PRICE & MYERS

Central Somers Town, London, NW1 1DN

Polygon Residential, Plot 2 - SUDS Drainage Statement

Version 1

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November 2015
23468
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Version	Date	By	Notes
1	20.11.15	JL	Issued for Planning

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1 The Site

The site is located in the London Borough of Camden, in an area north of Polygon Road, with Chalton Street to the west and Edith Neville Primary School adjacent to the east. The site area is approximately 580m² comprising of a mix of hardstanding children's play areas, and soft landscaped area.

The location of the existing school and grounds is shown in the figure below. National grid reference TQ2968583176

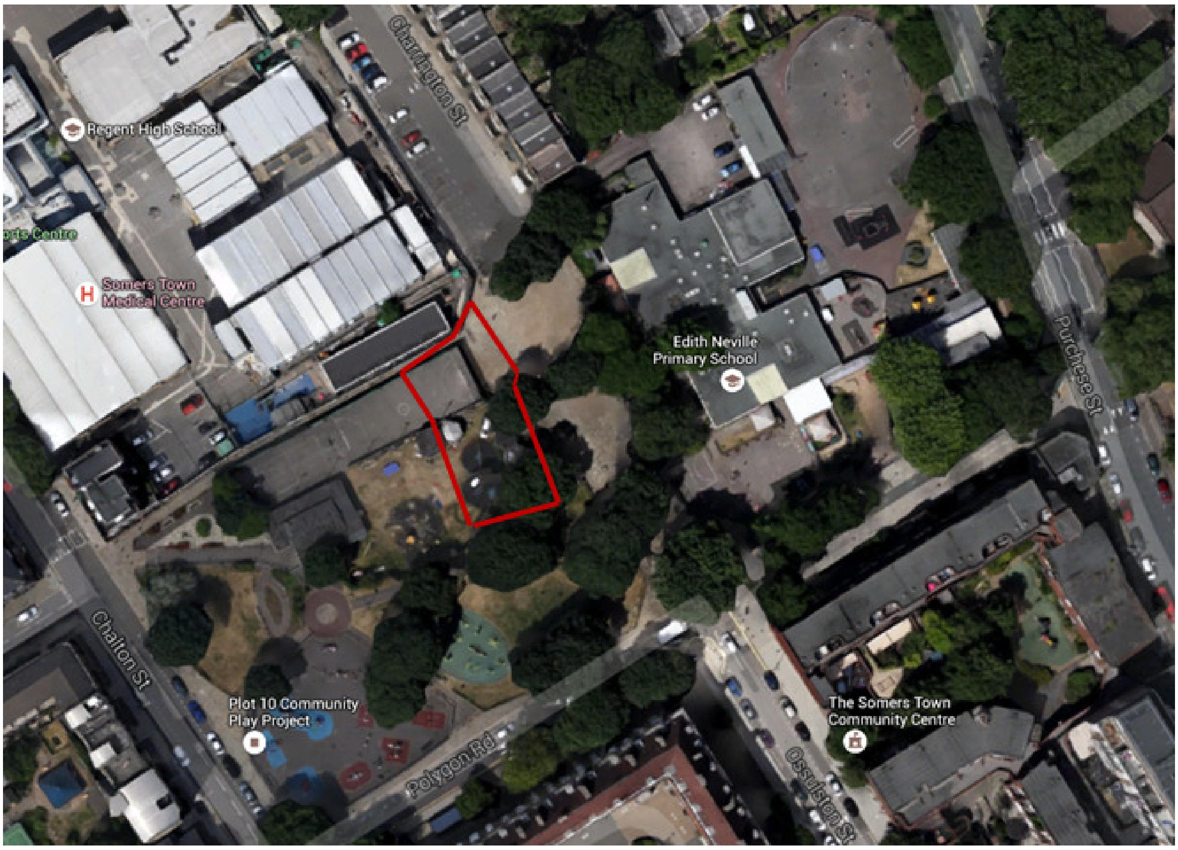

Figure 1 - Proposed site Imagery © 2015. The GeoInformation Group, Map data © 2015 Google

The Environment Agency (EA) indicative flood outline map shows that the site is located within Flood Zone 1, therefore the flood risk is considered to be 'low'. Camden's Strategic Flood Risk Assessment (SFRA) 2014, also shows the proposed development to be outside of any Local Flood Risk Zones as illustrated in Figure 2.

