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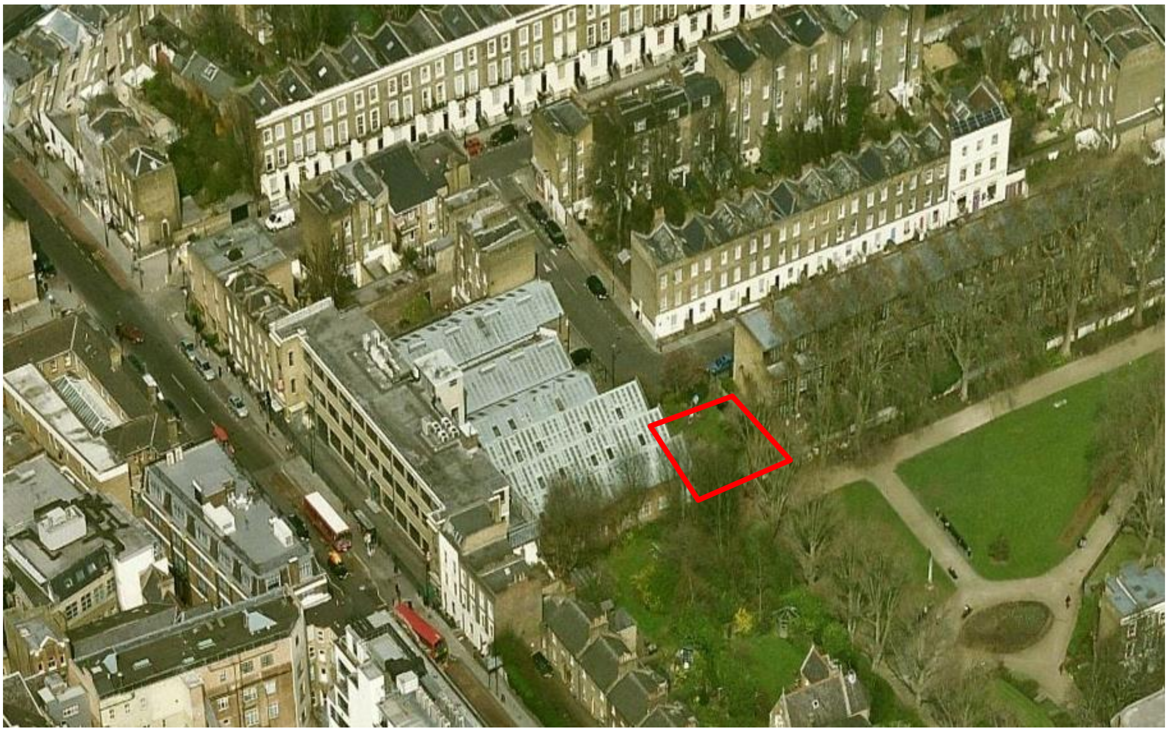
CAROL STREET, CAMDEN

SuDS Assessment and Drainage Statement



Site reference

25 Carol Street,
Camden,
North West London,
NW1 0HT

Client

engineersHRW

Date

July 2017

Report No.

ICS-1909.07.001 Rev B

Revision	Compiled by	Checked by	Issue date
A	Richard White B.Sc (Hons) C.Env C.WEM I.Eng MCIWEM	William Piotrowski B.Sc. (Hons)	1st September 2017
B	Richard White B.Sc (Hons) C.Env C.WEM I.Eng MCIWEM	William Piotrowski B.Sc. (Hons)	15th September 2017

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1.0 Summary

This SuDS Assessment and drainage statement is to support proposed development at Carol Street, and finds the following:

ITEM	RESPONSE
Site Location	The site is located in Camden, North West London, fronting onto Carol Street, with St. Martin's Gardens to the rear, 175m East of Camden Town Station. The approximate grid reference of E = 529082, N = 183859.
Size and Current Land Usage	The site area extends to 290m^2 and currently contains a play area with soft landscaping with approximately 72.5m^2 of paving.
Flood Zone	The whole site falls within Flood Zones 1, which is classified as low probability of flooding.
Proposed Development	It is proposed to clear the existing site and to construct a live/work building containing studio and workshop space at ground and basement levels and a two bedroom dwelling with further studio space at first and second floors.
Floor Levels	Finished floor levels for the ground floor have been set by the Architect at 26.00m AOD for the ground floor and 22.75m AOD for the basement.
Proposed Foul Drainage	It is proposed that the bulk of the site will discharge via a gravity drainage system utilising a new combined water connection from the site. Flows from the basement will need to be pumped, as there are insufficient falls to allow a gravity connection.
Proposed Surface Water Drainage	It is proposed that the site will discharge via a gravity drainage system utilising the new combined water connection from the site. The discharge will be limited to 5 l/s in line with guidance from HR Wallingford. Surface waters from the West of the building will need to be pumped to the attenuation tank due to complexities in routing the drains though the building.

2.0 Introduction

2.1 Commission

The Client, Engineers HRW has commissioned Infrastruct CS Ltd to prepare a SuDS Assessment and drainage statement to support a planning application for the development of a new live/work building.

2.2 Guidance

This SuDS assessment has been compiled in accordance with the recommendations of the National Planning Policy Framework, the Planning Practice Guidance to the National Planning Policy Framework and Ciria C753.

2.3 Aims and Objectives

The purpose of this SuDS assessment is to demonstrate where SuDS systems can safely be implemented within the best practice guidelines given in C753.

This report will also identify the flood risk zone, consider the proposed drainage, recommend appropriate flood risk mitigation measures, where necessary and will be used to support the planning application proposals.

This report is based on information made available at the time of writing. Consequently, there is potential for additional information to be published which may lead to changes to the conclusions drawn in this report. As such Infrastruct CS Ltd cannot be held responsible for such changes.

3.0 Site Details

3.1 Location

The site is located in Camden, North West London, fronting onto Carol Street, with St. Martin's Gardens to the rear. Located approximately 175m East of Camden Town Station.

Fig 3.1 Location Plan

3.2 Grid Reference

The approximate Ordnance Survey national grid reference for the centre of the site;

E = 529082, N = 183859.

3.3 Topography and Description of the Site

A detailed topographic survey for the development site has been undertaken by Randall Surveys LLP in February 2015 and this can be found within Appendix A of this report.

The site is rectangular is shape, approximately 21.5m in length and 14m in width. The site is largely soft landscaping and unmade ground with approximately 80m2 of paving.

The topography of the overall site is relatively flat, with a low point of 25.41mAOD where the site adjoins No 23.

The site area extends to 290m^2 and was last used as a garden/recreation area. Comprised of soft landscaping with approximately 80m2 of paving. The site is surrounded by commercial and residential properties.

A site investigation has not been undertaken. However, information obtained from the British Geological Survey indicate that the strata is likely to be silty clays or clay, which are assumed to have poor infiltration properties.

3.5 Existing Drainage Description

From a review of the topographic survey, there does not appear to be a positive drainage connection serving the site.

3.6 Local Rivers and Water Courses

The nearest main river watercourse to the development site is the Regents Canal 200m to the North. The local water courses are highlighted in the below figure.

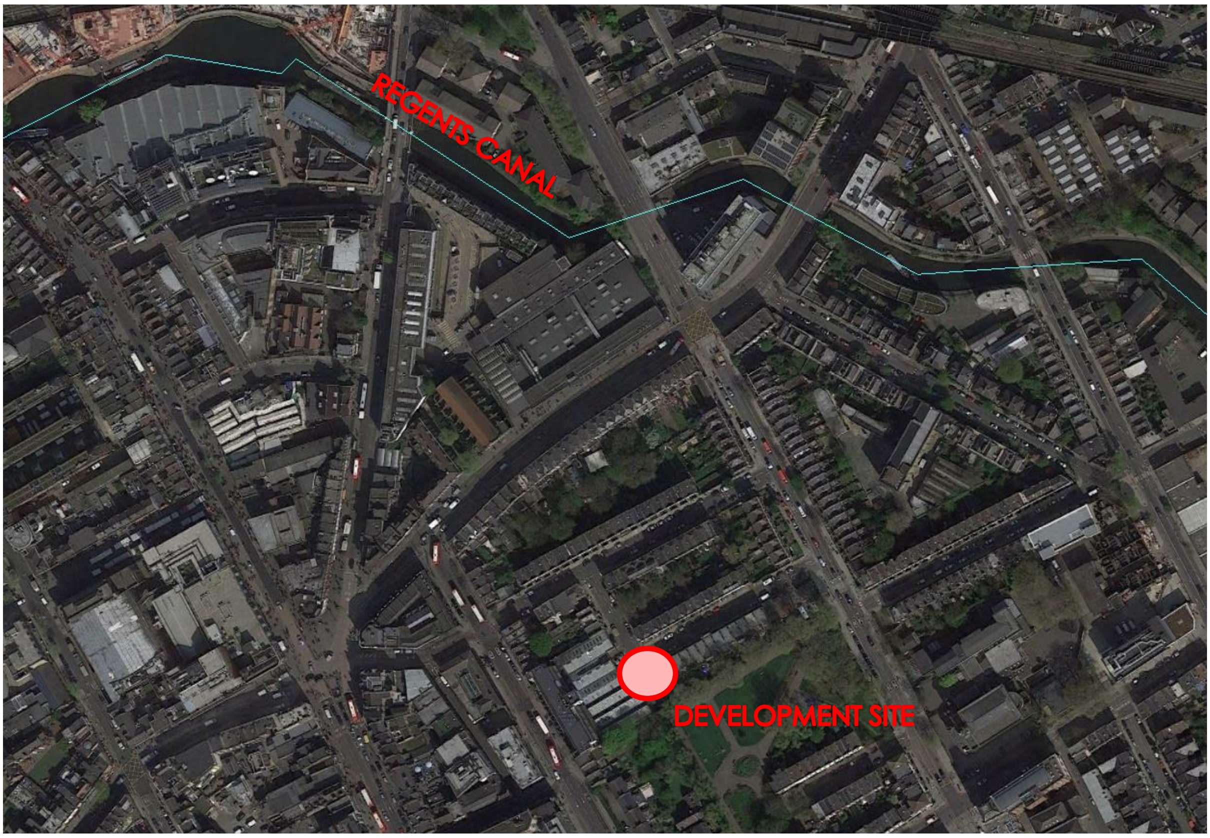


Fig 3.6.1 – Local Above Ground Watercourses

There is also a culverted watercourse taking flows from the Highgate Ponds running adjacent to Royal College Street, approximately 250m to the East.

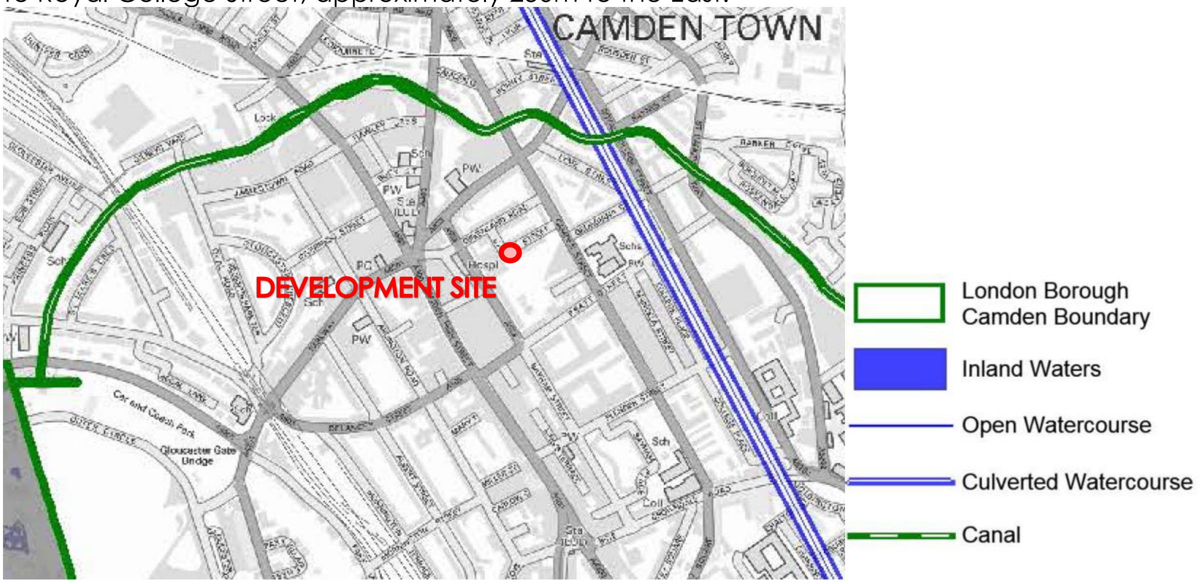


Fig 3.6.2 – Local Below Ground Watercourses

The local rivers are not shown to pose any risk to the development itself on the EA flood maps.

3.7 Proposed Development

It is proposed to clear the existing site to provide a live/work building consisting of a 2-bedroom dwelling within the upper floors and an associated ground floor and basement studio. The footprint of the building is 137sqm at ground floor level with a slightly larger basement which has a footprint of 207sqm.

The overall impermeable area of the site will increase following the proposed the works. As a result, the flow rates, and volumes will increase without mitigation measures in place. The final design will look to mitigate any increase in the flood risk this development will have both on itself and on downstream properties.

