Technical Note for Surface Water Drainage Condition Discharge

Prepared for:
Kalpesh Patel

Location:
40 Oakfield Gardens
London
N18 1NX

September 2022

Our reference:
92181-Valand-DeaneCrftRd

Unda Consulting Limited, Southpoint, Old Brighton Road, Gatwick, West Sussex, RH11 0PR
+44 (0) 1293 214 444
enquiries@unda.co.uk

Document Issue Record

Location:	40 Oakfield Gardens, London, N18 1NX				
Application:	Conversion of single family dwelling house into 2 x self-contained flats with private amenity space, involving single storey rear extension				
Prepared for:	Kalpesh Patel				
Title:	Surface Water Drainage Technical Note				
Project No.:	92181	**Date:**	28th September 2022	**Issue No.:**	1.0
Written By:	A. Rousou BSc (Hons)	**Checked By:**	E. Bouet, BSc (Hons)	**Authorised By:**	E. Bouet, BSc (Hons)

1. Introduction

1.1. This Surface Water Drainage Technical Note has been prepared by Unda Consulting Limited on behalf of Kalpesh Patel, to address Condition 6 and part of Condition 9 of a planning application.

1.2. The Planning application relates to construction of conversion of single family dwelling house into 2 x self-contained flats with private amenity space, involving single storey rear extension. These works are proposed to be undertaken at 40 Oakfield Gardens, London N18 1NX.

1.3. Post development the total roof area of the residential dwelling and timber sheds will be approximately 72m².

1.4. This report assesses the surface water drainage arrangement for the proposed development, which forms Condition 6 and Part of Condition 9 of a planning application. Conditions 6 and 9 states the following:

Condition 6:
6 The development shall not commence until a Sustainable Drainage Strategy has been submitted to and approved in writing by the Local Planning Authority. The details shall be based on the disposal of surface water by means of a sustainable drainage system in accordance with the principles as set out in the Technical Guidance to the National Planning Policy Framework and should be in line with our DMD Policy SuDS Requirements:

a. Shall be designed to a 1 in 1 and 1 in 100 year storm event with the allowance for climate change;
b. Follow the SuDS management train and London Plan Drainage Hierarchy by providing a number of treatment phases corresponding to their pollution potential;
c. Should maximise opportunities for sustainable development, improve water quality, biodiversity, local amenity and recreation value;
d. The system must be designed to allow for flows that exceed the design capacity to be stored on site or conveyed off-site with minimum impact;
e. Clear ownership, management and maintenance arrangements must be established; and
f. The details submitted shall include levels, sizing, cross sections and specifications for all drainage features.

Condition 9:
9 Prior to first occupation, details of the internal consumption of potable water shall be submitted to and approved in writing by the Local Planning Authority. Submitted details will demonstrate reduced water consumption through the use of water efficient fittings, appliances and recycling systems to show consumption equal to or less than 105 litres per person per day.

The development shall be carried out strictly in accordance with the details so approved and maintained as such thereafter.

1.5. This Technical Note provides the information required to address the surface water elements of planning application Condition 6 and part of Condition 9.

2. Existing Site:

2.1. The existing site is occupied by a three storey terraced, single family dwelling with a total site area of approximately 145m^2.

2.2. The site is located on a residential street therefore the surrounding area is characterised by residential dwellings.

Figure 1: Site location (Source: Google)

Site Topography:

2.3. Environment Agency LiDAR has been used to assess the topography across the site and wider area. Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground surface. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at high spatial resolutions. The EA's LIDAR data archive contains digital elevation data derived from surveys carried out by the EA's specialist remote sensing team. Accurate elevation data is available for over 70% of England. The LiDAR technique records an elevation accurate to +0.3m every 2m. This dataset is derived from a combination of the full dataset which has been merged and re-sampled to give the best possible coverage. The dataset can be supplied as a Digital Surface Model (DSM) produced from the signal returned to the LIDAR (which includes heights of objects, such as vehicles, buildings and vegetation, as well as the terrain surface) or as a Digital Terrain Model (DTM) produced by removing objects from the Digital Surface Model. 1.0m horizontal resolution DTM LiDAR data has been used for the purposes of this study.

2.4. Topographic site levels are shown to range between approximately 20.89mAOD and 21.33mAOD.

Existing Ground Conditions:

2.5. The 1:50,000 BGS map shows the site to be located directly upon the bedrock of London Clay Formation - Clay, Silt and Sand.

2.6. According to BGS mapping the site is underlain by Enfield Silt Member - Clay and Silt superficial deposits.

2.7. The soil type taken from the BGS UKSO Soil Map Viewer, shows a soil parent material of Deep Loam Loess with a soil texture of Silt to Silty Loam.

2.8. There are no nearby BGS borehole logs in the vicinity of the site.

2.9. The published Environment Agency Groundwater Vulnerability map shows the site is not located within a Groundwater Source Protection Zone.

