NORMAN BROMLEY
PARTNERSHIP

PROJECT REF **BS 2141**

DATE **April 2021**

457 Kingston Road, Epsom KT19 0DB

Sustainable Urban Development Scheme (SuDS) Report

PREPARED FOR:

Jemada Homes Ltd

PREPARED BY:

Norman Bromley Partnership LLP
Bridge House
97 – 101 High Street
Tonbridge
Kent TN9 1DR

Telephone No. 01732 773737
E.Mail: mail@normanbromley.co.uk
Website: www.normanbromley.co.uk

INDEX

1. Executive Summary

The purpose of this report is to assess the potential for disposing of surface water through a sustainable urban drainage system (SUDS) to satisfy the planning permission granted for a new residential development at 457 Kingston Road, Epsom, Surrey. KT19 0BD.

Epsom and Ewell Borough Council have stipulated that drainage designs should satisfy the SuDS Hierarchy and be compliant with the national Non-Statutory Technical Standards for SuDS, NPPF and Ministerial Statement on SuDS to ensure the design meets the national Non-Statutory Technical Standards for SuDS and the final drainage design does not increase flood risk on or off site.

This report utilises option 2: the Wallingford Greenfield run-off (IH124 method) to calculate the run-off rates and attenuation storage.

1.1. Sustainable Drainage System Summary

The site is approximately 1091m^2 area, 328m^2 of which is tarmac car park. Over 90% of the hard landscaping is impermeable. It is believed that the Site in not suitable for infiltration as data shows that the soil is loamy clay with slow permeability. This will require confirmation via a soil and geological survey. We were unable to determine whether the site is contaminated at the time of writing this report.

The existing installation comprises internal rainwater pipes which connect into a combined foul and surface water below ground drainage system within the site which discharges into a pumping station located on the site. There is a car park and hard landscaping around the building. A series of external gullies collects the surface water drainage where it eventually flows into the pumping station. The gravity outflow of which connects into a sewer under Kingston Road. The existing installation thus provides a controlled constant flow output to the sewer.

It may be however be possible to discharge the car park surface water drainage into a rainwater attenuator of 12m^3 actual capacity and connect to a new surface water sewer connection in Tealing Drive. Thames Water utility data shows the depth of this sewer is unknown. Connection would be subject to whether the new drain will coordinate with existing services in the footpath and road and whether the sewer is of a suitable depth. Flow will be controlled from the site by means of a Flow Control Device, limited to 2.0 l/s.

It may also be possible to install a permeable car park surface however the effectiveness of this would have to be confirmed by soil and geological analysis.

There is also the potential to remove some of the hard landscaping and provide soft landscaping.

The calculations show that interception or attenuation of 12.0m^3 will be required. It is recommended that a crate type attenuation chamber is installed in the car park, capable of holding 12.0m^3 of surface water shall be designed into the drainage system.

The development thus complies with all aspects of a sustainable urban drainage design.

2. INTRODUCTION

Norman Bromley Partnership LLP have been instructed to undertake a Sustainable Urban Drainage System (SuDS) assessment of the proposed development at 457 Kingston Road, Epsom. Surrey. KT19 0BD.

This SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (DEFRA, 2011) and the national planning policy guidance (NPPF, 2012). A surface water drainage assessment is presented with reference to the hydrological and hydrogeological context of the development. The report findings are based upon professional judgement and are summarised below.

The report has used baseline data on flood risk from the Environment Agency (EA), rainfall data from the Flood Estimation Handbook (FEH), and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets and standards in the text.

Drainage on the Site has been assessed by considering the following key constraints:

- Topography of the Site
- Local water features and hydrological context
- Underlying geology, soil types and permeability
- Layout and geometry of the proposed development
- Calculated surface water run-off generated during 1 in 100 year + climate change critical storm events.

2.1. What are SuDS?

A Sustainable Urban Drainage System (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SUDS can also significantly improve the quality of water leaving the Site and can enhance the amenity and biodiversity that a site has to offer.

