

3.   Click the "View Output through GenScn" button, .

4.   In the "Locations" frame, select "RCH 5" and "UPMARLBR."

5.   In the "Scenarios" frame, select "OBSERVED" and "SED_RIV."

6.   In the "Constituents" frame, select "SEDIMENT" and "SSED4."

7.   In the "Time Series" frame, click (Add to Time Series List).

8.   In the "Dates" frame, change the dates to the following:
                Start: 1987/6/1
                End: 1987/12/31

9.   Select the "SEDIMENT" and "SSED" time series and click (Generate Graphs)
        in the "Analysis" frame.

10.   In the "Graph" window, make sure "Standard" is checked. Click GENERATE.

11.   **Double click** on the "SSED, SEDIMENT" axis.

12.   Make sure the "Axes" tab is selected. In the "Left Y-axis" frame, change the "Max"
        to "200."
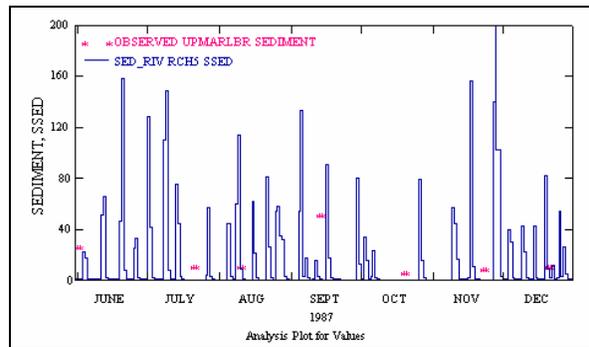
13.   Click APPLY.

14.   Click OK. Your plot should look like the following:
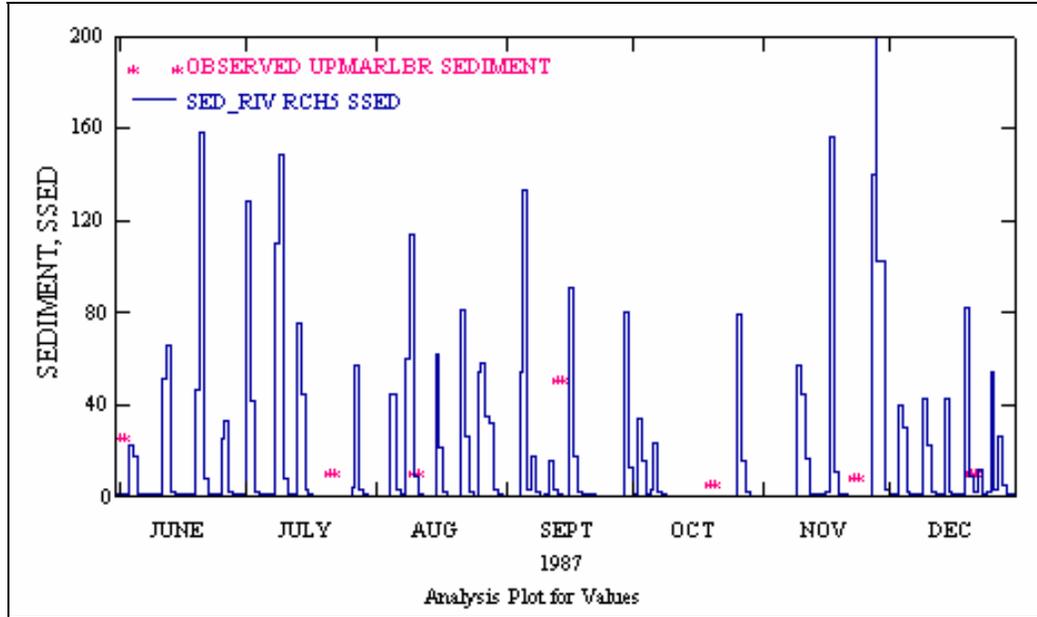
Compare this plot to the plot created in Step 40:
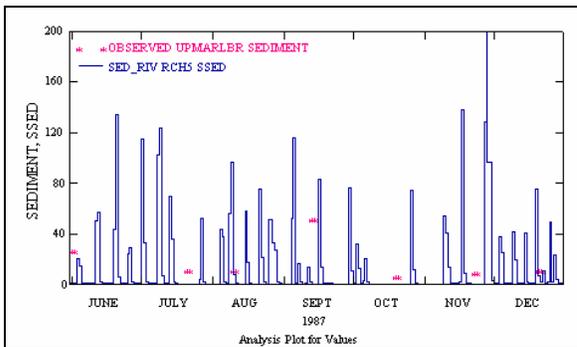
| Plot created in Step 40 | Plot with adjusted TAUCS and TAUCD |

> **Note:** Adjusting the scour and deposition parameters (TAUCS and TAUCD) caused an increase in sediment loads.

In the following steps, we will plot the DEPSCR time series; this plot will help you understand the magnitude and timing of deposition and scour.