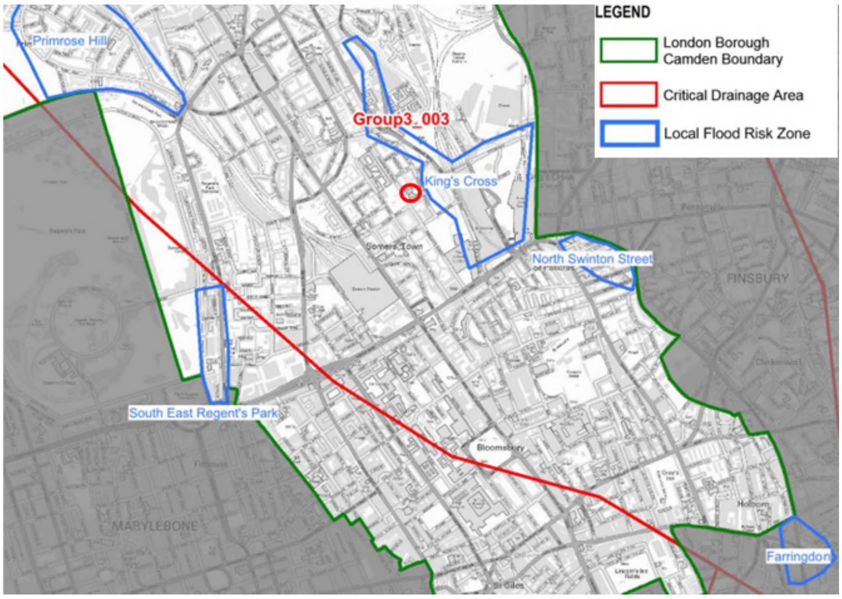

Figure 2 – Camden SFRA 2014, Critical Drainage Areas/ Local Flood Risk Zones

2 Development Proposals

It is proposed that an 8 storey building consisting of 35 residential units and a ground floor commercial unit be constructed to form part of the wider Somers Town development. The wider proposals involve the redevelopment of the existing Edith Neville Primary School, a new community hub including a nursery and children's play facilities. Extensive improvements to surrounding public open spaces are also proposed along with the development of a further two nearby residential plots.

Development proposals, for the residential plot considered in this report, are shown below in Figure 3. The design is being carried out by Duggan Morris Architects and the proposals can be seen in their drawings.

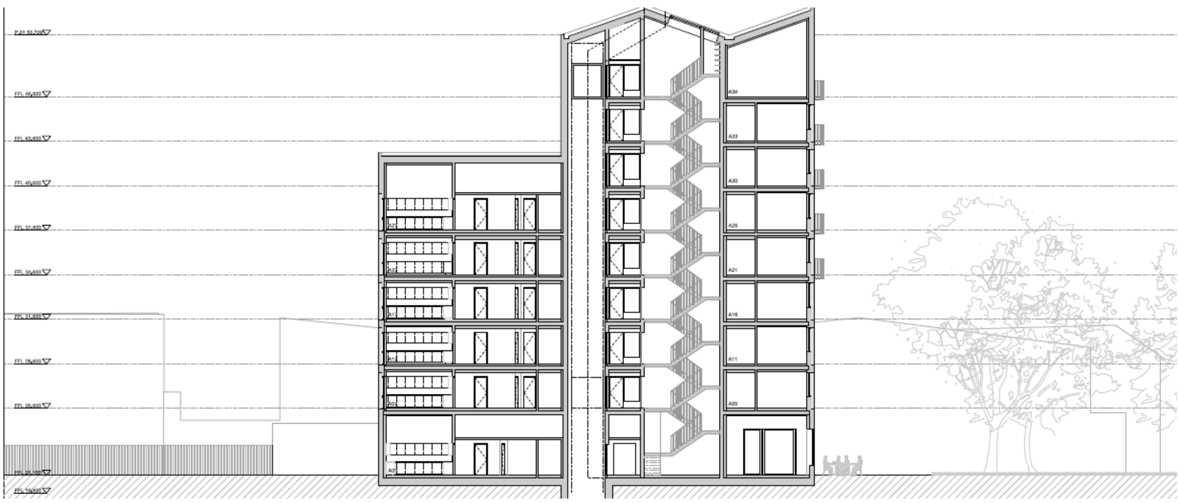

Figure 3 – Plot 2, Proposed Section Plan

3 Existing Drainage

Surface Water Run-Off Rates

The site area is approximately 580m^2 (0.058 ha), of which 50% is currently impermeable. The existing run-off rate for the 1 in 100 year storm event was calculated using the modified rational method for the impermeable areas as shown below:

