

Soakaway Design for
in accordance with BRE Digest 365
For Proposed Residential Development on Land at Plas Fron,
Cross Lanes, Wrexham.

For A, O, H Owen

Results of Trial Pit TP2

75%	25%	25%-75%
94.5	31.5	63.0 mins

Calculating Soil Infiltration Rate. (from BRE 365).

When trimmed and clean the trial pit was 1.5m deep, 1.0m long and 0.3m wide.

Volume outflowing between 75% and 25% effective depth: V_{p75-25}

$$= 1.0 \times 0.3 \times (0.843 - 0.281) = \mathbf{0.169 \text{ m}^3}.$$

The mean surface area through which outflow occurs, taken to be the pit sides to 50% effective depth and including base of the pit: a_{p50}

$$= (1.0 \times 0.562 \times 2) + (0.3 \times 0.562 \times 2) + (1.0 \times 0.3) = \mathbf{1.761 \text{ m}^2}$$

The time for the outflow between 75% and 25% effective depth: t_{p75-25}

= 63mins.

$$\text{Soil infiltration rate, } f = \frac{0.169}{1.761 \times 63 \times 60} = \mathbf{2.54 \times 10^{-5}}$$

75m² Per Gully

Design a soakaway to provide storage for a 1 in 100 year + 30% climate change for series of storm durations

Stone trench soakaway to have 30% voids & 150mm perforated distribution pipe.

Trial Pit 2: Impermeable surface area of road: 75.0m².

Calculations for design of length of soakaway

Calculate design rainfall:

From table $r = 0.39$

$$M5-30 = 20\text{mm} \times Z1$$

$$M5-30 = 20\text{mm} \times 0.80 = 16.0\text{mm}$$

$$M100-30 = 16.0 \times Z2$$

$$M100-30 = 16.0 \times 2.0 \text{ (for England and Wales)} = 32.0\text{mm}$$

$$\text{Add 30\% climate change} = 41.6\text{mm}$$

Inflow to soakaway I:

$$\begin{aligned} I &= A \times R \\ &= \text{impermeable surface area} \times \text{M100-D min rainfall} \\ I &= 75.0 \times 0.0416 \\ &= \mathbf{3.12\text{m}^3} \end{aligned}$$

Outflow to soakaway O:

$$\begin{aligned} O &= a^{S50} \times f \times D \\ &= \text{internal surface area of soakaway pit to 50\% storage depth (excluding base area)} \\ &\quad \times \text{soil percolation rate} \times \text{storm duration} \end{aligned}$$

$$\begin{aligned} \text{For pit 1.0m wide} \times \text{1.5m depth} \times \text{Lm long} \\ a^{S50} &= 2(1.0+L) \times 1.5/2 = \mathbf{1.5 + 1.5L\text{m}^2} \\ F &= \mathbf{2.54 \times 10^{-5}\text{m/s}} \text{ from percolation tests} \\ O &= (1.5 + 1.5L) \times (2.54 \times 10^{-5}) \times (D \times 60) \text{ m}^3 \end{aligned}$$

Soakaway Storage volume: S

$$\begin{aligned} &\text{Effective volume of modular crate soakaway} \\ \text{Volume of System} &= 1.0 \times 1.5 \times 0.95 \times L = \mathbf{1.425L\text{m}^3} \end{aligned}$$

For satisfactory storage of the M100-30 min run-off

Volume equation $I - O = S$

$$\begin{aligned} 3.120 - (1.5 + 1.5L) \times (2.54 \times 10^{-5}) \times (30 \times 60) &= 1.425L \\ 3.120 - (0.069 + 0.069L) &= 1.425L \end{aligned}$$

$$\text{Required soakaway width } \mathbf{L = 2.04\text{m}}$$

Summary of calculations for a range of M100-D storms + 30% climate change showing maximum length of soakaway required: L

Storm Duration D-min	M5-D (20xZ1)	Z2	M100-D	30%	Length (m)
15	12.6	1.94	24.44	31.77	1.61
60	20.0	2.03	40.60	52.78	2.25
120	24.2	2.01	48.64	63.23	2.63
240	29.2	1.97	57.52	74.78	2.56
360	32.4	1.94	62.85	81.71	2.36

The required soakaway is to be sized: L x W x D = 2.63m x 1.0m x 1.5m. Soakaway to use modular crates.

Check on time of emptying half storage volume of M100 – 240, t_{s50}

$$t_{s50} = \frac{S \times 0.5}{a^{S50} f} = \frac{1.425 \times 2.63 \times 0.5}{[1.5 + (1.5 \times 2.63)] \times (2.54 \times 10^{-5})} = 13549 \text{ seconds} = \mathbf{3.76 \text{ hrs}}$$