There are a range of SUDS options available to provide effective surface water management that intercept and store excess run-off. When considering these options the destination of the run off should be considered using the order of preference outlined DEFRA's Draft National Standards for SUDS (2011):

- Discharge to the ground
- Discharge to a surface water body
- Discharge to a surface water sewer

- Discharge to a local highway drain
- Discharge to a combined sewer

Guidance suggests that where possible there should be no discharge to surface water or sewer that results from the first 5 mm of rainfall.

3. PROPOSED DEVELOPMENT

Site Address:
457 Kingston Road, Epsom, Surrey. KT19 0BD.

The development consists of conversion of existing offices into 18 new residential apartments. The footprint of the building remains the same.

3.1. Site Map and Information

The approximate site area of the development is 1095m^2.

The site is serviced by a combined foul and surface water drainage system discharging to an onsite pump chamber with final discharge via gravity into a sewer in Kingston Road.

There are no nature conservation areas in the vicinity of the Site, so there are no ecological concerns. The Site is not located within a Groundwater Source Protection Zone, as defined by the Environment Agency.

4. PEAK FLOW RATES AND ATTENUATION VOLUMES

An estimation of run-off is required to permit effective Site water management and prevent any increase in flood risk to off-site receptors. The run-off from the site has been calculated in accordance with The SUDS Manual (C753, 2015).

4.1. Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the National Planning Policy Framework (NPPF) recommends that the effects of climate change are incorporated into Flood Risk Assessments. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the NPPF technical guidance note (NPPF, 2012b).

A figure of 40% has been used in these calculations for future climate change rainfall.

4.2. Surface Water Run-Off from the Site

The potential surface water run-off generated from the Site during 1 in 1, 1 in 10, 1 in 30, and 1 in 100-year return period rainfall events have been calculated for a storm duration of 6 hours. The method used for calculating the runoff complies with the NPPF (2012a) and assumes that the excess runoff associated with the proposed development (plus an allowance for future climate change) will need to be managed by the proposed SUDS scheme even though the development will retain approximately the same extent of the Site covered in impermeable hard standing.

The QBAR method has been used to estimate the runoff from the permeable areas of the Site for the existing and proposed development. The QBAR method is typically used for estimating runoff from small catchments and this is defined in Table 4.2 of the SUDS Manual. The formula is:

$$QBAR = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SPR^{2.17}$$

Where:

- QBAR = Catchment mean annual peak flow (approximately 43% annual probability or 2.3- year return period) (m^3/s)
- AREA = Catchment Area (km^2)
- SAAR = Standard annual rainfall for the period 1941 to 1970 (mm)
- SPR = Standard Percentage Runoff coefficient for the SOIL category
- SOIL = Soil index (from Flood Studies or Wallingford Procedure WRAP maps). It is a weighted sum of individual soil class fractions

For the impermeable surfaces, it has been assumed that 100% runoff will occur from these in the existing and proposed development. Future climate change has been accounted for in the proposed development calculations with an influence of +40% for both impermeable and permeable surfaces, in accordance with the NPPF (2012b).

The formula for determining the peak greenfield runoff rate should theoretically not be applied to areas less than 50 hectares. As many developments are smaller than this size this constraint is avoided by calculating QBAR for 50 hectares and linearly interpolating flow rates for smaller areas. The correlation equation for these areas therefore becomes:

$QBAR = (0.583 \times SAAR^{1.17} \times SPR^{2.17}) \times (.001 \times (AREA/0.5))$

The AREA in m^2 is 1095

The SAAR is 608mm
The SPR is 0.47
The SOIL type is 4 (estimated)

The above figures are used to calculate QBAR, which in this case equates to 0.47 l/s

The following table shows the site discharge rates, calculated for 1, 10, 30, and 100-year rainfall events. These are calculated using the Growth Curve Factors, which have been derived for each of the 10 hydrological regions of the UK. This is based on the work carried out by the Flood Studies research (see FSSR 14).

