Exercise 6. Structure Design: Rountree Tributary

The premise of stream simulation is to design a streambed then "wrap" the structure around it. In previous exercises, you selected a design alignment, profile, channel cross-section and bedmix. In this exercise you will use the design cross-section graph provided below and the profile graph from exercise 4 to select a structure and determine its dimensions.

First choose a structure width that will span bankfull width and also provide room for banks and any floodplain you plan to provide. The cross-section graph is located at the center of the structure and includes 2.5 ft of bank on each side. You can shorten or extend this depending on your objectives and hydraulic modeling results to be performed. Objectives in addition to passing fish, wood, sediment and water might include passage of reptiles, amphibians, small and large mammals and people.

Bankfull width (ft): 15 Bank width (ft): 5 Structure width (ft): 20 Bankfull elev (ft): 84.6

Now identify the LVAP elevation and select an elevation for the invert or bottom of footer that extends down below the LVAP. Draw this on the cross-section and profile graphs.

Invert/bottom of footer elev (ft): center 79.0 upstream 80.2 downstream 77.8 **(draw parallel line)**

Next identify the types of structures that would work including open bottom and enclosed structures. Select a preliminary structure and dimensions from the information provided below and taking into account the elevation of the road. Determine the minimum and maximum cover limits for the structure. Check to make sure the structure will extend below the LVAP and meet cover requirements. For open bottom structures, determine the top elevation of the footers. Ideally the top of the footers will extend up to bankfull elevation to allow the streambed to be constructed prior to setting the structure. Draw the structure on the cross-section.

Structure: Type conspan Material concrete Width (ft) 20 Height (ft) 8

Minimum cover (ft): 0 Maximum cover (ft): 50 Available cover (ft): 14

Top of footer elev (ft): center 84.6 upstream 85.8 downstream 83.4

Then using the design slope, draw the structure on the profile graph. Now determine the total length of the structure. Assume you will keep the existing road width, choose an embankment slope (e.g. 2:1, 3:1, 4:1, headwalls), and sketch in your embankment if it differs from the existing. The current embankment slope is about 1½:1. The embankments should reach out from the road shoulder down to the bankfull elevation. You can use a headwall to shorten the structure with associated cost considerations. Finally determine the total length of the structure.

End Treatment: headwall/bevel/square Side slope: 2:1 To: bankfull/top headwall

Design slope (ft/ft) to calc. elev. up and dn. from center: 0.021 Final structure length (ft): 110

The final steps are to check hydraulic capacity to ensure the structure will pass at least the 100-yr flood with a HW/D<0.8. Then perform a sediment mobility and stability check and adjust streambed sediment sizes accordingly.

