CE 544 Open Channel Hydraulics
Final Exam, Winter 2015

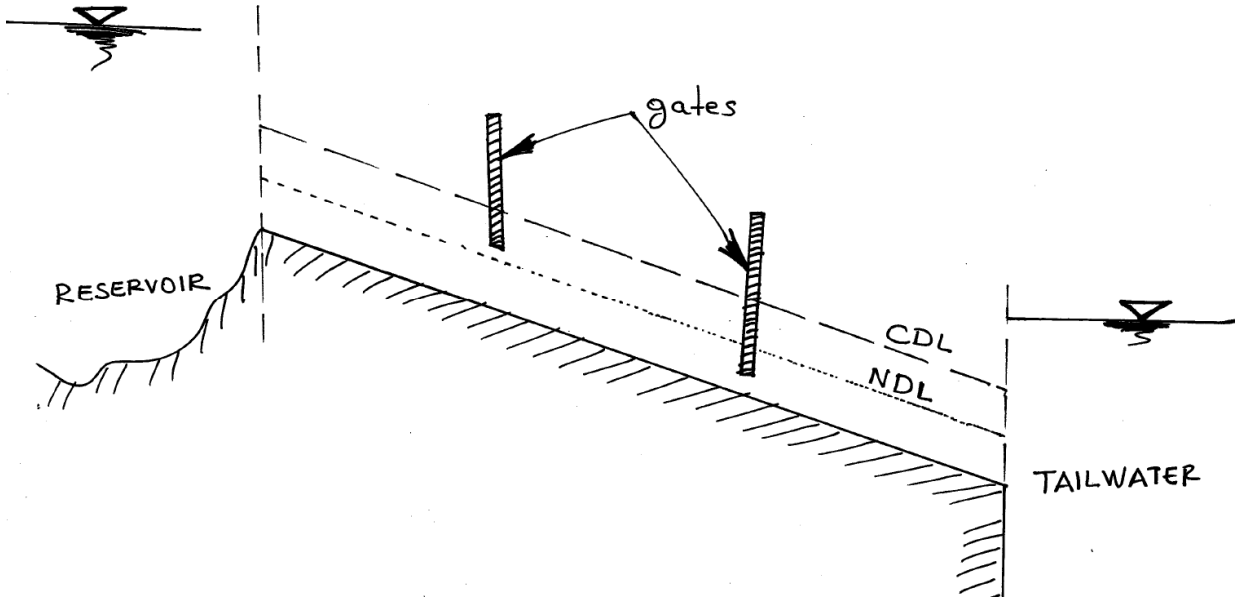
Instructor: Arturo Leon

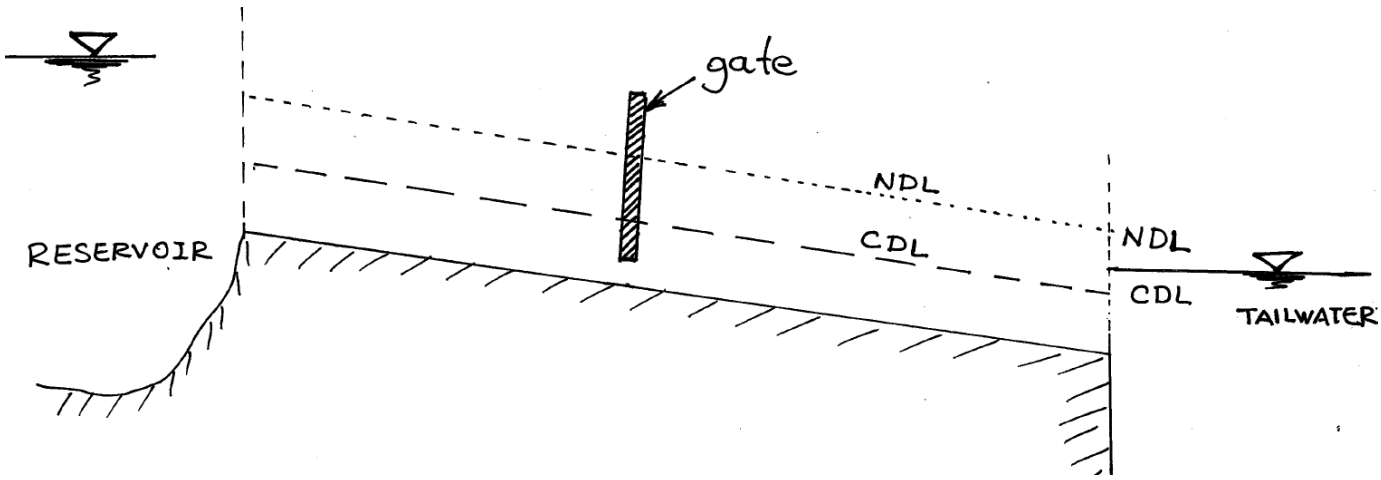
Name: _____ **Date:** 03/19/2015

- ✓ **You will have 1h 50 minutes to complete the exam. The exam is closed book, closed notes and open mind.**
- ✓ **The procedure will be graded. Please justify your answers**

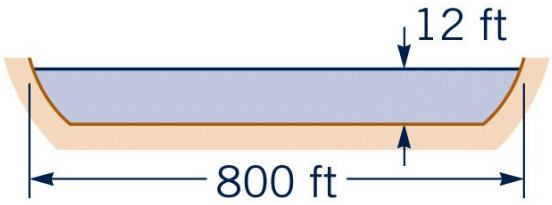
1. (20 points) Sketch and label the types of water surface profiles in the two channels below. **Assume very long (e.g., infinitely long reaches**).

