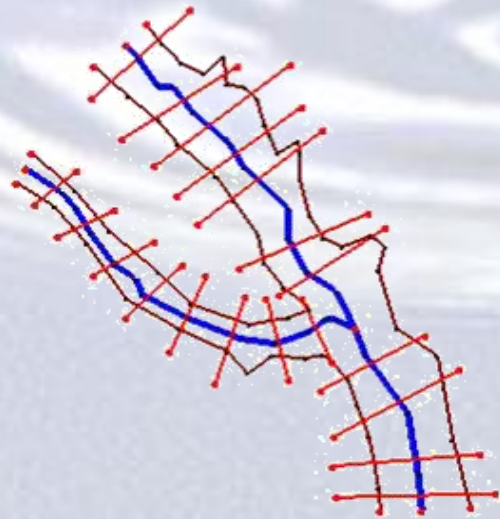
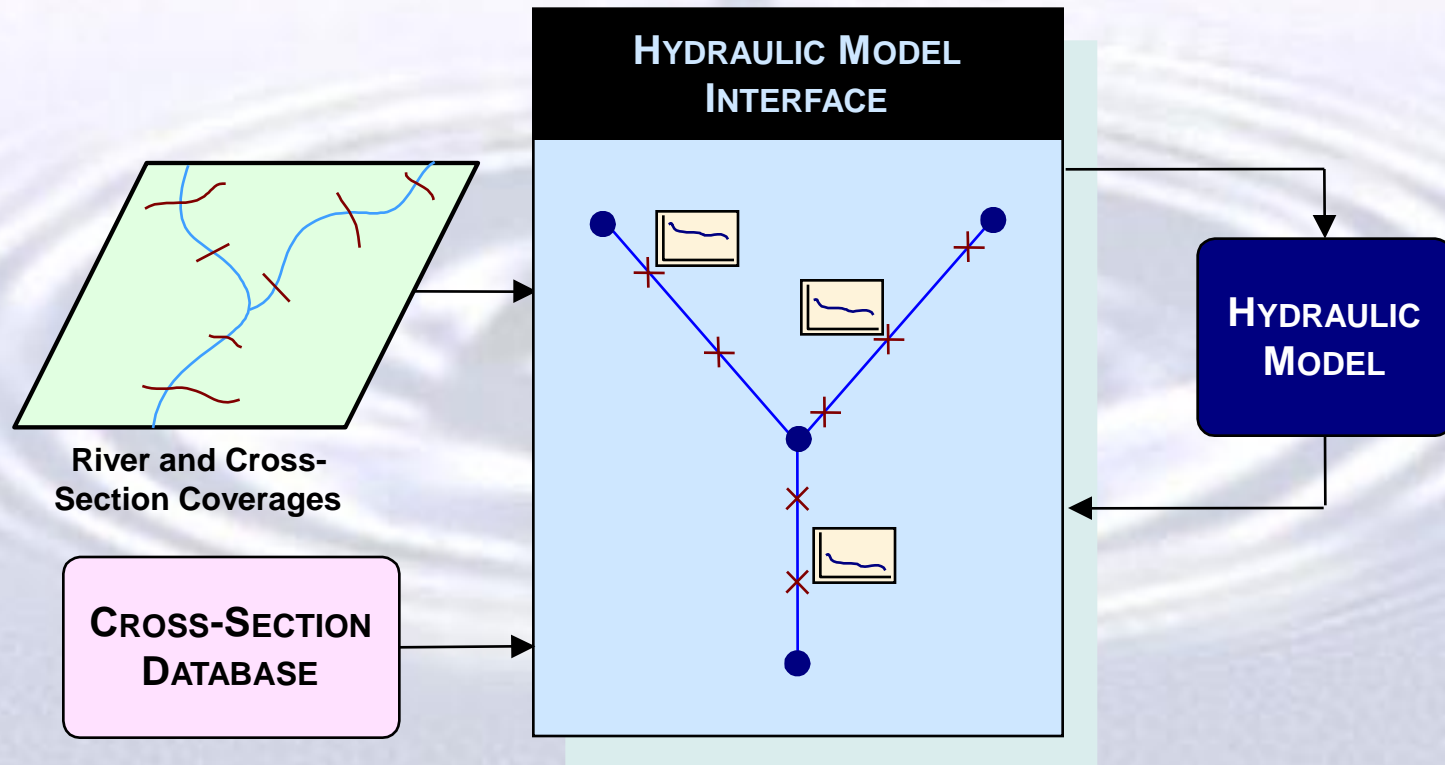


Floodplain Delineation using HEC-RAS and WMS



Hydraulic Model Interface



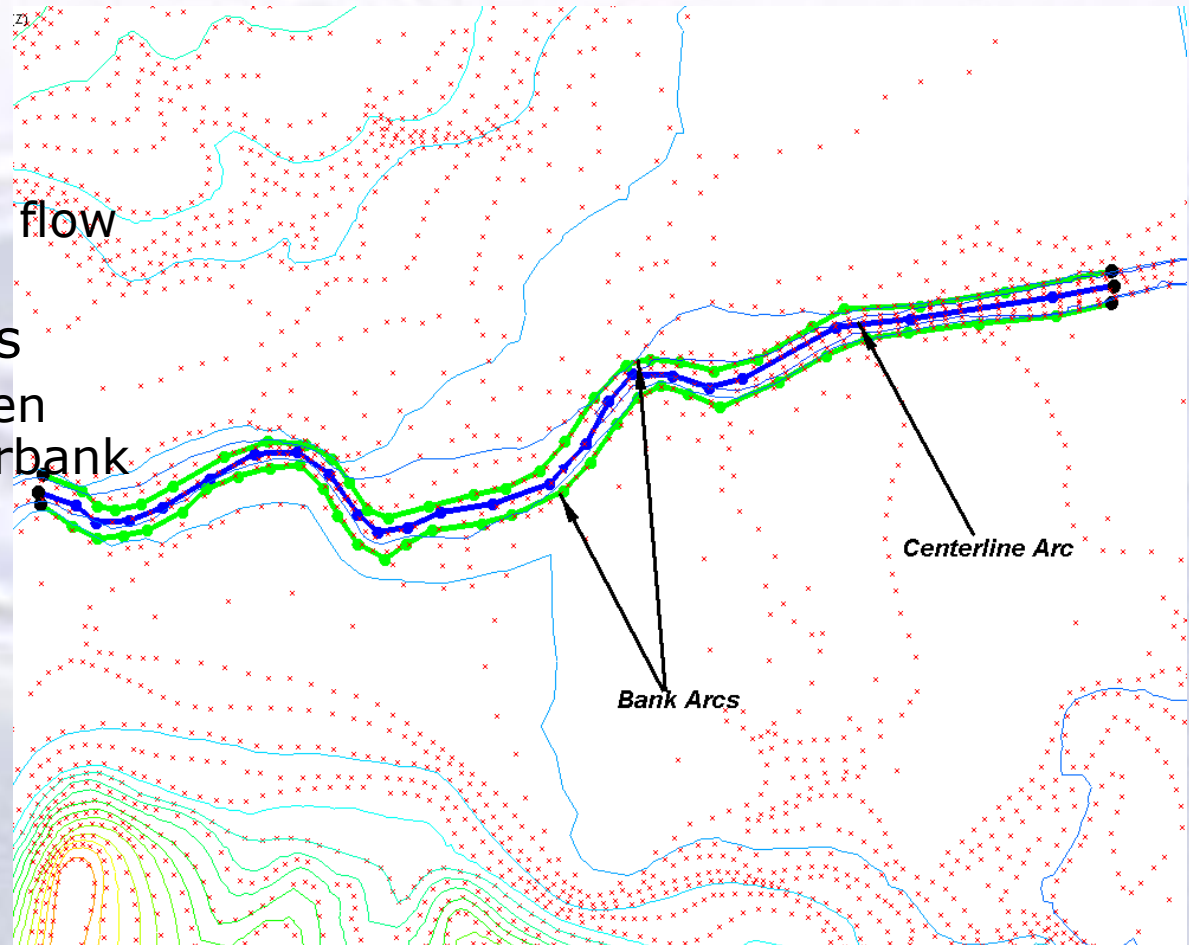
Conceptual Model

- Centerline Coverage
- Cross Section Coverage
- Area Property Coverage

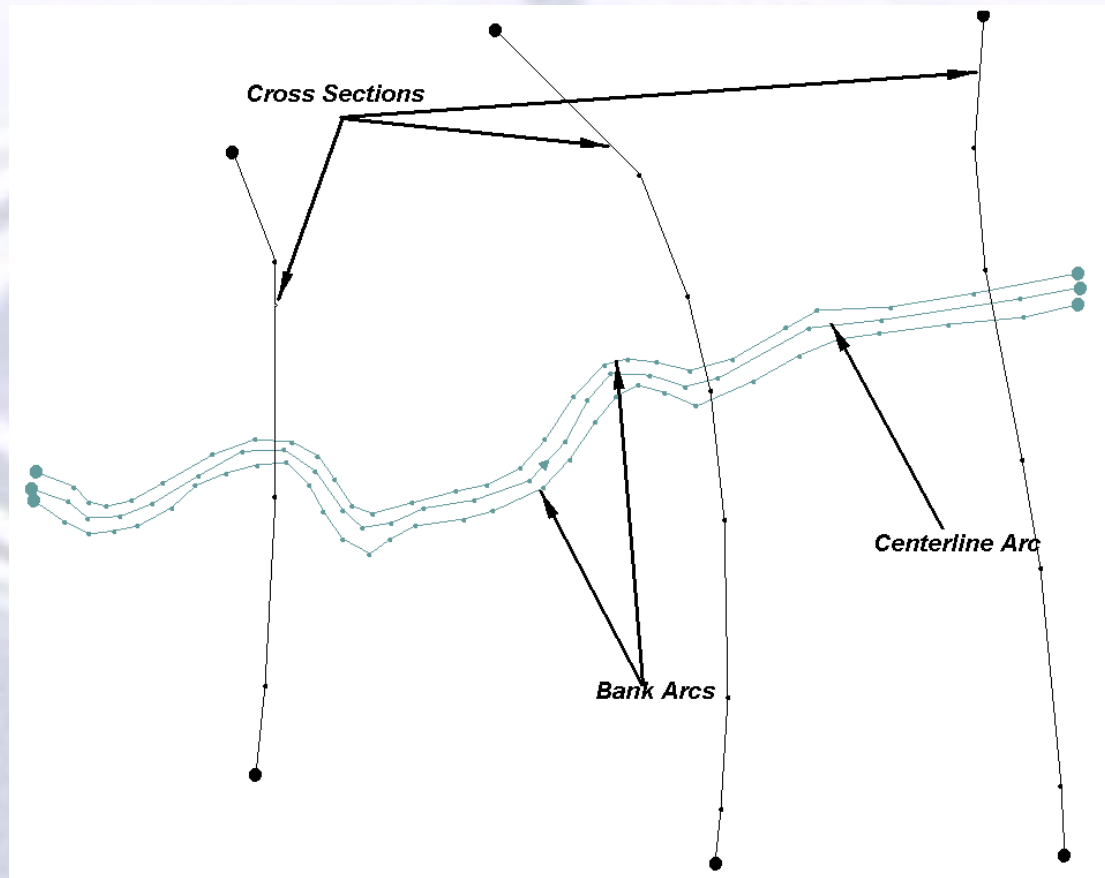


Centerline Coverage

- Define Channel Centerline
 - Channel Arc
 - Direction defines flow direction
- Optional Bank Arcs
 - Boundary between channel and overbank areas



