The method used to compute flash flood guidance is the reverse of the normal use of a rainfall-runoff model in which runoff is desired. For flash flood guidance purposes an amount of rain is needed that produces a given amount of runoff.

The equation for flash flood guidance calculations can be written as follows:

$$FFG = f(R) \tag{1}$$

    where FFG is the flash flood guidance in inches
          R   is the runoff in inches

In some of the rainfall-runoff models (e.g. Sacramento Model) impervious area is integrated within the model. In other cases, such as with the event API models, impervious area is not a model parameter. In order to apply these API models to urban areas for computing FFG the impervious area needs to be specified as an additional parameter. Equation 1 becomes:

$$FFG = R*I + f(R*1-I)) \tag{2}$$

    where I is the percent impervious area

Regardless of the types of guidance two values are required to compute flash flood guidance for a desired area:

    o the runoff required to initiate flooding
    o the current soil moisture conditions

Adjustment for High Flow

The computation of runoff R above assumes the stream has very little flow compared with the flow at flood stage. At high flows for headwaters and other gaged locations the additional runoff needed to fill the channel to flood stage is called threshold runoff Rh (Rh $\leq$ R). Rh is substituted for R in Equation 2 and is computed by the following equation:

$$Rh = (Qf-Qi) / Qp \tag{3}$$

    where Rh is the threshold runoff in inches at a high flow
          Qf is the flow in cubic feet per second (CFS) at flood stage
          Qi is the flow in CFS at a time in the future
          Qp is the unit hydrograph peak in CFS

Qi in Equation 3 is set to zero if the adjustment for high base flow is not desired.

For small streams where areal FFG is desired the threshold runoff R has been determined from channel hydraulics as part of the development

effort. To adjust the small stream for high flow a ratio (C) is
applied:

$$Rh = R(1-C) \tag{4}$$

where Rh is the threshold runoff in inches with streams at high
             flows
        R is the threshold runoff at low or no flow
        C is the ratio of flow at a time in the future divided by
             the bankfull flow

For headwaters and small streams Equation 2 is solved by an iterative
process that results in producing the threshold runoff R. At a high
flow Rh is substituted for R in Equation 2. For headwaters Rh is
determined by Equation 3 and for small streams by Equation 4.

Adjustment for Intensity

To adjust flash flood guidance for intensity two options are
available:

   o adjust runoff
   o assign a specific value for flash flood guidance independent of
      soil moisture conditions

Equation 4 adjusts threshold runoff Rh by intensity factor INTEN:

$$Rh = Rh * INTEN \tag{5}$$

For the second option:

$$FFG = INTEN \tag{6}$$