Problem #1

A trapezoidal channel has a bottom width of b = 30 ft and side slopes m = 2, and it carries Q = 5100 cfs. Use excel to solve this problem and also describe/interpret your results in words. Show all equations and units.

(a) Calculate and plot the specific energy diagram for this channel. Use a depth range of 2 to 24 ft.

(b) Three piers, each 2.5 ft wide, support a bridge spanning the channel at a bridge section. Assume that at this location the channel section is trapezoidal with m = 2 and b = 30-3(2.5) = 22.5 ft. Calculate the specific energy diagram at the bridge section. Plot the curve on the same graph as (a).

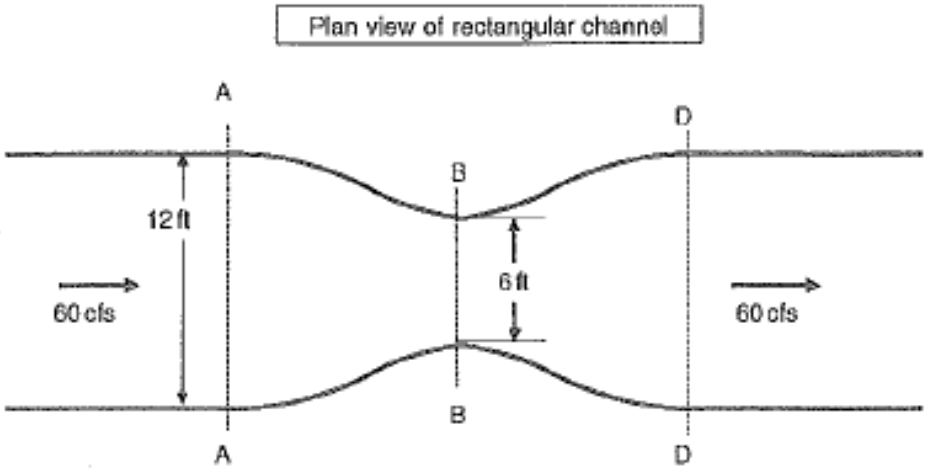
(c) Determine the approximate flow depth at the bridge section if the depth upstream is 16 ft.

Problem #2

A hydraulic jump occurs in a 36-in storm sewer carrying 20 cfs. The flow depth just upstream of the jump is 1.0 ft. Determine the flow depth downstream of the jump.

Problem #3

Suppose the nearly horizontal, 12-ft wide rectangular channel shown below carries 60 cfs at a depth of 3 ft. The width is contracted to 6 ft at Section B. In addition, there is a smooth step rise of Δz in the channel bottom at the contracted section. Determine the flow depth at A and B for Δz of (a) 0.5 ft and (b) 1.0 ft and interpret your results.



Problem #4

Assuming no energy loss, what is the maximum value of Δz that will permit the unit flow rate of 6 m^2/s to pass over the hump without increasing the upstream depth in the channel shown below?