Example Problem

Use Snyder's method to develop a UH for the area of 100mi2 described below. Sketch the appropriate shape. What duration rainfall does this correspond to?

$C_t = 1.8$, $L = 18$mi,

$C_p = 0.6$, $L_c = 10$mi

Calculate t_p

$t_p = C_t(LL_C)^{0.3}$

$= 1.8(18 \cdot 10)^{0.3}$ hr,

$= 8.6$ hr

Calculate Qp

$Q_p = 640(c_p)(A)/t_p$

$= 640(0.6)(100)/8.6$

$= 4465$ cfs

Since this is a small watershed,

$Tb \approx 4tp = 4(8.6)$

$= 34.4$ hr

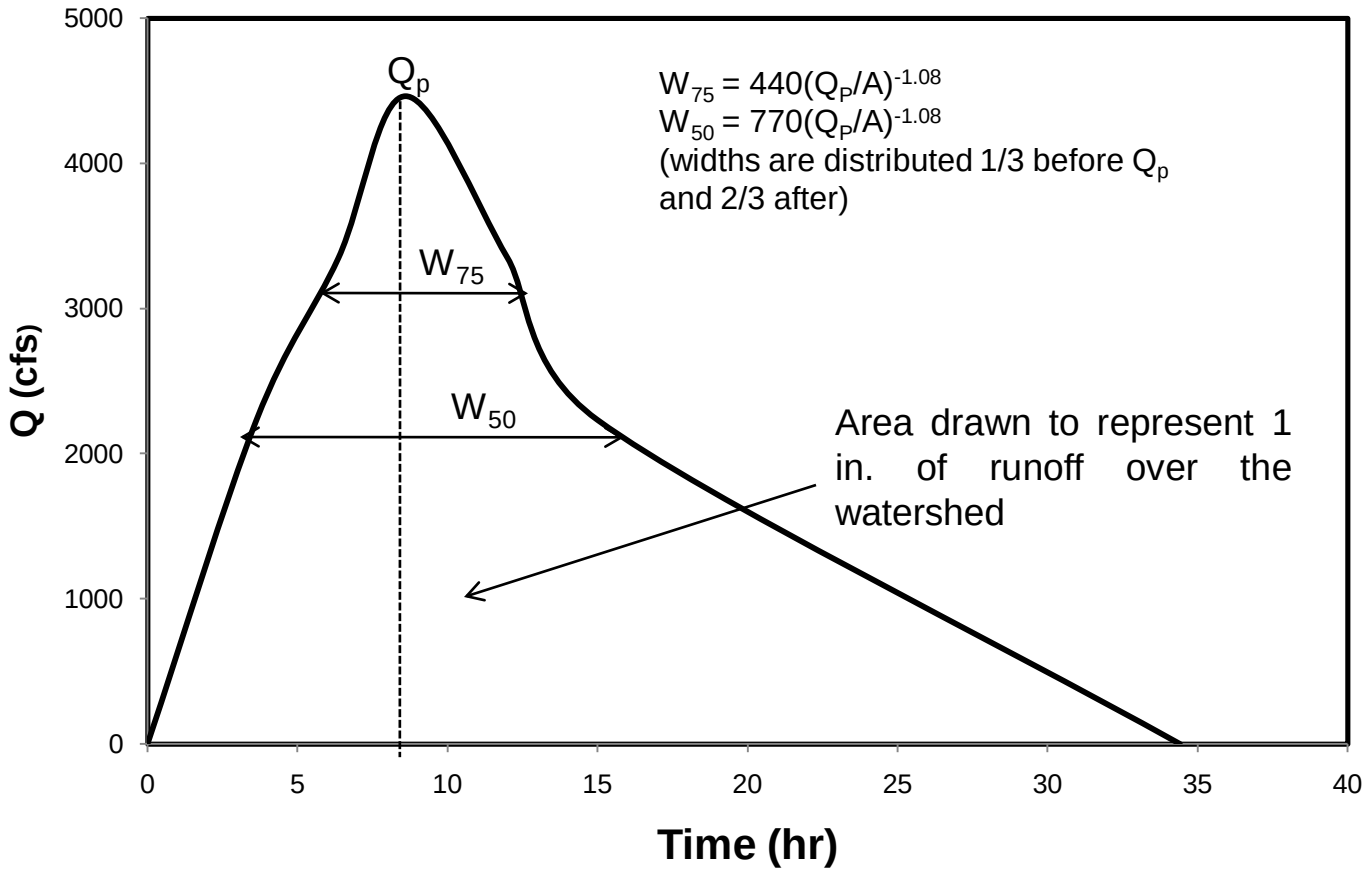
Duration of rainfall

$D = t_p/5.5$ hr

$= 8.6/5.5$ hr

$= 1.6$ hr

Example Problem Contd…



Example Problem

Use the SCS method to develop a UH for the area of 10 mi^2 described below. Use rainfall duration of D = 2 hr

C_t = 1.8, L= 5mi,

C_p = 0.6, L_c= 2mi

The watershed consist CN = 78 and the average slope in the watershed is 100 ft/mi. Sketch the resulting SCS triangular hydrograph .

Solution

Find t_p by the eq.

$$t_p = \frac{L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7}}{19000 y^{0.5}}$$

Convert L= 5mi, or (5*5280 ft/mi) = 26400 ft.

Slope is 100 ft/mi, so y = (100ft/mi) (1mi/5280 ft)(100%) = 1.9%

Substituting these values in eq. of t_p, we get t_p = 3.36 hr

Example Problem Contd…

Find T_R using eq.

$$T_R = \frac{D}{2} + t_p$$

Given rainfall duration is 2 hr, T_R = 4.36 hr, the rise of the hydrograph

Then find Q_p using the eq, given A= 10 mi^2

$$Q_p = \frac{484A}{T_R}$$. Hence Q_p = 1.110 cfs

To complete the graph, it is also necessary to know the time of fall B. The volume is known to be 1 in. of direct runoff over the watershed.

