**TIM 155 2017: Problem Set 4**

Due Thursday, May 4, in class.

1. An analysis of the hydrology of a lake shows average inflows of 7 cfs, and an average volume of 88 thousand acre-feet (taf). Four factories are point-source polluters into the lake of a total of 60 tonnes per year of pollutant A. There also are farms with non-point-source runoff of the same pollutant (pollutant A) into the lake. The lake concentration of pollutant A is 29 ppm. Your job is to estimate the relative impact of ***non-point sources*** of pollutant A on the lake.

1.a Convert lake inflow (7 cfs) and volume (88 taf) into metric mass equivalents (tonnes/yr and tonnes, respectively). (0.5 points)

1.b Provide two assumptions that will simplify your mathematical task (0.5 points)

1.c Calculate the residence time in years of point-source discharges of pollutant A in the lake. (0.5 points)

1.d (*This is a side note to the rest of the question.)* 60 te per year may seem like a lot, but try converting it into cfs. Assume mass equivalent to water. (But we can’t really decide whether this is a lot or a little unless we know the potential this pollutant has to cause damage, which isn’t stated.) (0.5 points)

1.e Calculate the quantity (in tonnes) of pollutant A from point sources in the lake. (0.5 points)

1.f If factories were the only source of pollutant A, what would be the lake’s concentration of pollutant A? What is the remaining unaccounted-for concentration (i.e., how many ppm are left over)? What percentage of the total concentration of pollutant A in the lake comes from non-point sources? (0.5 points)

1.g How many tonnes of pollutant A do you estimate are entering the lake each year from non-point sources? (0.5 points)

2. Many people believe that California provides a wonderful quality of life to its residents. Water availability and consumption play an important role in Californians’ quality of life. Your challenge is to determine if there is enough water in the world for everyone to consume water the way California does? Answer this question both for the world as a whole as well as for the major regions of the world. Your answer will require text, calculations, and tables. *(You can find a list of regions in Table 2 of our FAO Review of World Water Resources, p. 35 of the pdf. A different set of regions can be found in Table 1 of World Population Prospects, p. 7 of pdf. Either can be used.)*

2.a Explain how you will account for the different water-use sectors in California. (environmental, agricultural, domestic, industrial, etc.). *Hint: it is OK to make simplifying assumptions – just say what they are and why you are making them.* (0.5 points)

2.b For every data source give a citation. (0.5 points)

2.c Explain your calculations. (0.5 points)

2.d Your answer should include a table that lists (a) regions; (b) how much water is needed for the region’s population to consume water at the same rate California does; (c) available water supply to the region; and (d) either how much extra water the region has beyond what is needed or how much additional water is needed to consume the way California does. The table could have (a) through (d) as its columns. It should be clearly labeled, use consistent units, and be neatly presented, and be accompanied by a paragraph that explains your findings. (0.5 points)

2.e Be sure that you always list the units of the numbers in your text and tables. (e.g., gallons per day; cubic kilometers per year). Also show your conversions. (0.5 points)

3. In the *FAO Review of World Water Resources*, compare Table 6 with the United States row in Table 11. The numbers are different. First explain what the differences are with respect to internal renewable water resources and external renewable water resources. Then offer at least two reasons from the nearby text about why the numbers for this one country may be so different. (0.5 points)

4.a This week’s required reading from the UN World Water Development Report first describes global water scarcity and then focuses on possible technological solutions to meet water supply and quality needs. In a couple of paragraphs, summarize the key points of Ch. 2. Then say which figure in Chapter 2 you found most interesting and why. (0.5 points)

4.b Now summarize the key points of Chs 15 and 16 (they are very short chapters!). Underline in your answer what you think is the single most important point. Then go on line and look for private company solutions that are related to or solve the problem/issue you thought was most important. Explain what you found. (0.5 points)

5. 4 million acre-feet of water pass through a hydropower system every year. The system includes a drop to the turbines of 10 meters. Assuming a 90% efficiency rate, how many MW will be generated if all the water passes through the turbines? Show your work. (0.5 points)