Appendix 5

Greenfield runoff and stormwater storage

Table A5-1. Generalised assessment of Greenfield runoff rates (QBAR, Q100), and the storage volumes (Vol_{lower}, Vol_{upper}) required to attenuate runoff in a 1 in 100 year storm to Greenfield rates (Q100), allowing for a 30 per cent increase in rainfall depth under climate change. It has been assumed that there is no infiltration into the ground. It is important to note that these values are estimates only and should not be used for design purposes.

SAAR (mm)	Soil index	r[1]	Runoff and storage	Site area (ha)						
				0.1	1	5	10	25	50	100
1200	0.15	-	QBAR[2]	0.1[5]	0.8	3.8	7.6	19.0	38.0	70.5
			Q100[3]	0.2	1.8	9.2	18.4	46.0	92.1	170.6
		0.3	Vol_{lower}[4]	95	984	4889	9779	24446	48877	99953
			Vol_{upper}[4]	139	1422	7075	14149	35373	70729	143843
		0.4	Vol_{lower}	73	751	3740	7480	18700	37392	76189
			Vol_{upper}	97	996	4953	9906	24764	49515	100735
	0.30	-	QBAR	0.3	3.4	17.1	34.2	85.6	171.2	317.3
			Q100	0.8	8.3	41.4	82.9	207.2	414.3	767.8
		0.3	Vol_{lower}	60	593	2966	5929	14823	29583	60791
			Vol_{upper}	90	890	4455	8907	22269	44542	91211
		0.4	Vol_{lower}	51	507	2538	5074	12680	25349	51746
			Vol_{upper}	70	694	3471	6940	17350	34703	70930
	0.45	-	QBAR	0.8	8.3	41.3	82.5	206.3	412.7	764.8
			Q100	2.0	20.0	99.9	199.7	499.4	998.7	1850.8
		0.3	Vol_{lower}	42	422	2110	4221	10526	21002	43117
			Vol_{upper}	67	665	3327	6655	16635	33270	68179
		0.4	Vol_{lower}	39	392	1961	3922	9758	19306	39182
			Vol_{upper}	55	555	2775	5551	13877	27754	56691
900	0.15	-	QBAR	0.1	0.5	2.7	5.4	13.6	27.2	50.4
			Q100	0.1	1.3	6.6	13.2	32.9	65.8	121.8
		0.3	Vol_{lower}	119	1088	5418	10837	27116	54231	111261
			Vol_{upper}	156	1510	7531	15061	37671	75341	152402
		0.4	Vol_{lower}	86	814	4051	8103	20272	40544	82725
			Vol_{upper}	112	1069	5327	10653	26651	53301	108321
	0.30	-	QBAR	0.2	2.4	12.2	24.5	61.1	122.3	226.6
			Q100	0.6	5.9	29.6	59.2	147.9	295.9	548.3
		0.3	Vol_{lower}	67	669	3341	6682	16709	33414	68458
			Vol_{upper}	98	989	4939	9878	24701	49397	100973
		0.4	Vol_{lower}	55	558	2785	5571	13930	27854	56877
			Vol_{upper}	75	754	3767	7534	18836	37670	76955
	0.45	-	QBAR	0.6	5.9	29.5	58.9	147.4	294.7	546.2
			Q100	1.4	14.3	71.3	142.7	356.6	713.3	1321.8
		0.3	Vol_{lower}	49	482	2413	4825	12056	24074	49272
			Vol_{upper}	75	745	3726	7451	18630	37258	76191
		0.4	Vol_{lower}	44	437	2187	4373	10901	21694	44044
			Vol_{upper}	61	607	3036	6071	15180	30323	61876

Notes:

[1] – r is the ratio of the M5-60 minute rainfall to the M5-2 day rainfall. A value of 20 has been used for M5

[2] – Greenfield runoff rate with a 1 in 2.3 year return period ($l\ s^{-1}$)

[3] – Greenfield runoff rate with a 1 in 100 year return period ($l\ s^{-1}$)

[4] – The storage volume required is partly dependent on the technique(s) employed to control runoff. Some techniques allow a given discharge rate to be achieved with less storage than others; hence, lower and upper limits for storage volume are shown (m^3)

[5] – It is very difficult to restrict surface water discharge to less than 2 $l\ s^{-1}$ (shown in red)

Casestudy – The Moorhayes Park SUDS pond

At present, Moorhayes Park in Tiverton provides the only example of a SUDS scheme for residential development in Mid Devon (Environment Agency, 2007). A 1 500 m^3 attenuation pond has been excavated to serve the 10 ha development; additional capacity, in excess of 3 000 m^3, is provided by the surrounding public open space (Photographs 15 and 16, Appendix 2). The pond discharges via two outlet structures (hydroslides with constrictive flow rates of 40 $l\ s^{-1}$ and 80 $l\ s^{-1}$) to a watercourse near Harding Crescent (NGR SS 9615 1349; Figure A3-2b, Appendix 3). At this time, the SUDS scheme has not been adopted. South West Water does not currently adopt any SUDS arrangements, although it continues to review this policy in line with national guidance for the water industry (South West Water, 2007). In view of the strategic importance of the Moorhayes pond, a mechanism for the adoption and long-term maintenance of it should be established as soon as possible. This should include the preparation of an operation and maintenance manual, if this has not already been done.

Table A5-2. Summary of typical SUDS components. Local ground conditions (e.g. soil permeability, groundwater vulnerability) must be taken into account in the selection of appropriate techniques

Component	Description	Potential for flow rate control	Potential for runoff volume reduction	Maintenance requirement	Space take-up	Cost	Public safety concerns to be addressed at the design stage
Soakaways	Sub-surface structures that store and dispose of water via infiltration	High	High	Low	Low	Medium	No
Infiltration basins	Depressions in the surface that are designed to store runoff and infiltrate the water to the ground	High	High	Medium	High	Low	Yes
Filter drains and perforated pipes	Trenches filled with permeable material. A perforated pipe may be built into the base of the trench to collect and convey the water	High	Low	Medium	Low	Medium	No
Filter strips	Wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas	Medium	Low	High	High	Medium	No
Wet ponds	Basins that have a permanent pool of water	Medium	Low	High	High	High	Yes
Constructed wetlands	Ponds with shallow areas and aquatic vegetation	Medium	Low	High	High	High	Yes
Swales	Normally dry. Broad, shallow channels covered by grass or other suitable vegetation	High	Medium	Low	High	Low	Yes
Detention basins	Normally dry. They are designed to detain a certain volume of runoff	High	Low	Low	High	Low	Yes
Pipes, subsurface storage	Conduits used for conveyance and/or storage	High	Low	Low	Low	Medium	No
Permeable pavements	Allow rainwater to infiltrate through the surface into an underlying storage layer	High	High	Medium	Low	Medium	No
Green roofs	Vegetated roofs that reduce runoff volume and rate	High	High	High	Low	High	No
Rainwater harvesting	Water is collected from the roof, diverted through a filter and stored in a tank for re-use (e.g. toilets, washing machines, gardens)	High	Medium	High	Low	High	Yes

Source – Woods-Ballard et al. (2007)