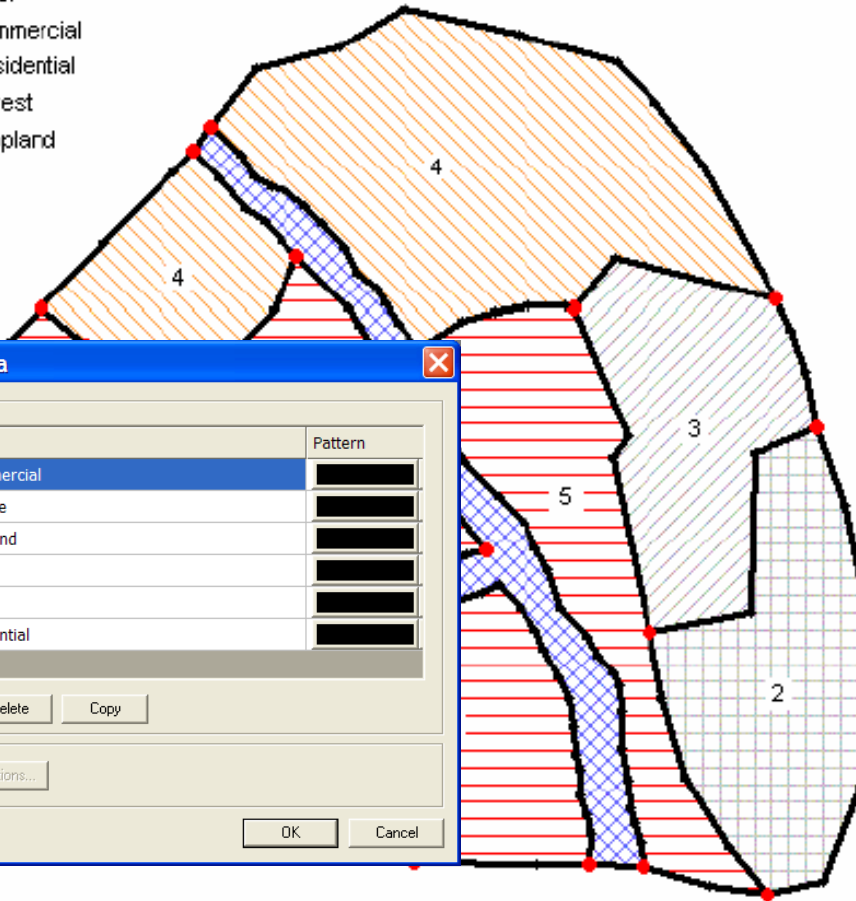
Cross-Section Coverage









Area Property Coverage

SYMBOL ID - NAME

-  1 River
-  2 Commercial
-  3 Residential
-  4 Forest
-  5 Cropland



Materials Data

Materials			
	ID	Name	Pattern
1	1	Commercial	
2	0	Disable	
3	2	cropland	
4	3	forest	
5	5	river	
6	4	residential	

New Delete Copy

☐ Legend Options...

Help OK Cancel

HEC-RAS Model Cont...

Database	Roughness
xsecs2	Materials

OK Cancel

Hecras Material ...

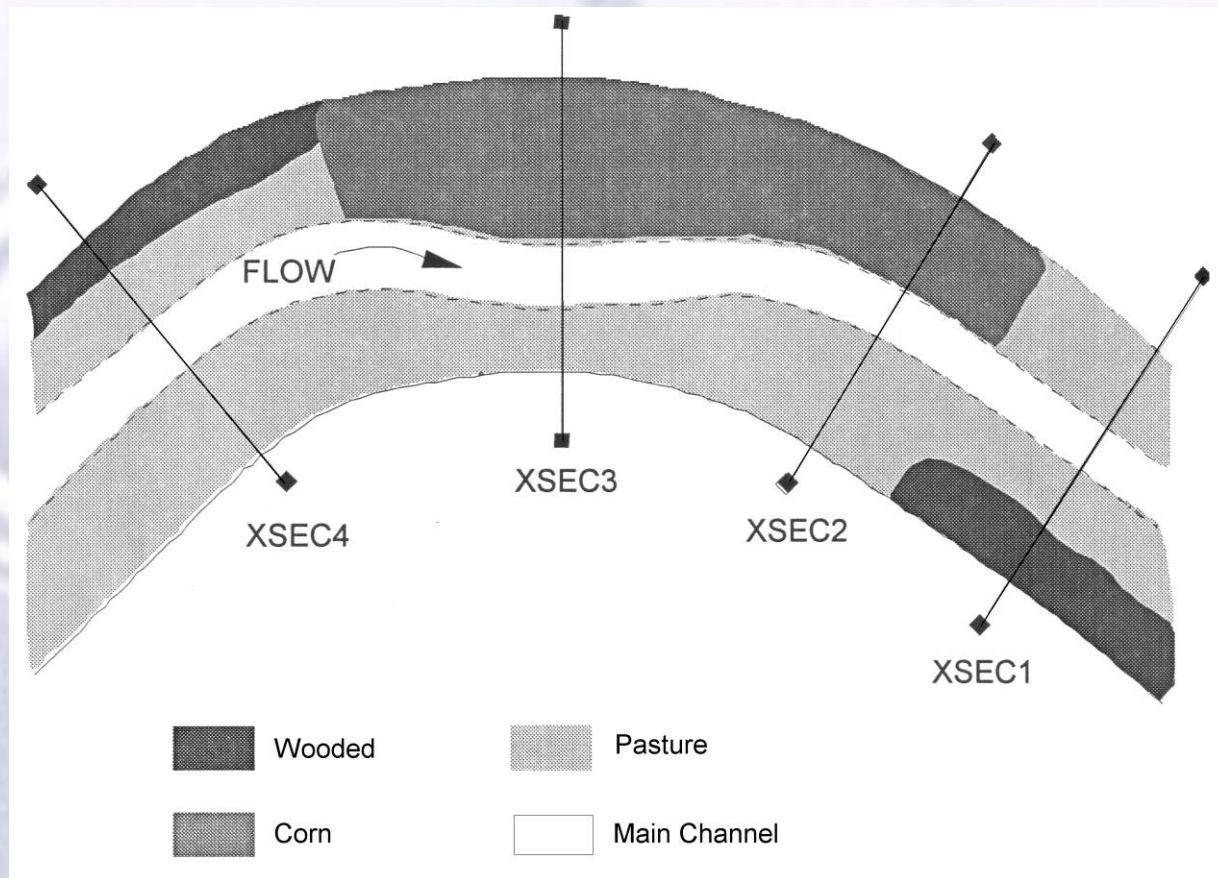
Materials	
Material	Roughness
Commercial	0.07
cropland	0.04
forest	0.12
river	0.03
residential	0.08

OK Cancel

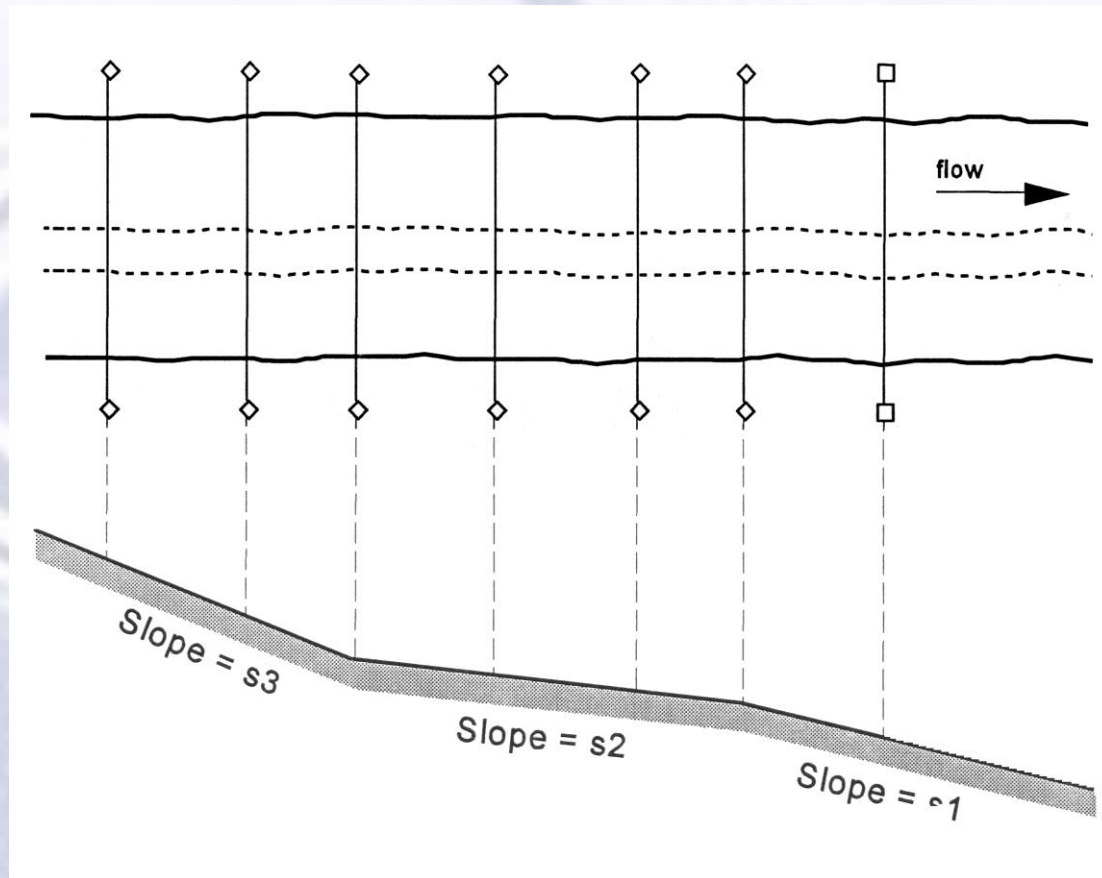
Placing Cross Sections

- Changes in flow rate
- Changes in roughness
 - Material zones
- Changes in conveyance
 - Geometry changes (also affects h_e)
 - Slope Breaks
- Large Distances