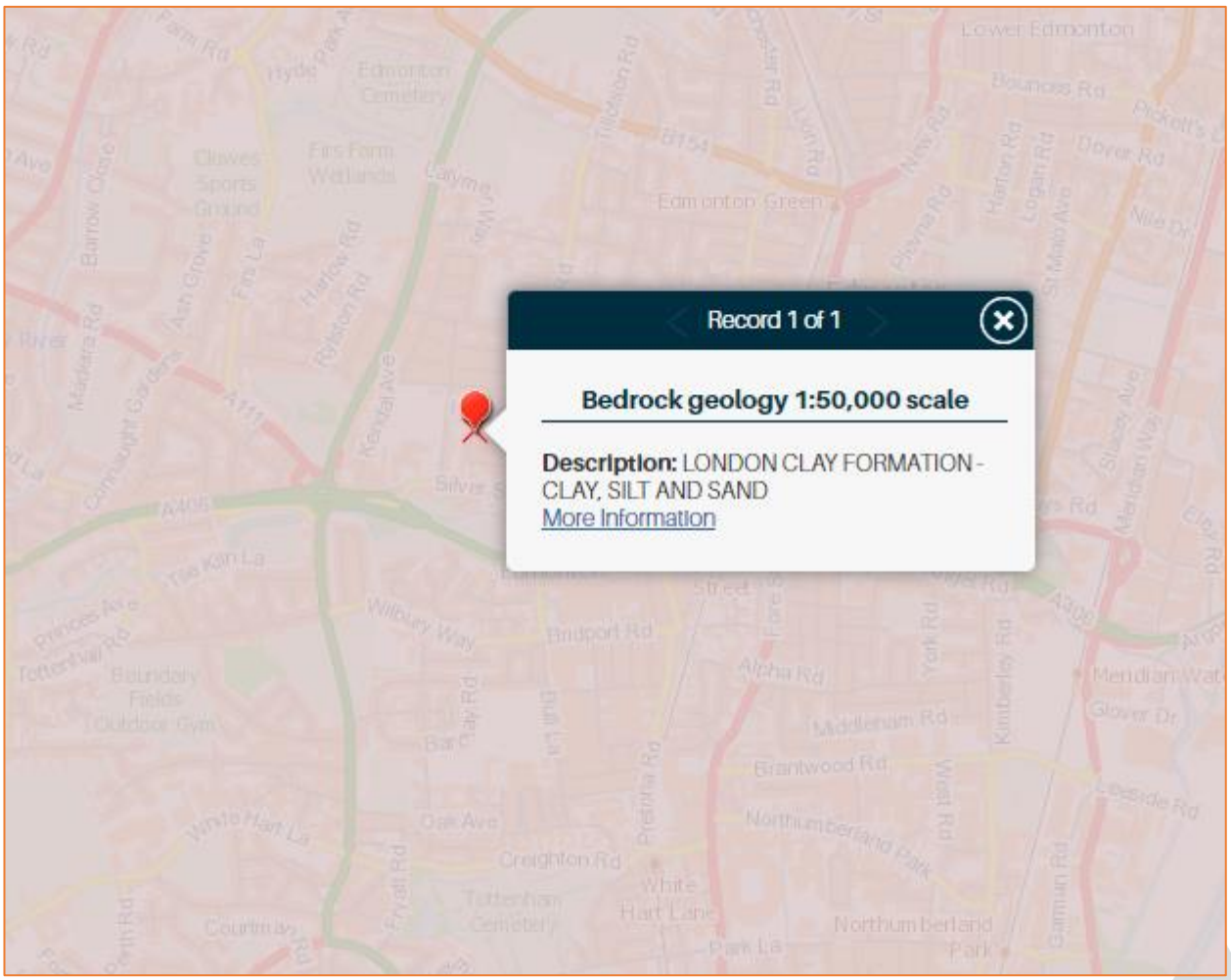

Figure 2: BGS Bedrock Geology (Source: BGS)

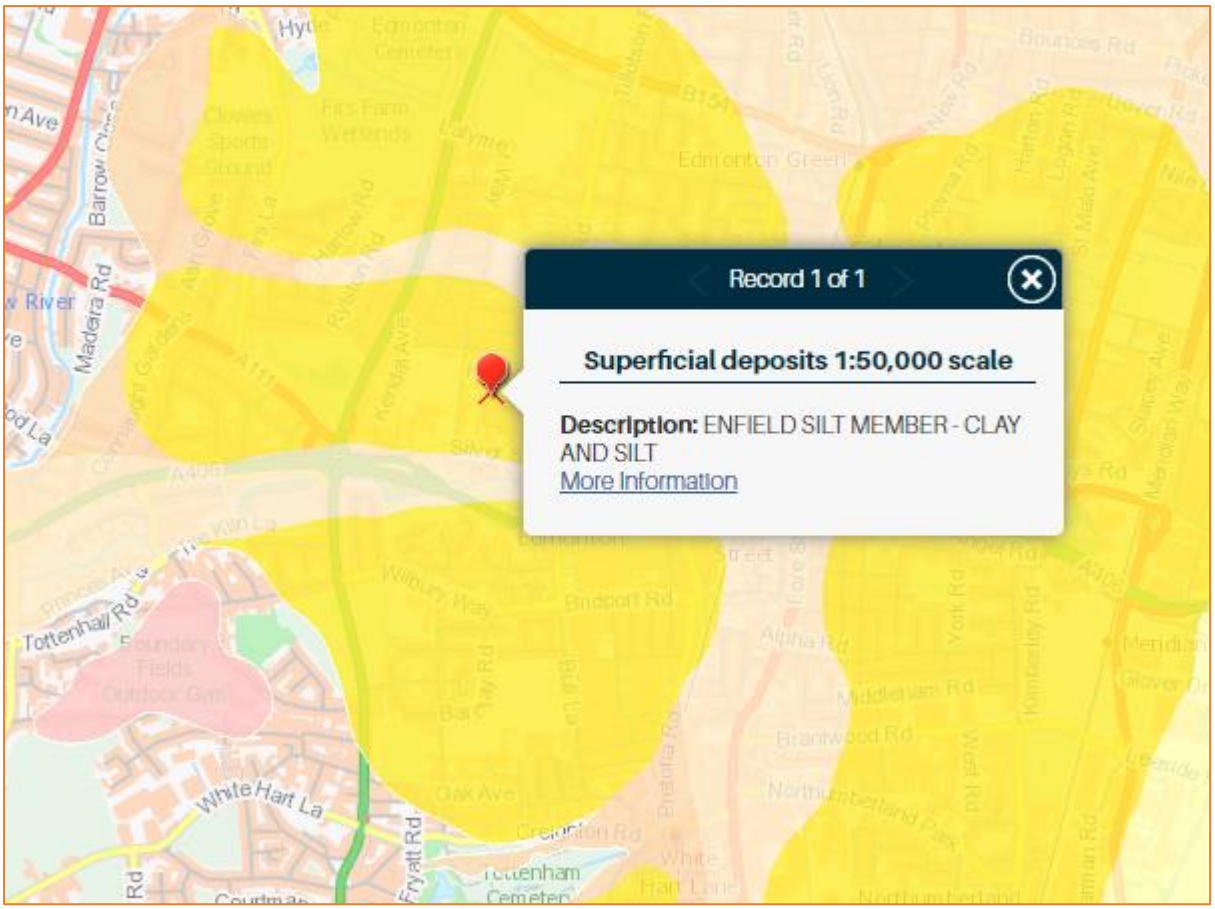

Figure 3: BGS Superficial Deposits (Source: BGS)

