uation 8.57 depends on the food-to-micro- ratio, as given in table 8.17. K is the frac- of BOD that appears as excess biological solids. rickling filters and extended aeration, K ranges 0.2 to 0.33. For conventional and step aeration, K s from 0.33 to 0.42. K is known as the *cell yield ld coefficient.*

Table 8.17
Cell Yield (Yield Coefficient)

$R_{F:M}$	K
0.05	0.2
0.07	0.21
0.1	0.24
0.15	0.28
0.2	0.33
0.3	0.37
0.4	0.4
0.5	0.43

tions 8.56 and 8.57 give dry weight of sludge. As- ng the sludge specific gravity is near 1, the vol- of wet sludge with a solids concentration, s, can und from the dry weight by using equation 8.58.

$$\text{lons of sludge/day} = \frac{\text{dried weight per day, lbm}}{(s)(8.345)} \qquad 8.58$$

al values of s are given in table 8.18.

Table 8.18
Total Sludge Solids, s
(also, see table 8.16)

source or type of sludge	s, as fraction
primary settling tank sludge	0.06 to 0.08
primary settling tank sludge mixed with filter sludge	0.04 to 0.06
primary settling tank sludge mixed with activated sludge from aeration lagoons	0.03 to 0.04
excess activated sludge	0.005 to 0.02
filter backwashing water	0.01 to 0.1
softening sludge	0.02 to 0.15

specific gravity of the wet sludge is:

$$\frac{1}{G)_{\text{total}}} = \frac{\text{fraction moisture}}{1.0} + \frac{\text{fraction solids}}{(SG)_{\text{solids}}} \qquad 8.59$$

ume of sludge is:

$$V = \frac{W}{(SG)_{\text{total}}(62.4)} \text{ in ft}^3\text{/day} \qquad 8.60$$

Example 8.8

A trickling filter plant processes domestic waste with the following characteristics: 190 mg/l BOD, 230 mg/l SS, and 4,000,000 gpd.

(a) What is the wet sludge volume from the primary sedimentation tank and trickling filter? Assume the combined sludge solids content is 5%.

(b) What is the approximate weight of dry solids produced per person-day?

step 1: Find the weight of the dry solids obtained from the primary settling basin. From equation 8.56, assuming 50% of solids can be removed.

$$W_p = (0.5)(230)(4\,\text{EE6})(8.345\,\text{EE}\ 6)$$
$$= 3839\,\text{pounds/day}$$

Assume a 30% BOD reduction, so the BOD leaving the basin is $(0.7)(190) = 133$ mg/l.

step 2: Assume a cell yield value of 0.25. Then, the weight of dry solids from the filter is given by equation 8.57.

$$W_s = (0.25)(133)(4\,\text{EE6})(8.345\,\text{EE}\ 6)$$
$$= 1110\,\text{pounds/day}$$

step 3: The wet sludge volume can be found from equation 8.58.

$$\frac{3839 + 1110}{(0.05)(8.345)} = 11{,}860\,\text{gallons/day}$$

step 4: The equivalent population is given by equation 8.12.

$$P_e = \frac{(190)(8.345)(4)}{0.17} = 37{,}310\,\text{people}$$

step 5: The per capita dried solids rate is

$$\frac{3839 + 1110}{37{,}310} = 0.13\frac{\text{lbm dry solids}}{\text{person-day}}$$

B. SLUDGE THICKENING

Since the volume of wet sludge is inversely proportional to its solids content (equation 8.58), thickening of sludge is desirable. Thickening is required to at least 4% solids if dewatering is to be feasible. *Gravity thickening* uses a stirred sedimentation tank into which sludge is fed. A doubling of solids content is usually possible with a gravity thickener.