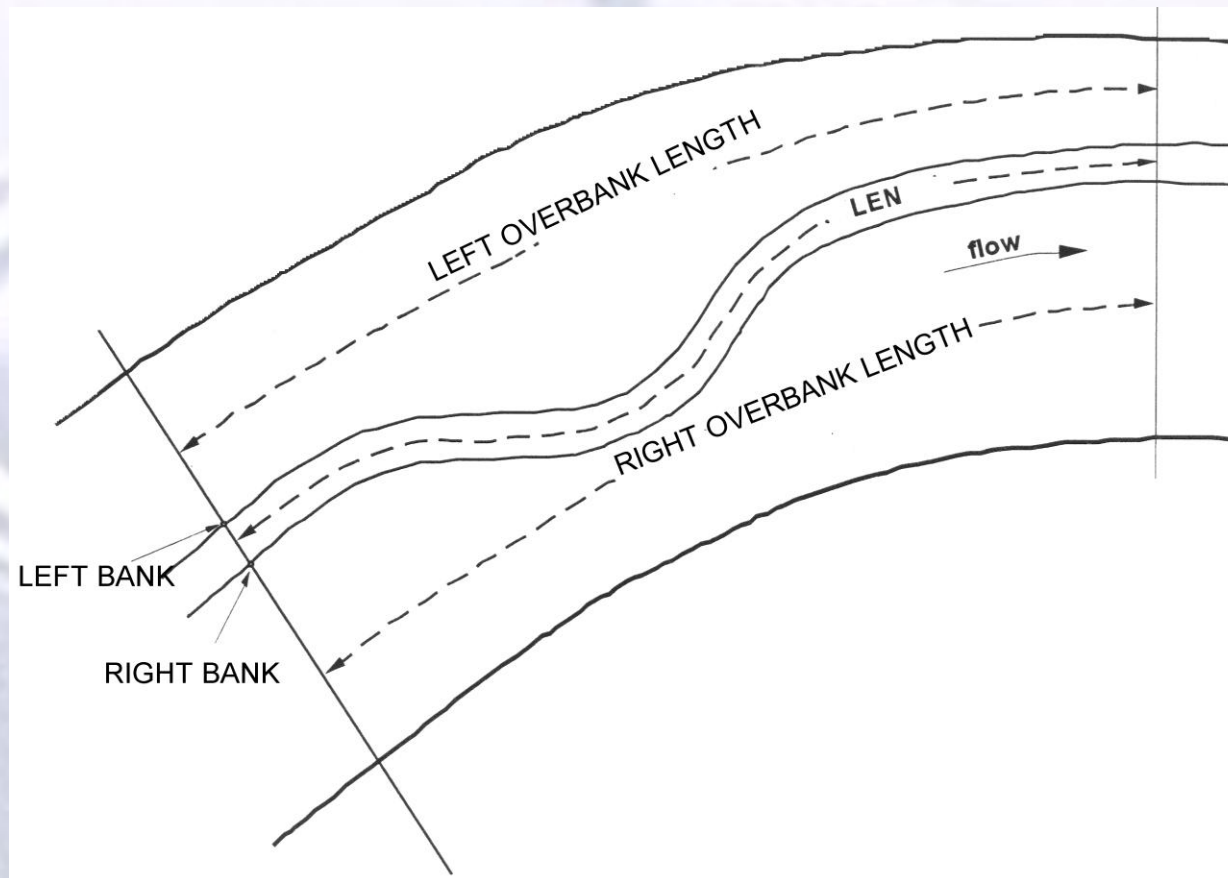
Roughness Breaks



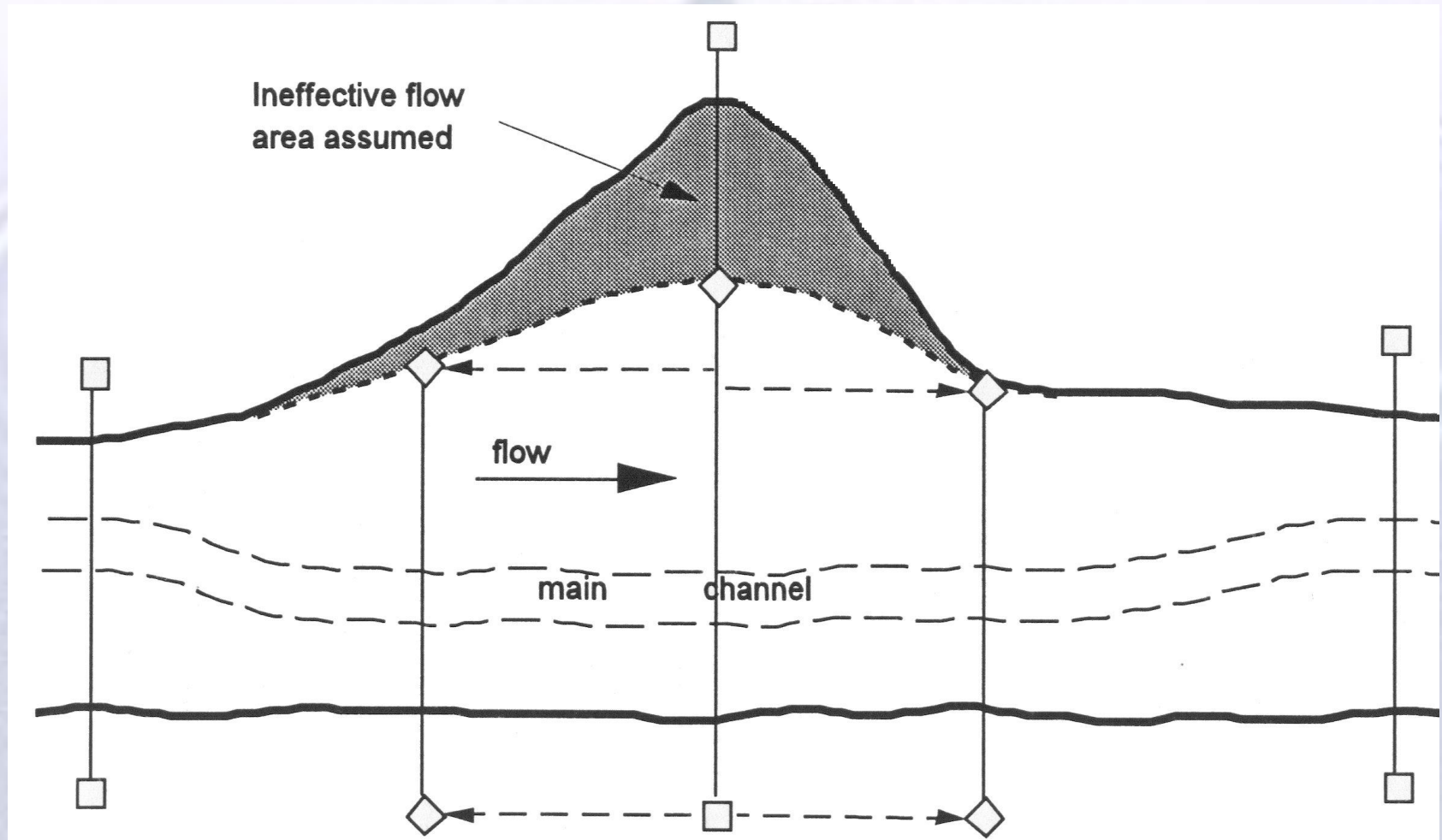
Slope Breaks



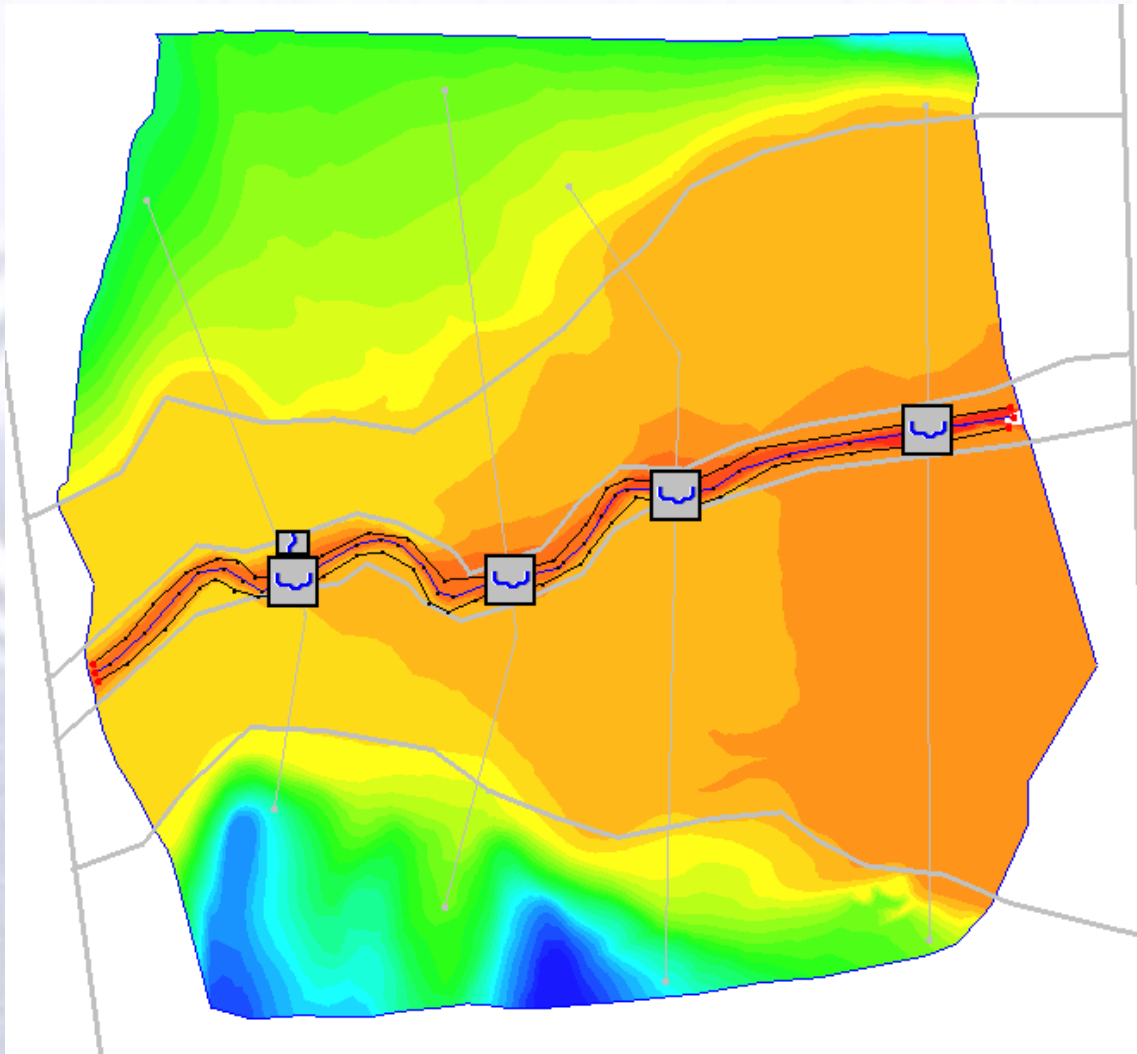
Flow Lengths



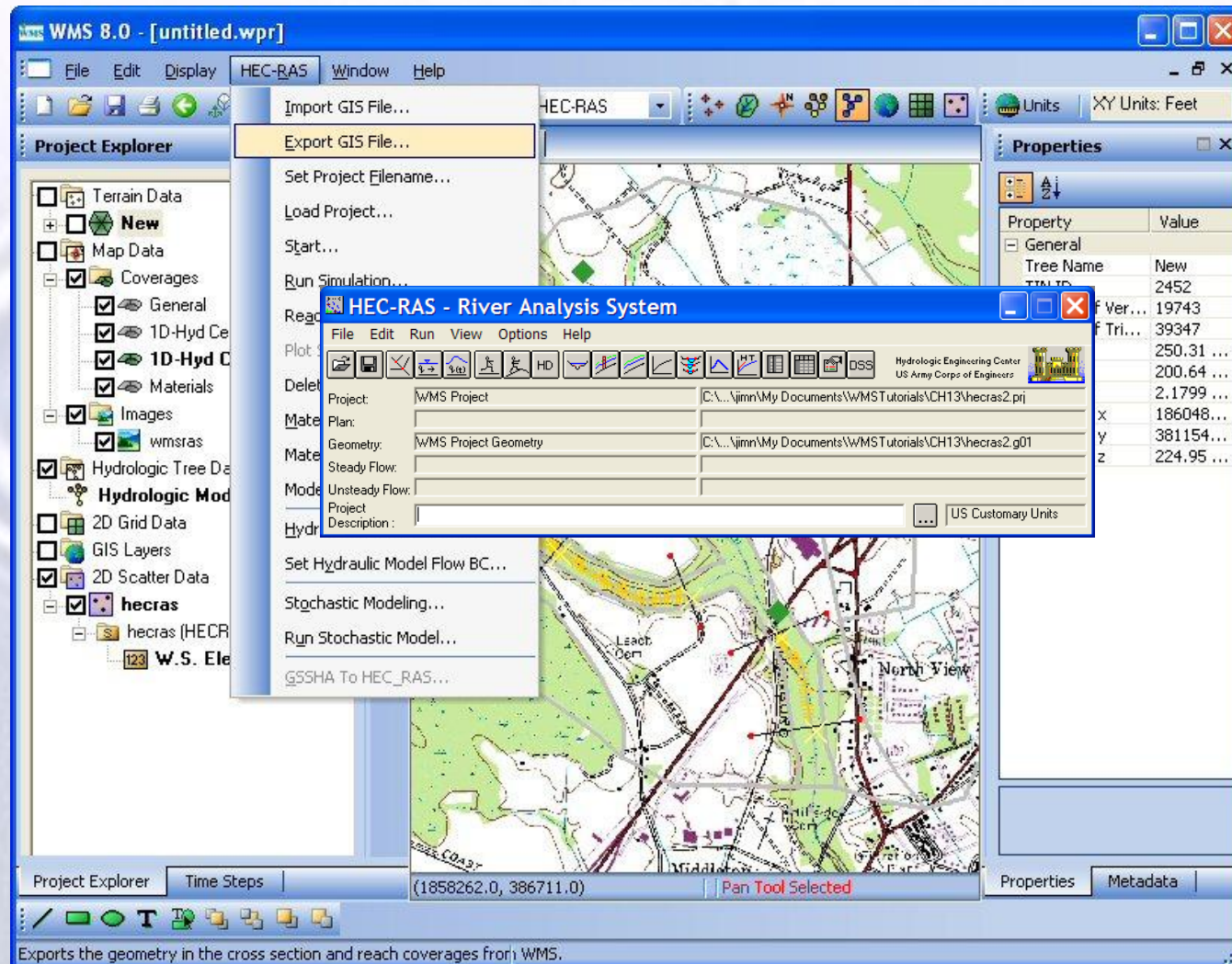
Ineffective Flow Zones



Conceptual Model to Schematic

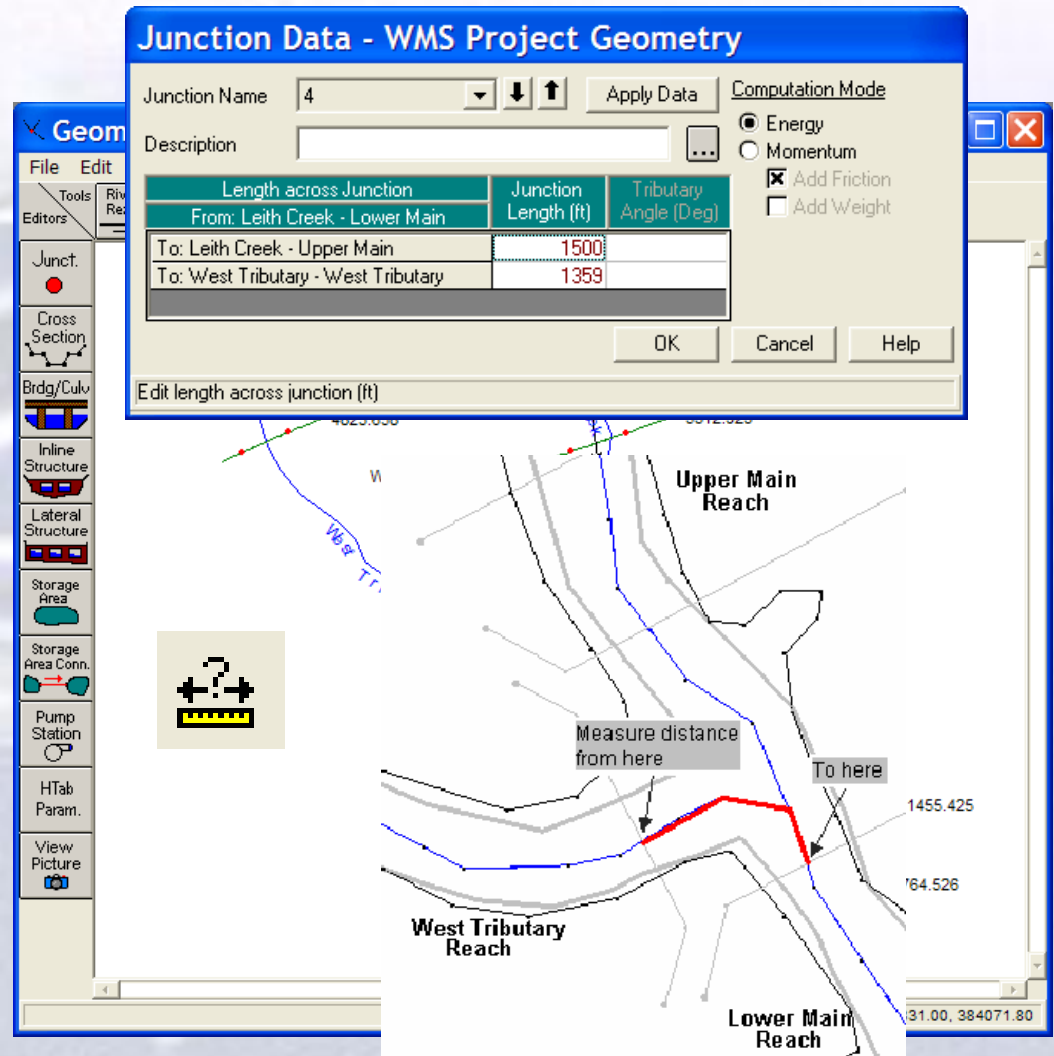


Starting the HEC-RAS Project



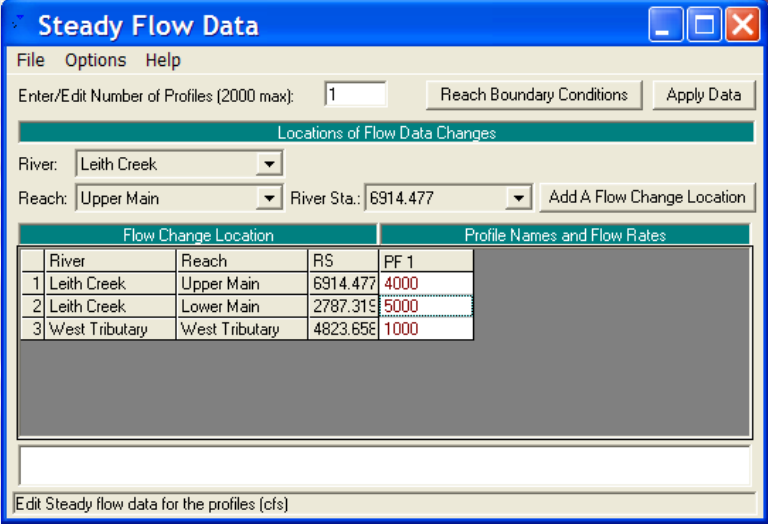
Verifying the Geometry

- Schematic
- Cross Sections
- Junction Lengths



Defining the Boundary Conditions

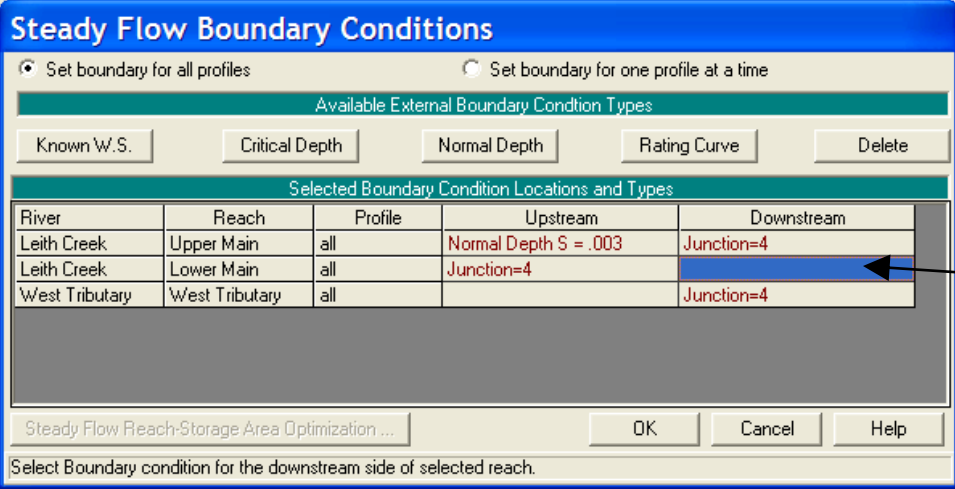
- Flow Rates
- Normal Depth
 - Slopes



The 'Steady Flow Data' dialog box is shown. It has a menu bar with 'File', 'Options', and 'Help'. Below the menu bar, there is a field 'Enter/Edit Number of Profiles (2000 max):' with the value '1' and two buttons: 'Reach Boundary Conditions' and 'Apply Data'. A section titled 'Locations of Flow Data Changes' contains a 'River:' dropdown set to 'Leith Creek', a 'Reach:' dropdown set to 'Upper Main', and a 'River Sta.:' dropdown set to '6914.477', followed by an 'Add A Flow Change Location' button. Below this is a table with two main sections: 'Flow Change Location' and 'Profile Names and Flow Rates'.

