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Determination of soakaway storage requirement and proposed dimensions

Development description and estimate of Impervious areas

Approximately 571.77m² of roof drainage from proposed development, approximately 374m² from proposed car park and approximately 574m² from proposed access road.

Total impervious area 1519.77 m²

Design Procedure from BRE Digest 365 for standard return period 10yr

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

$$S = I - O$$

Where: S = Required storage in the soakaway to balance inflow and outflow.
I = Inflow from Impermeable Areas drained to soakaway.
O = Outflow Infiltrating into the soil.

I = Total inflow Volume

I = Inflow to soakaway from on-site impervious areas
= Impervious Area, A x Total Rainfall (10yr Return Period)

O = Outflow Volume = as50 x f x D x 60

as50 = Internal Surface Area of soakaway to 50% effective depth (m²)
f = Soil Infiltration Rate (Taken from Infiltration Test Calc sheets) (m/s)
D = Storm Duration (mins)

f = Soil Infiltration Rate

Figures determined in accordance with BRE standard Infiltration tests carried out on 22nd March 2011.

Average 1.63 x 10⁻⁵

Average infiltration rate used in design.

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Rainfall Parameters

Storm return frequency - 1 in (yrs)	10.00	(Required Return Period in BRE Digest 365)
M5-60 min rainfall (mm)	20.00	(BRE Digest 365: 20mm to be taken for all UK)
Ratio (M5-60 / M5-2day) - r	0.35	(From Map on Page 3)

Drainage Area

Total impervious area A (m2)	1519.77
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Soakaway Details

(Rectangular soakaway)	Length L (m) =	106.00	
	Width W (m) =	0.60	
	Effective Depth d (m) =	1.50	
	Design Area (m²), as50 (m2)=	159.90	Area of sidesto 50% depth
	Percentage Voids P (%) =	30	Typical 30% for single size stone
	Design Volume V (m3) =	28.62	(P/100xLxWxd)

Soil Infiltration

Infiltration Rate f (m/s) =	1.63E-05	From infiltration test results
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Calculations in table below

Total rainfall R = M5-60 * Z1 * Z2 (calculated page 3)

Inflow Volume, I = A x R (100% run-off)

Outflow Volume O = as50 * f * D * 60

Storage Volume S = I - O

Storm duration (D)		R	I	O	S
(Minutes)	(Hrs)	(M10-D) (mm)	m³	m³	m³
15	0.25	15.16	23.042	2.346	20.697
30	0.50	19.51	29.650	4.691	24.958
60	1.00	24.80	37.690	9.383	28.307
120	2.00	30.34	46.108	18.766	27.342
240	4.00	36.53	55.512	37.532	17.980
360	6.00	40.85	62.084	56.298	5.786
600	10.00	46.46	70.601	93.829	0.000
1440	24.00	58.07	88.256	225.190	0.000

Max

Crit D

Design Storage Requirement = Maximum Volume (m³) = 28.307

Proposed Soakaway Dimension Check = OK, but check Time of Emptying

Time of Emptying of Soakaway (Taken from BRE Digest 365)

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

ts50 = Time to empty 50% of total storage volume

ts50 = $\frac{S \times 0.5}{as50 \times f \times 3600}$ = 1.53 hrs < 24hrs, Therefore Design Acceptable

Summary of acceptable dimensions:

Length =	106.00 m
Width =	0.60 m
Effective Depth =	1.50 m

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Values of Factor Z1 (From BRE 365 - Table 1)

Ratio	Rainfall Duration (mins)							
r	15	30	60	120	240	360	600	1440
0.12	0.450	0.670	1.000	1.480	2.170	2.750	3.700	6.000
0.15	0.480	0.690	1.000	1.420	2.020	2.460	3.230	4.900
0.18	0.510	0.710	1.000	1.360	1.860	2.250	2.860	4.300
0.20	0.530	0.723	1.000	1.340	1.800	2.163	2.700	3.833
0.21	0.540	0.730	1.000	1.330	1.770	2.120	2.620	3.600
0.24	0.560	0.750	1.000	1.300	1.710	2.000	2.400	3.350
0.25	0.567	0.753	1.000	1.290	1.687	1.960	2.347	3.267
0.27	0.580	0.760	1.000	1.270	1.640	1.880	2.240	3.100
0.30	0.590	0.770	1.000	1.250	1.570	1.780	2.120	2.840
0.33	0.610	0.780	1.000	1.230	1.530	1.730	2.040	2.600
0.35	0.617	0.787	1.000	1.223	1.497	1.690	1.947	2.480
0.36	0.620	0.790	1.000	1.220	1.480	1.670	1.900	2.420
0.39	0.630	0.800	1.000	1.210	1.460	1.620	1.820	2.280
0.40	0.633	0.803	1.000	1.207	1.447	1.603	1.793	2.240
0.42	0.640	0.810	1.000	1.200	1.420	1.570	1.740	2.160
0.45	0.650	0.820	1.000	1.190	1.380	1.510	1.680	2.030

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Calculating Design Rainfall, R (10yr Return Period)

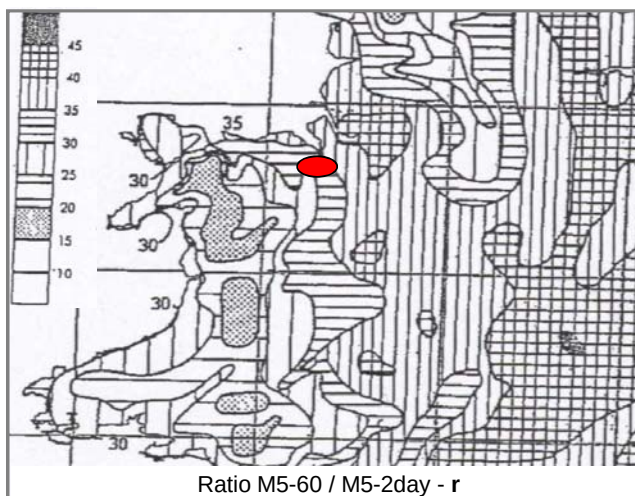
Pro-rata values **

M5-60 rain (mm) 20.00 (Taken from Page 1)
Ratio M5-60/M5-2day 0.35 (Taken from Page 1)

Duration (mins)	Duration (hrs)	Factor Z1	R (M5-D) (mm)	Z2 Values - M10			Prorata Z2	R (M10-D) (mm)
				Z2 low	Diff (mm)	Z2 high		
2	15.0	0.25	12.333	1.22	5.00	1.24	1.229	15.162
3	30.0	0.50	15.733	1.24	5.00	1.24	1.240	19.509
4	60.0	1.00	20.000	1.24	5.00	1.24	1.240	24.800
5	120.0	2.00	24.467	1.24	5.00	1.24	1.240	30.339
6	240.0	4.00	29.933	1.24	5.00	1.22	1.220	36.527
7	360.0	6.00	33.800	1.22	10.00	1.19	1.209	40.851
8	600.0	10.00	38.933	1.22	10.00	1.19	1.193	46.455
9	1440.0	24.00	49.600	1.19	10.00	1.17	1.171	58.072

Z2 Factors - England & Wales (from BRE 365 Table 2)

M5 Rain (mm)	Diff (mm)	M10
0	5	1.190
5	5	1.190
10	5	1.220
15	5	1.240
20	5	1.240
25	5	1.240
30	10	1.220
40	10	1.190
50	25	1.170
75	25	1.140
100	50	1.130
150	50	1.120
200	50	1.110



Ratio M5-60 / M5-2day - r