BIE 5300/6300 Assignment #3
Weir Calculations

24 Sep 04 (due 28 Sep 04)

Show your calculations in an organized and neat format. Indicate any assumptions or relevant comments.

I. Hydraulically, what is the difference between a suppressed weir and a contracted weir?

II. A rectangular sharp-crested weir is installed in a straight section of a rectangular open channel with B = 10 ft, L = 7 ft, P = 3 ft, and h_u = 1.37 ft. The downstream water surface is well below the weir crest elevation.

(a) Do the stated conditions meet all the guidelines for setting and operating weirs, as given in the lecture notes? If no, which are violated?
(b) You are required to estimate the discharge over the weir for the stated conditions. Assuming negligible approach velocity, estimate Q_f in cfs.
(c) Estimate the discharge, Q_f, without assuming a negligible approach velocity (hint: use H_u instead of h_u in the calibration equation).
(d) Now suppose h_d = 0.31 ft and everything else is the same as given above. Estimate Q_s in cfs.

III. A Cipoletti weir is installed in an open channel. The approach velocity is negligible. If the crest length is 0.90 m and the upstream depth, h_u, is 0.22 m, referenced to the crest elevation, what is the estimated free-flow discharge?

IV. An overshot gate with L = 8.0 ft and G_w = 12.0 ft is installed in a canal. At the downstream side of the gate is a reservoir with a constant water surface elevation which is 0.29 ft above the gate hinge. The irrigation district needs you to develop and plot calibration curves for gate openings of: θ = 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 degrees. The plot should have h_u on the abscissa and Q on the ordinate. Both the abscissa and ordinate must start at zero. Each curve on the plot must be labeled with its corresponding gate opening angle.

V. A new trapezoidal concrete canal with a base width of 2.0 m and inverse side slopes of 1.5 has a total lined depth of 2.5 m. The bed slope of the canal is 0.00015 m/m and the length is 2.35 km, all straight in alignment (no curves or bends). At the end of the section there is a sudden drop in the bed elevation of 3.5 m, then the same channel cross section continues downstream, with the same bed slope. Design a sharp-crested weir, just upstream of the elevation drop, for a maximum flow rate of 7.0 m^3/s. Make sure the canal lining won't be overtopped upstream of the weir.