Average Linear Velocity Of Groundwater

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A. Identify is the direction of groundwater flow (i.e. Well A to B or Well B to A)

Well	head (m)
A	159.5
B	156

As we know water flows from high energy to low energy. In this case energy is expressed as total hydraulic head.

Based on head in the wells water is flowing from: **Well A to Well B**

B. Quantify the travel time between wells in the gravel aquifer

To determine the travel time we need to know the average linear velocity. So lets start with Darcy's law...

$$q = -k\frac{dh}{ds}$$

where $k = 10\ cm/sec = 0.1\ m/sec$

$h_1 = 159.5m$

$h_2 = 156m$

$ds = 550m$

$$q = -0.1\ m/sec\ \frac{156\ m - 159.5m}{550m}$$

$$q = 6 \times 10^{-4}\ m/s$$

Now solve for $\bar{V}$ (ave. lin. velocity)

$$\bar{V} = \frac{q}{n_e} = \frac{6 \times 10^{-4}\ m/s}{0.21} = 3 \times 10^{-3}\ m/s$$

We know that velocity is just distance divided by time. So lets solve for time.

$$V = \frac{d}{t} \Rightarrow t = \frac{d}{V}$$

$$t = \frac{550\ m}{3 \times 10^{-3}\ m/s} = 183{,}333\ sec$$

Seconds is not super useful here so lets convert to days.

or

$t = 2$ days

C. Determine the total groundwater discharge (Q) through the confined gravel aquifer.

Lets go back to Darcy's law to determine the total discharge through the aquifer.

$$q = \frac{Q}{A} \Rightarrow Q = qA$$

where $A = 500m \times 80m$

$$Q = 6 \times 10^{-4}\ m/sec\ (500m \times 80m)$$

$Q = 24\ m^3/sec$