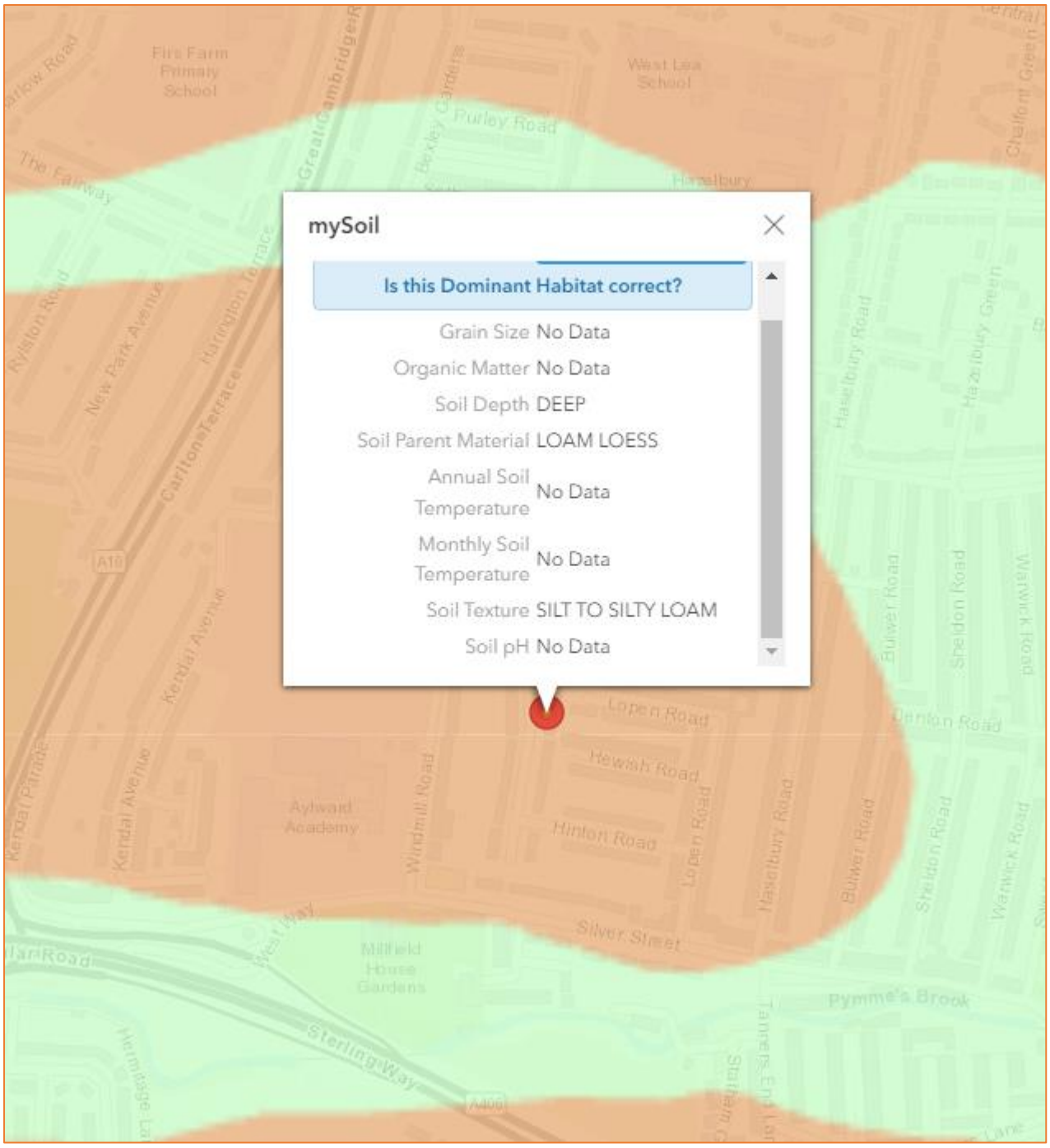

Figure 4: Soil Map (Source: UK Soils, BGS)

Nearby Watercourses / Drainage Features:

2.10. The nearest existing watercourse is the Pymmes Brook located approximately 280m south of the site.

Existing Drainage:

2.11. It is understood the existing site discharges to sewer at an unattenuated rate.

3. Development Proposals:

Proposed Development:

3.1. Discharge of Surface Water Planning Condition 6 and part of Condition 9 is for the conversion of single family dwelling house into 2 x self-contained flats with private amenity space, involving single storey rear extension at 40 Oakfield Gardens, London N18 1NX. Post development the total roof area of the residential dwelling and timber sheds will be approximately 72m².

3.2. However, betterment will be provided by attenuating part of the existing roof as well as an increasing the permeable area located within the front garden.

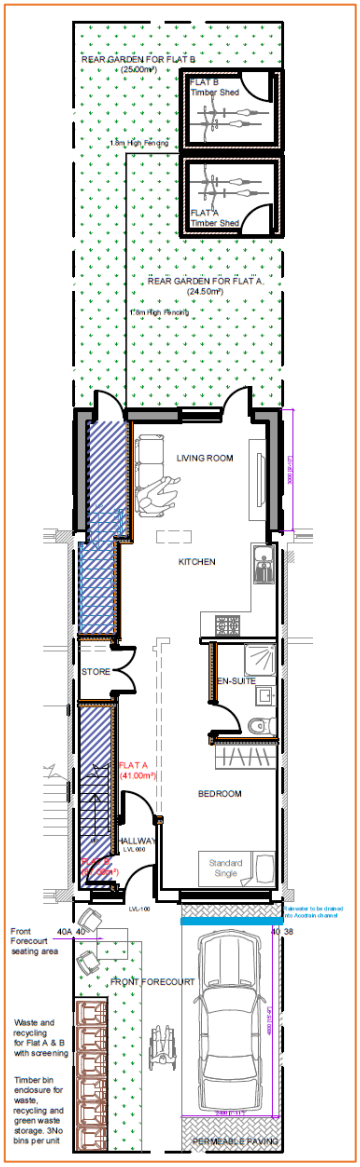

Figure 6: Proposed Site Layout Plan (Source: DS3 Studios)

4. Surface Water Drainage Strategy:

4.1. In order to mitigate flood risk posed by post development runoff, adequate control measures will need to be considered within the site. This will ensure that surface water runoff is dealt with at source and flood risk is not increased elsewhere.

