CEE3361 **Water Resources Management** **S.P.Simonovic**

Assignment 1

Basic calculations of water management

Background—While it is important for the water manager to know subjects such as hydrology, hydraulics, and environmental engineering, many water management decisions are based on general concepts without much engineering detail. Thus, an engineer who knows a subject in great detail may be at a disadvantage without being aware of other broad issues. As a starting point to understand water management, the assignment presents basic units and calculations across these broad issues. The problems are simple and designed to give you a feel for how water quantities and rates of flow are measured. In water management, the measurement of volumes and rates of flow depends on the amount of water involved, from an individual glass of water to the contents of a giant reservoir, or from the flow of a household tap to flow of the St. Lawrence River.

Problems

PART A (in class)

1. A fire hydrant in front of a residence is measured to have a minimum discharge of 160 gallons per minute. How many liters/sec is that?
2. For a city of 450,000 people and an annual average water use of 350 liters per capita per day. How many million cubic meters do they use in a year?
3. The Fanshawe reservoir contains 12 billion liters of water. How many million cubic meters is that?
4. What is the water usage of a house during February if there are four persons using an average of 300 liters each per day?
5. Find
    a. What is the average rate of water flow required for a city of 350,000 population, with a per capita use of 350 liters per capita per day? Express in cubic meters per day.
    b. The same city's peak day and peak hour will be important in designing storage and treatment facilities. Factors for these vary, but if peak day ratio is 2.5 and the peak hour ratio is 6.0 times the average hour, what will be the peak day and peak hour demands?

6. It is common to convert rates of flow, which may be given in units such as average m^3/sec during a day, week, or month to volumes of water that flow in the same time period or an accumulation of time periods. Mean monthly flows of Thames River hydrometric station "North Thames River near Thorndale" which provides more than 95% of the inflows for the Fanshawe reservoir are given below in m^3/sec. Find the total flow volume for the year in million cubic meters.

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Mean flow (m^3/sec)	18.80	23.50	46.66	35.35	13.89	6.58	4.96	4.18	6.93	9.76	18.09	23.21

7. The following are annual discharges in m^3/sec reported for some rivers: Mississippi – 17,555 m^3/sec; Nile – 11,890 m^3/sec; Amazon – 203,882 m^3/sec; Danube – 6,500 m^3/s. Convert the flows to km^3/year.

8. A reservoir has a capacity of 5,000 acre-feet. How many gallons is that? How many cubic meters?

PART B (at home)

9. An area of 10,000 Ha is expected to receive 6 mm of rainfall in the next 24 hours. A nearby reservoir has 10 million gallons in storage and is expected to handle all the incoming rainfall volume. Find the total required reservoir storage in million cubic meters.
10. Estimate your personal daily water consumption (average over three days): include shower, bathroom use, drinking, washing, cooking, etc.
    a. Describe the procedure you used to estimate your water use in details.
    b. Find out what is the water rate in London?
    c. Calculate your daily water cost per category of use according to the current rate?

Due Thursday, January 19, 2012