A copy of the site master plan and floor plans can be found within Appendix B of this report.

4.0 Flood Risk Policy

4.1 Environment Agency Flood Map

The development site is situated in the Environment Agency Thames Region and their Flood Zone maps for the area indicate fluvial flooding extents.

The flood map for the development site shown below suggests that the whole site falls within Flood Zone 1, which is defined as land assessed as having a less than 1 in 1000 annual probability of tidal flooding in any one year.

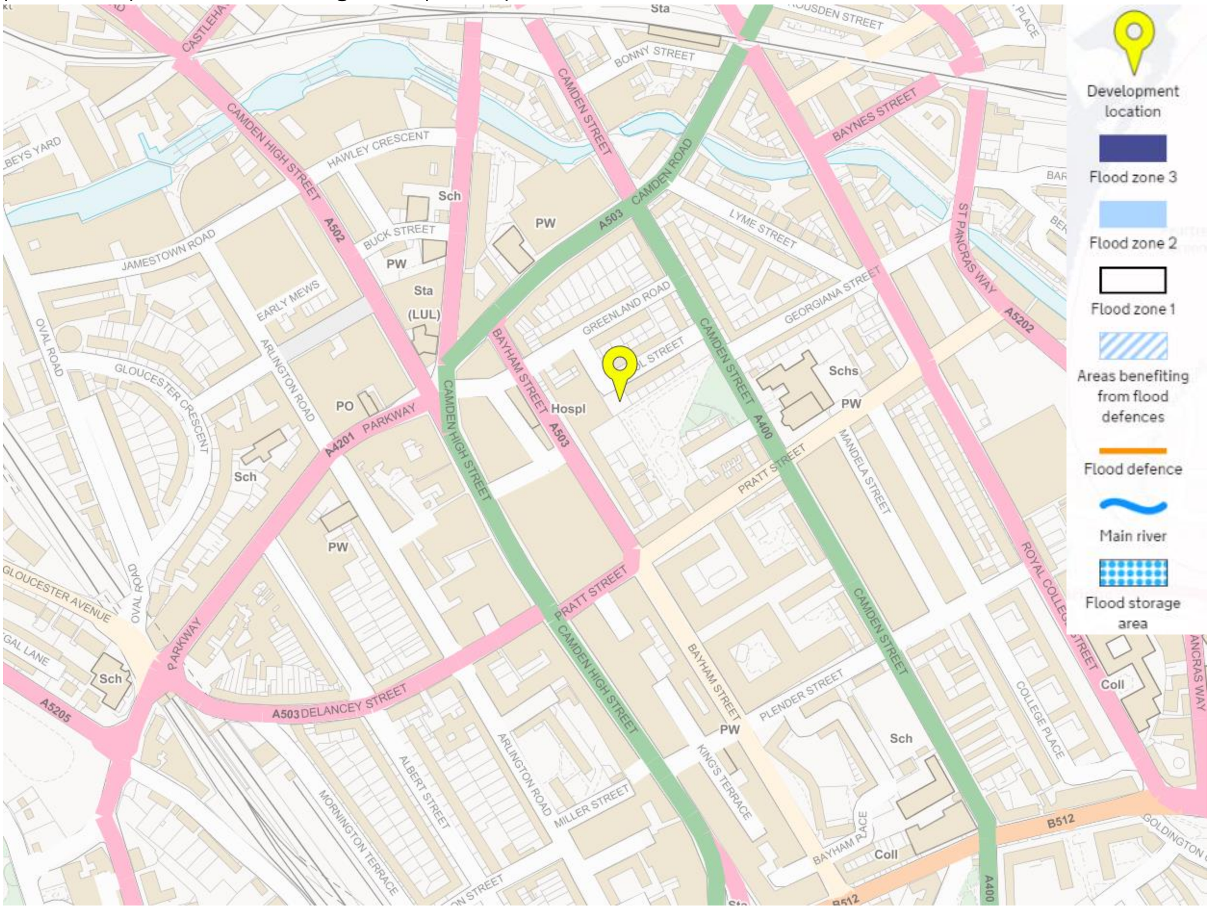


Fig 4.1 – Environment Agency Flood Zone map

5.0 Flood Risk As A Result Of The Development

5.1 Effect of The Development Generally

Development by its nature usually has the potential to increase the impermeable area with a resultant increased risk of causing rapid surface water runoff to watercourses and sewers, thereby causing surcharging and potential flooding. There is also the potential for pollutants to be mobilised and consequently flushed into the receiving surface water system.

Increases in both the peak runoff rate (usually measured in litres per second l/s) and runoff volume (cubic metres m^3) can result.

5.2 Surface Water Drainage & Sustainable Drainage Systems

Sustainable Drainage techniques (SUDS) covers a range of approaches to manage surface water runoff so that-

'*Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.*' This should be demonstrated as part of the SuDS assessment.

5.3 Greenfield Runoff Rates

The site has an area of 0.030ha. MicroDrainage calculation for this area gives the rates below for a greenfield site of this size.

Return Period	Runoff Rate (l/s)
1	0.1
2 - Qbar	0.1
30	0.2
100	0.4

Table 5.3.1: Greenfield runoff rates - See Appendix E for MicroDrainage calculations.
Please refer to section 8.3 for a discussion to the proposed outflow rates from the site.

5.3 Existing Runoff Rates

The existing site has an impermeable area of 0.008ha. MicroDrainage calculation for this area gives the rates below for an impermeable area of this size.

Return Period	Runoff Rate (l/s)	Runoff Volume (m^3)
1	1.3	3.3
2 - Qbar	1.7	3.8
30	3.3	6.1
100	3.9	7.5

Table 5.3.2: Existing runoff rates and volumes - See Appendix E for MicroDrainage calculations.

6.0 Assessment Of Suds Hierarchy

A hierarchical approach has been undertaken in consideration of the application of SuDS in relation to the development. This is in order to meet the design philosophy of ensuring that surface water run-off is managed as close to its source as possible and the existing situation is replicated as closely as possible.

The following drainage hierarchy has been undertaken with reference to the procedures set out in the SuDS Manual (CIRIA C753, 2015) to assess the viability of the application of SuDS techniques to this scheme:

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.

The sustainable drainage hierarchy shown above is intended to ensure that all practical and reasonable measures are taken to manage surface water higher up the hierarchy (1 being the highest) and that the amount of surface water managed at the bottom of the hierarchy is minimised.

Sustainable urban drainage systems have been considered for this development unless there are practical reasons for not doing so. Such reasons include the local ground conditions, rising groundwater, and risk from fluvial flooding.

6.1 Store rainwater for later use

Given the scale of the project and the extent of permeable landscaping provided combined with the rainwater attenuation we do not believe rainwater harvesting would be required or economically viable for this development. Provision for storing rainwater below ground for either irrigation of landscaping areas or internal re-use within the building has been discounted.

However, Water Butts should be installed for the irrigation of the garden area. As the water butts may be full at the time of an extreme storm event, any capacity within these cannot be used to offset the attenuation tank.

6.2 use infiltration techniques, such as porous surfaces in non-clay areas

Due to the layout of the site, there is insufficient area greater than 5m from proposed buildings, the existing buildings, retaining wall or roads. It would therefore not be possible to utilise an infiltration system within the requirements of Building Regulations Part H.

The anticipated clay strata is also unlikely to lend itself to an infiltration system.

As such this report finds item 2 of the drainage hierarchy unsuitable given the constraints of the development site.

6.3 Attenuate rainwater in ponds or open water features for gradual release

Due to the layout of the site, there is insufficient area within the site in which to site a suitably sized pond.

As such this report finds item 3 of the drainage hierarchy unsuitable given the constraints of the development site.

6.4 attenuate rainwater by storing in tanks or sealed water features for gradual release

It is proposed that the rain water be attenuated to a rate of 5l/s within the tanked crates, for release into the existing Thames Water combined drainage system.

Unfortunately, the site has no water courses in the immediate vicinity. Meaning waters will need to be discharged at an attenuated rate to the local combined water drainage system. See 6.7 below and 8.4 later in the report for a discussion of this.

6.5 Discharge rainwater direct to a watercourse

There are no watercourses within the locality of the site. As such this report finds item 5 of the drainage hierarchy unsuitable given the constraints of the development site.

6.6 Discharge rainwater to a surface water/drain

There are no existing Thames Water surface water sewers in the vicinity of the development site, so this technique has been discounted.

6.7 Discharge rainwater to a combined water/drain

It is proposed that waters are discharged into the Combined Water Sewer serving the site at an attenuated rate of 5l/s. The proposed rate is discussed further in section 8.3.

7.0 Assessment Of SuDS Measures

SuDS are drainage systems that aim to reduce the runoff rate by adopting techniques which replicate the natural drainage of the area. By temporarily storing stormwater on-site, they gain the advantage of a reduction in the runoff rates. In addition to this, SuDS provides further additional benefits to the environment and to the local environment, such as improvement to the biodiversity, water quality, health, and wellbeing. As well as reducing urban heat, air pollution, and CO2 levels.

SuDS have various components that can realise a reduction to the runoff rate and provide a sustainable solution to drainage. The following is a discussion of the typical SuDS components which can be installed in a residential development such as the one proposed:

7.1 Rainwater Harvesting

DESCRIPTION

Rainwater harvesting (RWH) is the collection of rainwater runoff for use. Runoff can be collected from roofs and other impermeable areas, stored, treated (where required) and then used as a supply of water for domestic, commercial, industrial and/or institutional properties. RWH systems have several key benefits:

- They can meet some of the buildings water demand, delivering sustainability and climate resilience benefits.
- They can help reduce the volume of runoff from a site.
- They can help reduce the volume of attenuation storage required on the site.

SUITABILITY

Given the scale of the project and the extent of permeable landscaping provided combined with the rainwater attenuation we do not believe rainwater harvesting would be required or economically viable for this development.

7.2 Green Roofs

DESCRIPTION

Green roofs are areas of living vegetation, installed on the top of buildings, for a range of reasons including visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff.

SUITABILITY

The current roof design does not lend itself to a green roof.

7.3 Filter Strips

DESCRIPTION

Filter strips are vegetated strips of land designed to accept runoff as overland sheet flow from upstream development. They lie between a hard-surfaced area and a receiving stream, surface water collection, treatment or disposal system.

They treat runoff by vegetative filtering and promote settlement of particulate pollutants and infiltration.

SUITABILITY

Due to the layout of the site, there is insufficient area available for filter strips to be utilised properly.

7.4 Filter Drains

DESCRIPTION

Filter drains are shallow excavations filled with rubble or stone that create temporary subsurface storage for either infiltration or filtration of storm water runoff. Ideally, they should receive lateral inflow from an adjacent impermeable surface, but point source inflows may be acceptable. Infiltration filter drains allow water to exfiltrate into the surrounding soils from the bottom and sides of the trench. Filtration or filter trenches can be used to filter and convey storm water to downstream SuDS components.

SUITABILITY

Due to the layout of the site, there are insufficient areas greater than 5m from proposed buildings, the existing buildings, retaining wall or roads. We also anticipate poor soakage rates, based on the information from the BGS. It would therefore not be possible to utilise an infiltration system within the requirements of Building Regulations Part H.

7.5 Pervious Pavements

DESCRIPTION

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment.

SUITABILITY

With the exception of areas above the proposed basement, permeable paving is to be used on the site. Please see appendix C for confirmation of the proposed areas

7.6 Swales

DESCRIPTION

Swales are shallow, flat-bottomed, vegetated open channels designed to convey, treat and often attenuate surface water runoff. When incorporated into site design, they can enhance the natural landscape and provide aesthetic and biodiversity benefits. They are often used to drain roads, paths or car parks, where it is convenience to collect distributed inflows or runoff, or as means of conveying runoff on the surface while enhancing access corridors or other open space. Swales can have a variety of profiles, can be uniform or non-uniform, and can incorporate a range of different planting strategies depending upon the site characteristics and system objectives.

SUITABILITY

Due to the layout of the site, there is insufficient area within the development site in which to locate any swales.

7.7 Geocellular/Modular Systems

DESCRIPTION

Modular plastic geocellular systems with a high void ratio, that can be used to create a below ground infiltration (soakaway) or storage structure or a tanked attenuation system with limited outflow.

SUITABILITY

Whilst geocellular systems cannot be used for infiltration, they can be used as an attenuation structure. These will need to be sized to ensure sufficient storage is provided for the proposed outflow rates.

7.8 Sand Filters

DESCRIPTION

Sand filters are single or multi-chambered structures designed to treat surface water runoff through filtration using a sand bed as the primary filter medium. The filters can be designed with an impervious lining, or to allow infiltration, depending on the soil type. Temporary storage of runoff is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.

SUITABILITY

High levels of pollutants are not anticipated to come from the roof or paved elements of the works. This technique has therefore been discounted.

7.9 Infiltration Basins

DESCRIPTION

Infiltration basins are vegetated depressions designed to store runoff and infiltrate it gradually into the ground.

SUITABILITY

Due to the layout of the site, there is insufficient area within the site in which to site a suitably sized infiltration basin, there would also be concerns regarding the proximity of an infiltration feature to local structures, both on and off site.

