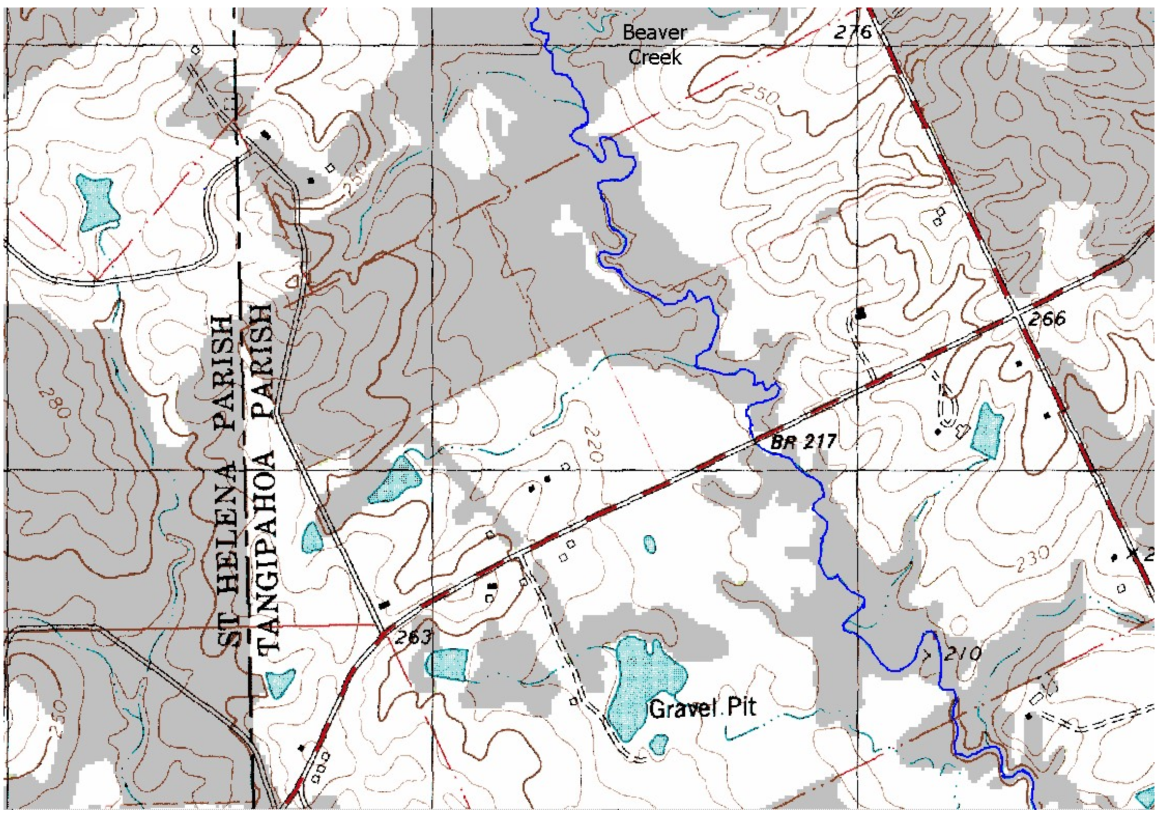
Bridge Development
Workshop

1 Objective

This workshop will help students learn how to use HEC-RAS to enter and edit bridge data, place ineffective flow areas, and define a bridge modeling approach.

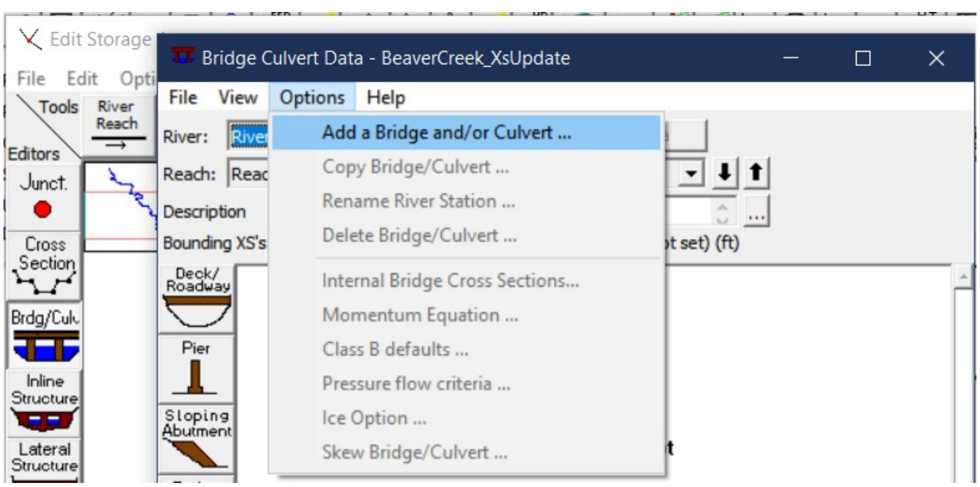
2 Background

The stream for this example is a section of Beaver Creek located near Kentwood, Louisiana. The bridge crossing is located along State Highway 1049, near the middle of the river reach. The field data for this example was obtained from the USGS study "Backwater at Bridges and Densely Wooded Flood Plains, Beaver Creek Near Kentwood, Louisiana" by George J. Arcement, B.E. Colson, and C.O. Ming.



