

Example Problem 3.2
Final Clarifier

A final clarifier is to be designed for an activated sludge plant treating an industrial wastewater having a design flow of 1.2 MGD. Batch settling studies have been performed in the laboratory using an acclimated culture of activated sludge and a graduate cylinder with a very slow rotating stirrer. The MLSS in the test was 2500 mg/l. The interface height versus settling time is shown in Figure 3.17. The design MLSS is 2500 mg/l and the design underflow concentration is 10,000 mg/l. Determine:

1. The area required for clarification.
2. The area required for thickening.
3. The design diameter.

Solution

A material balance for the recycle is

$$(1.2 \text{ MGD})(0) + (R)(10,000) = (1.2 \text{ MGD} + R)(2500)$$

Thus, $R = 0.40 \text{ MGD}$. The interface height of the underflow is $H_u = C_o H_o / C_u = (2500)(2.13/10,000) = 0.53 \text{ ft}$. The bisecting angle and tangent construction is shown on the graph, and the intersection within the H_u line gives a t_u value of 48 min. The settling velocity, V_o , is 3.48 ft/hr. The area required for thickening is

$$A_t = 1.5(Q + R) \frac{t_u}{H_o}$$

1.5	$1.60 \times 10^6 \text{ gal}$	48 min	ft ³
	1440 min	2.13 ft	7.48 gal
= 5021 ft ²			

The area required for clarification is

$$A_c = 2.0 \frac{Q}{V_o}$$

2.0	$1.2 \times 10^6 \text{ gal}$	hr	ft ³
	24 hr	3.48 ft	7.48 gal
= 3842 ft ²			

The area for thickening controls, thus the diameter, is

$$D = \left[\frac{4}{\pi} (5021 \text{ ft}^2) \right]^{1/2}$$

= 80.0 ft Use 80.0 ft for standard size.

Figure 3.17. Graph for Example Problem 3.2