$Q_{100\ HARD}$ = 2.78 x A x i (where A is the catchment area in ha and i is the rainfall intensity in mm/hr as estimated using Micro Drainage software)

$Q_{100\ HARD}$ = 2.78 x 0.029 x 106.32 = 8.57 l/sec

The Greenfield run-off rate for the soft landscaped areas of the site was estimated using the Greenfield run-off estimator tool (uksuds.com, Appendix A) using the BFI specified from FEH data. The 1 in 100 year Greenfield run-off rate can be calculated by multiplying the 100 year growth curve factor by Q_{bar}. The Greenfield run-off rate is estimated based on a minimum site area of 0.1ha. Therefore the rate will be interpolated based on Plot 2's permeable areas on site.

Q_{100GF} = 3.19 x 0.37 x 0.29 = 0.34 l/sec

The total run-off rate for the existing site is:

$Q_{100\ TOTAL}$ = 8.57 + 0.34 = 8.91 l/sec.

The same calculation was carried out using rainfall intensity values 'i' from Micro Drainage software for the 1 in 1 year and 1 in 30 year rainfall events. The flow rates for these storm events were found to be as follows:

Q_1 = (2.78 x 0.029 x 33.60) +0.34 = 3.05 l/sec
Q_{30} = (2.78 x 0.029 x 82.60) +0.34 = 7.00 l/sec

Surface Water Run-Off Volume

FEH data was used to determine the depth of rainfall for the 1 in 100 year 6 hour rainfall event. This was found to be 77.24 mm. The pre-development volume of run-off (V) can therefore be calculated for the 290m^2 impermeable site area as below:

V_{100} = 0.077 x 290 = 22.33 m^3

Foul Water

As previously mentioned, the existing site area is currently comprises of children's play area and soft landscaped area. Therefore, no foul flows currently discharge from the site.

Thames Water record plans indicate that a 1245x787mm combined public sewer runs under the northern area of the existing site. A build over agreement with Thames Water will be required prior to the construction of the new school.

4 Proposed Drainage

Surface Water Run-Off

The proposed development will increase the impermeable areas on the site to be the entire site area (0.058ha). Therefore the peak surface water flow rate and volume to the public sewer will be increased. The proposed run-off rate for the 1 in 100 year storm event was calculated using the modified rational method for the proposed impermeable areas as shown below. This includes a 30% allowance for climate change:

$$Q_{100\ PROPOSED} = 2.78 \times 0.058 \times 138.216 = 22.29\ \text{l/sec}$$

FEH data was used to determine the depth of rainfall for the 1 in 100 year 6 hour rainfall event. This was found to be 77.24 mm. The pre-development volume of run-off (V) can therefore be calculated as below:

$V_{100} = (0.077 \times 580) = 44.66\ m^3$

$V_{100+cc} = (44.66)1.3 = 58.06\ m^3$ (1.3 = 30% allowance for climate change)

The surface water drainage system will be designed for the 1 in 100 year + 30% for climate change storm event to reduce the flood risk on site and the public sewer network downstream of the site outfall.

SUDS Assessment

The London Plan states that new developments should aim to achieve Greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the Sustainable Drainage Systems (SUDS) hierarchy. SUDS can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics natural conditions. The SUDS hierarchy states that storing rainwater for reuse within the building should be prioritised, followed by infiltration techniques. However, published information confirms that the site is underlain by London Clay which is unsuitable for the use of infiltration techniques. Furthermore, infiltration systems must be constructed at least 5m away from structures which is not possible on this site as the building covers the entire site footprint.

