



Drainage Design - Planning Condition

1 Burford Close, Ickenham, Uxbridge, UB10 8EH

Reference: 254 -Rev - V1

Date: Jul-22

- 1 Introduction**
- 2 Site Characteristics**
- 3 Discharge Arrangement**
- 4 Peak Runoff**
- 5 Proposed Sustainable Drainage**
- 6 Maintenance and Management Plan**

Appendices

- A Distribution Existing and Proposed Areas**
- B Site Characteristics**
- C Drainage Calculations**
- D Drainage System General Arrangement**

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Purpose of this report

- 1.1 The purpose of this statement is to accompany the technical drawings and details showing the proposed Surface Water drainage system which addresses each point relating to relevant planning conditions.

Site Characteristics

2

Site Characteristics

2.1 The site background is clearly identified through answers to the questions in table 1 below.

Table 1: Site Characteristics . See appendix B for support documentation

TOPIC	QUESTION	ANSWER
Protected species or habitat	Is the site near to designated sites and priority habitats?	No
Flood Plain	Is the site located in the flood plain?	No
Soils and Geology	Soil permeability? - See appendix B for results	No
Space constraints	Space for SuDS components?	Yes
Topography	Sited on a flat site?	Yes
	Sited on a steep slope (5-15%)	No
	Sited on a very steep slope (>15%)	No
Groundwater	Is the site at groundwater flood risk?	No
Contaminated land	Are there contaminated soils on site?	Unknown
Source Protection Zone	Is the site within a SPZ 3?	No
Runoff characteristics	Is the development in a high risk flooding area?	No

Existing and Proposed Site

2.2 The distribution of catchment areas for existing and proposed site is as per table 2 below. See appendix A for details

Table 2 : Existing and Proposed catchment areas in hectares

Description	Existing Site	Proposed Site
Impermeable Areas	0.014	0.012
Permeable Areas	Connected to Drainage	0.000
	Self Draining Areas	0.006
Areas Draining Away from drainage System	0.007	0.005
Total Development Area	0.027	0.027

2.3 It has been assumed that the positively drained areas will have different runoff coefficients depending on the type of surface as follow:

Impermeable Surface	1.0
Permeable Surfaces	0.5
Grass Areas	0.3

Evaluation of Discharge Point

3.1 The SuDS design takes into account Building Regulations Section H3 and the National Planning Practice Guidance. The aim is to discharge surface water run-off as high up the drainage hierarchy, as reasonably practicable:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer.

3.2 The discharge point has been evaluated following the NPPG and Building regulations. The findings are in table 3 below.

Table 3: Drainage Hierarchy evaluation

Superficial geology classification	The British Geological Society records show that the superficial deposits are No results found.
Bedrock geology classification	The British Geological Society records of the site show that it is located within the London Clay Formation - Clay, Silt and Sand.
Landis Top Soil Infiltration	The SOILSCAPE's records of the site show that it is located within an area of impeded drainage soils.
Groundwater	The British Geological Survey's flood risk susceptibility maps show that the development has limited susceptibility to ground water flooding. The risk from groundwater flood to the site is considered very low.
Is infiltration feasible?	The soils on the site are likely to have very low permeability. Therefore infiltration is not feasible.
Is a discharge to a watercourse possible?	There are no watercourses in the proximity to the site.
Is a discharge to a surface water sewer possible?	There are no surface water sewers in the proximity to the site.
Is a discharge to a combined sewer possible?	There is a combined water sewer and connection is possible.

Existing and Proposed Peak Run-off Calculations

4.1 The current site is a Brownfield. The peak runoff rate for the existing site was calculated as per table 4 and discharge rates as per table 5.