15.   In the "Constituents" frame, select "DEPSCR4."

16.   In the "Time Series" frame, click ☐ (Add to Time Series List).

17.   In the "Dates" frame, click **Reset** (Reset Dates).

18.   Select the "DEPSCR" time series and click (Generate Graphs) in the "Analysis" frame.

19.   In the "Graph" window, be sure that "Standard" is checked and click GENERATE. The following graph will appear:

SED_RIV DEPSCR at RCH5
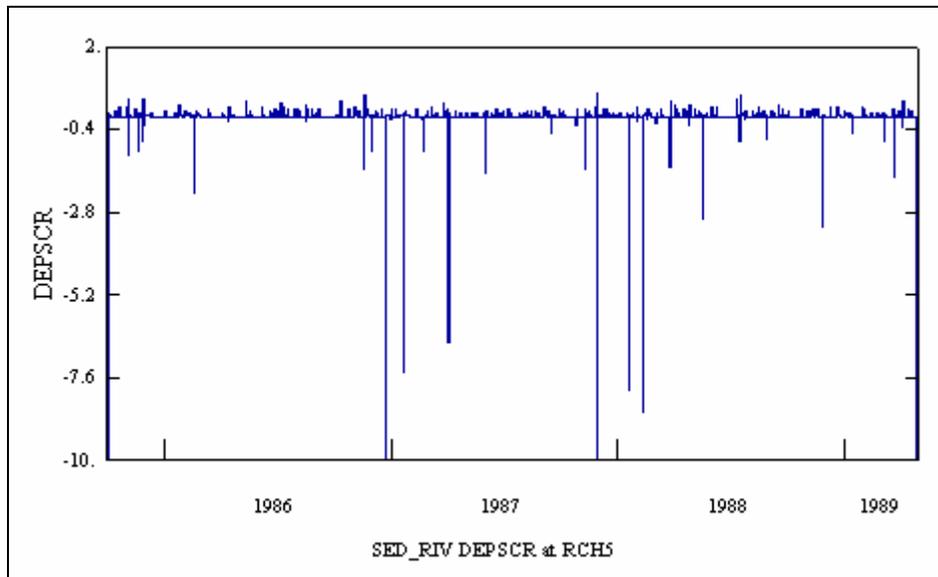
> **Note:** The negative values in this plot represent scour of sediment from the channel bottom. The positive values represent sediment deposition in the channel.

> **Note:** The axis was changed to range from "–10" to "2."

These plots can help us understand the sediment dynamics in the stream. The plot of observed and simulated sediment indicates whether the model is consistent with measured data; unfortunately, the quantity and temporal resolution of the observed data is not adequate to determine if we are accurately simulating the sediment loading and transport. For most sediment modeling efforts, data need to be collected that represent the sediment pollutograph for various storm magnitudes. Without this type of information, it is difficult to determine the accuracy of a calibration, but you can make sure that the simulated sediment loads and transport are reasonable by examining multiple output time series and determining whether anything abnormal is occurring. The following section explains the types of plots that should be made (with or without adequate observed data) to make sure that nothing unreasonable is happening during the simulation.

20.   Exit GenScn and return to WinHSPF.

21.   Click ☐ (Output Manager).

22.   Click the button beside "Other."

23.   Click ADD. The "WinHSPF – Add Output" window will appear.

24.   In the "Operation" frame, scroll down and select "RCHRES 5."

25.   In the "Group/Member" panel, select "SEDTRN: SSED (1,1)."

26.   Click OK.

27.   Repeat these steps for the following:

        SEDTRN:SSED(2,1)

        SEDTRN:SSED(3,1)

        SEDTRN:DEPSCR(1,1)

        SEDTRN:DEPSCR(2,1)

        SEDTRN: DEPSCR(3,1)

        Note: Recall that SSED represents the in-stream suspended sediment concentrations
        and DEPSCR represents deposition and scour of sediment from the reach.
        The subscripts represent sediment fractions: "1" for sand, "2" for silt, "3" for
        clay, and "4" for the sum of sand silt and clay.

28.   Click the "Input Data Editor" button, ☐.

29.   **Double click** EXT TARGETS.

30.   Change the value in the column "Tran" to "SUM" for RCHRES 5: SEDTRN,
        DEPSCR 1, 2, and 3.

VolName	VolId	Group	MemName	MemSub1	MemSub2	MultFact	Tran	VolName
RCHRES	5	SEDTRN	SSED	4	1	1	AVER	WDM1
RCHRES	5	SEDTRN	DEPSCR	4	1	1	SUM	WDM1
RCHRES	5	SEDTRN	SSED	1	1	1	AVER	WDM1
RCHRES	5	SEDTRN	SSED	2	1	1	AVER	WDM1
RCHRES	5	SEDTRN	SSED	3	1	1	AVER	WDM1
RCHRES	5	SEDTRN	DEPSCR	1	1	1	SUM	WDM1
RCHRES	5	SEDTRN	DEPSCR	2	1	1	SUM	WDM1
RCHRES	5	SEDTRN	DEPSCR	3	1	1	SUM	WDM1

31.   Click APPLY.

32.   Click OK. Click CLOSE.

33.   Click the "Run HSPF" button, [≣↓].

34.   Click SAVE/RUN.

35.   Click the "View Output through GenScn" button, [📊].

36.   In the "Scenarios" frame, select "OBSERVED" and "SED_RIV."

37.   In the "Constituents" frame, select "SEDIMENT" and "SSED1," "SSED2,"
        "SSED3," and "SSED4."

38.   In the "Time Series" frame, click [✚] (Add to Time Series List).

> **Note:** The records for the SSED and DEPSCR time series indicate the subscript
>   number (SSED1, DEPSCR3, etc), but not the sediment fraction type (sand,
>   silt, clay, or total).

We will change the constituent names within GenScn so that we don't have to keep track of
them by their subscript numbers.

