CE 5364 Groundwater Transport Phenomena
Exercise Set 1

Exercises

1. A sand column has the following characteristics[1]:

$$K = 10^{-4}\frac{cm}{s};\;\; A = 75cm^2; \qquad \frac{dh}{dl} = 0.01;\;\; n = 0.20 \tag{1}$$

   Determine:

   (a) Sketch the system.

   (b) The specific discharge.

   (c) The pore velocity.

   (d) The volumetric flow rate through the column.

[1] Problem 2-3, pg. 578 in Bedient, et. al.

2. Three geologic formations overlie one another with the characteristics listed below.[2]

$$\begin{aligned} b_1 &= 50\ ft & K_1 &= 0.0002\frac{ft}{s} \\ b_2 &= 20\ ft & K_2 &= 0.000005\frac{ft}{s} \\ b_3 &= 210\ ft & K_3 &= 0.001\frac{ft}{s} \end{aligned} \tag{2}$$

A constant velocity vertical flow field exists across the three formations. The hydraulic head at the top of the formations (top of formation 1) is 33 feet. The hydraulic head at the bottom of the formations (bottom of formation 3) is 21 feet.

Determine:

(a) Sketch the system.

(b) The hydraulic head at the internal boundary between formation 1 and 2.

(c) The hydraulic head at the internal boundary between formation 2 and 3.

(d) Approximate time for a tracer to flow (vertically) through the three layers if the porosities n_1, n_2, and n_3 are 0.30,0.42, and 0.35, respectively

[2]Problem 2-12, pg. 579 in Bedient, et. al.