UCL

New Student Centre

Drainage Proforma

June 2015

curtins

Advice Note on contents of a Surface Water Drainage Statement

London Borough of Camden

1. Introduction

1.1 The Government has strengthened planning policy on the provision of sustainable drainage and new consultation arrangements for 'major' planning applications will come into force from 6 April 2015 as defined in the Written Ministerial Statement (18th Dec 2014).

1.2 The new requirements make Lead Local Flood Authorises statutory consultees with respect to flood risk and SuDS for all major applications. Previously the Environment Agency had that statutory responsibility for sites above 1ha in flood zone 1.

1.3 Therefore all 'major' planning applications submitted from 6 April 2015 are required demonstrate compliance with this policy and we'd encourage this is shown in a **Surface Water Drainage Statement**.

1.4 The purpose of this advice note is to set out what information should be included in such statements.

2. Requirements

2.1 It is essential that the type of Sustainable Drainage System (SuDS) for a site, along with **details of its extent and position**, is identified within the planning application to clearly demonstrate that the proposed SuDS can be accommodated within the development.

2.2 It will now not be acceptable to leave the design of SuDs to a later stage to be dealt with by planning conditions.

2.3 The NPPF paragraph 103 requires that developments do not increase flood risk elsewhere, and gives priority to the use of SuDS. Major developments must include SuDS for the management of run-off, unless demonstrated to be inappropriate. The proposed minimum standards of operation must be appropriate and as such, a **maintenance plan** should be included within the Surface Water Drainage Statement,clearly demonstrating that the SuDS have been designed to ensure that the maintenance and operation requirements are economically proportionate Planning Practice Guidance suggests that this should be considered by reference to the costs that would be incurred by consumers for the use of an effective drainage system connecting directly to a public sewer.

2.4 Camden Council will use planning conditions or obligations to ensure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

2.5 Within Camden, SuDS systems must be designed in accordance with London Plan policy 5.13. This requires that developments should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and 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 following **drainage hierarchy**:

1 store rainwater for later use
2 use infiltration techniques, such as porous surfaces in non-clay areas
3 attenuate rainwater in ponds or open water features for gradual release
4 attenuate rainwater by storing in tanks or sealed water features for gradual release
5 discharge rainwater direct to a watercourse
6 discharge rainwater to a surface water sewer/drain
7 discharge rainwater to the combined sewer.

2.6 The hierarchy above seeks to ensure that surface water run-off is controlled as near to its source as possible to mimic natural drainage systems and retain water on or near to the site, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible.

2.7 Before disposal of surface water to the public sewer is considered all other options set out in the drainage hierarchy should be exhausted. When no other practicable alternative exists to dispose of surface water other than the public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

2.8 Best practice guidance within the non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems will also need to be followed. Runoff volumes from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the **greenfield runoff volume** for the same event.

2.9 Camden Development Policy 23 (Water) requires developments to reduce pressure on combined sewer network and the risk of flooding by limiting the rate of run-off through sustainable urban drainage systems. This policy also requires that developments in areas known to be at risk of surface water flooding are designed to cope with being flooded. Camden's SFRA surface water flood maps, updated SFRA figures 6 (LFRZs), and 4e (increased susceptibility to elevated groundwater) , as well as the Environment Agency updated flood maps for surface water (ufmfsw), should be referred to when determining whether developments are in an area at risk of flooding.

2.10 Camden Planning Guidance 3 (CPG3) requires developments to achieve a greenfield run off rate once SuDS have been installed. Where it can be demonstrated that this is not feasible, a minimum 50% reduction in run off rate across the development is required. Further guidance on how to reduce the risk of flooding can be found in CPG3 paragraphs 11.4-11.8.

2.11 Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

3. Further information and guidance

3.1 Applicants are strongly advised to discuss their proposals with the Lead Local Flood Authority at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.

3.2 For general clarification of these requirements please Camden's Local Planning Authority or Lead Local Flood Authority

