DRAINAGE STATEMENT

Site: Land at Hayes End Road, Hayes, UB4 8EH

Client: Bugler Homes Ltd

Prepared by: DHA Environment
Eclipse House
Eclipse Park
Sittingbourne Road
Maidstone ME14 3EN

Date: September 2020

1.1 Introduction

1.1.1 This Drainage Statement has been prepared by DHA Environment to support a detailed planning application for the demolition of existing buildings and redevelopment of the site to provide a building of 5 storeys with flexible commercial floorspace at ground floor and residential accommodation at upper floors, with associated residential amenity space, landscaping, car and cycle parking, refuse storage and access on a 0.196 hectare brownfield site on land at Hayes End Road, Hayes.

1.1.2 Reference has been made to the Environment Agency online flood maps which indicate the site is located within Flood Zone 1, Low Risk of flooding. Given the site is located within Flood Zone 1 and is less than one hectare in size a Flood Risk Assessment is not required as part of the planning application.

1.1.3 The site can be considered to be major development as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010 and as such this report has been prepared to outline the surface water drainage for the site.

1.2 Summary of existing development

Location

1.2.1 The site is located on Hayes End Road, Hayes and is centred on grid reference 508859,181920. Figure 1 below highlights the site in a local context.



Figure 1 – Site Location

Existing Site

1.2.2 A topographical survey of the site was carried out by Laser Survey Services and is contained on drawing 14529-TS-01 in **Appendix A.** The site is broadly rectangular in shape and is generally flat at a level of circa 40.75m AOD. The site currently comprises an existing commercial building with two units, a tool hire and care dealership and associated hard standing. The site has the following boundary conditions:

- North - Commercial Unit.
- East - Hayes End Road with commercial units beyond.
- West - Commercial unit
- South - Commercial unit fronting Uxbridge Road.

Existing Drainage

1.2.3 Thames Water asset plans are shown in **Appendix B** and indicate the location of public sewers in the area. These records do not indicate any private drainage that maybe present.

1.2.4 In October 2011 the ownership of any private sewer serving more than one property was automatically transferred to the Water Authority although many of these sewers are yet to be recorded on the asset plans.

Surface Water

1.2.5 Thames Water asset plans show there to be 300mm diameter surface water sewer draining from South to North along Hayes End Road.

Foul Water

1.2.6 Thames Water asset plans show there to be 225mm diameter foul water sewer draining from South to North along Hayes End Road.

1.2.7 A drainage survey was carried out by Jetclean maintenance services on the 5th May 2020 to determine how the existing site drains. This show the site to be positively drained via a network of sewers which discharge into the public 300mm diameter public sewer in Hayes End Road via two number 100mm diameter outfall pipes. A copy of the drainage survey in contained within **Appendix B**. Based on a conservative gradient of 1 in 100 for the outfall pipes the capacity of each can be calculated to be 6l/s providing a total of 12l/s.

1.2.1 The discharge rates from the site have been calculated by using the Flood Studies Report ICP (SuDS) method based on the total site area of 0.196 hectares for a partly urbanised catchment. The calculations can be seen in **Appendix C** and have been summarised in table 3-1 below:

Catchment Reference	*Qbar (l/s)*	*1 in 1 year*	*1 in 30 years*	*1 in100 years*
Total	**2.2**	1.9	3.9	4.5

Table 1 - Summary of existing runoff rates

Geology and Hydrogeology

1.2.2 The site is currently 100% paved and is currently in use so it was not possible to carry out specific site infiltration testing. The online British Geological Survey maps indicate that the site is underlain by superficial deposits comprising of the Langley Slit Member over bedrock comprising of the London Clay Formation. This geology and is not considered compatible with the use infiltration SuDS.

Flood Risk

1.2.3 Reference has been made to the Environment Agency Flood maps which indicate the site to be located within Flood Zone 1. An extract of the flood map is contained in **Appendix D.** Given the site is located within Flood Zone 1 and is less than one hectare in size a Flood Risk Assessment is not required as part of a planning application.

1.3 Proposed Development

1.3.1 The proposals consist of the demolition of the existing building and the construction of five storey mixed used development comprising of 145m^2 of flexible commercial space at ground level and 29 residential flats on upper floors on land at Hayes End Road, Hayes. The proposed masterplan is shown in **Appendix E**. The site has a total area of 0.196 hectares of which 0.143 hectare are to comprise of impermeable surfaces. This is a reduction of 0.053 hectares from the existing situation. The proposed developable areas are summarised on drawing 14529-D-01 contained in **Appendix F**.

Proposed Surface Water Drainage Strategy

1.3.2 The principles of the proposed surface water drainage are shown on drawing 14529-D-02 contained in **Appendix F**. Sustainable Urban Drainage (SuDS) techniques will be used to deal with the surface water drainage generated by the development. This will reduce off site runoff compared with the existing situation and reduce the risk of downstream flooding.

1.3.3 As described in section 1.2.2 it was not possible to carry out site specific infiltration testing, however this will be carried out as part of the detailed drainage design. Given the local geology however, it is not expected to be a feasible option and as such connection to the existing surface water sewer at an attenuated rate has been assumed and is described below.

1.3.4 The area of carpark will consist of porous block paving which will provide surface water attenuation at shallow depth to enable a gravity connection into the existing surface water outfall. The porous pavement will be lined to prevent any ingress of groundwater which would in turn discharge into the public sewer.

1.3.5 Surface water from the hardstanding at the front of the building will drain to a channel drain which will discharge into the porous paving. Rainwater pipes on the front of the building will connect directly into the channel drain with other rainwater pipes draining directly into the porous paving.

1.3.6 The provision of porous paving provides attenuation at source without the need of an extensive pipe network and also provided and element of pollution control.

1.3.7 The porous pavement will discharge into a control manhole before connecting into the existing outfall sewer at a rate of 2 l/s which is the minimum which can practically be controlled and equivalent to the greenfield condition. This is in accordance with the policies set out in the London Plan which requires that runoff form brownfield sites are attenuated back to the greenfield conditions. This is a

significant reduction to the current discharge rate which has been calculated to be 12 l/s.

1.3.8 The proposed surface water attenuation has been modelled using Windes to accommodate all return periods up to and including the 1 in 100 year rainfall event with a 40% allowance for climate change. Calculations are contained within **Appendix F**.

1.3.9 London Borough of Hillington SuDS proforma is contained within **Appendix F** and summarises the information in this report.

Proposed Foul Water Drainage Strategy

1.3.10 A peak foul water flow of 1.34 l/s has been calculated for a 29 unit development based a daily flow rate of 4000 litres per unit per day.

1.3.11 It is proposed that the foul water from the development is collected in a system of gravity sewers discharging to the existing foul water sewer in Hayes End Road.

1.3.12 Any reinforcement of the existing network will be covered by the Infrastructure Charge required for the connection of each property.

1.3.13 There are no plans to construct treatment works on the site, nor to discharge any effluent treated or not, to ground water.

