

Laurenson

The **Laurenson Runoff Routing** procedure can be applied to rural and urban catchments in both design storm and continuous simulation situations. It allows for the non-linear response from catchments over a large range of event magnitudes.



This method may not be available for your region. For more information, refer to the [Regionalisation](#) topic.

The Laurenson procedure is also known as the **RAFTS** model, and is originally from a paper Aitken, A.P. (1975) Hydrologic investigation and design of urban stormwater drainage systems. Aust. Water Resources Council Tech. Paper No. 10, Dept of the Environment and Conservation, A.G.P.S., Canberra. However the equation is repeated in: ARR Volume 1 on page 187. See also the reference Sobinoff, P. Pola, J.P. and O'Loughlin, G.C. (1983) Runoff routing parameters for the Newcastle-Sydney-Wollongong region. Hydrol. And Water Resources Symposium 1983, inst. Engrs Aust., Natl Conf. publ. No. 83/13, pp. 28-32. The equation is only suitable for an n value of 0.025.

Further modifications were made by Willing and Partners following calibration runs on project catchments between 1976 and 1985.

The hydrological data requirements are: catchment area, slope, degree of urbanisation, loss rates, observed or design rainfall.

These data are used to compute the storage delay coefficient for each of the sub-catchments and hence to develop the non-linear runoff hydrograph. A default exponent is adopted, although the user may override this value with either a different non-linear exponent or a rating table of flow vs an exponent to define different degrees of catchment non-linear response.

Each sub-catchment is divided into 10 sub-areas. Each of the sub-areas is treated as a cascading non-linear storage obeying the relationship:

$$S=Bq^{(n+1)}$$

where:

S = volume of storage (hrs x m³/s)

B = storage delay time coefficient

n = storage non-linearity exponent by default is set to -0.285 (AR&R, 1997)

The rainfall is applied to each sub-area, an excess computed and the excess converted into an instantaneous inflow. This instantaneous flow is then routed through the sub-area storage to develop an individual sub-catchment outlet hydrograph.

Catchment Area [X]

Name:

Runoff
 Pollution
 Advanced
 Rainwater Tank

Preliminary Sizing

Area (acre)

Volumetric Runoff Coefficient

Area (acre)

Runoff Method ▾

Initial Rainfall Loss (in)

Continuing Rainfall Loss (in/hr)

B

N

Adapt Factor

Manning's n

Degree Urbanization (%)

Catchment Slope (ft/ft)

Runoff Method Help

Initial Rainfall Loss - Specifies the depth of rainfall that infiltrates before any runoff occurs.

Continuous Rainfall Loss - Specifies the loss that occurs after the initial loss has been satisfied.

B - B can be entered or calculated from:

$$B = 0.285 A^{0.52} (1 + U)^{-1.97} S_c^{-0.50}$$

where:

A = catchment area (km²)

U = fraction of catchment urbanised

S_c = modified equal area slope (%)

N - Storage non-linearity exponent by default is set to -0.285

Adapt Factor - Can be used as a multiplication factor used during calibration to modify the calculated B. It will default to value of 1.

Manning's n - PERN is an adaption factor used to introduce the effect of pervious catchment roughness as follows:

n	PERN
0.01	0.4

0.015	0.5
0.025	1.0
0.10	3.0

Degree Urbanization - Fraction of catchment urbanised.

Catchment Slope - Modified equal area slope (%).

References

Laurenson E.M. (1964) A Catchment Storage Model for Runoff Routing, Journal of Hydrology, Volume 2, pp 141-163

Institution of Engineers, Australia. (1987) Australian Rainfall and Runoff - A Guide to Flood Estimation (edited by D.H. Pilgrim and R.P. Canterford), Volumes 1 and 2, Revised Edition, November, 1987, Canberra