Flow Change Location			Profile Names and Flow Rates	
River	Reach	RS	PF 1	
1 Leith Creek	Upper Main	6914.477	4000	
2 Leith Creek	Lower Main	2787.319	5000	
3 West Tributary	West Tributary	4823.656	1000	

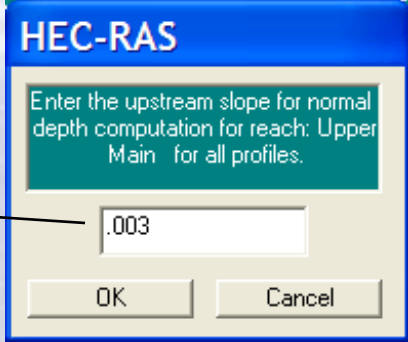
At the bottom of the dialog is a text box with the label 'Edit Steady flow data for the profiles (cfs)'.



The 'Steady Flow Boundary Conditions' dialog box is shown. It has two radio buttons: 'Set boundary for all profiles' (selected) and 'Set boundary for one profile at a time'. Below these is a section titled 'Available External Boundary Condition Types' with five buttons: 'Known W.S.', 'Critical Depth', 'Normal Depth', 'Rating Curve', and 'Delete'. The 'Normal Depth' button is highlighted. Below this is a section titled 'Selected Boundary Condition Locations and Types' with a table.

River	Reach	Profile	Upstream	Downstream
Leith Creek	Upper Main	all	Normal Depth S = .003	Junction=4
Leith Creek	Lower Main	all	Junction=4	
West Tributary	West Tributary	all		Junction=4