Table 4: Peak run-off rate calculation method for existing site

Method Used	Calculation Method
<input type="checkbox"/>	Report124 Flood Estimation for Small Catchments method has been used to estimate the site peak flow rates
<input checked="" type="checkbox"/>	This is a brownfield site, runoff rates are calculated in accordance with best practice simulation modelling and using the modified rational method
<input type="checkbox"/>	This is a brownfield site where the pre-development drainage isn't known. The runoff rates are calculated using the Greenfield model with soil type 5

4.2 The runoff flow produced by the development will be controlled as per table 5.

Table 5: Runoff discharge rate control

Control Used	Description of runoff discharge
<input type="checkbox"/>	Water will be discharged into the ground via a SuDS as described in table 6 below
<input type="checkbox"/>	The peak discharge rate has been reduced to Greenfield Qbar flow
<input type="checkbox"/>	The peak discharge rate has been taken as 0.7 l/s as it is not possible to reduce it to the Greenfield Qbar rate
<input type="checkbox"/>	The peak discharge rate has been reduced to Brownfield pre-development 1 in 1 flow
<input checked="" type="checkbox"/>	The peak discharge rate has been reduced by 60% from the existing Brownfield pre-development 1 in 2 flow rate

Run-off flows

4.3 The size of the SuDS has been calculated for all events up to the 1 in 100 including an allowance for climate change of 40%. As per tables above, it is proposed to discharge at a rate of 1 l/s. See table 6 for values and appendix C for calculations.

Table 6: Peak discharge rates for SuDS

Return Period Event	Discharge Rate (l/s)			Infiltration Rate (m/hr)
	Existing Greenfield	Existing Brownfield	Proposed	
Qbar	0.10	N/A	N/A	0.0000
1 in 1	0.10	1.90	0.4	0.0000
1 in 2	0.10	2.50	0.4	0.0000
1 in 30	0.30	4.60	0.7	0.0000
1 in 100	0.40	5.80	0.7	0.0000
1 in 100 + CC	N/A	N/A	0.8	0.0000

Proposed Sustainable Drainage System

5.1 The following sustainable drainage systems have been used for this site. The drainage design uses these drainage system through out the site. See table 7 for details.

Table 7: Proposed Drainage System

SuDS Proposed	Feasible	Proposed
Use of green roofs	No	No
Store rainwater for later use	No	No
Use infiltration techniques, for instance soakaways, permeable surfaces	No	No
Attenuate rainwater in ponds or open water features for gradual release	No	No
Attenuate rainwater by storing in tanks or sealed water features for gradual release	Yes	Yes

Discharge Point Proposed	Feasible	Proposed
Discharge rainwater direct to a watercourse	No	No
Discharge rainwater to a surface water sewer/drain	Unknown	No
Discharge rainwater to the combined sewer	Yes	Yes

5.2 The location and details of the SuDS can be seen drainage layouts in appendix D. Calculations are in appendix C.

5.3 The drainage calculations demonstrate:

- No flooding occurs for the 1 in 30 storm events.
- Any flooding for the 1 in 100 year + 40% climate change event can be safely contained on site

5.4 The proposed drainage strategy presents one possible solution to demonstrate that the development can be sustainably drained, to comply with the requirements of the NPPF. Other solutions may be feasible and may prove to be better suited to the site. These will become apparent during the detailed design stage. The strategy above should not therefore be interpreted as the definitive scheme solution.

Management of Exceedance Flows

5.5 The drainage network has been designed to attenuate surface runoff for all events up to and including the 1% AEP + CC(1 in 100 years). However consideration has been given to what may happen when the design capacity of the surface water drainage network is exceeded. Surface water will flow to the lowest points within the site located to the front of the property. The flood risk to the buildings would therefore remain low. See appendix D.