1.4 Conclusions

1.4.1 The detailed planning proposals consist of the demolition of the existing building and the construction of five storey mixed used development comprising on 145m^2 of flexible commercial floorspace and 29 residential flats on land at Hayes End Road, Hayes.

1.4.2 A Sustainable Urban Drainage system has been incorporated as part of the surface water drainage strategy to accommodate the surface water generated by the development. This will be in the form of lined porous paving which will reduce surface water runoff into the existing surface water sewer freeing up capacity and reducing the risk of downstream flooding.

1.4.3 It is proposed that the foul water from the development is collected in a system of gravity sewers discharging to the existing foul water drainage network.

APPENDIX A

Existing Topographical Survey

DO NOT SCALE



REV	DATE	BY	DESCRIPTION	CHK	APD

client

BUGLER DEVELOPMENTS

project

HAYES END ROAD, HAYES

title

TOPOGRAPHICAL SURVEY

project	drwg	rev
14529	TS-01	P1

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:250	20.04.20

status: FOR INFORMATION — P

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CAD Reference:

A3

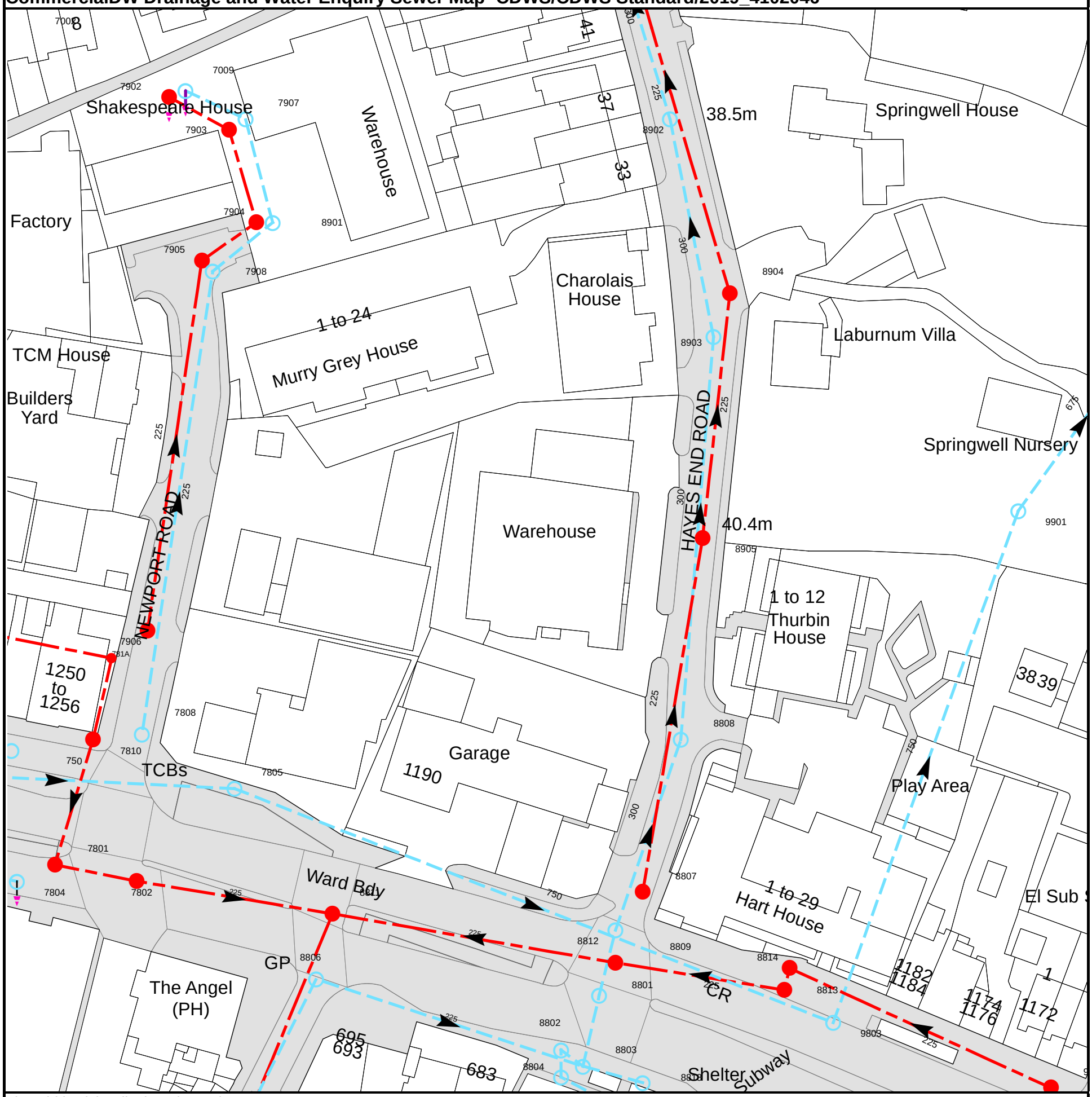
APPENDIX B

Thames Water Asset plans

Brandon Tool Hire



CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2019_4102046



The width of the displayed area is 200m

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.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7807	41.42	39.89
7810	41.61	39.92
781A	n/a	n/a
7808	41.46	40.23
7906	41.24	39.45
7902	39.74	37.92
7009	39.75	38.01
7805	41.88	38.28
8806	41.86	40.69
8811	41.99	39.3
8802	n/a	n/a
8804	n/a	n/a
8803	41.92	40.47
8801	41.78	40.31
8809	41.88	40.23
8812	41.83	39.46
8818	n/a	n/a
7804	n/a	n/a
7802	41.83	39.65
7801	41.75	39.7
8807	41.61	39.72
8813	41.72	39.6
8814	41.79	39.64
9803	41.81	37.88
9801	41.74	39.74
8808	41.22	39.83
8905	40.27	38.3
9901	40.61	37.38
8903	39.41	37.9
8904	39.2	37.24
7908	40.37	38.86
7905	40.35	38.4
7904	40.21	38.23
8901	40.2	38.71
7903	39.92	38.06
7907	39.92	38.56
8902	38.57	37.35

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.