7.10 Detention Basins

DESCRIPTION

Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin and when the flows rise, because the outlet is restricted, the basin fills and provides storage of runoff and flow attenuation. They can also be off-line components into which runoff is diverted once flows reach a specified threshold.

Detention basins can be vegetated depressions (that can provide treatment when designed to manage regular flows) or hard landscaped storage areas (that will tend not to provide any treatment and are normally designed as off-line components).

Where the basin is vegetated, the soil surface can absorb some runoff, so can be used to support the prevention of runoff from the site for small rainfall events (interception), provided that small amounts of infiltration would not pose a risk to ground water. The principal water quality benefits of vegetated detention basins are associated with the removal of sediment and buoyant materials, but levels of nutrients, heavy metals, toxic materials and oxygen-demanding materials may also be significantly reduced. The water quality benefits of a vegetated detention basin increase as the detention time for an event becomes longer. Where designed appropriately, some or all the basin area can also be used as a recreational or other amenity facility.

SUITABILITY

Due to the layout of the site, there is insufficient area within the site in which to site a suitably sized detention basin.

7.11 Ponds

DESCRIPTION

Ponds can provide both stormwater attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Runoff from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations.

SUITABILITY

Due to the layout of the site, there is insufficient area within the site in which to site a suitably sized pond.

7.12 Stormwater Wetlands

DESCRIPTION

Wetlands provide both stormwater attenuation and treatment. They comprise shallow ponds and marshy areas, covered almost entirely in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants by facilitating adhesion to vegetation and aerobic decomposition. They also provide significant ecological benefits.

SUITABILITY

Due to the layout of the site, there is insufficient area within the site in which to site a suitably sized pond.

7.13 Perforated Ring Soakaways

DESCRIPTION

Perforated ring soakaways are circular manhole segment rings with perforations to allow surface water to be stored inside them and then dispersed into the surrounding ground strata.

SUITABILITY

Due to the layout of the site, there is insufficient area greater than 5m from proposed buildings, the existing buildings, retaining wall or roads. It would therefore not be possible to utilise an infiltration system within the requirements of Building Regulations Part H. It is also anticipated that soakage will be poor within the development site.

7.14 Bio-Retention Areas

DESCRIPTION

Rainwater gardens are usually above ground vegetated drainage features in which roof runoff can be drained into and infiltrated through a filter material contained within a retaining structure such as timber or concrete container. They are designed to allow infiltration. They promote the capture of suspended particulate load in roof runoff to settle out, thus providing effective pollutant removal.

SUITABILITY

High levels of pollutants are not anticipated to come from the roof or paving elements of the works. This technique has therefore been discounted.

8.0 Proposed Drainage Strategy

8.1 Drainage Strategy & Design

The information below is not intended to provide a definitive solution to the drainage associated with the development site but to outline the design intent and ensure that a suitable solution is feasible within the constraints of the development site and development proposals. Reference should be made to the strategic drainage arrangement drawing listed within Appendix C of this report.

8.2 Proposed Foul Water Strategy

Foul water flows generated from the new dwelling and studio are proposed to discharge in a Northerly direction and join the adopted combined water sewer within the Carol Street. As there is no connection from the existing site, a new connection will need to be made to the 1219x813 Combined Sewer beneath Carol Street.

Due to the depth of the basement, is unlikely that the flows from the studio will be able to gravitate to this sewer. These will need to be pumped up to the gravity system serving the ground floor and dwelling above. Providing additional protection, should the Thames Water system surcharge.

A Section 106 agreement will be required to allow connection of the on-site system to the Thames Water Sewer.

8.3 Proposed Surface Water Strategy

Surface water flows generated from the new dwelling and hardstanding are proposed to discharge in a Northerly direction and join the adopted combined water sewer within the Carol Street.

The London Borough of Camden Advice Note on contents of a Surface Water Drainage Statement requires that:

> "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"

The UK Sustainable Drainage Guidance and Tools produced by HR Wallingford recommend that where sites are small and limits of discharge are less than 5l/s there is a risk of throttle blockage. In this situation a minimum of 5l/s or the calculated values of Q1, Q30 or Q100 is allowed, whichever is the greater. Given the constraints of flow control valves, this report considers a proposed flow rate of 5.0 l/s for the development site, with sufficient on-site storage to accommodate the flows associated with a 1 in 100-year storm event with an additional allowance of 40% for climate change. It is therefore proposed to utilise a flow control device such as an 62mm orifice plate, set to 5.0l/s and tanked storage crates to attenuate flows within the development site. The MicroDrainage results for these calculations can be found at the rear of this document, Appendix E.

9.0 Conclusion

The Environment Agency requires that for all sites, the following surface water principles have been followed. Based on the strategy within this report, all of the following have been met.

- That surface water runoff from the development will not increase flood risk to the development or third parties.
- That an allowance for climate change has been incorporated, which means adding an extra amount to peak rainfall, which relates to the lifetime of the development.
- That the residual risk of flooding has been addressed should failure or exceedance of the drainage system occur.

Furthermore, the development itself has achieved:

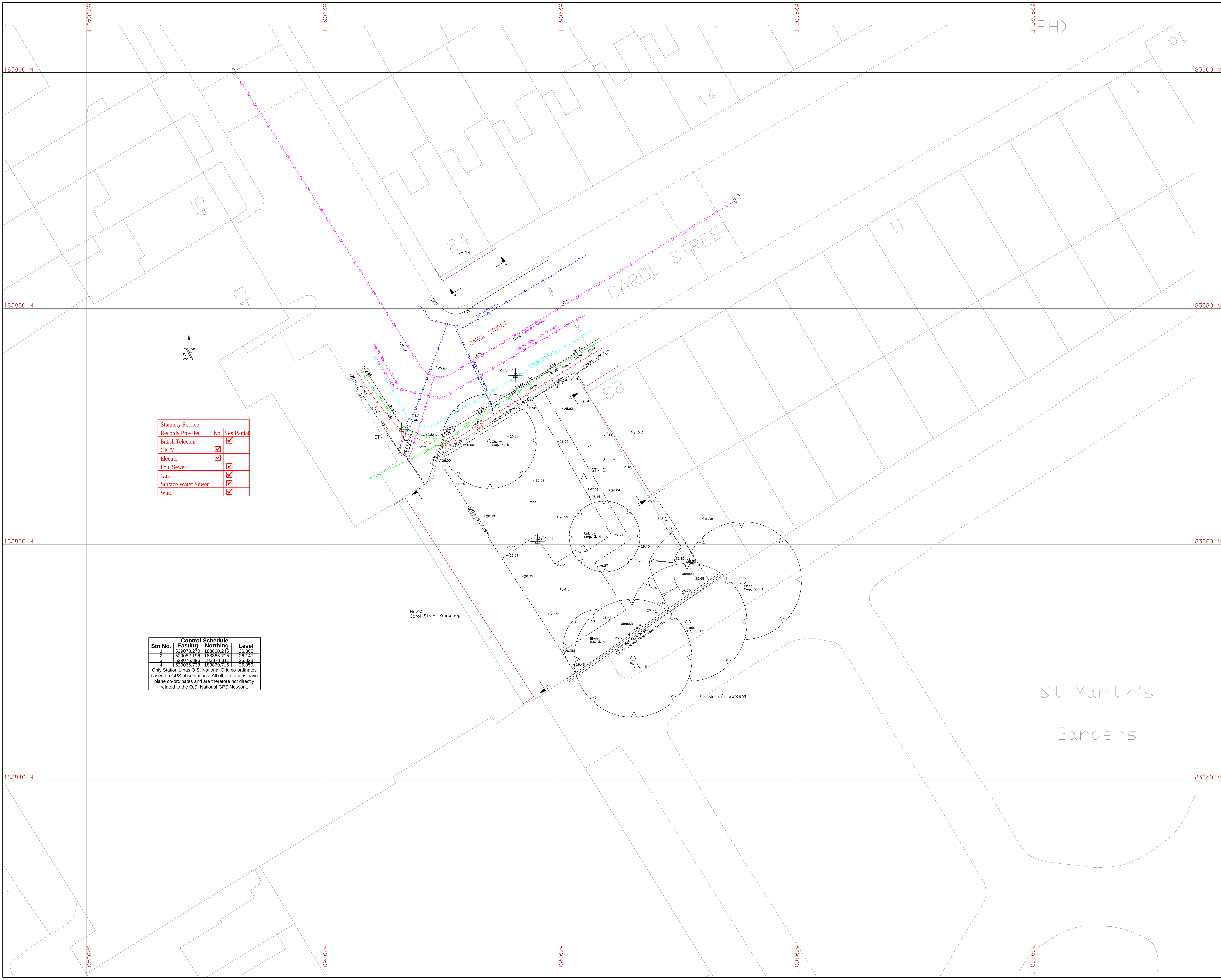
- Construction techniques that will help mitigate against flood risk.

The development site lies within land classified as Flood Zone 1, which is considered at a low risk of flooding. The concern is, therefore, the flood risk that the new development may have off-site. As the flows from site are reduced to the minimum achievable under HR Wallingford guidance, with permeable paving use to reflect the current situation wherever possible; it is the view of this report that the site addresses all requirements of SuDS systems noted in Ciria C753 and the SFRA for the Camden area.

References & Bibliography

- The National Planning Policy Framework March 2012
- Planning Practice Guidance.
- Code for Sustainable Homes - Department of Communities and Local Government. Revised February 2008.
- Environment Agency - Rainfall-Runoff Management for Developments
- Environment Agency indicative flood maps http://maps.environment- agency gov.uk
- Environment Agency indicative groundwater source protection zone maps http://maps.environment- agency gov.uk
- Environment Agency indicative Aquifer designation maps http://maps.environment-agency gov.uk
- CIRIA 2007, The Sustainable Drainage Systems (SUDS) Manual C697
- CIRIA 2015, The Sustainable Drainage Systems (SUDS) Manual C753
- Sewers for Adoption 6th Edition and interim guidance prior to the introduction of sewers for adoption 7th edition WRC
- Flood Warning information https://flood-warning-information.service.gov.uk/long-term-flood-risk/
- Environment Agency - Adapting to Climate Change: Advice for the Flood and Coastal Erosion Management Authorities March 2016
- Flood Risk Assessments: Climate Change Allowances https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
- Flood risk assessments: climate change allowances - Environment Agency Updated 12 April 2016.
- Environment Agency updated flood maps for surface water (ufmfsw), http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2
- http://camden.gov.uk Camden Development Policy 23
- http://camden.gov.uk Camden SFRA
- http://camden.gov.uk Camden Planning Guidance 3 (CPG3)

Appendix A – Site Topographic Survey



Statutory Service Records Provided	No	Yes	Partial
British Telecom		☑	
CATV	☑		
Electric	☑		
Foul Sewer		☑	
Gas		☑	
Surface Water Sewer		☑	
Water		☑	

Control Schedule

Stn No.	Easting	Northing	Level
1	529078.270	183860.245	26.305
2	529082.196	183865.715	26.147
3	529076.396	183874.311	25.828
4	529066.738	183869.716	26.059

Only Station 1 has O.S. National Grid co-ordinates based on GPS observations. All other stations have plane co-ordinates and are therefore not directly related to the O.S. National GPS Network.

CONTROL DATA

FEATURES

LEVEL DATA

TREES

OVERHEAD CABLES

FENCE TYPES

ABBREVIATIONS

IMPORTANT NOTES

UNDERGROUND SERVICES – TRACED

UNDERGROUND SERVICES – NOT TRACED

NOTES

PLAN PRODUCTION BY

RANDALL SURVEYS LLP

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Land and Hydrographic Surveyors
Architectural Building Surveyors
Underground Services Location