Maintenance and Management plan responsibility

6.1 The SuDS will be maintained by The Owner the property

Maintenance and Management plan for proposed SuDS

6.2 The maintenance and Management Plan Guidance from the SuDS Manual, CIRIA C753 (CIRIA, 2015) is to be followed for the effective maintenance of the proposed SuDS techniques outlined above. The maintenance for SuDS structures are as follow:

Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Maintenance and Management Plan 6

Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

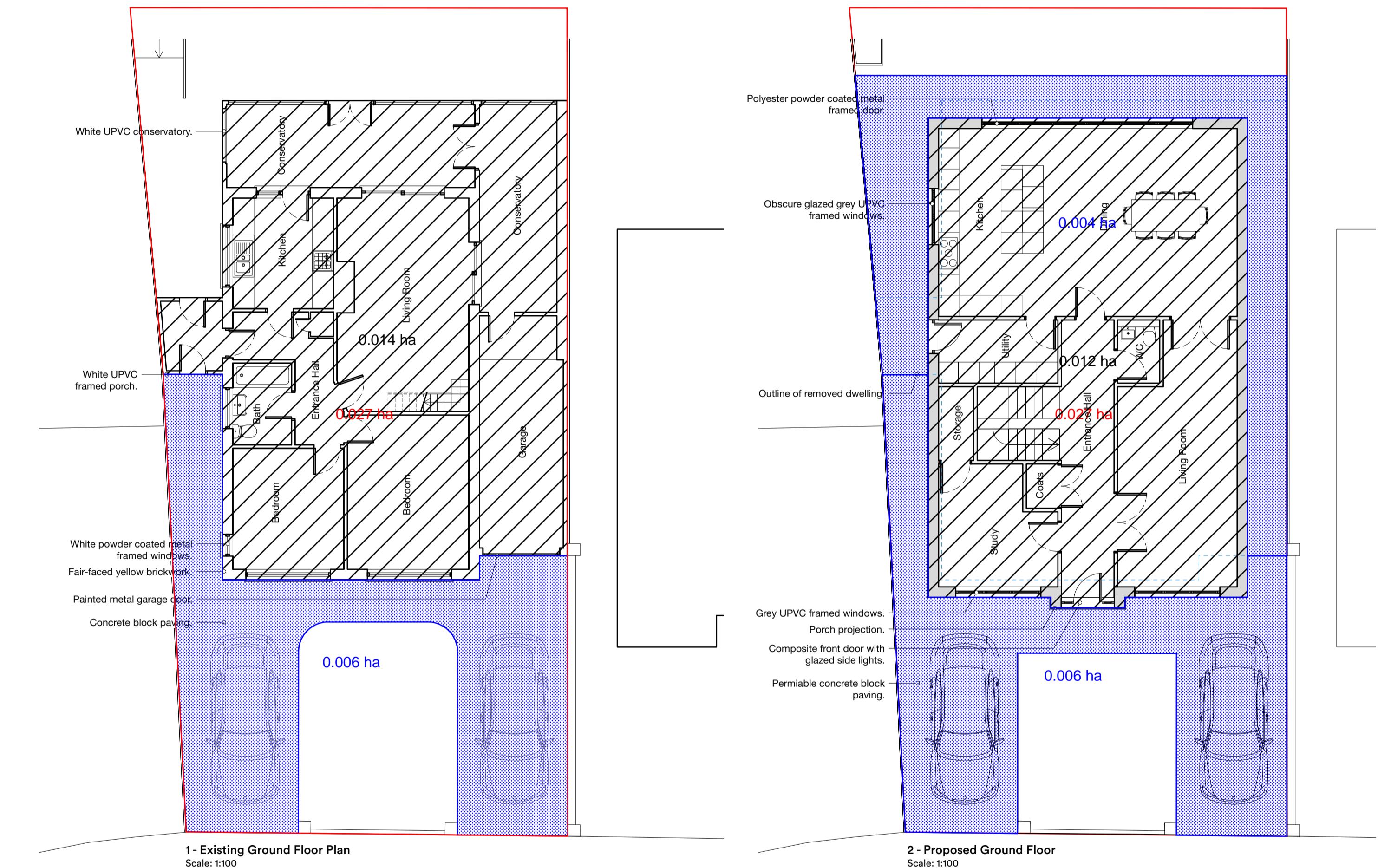


Appendix A



Drawing Scale Bar			
Drawing scale	Line length	Drawing scale	Line length
1:5 = 0.25 metres	1:200 = 10.0 metres		
1:10 = 0.5 metres	1:250 = 12.5 metres		
1:20 = 1.25 metres	1:350 = 18.75 metres		
1:25 = 1.25 metres	1:1000 = 50.0 metres		
1:50 = 2.5 metres	1:1250 = 62.5 metres		
1:100 = 5.0 metres	1:2500 = 125.0 metres		
Measure length of line above for checking of scale			

