A river catchment flood model

R. K. PRICE

Mr R. B. Bulman, Consultant

Could the Author please indicate how the durations were determined for the design rainfall events referred to in § 22? The critical durations will, of course, relate to the catchment as a whole and affect the mean intensities of the events.

33. So far as is possible from the data published for the River Rhymney rough estimates are shown in Table 3 for critical duration to Llanedeyrn and mean intensity. The response of the catchment is far from linear. Would a rigorous analysis confirm this?

34. The River Rhymney appears to provide a good example for discounting the main assumption (a) of the unit hydrograph given in § 6.

Mr R. Hepworth, Ward, Ashcroft and Parkman

In the case of the River Rhymney, it seems to me that the critical 100 year event would be shorter for the improved channel than for the original channel and that the peak discharge would be increased by more than 3%, although perhaps not significantly.

36. With regard to the River Soar study, does the method of analysis confirm that, for a given event, flood plain storage does not have an attenuating effect on peak discharge?

Dr Price

A correction should be made to the time scale in Fig. 5. The time in hours should be divided by 4, to give a maximum time on the scale of 25 h.

38. The duration of the design rainfall events referred to by Mr Bulman was determined as described on page 462 in volume I of the FSR.¹ This duration relates to the whole of the catchment down to Llanedeyrn. The mean intensities of the events were derived following the procedure outlined on page 464 in volume I of the FSR.

Table 3

Event	Critical duration, h	Net rainfall, mm	Mean intensity, mm/h	Peak discharge, m ³ /s
Median annual flood	6.1	26	4.3	82
10 year event	9.5	45	4.7	89
100 year event	7.2	66	9.2	174

DISCUSSION

39. The suggestion by Mr Bulman that the response of the Rhymney catchment is non-linear and that unit hydrograph theory is therefore inapplicable does not necessarily follow from the data in Table 3. Besides the difficulty in identifying the derivation of the critical durations in Table 3, caution is needed when relating design storm duration to the behaviour of observed or even simulated events. The specification in the FSR of design storm profile, duration, rainfall depth and catchment wetness to give a peak discharge of required return period is a consequence of an extensive simulation and statistical study on a number of different catchments. The choice of one critical duration for a catchment is discussed on page 452 in volume I of the FSR. A careful study of the reasoning behind the choice of each of the design variables shows that if the FSR unit hydrograph losses method is to be used, the recommended procedure for selecting the values of the design variables must be followed. A rigorous analysis of the Rhymney catchment would, in my opinion, confirm that the response of the catchment is effectively linear and that unit hydrograph theory is applicable.

40. The effect of improvements to the channel on the response of the catchment should not be reflected in any adjustment to the storm duration as suggested by Mr Hepworth, primarily for the reasons already given. However, there would be an adjustment to the time to peak of the unit hydrograph because of a postulated decrease in the lag time between the centroid of total rainfall and peak flow. Such an adjustment would lead to a larger peak discharge, although I would agree that this increase would probably not be significant.

41. Flood plain storage in the Soar does not have a significant attenuating effect on peak discharge for design events. The attenuation of peak discharge depends not only on the flood plain storage available but also on the shape of the discharge hydrograph near the peak. If the hydrograph is flat near the peak the attenuation along a reach is less than that for a more peaked hydrograph. In the case of the Soar below the confluence with the Wreake, the contributing design hydrographs from the tributaries happen to produce a hydrograph with a comparatively flat top. This is because of a 6 h lag between the peak discharges from the Soar and the Wreake. It is conceivable that channel improvements to the Wreake could reduce this lag, in which case the design hydrograph in the lower half of the Soar would be more peaked and the attenuation greater.