   CDL = Critical depth line
   NDL = Normal depth line

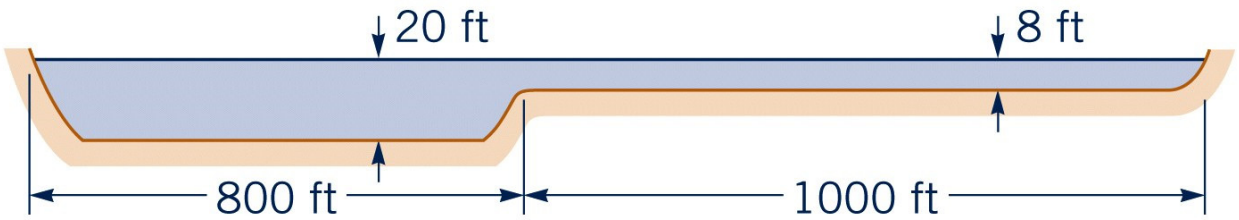



gate
NDL
CDL
RESERVOIR
NDL
CDL
TAILWATER

2. (20 points) At a given location, under normal conditions a river flows with a Manning coefficient of **0.040**, and a cross section as indicated in Figure (a) [see below]. During flood conditions at this location, the river has a Manning coefficient of **0.060** and a cross section as shown in Figure (b). Determine the ratio of the flowrate during flood conditions to that during normal conditions.

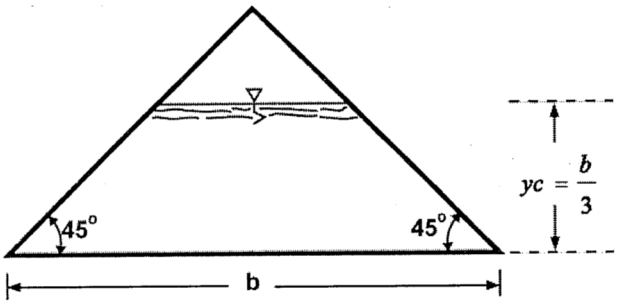


(*a*)



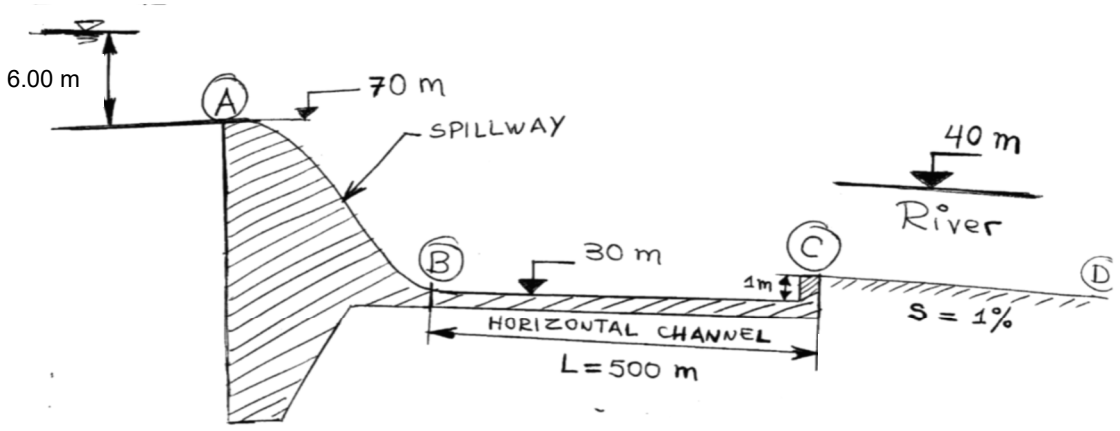
(*b*)

3. (10 points) If the critical flow depth (y_c) for the channel below is $y_c = b/3$, determine "b" as a function of the flow discharge (Q).



4. (10 points) We discussed in class that piers of a bridge may produce contraction of the flow. Assuming that there is no flow choking, will the water stage increase or decrease at the location of the contraction for (a) subcritical flow, (b) supercritical flow? To receive credit, justify briefly your answer for each flow type.

5. (20 points) A rectangular channel (b = 100 m) has a spillway and the configuration shown below. If the flow discharge is Q = 1000 m^3/s, determine if the hydraulic jump will occur upstream or downstream of section B. Justify your answer.



6. (20 points) A **very long (i.e., infinitely long)** rectangular channel connects reservoirs "A" and "B" as sketched below. The channel has a width of 10 m, a longitudinal slope of 0.020 and a Manning's roughness "*n*" of 0.040. If the upstream reservoir water surface is 4 meters **above** the channel inlet invert and the downstream reservoir water surface is 5 meters **below** the channel outlet invert, determine the flow discharge in the channel in m^3/s. Neglect **local** head losses.