Drainage Hierarchy:

4.2. The drainage strategy for the site has been prepared according to the drainage discharge hierarchy from CIRIA C753 The Suds Manual, as follows:

- Infiltration to the maximum extent that is practical;
- Discharge to surface waters;
- Discharge to surface water sewer.

Infiltration Potential:

4.3. Records from the BGS indicate that the site is located directly upon the bedrock of London Clay Formation - Clay, Silt and Sand.

4.4. Due to the constraints of the site, there is insufficient space for the provision of infiltration SUDs to be viable therefore attenuated discharge is proposed.

Proposed Discharge Rate:

4.5. Existing greenfield runoff rates for the total site have been calculated as 0.0 l/s for the 1:1 annual runoff event, 0.1 l/s for the 1:30 year event and 0.2 l/s for the 1:100 year event. Refer to calculations in appendix.

4.6. Runoff from the front draining part of the roof will discharge into cellular storage located in the front garden. This will then discharge into the sites existing surface water pipework via an orifice plate. There will also be an area of permeable paving located within the front garden.

4.7. Below ground cellular storage is being utilised so it can be located within a communal area and to fit within the sites tight constraints.

4.8. The remaining impermeable areas will discharge to sewer at an unattenuated rate.

Cellular Storage Attenuation:

4.9. The frontward draining part of the roof (23m^2) will discharge into the cellular storage located beneath the front garden.

4.10. The proposed development comprises some 23m^2 of potentially impermeable surfacing. In order to comply with CIRIA C753 The SuDS Manual, a 10% allowance will be added to take into account future urban creep. Applying a 10% allowance to all new impermeable surfacing (23m^2) gives a value of 25.3m^2. Therefore, all drainage calculations have been made on the basis of a total impermeable area of 25.3m^2.

4.11. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas (25.3m^2) arising from the critical 1:100 year + 40% climate change event can be provided within a cellular attenuation of dimensions 4m^2 x 0.40m deep x 0.95 (voids).

4.12. Preliminary calculations indicated that approximately 1.52m^3 of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 40% climate change event.

4.13. *Please note that the levels of the cellular storage within the Micro drainage calculations are arbitrary for modelling purposes.*

4.14. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the appendix.

Water Re-use:

4.15. Runoff from the flats could be collected, filtered and stored in a rainwater harvesting (RWH) tank, which would be buried under a soft landscaped area in the garden. From the tank, water could be piped to toilets, and to an outlet where it can be drawn off for irrigation use. The toilets and outlet would have a back-up connection to a mains water supply, to provide water when the RWH tanks are empty.

4.16. If the RWH tank contains more water than required for toilet and garden usage, the additional water will be discharged via the surface water connection to the cellular storage; which in turn would discharge at a controlled rate, detailed within strategy. If there is insufficient space within the cellular storage, excess water from the rainwater harvesting tank could be discharged to sewer at an unattenuated rate.

Water Quality:

4.17. Water quality has been assessed in line with the Simple Index approach from Chapter 26 of CIRIA C753 The SuDS Manual:
Step 1 – Allocate suitable pollution hazard indices for the proposed land use.
Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

4.18. The highest pollution hazard level for the proposed land use is Low (residential car parks and low trafficked roads). The pollution hazard indices for this land use are shown in Table 2 below.

Total suspended solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

Table 3: Pollution Hazard Indices for the proposed site (from Table 26.2 of CIRIA C753 The SuDS Manual)

4.19. All SuDS components are assessed for their effectiveness in pollutant removal prior to discharge to ground in Table 26.3 in CIRIA C753 The SuDS Manual. The pollution mitigation indices for permeable pavements are show in Table 3 below.

Total suspended solids (TSS)	Metals	Hydrocarbons
0.7	0.6	0.7

Table 4: Pollution Mitigation Indices for permeable pavements (from Table 26.3 of CIRIA C753 The SuDS Manual)

4.20. The Pollution Mitigation Indices for permeable pavement are greater than the Pollution Hazard Indices for car parks and low trafficked roads. Therefore, permeable pavements will provide sufficient water quality treatment prior to discharge to ground.

4.21. Runoff from roof areas is considered to be uncontaminated and does not warrant any form of treatment process to improve water quality. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

Design Exceedance:

4.22. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

Adoption and Maintenance:

4.23. It is proposed that all SuDS facilities will be jointly maintained privately by the end users.

4.24. A draft Maintenance Schedule is outlined in the Table below.

Cellular Storage:

4.33. It is not envisaged that silt build up within the cellular crate systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits and inspection chambers on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection and silt removal (as necessary). Inspection should be undertaken using CCTV equipment offered up the inspection tunnels located within the crate system. Camera access can be gained via inspection chambers and inlet pipework located at each end of the tunnels.

4.34. Silt removal can be achieved by jetting the inspection tunnels. Jetting should be undertaken in accordance with current jetting guidelines, in particular the Code of Practice for Sewer Jetting published by The Water Research Centre. Jetting at 150bar at 300l/min should be more than adequate in removing any build-up of material within the tunnel. The crate system will take higher pressures. However, unlike regular jetting which relies heavily on high pressure to remove hardened deposits on the inner bore of pipes, effective cleansing of a crate system relies more on the delivery flow rate to flush solids back through the system.

