

square foot surface area of the clarifier.

$$\text{Clarifier hydraulic loading} \left(\frac{\text{gpd}}{\text{ft}^2} \right) = \frac{\text{Clarifier influent flow}(\text{gpd})}{\text{Clarifier surface area}(\text{ft}^2)}$$

Rectangular clarifier surface area = width * length

Circular clarifier surface area = $0.785 * \text{Diameter}^2$

4.7.2 Detention Time

Detention time is the length of time that wastewater stays in the settling tank is called the detention time. It is also the time it takes for a unit volume of wastewater to pass entirely through a primary clarifier

$$\text{Clarifier detention time (hr)} = \frac{\text{Clarifier volume}(\text{cu.ft or gal})}{\text{Influent flow (cu.ft or gal)/hr}}$$

Rectangular clarifier volume = width * length * depth of water

Circular clarifier volume = $0.785 * \text{Diameter}^2 * \text{depth of water}$

Typically volume is calculated in cu. ft and influent flow is given in gallons. Use 7.48 gal/ft³ conversion factor to convert volume in cu. ft to gallons.

4.7.3 Weir Overflow Rate

The weirs at the end of the primary clarifier allow for the even distribution of the the outlet flow across the entire length of the weir. An adequate length of weir is needed to ensure smooth and even flow of wastewater over the weirs. Weir overflow rate measures the number of gallons of wastewater per day flowing over one foot of weir.

$$\text{Weir over flow rate} \left(\frac{\text{gpd}}{\text{ft}} \right) = \left(\frac{\text{Clarifier influent flow}(\text{gpd})}{\text{Total effluent weir length (ft)}} \right)$$

Circular clarifier weir length = $3.14 * \text{Diameter}$

Example problem for (a), (b) and (c) above:

A circular clarifier receives a flow of 11 MGD. If the clarifier is 90 ft. in diameter and is 12 ft. deep, what is: a) the hydraulic/surface loading rate, b) clarifier detention time in hours, and c) weir overflow rate?

a) Hydraulic/surface loading rate:

$$\text{Clarifier hydraulic loading} \left(\frac{\text{gpd}}{\text{ft}^2} \right) = \frac{\frac{11 \text{MG}}{\text{day}} * \frac{10^6 \text{gal}}{\text{MG}}}{0.785 * 90^2 \text{ft}^2} = \boxed{1,730 \text{gpd/ft}^2}$$

b) Clarifier detention time:

$$\text{Clarifier detention time (hr)} = \frac{\text{Clarifier volume}(\text{cu.ft or gal})}{\text{Influent flow (cu.ft or gal)/hr}}$$

$$\text{Clarifier detention time (hr)} = \frac{(0.785 * 90^2 * 15) \text{ft}^3}{\frac{11 \text{MG}}{\text{day}} * \frac{10^6 \text{gal}}{\text{MG}} * \frac{\text{ft}^3}{7.48 \text{gal}} * \frac{\text{day}}{24 \text{hrs}}} = \boxed{2 \text{hrs}}$$