APPENDIX C

Existing Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.196	Urban	0.750
SAAR (mm)	658	Region Number	Region 6

Results l/s

QBAR Rural	0.8
QBAR Urban	2.2
Q100 years	4.5
Q1 year	1.9
Q30 years	3.9
Q100 years	4.5

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APPENDIX D

Environment Agency Flood maps

Flood map for planning

Your reference	Location (easting/northing)	Created
14549	**508869/181907**	**20 Apr 2020 16:15**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

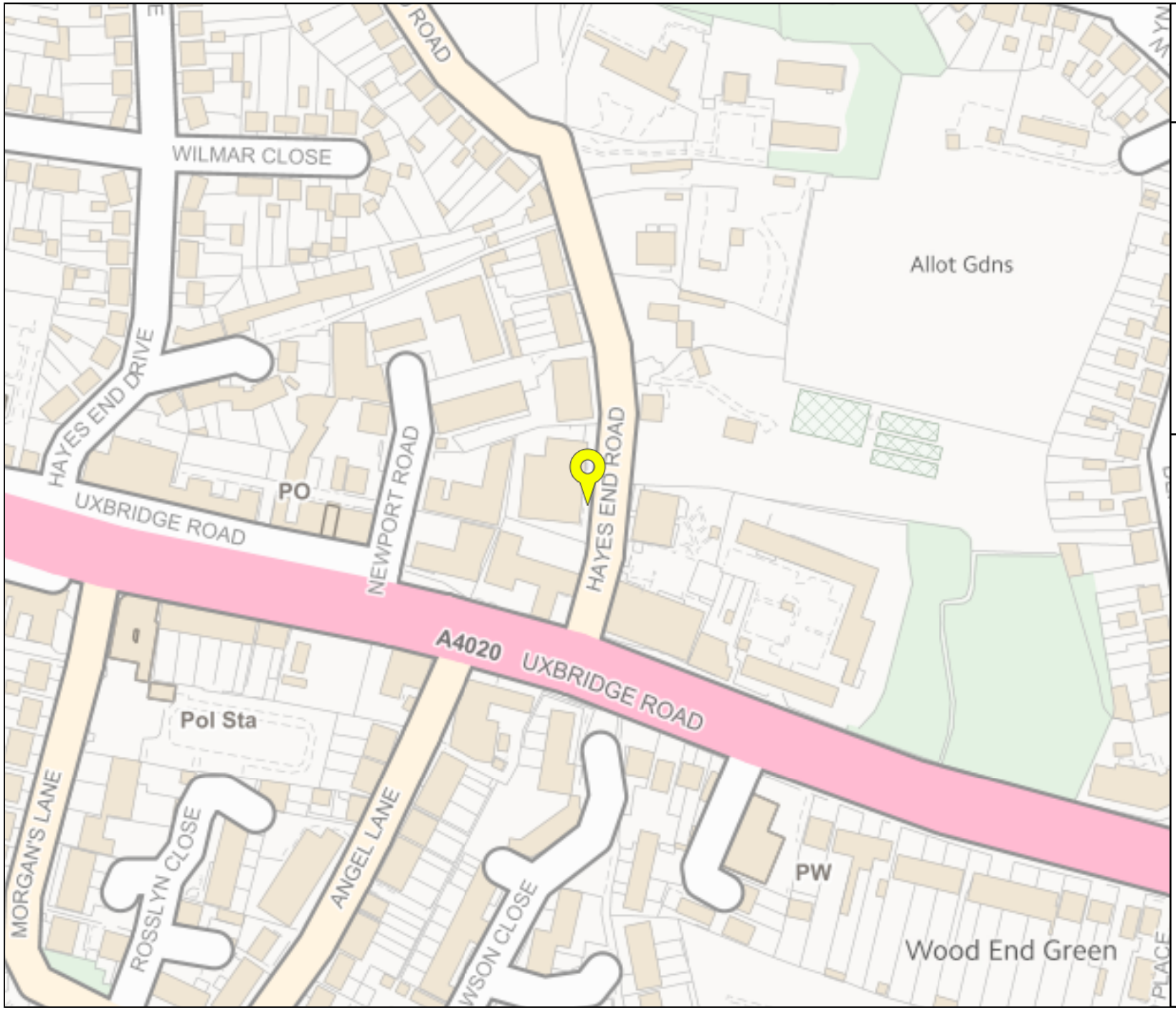
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/



Environment Agency

Flood map for planning

Your reference
14549

Location (easting/northing)
508869/181907

Scale
1:2500

Created
20 Apr 2020 16:15

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

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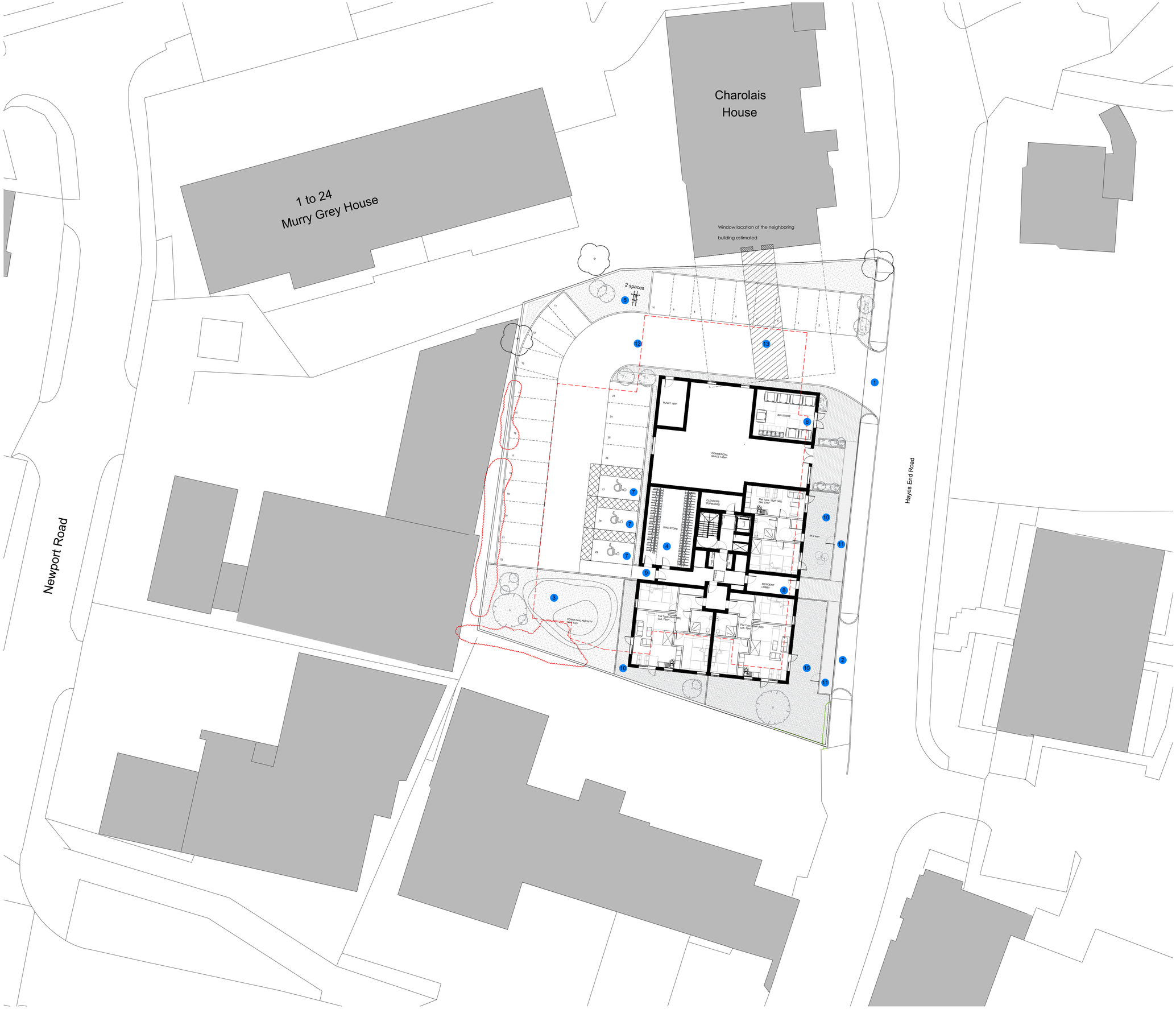
APPENDIX E

Proposed scheme drawings



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For Construction & Fabrication Purposes - Do not scale from this drawing, use only the illustrated dimensions herein. Additional dimensions are to be requested and checked directly.

