

CE 3372 – Water Systems Design

Exercise Set 18

Purpose: Develop expertise in application of Gradually Varied Flow equation in Open Channel Flow

Exercises

1. Water flows at a steady rate of $192 \text{ ft}^3/\text{s}$ through a concrete-lined rectangular channel 16 ft wide as depicted in Figure 1. The water enters the 0.35% sloped channel ($S_0 = 0.0035$) at location 1 and is flowing at 110% normal depth ($1.1 \times y_n$). The water exits over a 3-foot tall weir (assume sharp-crest weir) at location 2.¹

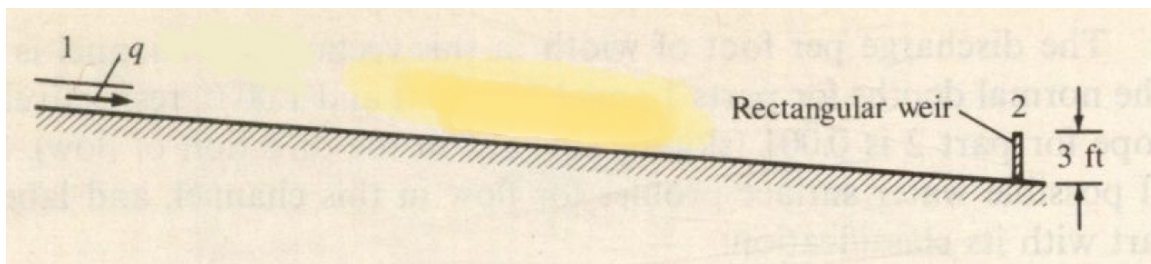


Figure 1: Profile of concrete-lined rectangular channel.

Determine:

- i The critical depth for the channel (in feet).
- ii Assuming flow over the weir must pass through critical depth, what is the pool depth just upstream of the weir? (Hint: Add the critical depth to the weir height as an approximation to the pool depth)
- iii Using the variable-step method, determine the water-surface profile from location 2 to location 1.
- iv How far upstream from the weir is the flow at 110% normal depth? (i.e. how far upstream is location 1 from location 2).
- v What is the average Δx in your computations if the Δy is 0.1 feet?
- vi Include a plot of the water surface elevation, and the channel bottom elevation (a profile plot – like the figure, but with the horizontal distance as the x-axis).

¹The water-surface-profile spreadsheet on the class server can be adapted to this problem, or you can create your own.