Simplified Bridge Hydraulics in HEC-RAS
Solution

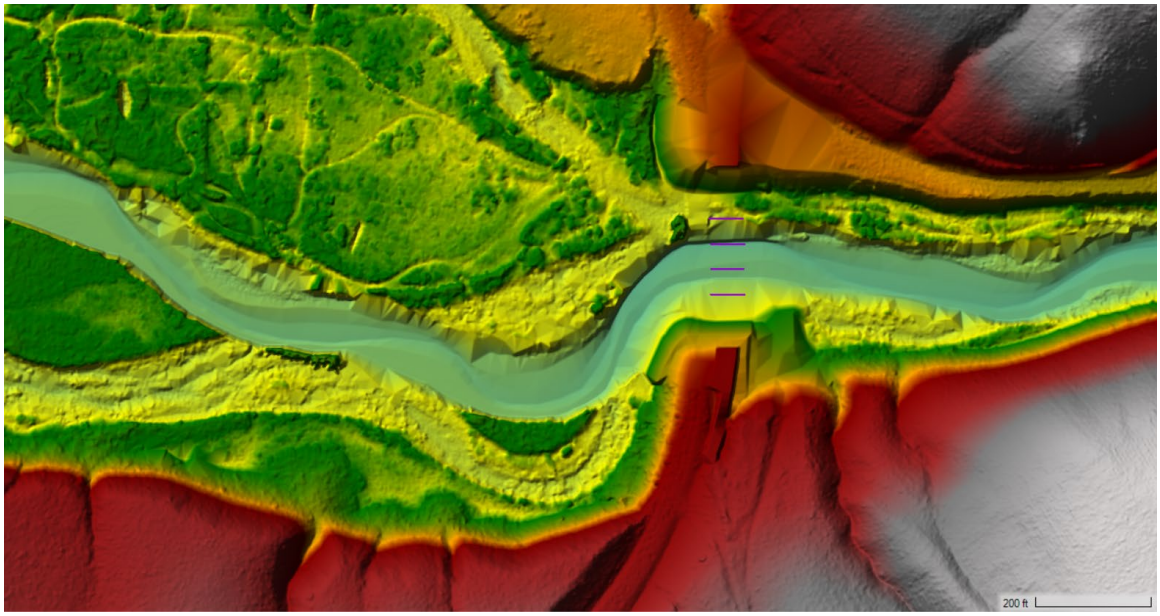
Objective

This workshop will help students learn how to use HEC-RAS to use the 1D bridge option inside a 2D flow area.

The workshop will begin by developing a base geometry and plan that models a section of river with the shallow water equations (SWE) and then another geometry and plan will be developed with a Connection structure that will operate in bridge mode to simulate a road crossing. These simulations will then be compared.

