areas of 2.6 km^2 and for durations of a few tens of minutes, maximum rainfall rates depend on extreme upward velocities associated with vigorous thunderstorms. These high velocities are related to storm dynamics, and topographic effects are negligible. Hence, the same maximum intensities may be expected within the same air mass over various types of terrain. As duration increases, terrain roughness becomes increasingly important. First, upslopes and roughness accentuate upward velocities. Secondly, intense thunderstorms tend to remain in one place longer over a topographically favourable site than over smooth terrain, where they drift with the wind or propagate laterally by their own dynamics. Finally, the probability of continued rainfall after an intense thunderstorm is enhanced by terrain roughness.

The basic PMP values of Figure 5.15 are applicable to the southern edge of the project basin. Smooth PMP in rough terrain is hypothetical, but serves as an index for consistent application of adjustments for orographic effects (sections 5.3.2.2 and 5.3.2.3.).

Experience with severe storms throughout the country was useful in shaping the depth–duration curves beyond 6 hours. The adopted curve of Figure 5.16 was developed to extend the 6-hour curves from 6 to 24 hours (dashed lines in Figure 5.15).

5.3.2.5 Adjustment for moisture and latitudinal gradient

A moisture adjustment chart was developed for the relatively smooth north-western section of the project basin. This chart (Figure 5.17) was based on assessment of mean dew points and maximum persisting 12-hour dew points. Analysis indicated a gradient of about 1˚C from the extreme south-western corner of the total basin (outside the area shown) to the north-eastern corner. This gradient corresponds to a difference in rainfall of about 10 per cent, according to the usual model for convective rain in extreme storms (United States Weather Bureau, 1960). Figure 5.17 shows the moisture index lines, in percentages, for adjusting PMP values.

A latitudinal gradient chart (Figure 5.18) was developed for the mountainous portion of the project basin. This chart was based on rainfall-frequency gradients resulting primarily from sheltering by mountains. Moisture effects were incorporated.

5.3.2.6 Six-hour 2.6 km^2 PMP index map

The concepts and charts discussed above were used to develop the 6-hour 2.6 km^2 PMP index map (Figure 5.19) for the project basin. Six-hour PMP values from Figure 5.15 of 874, 912 (interpolated), and 950 mm were assigned to smooth, intermediate and rough terrain categories, respectively, and

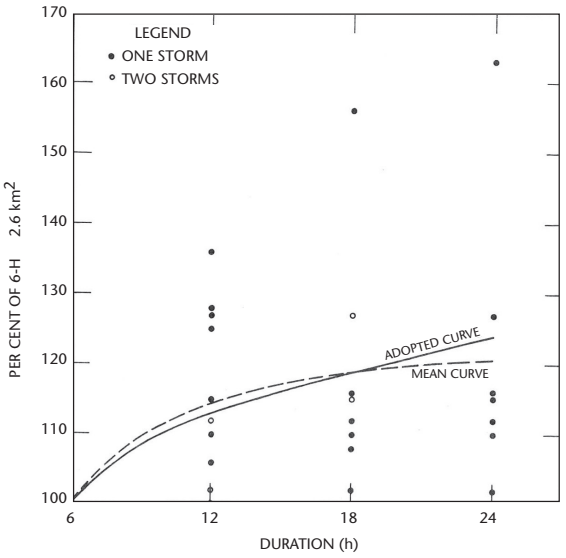

Figure 5.16. PMP depth–duration curves for basins up to 259 km^2 in Tennessee River basin (Zurndorfer and others, 1986)

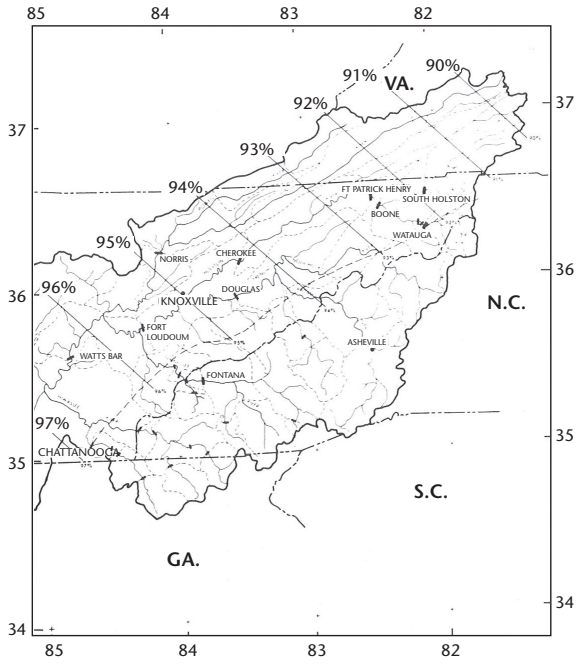

Figure 5.17. Moisture index chart for north-western portion of Tennessee River basin over Chattanooga, Tenessee (Zurndorfer and others, 1986)