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digest

Soakaway design

Digest 365

BRE Construction Division

Soakaways have been the traditional way to dispose of stormwater from buildings and paved areas remote from a public sewer or watercourse. In recent years, soakaways have been used within urban, fully-sewered areas to limit the impact on discharge of new upstream building works and to avoid costs of sewer upgrading outside a development. Soakaways are seen increasingly as a more widely applicable option alongside other means of stormwater control and disposal.

Soakaways must store the immediate stormwater run-off and allow for its efficient infiltration into the adjacent soil. They must discharge their stored water sufficiently quickly to provide the necessary capacity to receive runoff from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics. They can be constructed in many different forms and from a range of materials.

This Digest describes design and construction procedures for soakaways, explains how to calculate rainfall design values and soil infiltration rates, and gives design examples.

Digest 365 is being reissued with minor typographical amendments to coincide with the publication of BRESOAK Soakaway design software (Ref. AP241).

Courtesy of Hughes Concrete Ltd

Precast concrete soakaway rings being installed for drainage of a supermarket car park

BRESOAK Soakaway design software (ref. AP241)

BRESOAK software helps designers to plan soakaways in line with the advice in Digest 365. The software will save time in designing soakaways, and give confidence that the results will be fully in line with Digest 365 and acceptable for building control purposes. Full details are available on www.ihsbrepress.com.

Shape and size

Soakaways for areas less than 100 m^2 have traditionally been built as square or circular pits, either filled with rubble or lined with dry-jointed brickwork or precast perforated concrete ring units surrounded by suitable granular backfill. BS 8301 suggests that soakaways may take the form of trenches that follow convenient contours: compared with square or circular shapes, they have larger internal surface areas for infiltration of stormwater for a given stored volume. The designer must consider the merits of the more compact square or circular forms against the better rate of discharge from the trench in the particular conditions of soil type, available space, site layout and topography.

For drained areas above 100 m^2, soakaways can be precast ring or of trench type and not substantially deeper than soakaways that serve small areas: 3 to 4 m is adequate if ground conditions allow. Although limiting the depth does mean the length must be increased, trench soakaways are cheaper to dig with readily available excavating equipment.

Soil infiltration characteristics

The method of determination must give representative results for the proposed site of the soakaway. This is achieved by:

- Excavating a trial pit of sufficient size to represent a section of the design soakaway.
- Filling the pit several times in quick succession whilst monitoring the rate of seepage, to represent soil moisture conditions typical of the site when the soakaway becomes operative.
- Examining site data to ensure that variations in soil conditions, areas of filled land, preferential underground seepage routes, variations in the level of groundwater, and any geotechnical and geological factors likely to affect the long-term percolation and stability of the area surrounding the soakaway have been assessed. Groundwater should not rise to

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the level of the base of the soakaway during annual variations in the water table. Local building control and/or planning authorities should advise where fluctuations in groundwater level may cause a problem in the long term for any proposed depth of excavation.

Design procedure

The design method for sizing a soakaway is based upon the equation of volumes:

$I - O = S$

where:

I = the inflow from the impermeable area drained to the soakaway

O = the outflow infiltrating into the soil during rainfall

S = the required storage in the soakaway to balance temporarily inflow and outflow.

Inflow to the soakaway

$I = A \times R$

where:

A = the impermeable area drained to the soakaway

R = the total rainfall in a design storm (a 10-year return period should be used); calculation of R is shown in the box below.

Outflow from the soakaway

$O = a_{s50} \times f \times D$

where:

a_{s50} = the internal surface area of the soakaway to 50% effective depth: this excludes the base area whic is assumed to clog with fine particles and become ineffective in the long term

f = the soil infiltration rate determined in a trial pit at the site of the soakaway

D = the storm duration.

Required storage volume in the soakaway, *S*

Storage must equal or be greater than inflow minus outflow, defined above, and is the required effective volume available between the base of the soakaway and the invert of the drain discharging to the soakaway.

There are four steps in the design procedure:

1 carry out a site investigation to determine the soil infiltration rate.

2 decide on a construction type (eg filled pit in square, circular or trench form, or concrete ring units with granular surround).

3 calculate required storage volume, *S*, from inflow minus outflow for a range of durations of 10-year design storms to determine the maximum storage predicted for the type of soakaway.