At the bottom of the dialog is a text box with the label 'Steady Flow Reach-Storage Area Optimization ...' and three buttons: 'OK', 'Cancel', and 'Help'. Below the dialog is a text box with the label 'Select Boundary condition for the downstream side of selected reach.'



The 'HEC-RAS' dialog box is shown. It has a title bar with 'HEC-RAS'. The main text area contains the instruction 'Enter the upstream slope for normal depth computation for reach: Upper Main for all profiles.' Below this is a text input field containing the value '.003'. At the bottom are two buttons: 'OK' and 'Cancel'.

Running HECRAS

Steady Flow Analysis

File Options Help

Plan : Short ID

Geometry File :

Steady Flow File :

Flow Regime
☒ Subcritical
☐ Supercritical
☐ Mixed

Plan Description :

COMPUTE

Enter to compute water surface profiles

Set Locations for Flow Distribution

Set Global Subsection Distribution

Set Global SubSections LOB Channel ROB

Set Specific Location Subsection Distribution

River:

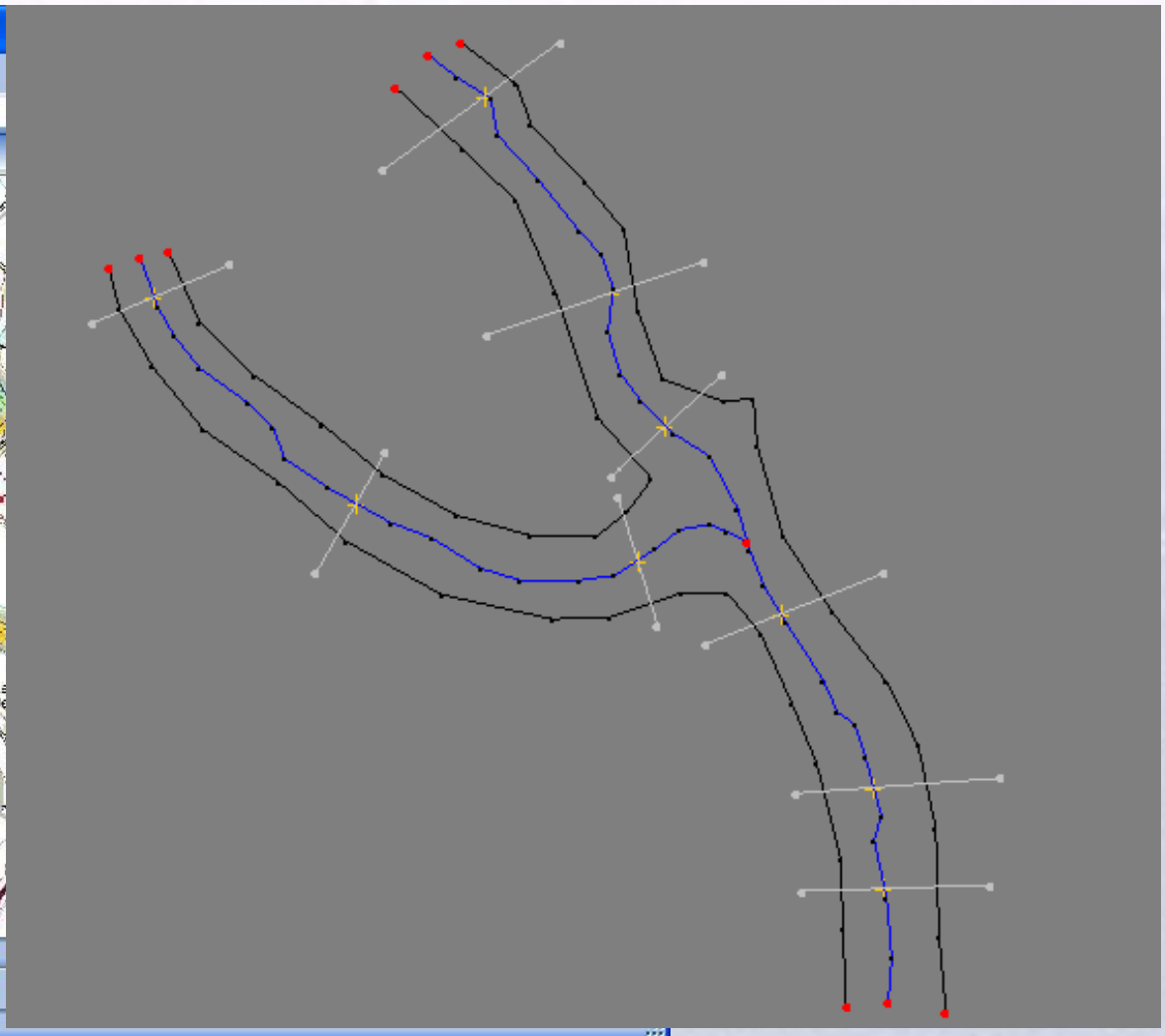
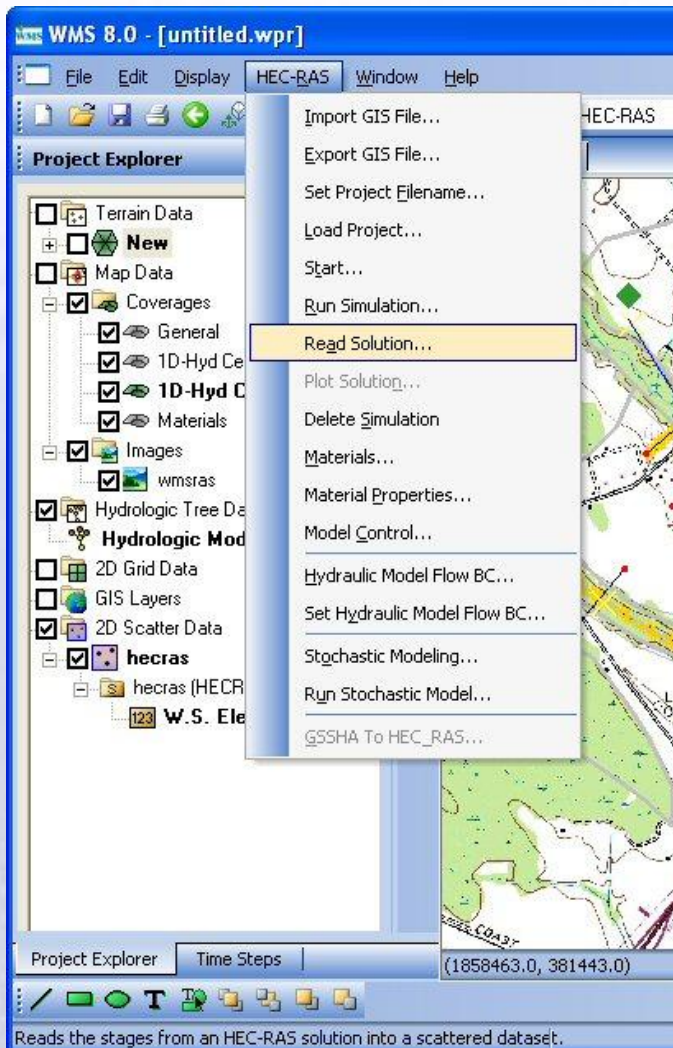
Reach: **Number of SubSections (Max 45 total)**