3 Enter Bridge Information

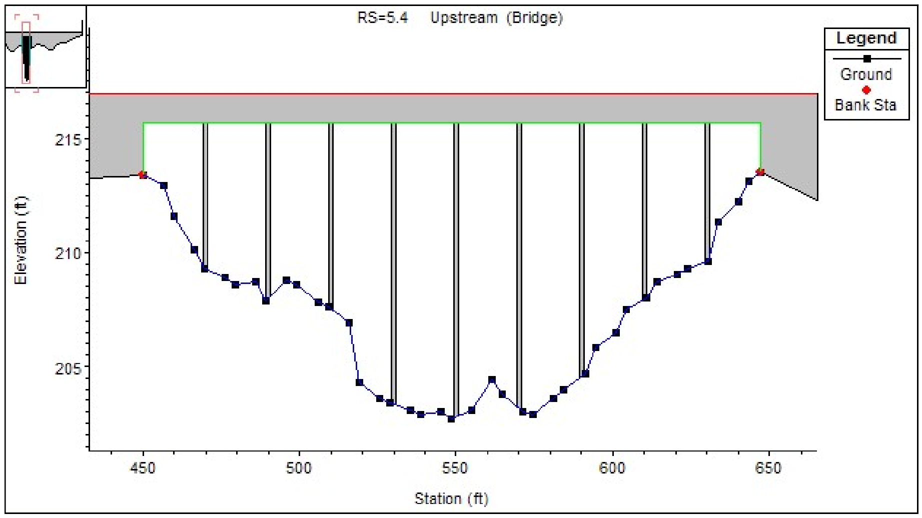
1. **Start HEC-RAS**.
2. **Open** the **"BridgeDevWorkshop"** dataset in the Bridge Development Workshop folder.
3. Save a **new geometry** from the existing geometry, and name it *"Bvr Crk Bridge-Energy"*
4. **Add** a new Bridge at **Station 5.4** from the Bridge/ Culvert Editor.



5. Enter the bridge data based on the following information:
    a. Road embankment is at a constant elevation of **216.93**ft.
    b. The bridge low chord is at elevation of **215.7 ft**.
    c. The bridge opening has vertical walls at cross section stationing **450** ft and **647** ft.

d. The bridge deck is **40** ft wide, and the upstream side of the bridge deck is **30** ft from the upstream cross-section. The upstream and downstream sides of the bridge are exactly the same.

e. The bridge has **9 piers**. The piers are **1.25** ft wide each and have a square nose. The piers are spaced **20** ft. apart on center, starting with the first pier at station **470** ft.



4 Enter the Ineffective Flow Area Data

6. Starting with the bridge's upstream cross-section (5.41), place simple ineffective areas to remove conveyance where the flow will be contracted.
   a. Assume a **contraction ratio of 1:1** to determine the stationing of the ineffective flow areas.
   b. For the trigger elevation the top of the roadway is a decent place to start.
7. Similarly, add ineffective flow areas to the downstream cross-section (5.39)
   a. Assume an **expansion ratio of 2:1** to determine the stationing
   b. For the trigger elevation, the top of the bridge opening is a decent place to start.
8. Finally, **set** appropriate **expansion/contraction coefficients** for upstream and downstream cross-sections.

Question: If the expansion and contraction ratios were not provided, how would you estimate them?

Question: What expansion and contraction coefficients did you use?

5 Set Bridge Modeling Approach

9. **Set** the **Bridge Modeling Approach** for **Low Flow** to use the **Highest Energy** answer among the Energy, Momentum, and Yarnell solutions.
    a. Note, you will have to find the appropriate parameters for both the Yarnell and Momentum equations.
10. **Set** the **Bridge Modeling Approach** for **High Flow** to use **Energy Only**
11. Close the bridge editor and **save** the geometry.
12. **Create** another **new Geometry** and switch the bridge **High Flow Method** to **Pressure / Weir**. **Save the** geometry as *"Bvr Crk Bridge-PW"*
    a. Set the fully submerged coefficient of discharge ***Cd*** to the typical **0.8**.

Question: What Momentum and Yarnell parameters did you use and why?

Question: In looking at the geometry of the bridge, which high flow method would you anticipate being more appropriate and why?

6 Create Steady Flow Plans

13. **Create Steady Flow Plans** for each geometry using the existing flow file that has 3 flows for 5000, 10000, and 14000 cfs.
14. Give the Plans appropriate **Titles** and **Short IDs** to indicate what high flow method is used.
15. **Compute** each plan.
16. **Fix** any **geometry errors** that are preventing the plans from running.

Congratulations, you have completed this workshop! In the next workshop you will analyze the results of each plan, determine which is the best bridge modeling approach, and make adjustments to improve the solution as needed.