CEE 345 Part 2, Assignment #4, Due 6/1, 11:30am

1. Some data collected by one of the groups during the laboratory experiment investigating flow in the flume in the absence of the sill are summarized below. These data were for an upstream and a downstream location that were separated by 3.60 m. In three trials, the times required for a floating object to travel between the two locations were 4.70, 4.70, and 4.50 s, respectively. The channel width was 31.4 cm.

	Upstream	Downstream
Water surface (cm)	33.27	33.20
Channel bottom (cm)	20.18	21.60

   a) Compute the flow rate per unit width (q) in m^2/s, treating the measured velocity as the average velocity between the two measuring points.

   b) Plot y vs. E curve for the value of q determined in part (a). Was the flow sub-critical or super-critical under the test conditions?

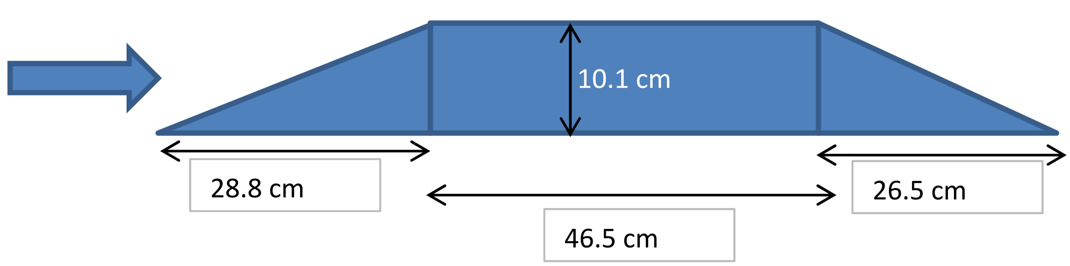
   c) Determine the depth, velocity, and specific energy at the condition of E_{min} for the given q.

   d) Determine V and E at the two measuring points, based on the flow depths at those locations.

   e) Determine the frictional headloss between the two measuring points, assuming that the channel bottom was horizontal.

   f) Approximating the (gradually varying) velocity in the channel as constant and equal to V_{avg}, find the best-fit value of the Manning n coefficient for the channel. Does this value seem reasonable based on tabulated information?

2. Data from some additional experiments with the sill in place are presented below, along with a schematic showing the dimensions of the sill. The flow rate for this experiment was the same as that in the experiments for question #1. Locations 1-5 were, respectively, 2 cm upstream of the sill, at the top of the upstream ramp, in the middle of the flat portion of the sill, at the top of the downstream ramp, and 2 cm downstream of the sill.



Location:	1	2	3	4	5
Water surface*	44.18	42.52	41.31	38.40	26.97
Channel bottom	20.13	30.24	31.60	31.55	21.55

*All values in cm.

a) Find the specific energy and the Froude number at the five locations where measurements were taken. Are the Froude numbers consistent with the observed upstream and downstream flow regimes?

b) What is the 'alternate depth' for the flow at location #1? What about at location #5? Why does the alternate depth for the upstream flow (the depth that would apply if the flow were super-critical) not equal the measured depth when the flow actually became super-critical (downstream)?

c) Compare the actual headloss between locations #1 and #5 to the headloss that would be expected based on the Manning equation, using V_{avg} and the n value determined in question 1. What do you think is the main reason for the difference between the computed and measured values?

3. Data collected when the sill was absent and a hydraulic jump was induced in the channel are summarized below.

	Upstream	Downstream
Water surface (cm)	25.14	36.59
Channel bottom (cm)	20.23	21.52

a) Given the data for the upstream conditions, compute the theoretical value of the downstream water depth and compare it to the measured value.

b) Based on the measured change in water depth, what was the headloss across the jump, and what fraction of the power in the water was dissipated by the jump?

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