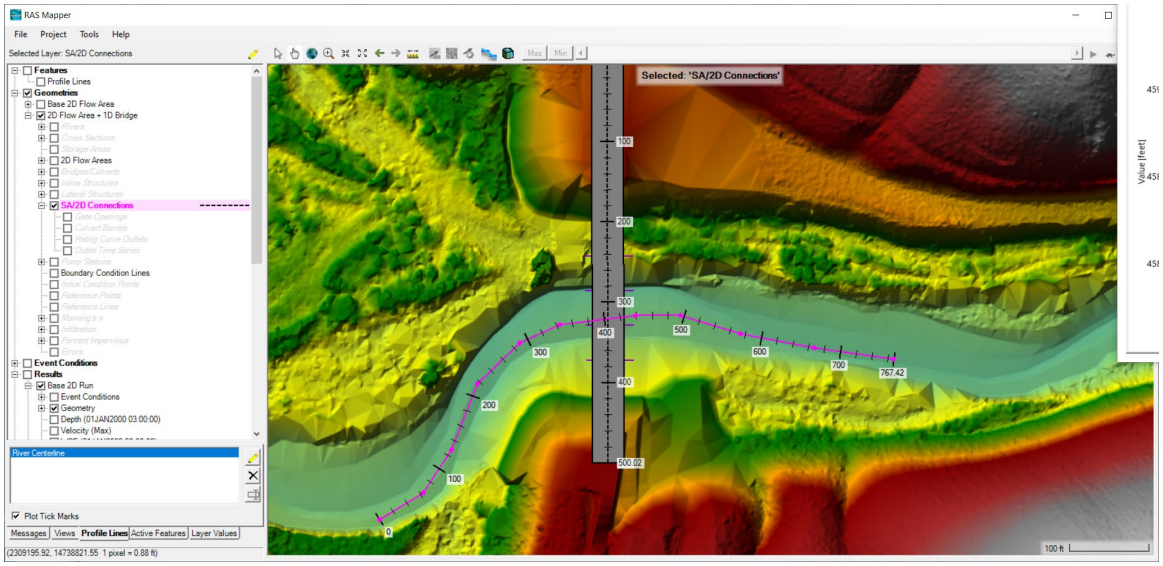
Background

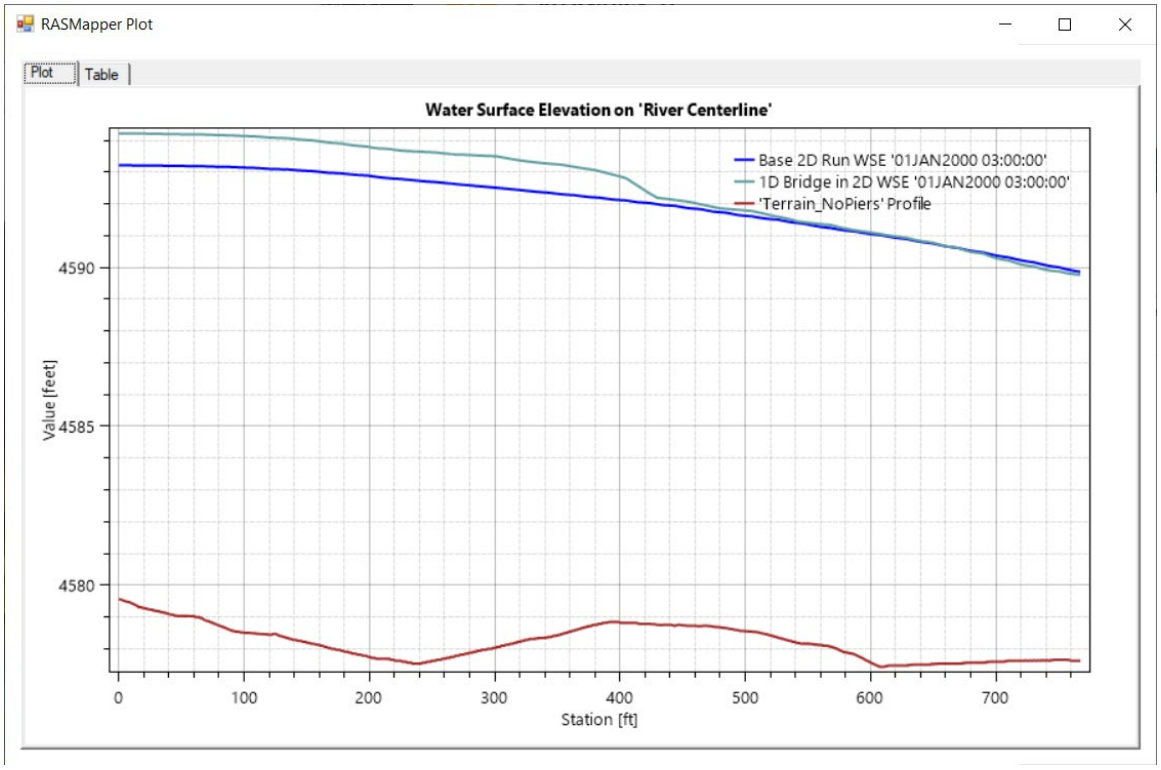
The figure below shows the terrain and bridge crossing (flow west to east). The floodplain is highly constricted at the bridge which includes four rows of piers, these piers are marked by purple lines in the view below. The square piers have 4ft sides.