Therefore, in accordance with the London Plan, surface water should be attenuated to Greenfield run-off rates before draining to the public sewers. The Greenfield run-off rate for the site was estimated using the Greenfield run-off estimator tool (uksuds.com, Appendix A) using the BFI specified from FEH data. The 1 in 100 year Greenfield run-off rate can be calculated by multiplying the 100 year growth curve factor by Q_{bar}: The rate will be interpolated based on Plot 2's site area.

$$Q_{100GF} = 3.19 \times 0.37 \times 0.58 = 0.68 \text{ l/sec}$$

However, the joint Defra and EA R&D Technical Report (Preliminary Rainfall Runoff Management for Developments) states that the minimum limiting discharge for attenuation systems in 5 l/sec, as lower flow rates require small diameter flow control devices which are at risk of blockages. Therefore, surface water from the site will be attenuated to 5 l/sec before draining to the public sewers. Preliminary calculations (Appendix B) show that a storage volume of 16m^3 is required to attenuate surface water to 5 l/sec for the 1 in 100 year plus 30% (climate change) storm event. This volume will be provided in a below ground attenuation tank.

The proposed location of the surface water attenuation tank is shown in the preliminary surface water drainage sketch presented in Appendix C. As shown in the sketch, it is proposed that the attenuated flows will then discharge via gravity to the 1168x762mm public sewer, shown on Thames Water record plans running from north to south, adjacent to the eastern site boundary. CCTV Survey information will be required to determine if an existing connection to the public sewer can be utilised or if a new direct connection is required.

Rainwater harvesting is also an option that could be incorporated into the detailed design. The attenuation tank will be designed to cope with surface water from all the roof and hardstanding areas. This is because the amount of storage available within the rainwater harvester is dependent on the water demand from the building users. If a storm were to occur during a period when there was little water demand from the building users (and the harvester is full) the inflow to the harvester will be equal to the outflow, providing no attenuation benefits before entering the attenuation tank.

Further details of the SUDS strategy are provided in the Camden drainage proforma document in Appendix D.

SUDS Maintenance

It is the responsibility of the site owners to ensure that the SUDS are maintained throughout their life. Maintenance and cleaning of gullies, drain manholes (including catchpits) and attenuation tanks will assure adequate performance. A maintenance program is outlined in the table below.

SUDS Element	Maintenance		
Attenuation Storage	Maintenance Issues	Failure of components, blockage from debris	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect and identify any elements that are not operating correctly.	Monthly for three months, then six monthly or as required
		Remove sediment/debris from catchment surface that may lead to blockage of structures.	Monthly or as required
		Remove sediment/debris from catchpits/gullies and control structures.	Annually, after severe storms or as required
	Remedial Work	Repair inlets, outlets, vents, overflows and control structures.	As required
	Monitoring	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are in good condition and operating as designed.	Annually or after severe storms

Foul Water

Guidance has been taken from Table 5 of ‘Building Regulations - Part H’ to approximate the proposed flow rate from the proposed development based on the proposed number of dwellings. The proposed 8 storey residential plot will comprise of 35 dwellings. Therefore, the proposed foul water discharge rate has been calculated to be 6.2 litres/ sec.

As stated in Section 2, a commercial unit is also proposed on the ground floor of the building. This will provide access to separate toilet facilities. An additional flow rate of 1.12 litres/ sec has been calculated for these facilities, based on guidance set out in BS EN 12056.

The overall foul discharge from the site is therefore estimated to be 7.32 litres/ sec.

As previously stated Thames Water record plans indicate that an 1168x762mm public sewer runs adjacent to the eastern site boundary. It is proposed that foul water discharges from the site to this sewer via a new gravity fed connection.

A S106 application will need to be made to Thames Water to permit the proposed connection.

APPENDIX A – Greenfield Run-off Calculations

Greenfield runoff estimation for sites

HR Wallingford
Working with water

Site name:	Plot 2 - Central Somers Town
Site location:	NW1 1DN

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude:	51.53235° N
Longitude:	0.13071° W
Reference:	gcpvjj0vdnr9 / 0.1
Date:	9 Nov 2015

Site characteristics

Total site area	0.1	ha
Significant public open space	0	ha
Area positively drained	0.1	ha

Methodology

Greenfield runoff method	IH124

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	2
HOST class	N/A
SPR	0.30

Hydrological characteristics

	Default	Edited	
SAAR	620	620	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.75	0.75	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	0.16	0.16	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

