$$Q = 1\frac{ft}{s} * (2 * 0.5)ft^2 = 1\frac{ft^3}{s}$$

$$Q = 1\frac{\cancel{ft^3}}{\cancel{s}} * \frac{(1440 * 60)\cancel{s}}{day} * 7.48\frac{gal}{\cancel{ft^3}} = \boxed{646,272\frac{gal}{day}}$$

3. A wastewater channel is 3.25 feet wide and is conveying a wastewater flow of 3.5 MGD. The wastewater flow is 8 inches deep. Calculate the velocity of this flow.

Solution:

Velocity = Distance/Time

Area = height (h) x width (w)

Area x Velocity = Volume/Time (Flow Rate)
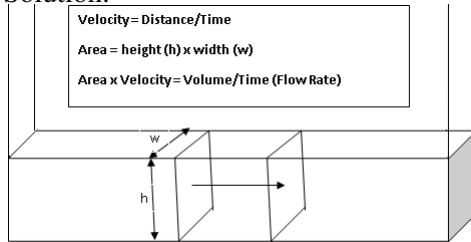
$$Q = V * A \implies V = \frac{Q}{A}$$

$$\implies V\frac{ft}{s} = \frac{3.5\frac{MG}{day} * \frac{1000000\cancel{gal}}{MG} * \frac{ft^{\cancel{3}}}{7.48\cancel{gal}} * \frac{\cancel{day}}{(1440*60)s}}{(3.25*0.75)\cancel{ft^2}} = \boxed{2.2\frac{ft}{s}}$$

4. A plastic float is dropped into a wastewater channel and is found to travel 10 feet in 4.2 seconds. The channel is 2.4 feet wide and is flowing 1.8 feet deep. Calculate the flow rate of this wastewater in cubic feet per second.

Solution:

$$Q = V * A$$

$$\implies Q\left(\frac{ft^3}{s}\right) = \frac{10ft}{4.2s} * (2.4 * 1.8)ft^2 = \boxed{10.3\frac{ft^3}{s}}$$

4.6.2 Grit Removal Rates

Typical grit removal ranges from 0.5 to 30 ft³/MG

Example Problems:

1. At a wastewater treatment plant which receives a flow rate of 650,000 gallons per day, a total of 50 cubic feet of grit was removed for the month. Calculate the rate of grit removal assuming 30 days in a month.

Solution:

$$GritRemoval\frac{ft^3}{MG} = 50\frac{ft^3}{\cancel{month}} * \frac{\cancel{month}}{30\cancel{days}} * \frac{\cancel{day}}{650,000\cancel{gal}} * 1,000,000\frac{\cancel{gal}}{MG} = \boxed{2.6\frac{ft^3}{MG}}$$

4.7 Primary Treatment Calculations

4.7.1 Hydraulic or Surface Loading Rate

The hydraulic or surface loading rate measures how rapidly wastewater moves through the primary clarifier. It is measured in terms of the number of gallons flowing each day through one