

Appendix C

FSSR 14 Regional Growth Curves with Irish River Data and FSSR 16 (Greenfield) Rainfall – Runoff Model Estimation

C1 FSSR 14 Growth Curves with Irish River Data

The Irish FSR growth curve is reported against the 10 curves for regions in UK in FSSR 14. The Irish curve is an average for the whole country and for all rivers. Provisional analysis of local rivers in the Dublin region, which are all relatively small, have been analysed and show a significantly different growth curve. These are plotted, along with the River Boyne curve analysis, in Figure C2. Figure C1 provides the UK regions that relate to the UK individual curves.

The results of the Dublin rivers can be seen to fit closely with eastern UK rivers and therefore some degree of confidence can be held in the findings.

It is recognised that further more detailed work is warranted to look into this subject, as the implications for drainage design are quite significant. However for the purpose of carrying out drainage design for new developments, it is proposed that the recommended curve in Figure C2 is used in the Dublin Region until a more definitive study is carried out.

In Figure C2, the scale on the lower "X" axis is the Reduced Variate, which is a form of plotting return period curves. The return period is shown on the upper "X" axis. The "Y" scale is a dimensionless scale factor, to multiply the Q_{bar} value (return period of 2.3 years) for flows of any other return period.



Figure C1 UK Hydrological Growth Curve Regions

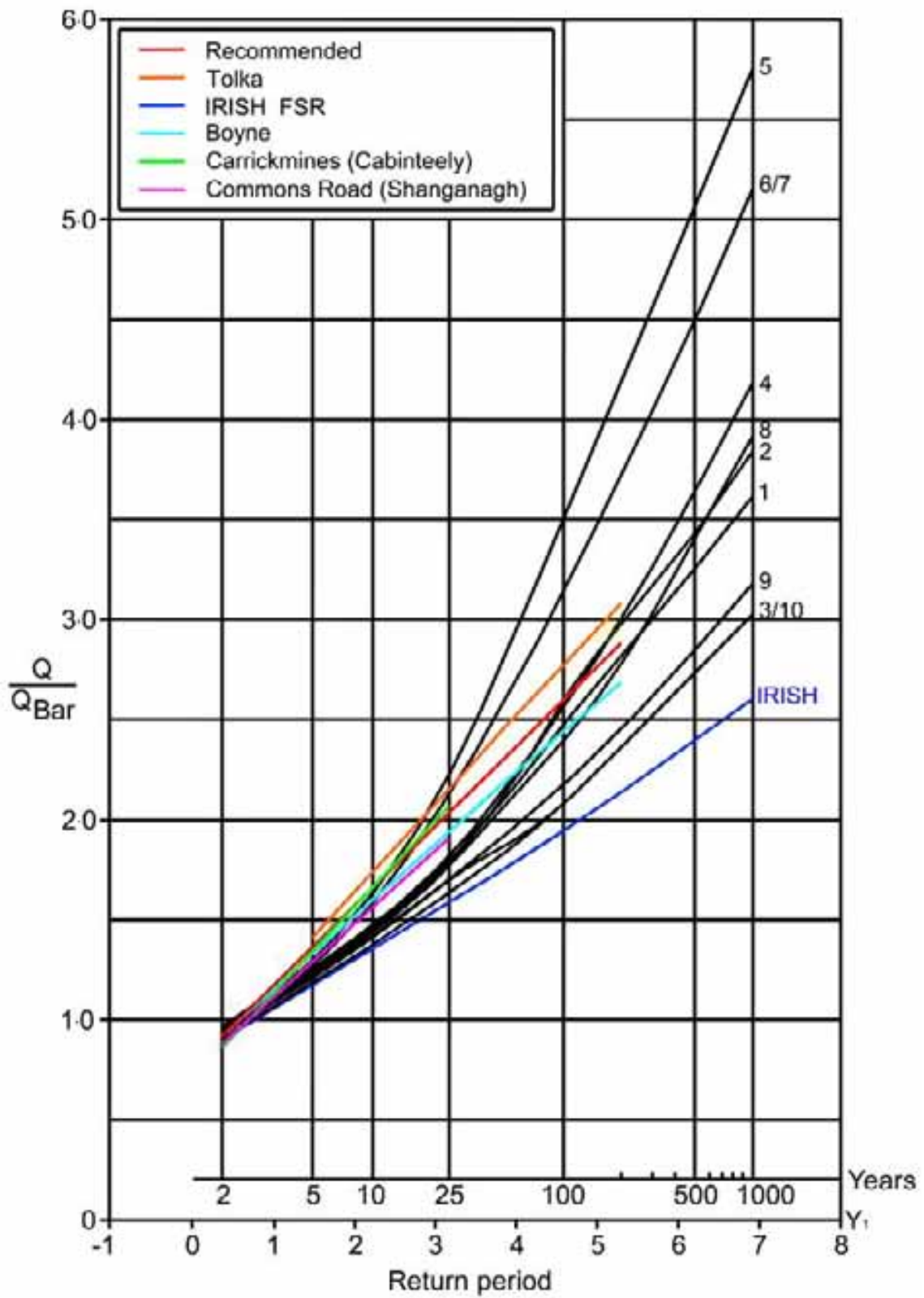


Figure C2 FSR Regional Growth Curves with Dublin Area Rivers

C2 Greenfield Runoff Volume

A simple assumption has been made in the design for long-term storage that the runoff from a greenfield site is equal to the SPR value for the soil type. There are a number of formulas produced by FSR and subsequent work that can be used to derive volumes of runoff, but FSSR 16 is both easy to use and is the most recent output in the FSSR series addressing this problem.

The FSSR 16 formula is:

$$PR_{RURAL} = SPR + DPR_{CWI} + DPR_{RAIN}$$

Where:

SPR is the standard percentage runoff, which is a function of the five soil classes S_1 to S_5

$$SPR = 10S_1 + 30S_2 + 37S_3 + 47S_4 + 53S_5$$

DPR_{CWI} is a dynamic component of the percentage runoff. This parameter reflects the increase in percentage runoff with catchment wetness. The catchment wetness index (CWI) is a function of the average annual rainfall. The relationship is shown in Figure C3.

$$DPR_{CWI} = 0.25 (CWI - 125)$$

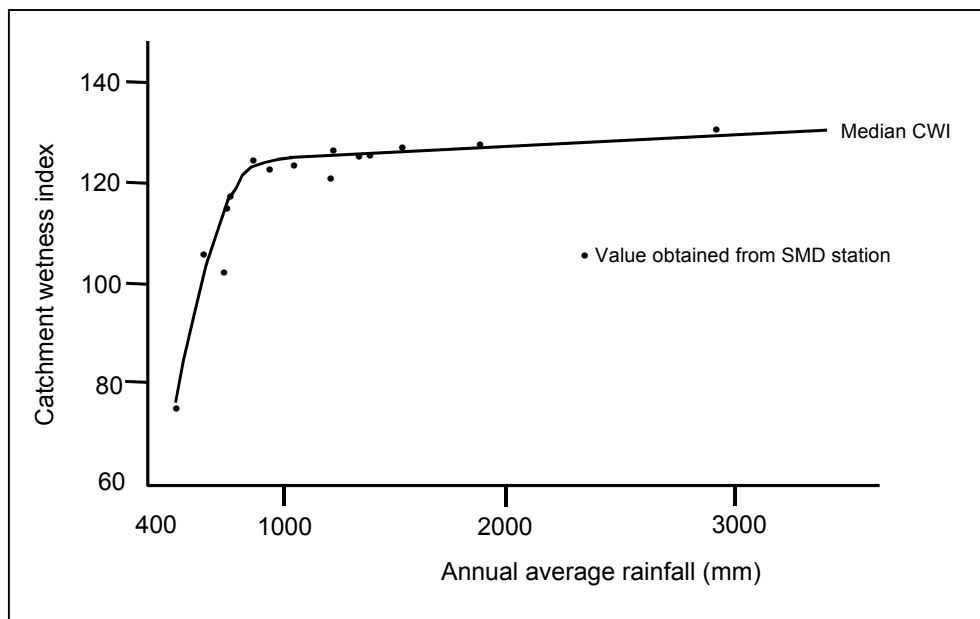


Figure C3 CWI vs. SAAR – Flood Studies Report

The DPR_{RAIN} is the second dynamic component that increases the percentage runoff from large rainfall events.

$$DPR_{RAIN} = 0.45(P - 40)^{0.7} \text{ for } P > 40 \text{ mm}$$

$$DPR_{RAIN} = 0 \text{ for } P \leq 40 \text{ mm}$$

Where P is the rainfall depth

It can be seen from the formula that the runoff proportion is slightly greater than the value of SPR for all areas where the AAR value is greater than 800mm. As much of Dublin is between 700 and 800mm, the formula slightly reduces the proportion of runoff. However as it is being applied to a storm of 60mm, this is counter-balanced by the rainfall depth term, as it is more than 40mm.

The derivation of this equation is for extreme events and for catchments that are significantly larger than those of development sites. Its accuracy therefore is to be treated with caution. However if account is to be taken of the volumetric effects of development, this is one of the accepted methods for assessing greenfield runoff volumes. It has the advantage of simplicity and therefore a rapid assessment of the impact of development can be made with respect to runoff volume.

The key feature of this formula is the important influence of soil type. In practice it indicates that developments on sandy soils create massive additional runoff compared to the pre-development condition, but development on clays do not. This is obvious, but it has very significant implications for the cost of developments in terms of the storage provision. Other parameters have very little influence.

Tests of the local soil permeability and relating it to SOIL type are therefore desirable.