4.35. A standard jet head with rear facing nozzles should be used. The head should be fed to the far end of the crate tunnel via the nearest inspection chamber, activated and retracted. As the nozzle is removed, debris will be swept back into the inspection chamber where it can then be removed with the use of a standard gully sucker. This method will ensure the effective removal of gross solids (carrier bags, cans, leaf litter etc.) from the system. Whilst 100% removal cannot be guaranteed, it has been shown that this jetting method will also remove an element of finer material which would otherwise be 'lost' within the system.

Infiltration Permeable Paving

4.36. Permeable surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. A brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

4.37. If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geotextile filter layer.
3. Inspect sub-base and remove, wash and replace if required.
4. Renew any geotextile layer.
5. Renew laying course, jointing material and concrete block paving.

4.38. Materials removed from the voids or the layers below the surface of the paving may contain hazardous substances such as heavy metals and hydrocarbons which may need to be disposed of as controlled waste.

Pipework and Catchpits:

4.39. It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection (every three months) and silt removal (as necessary).

Drainage Element	Maintenance Requirement	Frequency
Gutters & Downpipes	Inspect and remove silt/ debris	To be inspected every three months and silt/ debris removed as necessary.
Catchpits and Inspection Chambers	Inspect and remove silt	To be inspected every three months and silt/ debris removed as necessary. Flow control to be checked for blockages.
Cellular Storage	Inspect and remove debris	CCTCV inspection following first storm event. Monthly CCTV inspections for first 3 months. 6 monthly CCTV inspections thereafter. Jetting to remove silt as necessary.
Flow Controls	Inspected for blockage and blockage / debris build up removed	Every six months
Infiltration Permeable Paving	Sweeping/vacuuming to remove build-up of silt or other sediments	Three times a year or as necessary
	▪ Removal of weeds ▪ Replacement of cracked paving blocks Remedial work to cracks and depressions	As required

Table 6: Suggested Maintenance Regime for Elements of the Drainage Infrastructure

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are inspected:
Following the first storm event;
Monthly for the first 3 months following commissioning.

5. Discussion and Conclusions:

5.1. This Surface Water Drainage Technical Note has been prepared by Unda Consulting Limited on behalf of Kalpesh Patel, to address Condition 6 and part of Condition 9 of a planning application.

5.2. The Planning application relates to construction of conversion of single family dwelling house into 2 x self-contained flats with private amenity space, involving single storey rear extension. These works are proposed to be undertaken at 40 Oakfield Gardens, London N18 1NX.

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Surface Water Drainage Discussion

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5.25. Runoff from roof areas is considered to be uncontaminated and does not warrant any form of treatment process to improve water quality. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

5.26. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

5.27. This drainage strategy has been undertaken in accordance with the principles set out in NPPF. We can conclude that providing the development adheres to the conditions advised above, the said development proposals can be accommodated without increasing flood risk within the locality in accordance with objectives set by Central Government and the EA.

Unda Consulting Limited

September 2022

6. Appendix

A - Plans by others:

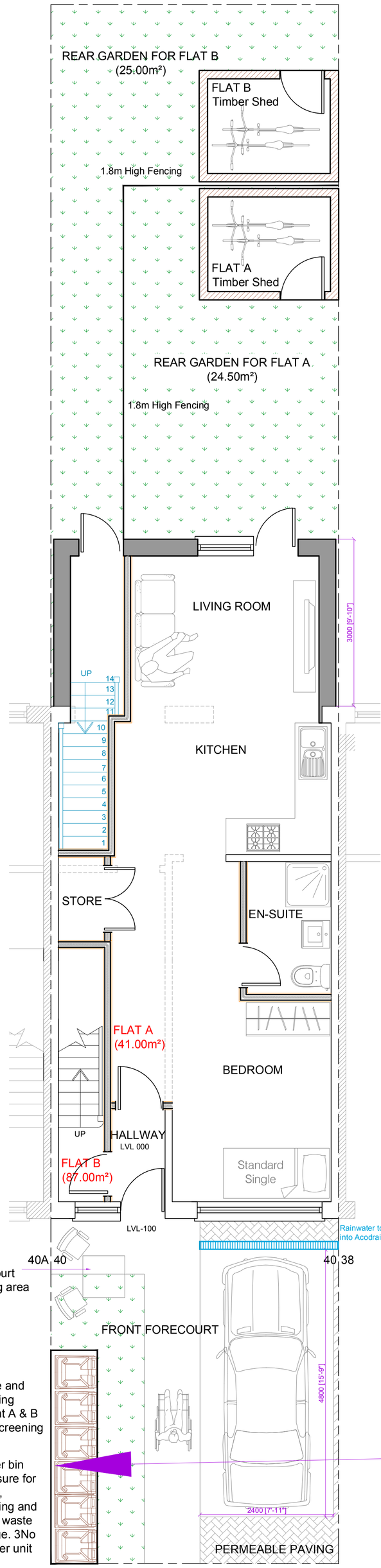
- Proposed Plans – DS3 Studios.

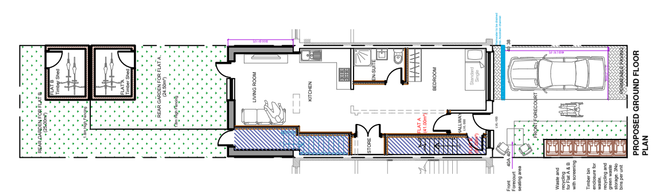
B - MicroDrainage Calculations:

- ICP SUDS Rural Runoff Calculations;
- Cellular Storage Attenuation Calculations.

C - Plans:

- Proposed Drainage Layout [92181-01].





IMPORTANT NOTE
The specification is to be read in conjunction with the plans/section details, and other associated Structural details as may be provided.
All work is to be carried out to the Local Authority Planning and Building Regulations Approval, and the Codes of Practice and British Standard where necessary.
All dimensions, levels, sizes, positions and locations of particulars as indicated on drawings are to be verified by the appointed Contractor on site prior to engaging in works. Any discrepancies must be reported to the Architect/Surveyor/Engineer or responsible person/s immediately.
The Contractor is responsible for ensuring compliance with the Construction, Design and Management Regulations, and associated Health & Safety on site precautions.