GENERAL NOTES



Rev Details Date By Chd

Drawing Status:
PRELIMINARY



EXISTING SITE 1:100

PROPOSED SITE 1:100

Client:
Project:
1 Burford Close, Ickenham, Uxbridge, UB10 8EH
Drawing:
Existing and Proposed Areas
Permeable and Impermeable

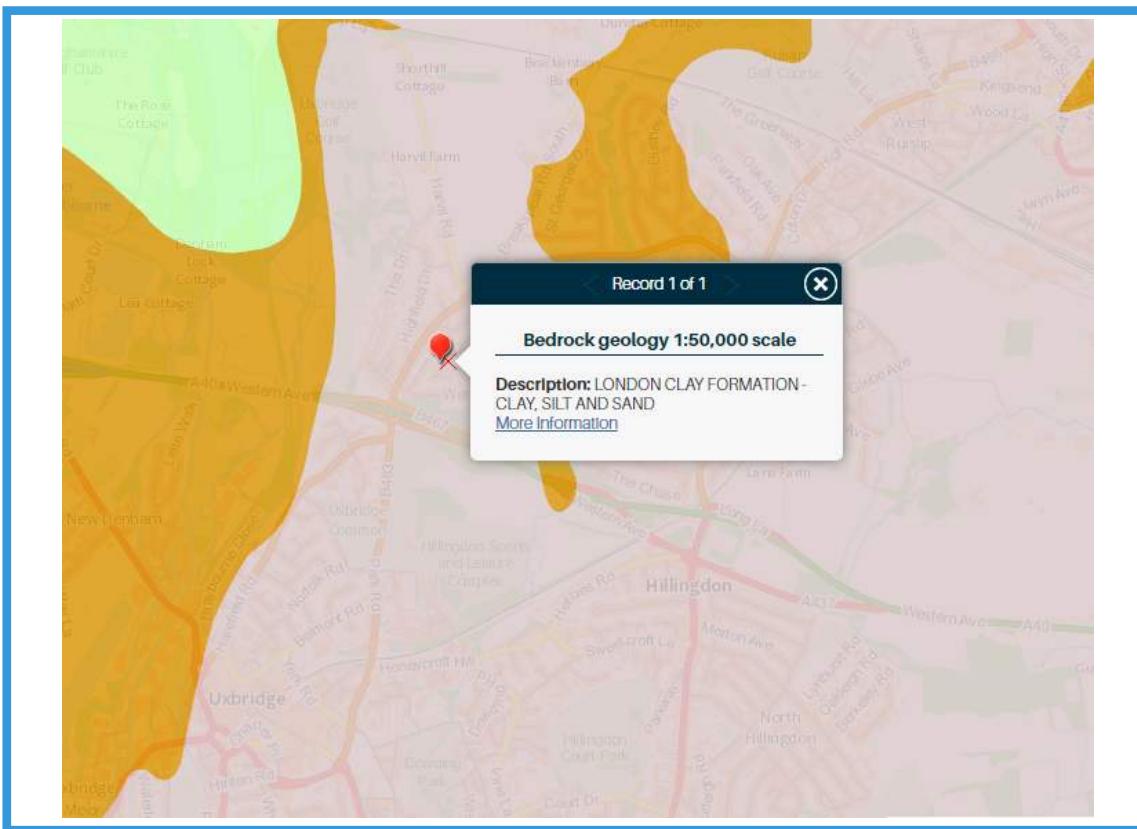


Appendix B

**GEOINDEX
ONSHORE**



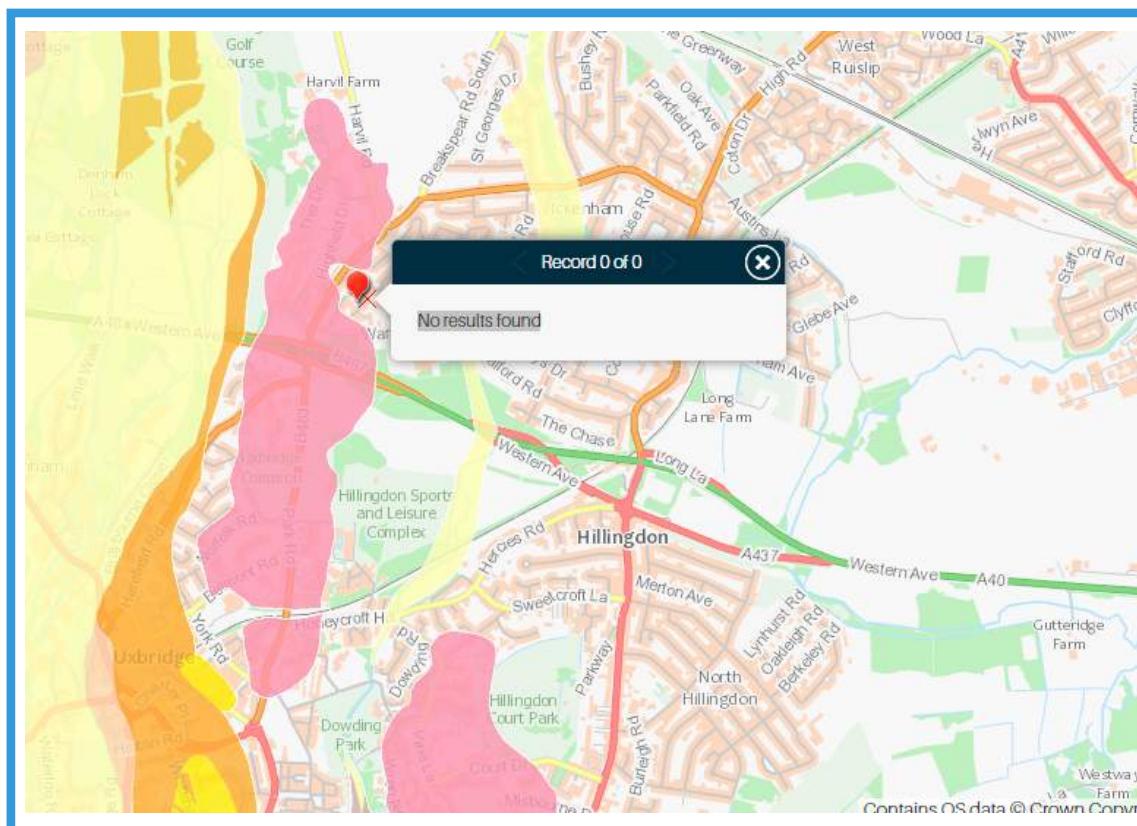
