The Old School.

The Pottery, Culmington, Ludlow, Shropshire. SY82DF. September 2021

Flood Risk Assessment / Drainage.

Appendix E : Design of a rectangular soakaway to BRE Digest 365.

Design of a rectangular soakaway to BRE Digest 365.

Assuming the initial design dimensions of 2.9m long x 1.5m wide x 1.54m deep which provides a volume of 6.6 cubic metres the BRE Digest 365 methodology can be used to calculate the required width of the soakaway using the Shropshire rainfall data and the infiltration rate of the soil on the site.

Shropshire Rainfall data.
Data provided by Shropshire Council for designing rectangular soakaway systems.

Storm duration D min	M5-Dmin =20mm x Z1	Z2	M10-D min =R mm
10	10.4	1.22	12.7
15	12.6	1.23	15.5
30	16.0	1.24	19.8
60	20.0	1.24	24.8
120	24.2	1.24	30.0
240	29.2	1.22	35.6
360	32.4	1.21	39.2
600	36.4	1.19	43.3

BRE Digest 365 methodology.

Inflow to soakaway : *I*

I = A x R
A = Impermeable surface area of development **(119sqm.)**
R = M10-D min rainfall **(SC data for each rainfall duration)**

Outflow from soakaway : O

O = a_{s50} *x f x D*
a_{s50} = Internal surface area of soakaway to 50% storage depth (excluding base area)
f = soil percolation rate **(*3.30 x 10-5* m/s)**
D = storm duration **(SC data)**

Soakaway storage volume : S

S = effective volume of soakaway with 30% free volume
S = Length x Depth x Width x 0.3.
S = 2.9 x 1.5 x Width x 0.3.
S = **1.3W**

To determine the width of the soakaway for each storm duration.
I – O = S

Typical calculations for the New Dwelling.

Example calculation for **10min** storm duration, ie **R = 12.7mm**

I = A x R.

I = 119sqm x 0.127m = **1.51 sqm.**

O = a_{s50} *x f x D*

O = 2 x (2.9 + W) x (1.5 ÷ 2) x 0.000033 x (10x60)
O = (4.35 + 1.5W) x 0.000033 x 600
O = (4.35 + 1.5W) x 0.0198

I – O = S
1.51 - (4.35 + 1.5W) x 0.0198 = 1.3W
1.51 - 0.0861 - 0.0297W = 1.3W
1.424 - 0.0297W = 1.3W
1.424 = 1.329W
W = 1.071m

Therefore, the width of soakaway for a 10Min storm duration = 1.071m.
The calculation is repeated for each storm duration using the Shropshire Council M10-*D*min storm data above to determine the maximum width required for the new soakaway.

The table below shows the results of the calculations for each storm duration.

Storm duration D min	**M10-D min = R mm**	***I = A x R.***	***Width dimension***
10	12.7	1.51	**1.07**
15	15.5	1.84	**1.27**
30	19.8	2.36	**1.5**
60	**24.8**	**2.95**	**1.6**
120	30.0	3.57	**1.58**
240	35.6	4.23	**1.08**
360	39.2	4.66	**0.6**

Maximum width for soakaway = 1.6m

The calculations confirm that the dimensions of the Rectangular Soakaway to BRE Digest 365 should be **2.9m long x 1.5m effective depth x 1.6m wide** to be suitable for the critical storm duration of around 1 hour for a 10 year event.

Calculation to check the time for half emptying of storage volume, t_{s50}. Target time within 24hrs.

$$t_{s50} = \frac{S \times 0.5}{a_{s50} \times f}$$

$$t_{s50} = \frac{(1.3 \times 1.6) \times 0.5}{(4.35 + (1.5 \times 1.6) \times (3.30 \times 10^{-5})}$$

t_{s50} = **1.4 hours.**

Confirmation that soakaway design is satisfactory to half empty within 24 hours.