Illustrated information from 3rd party consultants/specialists is shown as indicatively only.See other consultant / specialist drawings for full information and detail.

Scale:

0 2 6 10 20m

LEGEND

FFL 40.85 Proposed Finished floor level

N

1. Proposed vehicular access
2. Proposed pedestrian access
3. Proposed communal landscaped areas
4. Secure cycle storage
5. Sheffield Stands. Visitor cycle parking spaces
6. Refuse Store
7. Wheelchair accessible parking
8. Residential lobby
9. Secundary Lobby. Access from car parking
10. Proposed private terraces to ground floor units
11. Proposed private access to wheelchair ground floor units
12. Dashed red lines indicates existing buildings to be demolished
13. Hatch indicates 15m distance from the window of the neighboring building

Existing Building Footprint

Existing trees to be retained

Existing bushes to be removed

New Planting to be added

NB: OS map data and Topographical survey information overlayed

NB: For detailed existing ground levels please refer to topographical survey drawing produced by Laser Survey Services

Revision Note & Date

Rev	Date	Note	Initial

ON ARCHITECTURE

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Logan House, St Andrews Close
Canterbury,
CT1 2RP

London Studio
Ink Rooms, 28, Easton Street
Clerkenwell
WC1X 0DS

info@onarchitecture.co.uk
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Project Title
LAND OFF HAYES END ROAD

Clients Details
BUGLER HOMES

Drawing Title
SITE PLAN

BIM Number
N/A

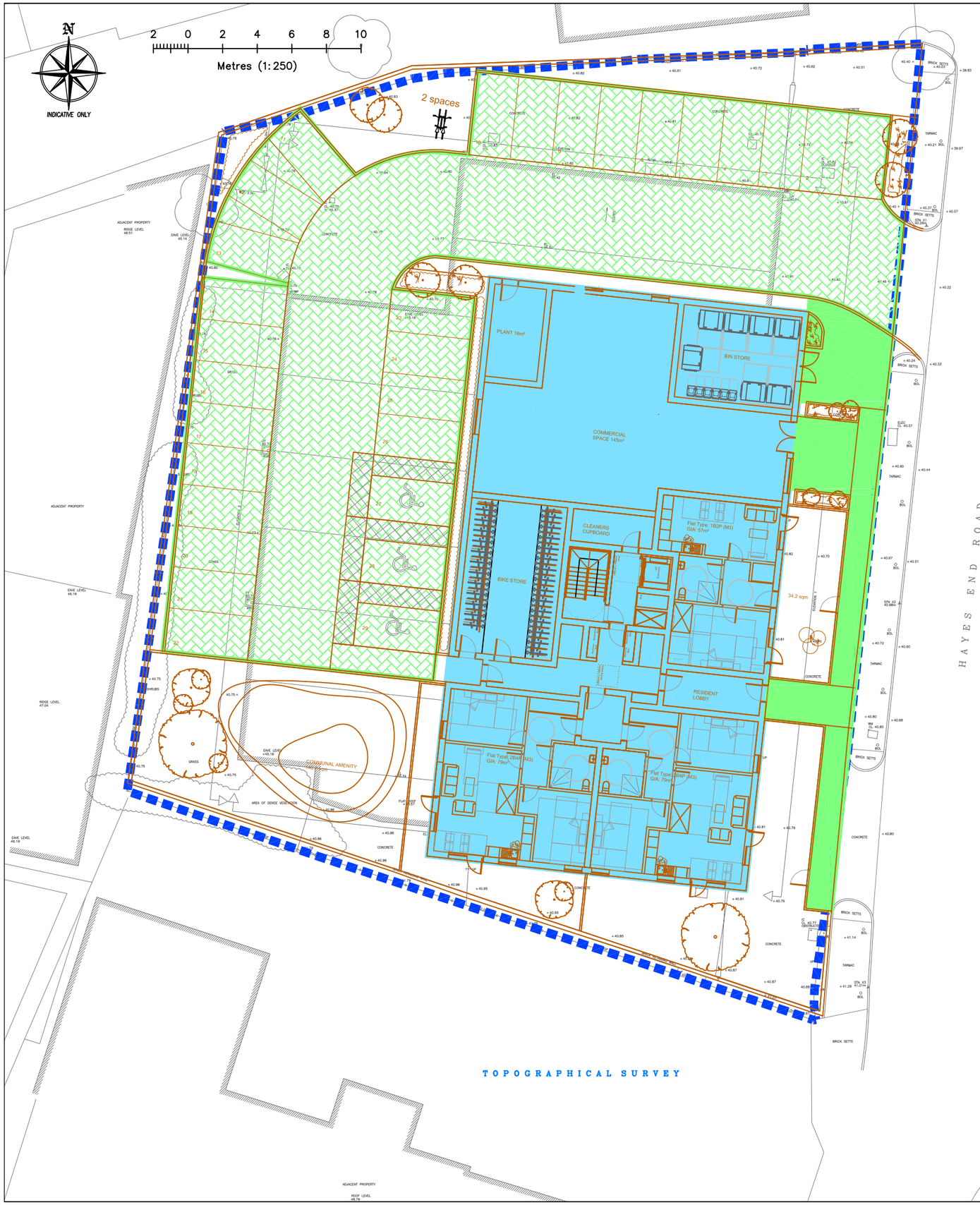
Scale	Date	Drawn	Checked
1:200 @ A1	17/04/2020	IR	NL

Drawing Status
DRAFT FOR COMMENTS

Project Number	Drawing Number	Drawing Revision
19.156	0100	P01

APPENDIX F

Proposed Drainage Strategy and Calculations



DO NOT SCALE

Proposed porous pavement	-	718 m²
Proposed Roof	-	624 m²
Proposed Hardstanding	-	92 m²
Total impermeable area	-	1,434m²