39.   **Double click** the SED_RIV: RCH5: SSED1 time series. The following screen will
        appear:

40.   In the cell that corresponds to "Constituent", **double click** and then enter "SS-Sand." Your screen should look similar to the following:
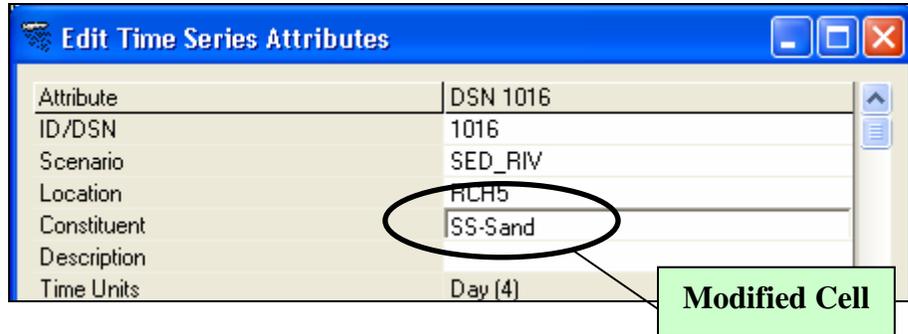
41.   Click OK.

42.   **Double click** the SED_RIV: RCH5: SSED2 time series.

43.   Following steps (39-41), change the name of this constituent to "SS-Silt."
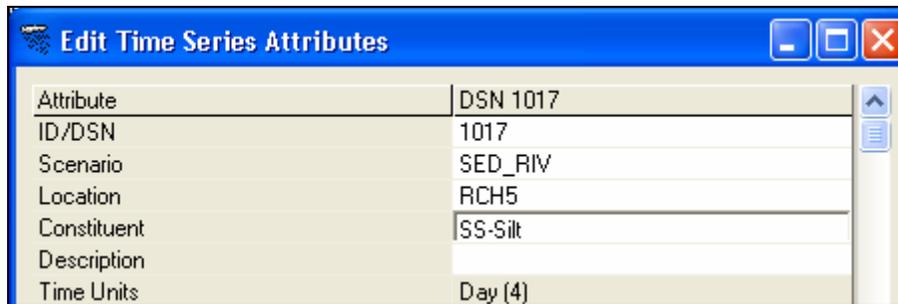
44.   **Double click** the SED_RIV: RCH5: SSED3 time series.

45.   Following steps (39-41), change the name of this constituent to "SS-Clay."

46.   **Double click** the SED_RIV: RCH5: SSED4 time series.

47.   Following steps (39-41), change name of this constituent to "SS-Total." The Time Series frame should look like the following:

Time Series (5 of 59)					
Type	File	DSN	Scenario	Location	Constituent
WDM	sed_riv	272	OBSERVED	UPMARLBR	SEDIMENT
WDM	sed_riv	1014	SED_RIV	RCH5	SS-Total
WDM	sed_riv	1016	SED_RIV	RCH5	SS-Sand
WDM	sed_riv	1017	SED_RIV	RCH5	SS-Silt
WDM	sed_riv	1018	SED_RIV	RCH5	SS-Clay

48.   In the "Dates" frame, change the dates to the following:
                  Start: 1987/6/1
                  End: 1987/12/31

49.   Select the "OBSERVED" time series and the four "SSED" time series and click
(Generate Graphs) in the Analysis frame.

50.   Click the "Generate Graphs" button, .

51.   In the "Graph" window, make sure "Standard" is checked. Click GENERATE. Your
plot should look like the following:
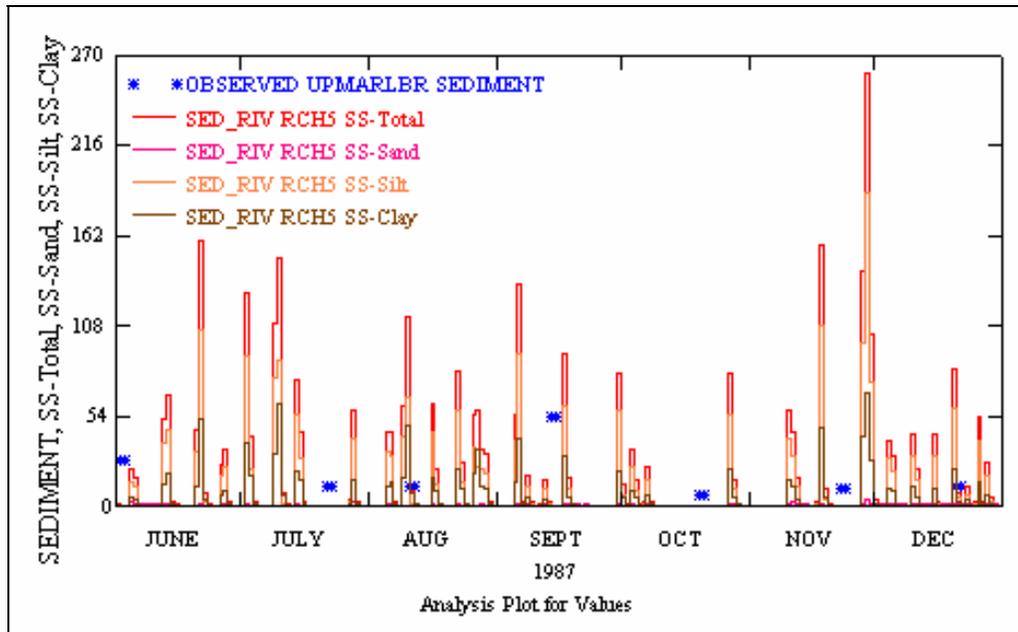
This plot indicates that the majority of the simulated transported sediment is silt. The
relative amounts of silt and clay in the water column depend on the soils within the
watershed. As expected, very little sand is suspended due to its tendency to settle out.