Site Discharge Rates		
	% of QBAR	Flow l/s
QBAR	1.00	0.47
1 in 1 Year	0.85	0.40
1 in 10 Year	1.62	0.76
1 in 30 Year	2.30	1.08
1 in 100 Year	3.19	1.50

The system will require a flow control device, to limit the flow to 1.5 l/s; however, there can be issues with a flow control device with such a small orifice, with the potential for blocking. It is recommended larger flow rate of 2.0 l/s should be used for the flow control device.

4.3. Attenuation Volume

An attenuation chamber of some form is considered to store rainfall at the development to ensure that the outfall during a peak rain event does not exceed the current outfall from the previous development.

The Rainfall in a 1 in 100-year event for 6 hours is 63mm per m^2, as calculated through the UK SUDS storage estimation tool (a copy of which is included in the appendix). This figure allows for climate change and an urban creep allowance factor.

From the SUDS storage estimation tool, it has been calculated that a total storage of 12.0m^3 will be required for this site. This calculation has excluded the building as the surface water drains are

combined with the foul drainage and are lower than the sewer and require pumping to lift to the sewer level.

Using the StormMaster attenuation storage system, a total of 35 crates would allow above the required 12.0m^3, further excess will be taken up by the pipework within the system. This has not been allowed for in the calculation. A suggested position for this attenuation store is shown on the SuDS Proposals drawing in Section 10.

It is suggested (as shown on the drawing) that the crates are laid 7x5x1 deep. This gives the shallowest option as the sewer depth is unknown.

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Nigel Love
Site name:	457 Kingston Road. 18No. Apartments
Site location:	457 Kingston Road, Epsom. Surrey KT19 0BD

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.36912° N
Longitude:	0.2665° W
Reference:	3632300921
Date:	Mar 30 2021 09:28

Site characteristics

Total site area (ha):	0.033
Significant public open space (ha):	0
Area positively drained (ha):	0.033
Impermeable area (ha):	0.033
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.03
Net impermable area for storage volume design (ha):	0.03
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	101.64
FEH / FSR conversion factor:	1.32	1.32
SAAR (mm):	633	608
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.14	0.14
Q_{BAR} for net site area (l/s):	0.14	0.14

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Flow control to max of 2 l/s/ha or Qbar
Interception rainfall depth (mm):	0
Minimum flow rate (l/s):	2

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m³):	12	12
Long term storage 1/100 years (m³):	0	0
Total storage 1/100 years (m³):	12	12

5. RUN-OFF DESTINATION

Possible means of discharging surface water generated on-site are described and assessed as below.

5.1. Green Roof

A green roof has not been considered for the project; it was not included within planning.

5.2. Discharge to the Ground

While no soil report is available, it is believed that the Site has relatively low permeability, consisting of a mix of impermeable loam and clay, and infiltration techniques are not considered viable for this Site. We have indicated a permeable surface on the car park as an option. This is subject to further soil and landscape investigation.

5.3. Discharge to Surface Water Body

There are no surface water bodies along the boundaries of the Site that will allow controlled discharge from the Site, and thus this option could not be considered. The Hogsmill River is the closest water course 200 metres away.

5.4. Discharge to Surface Water Sewer/Combined Sewer

The site below ground drainage is combined foul and surface water drainage. There are two separate connections from the site. One side which we believe carries both foul and the surface water drainage flows into an on-site pump station with a controlled flow output via gravity to the sewer. The other we believe is a foul water drainage only. We believe they both connect to a foul sewer on Kingston Road

5.5. Recommendations

It is recommended that the existing methodology for the building for the surface water drainage discharging via an existing pump station is retained around the vicinity of the building due to the existing site conditions. It is however viable to alter the surface water drainage to the car park and surrounding hard landscaping where a controlled discharge via attenuation could be provided as calculated in section 4.3, and controlled discharge using a flow control device as described in section 6. A new surface water sewer connection in Tealing Drive would be required subject to suitability. Both methods provide a controlled discharge to the local authority sewer system.