4 review the design to ensure its overall suitability considering space requirements, site layout and time for emptying.

This design method for sizing soakaways contains assumptions which generally combine to increase the factor of safety against surface flooding of the design:

- the percentage run-off is taken as 100% from the drained area, ie no reduction is made to the design run-off volume discharged to the soakaway for losses due to surface wetting or the filling of puddles during the storm.
- no allowance is made for the time taken for run-off to discharge to the soakaway: the required storage volume is calculated on the basis of instantaneous discharge to the soakaway.

Calculating design rainfall

Values of design rainfall, *R*, can be determined using Figure 1 and Tables 1 and 2 for different storm durations with a 10-year return period. The notation *MX-D* min is used to identify the storm, where:

X = the return period in years

D = the storm duration in minutes.

The 10-year return period rainfall of 15 minutes duration, known as M10-15 min, or of 30 minutes duration, known as M10-30 min rainfall, is calculated as follows:

From the map in Figure 1, determine the rainfall ratio, *r*, for the location of the soakaway (interpolating between contours). Use this in Table 1 to give the factor Z1 for the calculation of the 5-year return period rainfall total, M5-D min, for different storm durations, *D*.

The basis of the calculation is the M5-60 min rainfall: this can be taken to be 20 mm for all parts of the United Kingdom.

M5-D min rainfall = M5-60 min rainfall × Z1
= 20 mm × Z1
M10-D min = M5-D min × Z2
where Z2 is found from Table 2

For example, if, for the soakaway location, *r* on Figure 1 = 0.42, the M5-15 min can be found as follows:

M5-15 min rainfall = 20 mm × Z1 (for 15 min duration)

Read Z1 from Table 1 in the column for the required rainfall duration, *D*, (eg 15 min), and interpolate for the appropriate rainfall ratio, *r*, at the site: (eg *D* = 15 min; *r* = 0.42; Z1 = 0.64)
= 20 mm × 0.64
M5-15 mm rainfall = 12.8 mm

M5-30 min rainfall = M5-60 min rainfall × Z1 (for 30 min duration)
= 20 mm × 0.81
= 16.2 mm

The required 10-year return period rainfalls used in the soakaway design are calculated by interpolating the growth factors Z2 from Table 2.

For example,
M10-15 min rainfall = M5-15 min rainfall × Z2
= 12.8 mm × 1.23 (for England and Wales)
= 15.7 mm

M10-30 min rainfall = 16.2 mm × 1.24
= 20.1 mm

Other durations are calculated in the same way.

This procedure to determine the 10-year rainfalls must be used because the basic data are available only for 5-year returns.

Table 1 Values of Factor Z1 for rainfall duration *D* and ratio *r*

	Rainfall duration *D*									
	Minutes				Hours					
r	5	10	15	30	1	2	4	6	10	24
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.23	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03

Table 2 Growth factor Z2 for M10 rainfalls from M5 rainfalls

	M10 growth factor Z2	
M5 rainfall mm	England and Wales	Scotland and N Ireland
5	1.19	1.17
10	1.22	1.19
15	1.24	1.20
20	1.24	1.19
25	1.24	1.18
30	1.22	1.18
40	1.19	1.17
50	1.17	1.16
75	1.14	1.14
100	1.13	1.13

- the outflow from the soakaway is under-estimated; higher infiltration rates occur at greater depths of storage in practice than are adopted in design, and because the outflow is calculated on the basis of the rainfall duration rather than the run-off duration. The latter may be considerably longer, depending on the length of drains.

Soil infiltration rate

Excavate a soakage trial pit to the same depth as anticipated in the full-size soakaway; for run-off from 100 m^2 this will be 1 to 1.5 m below the invert level of the drain discharging to the soakaway. Overall depths of excavation will be typically 1.5 to 2.5 m for permeable areas up to 100 m^2 draining to the soakaway.

The trial pit should be 0.3 to 1 m wide and 1 to 3 m long. It should have vertical sides trimmed square and, if necessary for stability, should be filled with granular material. When granular fill is used, a full-height, perforated, vertical observation tube should be positioned in the pit so that water levels can be monitored with a dip tape. It should be possible to construct a suitably dimensioned pit with a backhoe loader or mini-excavator. Narrow, short pits use less water for the soakage tests but may be more difficult to trim and clean prior to testing. Measure the pit carefully before trials.