Upstream RS: LOB Channel ROB

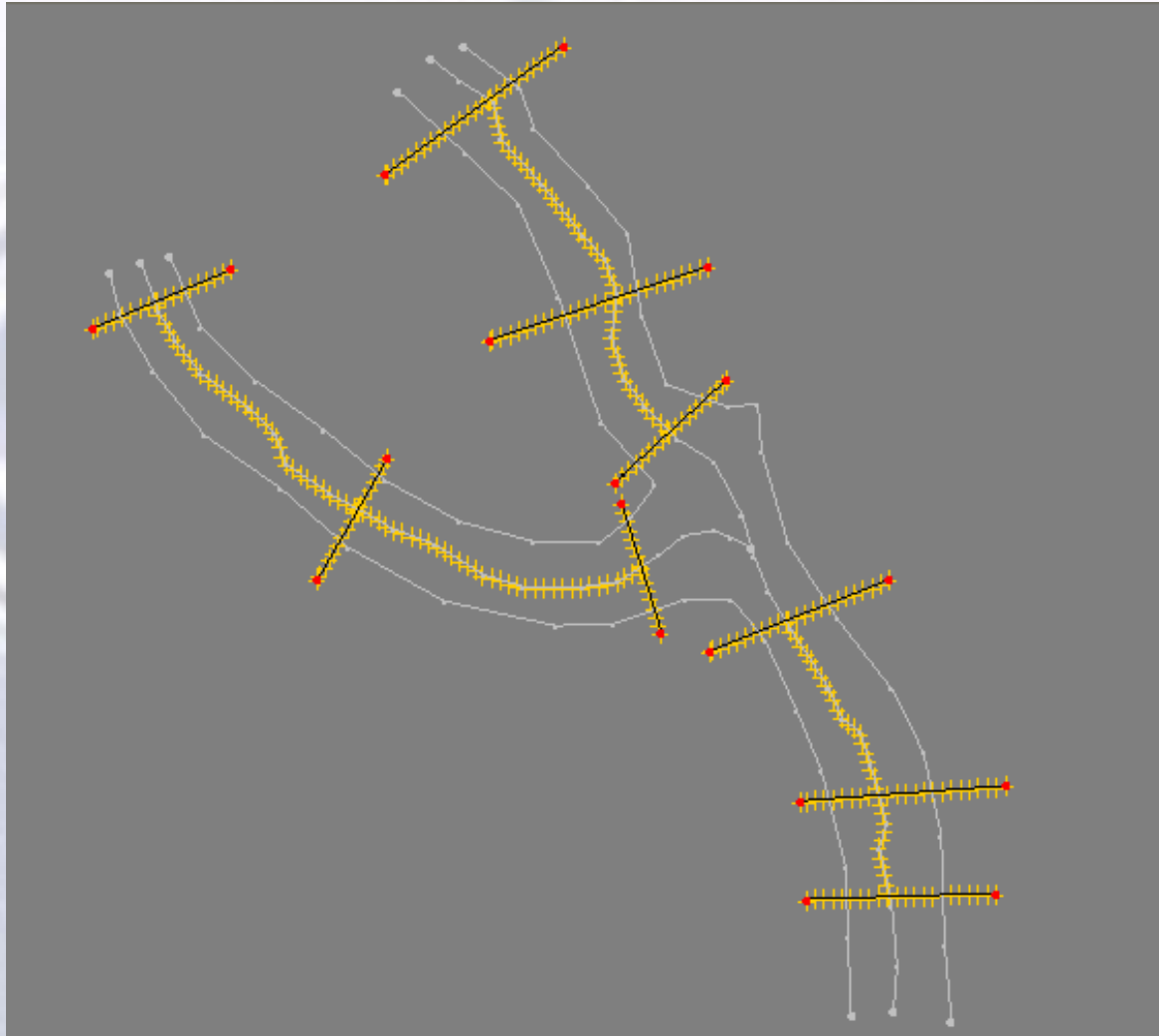
Downstream RS: **Set Selected Range**

OK Cancel Help Clear All

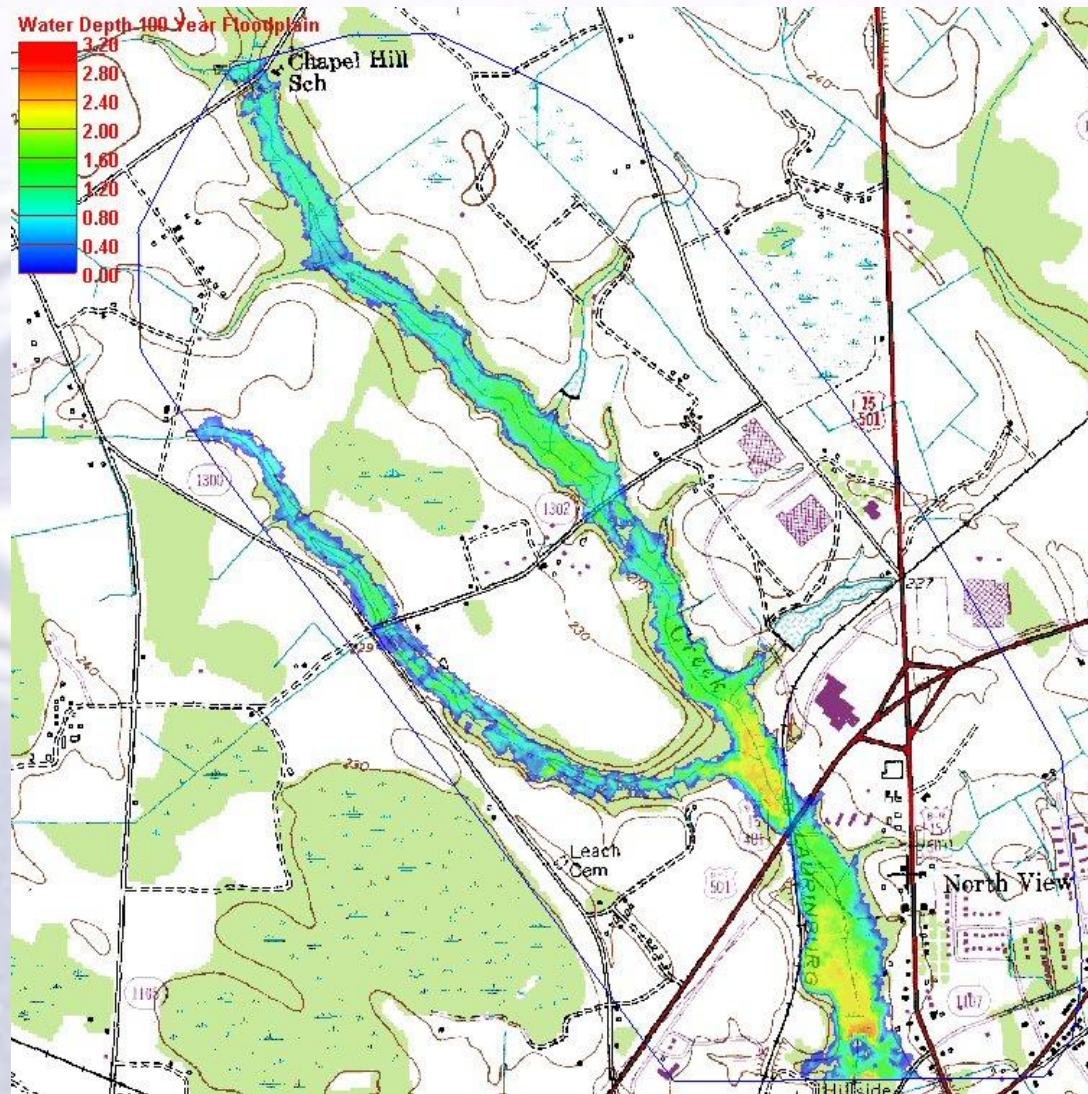
Reading a Solution



Interpolating Water Surface Elevations



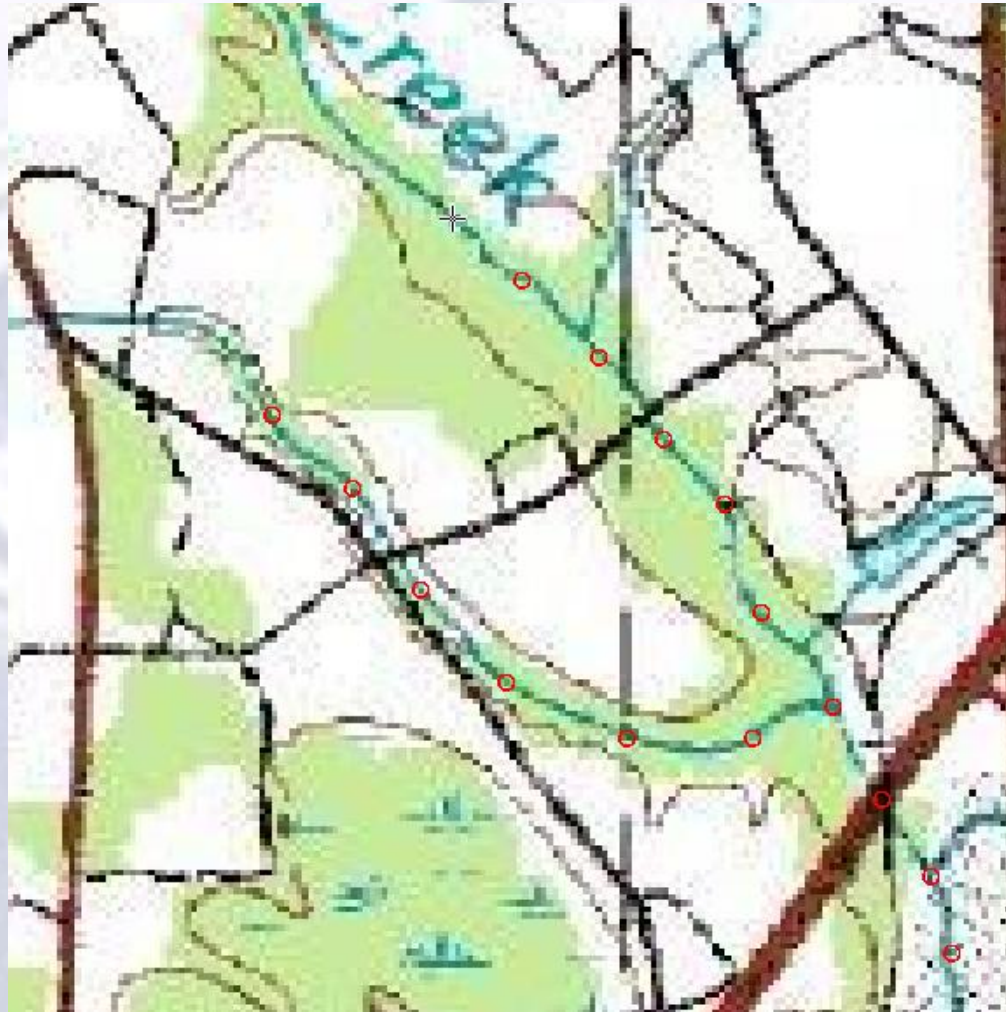
Floodplain Delineation



Creating Water Level Scatter Points

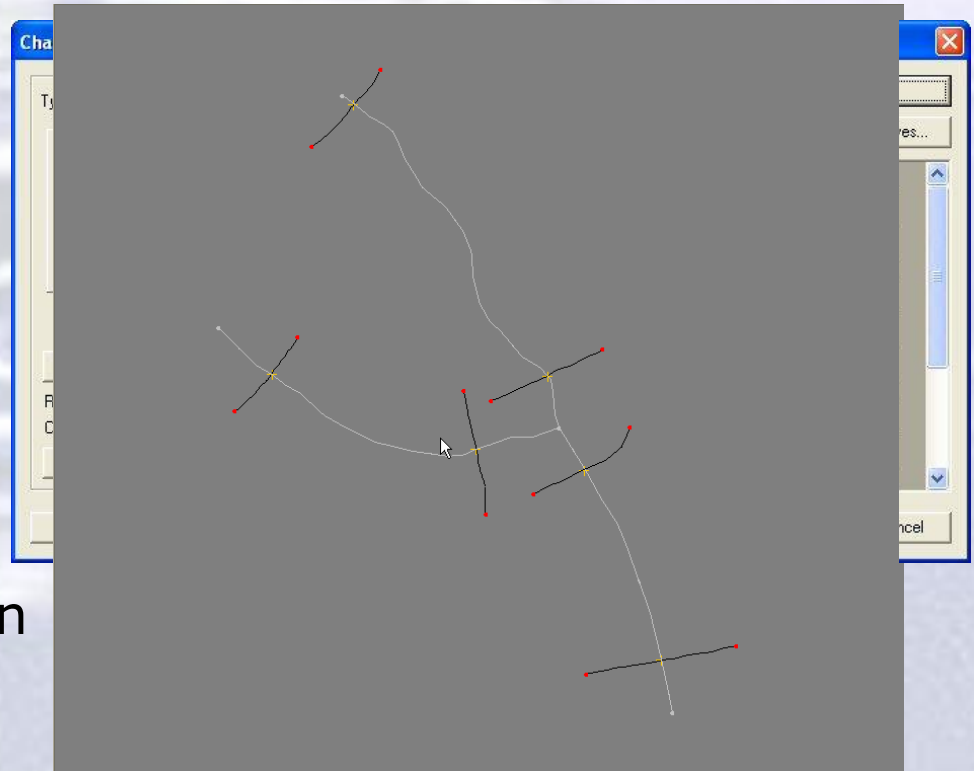
- Manually create using scatter points
- Channel calculator
- Import scatter points from a text file