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	University College London - New Student Centre
Address & post code or LPA reference	Gordon Street, London, WC1H 0EG.
Grid reference	TQ 29632 82377
Is the existing site developed or Greenfield?	Existing
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding?	As per the FRA for the site, the risk is considered to be low from both surface and ground water flooding.
Total Site Area served by drainage system (excluding open space) (Ha)*	0.09 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)	0.09 ha	0.09 ha	0 ha	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		X	N/A	e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		X	N/A	e.g. Is there a watercourse near by?
To surface water sewer	X		Awaiting TW PDE consent	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above		X		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		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	13.3 l/s	13.3 l/s	0.0 l/s	0%	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	24.0 l/s	15.1 l/s	8.9 l/s	37%	
1in 100	30.3 l/s	15.1 l/s	15.2 l/s	50.2%	
1 in 100 plus climate change	N/A	15.1 l/s			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	18.7 m^3	5.0 m^3	-13.7 m^3	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	40.0 m^3	12.3 m^3	-27.7 m^3	
1in 100 6 hour	38.4 m^3	20.5 m^3	-17.9 m^3	
1 in 100 6 hour plus climate change	49.8 m^3	26.3 m^3	-23.5 m^3	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)		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)**	London Clay formation- Clay, Silt and Sand	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	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	N/A	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?	Desk Study	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.	Yes, infiltration not deemed suitable, tank to be wrapped in impermeable membrane.	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. Storm water will be stored prior to release in underground attenuation tanks and slowly released via a flow control device.	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.	Underground attenuation tanks and a flow control device - 20m3 for essential requirement.	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?	Underground attenuation tanks and a flow control device - 20m3 for essential requirement.	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	Yes	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	Yes	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	Yes	
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	Yes	**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 (hydrobrake etc)	Hydrobrake	Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices not be used below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	UCL College	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?	UCL College maintenance plan	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	LO1254 DR01	N/A
Section 3	LO1254 DR01	N/A
Section 4	Stage C Report	7 of 10
Section 5	N/A	N/A
Section 6	N/A	N/A
Section 7	Ground Investigation Report	3 of 509
Section 8	N/A	N/A

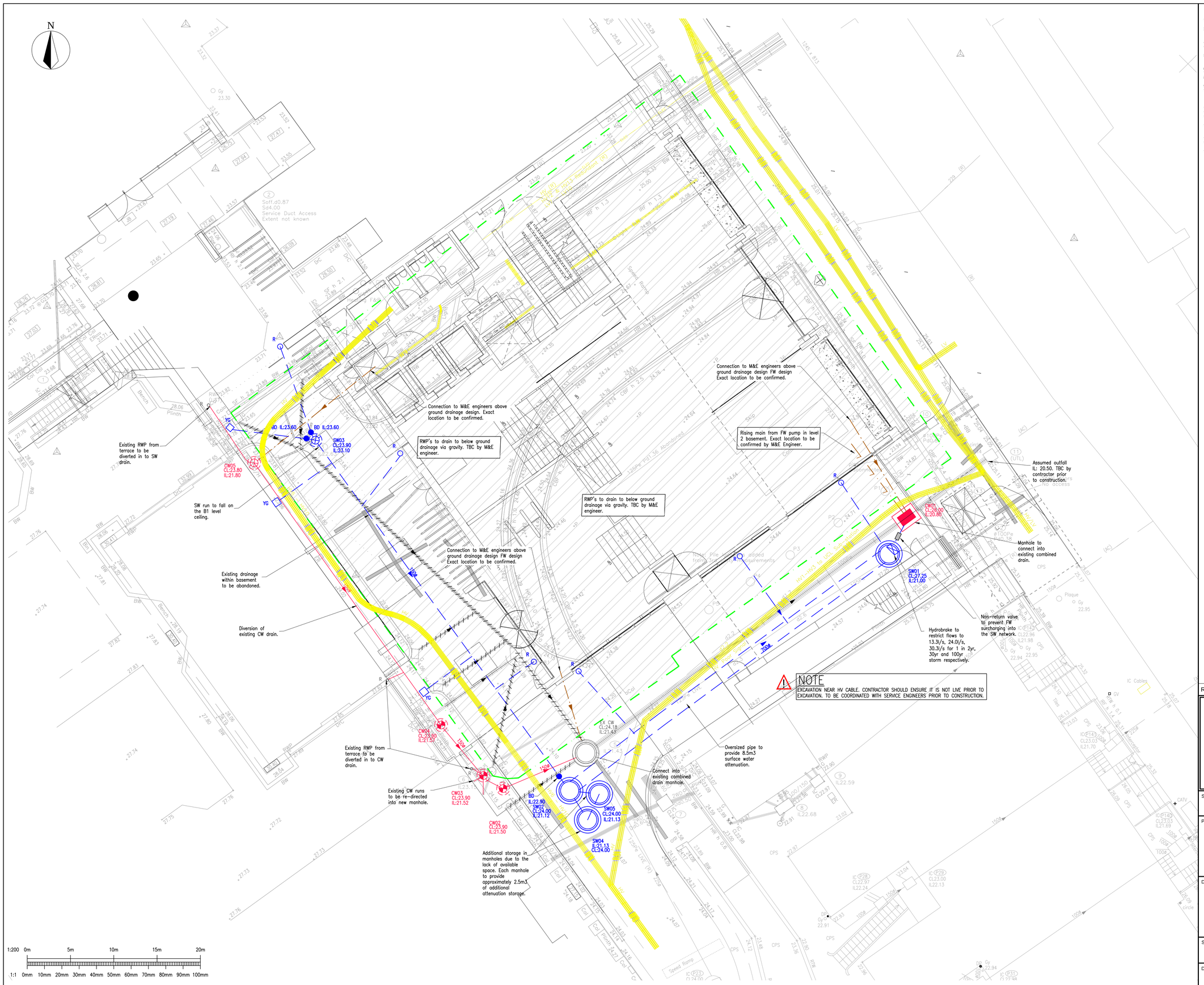
The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an