PROJECT NAME

SITE ADJACENT TO

43 CAROL STREET, NW1 OHT

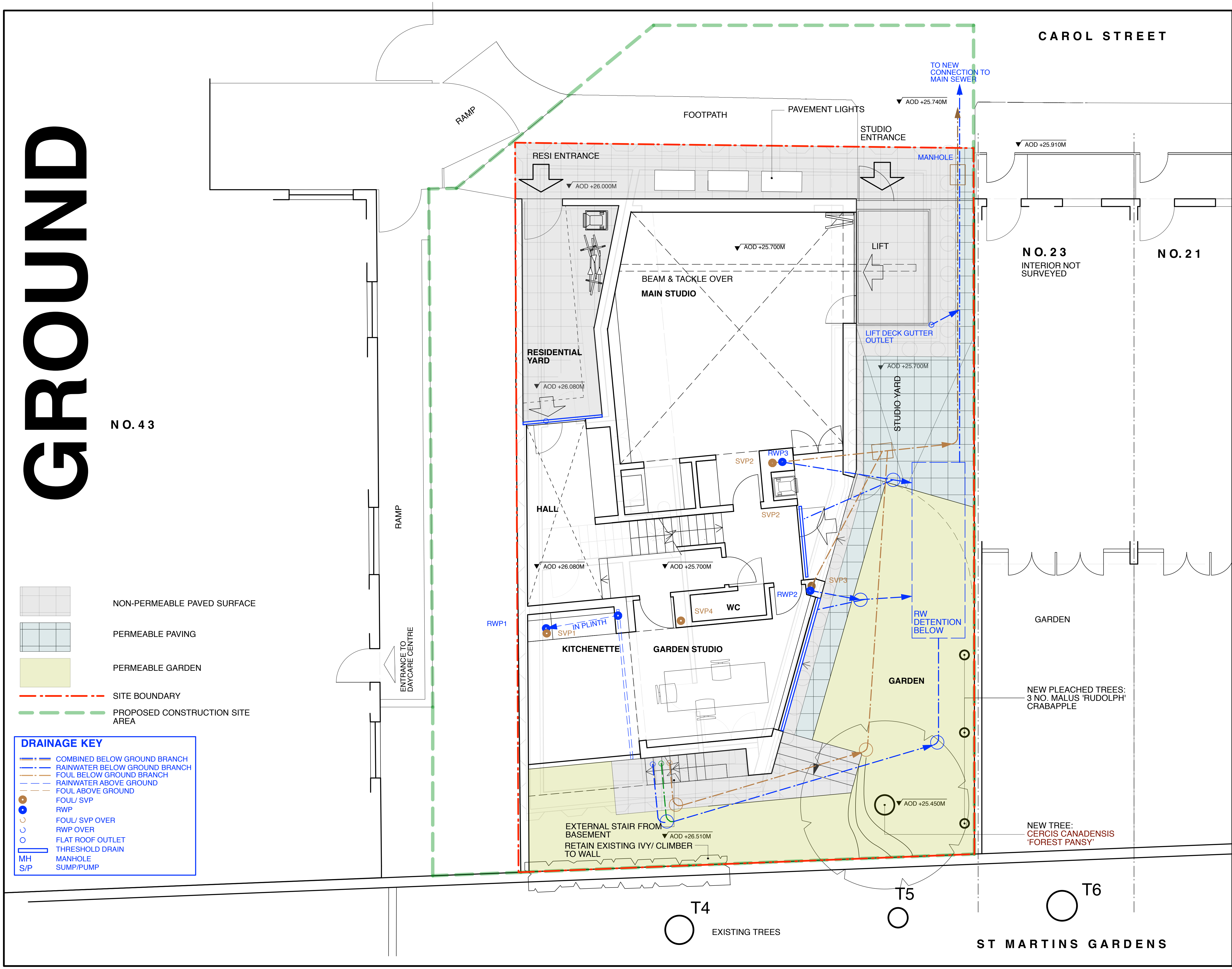
DRAWING TITLE

EXISTING SITE & SERVICES LAYOUT

SCALE 1/100	DRAWN SJP	PAPER SIZE A0
DATE February 2015	CHECKED DRD	REVISION

Dwg No. 13445/SP/1

Appendix B – Master Plans and Floor Plans



LAND ADJOINING 43 CAROL STREET
LONDON NW1

GROUND FLOOR PLAN

AS PROPOSED

CRL/GA/001/V

1:100 @ A3

DO NOT SCALE FROM THIS DRAWING
REFER ALL DISCREPANCIES TO ARCHITECT

REVISIONS/ ISSUE

07/06/2017 **M**
GARDEN DESIGNER FOR INFO

09/06/2017 **N**
ARBORICULTURALIST FOR INFO

23/06/2017 **P**
SE FOR INFO

26/06/2017 **Q**
BCO FOR INFO

07/08/2017 **R**
SE/ M&E FOR INFO/ COMMENT

15/08/2017 **S**
PC/ CLIENT FOR COMMENT

17/08/2017 **T**
SE/ M&E FOR INFO

22/08/2017 **U**
LIGHTING CONSULTANT FOR INFO

11/09/2017 **V**
CONSULTANTS FOR INFO

PLEASE USE SCALE BAR TO TAKE MEASUREMENTS WHEN READING FROM PDFS

M 1 2 3 4 5 10

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Appendix C – Drainage Strategy

BURIED UTILITIES RISK NOTE

- Buried utilities are present on and in the vicinity of the site.
- The Contractor must satisfy themselves that they have seen utility returns for the area and that appropriate Risk Assessment Method Statement (RAMS) are in place and implemented to ensure that buried and/or overhead services are located prior to any works taking place.
- Any RAMS shall address safe procedures for protection and working in the proximity of services.

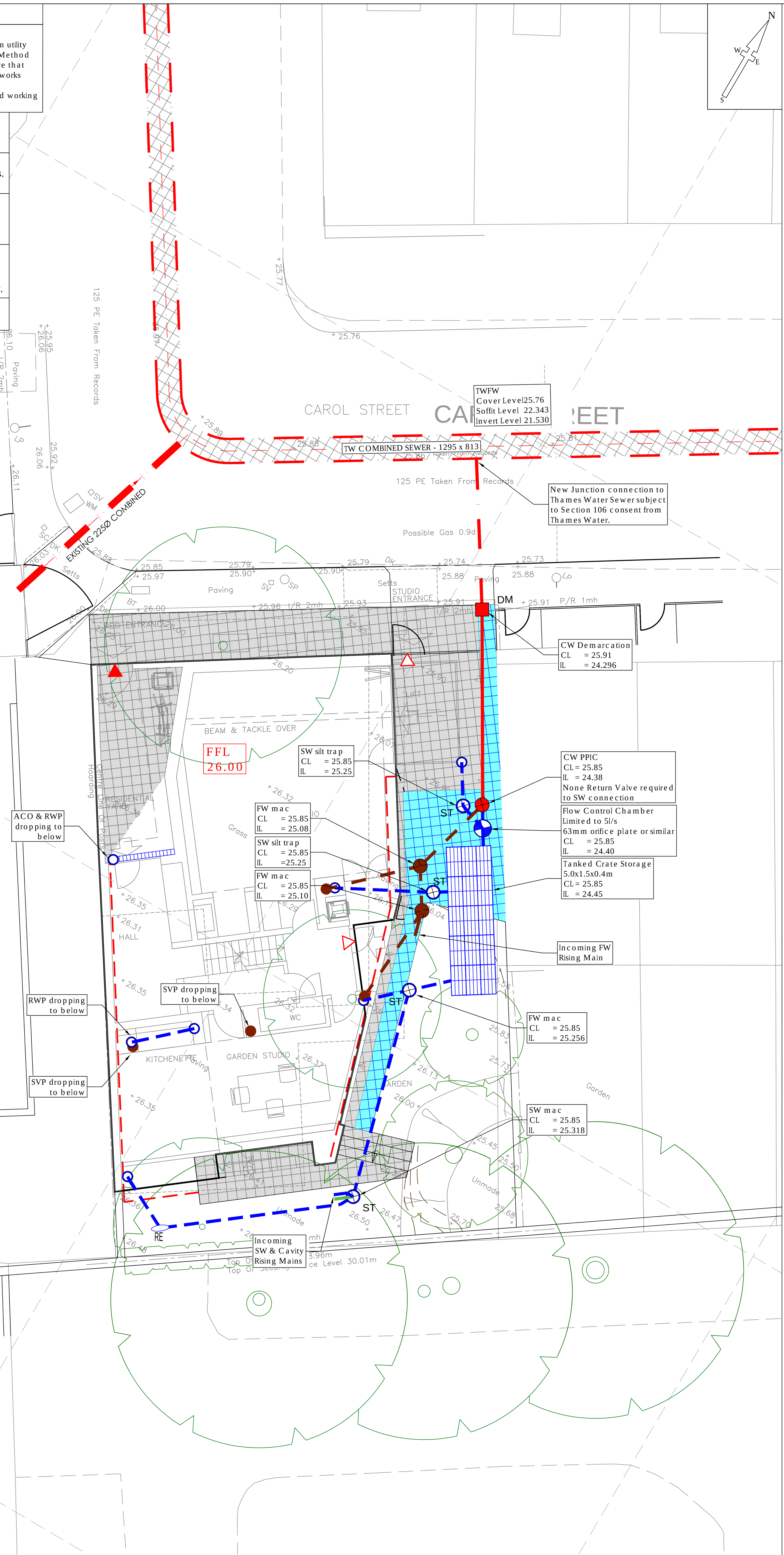
CDM RESIDUAL RISK ITEM
Existing services likely within working area.
Danger to site personnel and general public

CDM RESIDUAL RISK ITEM
Drainage pipes, manhole rings covers and fittings.
Risk of Manual handling injury.

CDM RESIDUAL RISK ITEM
Contact with waste water when making drainage connections.
Risk of infection from Weils disease etc.

CDM RESIDUAL RISK ITEM
Above Ground activities.
Possibility of objects falling from operations at high level onto persons working or passing below.

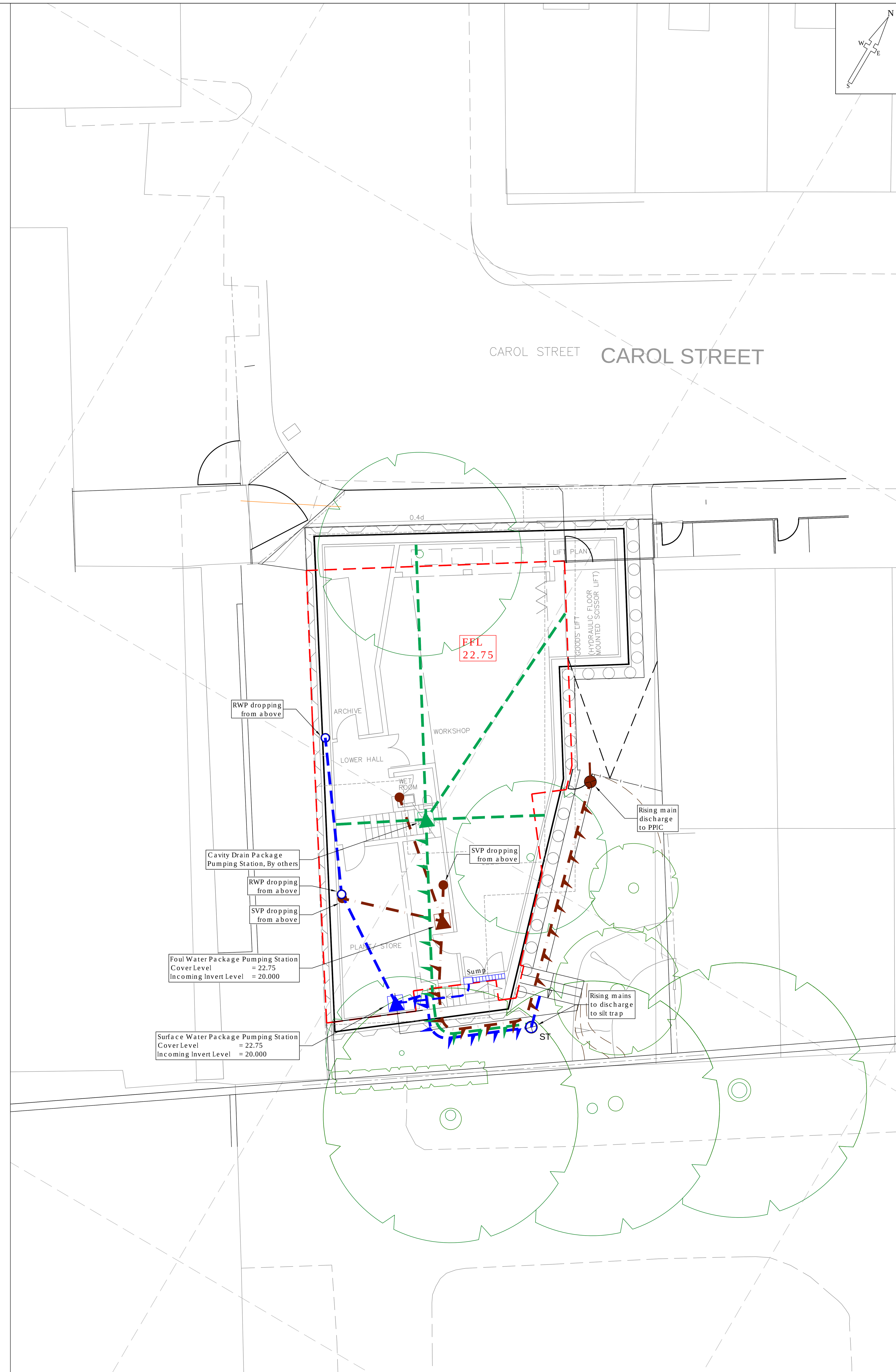
CDM RESIDUAL RISK ITEM
Works within confined spaces.



GROUND FLOOR DRAINAGE STRATEGY

DESIGN NOTE
WHERE POSSIBLE ALL FLOWS SHOULD BE ROUTED DIRECTLY TO GRAVITY DRAINAGE. M&E ENGINEER TO CONFIRM ROUTES.

DESIGN NOTE
SURFACE WATER DRAINAGE SIZED TO ACCOMMODATE A 1 in 100 YEAR STORM EVENT WITH 40% ALLOWANCE FOR CLIMATE CHANGE



BASEMENT DRAINAGE STRATEGY

NOT FOR CONSTRUCTION
TO SHOW PROOF OF CONCEPT

NOTE:

1. DO NOT SCALE, IF IN DOUBT ASK.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURAL ENGINEER'S DRAWINGS AND DETAILS, THE SPECIFICATION FOR THE WORKS, THE RELEVANT ARCHITECT'S DRAWINGS AND ANY OTHER SPECIALIST'S DRAWINGS.