GEOLOGY - BEDROCK - LONDON CLAY FORMATION - CLAY, SILT AND SAND



**GEOINDEX
ONSHORE**

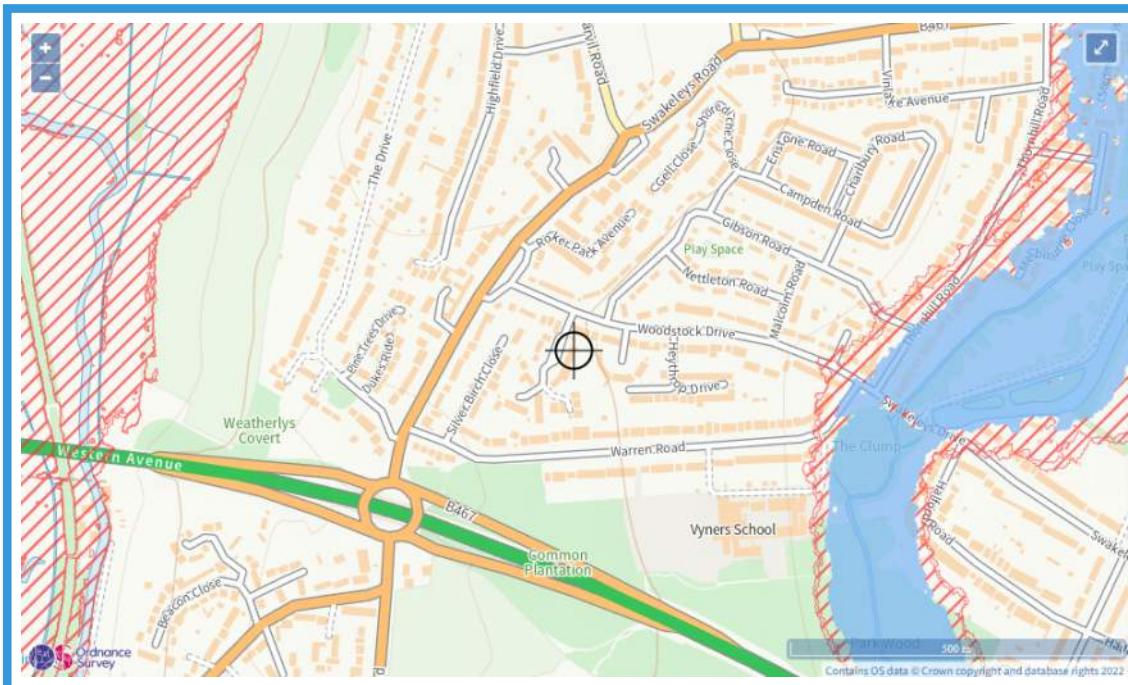
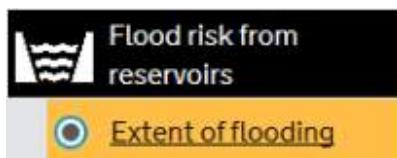
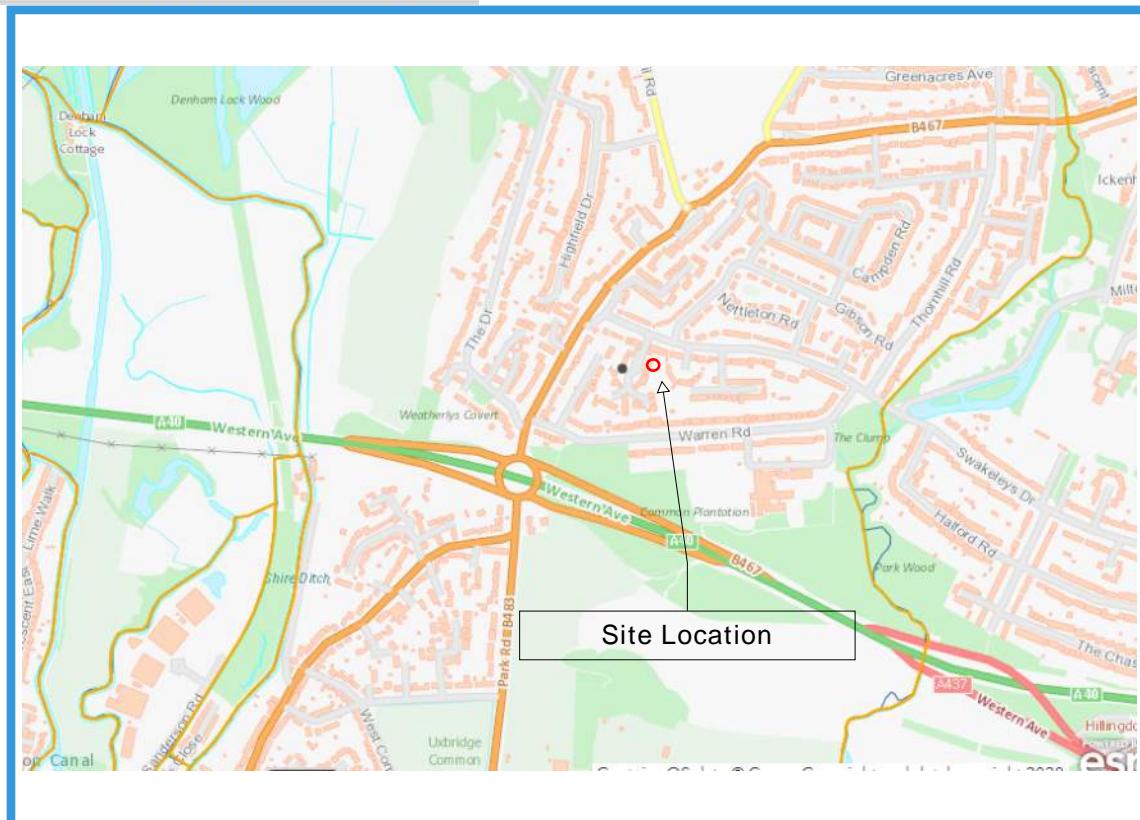


