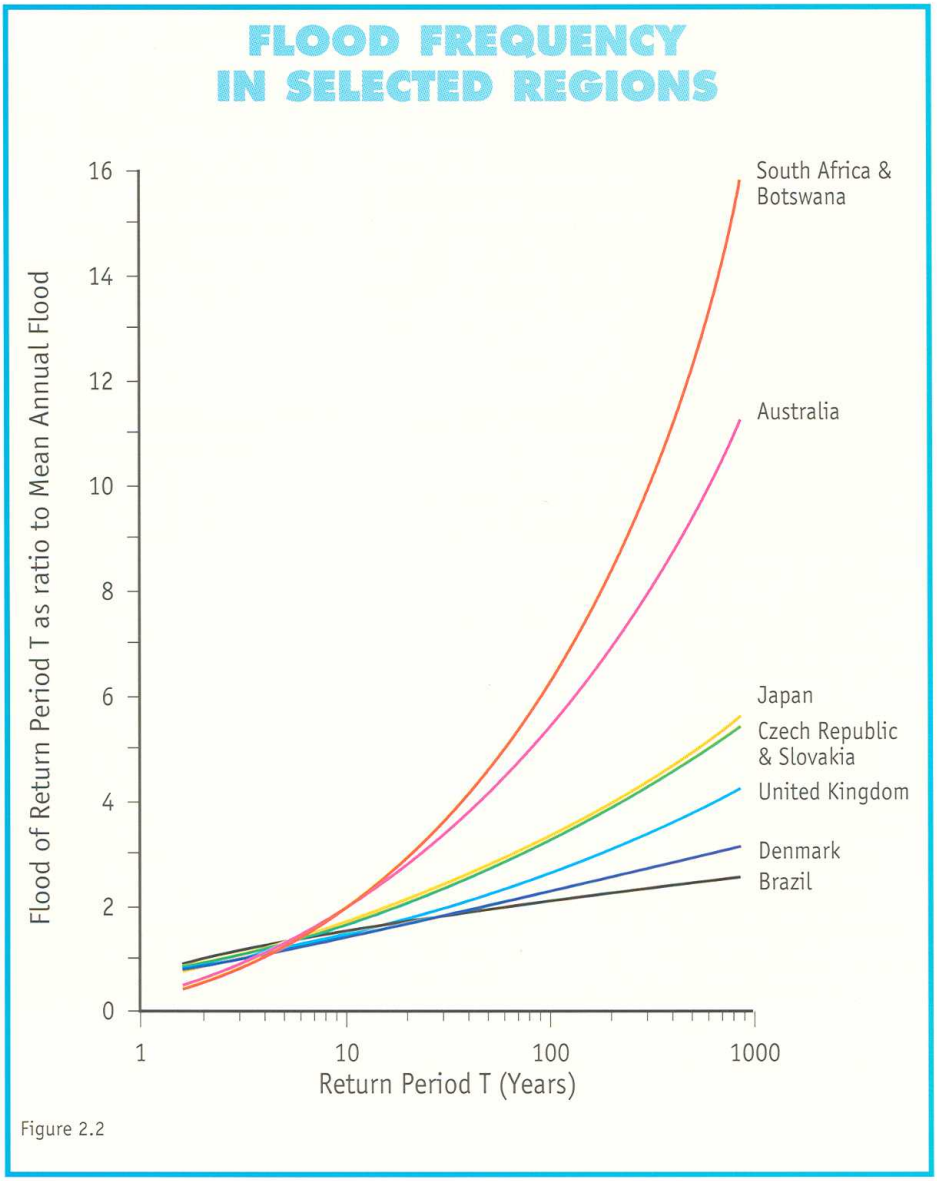

Figure 2.2

In designing a flood protection scheme it is usual to design against a flood with a specific return period, the «design return period», as this gives a measure of the degree of protection that the scheme will provide. The longer the design return period adopted for a scheme, the more secure it is against flooding. However, longer design return periods also mean higher costs and some compromise has to be adopted based on allowable damage levels and costs. Economic analysis can be used to set the design level to balance the cost of flood protection works with the damage that is avoided. Extra precautions have to be taken when human life would be at risk from overtopping. The United States and Canadian flood plain management systems (see chapter 3, below) both adopted the 100-year flood as the minimum level for design of flood protection works. Much longer return periods are commonly used for dams, up to 10,000 years is not uncommon, while many small urban drainage schemes may be designed for only a ten-year flood. Estimating the magnitude of floods with long return periods is difficult as flow records are often short and even when long records are available it is very likely that the nature of the catchment has changed over the years and this will have altered the flood regime. It is found that the rivers in a region have a similar flood distribution and the flood data from the region can be pooled to give more reliable estimates of the frequency of occurrence of rare floods for the

region. Representative flood frequency distributions for a number of regions of the world are shown in figure 2.2. In general the more arid regions have a wider variation of floods, as shown by steeper curves, while the humid regions show less variation. In the more arid regions of southern Africa the 100-year flood is 6.25 times the mean annual flood, while in northern Europe the factor is only of the order of 2.5. The wide variation of flood magnitudes in arid regions arises from the fact that rainfall is rare in these regions and when it does occur, it occurs in the form of heavy thunderstorms. There may thus be long periods, perhaps several years, without any appreciable river flow, followed by a short flash flood.

Probable Maximum Flood

How big a flood can occur? For many purposes it is possible to accept some risk of a design flood being exceeded with a low probability because the economic loss, averaged over several years, would be small. However, in other cases a higher level of security is required and for this purpose some estimate of the greatest flood that could occur at a particular site is often sought. This might be appropriate where exceeding the design flood could lead to loss of life. For example, a dam built on a river upstream of a town would cause many deaths if it were to collapse and in such cases it is often recommended or even required

Flooded street, Bangladesh, Dhaka.
Still Pictures. G. Moti