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…Oliver Mayall Infrastructure Engineer……..
Qualification of person responsible for signing off this pro-forma ..BEng (Hons).....

Company…Curtins……,.....
On behalf of (Client's details) ..University London College.....
Date:…02.06.15…….....



NOTES:

1. This drawing is to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
2. Do not scale from this drawing. All details and dimensions and levels are to be checked by the contractor prior to commencement of construction. Any discrepancies are to be reported to the Engineer.
3. All levels are in meters & dimensions in millimeters unless noted otherwise.
4. Design based on topographical survey and/or visual survey of existing drainage only. All existing sewers, connections, pipe sizes and invert levels to be confirmed.
5. All sewer lengths shown are from centerline of sewer structure to centerline of sewer structure/sewer for design purposes. It shall be the contractors responsibility to confirm all measurements.
6. All pipework to be vitrified clay under the building.
7. Where existing drainage is being used, allowances should be made to remediate this drainage.
8. Where there is no requirement to keep existing drainage, allowances should be made to abandon this.
9. Pipe diameters are indicative only. A capacity check shall be carried at detailed design stage.
10. A CCTV survey of the site is required to investigate all existing drainage and their connectivities/levels/routes. Any remediation works are to be undertaken as per the CCTV's recommendation prior to construction works. Proposed drainage design is subject to change following CCTV results.
11. Any new gully positions and falls to them are indicative and to be designed by the Architect.
12. All drainage points are indicative and TBC by M&E engineer.
13. Any drainage runs and their connections damaged through construction should be replaced where applicable to sufficient standard.
14. Curtins accept no responsibility for defects or inadequacies of existing drainage systems. Failure of site drainage due to on issue with these networks are outside of our remit unless specifically instructed otherwise.
15. Falls to gullies by others, exact location TBC and coordinated with level design.
16. Allow for smaller diameter branched runs, PPIC chambers, gullies, RWP branches etc. These are to be designed at a later detailed design stage.
17. Close coordination will be required to ensure drainage excavation does not damage HV cable due to the limited space available.

KEY:

PRIVATE DRAINAGE

- 150ø — SURFACE WATER DRAIN.
- SW02 CL:28.29 IL:27.88 — SURFACE WATER CHAMBER.
- R — RAIN WATER DOWN PIPE.
- RE — RODDING EYE.
- YG — YARD GULLY, 100Ø OUTLET.
- RG — ROAD GULLY, 150Ø OUTLET.
- 150ø — FOUL WATER DRAIN.
- SS — STUB STACK.
- SVP — SOIL AND VENT PIPE.
- FG — TRAPPED FOUL GULLY, 100Ø OUTLET.
- 150ø — COMBINED DRAIN.
- CW-** CL:= IL:= — COMBINED CHAMBER.

EXISTING DRAINAGE

- 150Ø — SURFACE WATER DRAIN TO REMAIN.
- 150Ø — FOUL WATER DRAIN TO REMAIN.
- 150Ø — COMBINED DRAIN TO REMAIN.
- 150Ø — SURFACE WATER DRAIN TO BE ABANDONED AND FILLED WITH PFA CEMENT GROUT.
- 150Ø — FOUL WATER DRAIN TO BE ABANDONED AND FILLED WITH PFA CEMENT GROUT.
- 150Ø — COMBINED DRAIN TO BE ABANDONED AND FILLED WITH PFA CEMENT GROUT.

