SUPPLEMENT GO w/FLOW

ANSWER SHEET

a) To calculate the volume of this pipe:

$\pi r^2 l = \pi (1.5 \text{ ft})^2 (1111\text{ft}) = 7{,}853.2$ cu. ft.

How many gallons can 7853.2 cu. ft hold?

(7.48 gallons/cu.ft) x (7,853.2 cu. ft) = 58,741.9 gallons

Flow rate 20 million gallons/day = 13,888.9 gallons per minute (need conversion number for minutes per day)

So 58,741.9 gallons ÷ 13,888.9 gallons per minute = **4.2 minutes**

b) What is the velocity in the pipe in feet per second?

We now know it takes 4.2 minutes for the water to travel a distance of 1111 feet.

Let's find out how many feet the water travels per second.

1111 ft/4.2 minutes = 264.52 ft/minute= **4.4 ft. per second**.

As a great thought exercise, and to extend the lesson, I propose asking the very same question about an 1111 ft long pipe with a 20 MGD flow rate, but I would change the diameter of the pipe and make it smaller. Students are likely to expect that the water will travel through the pipe more slowly, and that it would take longer to get from one end to the other, but in fact just the opposite is true. This is called Bernoulli's principle of fluid dynamics and could tie in really nicely to physics!