52.   Close the plot.

53.   In the "Scenarios" frame, select "SED_RIV."

54.   In the "Constituents" frame, select "DEPSCR1", "DEPSCR2", DEPSCR3", and "DEPSCR4."

55.   In the "Time Series" frame, click [+] (Add to Time Series List).

Type	File	DSN	Scenario	Location	Constituent	Start	SJDay	End	EJDay
WDM	sed_riv	272	OBSERVED	UPMARLBR	SEDIMENT	1985/1/1	46066	1990/12/31	48257
WDM	sed_riv	1014	SED_RIV	RCH5	SS-Total	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1016	SED_RIV	RCH5	SS-Sand	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1017	SED_RIV	RCH5	SS-Silt	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1018	SED_RIV	RCH5	SS-Clay	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1015	SED_RIV	RCH5	DEPSCR4	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1019	SED_RIV	RCH5	DEPSCR1	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1020	SED_RIV	RCH5	DEPSCR2	1985/10/1	46339	1989/4/30	47647
WDM	sed_riv	1021	SED_RIV	RCH5	DEPSCR3	1985/10/1	46339	1989/4/30	47647

Time Series (9 of 59)

> **Note:** Recall that, as with the SSED series, the DEPSCR time series records indicate the subscript number (DEPSCR4, DEPSCR2, etc), but not the sediment fraction type (sand, silt, clay, or total).

We will change the constituent names within GenScn so that we don't have to keep track of them by their subscript numbers.

56.   **Double click** the DEPSCR1 time series and change the constituent name to "DPS-Sand" (following steps 39-41).

57.   **Double click** the DEPSCR2 time series and change the constituent name to "DPS-Silt" (following steps 39-41).

58.   **Double click** the DEPSCR3 time series and change the constituent name to "DPS-Clay" (following steps 39-41).

59.   **Double click** the first DEPSCR4 time series and change the constituent name to "DPS-Totl" (following steps 39-41). The Time Series frame should look similar to the following:

Note: The "constituent" name cannot include more than eight characters.
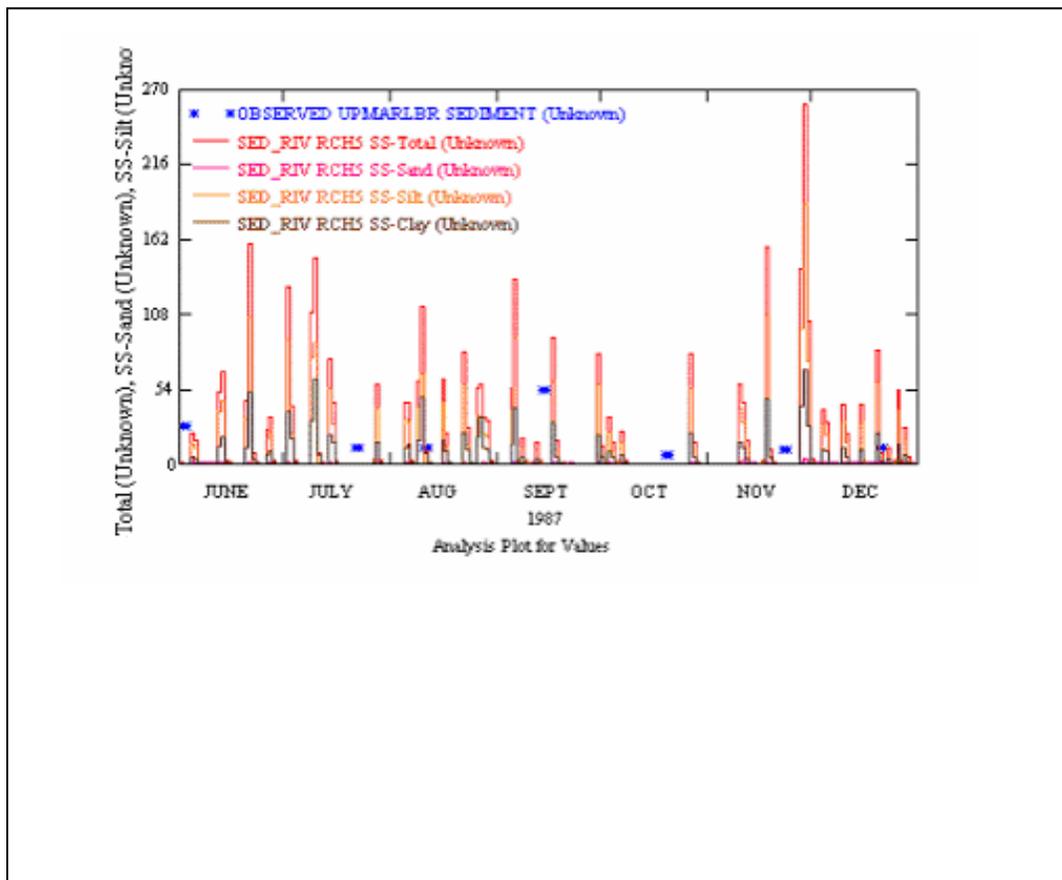
60.   In the "Dates" frame, make sure the dates are as follows:
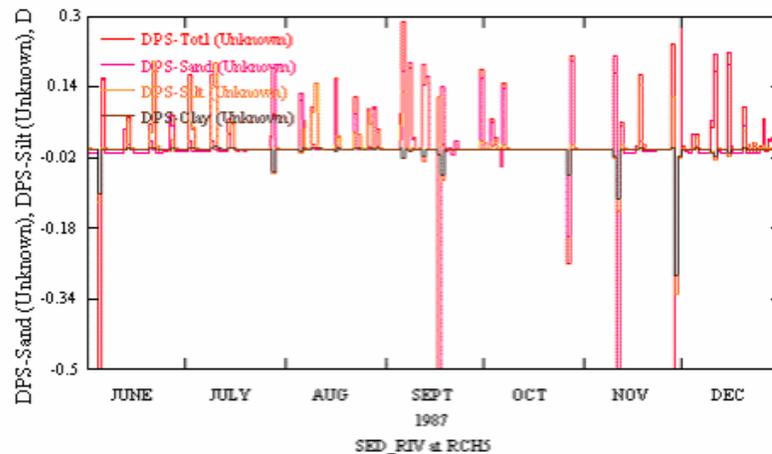   Start: 1987/6/1
          End: 1987/12/31