The Client/Building Owner must obtain any necessary PARTY WALL AGREEMENTS, prior to engaging in the works on site.

Rev. | Date | Comment

Scale Bar (1:100)
1m 2m 3m 4m 5m

DS3 STUDIOS
T: 07947-777-760
E: ds3studios@gmail.com

Client: MR. K. PATEL

Site Address: 40 OAKFIELD GARDENS
LONDON
N18 1NX

Project Title: SINGLE STOREY REAR EXTENSION/ CONVERSION OF DWELLING-HOUSE INTO TWO SELF CONTAINED FLATS

Status: PLANNING APPLICATION

Agent: K.VALAND

Date: 07.07.2021 | Scale: 1:50 @ A2

Drawing Title: PROPOSED GROUND FLOOR PLAN WITH LANDSCAPING

Ref: OAKG40 | Sheet No: PL-04 | Rev:

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.015	Urban	0.000
SAAR (mm)	632	Region Number	Region 6

Results l/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.2
Q1 year	0.0
Q30 years	0.1
Q100 years	0.2

Summary of Results for 1 year Return Period

Half Drain Time : 56 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	9.643	0.043	0.0	0.0	0.0	0.2	O K
30 min Summer	9.650	0.050	0.0	0.0	0.0	0.2	O K
60 min Summer	9.654	0.054	0.0	0.0	0.0	0.2	O K
120 min Summer	9.655	0.055	0.0	0.0	0.0	0.2	O K
180 min Summer	9.653	0.053	0.0	0.0	0.0	0.2	O K
240 min Summer	9.650	0.050	0.0	0.0	0.0	0.2	O K
360 min Summer	9.644	0.044	0.0	0.0	0.0	0.2	O K
480 min Summer	9.639	0.039	0.0	0.0	0.0	0.1	O K
600 min Summer	9.635	0.035	0.0	0.0	0.0	0.1	O K
720 min Summer	9.632	0.032	0.0	0.0	0.0	0.1	O K
960 min Summer	9.626	0.026	0.0	0.0	0.0	0.1	O K
1440 min Summer	9.620	0.020	0.0	0.0	0.0	0.1	O K
2160 min Summer	9.615	0.015	0.0	0.0	0.0	0.1	O K
2880 min Summer	9.613	0.013	0.0	0.0	0.0	0.0	O K
4320 min Summer	9.611	0.011	0.0	0.0	0.0	0.0	O K
5760 min Summer	9.609	0.009	0.0	0.0	0.0	0.0	O K
7200 min Summer	9.608	0.008	0.0	0.0	0.0	0.0	O K
8640 min Summer	9.608	0.008	0.0	0.0	0.0	0.0	O K
10080 min Summer	9.607	0.007	0.0	0.0	0.0	0.0	O K
15 min Winter	9.648	0.048	0.0	0.0	0.0	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	32.827	0.0	0.2	17
30 min Summer	21.088	0.0	0.2	30
60 min Summer	13.089	0.0	0.3	46
120 min Summer	7.947	0.0	0.4	80
180 min Summer	5.903	0.0	0.4	114
240 min Summer	4.774	0.0	0.4	148
360 min Summer	3.525	0.0	0.5	212
480 min Summer	2.831	0.0	0.5	276
600 min Summer	2.388	0.0	0.5	338
720 min Summer	2.078	0.0	0.6	398
960 min Summer	1.668	0.0	0.6	520
1440 min Summer	1.225	0.0	0.7	752
2160 min Summer	0.899	0.0	0.7	1104
2880 min Summer	0.722	0.0	0.8	1468
4320 min Summer	0.530	0.0	0.9	2180
5760 min Summer	0.426	0.0	0.9	2864
7200 min Summer	0.359	0.0	1.0	3672
8640 min Summer	0.312	0.0	1.0	4392
10080 min Summer	0.278	0.0	1.0	5080
15 min Winter	32.827	0.0	0.2	17

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	9.657	0.057	0.0	0.0	0.0	0.2	O K
60 min Winter	9.661	0.061	0.0	0.0	0.0	0.2	O K
120 min Winter	9.660	0.060	0.0	0.0	0.0	0.2	O K
180 min Winter	9.656	0.056	0.0	0.0	0.0	0.2	O K
240 min Winter	9.652	0.052	0.0	0.0	0.0	0.2	O K
360 min Winter	9.643	0.043	0.0	0.0	0.0	0.2	O K
480 min Winter	9.636	0.036	0.0	0.0	0.0	0.1	O K
600 min Winter	9.631	0.031	0.0	0.0	0.0	0.1	O K
720 min Winter	9.627	0.027	0.0	0.0	0.0	0.1	O K
960 min Winter	9.621	0.021	0.0	0.0	0.0	0.1	O K
1440 min Winter	9.615	0.015	0.0	0.0	0.0	0.1	O K
2160 min Winter	9.612	0.012	0.0	0.0	0.0	0.0	O K
2880 min Winter	9.611	0.011	0.0	0.0	0.0	0.0	O K
4320 min Winter	9.609	0.009	0.0	0.0	0.0	0.0	O K
5760 min Winter	9.608	0.008	0.0	0.0	0.0	0.0	O K
7200 min Winter	9.607	0.007	0.0	0.0	0.0	0.0	O K
8640 min Winter	9.606	0.006	0.0	0.0	0.0	0.0	O K
10080 min Winter	9.606	0.006	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	21.088	0.0	0.3	30
60 min Winter	13.089	0.0	0.3	48
120 min Winter	7.947	0.0	0.4	86
180 min Winter	5.903	0.0	0.4	124
240 min Winter	4.774	0.0	0.5	158
360 min Winter	3.525	0.0	0.5	224
480 min Winter	2.831	0.0	0.6	288
600 min Winter	2.388	0.0	0.6	350
720 min Winter	2.078	0.0	0.6	410
960 min Winter	1.668	0.0	0.7	530
1440 min Winter	1.225	0.0	0.7	752
2160 min Winter	0.899	0.0	0.8	1100
2880 min Winter	0.722	0.0	0.9	1508
4320 min Winter	0.530	0.0	1.0	2132
5760 min Winter	0.426	0.0	1.0	2880
7200 min Winter	0.359	0.0	1.1	3608
8640 min Winter	0.312	0.0	1.1	4320
10080 min Winter	0.278	0.0	1.2	5144