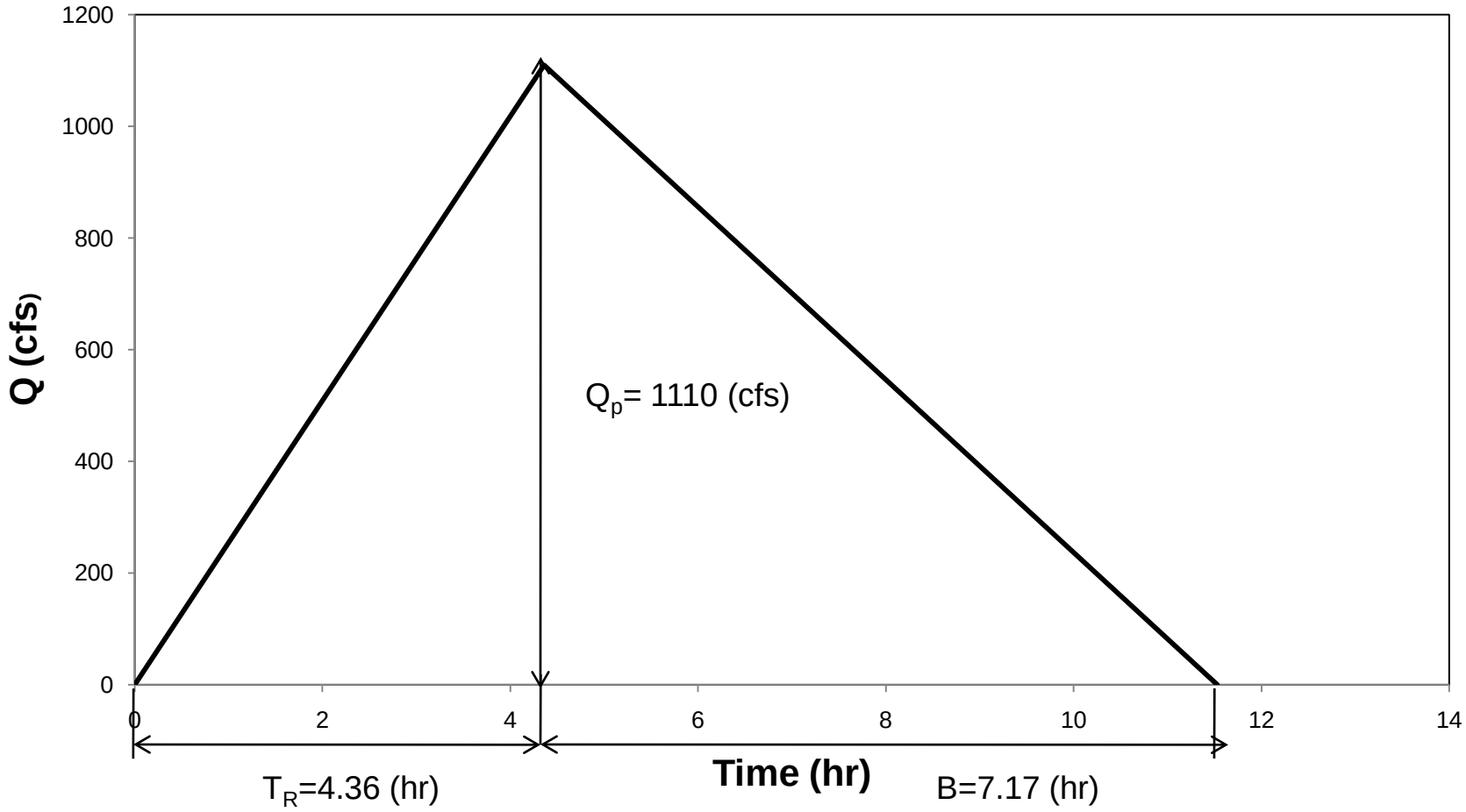
So, Vol. = (10mi^2) (5280ft/mi)^2 (ac/43560ft^2) (1 in.) = 6400 ac-in

Hence from eq.

$$Vol = \frac{Q_p T_R}{2} + \frac{Q_p B}{2}$$

B = 7.17 hr

Example Problem Contd…



Exercise problems

1. The stream flows due to three successive storms of 2.9, 4.9 and 3.9 cm of 6 hours duration each on a basin are given below. The area of the basin is 118.8 km^2 . Assuming a constant base flow of 20 cumec, derive a 6-hour unit hydrograph for the basin. An average storm loss of 0.15 cm/hr can be assumed (Hint :- Use UH convolution method)

Time (hr)	0	3	6	9	12	15	18	21	24	27	30	33
Flow (cumec)	20	50	92	140	199	202	204	144	84	45	29	20

Exercise problems Contd…

2. The ordinates of a 4-hour unit hydrograph for a particular basin are given below. Derive the ordinates of (i) the S-curve hydrograph, and (ii) the 2-hour unit hydrograph, and plot them, area of the basin is 630 km^2

Time (hr)	Discharge (cumec)
0	0
2	25
4	100
6	160
8	190
10	170
12	110

Time (hr)	Discharge (cumec)
14	70
16	30
18	20
20	6
22	1.5
24	0

Exercise problems Contd…

3. The following are the ordinates of the 9-hour unit hydrograph for the entire catchment of the river Damodar up to Tenughat dam site: and the catchment characteristics are , A = 4480 km^2, L = 318 km, L_{ca} = 198 km. Derive a 3-hour unit hydrograph for the catchment area of river Damodar up to the head of Tenughat reservoir, given the catchment characteristics as, A = 3780km^2, L = 284 km, L_{ca} = 184km. Use Snyder's approach with necessary modifications for the shape of the hydrograph.

Time (hr)	0	9	18	27	36	45	54	63	72	81	90
Flow (cumec)	0	69	1000	210	118	74	46	26	13	4	0