- HEC-RAS (hydraulic model) results

Manual Creation



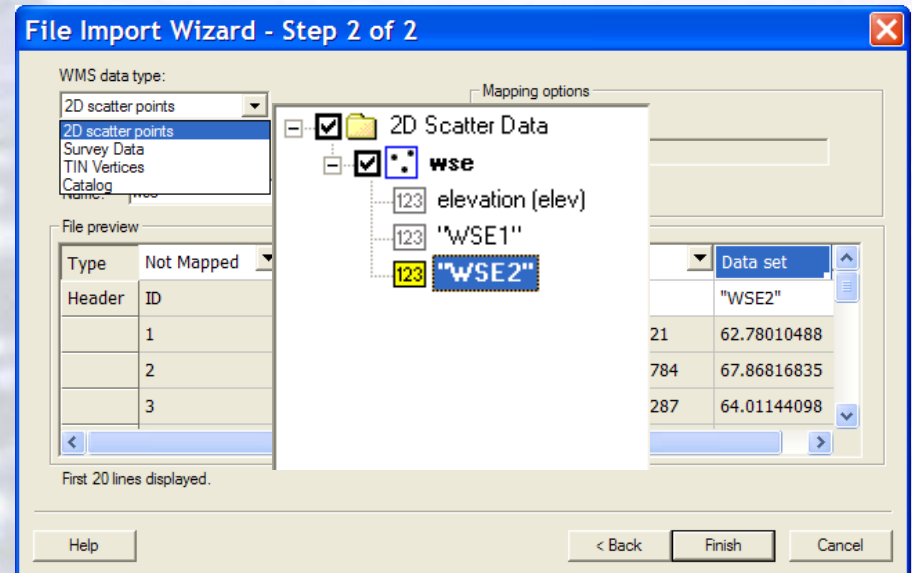
Channel Calculator

- Create Feature Arc
 - Cross section coverage
 - Define geometry
 - Manually
 - Cut from DTM
- Compute normal depth
 - Channel calculator
- Create Stage Point
 - Water Surface Elevation



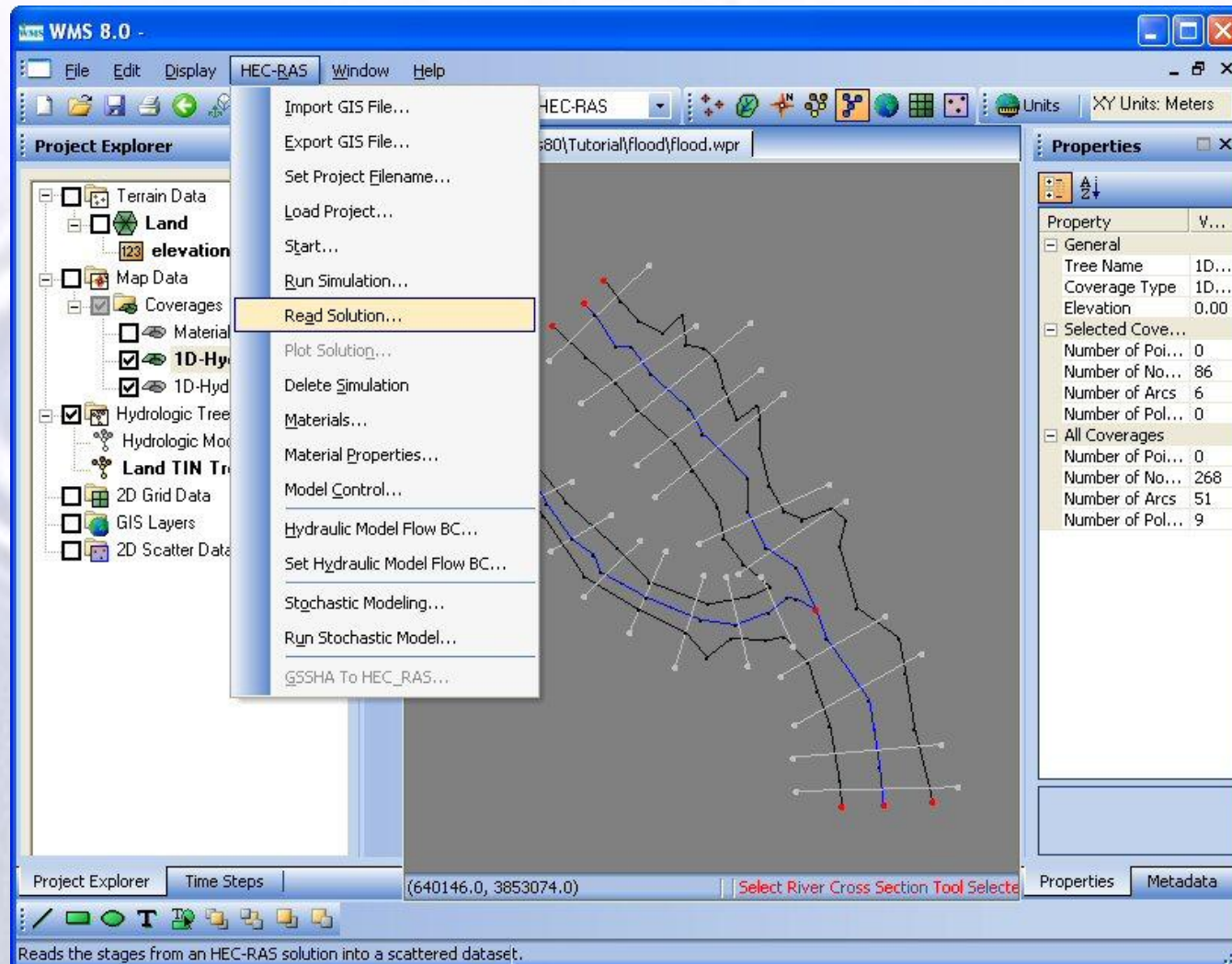
Import from Text File

- Delimited text file
- Open
 - Text Import Wizard
- Converts to scatter data set