Compare Results

Question: What is the difference in WS between the plans at the bridge?

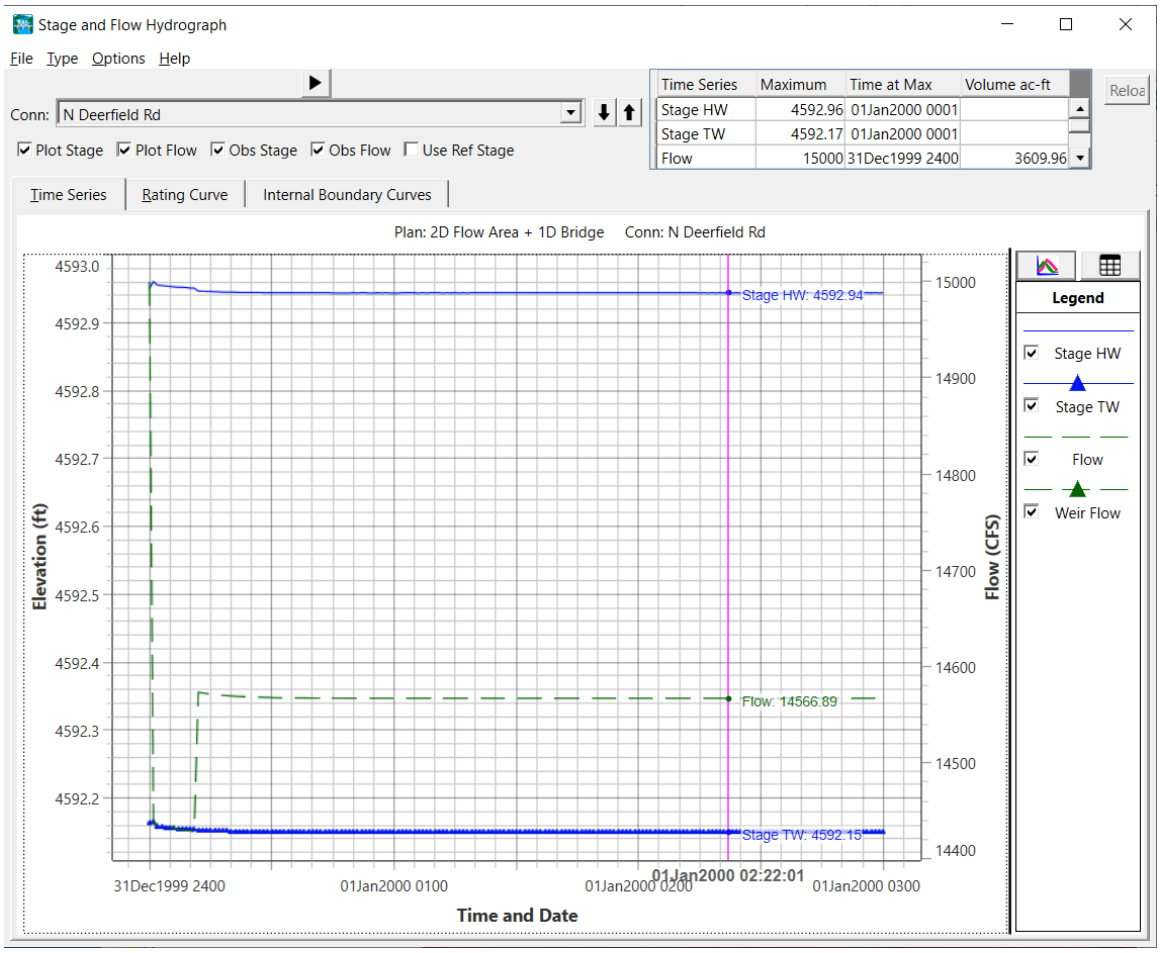




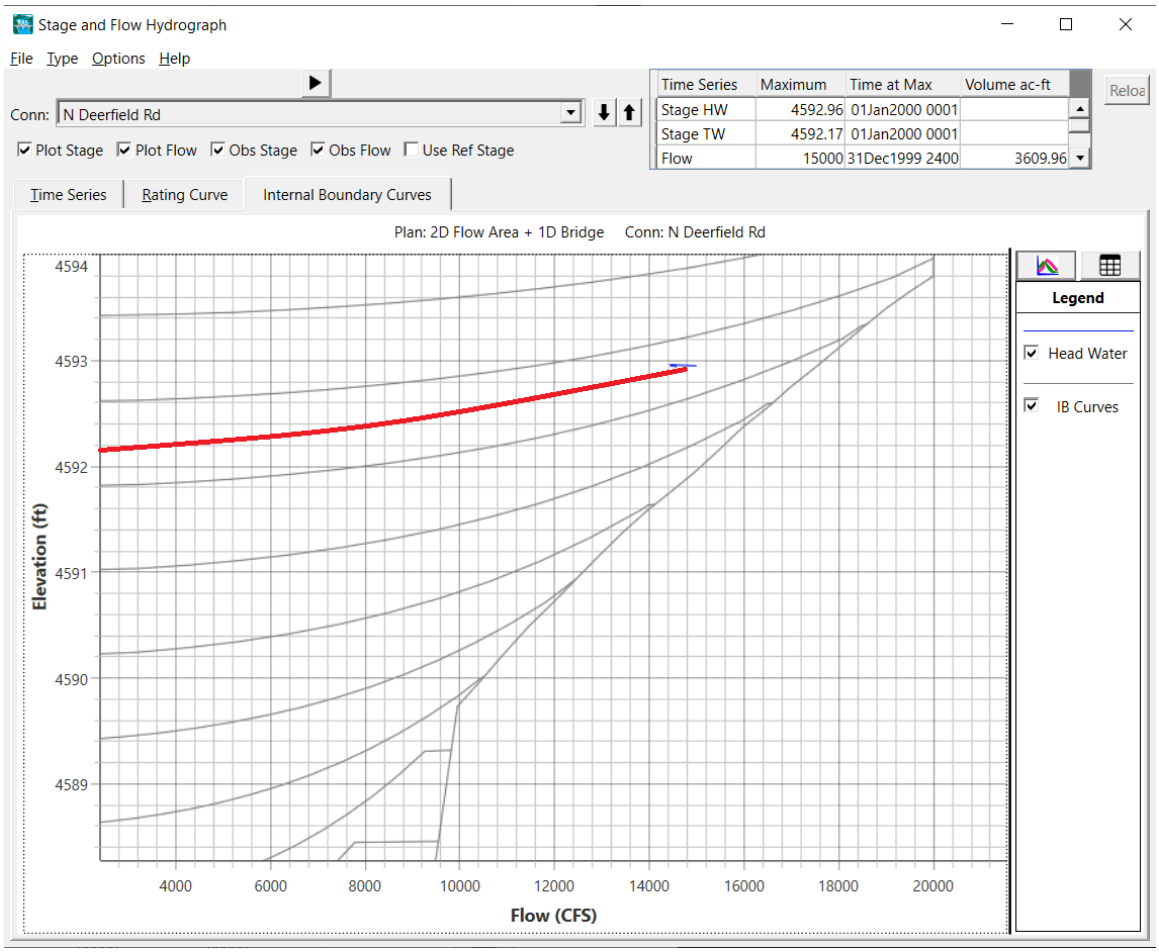
The bridge causes about 1ft or rise in the water surface, that rise persists upstream to that US boundary of the study area. You would need to continue the model further upstream to see full extent of the impact of the bridge to the maximum profile.

<u>Question</u>: Look at the family of bridge curves and for the flow through the bridge track back the HW to find the prescribed TW and try to verify the loses were applied correctly.

Plot the Stage and Flow Time series for the structure and see that the difference between the HW and TW is about 4592.94-4592.15 ~ 0.8 feet.