For safety reasons do not enter the pit.

A lot of water will be used to determine the soil infiltration rate so a water bowser may be needed. The inflow should be rapid so that the pit can be filled to its maximum effective depth in a short time, ie to the design invert level of the drain to the soakaway. Take care that the inflow does not cause the walls of the pit to collapse.

Fill the pit and allow it to drain three times to near empty; each time record the water level and time from filling, at intervals sufficiently close to clearly define water level versus time (Figure 2). The three fillings should be on the same or consecutive days.

Calculate the soil infiltration rate from the time taken for the water level to fall from 75% to 25% effective storage depth in the pit, using the lowest *f* value of the three test results for design:

where:

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

V_{p75-25} = the effective storage volume of water in the trial pit between 75% and 25% effective depth

a_{p50} = the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} = the time for the water level to fall from 75% to 25% effective depth.

If the test pit is deeper than about 3 m, it may be difficult to supply sufficient water for a full-depth soakage test. Tests may be conducted at less than full depth but determinations of the soil infiltration rate may be lower than those from the full-depth test. This is because relationships between depth of water in the soakage pit, the effective area of outflow and the infiltration rate can vary with depth, even when soil conditions themselves do not vary. The variation in infiltration rate with the depth at which the determination is made may be as much as a factor of two. From the results of a soakage trial in Figure 2, the calculated infiltration rate based upon a fall of water level from:

- 75% to 50% effective depth is 5.1×10^{-5} m/s
- 50% to 25% effective depth is 2.9×10^{-5} m/s.

The design method adopts the result determined from 75% to 25% effective depth of 3.3×10^{-5} m/s (see the box on page 5).

If it is impossible to carry out a full-depth soakage test, soil infiltration rate calculation should be based on the time