Greenfield runoff estimation for sites

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Site coordinates

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Date:	9 Nov 2015

Site characteristics

Total site area	0.1	ha
Significant public open space	0	ha
Area positively drained	0.1	ha

Methodology

Greenfield runoff method	FEH	
Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Specify BFI manually	
HOST class	N/A	
BFI / BFIHOST	0.33	
Qmed	0.322	l/s
Qbar / Qmed Conversion Factor	1.136	

Hydrological characteristics

	Default	Edited	
SAAR	620	620	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.75	0.75	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	0.37	0.37	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	5.00	l/s
1 in 100 years	5.00	5.00	l/s

Please note that a minimum flow of 5 l/s applies to any site

APPENDIX B – Micro Drainage Calculations

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 26 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.031	0.531	0.0	4.9	4.9	10.6	O K
30 min Summer	99.136	0.636	0.0	4.9	4.9	12.7	O K
60 min Summer	99.133	0.633	0.0	4.9	4.9	12.6	O K
120 min Summer	99.028	0.528	0.0	4.9	4.9	10.5	O K
180 min Summer	98.920	0.420	0.0	4.9	4.9	8.4	O K
240 min Summer	98.829	0.329	0.0	4.9	4.9	6.6	O K
360 min Summer	98.709	0.209	0.0	4.7	4.7	4.2	O K
480 min Summer	98.646	0.146	0.0	4.4	4.4	2.9	O K
600 min Summer	98.617	0.117	0.0	4.0	4.0	2.3	O K
720 min Summer	98.602	0.102	0.0	3.5	3.5	2.0	O K
960 min Summer	98.585	0.085	0.0	2.8	2.8	1.7	O K
1440 min Summer	98.568	0.068	0.0	2.1	2.1	1.4	O K
2160 min Summer	98.556	0.056	0.0	1.5	1.5	1.1	O K
2880 min Summer	98.549	0.049	0.0	1.2	1.2	1.0	O K
4320 min Summer	98.541	0.041	0.0	0.8	0.8	0.8	O K
5760 min Summer	98.536	0.036	0.0	0.7	0.7	0.7	O K
7200 min Summer	98.532	0.032	0.0	0.6	0.6	0.6	O K
8640 min Summer	98.530	0.030	0.0	0.5	0.5	0.6	O K
10080 min Summer	98.528	0.028	0.0	0.4	0.4	0.6	O K
15 min Winter	99.112	0.612	0.0	4.9	4.9	12.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.220	0.0	15.0	21
30 min Summer	89.266	0.0	19.4	32
60 min Summer	54.817	0.0	23.8	50
120 min Summer	32.511	0.0	28.3	82
180 min Summer	23.643	0.0	30.8	114
240 min Summer	18.757	0.0	32.6	144
360 min Summer	13.517	0.0	35.3	200
480 min Summer	10.710	0.0	37.3	256
600 min Summer	8.935	0.0	38.9	314
720 min Summer	7.702	0.0	40.2	374
960 min Summer	6.089	0.0	42.4	492
1440 min Summer	4.367	0.0	45.6	734
2160 min Summer	3.127	0.0	49.0	1100
2880 min Summer	2.465	0.0	51.5	1444
4320 min Summer	1.761	0.0	55.2	2192
5760 min Summer	1.387	0.0	57.9	2936
7200 min Summer	1.151	0.0	60.1	3584
8640 min Summer	0.988	0.0	61.9	4400
10080 min Summer	0.869	0.0	63.5	5064
15 min Winter	138.220	0.0	16.8	22

