■ **EXAMPLE 12.4**

Calculate the BOD and hydraulic loadings and BOD removal efficiency of a single-stage high-rate trickling filter based on the following data:

wastewater flow pattern = as shown in Fig. 12.16a

recirculation rate = as shown in Fig. 12.16a

settled wastewater BOD (primary effluent) = 130 mg/l

diameter of filter = 12.5 m

depth of media = 2.1 m

Solution

raw-wastewater flow = 280 gpm = 1530 m^3/d

recirculation flow = $0.50 \times 1530 = 765\ m^3/d$

$$\text{BOD load} = 1530\ m^3/d \times 130\ mg/l \times \frac{kg/m^3}{1000\ mg/l} = 200\ kg/d$$

surface area of filter = $\pi(12.5)^2/4 = 122\ m^2$

volume of media = $122 \times 2.1 = 256\ m^3$

$$\text{BOD loading} = \frac{200{,}000\ g}{256\ m^3} = 781\ g/m^3 \cdot d = 48.8\ lb/1000\ ft^3/day$$

$$\text{hydraulic loading} = \frac{1530\ m^3 + 765\ m^3}{122\ m^2} = 18.8\ m^3/m^2 = 0.32\ gpm/ft^2$$

By Eqs. 12.43 and 12.42,

$$F = \frac{1 + 0.5}{(1 + 0.1 \times 0.5)^2} = 1.36$$

$$E = \frac{100}{1 + 0.0561(48.8/1.36)^{0.5}} = 75\%$$

TF-3