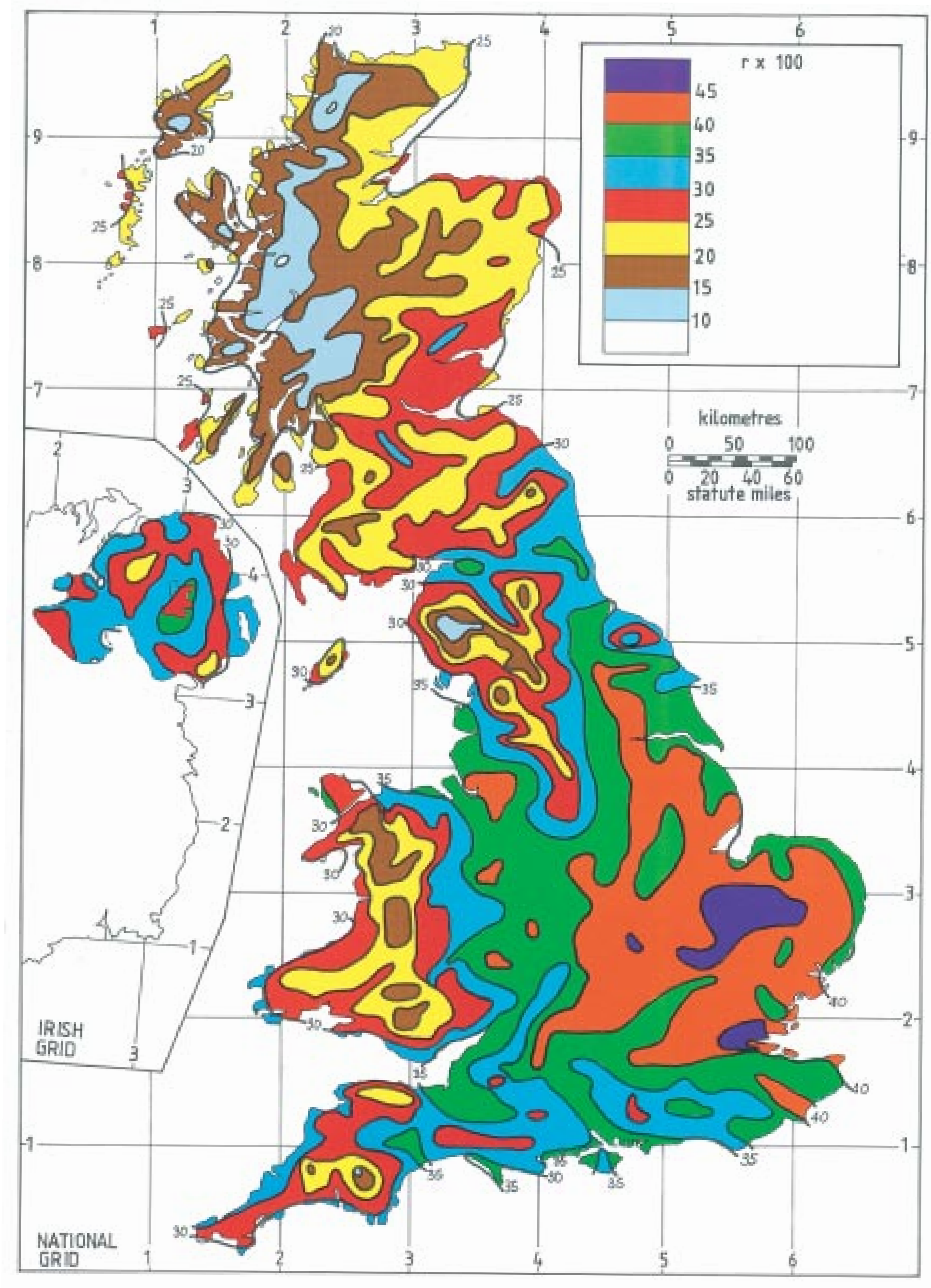

Figure 1 Ratio of 60-minute to 2-day rainfalls of 5-year return period – from *Design and analysis of urban storm damage* (Department of the Environment)

for fall of water level from 75% to 25% of the actual maximum water depth achieved in the test. The effective area of loss from the soakage pit is then calculated as the internal surface area of the pit to 50% maximum depth achieved plus the base area of the pit. In general, soakage trials should be undertaken where the drain will discharge to the soakaway. The use of full-depth and of repeat determinations at locations along the line of trench soakaways is very important when soil conditions vary; if the soil is fissured, infiltration rates can vary enormously. In these situations, a preliminary design length for the proposed soakaway should be calculated from the first soakage trial pit result and, if the design length exceeds 10 m, a second trial should be carried out at the design

Calculating soil infiltration rate

Figure 2 shows typical field observations from a soakage trial pit. It was known that the invert of the discharge drain was to be 1 m below ground surface. An effective storage depth of 1.5 m was adopted. When trimmed and clean, the trial pit was 2.51 m deep, 2.40 m long and 0.60 m wide

Volume outflowing between 75% and 25% effective depth:
$V_{p75-25} = 2.40 \times 0.60 \times (2.13 - 1.38) = 1.09\ m^3$

The mean surface area through which the outflow occurs, taken to be the pit sides to 50% effective depth and including the base of the pit:
$a_{p50} = (2.40 \times 0.755 \times 2) + (0.6 \times 0.755 \times 2) + (2.40 \times 0.60)$
$= 5.97\ m^2$

From Figure 2, the time for the outflow between 75% and 25% effective depth:
$t_{p75-25} = 102 - 11 = 91$ min

Soil infiltration rate, $f = \dfrac{1.09}{5.97 \times 91 \times 60} = 3.3 \times 10^{-5}$ m/sec

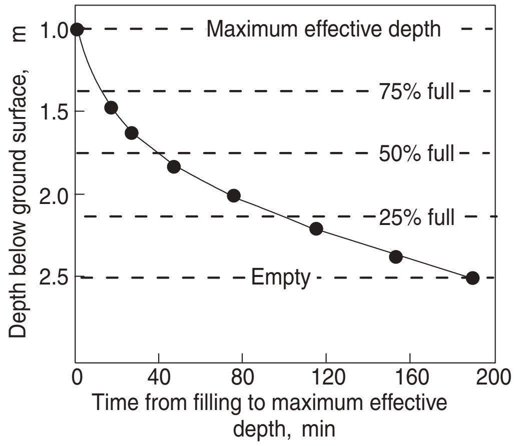

Figure 2 Field observations from a soakage trial pit 2.51 m deep; 2.4 m long; 0.6 m wide – no granular fill