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.246	0.746	0.0	4.9	4.9	14.9	O K
60 min Winter	99.240	0.740	0.0	4.9	4.9	14.8	O K
120 min Winter	99.064	0.564	0.0	4.9	4.9	11.3	O K
180 min Winter	98.895	0.395	0.0	4.9	4.9	7.9	O K
240 min Winter	98.770	0.270	0.0	4.9	4.9	5.4	O K
360 min Winter	98.640	0.140	0.0	4.3	4.3	2.8	O K
480 min Winter	98.605	0.105	0.0	3.6	3.6	2.1	O K
600 min Winter	98.590	0.090	0.0	3.0	3.0	1.8	O K
720 min Winter	98.580	0.080	0.0	2.6	2.6	1.6	O K
960 min Winter	98.569	0.069	0.0	2.1	2.1	1.4	O K
1440 min Winter	98.556	0.056	0.0	1.5	1.5	1.1	O K
2160 min Winter	98.546	0.046	0.0	1.1	1.1	0.9	O K
2880 min Winter	98.541	0.041	0.0	0.8	0.8	0.8	O K
4320 min Winter	98.534	0.034	0.0	0.6	0.6	0.7	O K
5760 min Winter	98.530	0.030	0.0	0.5	0.5	0.6	O K
7200 min Winter	98.527	0.027	0.0	0.4	0.4	0.5	O K
8640 min Winter	98.525	0.025	0.0	0.3	0.3	0.5	O K
10080 min Winter	98.523	0.023	0.0	0.3	0.3	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	89.266	0.0	21.7	33
60 min Winter	54.817	0.0	26.7	54
120 min Winter	32.511	0.0	31.7	88
180 min Winter	23.643	0.0	34.5	120
240 min Winter	18.757	0.0	36.5	148
360 min Winter	13.517	0.0	39.5	200
480 min Winter	10.710	0.0	41.7	254
600 min Winter	8.935	0.0	43.5	314
720 min Winter	7.702	0.0	45.0	372
960 min Winter	6.089	0.0	47.5	486
1440 min Winter	4.367	0.0	51.0	728
2160 min Winter	3.127	0.0	54.8	1104
2880 min Winter	2.465	0.0	57.6	1452
4320 min Winter	1.761	0.0	61.8	2188
5760 min Winter	1.387	0.0	64.8	2936
7200 min Winter	1.151	0.0	67.3	3680
8640 min Winter	0.988	0.0	69.3	4304
10080 min Winter	0.869	0.0	71.1	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.438	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.058

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.019	4	8	0.019	8	12	0.019

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 98.500 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	21.0	0.0	1.300	0.0	0.0
0.100	21.0	0.0	1.400	0.0	0.0
0.200	21.0	0.0	1.500	0.0	0.0
0.300	21.0	0.0	1.600	0.0	0.0
0.400	21.0	0.0	1.700	0.0	0.0
0.500	21.0	0.0	1.800	0.0	0.0
0.600	21.0	0.0	1.900	0.0	0.0
0.700	21.0	0.0	2.000	0.0	0.0
0.800	21.0	0.0	2.100	0.0	0.0
0.801	0.0	0.0	2.200	0.0	0.0
1.000	0.0	0.0	2.300	0.0	0.0
1.100	0.0	0.0	2.400	0.0	0.0
1.200	0.0	0.0	2.500	0.0	0.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0102-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	102
Invert Level (m)	98.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0
Flush-Flo™	0.353	4.9
Kick-Flo®	0.740	4.0
Mean Flow over Head Range	-	4.3

