CE 3354 Engineering Hydrology
Exercise Set 5

Exercises

1. An agricultural watershed was urbanized over a 20 year interval. A triangular one-hour unit hydrograph was developed for this watershed for an excess rainfall duration of one hour.

   Before urbanization, the average loss rate was 0.30 in/hr.

   Figure **??** is the unit hydrograph that has a peak discharge of 400 cfs/in occurring at 3 hours, and a base time of 9 hours.

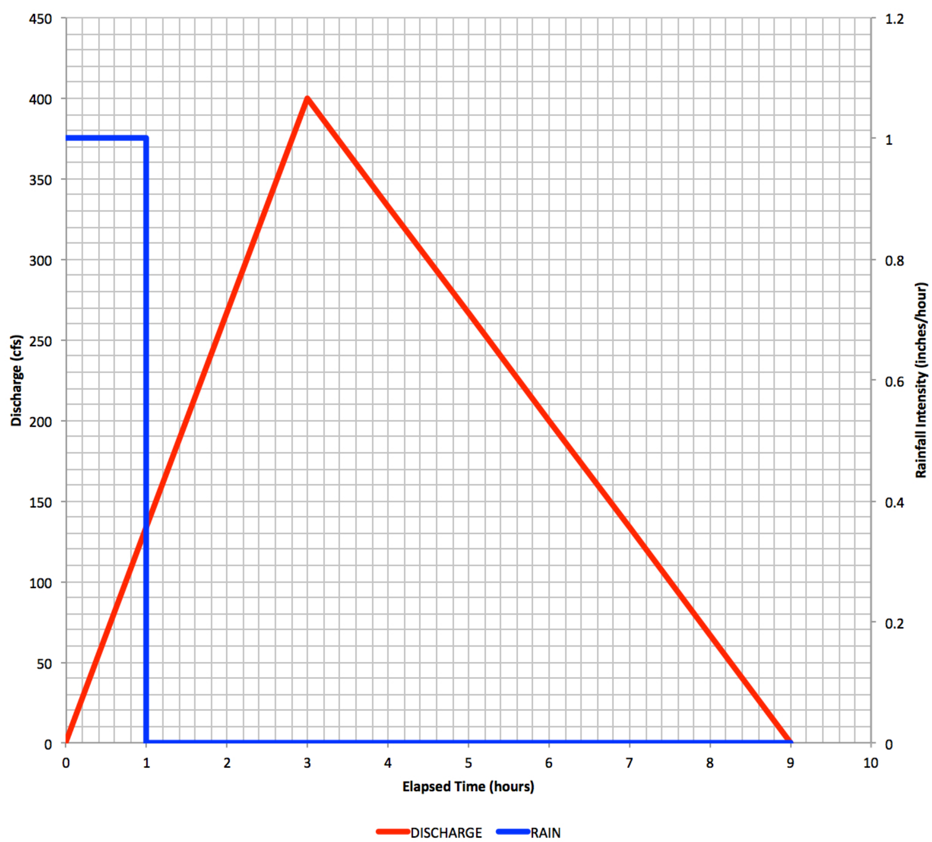

Figure 1: Pre-Urbanization unit hydrograph for excess rainfall of 1 in/hr for 1 hour.

After urbanization the loss rate was reduced to 0.15 in/hr and the peak discharge of the unit hydrograph increased to 600 cfs/in occurring at 1 hour, and the base time reduced to 6 hours. Figure **??** is the unit hydrograph with a peak discharge of 600 cfs occurring at 1 hours, and a time base of 6 hours.

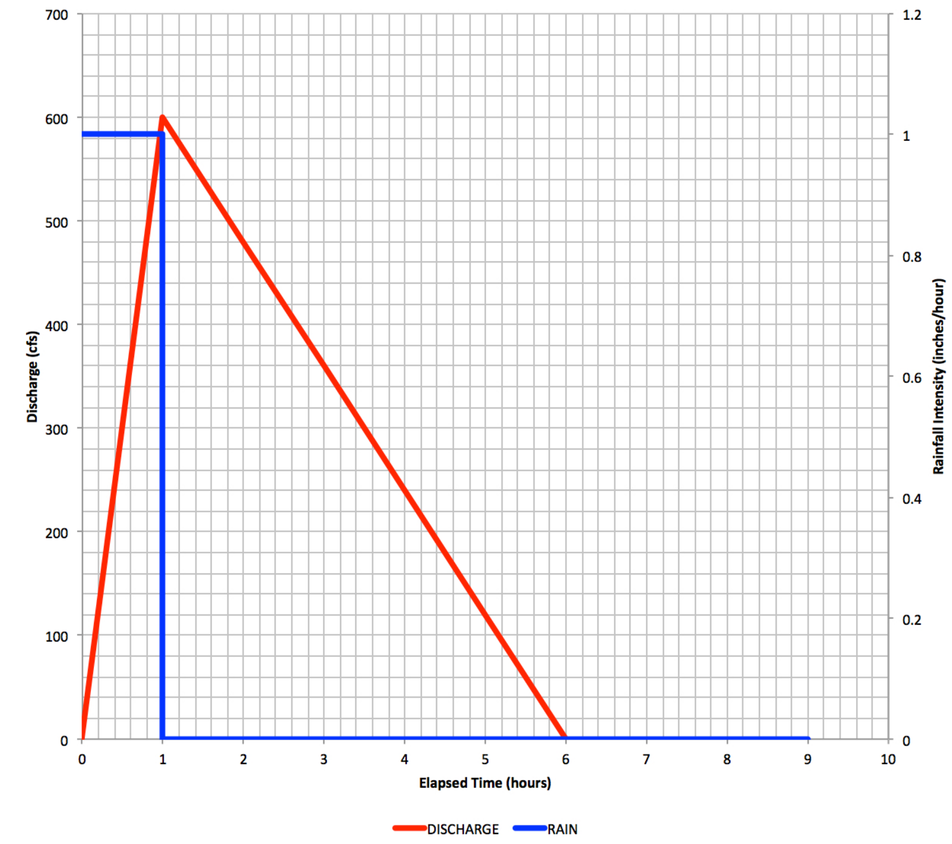

Figure 2: Post-Urbanization unit hydrograph for excess rainfall of 1 in/hr for 1 hour.

For a two hour storm in which 1 inch of rain fell in the first hour and 0.5 inch in the second hour, determine the direct runoff hydrographs before and after urbanization.[1]

[1]This exercise is the same as problem 7.5.7, pg. 238 in Chow, Maidment, Mays

2. A storm on April 16, 1977, on the Shoal Creek watershed at Northwest Park in Austin, Texas, resulted in the rainfall-runoff values in Figure ??.

   Use the linear regression method to determine the half-hour unit hydrograph for the watershed. The watershed drainage area is 7.03 mi^2. Assume that a uniform loss rate (constant loss model) is valid.[2]

TIME (HRS)	RAIN (IN)	DIRECT RUNOFF (CFS)
0.5	0.28	32.0
1.0	0.12	67.0
1.5	0.13	121.0
2.0	0.14	189.0
2.5	0.18	279.0
3.0	0.14	290.0
3.5	0.07	237.0
4.0		160.0
4.5		108.0
5.0		72.0
5.5		54.0
6.0		44.0
6.5		33.0
7.0		28.0
7.5		22.0
8.0		20.0
8.5		18.0
9.0		16.0

Figure 3: Observed storm rainfall incremental depths and observed direct runoff hydrograph

[2] This exercise is a hybrid of problems 7.6.2 and 7.6.5, pg 239 in Chow, Maidment, and Mays.