ID	X	Y	"WSE1"	"WSE2"
1	640874.10	3850391.40	62.25	62.78
2	639645.10	3852428.90	67.55	67.87
3	640561.20	3851155.20	63.41	64.01
4	639253.00	3851815.40	70.27	70.95
5	639322.10	3851748.40	70.21	70.34

HEC-RAS Results

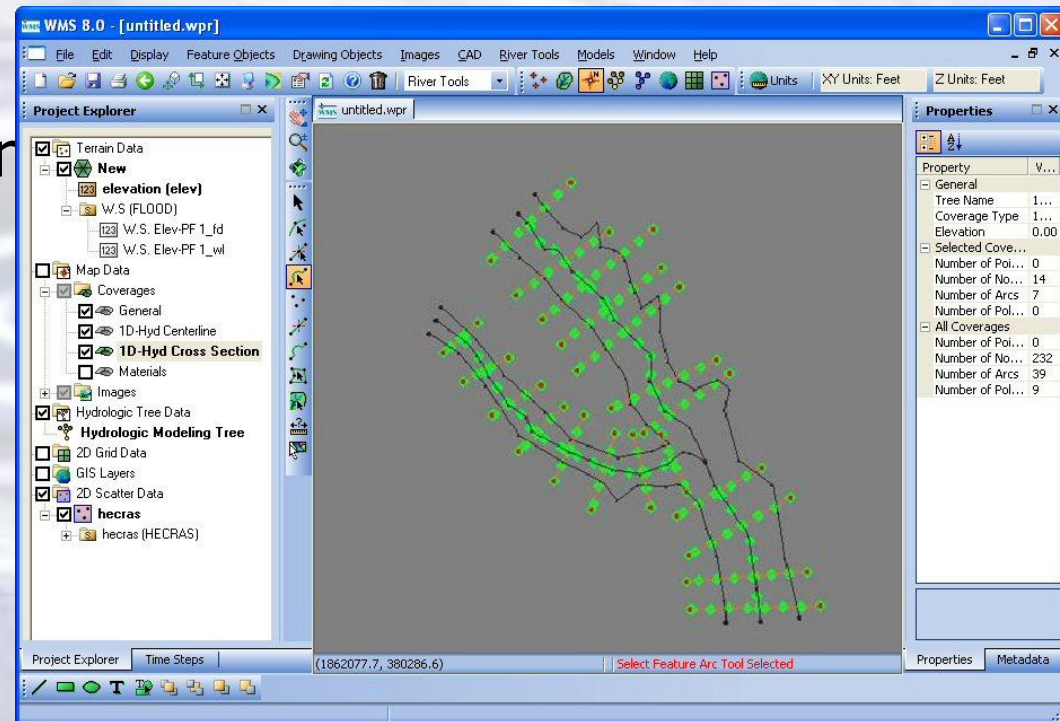


Creating a Water Level Surface

- Need a reasonably high density of water surface elevation points
 - Interpolate linearly along a centerline and extend along cross section lines
- Interpolate from the scattered water surface elevations to the DTM points

Interpolating Centerline and Cross Sections

- Done separately
 - 1D Hyd Centerline
 - 1D Hyd Cross Section
- At each vertex
- Distance between



Water Level Interpolation to the DTM

Floodplain Delineation

Data options

Select TIN
Land

Select stage scatter point set
new_data_set

Select stage data set
elevation

☒ No flood barrier coverage
☐ User defined flood barrier coverage

Select flood barrier coverage

Delineation options

☒ Search radius
Max search radius: 100.0

☒ Quadrants
Number of total stages: 12

☐ Flow path
Max flow distance: 10000.0

Number of stages in a quadrant: 3

Output options

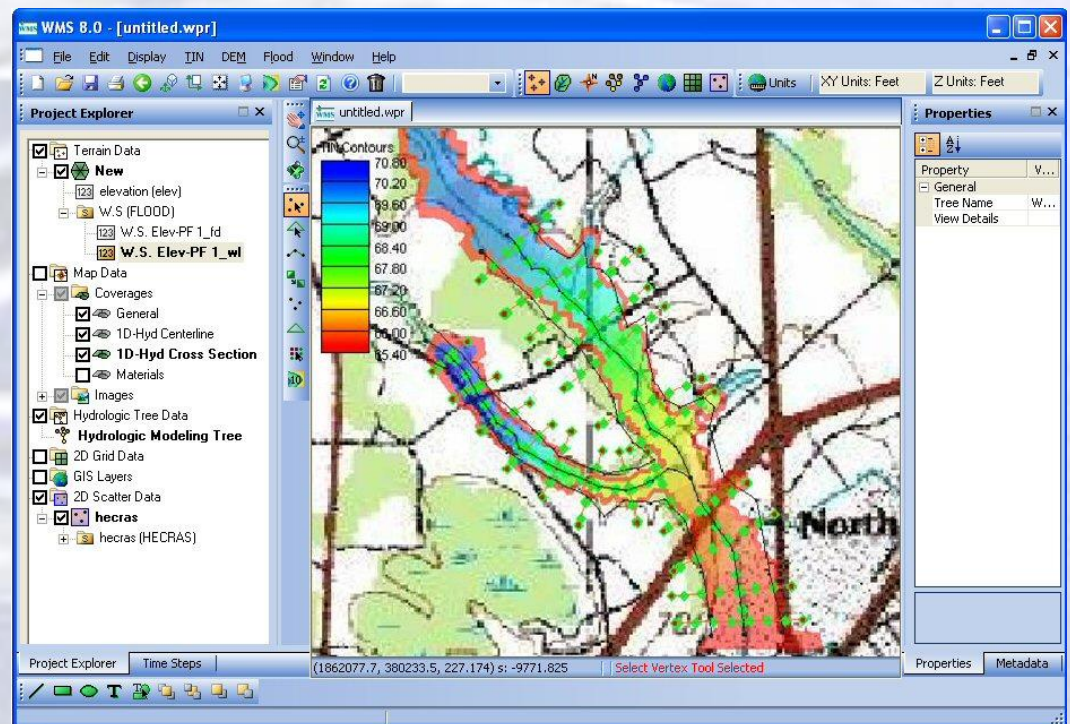
Solution
elevation

Data set names

☒ Flood depth
elevation_fd

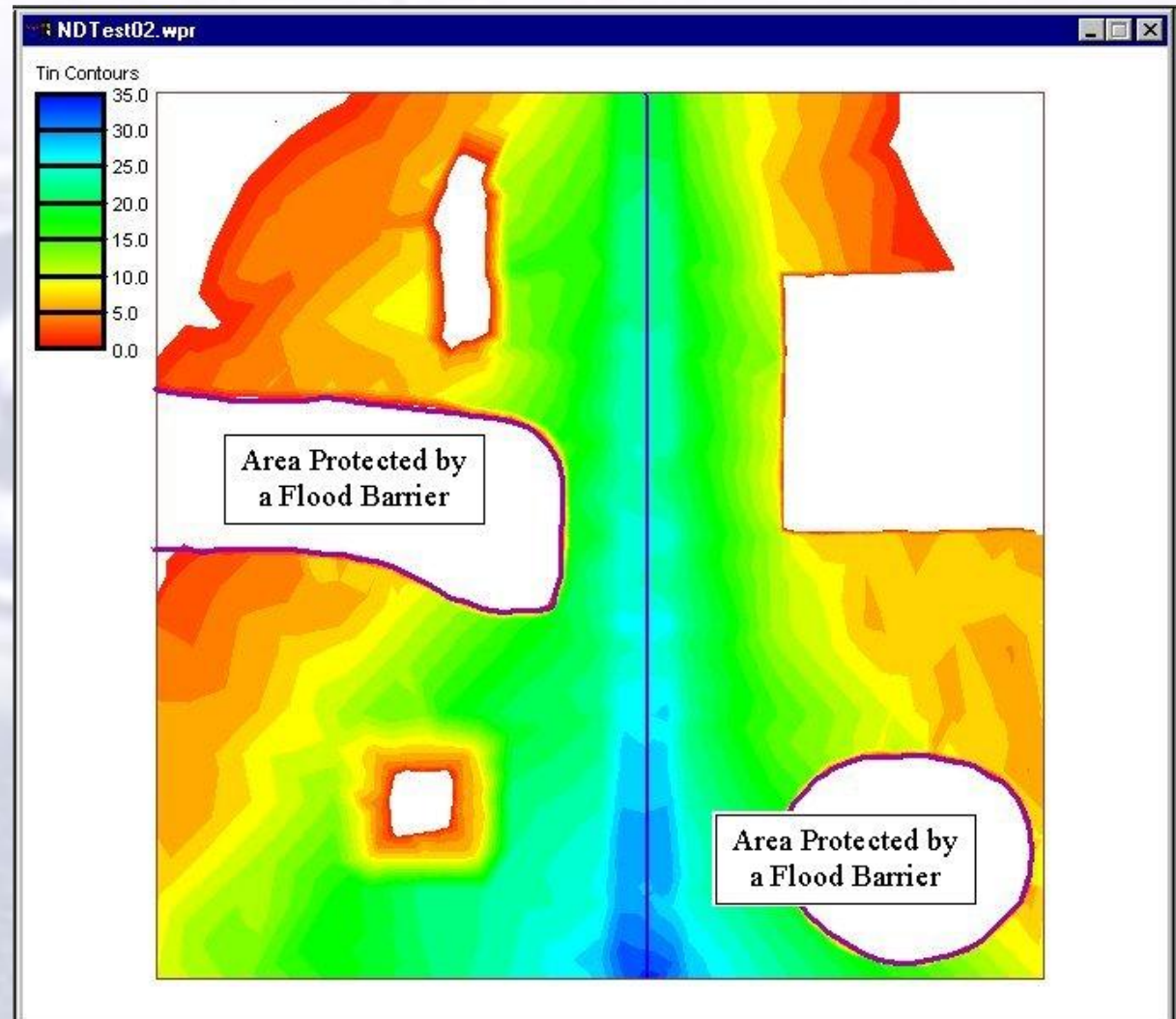
☒ Water level
elevation_wl

Help
OK
Cancel



Effect of Flow Path and Flood Barrier Coverage

- *Without flow paths*
- *With flow paths*
- *Without barriers*
- *With barriers*



Floodplain Delineation Output

- Flood depth data set
- Flood extent coverage
- Classified flood depth coverage
- Flood impact coverage

