Assignment 5

Detention pond routing and weir design

This is an exercise to introduce you to the reservoir level pool routing and its use in various design problems. Focus of the exercise is on the design of a detention pond with uncontrolled weir spillway for urban flood peak reduction.

Consider use of detention pond to store a flood waters during high flows and provide protection for the downstream community. The stage-storage curve (Table 1) is developed from the available topographic map of the pond location.

Table 1 The stage—storage curve

Elevation (m)	55.8	56.1	56.7	57.3	57.9	58.5	59.1	59.7	60.4
Storage (m^3)	0	141	1065	3330	7000	12301	18961	27071	37514

The design flood inflow hydrograph is given in Table 2.

Table 2 Inflow hydrograph

Hours	12	12.1	12.2	12.3	12.4	12.5	12.6
Inflow (m^3/s)	0.42	0.71	1.27	2.83	4.96	7.08	7.79

Hours	12.7	12.8	12.9	13.0	13.1	13.2	13.3
Inflow (m^3/s)	7.36	6.23	4.81	3.68	2.83	2.27	1.13

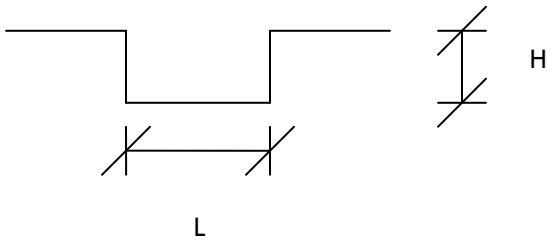
PART A (in class)

The outlet facility consists of a riser with rectangular weir (L = 1.5 m). The storage pond should be designed as a dry pond, thus the starting elevation and storage are 55.8 m and 0, respectively. With this information, answer the following questions:

1. What is the after development **peak discharge** (m^3/s) for the rectangular weir? How long is the **delay in peak discharge** (min)?

   Equation for a rectangular weir:

   $Q = 1.8\ L\ H^{3/2}$



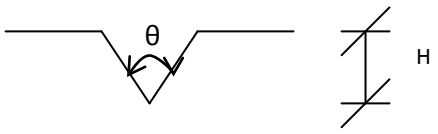
PART B (at home)

2. Design a v-notch weir to achieve the same after development peak discharge as the rectangular weir – find θ in degrees. Use trial and error method. As an initial estimate, use $\theta = 77^o$. Change the angle in increments of 1^o until an equivalent peak discharge is achieved.

3. What is the **reduction in peak discharge** (m^3/s) using the rectangular/v-notch weir? Approximately how long is the **delay in peak discharge (min)** observed? Show graphically.

   Equation for a v-notch weir:

   $Q = 1.42 \tan(\vartheta/2)\ H^{5/2}$



   Where L and H are in m and θ is in degrees.

Due Thursday, February 16, 2012