20–40 in. The peaking ratio equations derived for the average annual peak month and average annual peak day are

$$Q_m = Q\left(\frac{1.26}{Q^{0.0101}}\right) \quad (12.36)$$

$$B_m = B\left(\frac{1.91}{B^{0.0430}}\right) \quad (12.37)$$

$$S_m = S\left(\frac{2.18}{S^{0.0517}}\right) \quad (12.38)$$

$$Q_d = Q\left(\frac{1.96}{Q^{0.0360}}\right) \quad (12.39)$$

$$B_d = B\left(\frac{4.08}{B^{0.0732}}\right) \quad (12.40)$$

$$S_d = S\left(\frac{5.98}{S^{0.0716}}\right) \quad (12.41)$$

where

Q = average annual wastewater flow, mgd
B = average annual BOD load, lb/day
S = average annual suspended-solids load, lb/day
Q_m, B_m, S_m = average flow, BOD, and suspended-solids values during the peak month
Q_d, B_d, S_d = average flow, BOD, and suspended-solids values for the peak day

Diurnal flow variations depend primarily on the size of a municipality and industrial flows. Hourly flow rates range from a minimum of 20% to a maximum of 250% or more of the average daily rate for small communities and from 50% to 200% for larger cities. The wastewater flow diagrams in Fig. 12.16 exemplify hourly flow variations for two municipalities of different sizes.

■ **EXAMPLE 12.1** The sanitary sewer system in a municipality located in a humid climate receives over three-quarters of the wastewater discharges from domestic and commercial sources. The average annual wastewater flow is 10.0 mgd, containing 16,700 lb of BOD and 20,000 lb of suspended solids. Calculate the average daily wastewater flow, BOD load, and suspended-solids load during the peak month of the year.

Solution: Applying Eqs. (12.36) through (12.38),

$$Q_m = 10\left(\frac{1.26}{10^{0.0101}}\right) = 12.3 \text{ mgd}$$

$$B_m = 16{,}700\left(\frac{1.91}{16{,}700^{0.0430}}\right) = 21{,}000 \text{ lb/day}$$

$$S_m = 20{,}000\left(\frac{2.18}{20{,}000^{0.0517}}\right) = 26{,}100 \text{ lb/day}$$

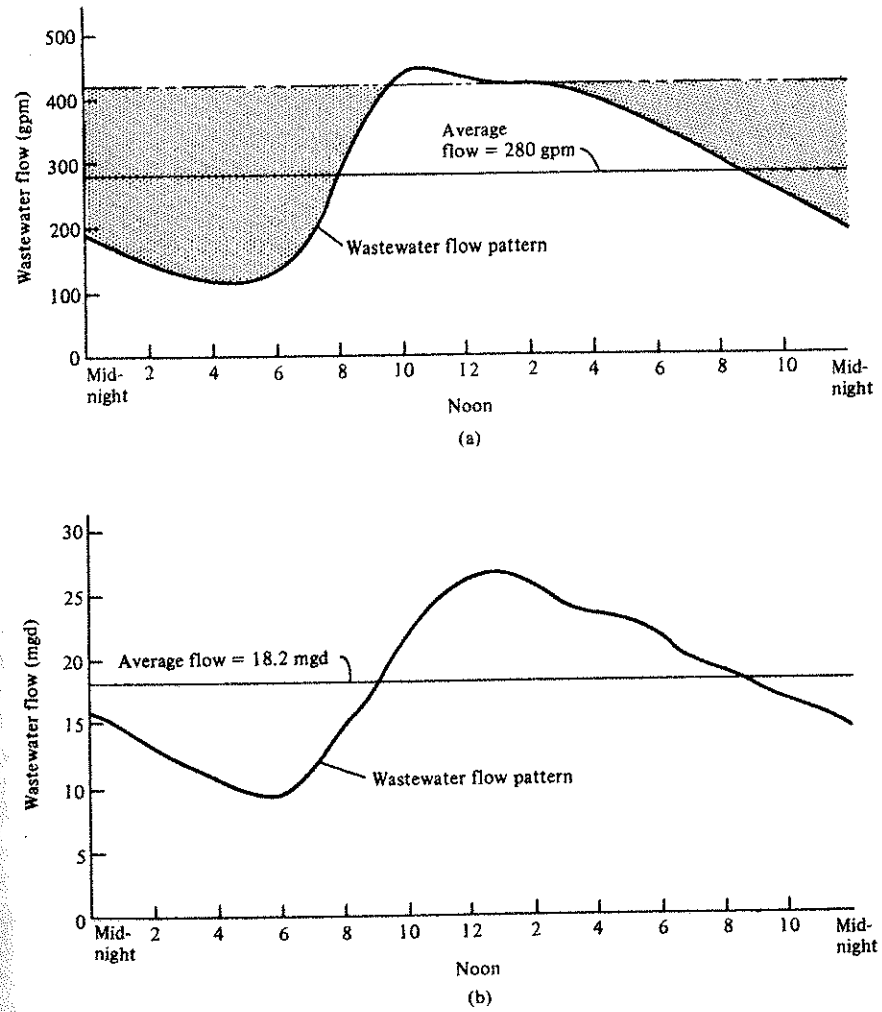

Figure 12.16 Diagrams of municipal wastewater flow showing hourly variations. (a) Flow diagram from a town with a population of 4500. (Shaded area is the typical recirculation flow for a high-rate trickling-filter plant at R = 0.5.) (b) Flow diagram from a city with a population of 150,000.