

# 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.

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 m<sup>3</sup>/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 storages to develop an individual sub-catchment outlet hydrograph.

Catchment Area

Name: Catchment Area

Runoff	Pollution	Advanced	Rainwater Tank
Preliminary Sizing			
Area (acre)	0.09		
Volumetric Runoff Coefficient	0.750		
Area (acre)			
Area (acre)	0.09		
Runoff Method	Laurenson		
Initial Rainfall Loss (in)	0.0		
Continuing Rainfall Loss (in/hr)	0.0		
B	0.000		
N	-0.285		
Adapt Factor	1.000		
Manning's n	0.000		
Degree Urbanization (%)	0		
Catchment Slope (#/ft)	0.00		

OK Cancel Apply

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.



[Back to: Help Documentation](#)

## Section Pages

- [Green Roof Runoff Method](#)
- [Time of Concentration](#)
  - [Time Of Concentration Calculator](#)
- [SCS](#)
  - [Curve Number Calculator](#)
- [Santa Barbara Urban Hydrograph](#)
- [Time Area Diagram](#)
- [UK Unit Hydrographs](#)
- [FSR Unit Hydrograph](#)
- [FEH Unit Hydrograph](#)
- [ReFH Unit Hydrograph](#)
- [Laurenson](#)

## Workflow - What's next...?



**Inflows** connect to either **Junctions** or **Stormwater controls** via **Inlets**.

Specify an **Outlet** on these objects then choose to connect to another Junction or Stormwater Control.

## 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 (km<sup>2</sup>)

**U** = fraction of catchment urbanised

**S<sub>c</sub>** = 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*