

ESS 132 - Quick guide to constructing and using unit hydrographs

Constructing a unit hydrograph:

1. Separate the baseflow from the observed streamflow to get the Direct Runoff Hydrograph.
2. Calculate total volume of direct runoff. $V_{DRH} = \sum Q_{DRH} \Delta t$
3. Express V_{DRH} as depth over the drainage basin (i.e. divide volume runoff by area of basin).
4. Obtain unit hydrograph by normalizing the DRH (i.e. divide to get the runoff values for a 1cm depth).
5. Find the duration or the effective rainfall hyetograph associated with your unit hydrograph.
 - a. Calculate the “lost” rainfall by finding the difference between the gross rainfall and the volume of runoff expressed as a height.
 - b. Find the infiltration rate (assuming it is constant) by dividing by the rainfall duration.
 - c. Determine the effective rainfall hyetograph by subtracting the infiltration rate from the gross rainfall rate. This gives you the duration of runoff that the hydrograph is appropriate for.

Using your unit hydrograph:

1. Ensure that your rainfall data is listed in the same time intervals as your unit hydrograph (i.e. if your unit hydrograph is appropriate for 1cm of runoff over 2 hours your rainfall data should be in 2-hour intervals). For the below example we will assume the unit hydrograph is for 2 hours.
2. If it is not provided separately, use the infiltration rate to calculate the “effective precipitation” (also known as runoff). Then calculate the total effective precipitation depth over each 2 hours.
3. Construct a table with rows being 1-hour intervals and the columns corresponding to each 2-hour interval of the storm labelled “Pulse 1, Pulse 2, Pulse 3, etc”.
4. For the first 2 hours of the storm (Pulse 1), scale the unit hydrograph as appropriate (e.g. if there is 0.5cm of effective precipitation over that first 2 hours then you would multiple your unit hydrograph by 0.5).
5. Enter the scaled unit hydrograph for Pulse 1 into your table beginning at Hour 0.
6. For the second 2 hours of the storm (Pulse 2), scale the units hydrograph as appropriate.
7. Enter the scaled unit hydrograph for Pulse 2 into your table beginning at Hour 2.
8. Continue this process until you have included all the Pulses for the storm.
9. For each hour, add the pulses of streamflow to get the total “event flow” at that time.
10. Lastly, add the “baseflow” amount to each hour to give the total streamflow.