61.   Select the four "DEPSCR" time series and click [icon] (Generate Graphs) in the
       Analysis frame.

62.   In the "Graph" window, make sure "Standard" is checked. Click GENERATE. We
       will show the DEPSCR plot with the suspended sediment (SSED) plot for illustration
       purposes.

SED_RIV at RCH5

With this plot, you can examine the simulation of each sediment fraction. A significant amount of sand is being scoured (as shown by the large negative values), but is settling out shortly after being scoured (as shown by the positive values). This explains why there is very little sand in the water column. Also, notice that when clay and silt are scoured from the channel, the suspended sediment concentrations increase.

Plots such as these can help you determine appropriate sediment parameter adjustments. For example, if sand is being scoured and silt and clay are being deposited, you might want to choose parameter adjustments that would reduce sand erosion and increase silt/clay erosion. In this hypothetical case, you might reduce the sand parameters (KSAND and EXPSND) in table SAND-PM, and/or change the silt and clay parameters (TAUCS, TAUCD, and M) in an effort to increase the scour. You might also try to determine whether the reason for little scour of silt and clay is because their storages are depleted. You can do this by plotting the bed storage (RSED) of each component and then examining the plot to determine whether there are extreme changes during the simulation period. You should determine whether the model is depleting storage by scouring all the sediment from the reach channel bottom.

63.   Close all plots and GenScn.

C. Add a sediment point source to the West Branch Patuxent model using the WinHSPF Point Source Tool

QUESTION ANSWERED:
3) How do I add a point source of sediment loading to a model using WinHSPF?

In this section, we will add a sediment point source to our model to examine the impacts of future development in this watershed. Recall that in HSPF, in-stream sediment consists of three fractions: sand, silt, and clay. For out point source simulation, we will assume the following scenario: There is a gravel-processing facility near our stream that discharges 2 MGD (millions of gallons per day) containing 120 mg/l of sand, 25 mg/l of silt, and 25 mg/l

of clay. We will assume that the flow is negligible, and include only the resulting sediment load of 1.0 tons/day of sand, 0.2 tons/day of silt, and 0.2 tons/day of clay.

1. Click ![factory icon] (Point Sources).

2. Click ADD NEW.

3. Click SIMPLE CREATE. The following window will appear:
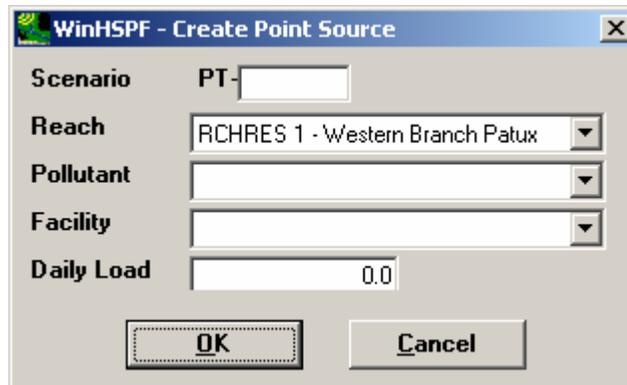
4. In the "Scenario" box, type "OBS."

5. In the "Reach" box, select "RCHRES 5 – Western Branch Patux."

6. In the "Pollutant" box, type "SAND."

7. In the "Facility" box, type "Sediment Point Load."

8. In the "Daily Load" box, type "1.0."
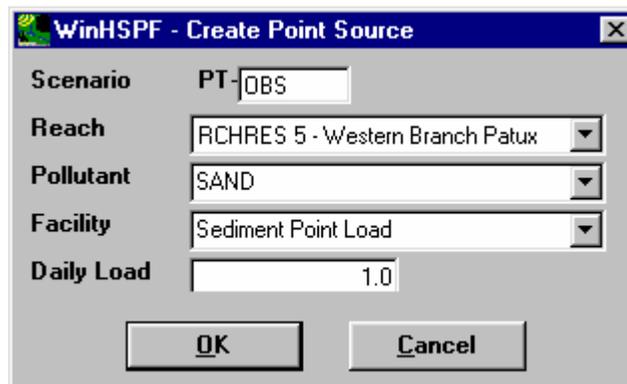
> **Note:** Generally, point loads should be entered in lbs/day. In the following steps, we will specify that this particular point source input will have units of tons/day.