DESIGNERS CDM NOTE - RESIDUAL RISKS IDENTIFIED

The design Engineer(s) have analysed this design as the scheme has been developed, in order to identify if there are any significant residual risk hazards (i.e. unusual, unexpected, abnormal or difficult).

Residual risks HAVE been identified and are therefore shown on this drawing. These risks have not been possible to remove by design.

This statement assumes that a competent Contractor with the appropriate qualified staff will be employed for the works, and that they will be familiar with site wide construction risks and hazards that they can reasonably be expected to encounter as part of their work.

Drainage Key

Sewers

- Foul water drain (private/non adoptable)
- Surface water drain (private/non adoptable)
- Cavity drain (private/non adoptable)
- Foul water sewer (Adoptable)
- Surface water sewer (Adoptable)
- Foul rising main (Private)
- Surface rising main (Private)
- Cavity rising main (Private)
- Existing foul water drain (private/non adopted)
- Existing surface water drain (private/non adopted)
- Existing foul water sewer (Adopted)
- Existing surface water sewer (Adopted)
- Existing combined water sewer (Adopted)
- Existing combined water sewer (Private)
- Redundant sewer

Chamber Key

FW	SW	
mac	mac	Mini access chamber (mac) - 300mmØ *
		PPIC - 475mmØ *
		P.C.C. units/brick *
DM	DM	Adoptable demarcation manhole within 1m of boundary *
		Pumping Stations
		Manhole Depth 1.25 to 1.5m * Depth 1.55 to 3.0m *

* General note
(Refer to standard details & long sections for chamber sizes. Size may need to increase dependant on number of incoming pipes/size of incoming pipes)

RE	Surface water rodding eye
F1	Manhole reference number
	Rain water down pipe (roddable access)
ST	Silt Trap (ST) with removable silt bucket
	Soil vent pipe/soil stack
yg	Yard gully (150m - 200mmØ trapped)
RG	Road gully (trapped) D400
fg	Floor gully (trapped)
	Linear drainage channel
	Cellular storage (refer to drawing for sizes)
	Retaining wall
FFL XX.XX	Finished Floor Level (FFL)
	Flow Control Chamber
	Block paving - Permeable
	Block paving - Standard (non-permeable)

Rev.	Date	Amendments	By	Chk'd
P03	12/09/17	Permeable and non permeable areas added to layout	ATD	RJW
P02	31/08/17	Layout updated, Drainage amended to suit	SNN	RJW
P01	26/06/17	Initial Issue	SNN	RJW

engineersHRW
London 0207 407 9575 Oxford 01865 251 206 www.ehrw.co.uk

Project:
25 Carol Street,
Camden, London.

Drawing title:
Proposed Drainage Strategy

Scale at A1:	Drawn by:	Date:	Chk'd by:
1:100 @ A1	SNN	26/06/2017	RJW

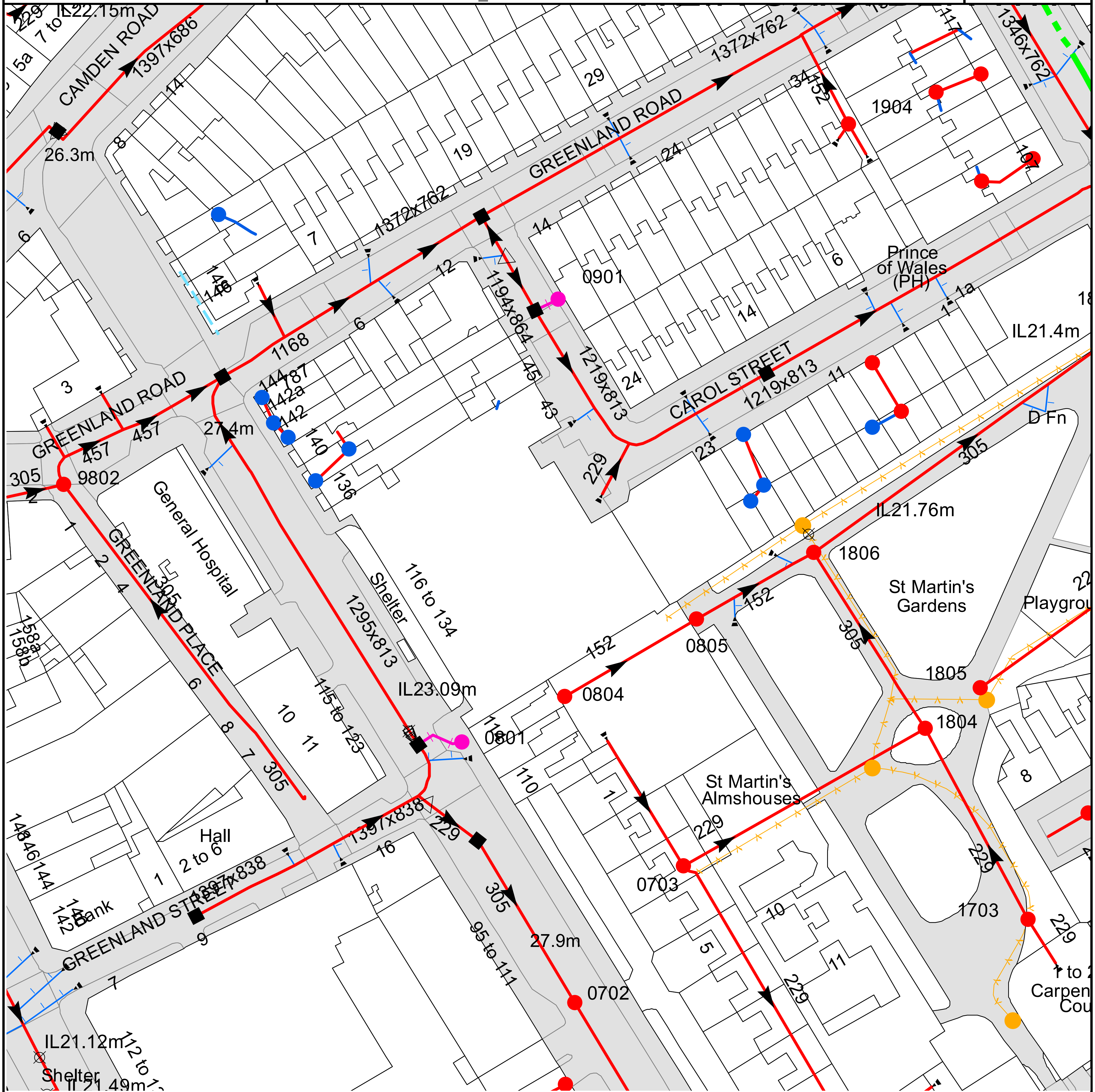
PRELIMINARY

Project Number:	Drawing Type:	Drawing No:	Revision:
1402	DR	50	P03

15-1909

Appendix D – Sewer Records

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2903302



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 529055,183857

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
08GE	n/a	n/a
0801	n/a	n/a
0901	n/a	n/a
0804	27.71	25.24
0702	27.97	23.66
0703	27.59	23.06
0805	26.34	24.87
08EJ	n/a	n/a
08EH	n/a	n/a
08EI	n/a	n/a
1806	26.3	21.78
1904	n/a	n/a
18CI	n/a	n/a
18DA	n/a	n/a
18CJ	n/a	n/a
1804	27.28	22.18
19GE	n/a	n/a
1805	26.63	n/a
19GF	n/a	n/a
19FC	n/a	n/a
1703	27.45	22.73
19FE	n/a	n/a
1802	26.8	21.57
07CD	n/a	n/a
9802	26.55	23.53
08GF	n/a	n/a
08GH	n/a	n/a
08GI	n/a	n/a
08GJ	n/a	n/a
99AB	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Thames Water

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Appendix E – Micro Drainage Calculations

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 6 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	25.062	0.362	0.0	4.6	4.6	2.6	O K
30 min Summer	25.076	0.376	0.0	4.7	4.7	2.7	O K
60 min Summer	25.023	0.323	0.0	4.3	4.3	2.3	O K
120 min Summer	24.930	0.230	0.0	3.6	3.6	1.6	O K
180 min Summer	24.871	0.171	0.0	3.0	3.0	1.2	O K
240 min Summer	24.834	0.134	0.0	2.6	2.6	1.0	O K
360 min Summer	24.795	0.095	0.0	2.0	2.0	0.7	O K
480 min Summer	24.780	0.080	0.0	1.7	1.7	0.6	O K
600 min Summer	24.771	0.071	0.0	1.4	1.4	0.5	O K
720 min Summer	24.765	0.065	0.0	1.2	1.2	0.5	O K
960 min Summer	24.756	0.056	0.0	1.0	1.0	0.4	O K
1440 min Summer	24.746	0.046	0.0	0.7	0.7	0.3	O K
2160 min Summer	24.736	0.036	0.0	0.5	0.5	0.3	O K
2880 min Summer	24.733	0.033	0.0	0.4	0.4	0.2	O K
4320 min Summer	24.728	0.028	0.0	0.3	0.3	0.2	O K
5760 min Summer	24.725	0.025	0.0	0.2	0.2	0.2	O K
7200 min Summer	24.722	0.022	0.0	0.2	0.2	0.2	O K
8640 min Summer	24.721	0.021	0.0	0.2	0.2	0.1	O K
10080 min Summer	24.720	0.020	0.0	0.1	0.1	0.1	O K
15 min Winter	25.109	0.409	0.0	4.9	4.9	2.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.774	0.0	5.1	16
30 min Summer	97.235	0.0	6.6	23
60 min Summer	59.609	0.0	8.0	40
120 min Summer	35.288	0.0	9.5	70
180 min Summer	25.632	0.0	10.4	100
240 min Summer	20.319	0.0	11.0	130
360 min Summer	14.638	0.0	11.9	188
480 min Summer	11.592	0.0	12.5	246
600 min Summer	9.667	0.0	13.0	308
720 min Summer	8.330	0.0	13.5	368
960 min Summer	6.583	0.0	14.2	490
1440 min Summer	4.718	0.0	15.3	732
2160 min Summer	3.376	0.0	16.4	1076
2880 min Summer	2.661	0.0	17.2	1468
4320 min Summer	1.900	0.0	18.5	2196
5760 min Summer	1.495	0.0	19.4	2936
7200 min Summer	1.241	0.0	20.1	3672
8640 min Summer	1.065	0.0	20.7	4312
10080 min Summer	0.936	0.0	21.2	5088
15 min Winter	150.774	0.0	5.7	16

Summary of Results for 100 year Return Period (+40%)

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	25.109	0.409	0.0	4.9	4.9	2.9	O K
60 min Winter	25.020	0.320	0.0	4.3	4.3	2.3	O K
120 min Winter	24.894	0.194	0.0	3.2	3.2	1.4	O K
180 min Winter	24.832	0.132	0.0	2.5	2.5	0.9	O K
240 min Winter	24.799	0.099	0.0	2.1	2.1	0.7	O K
360 min Winter	24.776	0.076	0.0	1.5	1.5	0.5	O K
480 min Winter	24.765	0.065	0.0	1.2	1.2	0.5	O K
600 min Winter	24.758	0.058	0.0	1.0	1.0	0.4	O K
720 min Winter	24.753	0.053	0.0	0.9	0.9	0.4	O K
960 min Winter	24.746	0.046	0.0	0.7	0.7	0.3	O K
1440 min Winter	24.737	0.037	0.0	0.5	0.5	0.3	O K
2160 min Winter	24.731	0.031	0.0	0.4	0.4	0.2	O K
2880 min Winter	24.729	0.029	0.0	0.3	0.3	0.2	O K
4320 min Winter	24.724	0.024	0.0	0.2	0.2	0.2	O K
5760 min Winter	24.721	0.021	0.0	0.2	0.2	0.1	O K
7200 min Winter	24.719	0.019	0.0	0.1	0.1	0.1	O K
8640 min Winter	24.718	0.018	0.0	0.1	0.1	0.1	O K
10080 min Winter	24.716	0.016	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	97.235	0.0	7.3	24
60 min Winter	59.609	0.0	9.0	40
120 min Winter	35.288	0.0	10.7	70
180 min Winter	25.632	0.0	11.6	100
240 min Winter	20.319	0.0	12.3	130
360 min Winter	14.638	0.0	13.3	188
480 min Winter	11.592	0.0	14.0	246
600 min Winter	9.667	0.0	14.6	310
720 min Winter	8.330	0.0	15.1	368
960 min Winter	6.583	0.0	15.9	492
1440 min Winter	4.718	0.0	17.1	726
2160 min Winter	3.376	0.0	18.4	1068
2880 min Winter	2.661	0.0	19.3	1456
4320 min Winter	1.900	0.0	20.7	2180
5760 min Winter	1.495	0.0	21.7	2840
7200 min Winter	1.241	0.0	22.5	3600
8640 min Winter	1.065	0.0	23.2	4352
10080 min Winter	0.936	0.0	23.8	5080

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)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.018

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.010	4	8	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Cellular Storage Structure

Invert Level (m) 24.700 Safety Factor 2.0
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	7.5	7.5	0.500	0.0	12.7
0.400	7.5	12.7			

