made to locate the 20, 30, 40, 50, 60, and 70 percent removal curves, and the curves have been drawn on the plot. The 20 percent curve intersects the x-axis at 16 minutes; thus, the overflow rate at that time is

$$V_o = \frac{10\,\text{ft}}{16\,\text{min}} \left| \frac{1440\,\text{min}}{\text{day}} \right| \frac{7.48\,\text{gal}}{\text{ft}^3}$$
$$= 6730\,\text{gal/day-ft}^2$$

The detention time in hours is 16/60 or 0.27 hours. The point midway between the 20 and 30 percent curves at 16 min is located as shown and is at a depth of 6.7 ft. In a like manner, the points midway between the 30 and 40, 40 and 50, 50 and 60, and 60 and 70 percent curves are located and the respective depths are 2.9, 2.0, 1.3, and 0.8 ft. Using these values, the total fraction removed (R_T) at 16 min (0.27 hr) is

$$R_T = 20 + (6.7/10)(30-20) + (2.9/10)(40-30) + (2.0/10)(50-40) + (1.3/10)(60-50) + (0.8/10)(70-60)$$
$$= 33.7\,\text{percent}$$

Similarly, the overflow rates, detention times, and total fractions removed are computed for the 30, 40, 50, and 60 percent curves and a summary of the reduced data is shown in Table 3.2.

Table 3.2. Reduced Data for 30, 40, 50, and 60 Percent Curves

Time t (hr)	Overflow Rate V_o (gal/day-ft^2)	Fraction Removed R_T (%)
0.27	6730	33.7
0.55	3260	48.7
0.77	2340	56.7
1.13	1590	63.8
1.60	1120	68.6

A plot of the fraction removed (R_T) versus detention time (t) is shown in Figure 3.12. Also, a plot of the fraction removed (R_T) versus overflow rate (V_o) is shown in Figure 3.13. For 65 percent removal the detention time is 1.22 hr; thus, the design detention time is (1.22)1.75 = 2.14 hr. For 65 percent removal the overflow rate is 1420 gal/day-ft^2; thus, the design overflow rate is (1420)(0.65) = 923 gal/day-ft^2. The required area is

$$A = \frac{2{,}000{,}000\,\text{gal}}{\text{day}} \left| \frac{\text{day-ft}^2}{923\,\text{gal}} \right. = 2167\,\text{ft}^2$$

Thus, the diameter, D, is

$$D = \left[\frac{4}{\pi}(2167)\right]^{1/2} = 52.5\,\text{ft or } \underline{55\,\text{ft for standard size}}$$

The required depth, H, is

$$H = \frac{2{,}000{,}000\,\text{gal}}{24\,\text{hr}} \left| \frac{2.14\,\text{hr}}{} \right| \frac{\text{ft}^3}{7.48\,\text{gal}} \left| \frac{4}{\pi} \right| \frac{}{(55\,\text{ft})^2}$$
$$= 10.03\,\text{ft} \quad \underline{\text{Use 10 ft-3 in.}}$$

Figure 3.12. Suspended Solids Removal versus Detention Time, for Example Problem 3.1

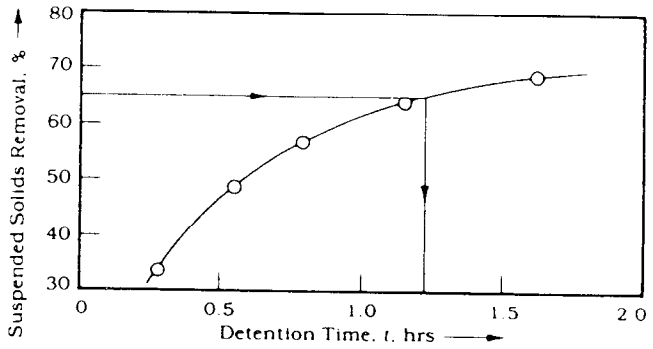
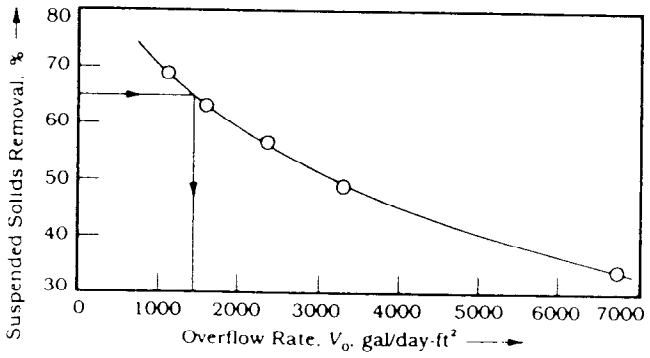


Figure 3.13. Suspended Solids Removal versus Overflow Rate, for Example Problem 3.1



SET-2