1/2

Example 8.3

Use the rational method to determine the 10-year Q_P for the watershed in Fig. 8.6, which is located in Houston (Harris County), Texas. The parking lot and park both slope toward a 100-meter-long swale running between them. Rain falling on the parking lot and park drains as overland flow to the swale and then flows to the watershed outlet. Adjacent land drains elsewhere. Mean flow velocities are 0.8, 0.3, and 1.0 m/s for the parking lot, park, and swale, respectively. Runoff coefficients C are 0.9 and 0.25 for the concrete parking lot and grass park, respectively.

Solution The watershed area is

$$A = (100\text{ m})(100\text{ m}) = 10{,}000\text{ m}^2$$

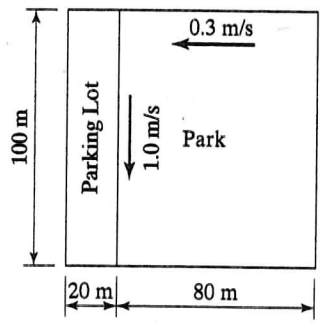

Figure 8.6 The watershed for Example 8.3 consists of a parking lot and a park.

that includes 2,000 m^3 for the parking lot (20 percent of total) and 8,000 m^3 of park. A composite C is computed as an average weighted in proportion to area.

$$C = 20\%(0.9) + 80\%(0.25) = 0.38$$

The most hydraulically remote point in the watershed is the northeast corner of the park. The flow path for determining t_C includes 80 m of overland flow across the park and flow for 100 m in the swale.

$$t_C = T_{\text{park}} + T_{\text{swale}} = \frac{80\text{ m}}{0.3\text{ m/s}} + \frac{100\text{ m}}{1.0\text{ m/s}} = 367\text{ s} = 6.1\text{ min}$$

Eq. 7.50 and Table 7.6 are used to determine the rainfall intensity for a 10-year recurrence interval.

$$i = \frac{a}{(t+b)^c} = \frac{81}{(6.1+7.7)^{0.753}} = 11.2\frac{\text{in.}}{\text{hr}}\left(28.5\frac{\text{cm}}{\text{hr}}\right)$$

The rational formula is applied to determine Q_p.

$$Q_p = CiA\text{ (conversion factors)}$$

$$Q_p = (0.38)\left(28.5\frac{\text{cm}}{\text{hr}}\right)\left(10{,}000\text{ m}^2\right)\left(\frac{\text{m}}{100\text{ cm}}\right)\left(\frac{\text{hr}}{3{,}600\text{ s}}\right) = 0.30\frac{\text{m}^3}{\text{s}}$$

SOURCE: Wurbs & James, 2002

TABLE 7.6 COEFFICIENTS FOR EQ. 7.50 FOR FOUR TEXAS COUNTIES

T	Brazos			Dallas			El Paso			Harris		
years	a	b	c	a	b	c	a	b	c	a	b	c
2	65	8.0	0.806	54	8.3	0.791	24	9.5	0.797	68	7.9	0.800
5	76	8.5	0.785	68	8.7	0.782	34	12.0	0.802	70	7.7	0.749
10	80	8.5	0.763	78	8.7	0.777	42	12.0	0.795	81	7.7	0.753
25	89	8.5	0.754	90	8.7	0.774	60	12.0	0.843	81	7.7	0.724
50	98	8.5	0.745	101	8.7	0.771	90	12.0	0.900	91	7.7	0.728
100	96	8.0	0.730	106	8.3	0.762	65	9.5	0.825	91	7.9	0.706

$$i = \frac{a}{(t+b)^c} \qquad \text{Eq. (7.50)}$$

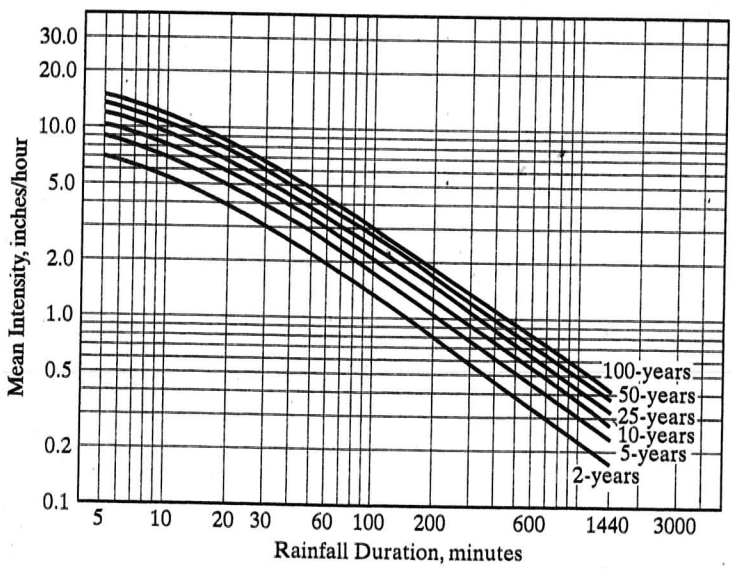

Figure 7.12 Rainfall IDF curves for Dallas County, Texas.

SOURCE: Wurbs & James, 2002