Hydrology Test 2

Take Home

**Due Thur Nov 18 8AM**

1.) The following weather data are available near a lake.

Net radiation 90 W/m2

Wind speed 2.5 m/s at a height of 2.0 m

Air pressure 85 kPa

Air Temperature 22 o C

Specific humidity 0.009 kg/kg

Surface roughness length zo = 3 x 10-4 m.

a) Indicate which of the following methods you have sufficient information to use to calculate lake evaporation (or equilibrium PET)

A. Priestley Taylor

B. Mass Transfer/Aerodynamic

C. Combination/Penman

D. Energy balance/Bowen Ratio

b) Calculate the evaporation in mm/day using all the methods for which there is sufficient information.

2.)  **Briefly** define each of the following terms and describe their differences: PET, ETo, and AET

3.) What is the difference in an Energy Limited environment vs a Water Limited environment?

4.) Consider a storm having excess rainfall of 2 cm for the first 2 hours and 3 cm for the second 2 hours. The 2 hour unit hydrograph of a watershed is given below. This watershed drains into a detention basin that has an area of 10 km2 .

|  |  |
| --- | --- |
| time (hr) | uh (M3/S/CM) |
| 0 | 0 |
| 2 | 1.8 |
| 4 | 30.9 |
| 6 | 85.6 |
| 8 | 41.8 |
| 10 | 14.6 |
| 12 | 5.5 |
| 14 | 1.8 |
| 16 | 0 |

a) Determine the drainage area (km2 )

b) Determine the peak direct runoff flow rate (m3/s)

c) Assuming that during the storm there is no outflow from the detention basis

determine the change in depth of water in the detention basin (m).

d) What is the storm lag time, time of concentration of the basin, and the storm hydrograph duration.

e) Theoretically, if the rainfall event was a constant 2cm per hour, consistently for 2 days, what would the time of concentration be?

5.) Develop a Hydrograph using the NRCS/SCS method for a rainfall event of duration 1.6 hours on a watershed with following properties:

-Hydraulic Length: 18 miles

-Average slope: 100ft/mi

-The watershed consists of a permanent meadow in good condition with soil group D (Use table 10.11 in your book)

Sketch the resulting hydrograph and label all components

6.) Why is the rising side of a storage vs discharge curve typically lower than the falling side? How does the Muskingum k and x parameters relate to this relationship?

7.) Briefly discuss the differences between Muskingum and Muskingum -Cunge and why Muskingum-Cunge is preferred to kinematic wave river routing?

8.) The hydrograph at the upstream end of a river is given in the following table. The reach of interest is 10 km long. Determine the hydrograph at 4km downstream and 10 km downstream. The slope of the stream is 0.001, B = 50m and the cross-sectional area of the streamflow at Qp = 187.5 m2. Assume no lateral flow. Assume a = 1.5 hr for a 6km or below.

|  |  |  |  |
| --- | --- | --- | --- |
| T(hr) | Q m3/s | T(hr) | Q m3/s |
| 0 | 12 | **11** | 154.8 |
| 1 | 14.4 | **12** | 126 |
| 2 | 21.6 | **13** | 93.6 |
| 3 | 34.2 | **14** | 70.8 |
| 4 | 60 | **15** | 54 |
| 5 | 93.6 | **16** | 39.6 |
| 6 | 128.4 | **17** | 28.8 |
| 7 | 161.4 | **18** | 20.4 |
| 8 | 176.4 | **19** | 14.4 |
| 9 | 180 | **20** | 12 |
| 10 | 175.2 |
|  |  |