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Problem 1

Compute hydraulic radius, hydraulic depth, wetted perimeter, and cross sectional area for a trapezoidal flood control channel with a bottom width of 20 ft, side slopes 2H:1V, and a top width ranging from 21 to 40 ft using an increment of 1 ft. Plot the relationship between the computed parameters and the depth of the water from the bottom of the channel, y. A MATLAB code could be useful to perform the calculations and plot the graph.

Problem 2

Compute hydraulic radius, hydraulic depth, wetted perimeter, and cross sectional area for a 1.5-m diameter culvert with a depth of flow y ranging from 0.1 to 1.24 m using an increment of 10 cm. Plot the relationship between the computed parameters and the depth of the water from the bottom of the channel, y. A MATLAB code could be useful to perform the calculations and plot the graph.

Problem 3

The flow depth and the flow velocity upstream of a 0.2-m sudden step rise in the bottom of a 5-m wide rectangular channel are 5 m and 4 m/s respectively. Assuming there are no losses in the transition, determine:

   a) The flow depth downstream of the step and the change in the water level;
   b) The flow depth and the water level downstream of the step if the channel bottom has a 0.2-m drop instead of the rise, as in (a).

Problem 4

A 10-m wide rectangular channel is carrying a discharge of 400 m³/s at a flow depth of 3.0 m. Determine the flow depth downstream of a step of 0.3 m if the step is: (i) a rise, and (ii) a drop. Does the water surface rise or drop downstream of the step in each case?
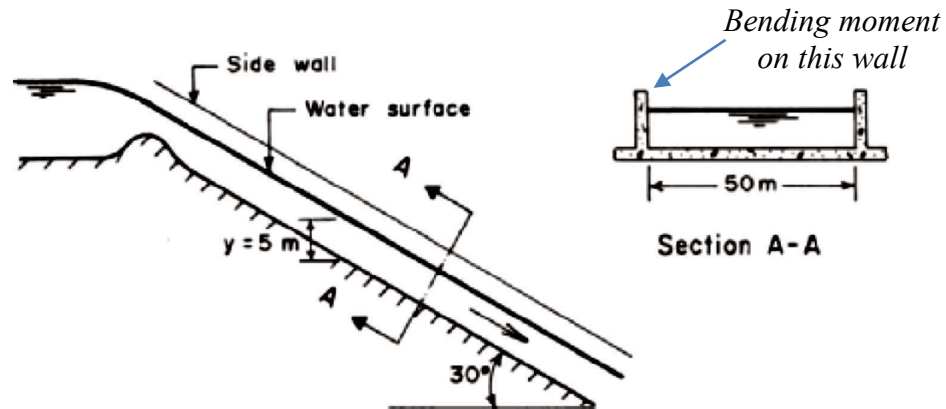
Problem 5

A 8-m wide rectangular channel carries a flow of 96 m³/s at a flow depth of 4 m. The channel width is constricted to 6 m in a length of 5 m. Assuming the channel transition has straight and vertical sides, and there are no losses, plot the water-surface profile in the transition. *Hint: you should find the water depth when the channel width is 8 m, 7.5 m, 7 m, 6.5 m, and 6 m.*

For Graduate Students:

Problem 6

While computing the bending moment and the shear force acting on the side walls of the spillway chute shown in the following figure, a structural engineer assumed that the water pressure varies linearly from zero at the free surface to $\rho g y$ at the invert of the chute, in which $y=$ flow depth measured vertically. What are the computed values for the bending moment and the shear force at the invert level? Are the computed results correct? If not, compute the percentage error.

Spillway chute