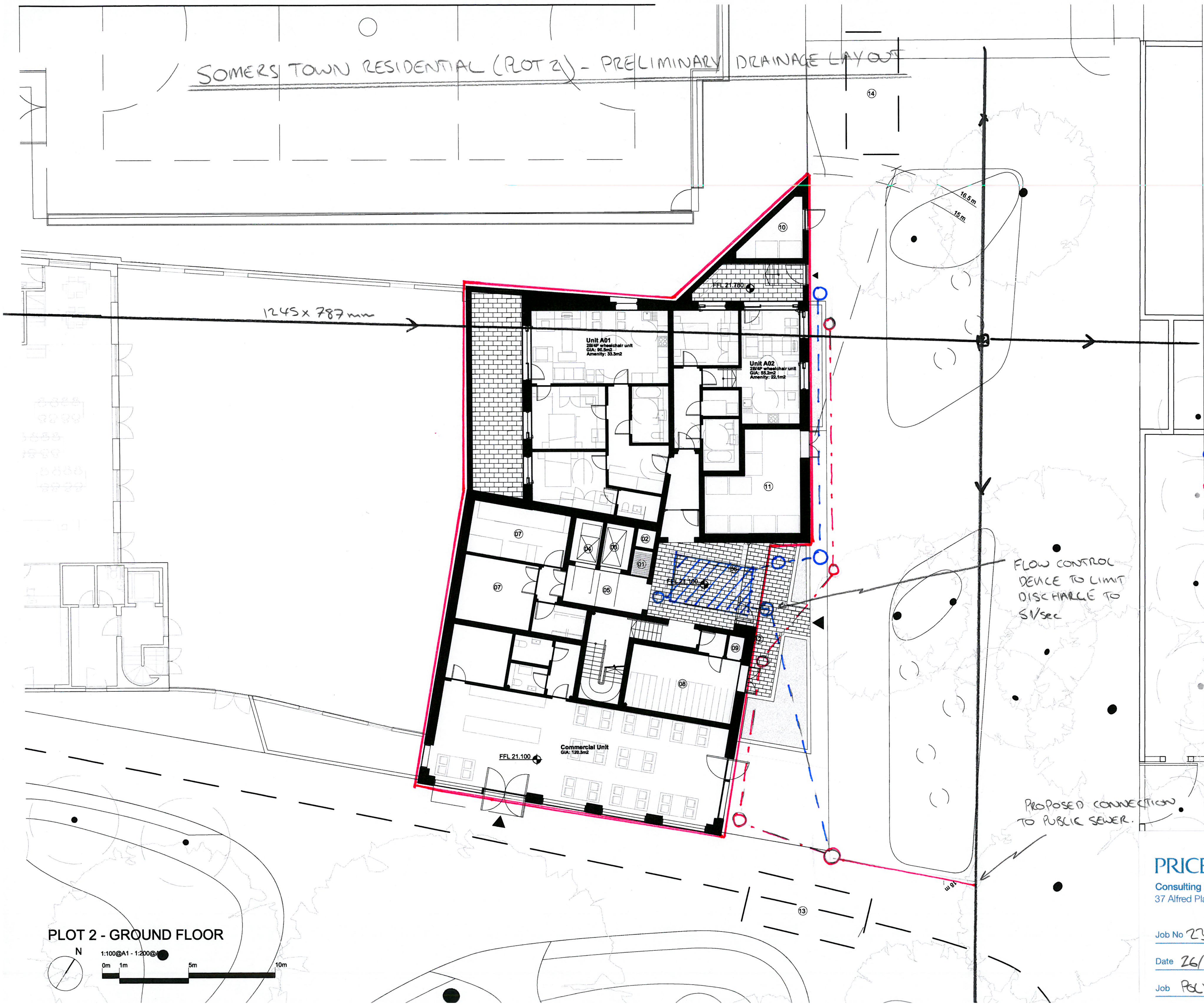
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	0.300	4.9	0.500	4.8	0.800	4.1
0.200	4.7	0.400	4.9	0.600	4.6	1.000	4.6

Hydro-Brake Optimum® Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	5.0	2.400	6.9	5.000	9.7	8.000	12.1
1.400	5.3	2.600	7.1	5.500	10.2	8.500	12.5
1.600	5.7	3.000	7.6	6.000	10.6	9.000	12.8
1.800	6.0	3.500	8.2	6.500	11.0	9.500	13.2
2.000	6.3	4.000	8.7	7.000	11.4		
2.200	6.6	4.500	9.2	7.500	11.8		

APPENDIX C – Preliminary Proposed Drainage Layout



KEY:

01 - Smoke vent
02 - Riser
03 - Lift car size (1.1m x 2.1m)
04 - Lift car size (1.1m x 1.4m)
05 - Fire fighting shaft
06 - Housing postboxes
07 - Plant
08 - Cycle store
09 - Incoming services
10 - Commercial unit refuse
11 - Housing refuse
12 - Dry riser / fire mains inlet

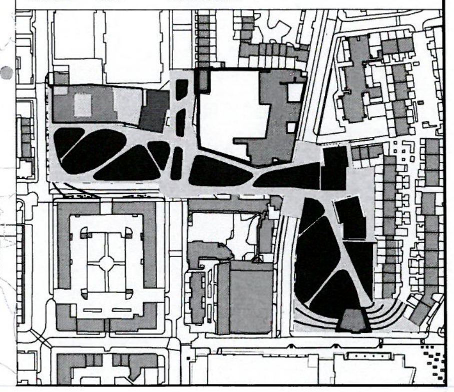
NOTES

1) MANHOLE POSITIONS ARE INDICATIVE
2) ONLY THE KEY MANHOLES ARE SHOWN
3) APPROVAL FROM THAMES WATER WILL BE REQUIRED TO BUILD OVER AND CONNECT PROPOSED DRAINAGE INTO EXISTING PUBLIC SEWERS
4) LOCATION OF EXISTING THAMES WATER SEWER IS INDICATIVE