REV	DATE	BY	DESCRIPTION	CHK	APD
P1	20.04.20	CS	First Issue	CS	CS

client
BUGLER DEVELOPMENTS

project
HAYES END ROAD, HAYES

title
PROPOSED CONTRIBUTING AREA

project	drwg	rev
14529	D-01	P1

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:250	20.04.20

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REV	DATE	BY	DESCRIPTION	CHK	APD
P1	20.04.20	CS	First Issue	CS	CS

client
BUGLER DEVELOPMENTS

project
HAYES END ROAD, HAYES

title
PROPOSED DRAINAGE PLAN

project	drwg	rev
14529	D-02	P1

Drawn	Checked	Approved	scale @ A3	date
CS	CS	CS	1:250	20.04.20

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CAD Reference: A3

Summary of Results for 1 year Return Period

Half Drain Time : 1685 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	40.136	0.036	0.0	0.0	0.0	7.7	O K
30 min Summer	40.153	0.053	0.0	0.0	0.0	11.4	O K
60 min Summer	40.172	0.072	0.0	0.0	0.0	15.5	O K
120 min Summer	40.194	0.094	0.0	0.0	0.0	20.0	O K
180 min Summer	40.207	0.107	0.0	0.0	0.0	22.8	O K
240 min Summer	40.217	0.117	0.0	0.0	0.0	25.0	O K
360 min Summer	40.232	0.132	0.0	0.0	0.0	28.3	O K
480 min Summer	40.244	0.144	0.0	0.0	0.0	30.8	O K
600 min Summer	40.253	0.153	0.0	0.0	0.0	32.8	O K
720 min Summer	40.261	0.161	0.0	0.0	0.0	34.5	O K
960 min Summer	40.270	0.170	0.0	0.1	0.1	36.4	O K
1440 min Summer	40.274	0.174	0.0	0.2	0.2	37.3	O K
2160 min Summer	40.278	0.178	0.0	0.2	0.2	38.0	O K
2880 min Summer	40.281	0.181	0.0	0.3	0.3	38.7	O K
4320 min Summer	40.284	0.184	0.0	0.3	0.3	39.4	O K
5760 min Summer	40.284	0.184	0.0	0.3	0.3	39.4	O K
7200 min Summer	40.284	0.184	0.0	0.3	0.3	39.3	O K
8640 min Summer	40.283	0.183	0.0	0.3	0.3	39.1	O K
10080 min Summer	40.282	0.182	0.0	0.3	0.3	38.9	O K
15 min Winter	40.143	0.043	0.0	0.0	0.0	9.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	41.398	0.0	0.0	19
30 min Summer	27.391	0.0	0.0	34
60 min Summer	17.456	0.0	0.0	64
120 min Summer	10.848	0.0	0.0	124
180 min Summer	8.118	0.0	0.0	184
240 min Summer	6.600	0.0	0.0	244
360 min Summer	4.925	0.0	0.0	364
480 min Summer	4.000	0.0	0.0	484
600 min Summer	3.404	0.0	0.3	604
720 min Summer	2.984	0.0	1.8	724
960 min Summer	2.419	0.0	4.3	962
1440 min Summer	1.801	0.0	8.2	1312
2160 min Summer	1.341	0.0	13.5	1560
2880 min Summer	1.089	0.0	16.6	1928
4320 min Summer	0.811	0.0	20.7	2680
5760 min Summer	0.655	0.0	24.4	3464
7200 min Summer	0.556	0.0	26.3	4248
8640 min Summer	0.486	0.0	27.6	5016
10080 min Summer	0.434	0.0	28.3	5752
15 min Winter	41.398	0.0	0.0	19

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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	40.162	0.062	0.0	0.0	0.0	13.2	O K
60 min Winter	40.183	0.083	0.0	0.0	0.0	17.8	O K
120 min Winter	40.207	0.107	0.0	0.0	0.0	22.9	O K
180 min Winter	40.222	0.122	0.0	0.0	0.0	26.0	O K
240 min Winter	40.233	0.133	0.0	0.0	0.0	28.5	O K
360 min Winter	40.250	0.150	0.0	0.0	0.0	32.1	O K
480 min Winter	40.263	0.163	0.0	0.0	0.0	34.8	O K
600 min Winter	40.271	0.171	0.0	0.1	0.1	36.6	O K
720 min Winter	40.276	0.176	0.0	0.2	0.2	37.7	O K
960 min Winter	40.282	0.182	0.0	0.3	0.3	38.9	O K
1440 min Winter	40.286	0.186	0.0	0.3	0.3	39.8	O K
2160 min Winter	40.290	0.190	0.0	0.4	0.4	40.7	O K
2880 min Winter	40.292	0.192	0.0	0.4	0.4	41.0	O K
4320 min Winter	40.291	0.191	0.0	0.4	0.4	40.9	O K
5760 min Winter	40.289	0.189	0.0	0.4	0.4	40.4	O K
7200 min Winter	40.287	0.187	0.0	0.3	0.3	40.0	O K
8640 min Winter	40.285	0.185	0.0	0.3	0.3	39.6	O K
10080 min Winter	40.284	0.184	0.0	0.3	0.3	39.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	27.391	0.0	0.0	34
60 min Winter	17.456	0.0	0.0	64
120 min Winter	10.848	0.0	0.0	124
180 min Winter	8.118	0.0	0.0	184
240 min Winter	6.600	0.0	0.0	244
360 min Winter	4.925	0.0	0.0	364
480 min Winter	4.000	0.0	2.2	478
600 min Winter	3.404	0.0	4.4	592
720 min Winter	2.984	0.0	6.3	702
960 min Winter	2.419	0.0	9.3	914
1440 min Winter	1.801	0.0	13.9	1108
2160 min Winter	1.341	0.0	19.8	1516
2880 min Winter	1.089	0.0	23.6	1932
4320 min Winter	0.811	0.0	28.5	2724
5760 min Winter	0.655	0.0	32.7	3512
7200 min Winter	0.556	0.0	35.2	4256
8640 min Winter	0.486	0.0	37.0	5016
10080 min Winter	0.434	0.0	38.2	5832

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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)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.146

Time (mins) From:	To:	Area (ha)
0	4	0.146

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Model Details

Storage is Online Cover Level (m) 40.750

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.8
Membrane Percolation (mm/hr)	1000	Length (m)	66.0
Max Percolation (l/s)	198.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	40.100	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 40.250

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Summary of Results for 30 year Return Period

