

Belsize Fire Station FRA Addendum

1. Discharge Rate

Whilst NPPF and NPPG require the runoff from a developed site with increased rainfall to account for climate change to not exceed the existing rate, the London Plan states the greenfield rate should be achieved "as far as possible" whilst the SPG states that this should be at greenfield rate, 50% of the existing rate or the limiting discharge of 5 l/s. The DEFRA's Best Practice Guide states that for previously developed sites the peak runoff should be as close as reasonably practicable to the greenfield rate but should not exceed the existing rate which implies that between the existing and the greenfield rate is acceptable.

The proposals are for a change of use of an existing building. In such cases other LBs (eg Merton) advise that they require the developed site runoff with climate change to not exceed the existing rate as they appreciate SUDS is not always a practical option on an existing site or building. The SUDS were therefore originally designed to not exceed the existing rate. To meet Camden's requirements the greenfield rate or the limiting discharge of 5 l/s, whichever is the greater, is now considered.

2. Critical Storm Duration

None of these policy documents above specify a storm duration and as rainfall intensity will with storm duration so will the peak flow. It is not enough to state "existing" or "greenfield" as this will require a variable control on any SUDS system depending on the storm duration which cannot be achieved in practice. It is therefore usual to specify a flow release rate for the "critical storm duration" which can then be controlled using a fixed flow control such as a hydrobrake. Using Kirpich's formula the time of entry (T_e) is given as 25 minutes and this represents the time for runoff from an impermeable area to reach the maximum flow. The Wallingford Manual then requires the time of flow through a pipe system (T_f) to be added to T_e to give the time of concentration (T_c). If T_f is taken as the same as the T_e the T_c is then 50 mins which is rounded to give a critical storm duration of 1 hour. However Camden has now advised the 6 hour is required.

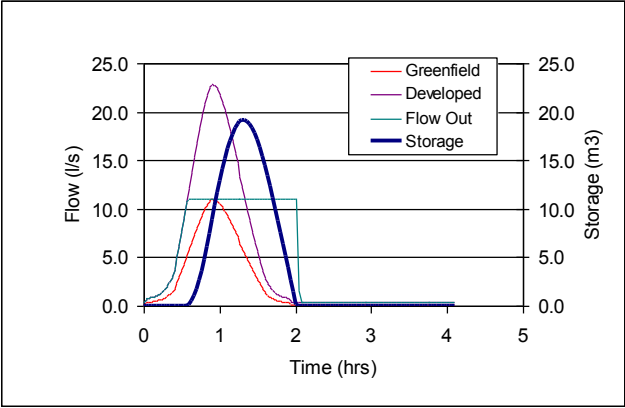
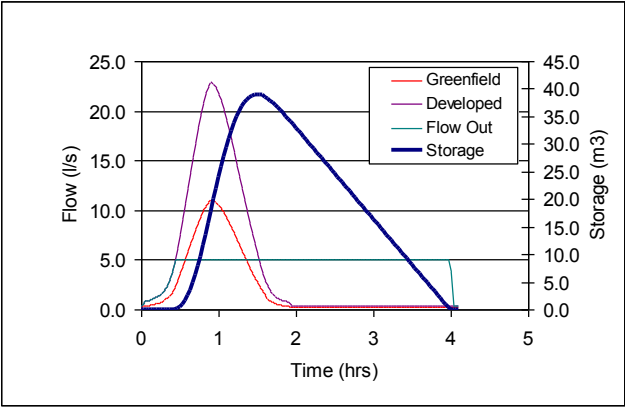
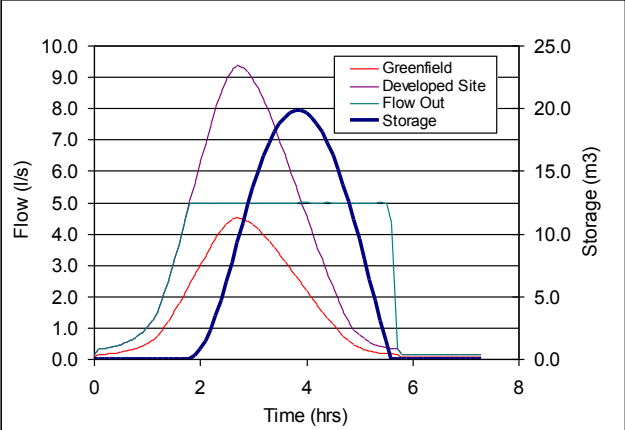
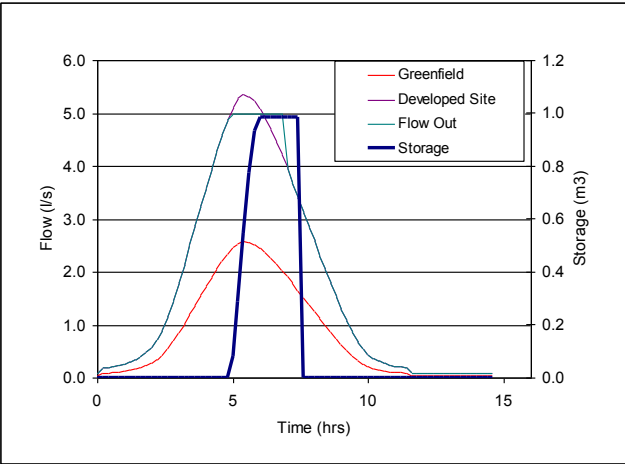
The FRA showed that the 1 hour storm on the existing site will provide a peak flow of 16.3 l/s, a greenfield rate of 11.0 l/s and for the developed site with a 40% increase in rainfall (DEFRA guidance of Feb 2016) a peak flow of 22.9 l/s. The 6 hour storm on the existing site gives a peak flow of 3.8 l/s, a greenfield rate of 2.6 l/s and the developed site with a 40% allowance a peak flow of 5.4 l/s.