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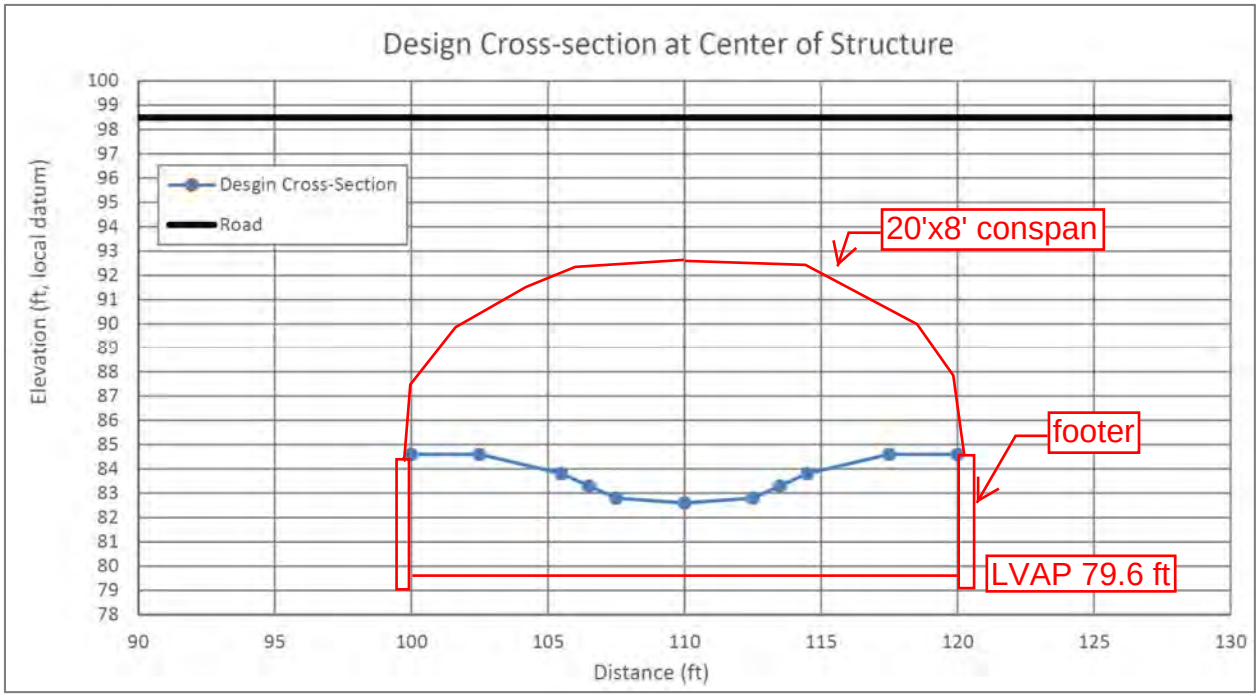
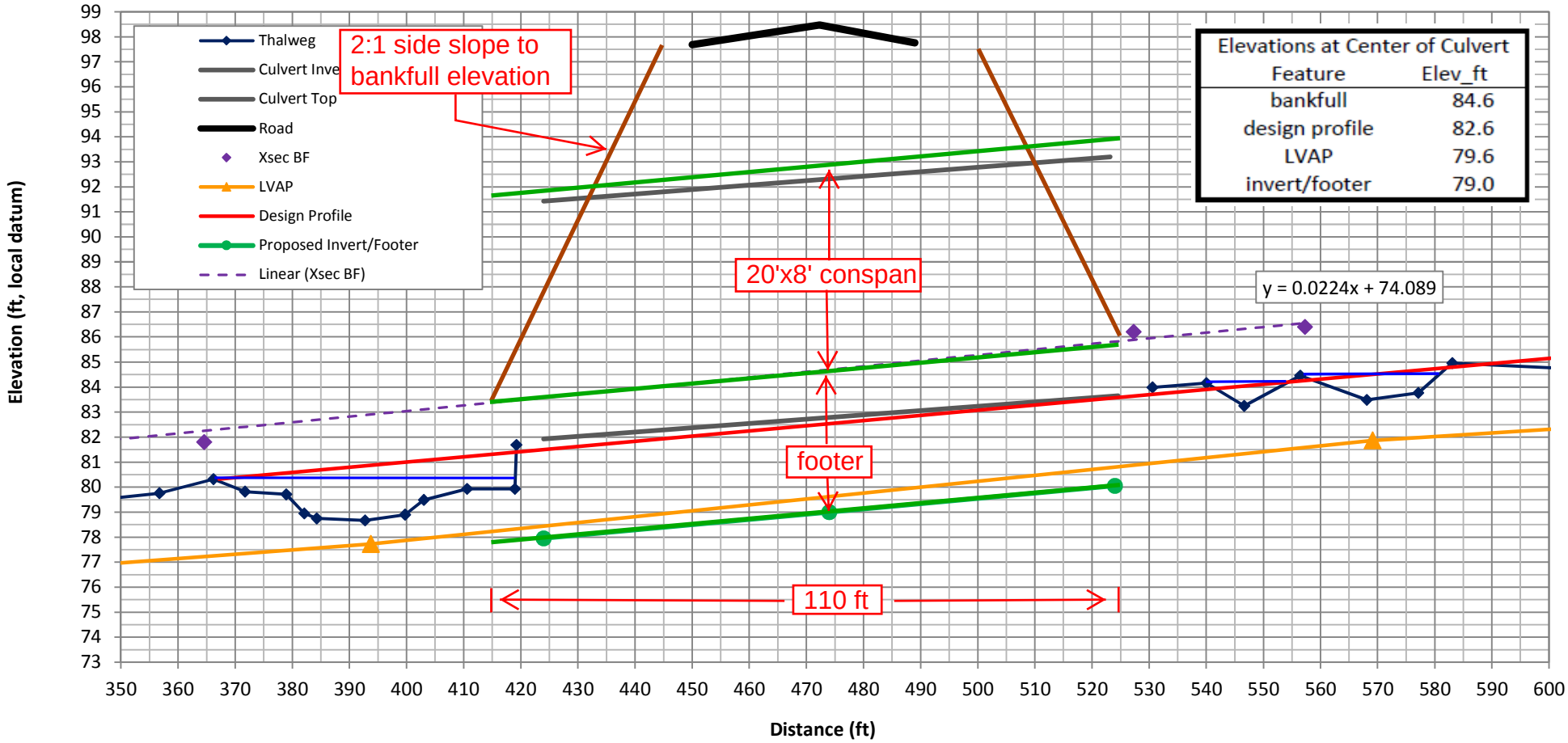
Rountree Tributary at W Main Street, Platteville, WI