Orifice Outflow Control

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 24.700

Summary of Results for 100 year Return Period

Half Drain Time : 6 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	24.941	0.241	0.0	3.7	3.7	1.7	O K
30 min Summer	24.949	0.249	0.0	3.7	3.7	1.8	O K
60 min Summer	24.911	0.211	0.0	3.4	3.4	1.5	O K
120 min Summer	24.847	0.147	0.0	2.7	2.7	1.1	O K
180 min Summer	24.811	0.111	0.0	2.3	2.3	0.8	O K
240 min Summer	24.790	0.090	0.0	2.0	2.0	0.6	O K
360 min Summer	24.773	0.073	0.0	1.5	1.5	0.5	O K
480 min Summer	24.764	0.064	0.0	1.2	1.2	0.5	O K
600 min Summer	24.757	0.057	0.0	1.0	1.0	0.4	O K
720 min Summer	24.753	0.053	0.0	0.9	0.9	0.4	O K
960 min Summer	24.745	0.045	0.0	0.7	0.7	0.3	O K
1440 min Summer	24.736	0.036	0.0	0.5	0.5	0.3	O K
2160 min Summer	24.731	0.031	0.0	0.4	0.4	0.2	O K
2880 min Summer	24.728	0.028	0.0	0.3	0.3	0.2	O K
4320 min Summer	24.723	0.023	0.0	0.2	0.2	0.2	O K
5760 min Summer	24.721	0.021	0.0	0.2	0.2	0.1	O K
7200 min Summer	24.719	0.019	0.0	0.1	0.1	0.1	O K
8640 min Summer	24.717	0.017	0.0	0.1	0.1	0.1	O K
10080 min Summer	24.716	0.016	0.0	0.1	0.1	0.1	O K
15 min Winter	24.970	0.270	0.0	3.9	3.9	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.695	0.0	3.6	15
30 min Summer	69.453	0.0	4.7	23
60 min Summer	42.578	0.0	5.7	38
120 min Summer	25.206	0.0	6.8	68
180 min Summer	18.309	0.0	7.4	98
240 min Summer	14.513	0.0	7.8	128
360 min Summer	10.456	0.0	8.5	188
480 min Summer	8.280	0.0	8.9	246
600 min Summer	6.905	0.0	9.3	308
720 min Summer	5.950	0.0	9.6	368
960 min Summer	4.702	0.0	10.2	490
1440 min Summer	3.370	0.0	10.9	720
2160 min Summer	2.412	0.0	11.7	1084
2880 min Summer	1.901	0.0	12.3	1464
4320 min Summer	1.357	0.0	13.2	2172
5760 min Summer	1.068	0.0	13.8	2864
7200 min Summer	0.886	0.0	14.4	3648
8640 min Summer	0.761	0.0	14.8	4400
10080 min Summer	0.669	0.0	15.2	5048
15 min Winter	107.695	0.0	4.1	16

Summary of Results for 100 year Return Period

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	24.965	0.265	0.0	3.9	3.9	1.9	O K
60 min Winter	24.902	0.202	0.0	3.3	3.3	1.4	O K
120 min Winter	24.822	0.122	0.0	2.4	2.4	0.9	O K
180 min Winter	24.787	0.087	0.0	1.9	1.9	0.6	O K
240 min Winter	24.775	0.075	0.0	1.5	1.5	0.5	O K
360 min Winter	24.761	0.061	0.0	1.1	1.1	0.4	O K
480 min Winter	24.753	0.053	0.0	0.9	0.9	0.4	O K
600 min Winter	24.747	0.047	0.0	0.7	0.7	0.3	O K
720 min Winter	24.743	0.043	0.0	0.6	0.6	0.3	O K
960 min Winter	24.736	0.036	0.0	0.5	0.5	0.3	O K
1440 min Winter	24.731	0.031	0.0	0.4	0.4	0.2	O K
2160 min Winter	24.727	0.027	0.0	0.3	0.3	0.2	O K
2880 min Winter	24.724	0.024	0.0	0.2	0.2	0.2	O K
4320 min Winter	24.720	0.020	0.0	0.1	0.1	0.1	O K
5760 min Winter	24.718	0.018	0.0	0.1	0.1	0.1	O K
7200 min Winter	24.716	0.016	0.0	0.1	0.1	0.1	O K
8640 min Winter	24.715	0.015	0.0	0.1	0.1	0.1	O K
10080 min Winter	24.714	0.014	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	69.453	0.0	5.2	24
60 min Winter	42.578	0.0	6.4	40
120 min Winter	25.206	0.0	7.6	70
180 min Winter	18.309	0.0	8.3	98
240 min Winter	14.513	0.0	8.8	128
360 min Winter	10.456	0.0	9.5	186
480 min Winter	8.280	0.0	10.0	250
600 min Winter	6.905	0.0	10.4	310
720 min Winter	5.950	0.0	10.8	370
960 min Winter	4.702	0.0	11.4	492
1440 min Winter	3.370	0.0	12.2	722
2160 min Winter	2.412	0.0	13.1	1072
2880 min Winter	1.901	0.0	13.8	1468
4320 min Winter	1.357	0.0	14.8	2128
5760 min Winter	1.068	0.0	15.5	2920
7200 min Winter	0.886	0.0	16.1	3632
8640 min Winter	0.761	0.0	16.6	4376
10080 min Winter	0.669	0.0	17.0	5080

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)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.018

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.010	4	8	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Cellular Storage Structure

Invert Level (m) 24.700 Safety Factor 2.0
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	7.5	7.5	0.500	0.0	12.7
0.400	7.5	12.7			

Orifice Outflow Control

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 24.700

Summary of Results for 30 year Return Period

Half Drain Time : 5 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	24.876	0.176	0.0	3.1	3.1	1.3	O K
30 min Summer	24.879	0.179	0.0	3.1	3.1	1.3	O K
60 min Summer	24.851	0.151	0.0	2.8	2.8	1.1	O K
120 min Summer	24.807	0.107	0.0	2.2	2.2	0.8	O K
180 min Summer	24.785	0.085	0.0	1.8	1.8	0.6	O K
240 min Summer	24.774	0.074	0.0	1.5	1.5	0.5	O K
360 min Summer	24.762	0.062	0.0	1.1	1.1	0.4	O K
480 min Summer	24.754	0.054	0.0	0.9	0.9	0.4	O K
600 min Summer	24.749	0.049	0.0	0.8	0.8	0.4	O K
720 min Summer	24.745	0.045	0.0	0.7	0.7	0.3	O K
960 min Summer	24.738	0.038	0.0	0.5	0.5	0.3	O K
1440 min Summer	24.732	0.032	0.0	0.4	0.4	0.2	O K
2160 min Summer	24.728	0.028	0.0	0.3	0.3	0.2	O K
2880 min Summer	24.725	0.025	0.0	0.2	0.2	0.2	O K
4320 min Summer	24.721	0.021	0.0	0.2	0.2	0.1	O K
5760 min Summer	24.719	0.019	0.0	0.1	0.1	0.1	O K
7200 min Summer	24.717	0.017	0.0	0.1	0.1	0.1	O K
8640 min Summer	24.716	0.016	0.0	0.1	0.1	0.1	O K
10080 min Summer	24.715	0.015	0.0	0.1	0.1	0.1	O K
15 min Winter	24.897	0.197	0.0	3.3	3.3	1.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	82.739	0.0	2.8	15
30 min Summer	52.969	0.0	3.6	23
60 min Summer	32.372	0.0	4.4	38
120 min Summer	19.195	0.0	5.2	68
180 min Summer	13.994	0.0	5.7	96
240 min Summer	11.137	0.0	6.0	128
360 min Summer	8.066	0.0	6.5	188
480 min Summer	6.410	0.0	6.9	248
600 min Summer	5.361	0.0	7.2	308
720 min Summer	4.631	0.0	7.5	368
960 min Summer	3.674	0.0	7.9	488
1440 min Summer	2.649	0.0	8.6	734
2160 min Summer	1.908	0.0	9.3	1092
2880 min Summer	1.511	0.0	9.8	1444
4320 min Summer	1.087	0.0	10.6	2148
5760 min Summer	0.859	0.0	11.1	2864
7200 min Summer	0.716	0.0	11.6	3592
8640 min Summer	0.617	0.0	12.0	4392
10080 min Summer	0.544	0.0	12.3	5032
15 min Winter	82.739	0.0	3.1	15

Summary of Results for 30 year Return Period

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	24.890	0.190	0.0	3.2	3.2	1.4	O K
60 min Winter	24.842	0.142	0.0	2.7	2.7	1.0	O K
120 min Winter	24.789	0.089	0.0	1.9	1.9	0.6	O K
180 min Winter	24.773	0.073	0.0	1.5	1.5	0.5	O K
240 min Winter	24.763	0.063	0.0	1.2	1.2	0.4	O K
360 min Winter	24.752	0.052	0.0	0.9	0.9	0.4	O K
480 min Winter	24.745	0.045	0.0	0.7	0.7	0.3	O K
600 min Winter	24.740	0.040	0.0	0.6	0.6	0.3	O K
720 min Winter	24.736	0.036	0.0	0.5	0.5	0.3	O K
960 min Winter	24.732	0.032	0.0	0.4	0.4	0.2	O K
1440 min Winter	24.728	0.028	0.0	0.3	0.3	0.2	O K
2160 min Winter	24.724	0.024	0.0	0.2	0.2	0.2	O K
2880 min Winter	24.721	0.021	0.0	0.2	0.2	0.1	O K
4320 min Winter	24.718	0.018	0.0	0.1	0.1	0.1	O K
5760 min Winter	24.716	0.016	0.0	0.1	0.1	0.1	O K
7200 min Winter	24.714	0.014	0.0	0.1	0.1	0.1	O K
8640 min Winter	24.713	0.013	0.0	0.1	0.1	0.1	O K
10080 min Winter	24.713	0.013	0.0	0.1	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	52.969	0.0	4.0	23
60 min Winter	32.372	0.0	4.9	38
120 min Winter	19.195	0.0	5.8	68
180 min Winter	13.994	0.0	6.3	98
240 min Winter	11.137	0.0	6.7	128
360 min Winter	8.066	0.0	7.3	186
480 min Winter	6.410	0.0	7.8	248
600 min Winter	5.361	0.0	8.1	314
720 min Winter	4.631	0.0	8.4	366
960 min Winter	3.674	0.0	8.9	494
1440 min Winter	2.649	0.0	9.6	734
2160 min Winter	1.908	0.0	10.4	1100
2880 min Winter	1.511	0.0	11.0	1416
4320 min Winter	1.087	0.0	11.8	2148
5760 min Winter	0.859	0.0	12.5	2880
7200 min Winter	0.716	0.0	13.0	3592
8640 min Winter	0.617	0.0	13.4	4360
10080 min Winter	0.544	0.0	13.8	5040

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.018

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.010	4	8	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Cellular Storage Structure

Invert Level (m) 24.700 Safety Factor 2.0
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	7.5	7.5	0.500	0.0	12.7
0.400	7.5	12.7			

Orifice Outflow Control

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 24.700

Summary of Results for 1 year Return Period

Half Drain Time : 6 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	24.773	0.073	0.0	1.5	1.5	0.5	O K
30 min Summer	24.774	0.074	0.0	1.5	1.5	0.5	O K
60 min Summer	24.768	0.068	0.0	1.3	1.3	0.5	O K
120 min Summer	24.757	0.057	0.0	1.0	1.0	0.4	O K
180 min Summer	24.749	0.049	0.0	0.8	0.8	0.4	O K
240 min Summer	24.744	0.044	0.0	0.7	0.7	0.3	O K
360 min Summer	24.737	0.037	0.0	0.5	0.5	0.3	O K
480 min Summer	24.734	0.034	0.0	0.4	0.4	0.2	O K
600 min Summer	24.731	0.031	0.0	0.4	0.4	0.2	O K
720 min Summer	24.730	0.030	0.0	0.3	0.3	0.2	O K
960 min Summer	24.726	0.026	0.0	0.2	0.2	0.2	O K
1440 min Summer	24.723	0.023	0.0	0.2	0.2	0.2	O K
2160 min Summer	24.720	0.020	0.0	0.1	0.1	0.1	O K
2880 min Summer	24.717	0.017	0.0	0.1	0.1	0.1	O K
4320 min Summer	24.715	0.015	0.0	0.1	0.1	0.1	O K
5760 min Summer	24.713	0.013	0.0	0.1	0.1	0.1	O K
7200 min Summer	24.712	0.012	0.0	0.1	0.1	0.1	O K
8640 min Summer	24.711	0.011	0.0	0.0	0.0	0.1	O K
10080 min Summer	24.711	0.011	0.0	0.0	0.0	0.1	O K
15 min Winter	24.778	0.078	0.0	1.6	1.6	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	33.683	0.0	1.1	15
30 min Summer	21.722	0.0	1.5	22
60 min Summer	13.524	0.0	1.8	36
120 min Summer	8.238	0.0	2.2	68
180 min Summer	6.132	0.0	2.5	98
240 min Summer	4.966	0.0	2.7	128
360 min Summer	3.663	0.0	3.0	188
480 min Summer	2.946	0.0	3.2	248
600 min Summer	2.487	0.0	3.4	308
720 min Summer	2.166	0.0	3.5	366
960 min Summer	1.742	0.0	3.8	492
1440 min Summer	1.281	0.0	4.1	732
2160 min Summer	0.942	0.0	4.6	1092
2880 min Summer	0.758	0.0	4.9	1464
4320 min Summer	0.557	0.0	5.4	2148
5760 min Summer	0.448	0.0	5.8	2848
7200 min Summer	0.378	0.0	6.1	3640
8640 min Summer	0.329	0.0	6.4	4360
10080 min Summer	0.293	0.0	6.6	5104
15 min Winter	33.683	0.0	1.3	15