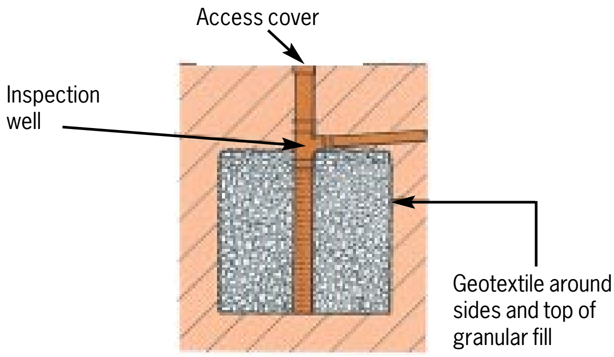

Figure 3 Small, filled soakaway with perforated inspection well extending to base of soakaway providing access to discharge drain outlet

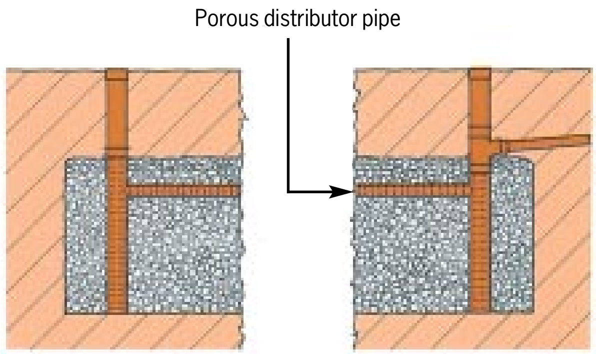

Figure 4 Trench type soakaway with horizontal distributor pipe

length distance along the line of the soakaway. In all ground conditions, a second trial pit should be dug if the trench soakaway (designed on the basis of one trial pit) is longer than 25 m; further trial pits are needed at intervals of 25 m along the line of a long soakaway. If more than one trial pit is used, the mean value of the soil percolation rates determined from the trial pits is adopted for the final design.

Time of emptying of soakaway

The soakaway should discharge from full to half-volume within 24 hours in readiness for subsequent storm inflow.

Construction details

Maintenance of soakaways has always presented problems, usually in finding them! This is certainly the case with rubble-filled ones. All soakaways should be provided with some form of inspection access, so that the point of discharge of the drain to the soakaway can be seen. This access will identify the location and will allow material to be cleared from the soakaway.

Little monitoring of soakaway performance is done, but this could be most informative about changes in soil infiltration rate and in warning of soakaway blockage in the long term. The inspection access should provide a clear view to the base of the soakaway, even when the soakaway is of the filled type (Figure 3). For small, filled soakaways, a 225 mm perforated pipe provides a suitable inspection well. Lined soakaways have the advantage of access for inspection and cleaning and this should be a feature of all soakaways. Trench-type soakaways should have at least two inspection access points, one at each end of a straight trench, with a horizontal perforated or porous distributor pipe linking the ends along the top of the granular fill (Figure 4). It may be convenient with a trench soakaway to have several drain discharge points along the length of the trench, each connected to the soakaway via an inspection access chamber.

In trench soakaways, the movement of suspended and floating material into the distributor pipe can be minimised by using wet wells with a T-piece inlet fitted to the distributor pipe (Figure 6). Two or more T-piece inlets to distributor pipes in two or more trench soakaways may be appropriate for large wet well designs. The advantages of sedimentation of fine material in the precast chamber, for ease of maintenance and extended operating life, are combined with the more efficient trench discharge characteristics.

Design examples

Design a soakaway to receive stormwater from 95 m^2 impermeable surface for a site near Southampton

Find the rainfall ratio from Figure 1 (r = 0.35) and calculate the storm rainfalls for a range of storm durations (Table 3).

Table 3 Rainfall results for a range of storm durations

Storm duration *D* min	M5-*D* min = 20 mm × Z1	Z2	M10-*D* min = *R* mm
10	10.2	1.22	12.4
15	12.4	1.23	15.3
30	15.8	1.24	19.6
60	20.0	1.24	24.8
120	24.4	1.24	30.3
240	30.0	1.22	36.6
360	33.8	1.21	40.9
600	39.0	1.19	46.6

Assuming the results from a soakage trial pit (Figure 2) were obtained at the site, they can be used to design a soakaway which will be filled with granular material having 30% free volume. The percentage void space of any granular fill material must be pre-determined for use in the design method.