The 100 year Peak Flows (l/s)

Duration (hrs)	1hr	3hr	6hr
Existing	16.3	6.7	3.8
Greenfield	11.0	4.5	2.6
Developed	22.9	9.4	5.4

3. To ensure Developed site runoff does not exceed Greenfield or Limiting Discharge of 5 l/s

To control the developed site runoff with a 40% increase in rainfall due to climate change to the limiting discharge of 5 l/s or the greenfield rate, whichever is the larger, will require a storage facility of 39m³ for the 1 hour storm, 20m³ for the 3 hour and 1m³ for the 6 hour storm. The 1 hour greenfield rate at 11 l/s is higher than the limiting discharge and this will require 19m³ of storage.

Storm	Existing Rate	Developed Site (l/s)	Greenfield Site (l/s)	Release Rate (l/s)	Max Storage (m3)
1 hr		22.89	11.0	11.00	19.1
1 hr		22.89	11.0	5.00	39.0
3 hr		9.39	4.50	5.00	19.8
6 hr		5.35	2.6	5.00	1.0

4. Storage and Attenuation

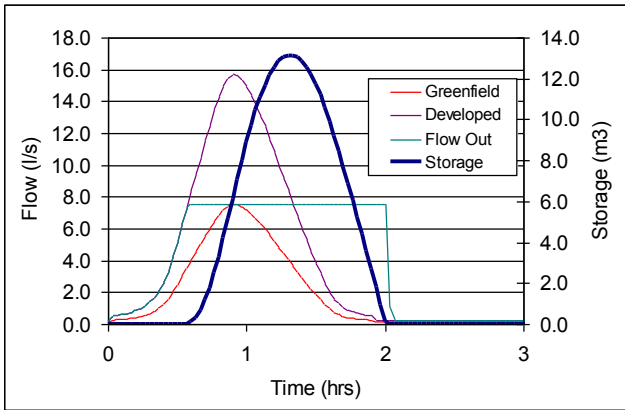
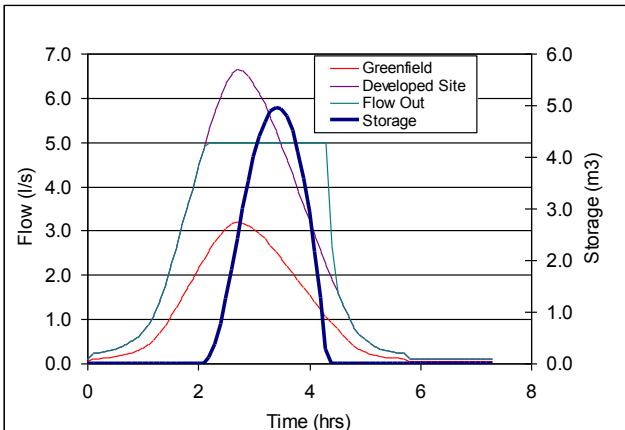
Assuming a typical storm cell is 1.2m wide, 2.4m long, 0.52m deep and with a 95% void space each can provide 1.42m³ of storage. To achieve the 1 hr greenfield rate will then require 14 storm cells over an area of 40m² whilst the greenfield 3 and 6 hour will require fewer storm cells.

Standard	Storage Volume Req'd (m ³)	No Storm Cells	Surface Area (m ²)
1 hr Greenfield	19.1	14	40.3
1 hr 5 l/s	39.0	28	80.6
3 hr 5 l/s	19.8	14	40.3
6 hr 5 l/s	1.0	1	2.9

The proposals are to use 16 storm cells under the car parking area and this will provide 22.7m³ of storage which is more than enough storage and restrict site runoff for the 1 hour storm to the greenfield rate or the 3 and 6 hour storm to the limiting discharge.

5. To ensure 30 year Storm does not exceed the installed storage volume

The 1hr, 3hr or 6hr 30 year storm will not cause the storage volume of 22.7m³ to be exceeded.

Storm	30 year Storm	Greenfield (l/s)	Developed (l/s)	Release (l/s)	Max Storage (m ³)
1 hr		7.58	15.72	7.58	13.1
3 hr		3.21	6.65	5.00	5.0