Summary of Results for 1 year Return Period

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	24.777	0.077	0.0	1.6	1.6	0.5	O K
60 min Winter	24.765	0.065	0.0	1.2	1.2	0.5	O K
120 min Winter	24.751	0.051	0.0	0.8	0.8	0.4	O K
180 min Winter	24.742	0.042	0.0	0.6	0.6	0.3	O K
240 min Winter	24.737	0.037	0.0	0.5	0.5	0.3	O K
360 min Winter	24.732	0.032	0.0	0.4	0.4	0.2	O K
480 min Winter	24.730	0.030	0.0	0.3	0.3	0.2	O K
600 min Winter	24.727	0.027	0.0	0.3	0.3	0.2	O K
720 min Winter	24.725	0.025	0.0	0.2	0.2	0.2	O K
960 min Winter	24.722	0.022	0.0	0.2	0.2	0.2	O K
1440 min Winter	24.719	0.019	0.0	0.1	0.1	0.1	O K
2160 min Winter	24.716	0.016	0.0	0.1	0.1	0.1	O K
2880 min Winter	24.715	0.015	0.0	0.1	0.1	0.1	O K
4320 min Winter	24.713	0.013	0.0	0.1	0.1	0.1	O K
5760 min Winter	24.711	0.011	0.0	0.0	0.0	0.1	O K
7200 min Winter	24.710	0.010	0.0	0.0	0.0	0.1	O K
8640 min Winter	24.710	0.010	0.0	0.0	0.0	0.1	O K
10080 min Winter	24.709	0.009	0.0	0.0	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	21.722	0.0	1.6	22
60 min Winter	13.524	0.0	2.0	38
120 min Winter	8.238	0.0	2.5	68
180 min Winter	6.132	0.0	2.8	98
240 min Winter	4.966	0.0	3.0	128
360 min Winter	3.663	0.0	3.3	186
480 min Winter	2.946	0.0	3.6	252
600 min Winter	2.487	0.0	3.8	306
720 min Winter	2.166	0.0	3.9	370
960 min Winter	1.742	0.0	4.2	490
1440 min Winter	1.281	0.0	4.6	714
2160 min Winter	0.942	0.0	5.1	1092
2880 min Winter	0.758	0.0	5.5	1480
4320 min Winter	0.557	0.0	6.1	2224
5760 min Winter	0.448	0.0	6.5	2840
7200 min Winter	0.378	0.0	6.9	3608
8640 min Winter	0.329	0.0	7.2	4288
10080 min Winter	0.293	0.0	7.4	5080

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.018

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.010	4	8	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Cellular Storage Structure

Invert Level (m) 24.700 Safety Factor 2.0
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	7.5	7.5	0.500	0.0	12.7
0.400	7.5	12.7			

Orifice Outflow Control

Diameter (m) 0.062 Discharge Coefficient 0.600 Invert Level (m) 24.700

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.030	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.4
Q1 year	0.1
Q30 years	0.2
Q100 years	0.4

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	24.807	0.107	4.2	0.1	O K
30 min Summer	24.796	0.096	3.5	0.1	O K
60 min Summer	24.777	0.077	2.4	0.1	O K
120 min Summer	24.758	0.058	1.6	0.1	O K
180 min Summer	24.750	0.050	1.2	0.1	O K
240 min Summer	24.746	0.046	0.9	0.0	O K
360 min Summer	24.738	0.038	0.7	0.0	O K
480 min Summer	24.734	0.034	0.6	0.0	O K
600 min Summer	24.731	0.031	0.5	0.0	O K
720 min Summer	24.729	0.029	0.4	0.0	O K
960 min Summer	24.725	0.025	0.3	0.0	O K
1440 min Summer	24.722	0.022	0.2	0.0	O K
2160 min Summer	24.718	0.018	0.2	0.0	O K
2880 min Summer	24.716	0.016	0.1	0.0	O K
4320 min Summer	24.713	0.013	0.1	0.0	O K
5760 min Summer	24.712	0.012	0.1	0.0	O K
7200 min Summer	24.710	0.010	0.1	0.0	O K
8640 min Summer	24.710	0.010	0.1	0.0	O K
10080 min Summer	24.709	0.009	0.0	0.0	O K
15 min Winter	24.807	0.107	4.2	0.1	O K
30 min Winter	24.788	0.088	3.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.695	0.0	1.6	10
30 min Summer	69.453	0.0	2.1	17
60 min Summer	42.578	0.0	2.6	32
120 min Summer	25.206	0.0	3.0	62
180 min Summer	18.309	0.0	3.3	94
240 min Summer	14.513	0.0	3.5	122
360 min Summer	10.456	0.0	3.8	184
480 min Summer	8.280	0.0	4.0	242
600 min Summer	6.905	0.0	4.1	300
720 min Summer	5.950	0.0	4.3	360
960 min Summer	4.702	0.0	4.5	486
1440 min Summer	3.370	0.0	4.9	720
2160 min Summer	2.412	0.0	5.2	1076
2880 min Summer	1.901	0.0	5.5	1424
4320 min Summer	1.357	0.0	5.9	2124
5760 min Summer	1.068	0.0	6.2	2936
7200 min Summer	0.886	0.0	6.4	3616
8640 min Summer	0.761	0.0	6.6	4296
10080 min Summer	0.669	0.0	6.7	5120
15 min Winter	107.695	0.0	1.8	10
30 min Winter	69.453	0.0	2.3	17

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	24.766	0.066	2.0	0.1	O K
120 min Winter	24.750	0.050	1.2	0.1	O K
180 min Winter	24.744	0.044	0.9	0.0	O K
240 min Winter	24.738	0.038	0.7	0.0	O K
360 min Winter	24.733	0.033	0.5	0.0	O K
480 min Winter	24.729	0.029	0.4	0.0	O K
600 min Winter	24.726	0.026	0.3	0.0	O K
720 min Winter	24.724	0.024	0.3	0.0	O K
960 min Winter	24.722	0.022	0.2	0.0	O K
1440 min Winter	24.718	0.018	0.2	0.0	O K
2160 min Winter	24.716	0.016	0.1	0.0	O K
2880 min Winter	24.713	0.013	0.1	0.0	O K
4320 min Winter	24.711	0.011	0.1	0.0	O K
5760 min Winter	24.710	0.010	0.1	0.0	O K
7200 min Winter	24.709	0.009	0.0	0.0	O K
8640 min Winter	24.708	0.008	0.0	0.0	O K
10080 min Winter	24.708	0.008	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	42.578	0.0	2.9	32
120 min Winter	25.206	0.0	3.4	64
180 min Winter	18.309	0.0	3.7	92
240 min Winter	14.513	0.0	3.9	124
360 min Winter	10.456	0.0	4.2	182
480 min Winter	8.280	0.0	4.5	238
600 min Winter	6.905	0.0	4.6	298
720 min Winter	5.950	0.0	4.8	358
960 min Winter	4.702	0.0	5.1	488
1440 min Winter	3.370	0.0	5.4	712
2160 min Winter	2.412	0.0	5.8	1104
2880 min Winter	1.901	0.0	6.1	1464
4320 min Winter	1.357	0.0	6.6	2196
5760 min Winter	1.068	0.0	6.9	2800
7200 min Winter	0.886	0.0	7.1	3728
8640 min Winter	0.761	0.0	7.4	4256
10080 min Winter	0.669	0.0	7.5	5176

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)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Pipe Structure

Diameter (m)	0.150	Length (m)	5.000
Slope (1:X)	40.000	Invert Level (m)	24.700

Pipe Outflow Control

Diameter (m)	0.100	Entry Loss Coefficient	0.500
Slope (1:X)	40.0	Coefficient of Contraction	0.600
Length (m)	5.000	Upstream Invert Level (m)	24.700
Roughness k (mm)	0.600		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	24.791	0.091	3.2	0.1	O K
30 min Summer	24.781	0.081	2.6	0.1	O K
60 min Summer	24.764	0.064	1.9	0.1	O K
120 min Summer	24.750	0.050	1.2	0.1	O K
180 min Summer	24.744	0.044	0.9	0.0	O K
240 min Summer	24.739	0.039	0.7	0.0	O K
360 min Summer	24.734	0.034	0.5	0.0	O K
480 min Summer	24.730	0.030	0.4	0.0	O K
600 min Summer	24.727	0.027	0.4	0.0	O K
720 min Summer	24.725	0.025	0.3	0.0	O K
960 min Summer	24.723	0.023	0.2	0.0	O K
1440 min Summer	24.719	0.019	0.2	0.0	O K
2160 min Summer	24.716	0.016	0.1	0.0	O K
2880 min Summer	24.714	0.014	0.1	0.0	O K
4320 min Summer	24.712	0.012	0.1	0.0	O K
5760 min Summer	24.710	0.010	0.1	0.0	O K
7200 min Summer	24.709	0.009	0.1	0.0	O K
8640 min Summer	24.709	0.009	0.0	0.0	O K
10080 min Summer	24.708	0.008	0.0	0.0	O K
15 min Winter	24.791	0.091	3.2	0.1	O K
30 min Winter	24.774	0.074	2.3	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	82.739	0.0	1.2	10
30 min Summer	52.969	0.0	1.6	17
60 min Summer	32.372	0.0	1.9	32
120 min Summer	19.195	0.0	2.3	62
180 min Summer	13.994	0.0	2.5	92
240 min Summer	11.137	0.0	2.7	124
360 min Summer	8.066	0.0	2.9	182
480 min Summer	6.410	0.0	3.1	242
600 min Summer	5.361	0.0	3.2	300
720 min Summer	4.631	0.0	3.3	368
960 min Summer	3.674	0.0	3.5	482
1440 min Summer	2.649	0.0	3.8	724
2160 min Summer	1.908	0.0	4.1	1096
2880 min Summer	1.511	0.0	4.4	1436
4320 min Summer	1.087	0.0	4.7	2172
5760 min Summer	0.859	0.0	5.0	2920
7200 min Summer	0.716	0.0	5.2	3672
8640 min Summer	0.617	0.0	5.3	4552
10080 min Summer	0.544	0.0	5.5	5032
15 min Winter	82.739	0.0	1.4	10
30 min Winter	52.969	0.0	1.8	17

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	24.756	0.056	1.5	0.1	O K
120 min Winter	24.745	0.045	0.9	0.0	O K
180 min Winter	24.737	0.037	0.7	0.0	O K
240 min Winter	24.733	0.033	0.5	0.0	O K
360 min Winter	24.728	0.028	0.4	0.0	O K
480 min Winter	24.725	0.025	0.3	0.0	O K
600 min Winter	24.723	0.023	0.3	0.0	O K
720 min Winter	24.722	0.022	0.2	0.0	O K
960 min Winter	24.719	0.019	0.2	0.0	O K
1440 min Winter	24.716	0.016	0.1	0.0	O K
2160 min Winter	24.713	0.013	0.1	0.0	O K
2880 min Winter	24.712	0.012	0.1	0.0	O K
4320 min Winter	24.710	0.010	0.1	0.0	O K
5760 min Winter	24.709	0.009	0.0	0.0	O K
7200 min Winter	24.708	0.008	0.0	0.0	O K
8640 min Winter	24.708	0.008	0.0	0.0	O K
10080 min Winter	24.707	0.007	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	32.372	0.0	2.2	32
120 min Winter	19.195	0.0	2.6	64
180 min Winter	13.994	0.0	2.8	96
240 min Winter	11.137	0.0	3.0	124
360 min Winter	8.066	0.0	3.3	174
480 min Winter	6.410	0.0	3.4	238
600 min Winter	5.361	0.0	3.6	296
720 min Winter	4.631	0.0	3.7	376
960 min Winter	3.674	0.0	4.0	478
1440 min Winter	2.649	0.0	4.3	714
2160 min Winter	1.908	0.0	4.6	1096
2880 min Winter	1.511	0.0	4.9	1464
4320 min Winter	1.087	0.0	5.3	2108
5760 min Winter	0.859	0.0	5.5	3016
7200 min Winter	0.716	0.0	5.8	3616
8640 min Winter	0.617	0.0	6.0	4320
10080 min Winter	0.544	0.0	6.1	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Pipe Structure

Diameter (m)	0.150	Length (m)	5.000
Slope (1:X)	40.000	Invert Level (m)	24.700

Pipe Outflow Control

Diameter (m)	0.100	Entry Loss Coefficient	0.500
Slope (1:X)	40.0	Coefficient of Contraction	0.600
Length (m)	5.000	Upstream Invert Level (m)	24.700
Roughness k (mm)	0.600		