9.   Click OK to return to the main Point Sources screen. Your screen should look like the following:
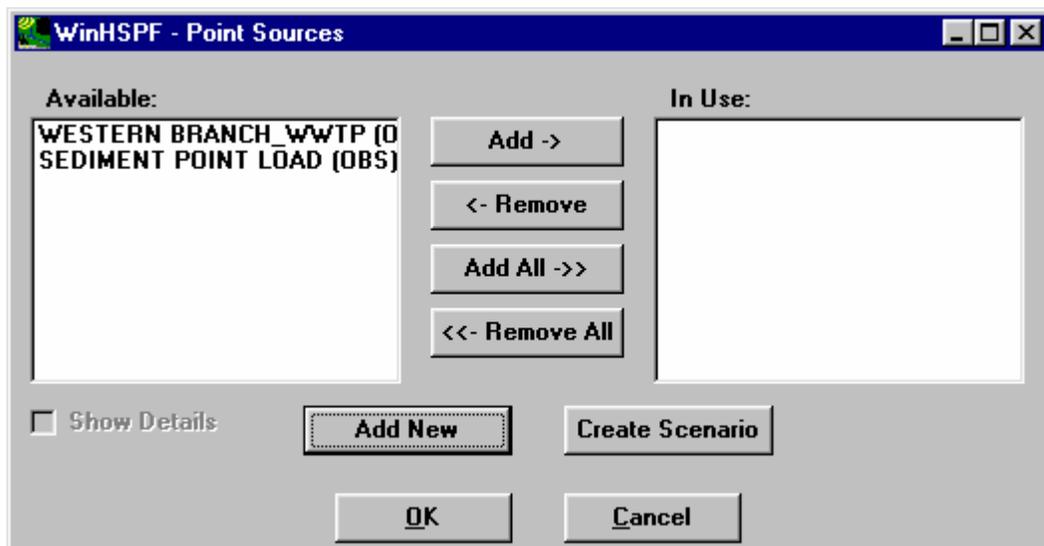
         Note: Notice that "SEDIMENT POINT LOAD" now appears in the "Available:" box.

10.   In the "Available:" box, select "SEDIMENT POINT LOAD" and click ADD →. "SEDIMENT POINT LOAD" will now appear in the "In Use" box.

11.   In the "In Use" box, select "SEDIMENT POINT LOAD."

12.   Click the box beside "Show Details." The point source will appear in the "Details of SEDIMENT POINT LOAD" frame.

13.   Click ADD NEW.

14.   Click SIMPLE CREATE.

15.   In the "Scenario" box, type "OBS."

16.   In the "Reach" box, select "RCHRES 5 – Western Branch Patux."

17.   In the "Pollutant" box, type "SILT."

18.   In the "Facility" box, select "SEDIMENT POINT LOAD."

19.   In the "Daily Load" box, type "0.2."

20.   Click OK to return to the main "Point Sources" screen. A new point load corresponding to "Silt" will appear in the "Details of SEDIMENT POINT LOAD"

frame.
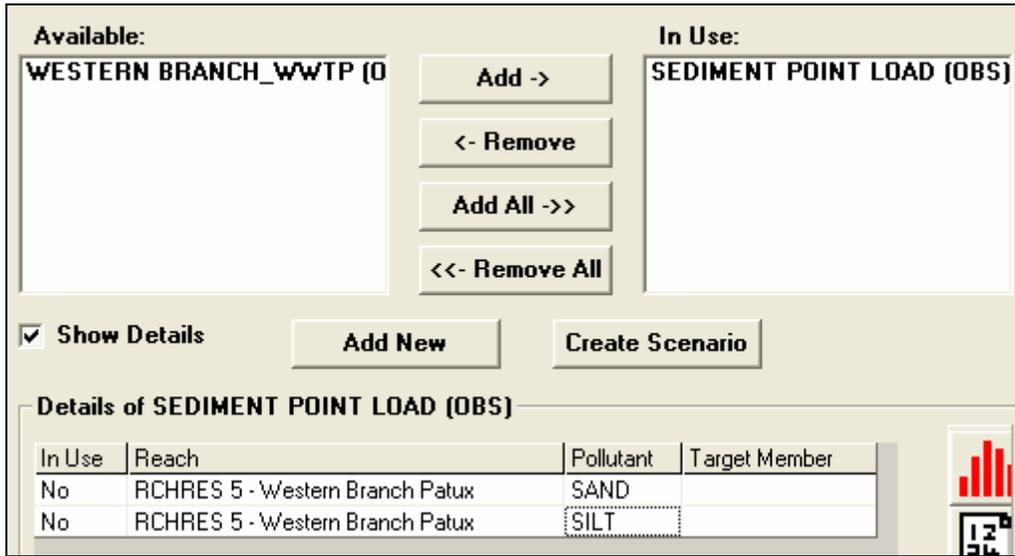
21.   Click ADD NEW.