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)	20.400	Shortest Storm (mins)	15
Ratio R	0.447	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.003

Time (mins) From:	To:	Area (ha)
0	4	0.003

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.600 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	4.0	4.0	0.400	4.0	4.0

Orifice Outflow Control

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.600

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

Half Drain Time : 104 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	9.802	0.202	0.0	0.1	0.1	0.8	Flood Risk
30 min Summer	9.848	0.248	0.0	0.1	0.1	0.9	Flood Risk
60 min Summer	9.877	0.277	0.0	0.1	0.1	1.1	Flood Risk
120 min Summer	9.882	0.282	0.0	0.1	0.1	1.1	Flood Risk
180 min Summer	9.876	0.276	0.0	0.1	0.1	1.0	Flood Risk
240 min Summer	9.866	0.266	0.0	0.1	0.1	1.0	Flood Risk
360 min Summer	9.845	0.245	0.0	0.1	0.1	0.9	Flood Risk
480 min Summer	9.824	0.224	0.0	0.1	0.1	0.9	Flood Risk
600 min Summer	9.806	0.206	0.0	0.1	0.1	0.8	Flood Risk
720 min Summer	9.790	0.190	0.0	0.1	0.1	0.7	Flood Risk
960 min Summer	9.764	0.164	0.0	0.1	0.1	0.6	Flood Risk
1440 min Summer	9.726	0.126	0.0	0.1	0.1	0.5	Flood Risk
2160 min Summer	9.690	0.090	0.0	0.1	0.1	0.3	O K
2880 min Summer	9.668	0.068	0.0	0.1	0.1	0.3	O K
4320 min Summer	9.643	0.043	0.0	0.0	0.0	0.2	O K
5760 min Summer	9.631	0.031	0.0	0.0	0.0	0.1	O K
7200 min Summer	9.624	0.024	0.0	0.0	0.0	0.1	O K
8640 min Summer	9.619	0.019	0.0	0.0	0.0	0.1	O K
10080 min Summer	9.616	0.016	0.0	0.0	0.0	0.1	O K
15 min Winter	9.827	0.227	0.0	0.1	0.1	0.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	146.763	0.0	0.8	18
30 min Summer	94.501	0.0	1.1	32
60 min Summer	57.877	0.0	1.3	60
120 min Summer	34.262	0.0	1.5	94
180 min Summer	24.904	0.0	1.7	126
240 min Summer	19.759	0.0	1.8	160
360 min Summer	14.202	0.0	1.9	230
480 min Summer	11.240	0.0	2.0	296
600 min Summer	9.369	0.0	2.1	362
720 min Summer	8.071	0.0	2.2	428
960 min Summer	6.374	0.0	2.3	552
1440 min Summer	4.565	0.0	2.5	796
2160 min Summer	3.265	0.0	2.6	1164
2880 min Summer	2.572	0.0	2.8	1524
4320 min Summer	1.835	0.0	3.0	2244
5760 min Summer	1.444	0.0	3.1	2944
7200 min Summer	1.198	0.0	3.2	3672
8640 min Summer	1.028	0.0	3.3	4408
10080 min Summer	0.903	0.0	3.4	5080
15 min Winter	146.763	0.0	0.9	18

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	9.880	0.280	0.0	0.1	0.1	1.1	Flood Risk
60 min Winter	9.915	0.315	0.0	0.1	0.1	1.2	Flood Risk
120 min Winter	9.920	0.320	0.0	0.1	0.1	1.2	Flood Risk
180 min Winter	9.911	0.311	0.0	0.1	0.1	1.2	Flood Risk
240 min Winter	9.897	0.297	0.0	0.1	0.1	1.1	Flood Risk
360 min Winter	9.865	0.265	0.0	0.1	0.1	1.0	Flood Risk
480 min Winter	9.837	0.237	0.0	0.1	0.1	0.9	Flood Risk
600 min Winter	9.811	0.211	0.0	0.1	0.1	0.8	Flood Risk
720 min Winter	9.790	0.190	0.0	0.1	0.1	0.7	Flood Risk
960 min Winter	9.755	0.155	0.0	0.1	0.1	0.6	Flood Risk
1440 min Winter	9.708	0.108	0.0	0.1	0.1	0.4	Flood Risk
2160 min Winter	9.669	0.069	0.0	0.1	0.1	0.3	O K
2880 min Winter	9.648	0.048	0.0	0.0	0.0	0.2	O K
4320 min Winter	9.628	0.028	0.0	0.0	0.0	0.1	O K
5760 min Winter	9.620	0.020	0.0	0.0	0.0	0.1	O K
7200 min Winter	9.615	0.015	0.0	0.0	0.0	0.1	O K
8640 min Winter	9.613	0.013	0.0	0.0	0.0	0.1	O K
10080 min Winter	9.612	0.012	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	94.501	0.0	1.2	32
60 min Winter	57.877	0.0	1.5	60
120 min Winter	34.262	0.0	1.7	98
180 min Winter	24.904	0.0	1.9	136
240 min Winter	19.759	0.0	2.0	174
360 min Winter	14.202	0.0	2.1	246
480 min Winter	11.240	0.0	2.3	318
600 min Winter	9.369	0.0	2.4	386
720 min Winter	8.071	0.0	2.4	450
960 min Winter	6.374	0.0	2.6	578
1440 min Winter	4.565	0.0	2.8	824
2160 min Winter	3.265	0.0	3.0	1188
2880 min Winter	2.572	0.0	3.1	1528
4320 min Winter	1.835	0.0	3.3	2248
5760 min Winter	1.444	0.0	3.5	2944
7200 min Winter	1.198	0.0	3.6	3672
8640 min Winter	1.028	0.0	3.7	4408
10080 min Winter	0.903	0.0	3.8	4984

