

NATIONAL EXAMINATION DEC 2003

98 - CIV – B4

Engineering Hydrology

3 Hours Duration

Notes:

1. Questions have the value shown.
 2. If doubts exist as to the interpretation of any question, clearly state all your assumptions and the question will be marked accordingly.
 3. Any non-communicating calculator is allowed.
 4. The exam is open book.
 5. Graph paper (6 sheets) is provided.
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1. What will be the maximum flow at the effluent of the parking lot shown on Figure 1 for the rain event tabulated below. Note that the triangular part of the parking lot is covered with gravel, and the rectangular part is paved. Flow velocity is 0.4 m/s on pavement, 0.2 m/s on gravel. A paved gutter, that runs in between the paved and the gravel part of the parking lot collects all the water and brings it to the end of the parking lot.

Rain event: 00 – 10 min: 9.0 cm/h
 10 – 20 min: 12.0 cm/h

(Value : 20%)

2. A new subdivision is planned near Ottawa. The 300 residential lots, of dimension 12 m × 25 m, are separated by a paved street 8 m wide by 2040 m long. The houses, of dimension 8 × 12 m, have gutters that direct the water collected on the roof to the grass (lawn, good hydrologic condition). Paved driveways, of dimension, 4 m × 7 m, drain to the streets. A park (lawn, fair hydrologic condition), of dimensions 50 m × 240 m, completes the subdivision. The grounds are relatively flat. The soil is Lansdowne clay. The time of concentration of the whole catchment is 30 minutes.
- What is the area of the subdivision, in m²?
 - To design the storm sewer exiting the subdivision, calculate the **maximum** amount of runoff generated by a 5 year storm on that catchment, in m³. Solve using the curve number method. Tabulate and explain all calculations and assumptions.
 - What would be the equivalent average runoff coefficient for the whole subdivision, i.e., the coefficient that, if used to calculate the runoff using the Rational method, would generate the same amount of runoff for this watershed?

(Value 20%)

3. The direct runoff hydrograph (hydrograph with baseflow removed) generated by a 4 hour storm on a watershed of 4320 hectares is tabulated below. What direct runoff hydrograph will result from a 6 hour storm that generates 2 cm of runoff on the same watershed?

Time (h)	Flow rate (m ³ /s)
0	0
4	10
8	30
12	20
16	10
20	5
24	0

(Value: 20%)

4. A city has dug a well to the aquitard (elevation of the aquitard: 115 m above sea level) in an aquifer where the water table was at 129.1 m. The city draws 3 L/s of water from the well. The water levels, at equilibrium, in three wells located in proximity of the city's well are presented in the table below.

Well	1	2	3
Radial distance (m)	10	100	200
Water elevation (m)	116.5	118.3	119.0

- a. Calculate the hydraulic conductivity (K) and the transmissivity (T) of this aquifer. Indicate units. Justify briefly your approach, i.e., formula, data used, hypotheses, ...
- b. Well No. 3 is the well of a neighboring town, and well No. 2 is an observation well for an experimental station. If the water table drawdown in these wells must not exceed 25 cm (well 3) and 1 m (well 2), respectively, what is the maximum flow rate at which the city can pump water from its well?

(Value 20%)

5. The annual maxima series has been extracted from the complete duration series for a river. The mean, standard deviation, and skew coefficient of the logarithm (base 10) of the flow rates are 2, 0.2, and -1.4 respectively. The flow rates are measured in m^3/s .
- a) What is the 100 year flood predicted by the Log Pearson III method?
- b) What is the probability that this flow rate will occur once in the next year?
- c) What is the risk that this flow rate will occur at least once in the next 100 years?
- d) Say you have at your disposal a flow duration curve that is constructed from the complete duration series for that river. You can read on that flow duration curve the flow rate that has been exceeded, say, 1% of the time. Is the flow rate that has been exceeded 1% of the time larger or smaller than the 100 year flood? Why? Explain clearly and concisely.

(Value: 20%)

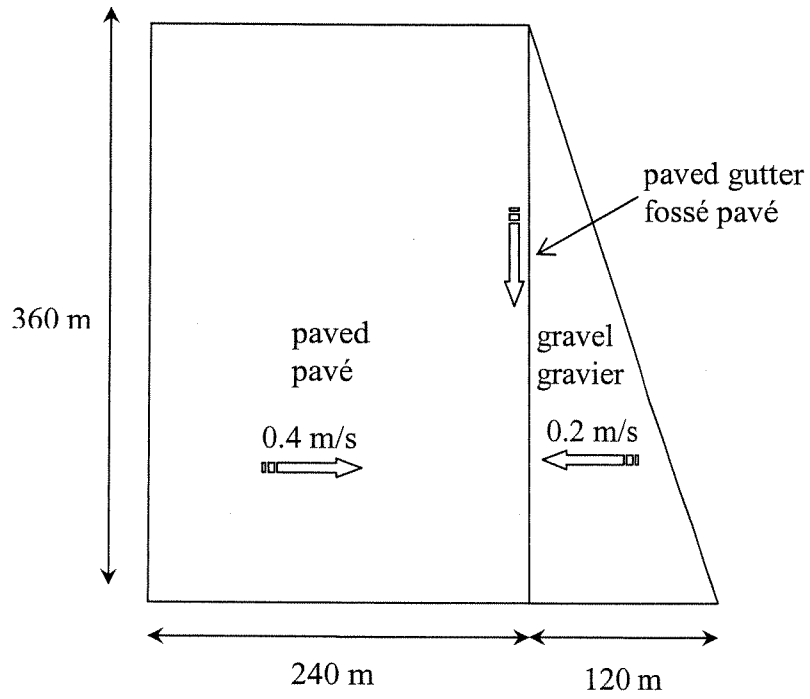


FIGURE 1