Greenfield Runoff Volume Method

The program can automatically calculate the total greenfield site discharge volume.

Rainfall Model

Select between FSR and FEH model data.

Return Period

Storm return period between 1 and 1000 years.

Storm Duration

Storms duration between 15 and 21600 minutes.

> *Note: there is no option to add Climate Change or select between Winter and Summer storm profiles as these settings have no impact on the pre-development values.*

Input for FSR based Discharge Volume

Area (ha)

Undeveloped gross area

SAAR (mm)

Average annual rainfall (1941-1970) from FSR figure II.3.1 or equivalent.

Urban

Proportion of area urbanised expressed as a decimal 0.000.

SPR

This value can be calculated from Figure I.4.18 (first revision) (Institute of Hydrology, 1978) which shows the various soil types. The soil classifications are also available from the Wallingford Procedure, Volume 3, Maps, “Winter rain acceptance potential”. The equation was first published in FSSR 16, 1985.

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

where S_1 - S_2 are the proportions of the catchment covered by soil classes 1-5 respectively.

Where measured flow records are available the SPR may be calculated from the Base Flow Index (BFI) from research published in FSSR 16 and it is not covered here – see also FEH, Volume 4, Chapter 1.

CWI

Catchment wetness index is a function of the average annual rainfall and is described in FSR figure I.6.62

Input for FEH based Discharge Volume

Most of these values are imported from the FEH CD-ROM software package via the on-screen ‘Import’ Button.

However on small catchments it is particularly important to check them against a site survey to verify the data where possible.

Site Location

This descriptive field allows the site location to be recorded. If the FEH details are imported from a .csv file then this field is filled in with the grid reference details.

Site Constants C, D1, D2, D3, E, F

These variables are used to generate the rainfall profile and should be the same as those used for the site location. The 1km grid point values are used as they are likely to be more representative of the actual site location. The catchment values may refer to some distance upstream, more indicative of the river catchment than the urban runoff area being designed for. They are combined with the return period and storm duration to generate the rainfall profile that is used to calculate the discharge volume.

Areal Reduction Factor

Reduces the rainfall as it calculated as point rainfall based on time and area. The value may be obtained from FEH Figure 4.3.4.

Area (ha)

This is the undeveloped gross area. It is input as hectares in the program for consistency with other data input but the equations express it in square kilometres.

SAAR (mm)

The standard average annual rainfall (1961-1990).

CWI

The catchment wetness index (which can be derived from SAAR).

URBEXT

The extent of urban and suburban cover. Either select the 1990 or 2000 values if available or simply enter a user-defined value. Please note that the year 2000 values are only available if using the FEH CD-ROM Version 2. If values for 1990 or 2000 are zero, please check the values as they may not be available from the FEH data.

SPRHOST

SPRHOST is calculated by the FEH CD program and written to the .CSV file.

Where measured flow records are available the SPR may be calculated from the Base Flow Index (BFI) from research published in FSSR 16 and it is not covered here – see also FEH, Volume 4, Chapter 1.

Max Allowable Volume Calculation Method

The runoff volume from the site is calculated in the following manner.

Calculate the total rainfall for the storm details specified (6 hour, 100 year return period by default).

Calculate the PR as defined below (this is the same as the unit hydrograph method. Note that the rainfall used in the PR equation is based on the same details as the total rainfall above).

PR (%)

Total percentage run off of the catchment is defined as follows:

FSR

$$PR_{total} = PR_{rural} \times (1 - 0.3 \times URBAN/100) + 70 \times (0.3 \times URBAN/100)$$

FEH

$$PR = PR_{rural} \times (1 - 0.615 \times URBEXT') + 70 \times (0.615 \times URBEXT')$$

where

$$PR_{rural} = SPR + DPR_{cwi} + DPR_{rain}$$

and

$$DPR_{rain} = 0.45 \times (P - 40)^{0.7} \; for \; P > 40mm$$

$$DPR_{rain} = 0 for \; P \leq 40mm$$

P is the rainfall depth

$$DPR_{cwi} = 0.25 \times (CWI - 125)$$

Discharge Volume (Runoff) (m^3)

Runoff = PR * Areal Reduction Factor * Total Rainfall * Area