Take the soakaway dimensions as:
2.4 m long × 2.5 m deep × 1.5 m effective storage depth, so that the soakage trial pit can form part of the full-scale soakaway.

Calculate the design width of the soakaway:
Volume equation $I - O = S$

Inflow to soakaway *I*

$I = A \times R$
= impermeable surface area × M10-D min rainfall eg for 10 min storm duration, M10-10 min = 12.4 mm = 0.0124 m
$I = 95 \times 0.0124$
$= 1.178\ m^3$

Outflow from soakaway *O*

$O = a_{s50} \times f \times D$
= internal surface area of soakaway pit to 50% storage depth (excluding base area) × soil percolation rate × storm duration
For rectangular pit 2.4 m long × 1.5 m effective depth × W m wide:
$a_{s50} = 2 \times (2.4 + W) \times (1.5 \div 2)$
$= 3.6 + 1.5\,W\ m^2$
$f = 3.3 \times 10^{-5}$ m/s from soakage trial
$O = (3.6 + 1.5\,W) \times (3.3 \times 10^{-5}) \times (D \times 60)\ m^3$

Soakaway storage volume *S*

S = effective volume of soakaway with 30% free volume
$= 2.4 \times 1.5 \times W \times 0.3$
$= 1.08\,W\ m^3$
For satisfactory storage of the M10-10 min run-off.
$I - O = S$
$1.178 - (3.6 + 1.5\,W) \times (3.3 \times 10^{-5}) \times (10 \times 60) = 1.08\,W$
Required soakaway width $W = 1$ m

Repeat the calculation for a range of M10-D min storms and determine the maximum width. Results are summarised in Table 4.

Table 4 Rainfall results for a range of M10-D min storms

Storm duration *D* – min	Required soakaway width *W* – m
10	1.00
15	1.20
30	1.41
60	1.53
120	1.41
240	0.99

A soakaway 2.4 m long × 1.5 m effective depth × 1.53 m wide would be suitable with the critical storm duration around 1 hour for 10-year events. The design may be suitable for the site layout but, if not, alternative shapes could be investigated. For example, if a narrow soakaway was necessary similar to the soakage trial pit (0.6 m wide × 1.5 m effective depth), calculations show that it must be 5.1 m long, with the critical storm duration around 30 min.

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

$$t_{s50} = \frac{S \times 0.5}{a_{s50} \times f} = \frac{(1.08 \times 1.53) \times 0.5}{(3.6 + [1.5 \times 1.53]) \times (3.3 \times 10^{-5})} \text{ seconds}$$

$t_{s50} = 1.2$ hours

This design is clearly satisfactory but with soil infiltration rates of about 10^{-7} it may take days for the soakaway to half empty so the performance would be unsuitable.

Design an alternative soakaway for the site at Southampton using perforated concrete ring units

The rainfall results in Table 3 can be used again; the soil infiltration rate is 3.3×10^{-5} m/s and the effective depth of storage is 1.5 m.

Use an initial design of 900 mm internal diameter concrete ring units, placed in a square pit of side length L, with granular backfill with 30% free volume between the rings and the sides of the pit.

Volume equation $I - O = S$

$I = A \times R$

$= 95 \times 0.0124$

$= 1.178$ m^3 for M10-10 min storm

$O = a_{s50} \times f \times D$

For a square soakaway with 1.5 m effective storage depth and excluding base area:

$a_{s50} = 4 \times L \times 1.5 \times 0.5$

$= 3L$ m^2

$O = 3L \times (3.3 \times 10^{-5}) \times (D \times 60)$ m^3

$= 0.0594L$ m^3 for M10-10 min storm

Soakaway storage volume S

= free volume in granular fill + volume within concrete ring units

Volume within 900 mm ring units = $3.142 \times 0.45^2 \times 1.5 = 0.95$ m^3

Free volume in granular fill surrounding ring units in a square pit

$= (1.5L^2 - [3.142 \times 0.50^2 \times 1.5]) \times 0.3$

$= 0.45L^2 - 0.353$ m^3

(0.50 m = internal radius of the concrete ring plus 50 mm wall thickness)