The car park surface could be replaced with a permeable surface, subject to further soil and geological analysis.

Some existing hard landscaping could be replaced with soft landscaping.

6. Drainage Maintenance

The actual maintenance regime, plans, and method statements will be the responsibility of the Management Company of the development. Included within this section is guidance on how the maintenance should be carried out, along with an example Method Statement.

6.1. Maintenance Plan

- Litter Management – Frequency: Monthly. All litter should be picked up from the external site
- Gullies and Channels – Frequency: Monthly. Remove silt and debris from all surface water collection points
- Impermeable Surfaces – Frequency: Once annually out of Autumn, Monthly during Autumn. Sweep all impermeable surfaces, with extra attention during Autumn and periods with heavy leaf fall
- Access Chambers – Frequency: Annual. Check chamber is not blocked and free flowing

6.2. Method Statement

Below is a typical method statement, and something similar should be adopted by the Management Company.

- All operatives must wear suitable PPE including high visibility clothing
- Traffic management to be installed in accordance with the Safety at Street Works and Road Works Code of Practice
- Using hand tools only, remove any debris from gully gratings and/or drainage channels
- Use hand tools to reform channel if necessary to facilitate flow of surface water
- Remove traffic

management Additional notes:

- Do not attempt to lift any ironwork
- Do not attempt to use any mechanical equipment on this drainage maintenance activity

7. CONCLUSIONS AND RECOMMENDATIONS

It is the recommendation of this report that the Site discharges the surface water in the first instance to the existing pumping station, with the remainder from the car park and surrounding hard landscaping being discharged via a new attenuator and flow control device to a new surface water sewer connection in sewer within Tealing Drive subject to suitability.

Attenuation of 12.0m^3 actual capacity shall be allowed to not increase the run-off rates during a 6 hour 100 year storm event, with a controlled discharge flow rate using a Flow Control Device restricted to 2.0 litres per second.

The property can be protected from exceedance flows with the use of overflows at roof level and drainage channels at door thresholds and upper ground floor external areas to prevent water cascading to the lower ground floor.

The adjacent sites can be protected by exceedance flows from the site with the use of drainage channels across the car park entrance.