Half Drain Time : 901 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	40.213	0.113	0.0	0.0	0.0	24.1	O K
30 min Summer	40.251	0.151	0.0	0.0	0.0	32.2	O K
60 min Summer	40.288	0.188	0.0	0.3	0.3	40.2	O K
120 min Summer	40.320	0.220	0.0	0.7	0.7	47.0	O K
180 min Summer	40.336	0.236	0.0	0.9	0.9	50.5	O K
240 min Summer	40.346	0.246	0.0	0.9	0.9	52.6	O K
360 min Summer	40.355	0.255	0.0	1.0	1.0	54.5	O K
480 min Summer	40.359	0.259	0.0	1.0	1.0	55.5	O K
600 min Summer	40.363	0.263	0.0	1.0	1.0	56.3	O K
720 min Summer	40.366	0.266	0.0	1.0	1.0	56.9	O K
960 min Summer	40.370	0.270	0.0	1.1	1.1	57.7	O K
1440 min Summer	40.372	0.272	0.0	1.1	1.1	58.3	O K
2160 min Summer	40.370	0.270	0.0	1.1	1.1	57.7	O K
2880 min Summer	40.364	0.264	0.0	1.0	1.0	56.5	O K
4320 min Summer	40.351	0.251	0.0	1.0	1.0	53.7	O K
5760 min Summer	40.340	0.240	0.0	0.9	0.9	51.3	O K
7200 min Summer	40.330	0.230	0.0	0.8	0.8	49.2	O K
8640 min Summer	40.322	0.222	0.0	0.8	0.8	47.6	O K
10080 min Summer	40.316	0.216	0.0	0.7	0.7	46.1	O K
15 min Winter	40.228	0.128	0.0	0.0	0.0	27.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	101.239	0.0	0.0	19
30 min Summer	65.473	0.0	0.0	34
60 min Summer	40.257	0.0	7.6	64
120 min Summer	23.937	0.0	15.8	122
180 min Summer	17.563	0.0	20.9	182
240 min Summer	14.070	0.0	24.7	242
360 min Summer	10.271	0.0	30.3	360
480 min Summer	8.204	0.0	34.4	408
600 min Summer	6.888	0.0	37.8	464
720 min Summer	5.969	0.0	40.5	522
960 min Summer	4.758	0.0	45.0	656
1440 min Summer	3.453	0.0	51.3	924
2160 min Summer	2.503	0.0	59.2	1320
2880 min Summer	1.990	0.0	64.0	1704
4320 min Summer	1.441	0.0	70.3	2464
5760 min Summer	1.146	0.0	75.9	3176
7200 min Summer	0.960	0.0	79.3	3888
8640 min Summer	0.830	0.0	81.8	4584
10080 min Summer	0.735	0.0	83.5	5256
15 min Winter	101.239	0.0	0.0	19

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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	40.271	0.171	0.0	0.1	0.1	36.5	O K
60 min Winter	40.311	0.211	0.0	0.7	0.7	45.1	O K
120 min Winter	40.346	0.246	0.0	0.9	0.9	52.7	O K
180 min Winter	40.365	0.265	0.0	1.0	1.0	56.7	O K
240 min Winter	40.376	0.276	0.0	1.1	1.1	59.1	O K
360 min Winter	40.388	0.288	0.0	1.1	1.1	61.6	O K
480 min Winter	40.392	0.292	0.0	1.2	1.2	62.4	O K
600 min Winter	40.395	0.295	0.0	1.2	1.2	63.1	O K
720 min Winter	40.398	0.298	0.0	1.2	1.2	63.6	O K
960 min Winter	40.399	0.299	0.0	1.2	1.2	63.9	O K
1440 min Winter	40.395	0.295	0.0	1.2	1.2	63.0	O K
2160 min Winter	40.383	0.283	0.0	1.1	1.1	60.4	O K
2880 min Winter	40.370	0.270	0.0	1.1	1.1	57.6	O K
4320 min Winter	40.347	0.247	0.0	0.9	0.9	52.8	O K
5760 min Winter	40.330	0.230	0.0	0.8	0.8	49.2	O K
7200 min Winter	40.318	0.218	0.0	0.7	0.7	46.5	O K
8640 min Winter	40.309	0.209	0.0	0.7	0.7	44.6	O K
10080 min Winter	40.304	0.204	0.0	0.6	0.6	43.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	65.473	0.0	3.2	34
60 min Winter	40.257	0.0	12.8	62
120 min Winter	23.937	0.0	22.0	120
180 min Winter	17.563	0.0	27.8	178
240 min Winter	14.070	0.0	32.0	234
360 min Winter	10.271	0.0	38.3	344
480 min Winter	8.204	0.0	43.0	442
600 min Winter	6.888	0.0	46.8	472
720 min Winter	5.969	0.0	49.9	548
960 min Winter	4.758	0.0	54.9	696
1440 min Winter	3.453	0.0	62.1	994
2160 min Winter	2.503	0.0	71.0	1404
2880 min Winter	1.990	0.0	76.5	1792
4320 min Winter	1.441	0.0	83.9	2552
5760 min Winter	1.146	0.0	90.5	3280
7200 min Winter	0.960	0.0	94.6	3960
8640 min Winter	0.830	0.0	97.7	4584
10080 min Winter	0.735	0.0	100.0	5248

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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)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.146

Time (mins) From:	To:	Area (ha)
0	4	0.146

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Model Details

Storage is Online Cover Level (m) 40.750

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.8
Membrane Percolation (mm/hr)	1000	Length (m)	66.0
Max Percolation (l/s)	198.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	40.100	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 40.250

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Summary of Results for 100 year Return Period

Half Drain Time : 760 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	40.253	0.153	0.0	0.0	0.0	32.7	O K
30 min Summer	40.302	0.202	0.0	0.6	0.6	43.2	O K
60 min Summer	40.347	0.247	0.0	0.9	0.9	52.9	O K
120 min Summer	40.385	0.285	0.0	1.1	1.1	60.9	O K
180 min Summer	40.404	0.304	0.0	1.2	1.2	65.0	O K
240 min Summer	40.414	0.314	0.0	1.3	1.3	67.2	O K
360 min Summer	40.423	0.323	0.0	1.3	1.3	69.1	O K
480 min Summer	40.427	0.327	0.0	1.3	1.3	69.9	O K
600 min Summer	40.430	0.330	0.0	1.3	1.3	70.6	O K
720 min Summer	40.432	0.332	0.0	1.3	1.3	71.1	O K
960 min Summer	40.435	0.335	0.0	1.4	1.4	71.6	O K
1440 min Summer	40.433	0.333	0.0	1.3	1.3	71.2	O K
2160 min Summer	40.424	0.324	0.0	1.3	1.3	69.2	O K
2880 min Summer	40.412	0.312	0.0	1.3	1.3	66.7	O K
4320 min Summer	40.390	0.290	0.0	1.2	1.2	61.9	O K
5760 min Summer	40.371	0.271	0.0	1.1	1.1	57.9	O K
7200 min Summer	40.356	0.256	0.0	1.0	1.0	54.6	O K
8640 min Summer	40.343	0.243	0.0	0.9	0.9	52.0	O K
10080 min Summer	40.333	0.233	0.0	0.8	0.8	49.8	O K
15 min Winter	40.273	0.173	0.0	0.2	0.2	37.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.593	0.0	0.2	19
30 min Summer	86.119	0.0	9.9	34
60 min Summer	52.778	0.0	21.2	64
120 min Summer	31.051	0.0	31.2	122
180 min Summer	22.647	0.0	37.5	182
240 min Summer	18.062	0.0	42.1	242
360 min Summer	13.097	0.0	48.8	352
480 min Summer	10.410	0.0	53.7	400
600 min Summer	8.704	0.0	57.5	458
720 min Summer	7.517	0.0	60.7	520
960 min Summer	5.959	0.0	65.9	654
1440 min Summer	4.288	0.0	73.1	924
2160 min Summer	3.080	0.0	82.0	1320
2880 min Summer	2.433	0.0	87.2	1704
4320 min Summer	1.744	0.0	94.2	2464
5760 min Summer	1.379	0.0	100.4	3176
7200 min Summer	1.149	0.0	104.2	3896
8640 min Summer	0.990	0.0	107.0	4584
10080 min Summer	0.873	0.0	108.9	5344
15 min Winter	132.593	0.0	3.7	19