Total volume $S = 0.95 + (0.45L^2 + 0.353) = 0.597 + 0.45L^2$ m^3

For satisfactory storage of the M10-10 min run-off

$I - O = S$

$1.178 - 0.0594L = 0.597 + 0.45L^2$

$0.45L^2 + 0.0594L - 0.581 = 0$

Solving the quadratic equation:

$$\text{Side length } L = \frac{-0.0594 + (0.0594^2 + 4 \times 0.45 \times 0.581)^{0.5}}{2 \times 0.45}$$

$L = 1.07$ m

Repeat for a range of M10-D min storms and determine the maximum size of excavation. Results are summarised in Table 5.

Table 5 Maximum size of excavation

Storm duration *D* – min	Required soakaway pit *L* – m
10	1.07
15	1.28
30	1.49
60	1.62
120	1.59
240	1.40

Choose a soakaway 1.62 m^2 subject to a check on time of emptying half the storage, t_{s50}

$$t_{s50} = \frac{S \times 0.5}{a_{s50} \times f} = \frac{(0.597 + 0.45(1.62)^2) \times 0.5}{(3 \times 1.62) \times (3.3 \times 10^{-5})} \text{ seconds} = 1.5 \text{ hours}$$

If the initial design using 900 mm concrete units and the calculation of the pit side length is unsatisfactory, select another standard size of unit and repeat the calculation.

Design a trench soakaway to receive stormwater run-off from 400 m² impermeable surface

Choose a trench 0.6 m wide, 1.5 m effective depth, with granular fill having 30% free volume. Calculate the soakaway trench length, L. The rainfall ratio r is 0.35 and soil infiltration rate f is 3.3×10^{-5} m/s.

Volume equation $I - O = S$

$I = A \times R$

$= 400 \times 0.0124$

$= 4.96$ m^3 for M10-10 min storm

$O = a_{s50} \times f \times D$

$a_{s50} = 2 \times (0.6 + L) \times (1.5 \div 2)$

$O = (0.9 + 1.5L) \times (3.3 \times 10^{-5}) \times (D \text{ x } 60)$ m^3

$= 0.01782 + 0.0297L$ m^3 for M10-10 min storm

Soakaway storage volume, S, = effective volume in trench with 30% free volume.

$S = L \times 0.6 \times 1.5 \times 0.3 = 0.27L$ m^3

For satisfactory storage of the M10-10 min run-off:

$I - O = S$

$4.96 - 0.01782 - 0.0297L = 0.27L$

$L = 16.5$ m

Repeat the calculation for a range of M10-D min storms and determine the maximum length. The results are summarised in Table 6.

A soakaway 22 m long, 1.5 m effective depth and 0.6 m wide is suitable; time for half emptying is 45 min. Such a design might be compatible with site layout and topography but an alternative trench cross-section could be investigated. Maintain the 1.5 m effective depth but use trench widths of 0.3 m and 1 m. The design lengths of trench for the widths are shown below for a range of 10-year return period storms. As the design width increases, the required length decreases and the critical storm duration increases. So if a design fails to meet the 24 hour time for half empty criterion, reducing the width and thereby increasing the length of a trench soakaway might achieve a satisfactory design. Similarly, if a design based upon a perforated precast concrete ring unit soakaway fails the 24 hour criterion, a trench-type soakaway may be satisfactory.

Table 6 Rainfall results for a range of M

Storm duration *D* – min	Required soakaway length *L* – m
10	16.5
15	19.7
30	21.9
60	21.9
120	19.2
240	14.0

With narrower, longer soakaways the volume of the soakaway trench is reduced relative to the wider trench designs: the storage is reduced because of the enhanced outflow performance. The volume of the trench designed 0.3 m wide is only 70% of a 1 m wide trench so there are savings in the cost of excavation and granular fill material (see Figure 5).

