Lecture Notes of 01-05-2020, Compiled by Dr M. L. Sahu, Associate Professor, CoAE, JNKVV Jabalpur

Requirements for the developments of Hydrograph & Unit Hydrograph

Most Important are data of

1. Streamflow
2. Rainfall
3. Graph Plotting accessories.

For these data we need

1. Continuous Recording type stream gauging system at any Section of river / stream.
2. Measurement of the area of catchment / watershed at this section of river / stream.
3. Recording type rain gauge in the watershed.

Data are being continuous recorded in rain gauge & stream gauge among these data we select the desirable data for preparation of hydrograph & unit hydrograph

Baseflow separation

Sources of Streamflow:

1. Channel Precipitation
2. Interflow
3. Ground water flow
4. Surface runoff

Out of these four sources Channel precipitation is generally ignored due to its meager quantity. It is usual to consider Interflow as a part of the surface flow in view of its quick response. The ground flow is termed as baseflow. Thus, major components of stream flow are baseflow (ground water flow) & Surface runoff.

What is baseflow?

Baseflow is a portion of streamflow that is not directly generated from the excess rainfall during a storm event. In other words, this is the flow that would exist in the stream without the contribution of direct runoff from the rainfall. Estimation of baseflow and direct runoff is useful to understand the hydrology of a watershed, including interaction of surface and sub-surface water, role of urbanization on runoff generation and the health of aquatic habitat within a stream.

What does mean by separation of base flow?

The separate quantification of base flow & surface runoff from the stream discharge data is called separation of base flow.

Methods of Baseflow separation:

Mainly following three methods are used for baseflow separation

1. Straight Line Method
2. Fixed Base Method
3. Variable Slope Method

1. Straight Line Method

In this method the separation of the base flow is achieved by joining with a straight line the beginning of the surface runoff to a point on the recession limb representing the end of the direct runoff.

In Fig. 1, point A represents the beginning of the direct runoff off and it is usually easy to identify in view of the sharp change in the runoff rate at that point. Point B, marking the end of the direct runoff is rather difficult to locate exactly.

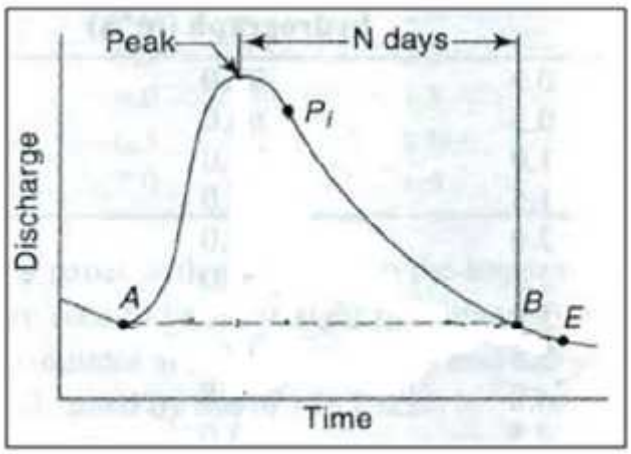

Fig. 1. Straight Line Method for base flow separation.
(Source: Subramanya, 2008)

An empirical equation for the time interval N (days) from the peak to the point B is

$N = 0.83\ A^{0.2}$

Where A is watershed area in km2 and N is in days. Points A and B are joined by a straight line to demarcate to the base flow and surface runoff. This method of base-flow separation is the simplest of all the three methods.

2. Fixed Base Method

In this method the base flow curve existing prior to the commencement of the surface runoff is extended till it intersects the ordinate drawn at the peak (point C in Fig. 2). This point is joined to point B by a straight line. Segment AC and CB demarcate the base flow and surface runoff. This is probably the most widely used base-flow separation procedure.

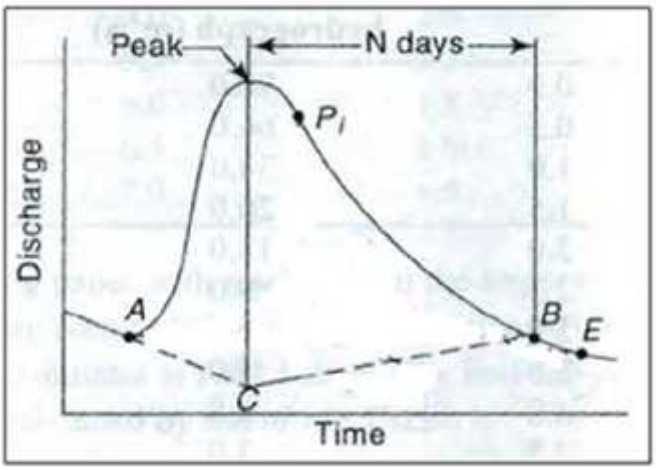

Fig. 2. Fixed Base Method for base flow separation.
(Source: Subramanya, 2008)

3. Variable Slope Method

In this method the base flow recession curve after the depletion of the flood water is extended backwards till it intersects the ordinate at the point of inflection (line EF in Fig. 3). Points A and F are joined by an arbitrary smooth curve. This method of base-flow separation is realistic in situations where the groundwater contributions are significant and reach the stream quickly.

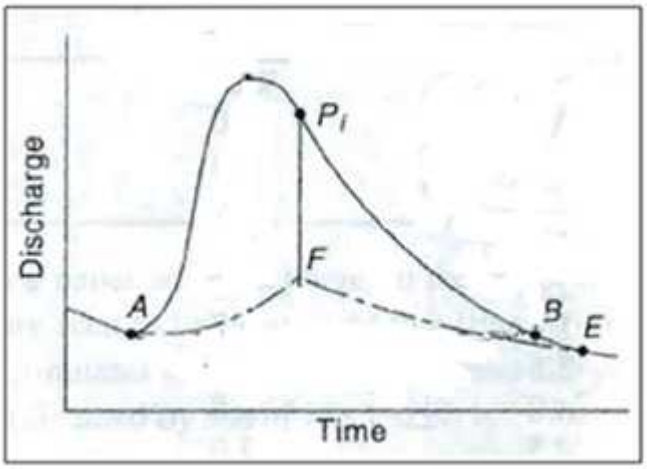

Fig. 3. Variable Slope Method for base flow separation.
(Source: Subramanya, 2008)

The surface runoff hydrograph obtained after the base-flow separation is also known as direct runoff hydrograph (DRH).