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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	40.328	0.228	0.0	0.8	0.8	48.7	O K
60 min Winter	40.379	0.279	0.0	1.1	1.1	59.6	O K
120 min Winter	40.421	0.321	0.0	1.3	1.3	68.7	O K
180 min Winter	40.443	0.343	0.0	1.4	1.4	73.3	O K
240 min Winter	40.455	0.355	0.0	1.4	1.4	75.9	Flood Risk
360 min Winter	40.466	0.366	0.0	1.5	1.5	78.3	Flood Risk
480 min Winter	40.469	0.369	0.0	1.5	1.5	78.9	Flood Risk
600 min Winter	40.471	0.371	0.0	1.5	1.5	79.3	Flood Risk
720 min Winter	40.472	0.372	0.0	1.5	1.5	79.5	Flood Risk
960 min Winter	40.470	0.370	0.0	1.5	1.5	79.1	Flood Risk
1440 min Winter	40.459	0.359	0.0	1.5	1.5	76.7	Flood Risk
2160 min Winter	40.437	0.337	0.0	1.4	1.4	72.1	O K
2880 min Winter	40.416	0.316	0.0	1.3	1.3	67.6	O K
4320 min Winter	40.381	0.281	0.0	1.1	1.1	60.1	O K
5760 min Winter	40.355	0.255	0.0	1.0	1.0	54.6	O K
7200 min Winter	40.337	0.237	0.0	0.9	0.9	50.6	O K
8640 min Winter	40.323	0.223	0.0	0.8	0.8	47.8	O K
10080 min Winter	40.313	0.213	0.0	0.7	0.7	45.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	86.119	0.0	15.4	33
60 min Winter	52.778	0.0	28.1	62
120 min Winter	31.051	0.0	39.3	120
180 min Winter	22.647	0.0	46.4	178
240 min Winter	18.062	0.0	51.5	234
360 min Winter	13.097	0.0	59.0	344
480 min Winter	10.410	0.0	64.5	442
600 min Winter	8.704	0.0	68.9	472
720 min Winter	7.517	0.0	72.5	548
960 min Winter	5.959	0.0	78.3	700
1440 min Winter	4.288	0.0	86.5	994
2160 min Winter	3.080	0.0	96.5	1408
2880 min Winter	2.433	0.0	102.6	1812
4320 min Winter	1.744	0.0	110.7	2552
5760 min Winter	1.379	0.0	117.9	3288
7200 min Winter	1.149	0.0	122.4	3968
8640 min Winter	0.990	0.0	125.9	4672
10080 min Winter	0.873	0.0	128.4	5344

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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)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.146

Time (mins) From:	To:	Area (ha)
0	4	0.146

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Model Details

Storage is Online Cover Level (m) 40.750

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.8
Membrane Percolation (mm/hr)	1000	Length (m)	66.0
Max Percolation (l/s)	198.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	40.100	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 40.250

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

Half Drain Time : 625 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	40.320	0.220	0.0	0.7	0.7	47.0	O K
30 min Summer	40.388	0.288	0.0	1.1	1.1	61.5	O K
60 min Summer	40.450	0.350	0.0	1.4	1.4	74.9	Flood Risk
120 min Summer	40.503	0.403	0.0	1.6	1.6	86.2	Flood Risk
180 min Summer	40.529	0.429	0.0	1.7	1.7	91.8	Flood Risk
240 min Summer	40.544	0.444	0.0	1.7	1.7	94.9	Flood Risk
360 min Summer	40.556	0.456	0.0	1.8	1.8	97.6	Flood Risk
480 min Summer	40.561	0.461	0.0	1.8	1.8	98.6	Flood Risk
600 min Summer	40.565	0.465	0.0	1.8	1.8	99.4	Flood Risk
720 min Summer	40.567	0.467	0.0	1.8	1.8	99.8	Flood Risk
960 min Summer	40.568	0.468	0.0	1.8	1.8	100.1	Flood Risk
1440 min Summer	40.562	0.462	0.0	1.8	1.8	98.8	Flood Risk
2160 min Summer	40.544	0.444	0.0	1.7	1.7	95.0	Flood Risk
2880 min Summer	40.523	0.423	0.0	1.7	1.7	90.6	Flood Risk
4320 min Summer	40.483	0.383	0.0	1.5	1.5	81.9	Flood Risk
5760 min Summer	40.450	0.350	0.0	1.4	1.4	74.8	O K
7200 min Summer	40.422	0.322	0.0	1.3	1.3	68.9	O K
8640 min Summer	40.401	0.301	0.0	1.2	1.2	64.3	O K
10080 min Summer	40.383	0.283	0.0	1.1	1.1	60.5	O K
15 min Winter	40.348	0.248	0.0	0.9	0.9	53.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	185.630	0.0	13.5	19
30 min Summer	120.567	0.0	28.3	34
60 min Summer	73.889	0.0	44.2	64
120 min Summer	43.472	0.0	58.3	122
180 min Summer	31.706	0.0	67.1	182
240 min Summer	25.287	0.0	73.5	242
360 min Summer	18.336	0.0	83.0	358
480 min Summer	14.573	0.0	89.9	406
600 min Summer	12.186	0.0	95.4	464
720 min Summer	10.523	0.0	100.0	526
960 min Summer	8.342	0.0	107.3	656
1440 min Summer	6.003	0.0	117.6	926
2160 min Summer	4.312	0.0	130.5	1336
2880 min Summer	3.407	0.0	138.3	1728
4320 min Summer	2.442	0.0	149.1	2468
5760 min Summer	1.930	0.0	158.4	3224
7200 min Summer	1.609	0.0	164.6	3960
8640 min Summer	1.386	0.0	169.4	4664
10080 min Summer	1.222	0.0	173.1	5352
15 min Winter	185.630	0.0	19.4	19