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.400	Shortest Storm (mins)	15
Ratio R	0.447	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.003

Time (mins) From:	To:	Area (ha)
0	4	0.003

Model Details

Storage is Online Cover Level (m) 10.000

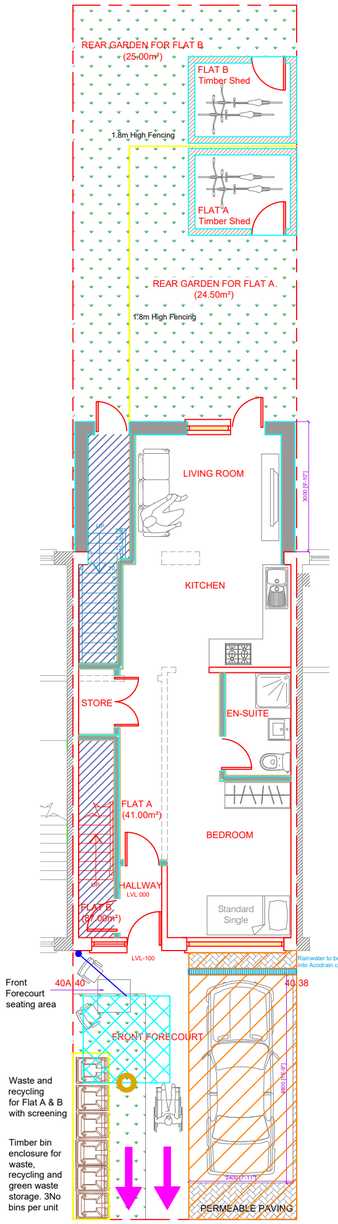
Cellular Storage Structure

Invert Level (m) 9.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

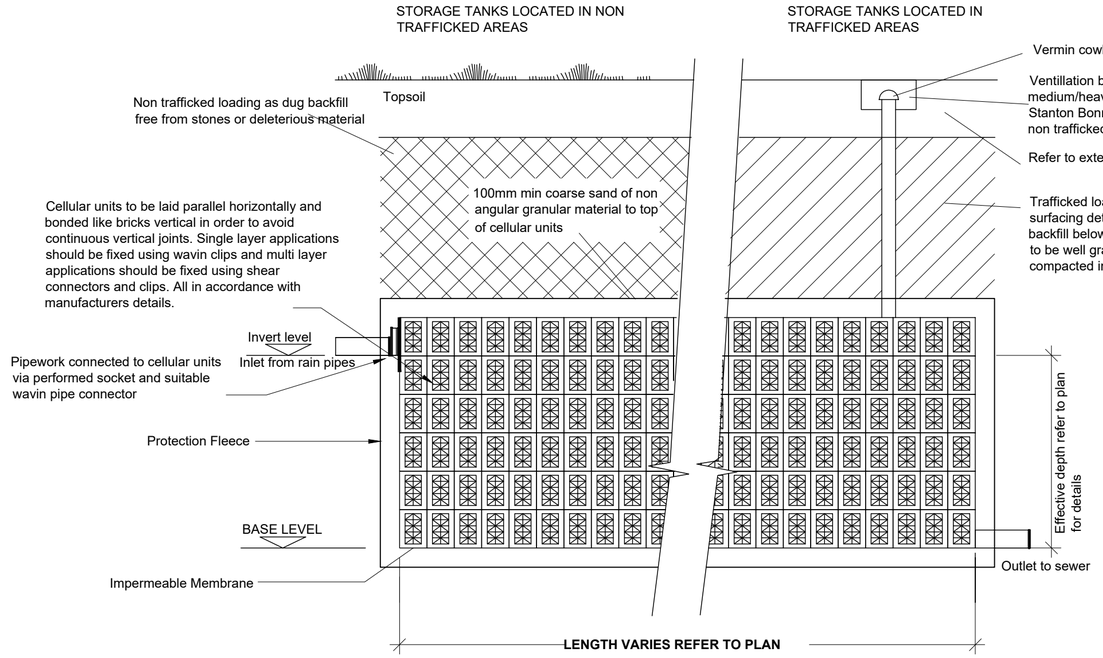
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	4.0	4.0	0.400	4.0	4.0

Orifice Outflow Control

Diameter (m) 0.010 Discharge Coefficient 0.600 Invert Level (m) 9.600



PROPOSED GROUND FLOOR PLAN



Cellular storage to sewer - NTS
(or other similar approved)

Notes:

1. Discharge of surface water via cellular storage attenuation. Preliminary calculations indicate that sufficient storage required to attenuate runoff arising from the proposed increase in impermeable areas, during the critical 1 in 100 year + 40% Climate Change event, can be provided within cellular storage attenuation of dimensions 4m^2 x 0.4m deep x 0.95 (voids).
2. Cellular Storage will discharge into the sites existing surface water pipework.

Legend

- Proposed Permeable Paving
- Proposed Cellular Storage
- Proposed Surface Water Downpipe
- Proposed Orifice Plate
- Proposed Surface Water Pipework
- Design Exceedance Route

Unda Consulting Ltd
Southpoint
Old Brighton Road
Gatwick
RH11 0PR

Tel: 01293 214444
Email: info@unda.co.uk
Web: www.unda.co.uk

Client:
Kalpesh Patel

Site Address:
40 Oakfield Gardens
London
N18 1NX

Job Reference:	Date:
92181-Valand-DeaneCrftRd	21-Sep-22
Drawing Number:	**Revision:**
92181-01	v1

Designed by:	Drawn by:	Checked by:
AR	AR	EB

Scale:	Disclaimer:
1:100@A2	The drawings provided are for planning purposes only.