Your Name:

CEE 370	Fall 2019

Homework #6

1. Groundwater and contaminant flow

Two groundwater wells are located 500 m apart within the same aquifer. Well #1 has a water level at 373 ft above mean sea level. The second well's water level is 401 ft above mean sea level. The mean hydraulic conductivity in this aquifer is 0.3 m/day, and the porosity is 0.45. Determine the following:

a. Darcy's velocity between the wells

b. True velocity between the wells

c. The time it takes for water to travel between the two wells

d. The time it takes for a contaminant to travel between the two wells. Assume that the contaminant has an affinity for the soil such that at any given time, 80% of it will be adsorbed and 20% will be dissolved in the water.

e. Calculate the partition coefficient (K) for this contaminant in units of L/kg. Use the information in part "d", the porosity, and assume an aquifer soil particle density (ρ_s) of 2.2 g/cm^3.

2. Lake Modeling

Julana Lake has a surface area of 4.1 x 10^6 m^2. The average depth of the lake is 15 m. The lake is fed by a stream having a flow rate of 2.02 m^3/s and a phosphorus concentration of 0.023 mg/L, A wastewater treatment plant discharges into the lake at a rate of 0.2 m^3/s and a phosphorus concentration of 1.1 mg/L. Runoff from the homes along the lake adds phosphorus at an average rate of 1.35 g/s. The settling rate of phosphorus from the lake averages 0.94 y^{-1}. The river flows from the lake at a flow rate of 2.42 m^3/s. Assume evaporation and precipitation to negate each other. Assume steady state conditions apply.

a. Make a clear sketch of the problem
b. What is the concentration of phosphorus in the river flowing from the lake?
c. Calculate the expected phosphorus concentration leaving the lake if there was a reduction in phosphorous concentration in the wastewater to 0.2 mg/L.

Given (from above): Surface area = 4.1 x 10^6 m^2, depth = 15 m, Q_{in} = 2.02 m^3/s, P_{in} = 0.023 mg/L, Q_{ww} = 0.2 m^3/s, P_{ww} = 1.1 mg/L or 0.2 mg/L, runoff = 1.35 g/s, settling rate = 0.94 y^{-1}, Q_{out} = 2.42 m^3/s, assuming evaporation and precipitation negate one another and system is steady state.

Assigned: 1 November 19
Due: 8 November 19

Your Name:

Answer Page

Fill in the boxes with the correct answer.

You will only get credit for a problem if you (1) fill in the box with the correct answer, (2) your answer is legible, and (3) you include attach page(s) with calculations backing up your answer, when requested for the problem.

Problem #

1	a.		m/s
	b.		m/s
	c.		yr
	d.		yr
	e.		L/kg

2	a (sketch)		
	b		mg/L
	c		mg/L