GENERAL

- BASEMENT OUTLINE

EXISTING SERVICES

- BT — TELECOMMUNICATION
- WATER — WATER
- GAS — GAS
- CABLE — CABLE
- ELEC — ELECTRICITY

Rev:	Description:	Date:	By:	Chkd:

curtins consulting
Curtins Consulting Ltd
40 Compton Street, London, EC1V 0AP
t: 020 7324 2240 f: 020 7324 2241
e: london@curtins.com www.curtins.com
Structures • Civils • Environmental • Infrastructure • Transport Planning • Health & Safety • Dispute Resolution
Birmingham • Bristol • Cardiff • Douglas • Edinburgh • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Status: PRELIMINARY

Project: UCL THE BEACH STUDENT CENTRE

Drg Title: DRAINAGE LAYOUT GROUND FLOOR

Scale:	Size:	First Issue:	Drawn:	Checked:
1:100	A1	17.04.15	OM	TL

Drg No: LO1254/DR01

Rev: P1

Executive Summary

In January 2013 Curtins Consulting Ltd were instructed by University College London (UCL) to undertake a Phase 2 Intrusive Investigation on the site located off Gordon Street, London. It is understood that the proposed development comprises a student centre.

The site investigation fieldwork was undertaken in February 2013 under the supervision of a suitably qualified engineer and comprised the advancement of three window sample boreholes.

It was originally envisaged that four window sample boreholes would be undertaken across the site, however, due to unforeseen circumstances, only three boreholes were advanced.

The made ground was quite varied across the site, but in general comprised of yellowish brown to brown sandy gravelly clay. Gravel is angular to subrounded, fine to coarse, with ash, clinker, flint and brick. A black geotextile was encountered in two of the window sample holes at 0.15m:

A concrete foundation slab was also observed at approximately 0.70 in two of the boreholes

The Lynch Hill Gravel Member was observed in two of the boreholes and comprises of gravelly sands and clays.

Although clay was observed in two of the three boreholes, it is considered unlikely that this would be the London Clay. The borehole logs from the Soil Mechanics site investigation indicate that the London Clay is encountered at approximately 6.50m depth.

The deeper cable percussive boreholes undertaken by Soil Mechanics indicate that below the London Clay is the Lambeth Group which comprises of very stiff locally hard dark grey sandy clay

The environmental chemistry results have been compared with the Tier 1 criteria for soils with respect to human health for the intended end use for a Soil Organic Matter value of 1%.

With reference to the Tier 1 Thresholds initial assessment shows that the thresholds have been exceeded in the shallow soils with respect to the intended end use in a number of locations.

Given these levels of contamination, it would normally be necessary to break the source/receptor pathway by installing a clean and inert capping layer or concrete or tarmac hard standing; however, it is proposed that the development will comprise of a five storey buildings with a three storey basement and as such will require the excavation of approximately 10.00 – 12.00m of both made ground and natural material. It is therefore envisaged that any of the potentially contaminated made ground observed across the site will be removed during the reduced level dig.

If the proposed basement does not fully occupy the plan area of the development site and any soft landscaping is proposed then these areas should be provided with a 300mm of 'clean and inert' cover. In providing this cover, in conjunction with building and hardstanding construction, any risk presented to site end users will be mitigated

Connections to Thames Water Sewer

There is an existing Thames Water sewer in Gordon Street to the south of the development. A connection has already been made to this sewer via the diverted drain installed during the enabling works. Consent (S106) was granted by Thames Water for *1no. 375mm dia combined connection to existing 1245 x 813mm dia combined sewer in Gordon Street via saddle junction*. Calculations carried out by BDP indicated that the combined flow rate from the development would be 31 l/s, proportioned as 21 l/s surface water and 10 l/s foul water. These flow rates relate to the new development and do not include diverted flows from the adjacent buildings, however, the 375mm diameter pipe installed has adequate capacity to convey these flows.

Proposed Surface Water

Calculations provided by BDP assessed the pre-development run-off based on a footprint of 935m^2 comprising 437m^2 impervious areas and 498m^2 semi-pervious areas. For a critical storm of duration 5 minutes, the following flow rates were calculated for varying return periods:

2 yr RP	13.3 l/s
30 yr RP	24.0 l/s
100yr RP	30.3 l/s

Under the London Plan, there will be a requirement to restrict the surface water rates off-site. The London Plan stipulates the following:

Essential: Use Sustainable Drainage Systems (SuDS) measures, wherever practical
Achieve 50% attenuation of the undeveloped site's surface water runoff at peak times

Preferred: Achieve 100% attenuation of the undeveloped site's surface water runoff at peak times

Based on the BDP calculations for pre-development flows, the restricting discharge for the essential standard would be 15.1 l/s. Greenfield run-off is generally around 3-4 l/s/ha, however, a minimum of 5 l/s is normally applied to this value due to the practicalities of restricting flows below this rate and the risk of blockage. In both instances, attenuation would be required and this will be in the order of 20m^3 and 35m^3 for the Essential and Preferred standards respectively. Due to the site's location in the centre of the city and the limited open space around the building, it is unlikely that achieving the preferred standard will be practicable or considered to be a reasonable expectation given the site constraints. Therefore based on the Thames approval the design of the surface water system should meet the Essential standards, providing approximately 20m^3.