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	24.759	0.059	1.7	0.1	O K
30 min Summer	24.754	0.054	1.4	0.1	O K
60 min Summer	24.747	0.047	1.0	0.1	O K
120 min Summer	24.737	0.037	0.6	0.0	O K
180 min Summer	24.732	0.032	0.5	0.0	O K
240 min Summer	24.729	0.029	0.4	0.0	O K
360 min Summer	24.725	0.025	0.3	0.0	O K
480 min Summer	24.722	0.022	0.2	0.0	O K
600 min Summer	24.720	0.020	0.2	0.0	O K
720 min Summer	24.719	0.019	0.2	0.0	O K
960 min Summer	24.717	0.017	0.1	0.0	O K
1440 min Summer	24.714	0.014	0.1	0.0	O K
2160 min Summer	24.712	0.012	0.1	0.0	O K
2880 min Summer	24.710	0.010	0.1	0.0	O K
4320 min Summer	24.709	0.009	0.0	0.0	O K
5760 min Summer	24.708	0.008	0.0	0.0	O K
7200 min Summer	24.708	0.008	0.0	0.0	O K
8640 min Summer	24.707	0.007	0.0	0.0	O K
10080 min Summer	24.707	0.007	0.0	0.0	O K
15 min Winter	24.759	0.059	1.7	0.1	O K
30 min Winter	24.751	0.051	1.2	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	43.505	0.0	0.7	10
30 min Summer	27.782	0.0	0.8	17
60 min Summer	17.052	0.0	1.0	32
120 min Summer	10.236	0.0	1.2	62
180 min Summer	7.551	0.0	1.4	92
240 min Summer	6.076	0.0	1.5	122
360 min Summer	4.455	0.0	1.6	180
480 min Summer	3.570	0.0	1.7	244
600 min Summer	3.005	0.0	1.8	300
720 min Summer	2.611	0.0	1.9	362
960 min Summer	2.090	0.0	2.0	484
1440 min Summer	1.528	0.0	2.2	728
2160 min Summer	1.117	0.0	2.4	1076
2880 min Summer	0.894	0.0	2.6	1424
4320 min Summer	0.653	0.0	2.8	2160
5760 min Summer	0.523	0.0	3.0	2904
7200 min Summer	0.440	0.0	3.2	3560
8640 min Summer	0.382	0.0	3.3	4240
10080 min Summer	0.339	0.0	3.4	4880
15 min Winter	43.505	0.0	0.7	10
30 min Winter	27.782	0.0	0.9	17

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	24.741	0.041	0.8	0.0	O K
120 min Winter	24.732	0.032	0.5	0.0	O K
180 min Winter	24.727	0.027	0.4	0.0	O K
240 min Winter	24.724	0.024	0.3	0.0	O K
360 min Winter	24.721	0.021	0.2	0.0	O K
480 min Winter	24.719	0.019	0.2	0.0	O K
600 min Winter	24.717	0.017	0.1	0.0	O K
720 min Winter	24.716	0.016	0.1	0.0	O K
960 min Winter	24.714	0.014	0.1	0.0	O K
1440 min Winter	24.712	0.012	0.1	0.0	O K
2160 min Winter	24.710	0.010	0.1	0.0	O K
2880 min Winter	24.709	0.009	0.0	0.0	O K
4320 min Winter	24.708	0.008	0.0	0.0	O K
5760 min Winter	24.707	0.007	0.0	0.0	O K
7200 min Winter	24.707	0.007	0.0	0.0	O K
8640 min Winter	24.706	0.006	0.0	0.0	O K
10080 min Winter	24.706	0.006	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	17.052	0.0	1.1	34
120 min Winter	10.236	0.0	1.4	62
180 min Winter	7.551	0.0	1.5	92
240 min Winter	6.076	0.0	1.6	124
360 min Winter	4.455	0.0	1.8	182
480 min Winter	3.570	0.0	1.9	244
600 min Winter	3.005	0.0	2.0	296
720 min Winter	2.611	0.0	2.1	370
960 min Winter	2.090	0.0	2.2	496
1440 min Winter	1.528	0.0	2.5	734
2160 min Winter	1.117	0.0	2.7	1132
2880 min Winter	0.894	0.0	2.9	1360
4320 min Winter	0.653	0.0	3.2	2224
5760 min Winter	0.523	0.0	3.4	2696
7200 min Winter	0.440	0.0	3.5	3496
8640 min Winter	0.382	0.0	3.7	3936
10080 min Winter	0.339	0.0	3.8	5048

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Pipe Structure

Diameter (m)	0.150	Length (m)	5.000
Slope (1:X)	40.000	Invert Level (m)	24.700

Pipe Outflow Control

Diameter (m)	0.100	Entry Loss Coefficient	0.500
Slope (1:X)	40.0	Coefficient of Contraction	0.600
Length (m)	5.000	Upstream Invert Level (m)	24.700
Roughness k (mm)	0.600		

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	24.753	0.053	1.3	0.1	O K
30 min Summer	24.749	0.049	1.1	0.1	O K
60 min Summer	24.741	0.041	0.8	0.0	O K
120 min Summer	24.733	0.033	0.5	0.0	O K
180 min Summer	24.729	0.029	0.4	0.0	O K
240 min Summer	24.726	0.026	0.3	0.0	O K
360 min Summer	24.722	0.022	0.2	0.0	O K
480 min Summer	24.720	0.020	0.2	0.0	O K
600 min Summer	24.718	0.018	0.2	0.0	O K
720 min Summer	24.717	0.017	0.1	0.0	O K
960 min Summer	24.716	0.016	0.1	0.0	O K
1440 min Summer	24.713	0.013	0.1	0.0	O K
2160 min Summer	24.711	0.011	0.1	0.0	O K
2880 min Summer	24.709	0.009	0.1	0.0	O K
4320 min Summer	24.708	0.008	0.0	0.0	O K
5760 min Summer	24.708	0.008	0.0	0.0	O K
7200 min Summer	24.707	0.007	0.0	0.0	O K
8640 min Summer	24.707	0.007	0.0	0.0	O K
10080 min Summer	24.706	0.006	0.0	0.0	O K
15 min Winter	24.753	0.053	1.3	0.1	O K
30 min Winter	24.746	0.046	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	33.683	0.0	0.5	10
30 min Summer	21.722	0.0	0.7	17
60 min Summer	13.524	0.0	0.8	32
120 min Summer	8.238	0.0	1.0	64
180 min Summer	6.132	0.0	1.1	94
240 min Summer	4.966	0.0	1.2	122
360 min Summer	3.663	0.0	1.3	184
480 min Summer	2.946	0.0	1.4	240
600 min Summer	2.487	0.0	1.5	306
720 min Summer	2.166	0.0	1.6	364
960 min Summer	1.742	0.0	1.7	486
1440 min Summer	1.281	0.0	1.8	714
2160 min Summer	0.942	0.0	2.0	1084
2880 min Summer	0.758	0.0	2.2	1452
4320 min Summer	0.557	0.0	2.4	2144
5760 min Summer	0.448	0.0	2.6	2720
7200 min Summer	0.378	0.0	2.7	3648
8640 min Summer	0.329	0.0	2.8	4344
10080 min Summer	0.293	0.0	3.0	4992
15 min Winter	33.683	0.0	0.6	10
30 min Winter	21.722	0.0	0.7	18

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	24.736	0.036	0.6	0.0	O K
120 min Winter	24.729	0.029	0.4	0.0	O K
180 min Winter	24.724	0.024	0.3	0.0	O K
240 min Winter	24.722	0.022	0.2	0.0	O K
360 min Winter	24.719	0.019	0.2	0.0	O K
480 min Winter	24.717	0.017	0.1	0.0	O K
600 min Winter	24.716	0.016	0.1	0.0	O K
720 min Winter	24.715	0.015	0.1	0.0	O K
960 min Winter	24.713	0.013	0.1	0.0	O K
1440 min Winter	24.710	0.010	0.1	0.0	O K
2160 min Winter	24.709	0.009	0.0	0.0	O K
2880 min Winter	24.708	0.008	0.0	0.0	O K
4320 min Winter	24.707	0.007	0.0	0.0	O K
5760 min Winter	24.707	0.007	0.0	0.0	O K
7200 min Winter	24.706	0.006	0.0	0.0	O K
8640 min Winter	24.706	0.006	0.0	0.0	O K
10080 min Winter	24.705	0.005	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	13.524	0.0	0.9	32
120 min Winter	8.238	0.0	1.1	62
180 min Winter	6.132	0.0	1.2	94
240 min Winter	4.966	0.0	1.3	116
360 min Winter	3.663	0.0	1.5	186
480 min Winter	2.946	0.0	1.6	226
600 min Winter	2.487	0.0	1.7	302
720 min Winter	2.166	0.0	1.7	368
960 min Winter	1.742	0.0	1.9	480
1440 min Winter	1.281	0.0	2.1	712
2160 min Winter	0.942	0.0	2.3	1068
2880 min Winter	0.758	0.0	2.4	1424
4320 min Winter	0.557	0.0	2.7	2112
5760 min Winter	0.448	0.0	2.9	2952
7200 min Winter	0.378	0.0	3.0	3600
8640 min Winter	0.329	0.0	3.2	4184
10080 min Winter	0.293	0.0	3.3	5168

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	21.000	Shortest Storm (mins)	15
Ratio R	0.441	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Model Details

Storage is Online Cover Level (m) 25.900

Pipe Structure

Diameter (m)	0.150	Length (m)	5.000
Slope (1:X)	40.000	Invert Level (m)	24.700

Pipe Outflow Control

Diameter (m)	0.100	Entry Loss Coefficient	0.500
Slope (1:X)	40.0	Coefficient of Contraction	0.600
Length (m)	5.000	Upstream Invert Level (m)	24.700
Roughness k (mm)	0.600		

Appendix F – LBC Surface Water Drainage Pro-forma

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	25 CAROL STREET
Address & post code or LPA reference	NW1 OHT
Grid reference	529082, 183859
Is the existing site developed or Greenfield?	Neither - Play Area/Recreation Ground
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding? If yes, please demonstrate how this is managed, in line with DP23?	A REWIEW OF THE MAPS FROM THE CAMDEN SFRA AND EA UFMFSW INDICATES THE SITE IS NOT IN AN LFRZ. BUT IS IN CDA GROUP3_003
Total Site Area served by drainage system (excluding open space) (Ha)*	0.018 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)	0.008	0.018	0.010	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped and section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	INFILTRATION	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
Existing and proposed MicroDrainage calculations	X		SEE SUDS REPORT	Please provide MicroDrainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration		X	NO AREAS GREATER THAN 5M FROM PROPERTY	e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		X	NO WATER COURSE	e.g. Is there a watercourse nearby?
To surface water sewer			COMBINED SEWER	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above				e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.
Has the drainage proposal had regard to the SuDS hierarchy?	X		YES, SEE REPORT 1909.07.001	Evidence must be provided to demonstrate that the proposed Sustainable Drainage strategy has had regard to the SuDS hierarchy as outlined in Section 2.5 above.
Layout plan showing where the sustainable drainage infrastructure will be located on site.	X		SEE SUDS REPORT 1909.07.001	Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

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	0.1	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	1.3	1.6	0.3	23	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	1.7	3.3	1.6	94	
1in 100	4.2	3.9	-0.3	-7	
1 in 100 plus climate change	N/A	4.9	NA	NA	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.

	Greenfield runoff volume (m^3)	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1	0	3.3	7.4	6.1	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	0	6.1	13.8	7.1	
1in 100 6 hour	0	4.2	9.5	5.3	
1 in 100 6 hour plus climate change	0	5.9	13.3	6.0	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)	5l/s 2.9m3	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
Percentage of attenuation volume stored above ground,	0% See report 1909.07.001	Percentage of attenuation volume which will be held above ground in swales/ponds/basins/green roofs etc. If 0, please demonstrate why.

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)**	CLAYS	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?	NA - Insufficent Space	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	NA	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?	NA	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.	NA	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 Water to be stored in tanked crates prior to release.	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.	2.9m3 of crate 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, including green roofs?	Tanked Crate Storage	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.
Will the drainage system contain the 1 in 100 +CC storm event? If no please demonstrate how buildings and utility plants will be protected.	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.
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 will exceedance events be catered on site without increasing flood risks (both on site and outside the development)?	Levels on site are generally lower than surromay undings. Some surface ponding may occur.	**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. Exceedance events are defined as those larger than the 1 in 100 +CC event.
How are rates being restricted (vortex control, orifice etc)	Orifice Palte (63mm)	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.	Homeowner	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?	Homeowner See Maintenance Manual 1909.07.002A	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	1909.07.001 PAGES 6 and 8	
Section 3	1909.07.001 PAGES 11-2 and 24	
Section 4	1909.07.001 PAGES 10 and 24	
Section 5	1909.07.001 PAGE 24	
Section 6	1909.07.001 PAGE 24	
Section 7	1909.07.001 PAGES 6 11 nd 16	
Section 8	1909.07.001 PAGES 13 and 22	

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 RICHARD JAMES WHITE……………………………………………………………………………………

Qualification of person responsible for signing off this pro-forma BSc (Hons), IEng, MCIWEM, CWEM, CENV……………………

Company INFRASTRUCT CS LTD……………………………………………………………………………………

On behalf of (Client's details) ENGINEERS HRW……………………………………………………………………

Date: 01/09/2017……………………………………