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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	40.424	0.324	0.0	1.3	1.3	69.3	O K
60 min Winter	40.495	0.395	0.0	1.6	1.6	84.4	Flood Risk
120 min Winter	40.554	0.454	0.0	1.8	1.8	97.1	Flood Risk
180 min Winter	40.584	0.484	0.0	1.9	1.9	103.6	Flood Risk
240 min Winter	40.602	0.502	0.0	1.9	1.9	107.3	Flood Risk
360 min Winter	40.618	0.518	0.0	2.0	2.0	110.7	Flood Risk
480 min Winter	40.621	0.521	0.0	2.0	2.0	111.5	Flood Risk
600 min Winter	40.622	0.522	0.0	2.0	2.0	111.5	Flood Risk
720 min Winter	40.622	0.522	0.0	2.0	2.0	111.6	Flood Risk
960 min Winter	40.618	0.518	0.0	2.0	2.0	110.7	Flood Risk
1440 min Winter	40.599	0.499	0.0	1.9	1.9	106.7	Flood Risk
2160 min Winter	40.563	0.463	0.0	1.8	1.8	99.1	Flood Risk
2880 min Winter	40.528	0.428	0.0	1.7	1.7	91.6	Flood Risk
4320 min Winter	40.469	0.369	0.0	1.5	1.5	79.0	Flood Risk
5760 min Winter	40.426	0.326	0.0	1.3	1.3	69.6	O K
7200 min Winter	40.393	0.293	0.0	1.2	1.2	62.7	O K
8640 min Winter	40.369	0.269	0.0	1.1	1.1	57.6	O K
10080 min Winter	40.351	0.251	0.0	1.0	1.0	53.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	120.567	0.0	36.0	33
60 min Winter	73.889	0.0	53.8	62
120 min Winter	43.472	0.0	69.7	120
180 min Winter	31.706	0.0	79.5	178
240 min Winter	25.287	0.0	86.8	236
360 min Winter	18.336	0.0	97.4	346
480 min Winter	14.573	0.0	105.1	448
600 min Winter	12.186	0.0	111.3	482
720 min Winter	10.523	0.0	116.5	556
960 min Winter	8.342	0.0	124.7	706
1440 min Winter	6.003	0.0	136.3	1008
2160 min Winter	4.312	0.0	150.9	1428
2880 min Winter	3.407	0.0	159.8	1820
4320 min Winter	2.442	0.0	172.2	2596
5760 min Winter	1.930	0.0	182.7	3344
7200 min Winter	1.609	0.0	190.0	4040
8640 min Winter	1.386	0.0	195.8	4760
10080 min Winter	1.222	0.0	200.3	5448

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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)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.146

Time (mins) From:	To:	Area (ha)
0	4	0.146

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Model Details

Storage is Online Cover Level (m) 40.750

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.8
Membrane Percolation (mm/hr)	1000	Length (m)	66.0
Max Percolation (l/s)	198.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	40.100	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 40.250

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APPENDIX G



Hillingdon SuDS Proforma

The London Sustainable Drainage Proforma

Introduction

This proforma is intended to accompany a drainage strategy prepared for a planning application where required by national or local planning policy. It should be used to summarise the key outputs from the strategy to allow assessing officers at the Lead Local Flood Authority (LLFA) to quickly assess compliance with sustainable drainage (SuDS) planning

The proforma is divided into 4 sections, which are intended to be used as follows:

1. Site and project information - Provide summary details of the development, site and drainage
2. Proposed discharge arrangement – Summarise site ground conditions to determine potential for infiltration. Select a surface water discharge method (or mix of methods) following the hierarchical approach set out in the London Plan.
3. Drainage strategy – Prioritise SuDS measures that manage runoff as close to source as possible and contribute to the four main pillars of SuDS; amenity, biodiversity, water quality and water quantity.
4. Supporting information – Provide cross references to the page or section of the drainage strategy report where the detailed information to support each element can be found. This may be more than one reference for each

Policy

Drainage strategies for developments in the London Borough of Hillingdon need to comply with the following policies on SuDS:

1. London Borough of Hillingdon Local Plan policies EM 6 and DMEI 10
2. London Plan policy 5.13 and draft New London Plan policy SI13
3. The National Planning Policy Framework (NPPF)

Technical Guidance

- Post-development surface water discharge rate should be limited to greenfield runoff rates. Proposals for higher discharge rates should be agreed with the LLFA ahead of submission of the Planning Application. Clear evidence should be provided with the Planning Application to show why greenfield rates cannot be achieved.
- Greenfield runoff rate is the runoff rate from a site in its natural state, prior to any development. This should be calculated using one of the runoff estimation methods set out in Table 24.1 of CIRIA C753 The SuDS Manual.
- Attenuation storage volumes required to reduce post-development discharge rates to greenfield rates should be calculated using one of the runoff estimation methods set out in Table 24.1 of CIRIA C753 The SuDS Manual.
- 'CC' refers to climate change allowance from the current Environment Agency guidance.
- An operation and maintenance strategy for proposed SuDS measures should be submitted with the Planning Application and include the details set out in section 32.2 of CIRIA C753 The SuDS Manual. The manual should be site-specific and not directly reproduce parts of The SuDS Manual.
- Other useful sources of guidance are:
  - London Borough of Hillingdon sustainable drainage requirements
  - The London Plan Sustainable Design and Construction SPG
  - DEFRA non-statutory technical standards for sustainable drainage
  - Environment Agency climate change guidance
  - CIRIA C753 The SuDS Manual

GREATER**LONDON**AUTHORITY

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Hayes End Road, Hayes
Address & post code	Hayes End Road, Hayes UB4 8JB
OS Grid ref. (Easting, Northing)	E 508857
	N 181916
LPA reference (if applicable)	
Brief description of proposed work	Demolition of existing warehouse and replacement with mixed used commercial building over 4 stories
Total site Area	1,960 m^2
Total existing impervious area	1,960 m^2
Total proposed impervious area	1,434 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No
Existing drainage connection type and location	Assumed connection into 300mm diameter sewer in Hayes End Road
Designer Name	C Smoker
Designer Position	Associate Director
Designer Company	DHA Planning

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Langley Silt Member
Bedrock geology classification	London Clay
Site infiltration rate	Not tested m/s
Depth to groundwater level	Not tested m below ground level
Is infiltration feasible?	No

2b. Drainage Hierarchy

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

2c. Proposed Discharge Details

Proposed discharge location	Existing connection into 300mm diameter sewer in Hayes End Road
Has the owner/regulator of the discharge location been consulted?	No. Existing connection at a reduced rate from current rate providing betterment

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	2.2			
1 in 1	1.9			2.0
1 in 30	3.9			2.0
1 in 100	4.5			2.0
1 in 100 + CC			106	2.0
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Orifice plate		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^3)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	1959	718	106
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	**1959**	**718**	**106**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	1.2.2
Drainage hierarchy (2b)	1.3
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	1.3
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	1.2.1 /1.3
Proposed SuDS measures & specifications (3b)	1.3
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	1.3
Detailed drainage design drawings, including exceedance flow routes	1.3
Detailed landscaping plans	1.3
Maintenance strategy	1.3
Demonstration of how the proposed SuDS measures improve:	1.3
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	