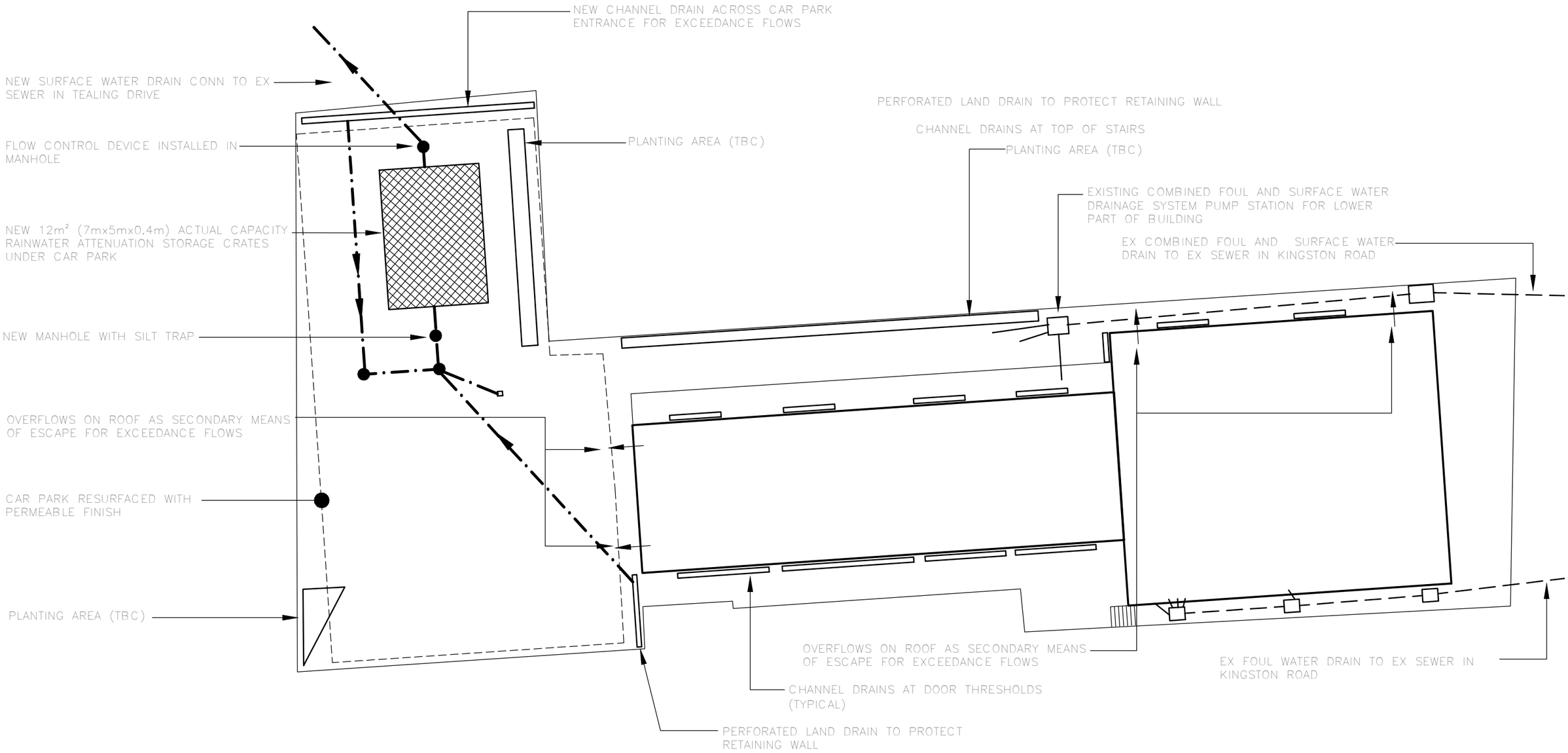
A permeable surface could be installed in the car park. This would be subject to further soil and local geological surveys to establish whether it is a viable option.

Attenuation of 12.0m^3 total shall be allowed to not increase the run-off rates during a 6 hour 100 year storm event, with a controlled discharge flow rate using a Flow Control Device restricted to 2.0 litres per second.

8. SuDS PROPOSAL PLAN

The site plan included with this report indicates the following:-

- Proposal to separate the car park surface water drainage from the existing surface water drainage installation.
- The existing below ground drainage system.
- Method of protecting site and surrounding during exceedance flows.



Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SUSTAINABLE URBAN DRAINAGE SYSTEM (SuDS) REPORT AND ALL OTHER PLANNING DOCUMENTS.
3. DO NOT SCALE FROM THIS DRAWING

Rev	Date	Revision	Dwn	Chk

Project
457 KINGSTON ROAD, EPSOM, SURREY. KT19 0BD
CONVERSION OF OFFICE BUILDING TO RESIDENTIAL DWELLINGS
P1

Client
JEMADA HOMES LTD

Title
SITE PLAN
SUSTAINABLE URBAN DRAINAGE SYSTEM (SuDS) PROPOSALS

NORMAN BROMLEY PARTNERSHIP
Consulting Engineers
Bridge House,
97-101 High Street,
Tonbridge,
Kent. TN9 1DR
Tel. No. (01732) 773737 Fax No. (01732) 773353
Email: mail@normanbromley.co.uk

Scale	Date	Drawn	Approved
N.T.S@A3	MAR'21	NL	

Drawing No.	Rev.
SBS 2141/1	P1