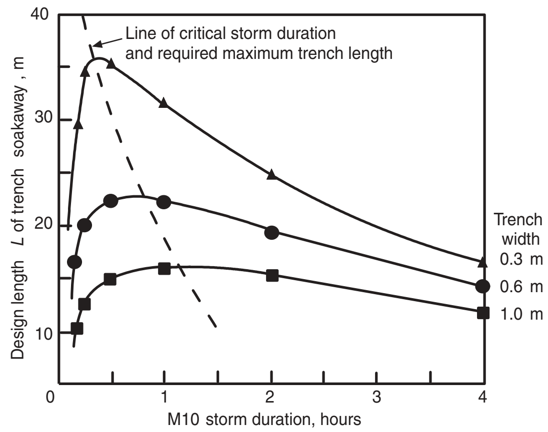

Figure 5 Required design length of trench soakaway plotted against design storm duration for 10-year return storm periods

Perforated, precast concrete ring unit soakaways should be installed within a square pit, with sides about twice the selected ring unit diameter. The need to oversize the soakaway pit for purposes of constructing the ring unit chamber may be used to advantage by incorporating the total excavation volume below the discharge drain invert in the design storage volume.

Granular material must be separated from the surrounding soil by a suitable geotextile to prevent migration of fines into the soakaway. If migration from surrounding soil occurs, it can cause ground settlement around the soakaway sufficient to affect the stability of adjacent buildings. The top surface of the granular fill should also be covered with geotextile to prevent the ingress of backfill material during and after surface reinstate-ment. Geotextile should not be wrapped around the outside of the ring units as it cannot be cleaned satisfactorily or removed when it has become blocked.

General considerations

Soakaways can provide a long-term, effective method of disposal of stormwater from impermeable areas of several hundreds of square metres. Long-term maintenance and inspection must be considered during the design and construction process. With wet well soakaways, vehicle-mounted suction emptying and jetting equipment can be used, so suitable access to inspection covers must be provided.

Pollution danger to the quality of groundwater must be considered. The limited evidence presently available suggests that roof surface run-off does not cause damage to groundwater quality and may be discharged directly to soakaways. Those pollutants entering the soakaway from roofs tend to remain in the soakaway, or in its immediate environs, attached to soil particles. However, paved surface run-off should be passed through a suitable form of oil interception device prior to discharge to soakaways. Maintenance of silt traps, gully pots and interceptors will improve the long-term performance, and the use of wet well chambers within the soakaway system can further assist in pollutant trapping and extending operating life.

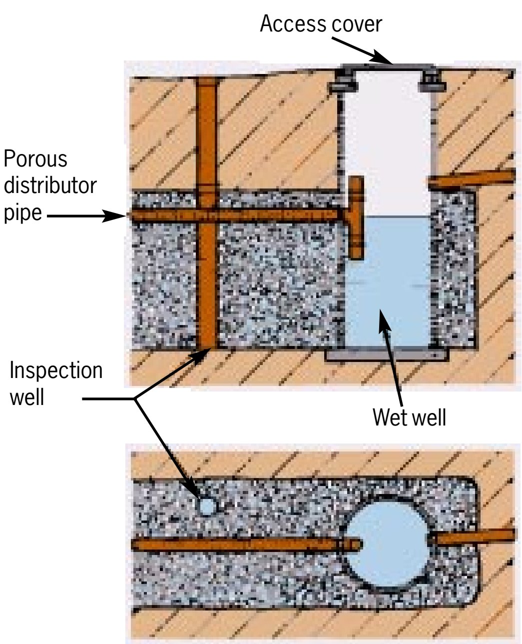

Figure 6 Trench-type soakaway with large wet well equipped with T-piece overflow to porous distributor pipe and separate inspection well

Care must be taken so that the introduction of large volumes of surface run-off into the soil does not disrupt the existing sub-surface drainage patterns; it may be advantageous to use extended trench soakaway systems. The effect of ground slope must be considered when siting soakaways to avoid waterlogging of downhill areas.

Soakaways should not normally be constructed closer than 5 m to building foundations. In chalk, or other soil and fill material subject to modification or instability, the advice of a specialist geotechnologist should be sought as to the advisability and siting of a soakaway.

Site investigations must be undertaken thoroughly and competently so that all aspects of soil properties, geotechnology and hydrogeology are adequately reviewed alongside the hydraulic designs of soakaways.

Further reading

British Standards BS 8301: 1985 Code of practice for building drainage.

Design and analysis of urban storm drainage. The Wallingford Procedure. Department of the Environment. National Water Council Standing Technical Committee Reports No 31. ISBN 0 901090 31 X.

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