22.   Click SIMPLE CREATE.

23.   In the "Scenario" box, type "OBS."

24.   In the "Reach" box, select "RCHRES 5 – Western Branch Patux."

25.   In the "Pollutant" box, type "CLAY."

26.   In the "Facility" box, select "SEDIMENT POINT LOAD."

27.   In the "Daily Load" box, type "0.2."

28.   Click on OK to return to the main "Point Sources" screen.

29.   In the "In Use" frame, click "SEDIMENT POINT LOAD." A new point source corresponding to "Clay" will appear in the "Details of SEDIMENT POINT LOAD" frame.
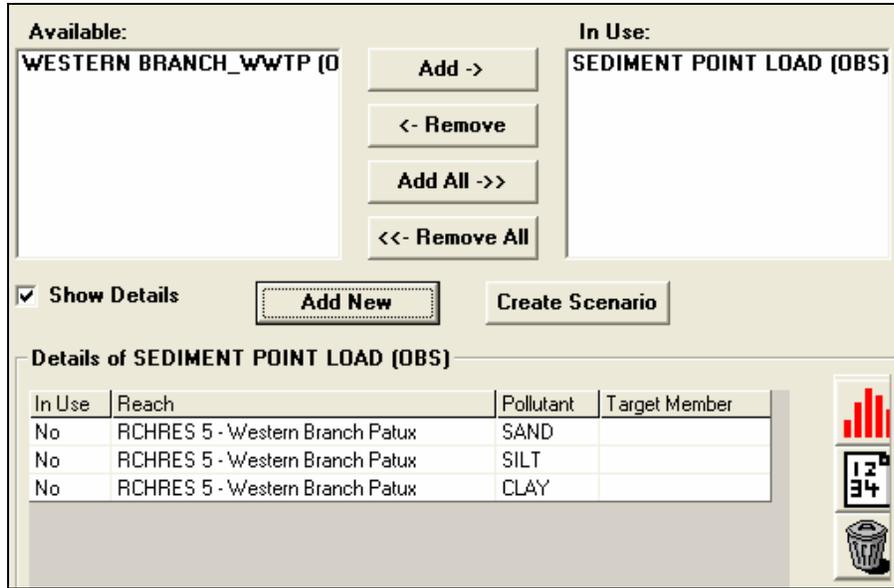
30. Change the "In Use" box that corresponds to "Sand", "Silt", and "Clay" to "Yes."
    Your screen should look like the following:
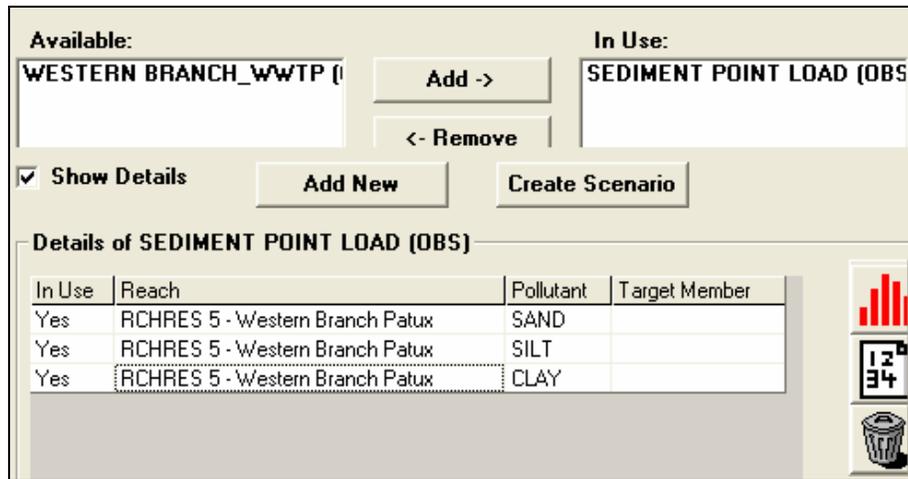
31. **Double click** in the "Target Member" column in the "SAND" row, select
    "ISED(1)|Sand". Your screen should look like the following:
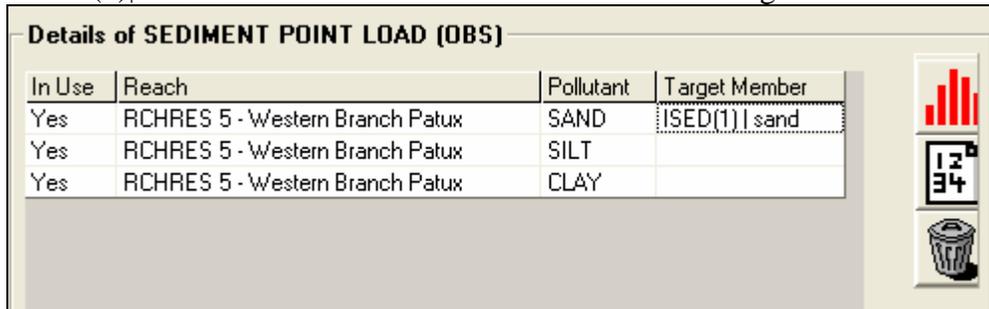
    Note: Changing the "Target Member" designates to which module (e.g., HYDR,

SEDTRN, etc.) the point source (or inflow) will be added. This step, depending on what option you choose, determines the required units of the time series being added (e.g., ISED requires units of tons/day).

32.   **Double click** in the "Target Member" column in the "SILT" row, select "ISED(2)|Silt".

33.   **Double click** in the "Target Member" column in the "CLAY" row, select "ISED(3)|Clay". Your screen should look like the following:

34.   Click on OK to close this window and return to the WinHSPF main window.

35.   Click the "Input Data Editor" button, .

36.   **Double click** EXT SOURCES.

37.   Scroll down until you see the records that correspond to "Sand," "Silt," and "Clay." Your screen should look like the following:

38.   Click CANCEL to exit the "Edit EXT SOURCES Block" window.

39.   Click CLOSE to exit the Input Data Editor.

43.   Click the "Run HSPF" button, [icon].

44.   Click SAVE/RUN.

45.   Click the "View Output through GenScn" button, [icon].

46.   In the "Scenarios" frame, select and "SED_RIV."

47.   In the "Constituents" frame, select "SS-Sand", "SS-Silt", "SS-Clay", and "SS-Total."

48.   In the "Time Series" frame, click [icon] (Add to Time Series List).

49.   In the "Dates" frame, change the dates to the following:
            Start: 1987/6/1
            End: 1987/12/31

50.   Select the four "SSED" time series and click [icon] (Generate Graphs) in the Analysis
       frame.

51.   In the "Graph" window, make sure "Standard" is checked. Click GENERATE. Your
       plot should look like the following:
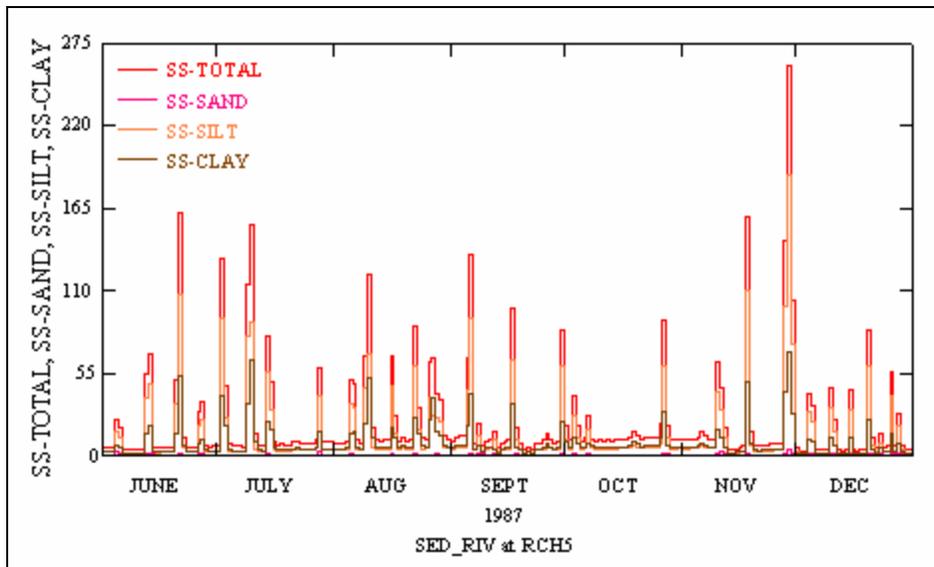
To examine the effects of adding the point source to our model, compare this graph with one
you created in the previous section:
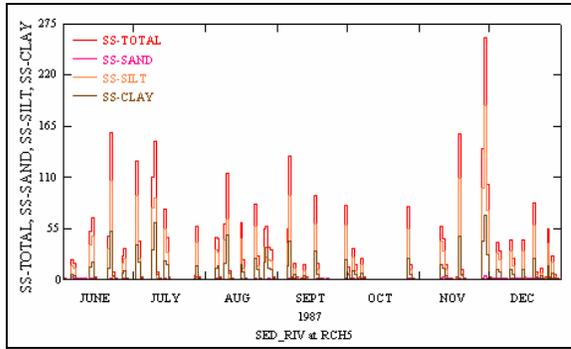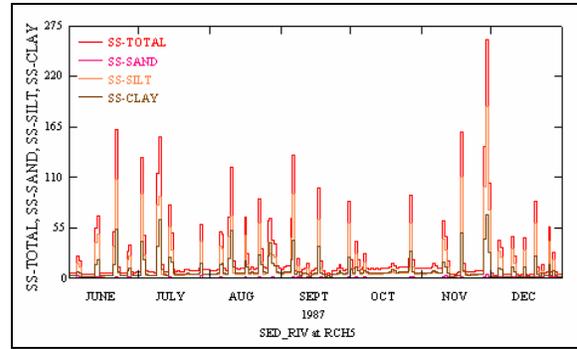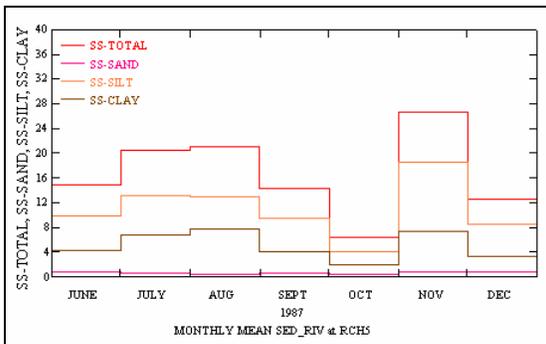
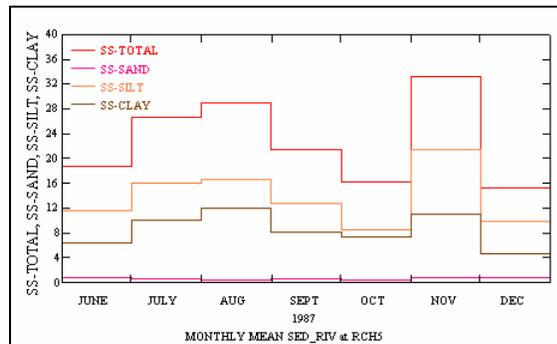No point source   Point source

The key difference in these plots is the base flow concentrations. To better examine the effects of the point source, look at the following plots for the *monthly average* of suspended sediment:

No point source   Point source

These graphs indicate that the point source added a significant amount of suspended sediment to Reach 5.

D. Sediment Calibration Steps

Land Sediment Loading Calibration

- Estimate 'target' sediment loading rates for each land use segment
- Calibrate model sediment loading rates to observed data and/or target rates

In-stream Calibration

- Estimate initial parameter values for both cohesive (silt, clay) and non-cohesive (sand) sediment fractions
- Perform sediment mass balance to determine land surface versus stream channel contributions
- Make calibration run and output TAU values (max and min daily) calculated by subroutine SHEAR

- Adjust TAUCS and TAUCD to affect scour and deposition of cohesive sediments at appropriate times
- Examine/evaluate sediment load simulation for both mass outflow and composition compared to available data
- Adjust M to improve calibration of cohesive sediments for storms with good flow simulation
- Adjust non-cohesive (sand) parameters based on bed and load composition compared to available data
- Re-do calibration run and output analyses