The Environment Agency request Sustainable Drainage Systems (SuDS) be used on site. For a development of this type, the opportunities to use SuDS will be limited as the building footprint occupies almost the entirety of the site. Our proposals are detailed below.

It is understood that a significant proportion of the roof would not be suitable for a green roof, however, the use of such a system where possible on the available roof space may be regarded favourably by consultees such as the Environment Agency and can provide further environmental benefits. The use of a green roofs is to be confirmed by others.

Example of green roof on flat roof construction

Underground attenuation tanks are ranked towards the bottom of the SuDS hierarchy, however, for this development, it is considered that these will be the most suitable solution. The tanks may take a number of physical forms but are to be formed from a 700mm diameter oversized pipes and offline manholes located along the access road providing the necessary attenuation to meet the 'Essential' standard within the London Plan. All offline manholes will be connected into the oversized pipe to ensure storm water only discharges into them during heavy storm events to help prevent unnecessary maintenance and potential blockages. For further details on the below ground drainage layout please refer to LO1254/DR01.

Falls on the roof and the positioning of the rainwater outlets will need to be designed in such a way as to allow all rainwater to be directed towards the proposed drains in the access road. Rainwater pipes will need to be routed along the ceiling above basement level and can be laid without fall as a syphonic drainage system has been employed. All above ground drainage is to be designed and agreed with the M&E engineer and is outside our remit of works.

The proposed development requires minimal drainage of external areas. The access road from Gordon Street to the rear of the development will fall towards the site, therefore, a small volume of run-off is to be expected. A linear drainage systems will be installed in the access road with the addition of several road gullies to drainage other impervious areas, these will all be connected to the surface water drainage network. It is not required to install a petrol interceptor.

Operation & Maintenance Considerations

- Like all drainage systems, SuDS components should be inspected and maintained. This ensures efficient operation and prevents failure. Usually SuDS components are on or near the surface and most can be managed using landscape maintenance techniques.

- For below-ground SuDS such as permeable paving and modular geocellular storage the manufacturer and designers will provide relevant maintenance advice. This should include routine and long-term actions that can be incorporated into the maintenance plan.

- The detailed design process will consider the maintenance of the components including any corrective maintenance to repair defects or improve performance. This will form the basis of the site's SuDS maintenance plan within the PFI concession documents.

- Table 1 below provides a breakdown of typical maintenance requirements for the various SuDs opportunities. Implementation of these actions will ensure that SuDs continues to function as intended.

- The level of inspection and maintenance varies depending on the type of SuDS component and degree of use within this site. Other variables within the detailed further design such as types of plants as well as biodiversity and amenity requirements will be finalised at the appropriate stage. Any variation resulting from the further detailed design to the typical maintenance regimes advocated below will be added in accordance with the CIRIA C697 SuDs Manual needs.

Table 1 (see next page) Typical Inspection and Maintenance Requirements

Activity	Indicative frequency	Typical tasks
Routine/regular maintenance	Monthly (for normal care of SuDS)	Litter picking Grass cutting (in season) Inspection of inlets, outlets and control structures
Occasional maintenance	Annually (dependent on the finalised & settled design)	Silt control around components. Vegetation management around components. Suction sweeping of permeable paving if any ponding. Silt removal from catch pits, soakaways and cellular storage plus outlet control structures.
Long Term Maintenance	Every 5 to 10 years following relevant inspections	Mechanically sweep & de-weed permeable paving, re-grit the joints with clean grit to spec. Flush & de-silt attenuation cell/tank systems and check air vents. Check flow control devices and their operation, including overflow release valves. Flush & de-silt French drains and filter drains, re-stone where necessary, remove any grass or wind seeded vegetation.
Remedial maintenance	As required (tasks to repair problems due to damage, vandalism or specific new problems)	Inlet/outlet repair. Erosion repairs. Reinstatement of edgings. Reinstatement following pollution. Removal of silt build up.