KEY

- (red line) = PLOT BOUNDARY
- (hatched box) = SURFACE WATER ATTENUATION TANK ($16m^3$ CAPACITY)
- (circle symbol) = FLOW CONTROL DEVICE
- (blue dashed line) = PROPOSED SURFACE WATER DRAINAGE
- (red dash-dot line) = PROPOSED FOUL WATER DRAINAGE
- (black arrow) = EXISTING THAMES WATER PUBLIC SEWER
- (red arrow) = PROPOSED COMBINED SEWER

revision	date	amendment
C	14.10.15	coordination issue - work in progress
B	29.09.15	coordination issue - work in progress
A	17.09.15	coordination issue - work in progress



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Job No 23468 Page SK002 Ver A
Date 26/11/15 Eng JC Chd KB
Job POLYGON RESIDENTIAL, PLOT 2

APPENDIX D – Camden SUDS Proforma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

1. Site Details

Site	SOMERS TOWN, POLYGON RESIDENTIAL, PLOT 2
Address & post code or LPA reference	NW1 1DN
Grid reference	TQ2968583176
Is the existing site developed or Greenfield?	DEVELOPED (CHILDRENS PLAY AREA)
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding?	NO
Total Site Area served by drainage system (excluding open space) (Ha)*	0.029 Ha

* The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0.029	0.058	0.029	If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	SEWER	SEWER	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Evidence that this is possible	Notes for developers
Infiltration			N/A	e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse			N/A	e.g. Is there a watercourse near by?
To surface water sewer			N/A	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above			N/A	e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	% Difference (difference /existing x 100)	Notes for developers
Greenfield QBAR	0.16	N/A	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	3.05	3.05	–	–	Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events.
1 in 30	7.00	5.00	2.00	28.57	
1in 100	8.91	5.00	3.91	43.88	
1 in 100 plus climate change	N/A	5.00	—	—	The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
GREENFIELD RUN OFF VOLUME		N/A	N/A	
1 in 1	4.06	8.12	4.06	Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	15.95	31.9	15.95	
1in 100 6 hour	22.33	44.66	22.33	
1 in 100 6 hour plus climate change	29.03	58.06	29.03	The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates (m^3) Min 5 l/s	~~[illegible]~~ 16m^3	Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to reduce rates by 50% (m^3)		Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] (m^3)		Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3		Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	Site underlain with London Clay	Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	NO – TBC by ground investigation	Infiltration rates should be no lower than 1x10 $^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	—	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?	—	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided..
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	—	Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	NO - As a 5m clearence is required from any structure, not possible as the building covers the entire site footprint	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	Option 1 16m³ of storage	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
Which Drainage Systems measures have been used?		SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	✓	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Drainage system can contain in the 1 in 100 storm event without flooding	✓	National standards require that the drainage system is designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
Drainage system can contain in the 1 in 100 +CC storm event without flooding	✓	
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	✓	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters

		must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How are rates being restricted (vortex control, orifice etc)	Vortex control	Detail of how the flow control systems have been designed to avoid pipe blockages and ease of maintenance should be provided.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.		If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained?		If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	POLYGON RESIDENTIAL, PLOT 2 - SUDS DRAINAGE STATEMENT	
Section 3	N/A	
Section 4	=" =	
Section 5	=" =	
Section 6	=" =	
Section 7	~~N/A~~ LONDON BOROUGH OF CAMDEN SFRA (Figure 4b) + BGS record information	
Section 8	POLYGON RESIDENTIAL, PLOT 2 - SUDS DRAINAGE STATEMENT.	

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form Completed By: JOHN LING

Qualification of person responsible for signing off this pro-forma: CIVIL ENGINEER MEng

Company: PRICE & MYERS

On behalf of (Client's details): CAMDEN COUNTY COUNCIL

Date: 20/11/15