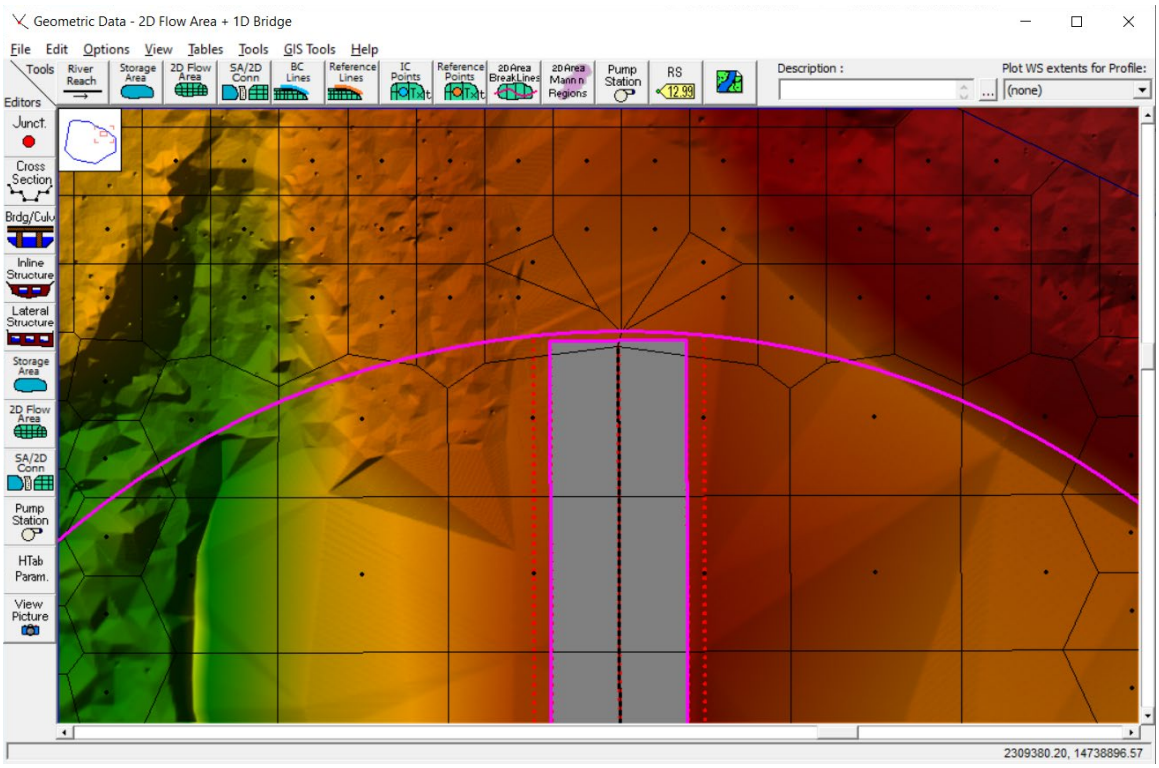


Click on the Internal Boundary Curves Tab and see the family of rating curves. A red line has been added to show interpretation of the Tailwater to Headwater that was applied for the bridge loses.



<u>Question</u>: Is the cell size adequate for modeling the terrain, bridge, piers, etc?

The cell sizes around the bridge were increased to 50 feet so that the center of the cells nearest the bridge would be centered at the XSs made to compute the bridge loses family of rating curves. This is larger than the background cell size of 20 ft. Dotted red lines are the Outside XS's for the 1D region. The 1D Simple bridge methodology in 2D Flow Areas in this version of RAS implements all the losses at the line of faces in the center of the bridge for the range between these red dotted lines. Future versions will relax that restriction.


Geometric Data - 2D Flow Area + 1D Bridge
File Edit Options View Tables Tools GIS Tools Help
Tools
River Reach
Storage Area
2D Flow Area
SA/2D Conn
BC Lines
Reference Lines
IC Points
Reference Points
2D Area BreakLines
2D Area Mann n Regions
Pump Station
RS
12.99
Description :
Plot WS extents for Profile:
(none)
Editors
Junct.
Cross Section
Brdg/Culv.
Inline Structure
Lateral Structure
Storage Area
2D Flow Area
SA/2D Conn
Pump Station
HTab Param.
View Picture
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