GEOLOGY - SUPERFICIAL DEPOSITS - No results found





Main River Map

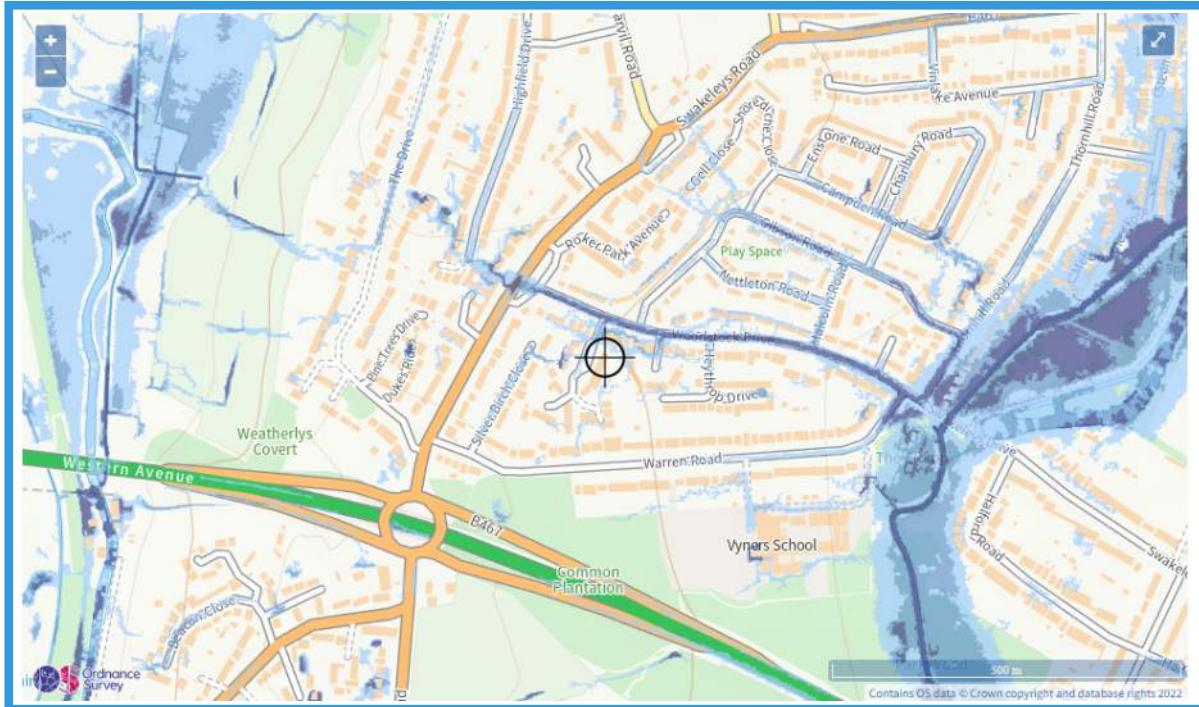


SITE SURFACE WATER FLOOD RISK

 Flood risk from surface water

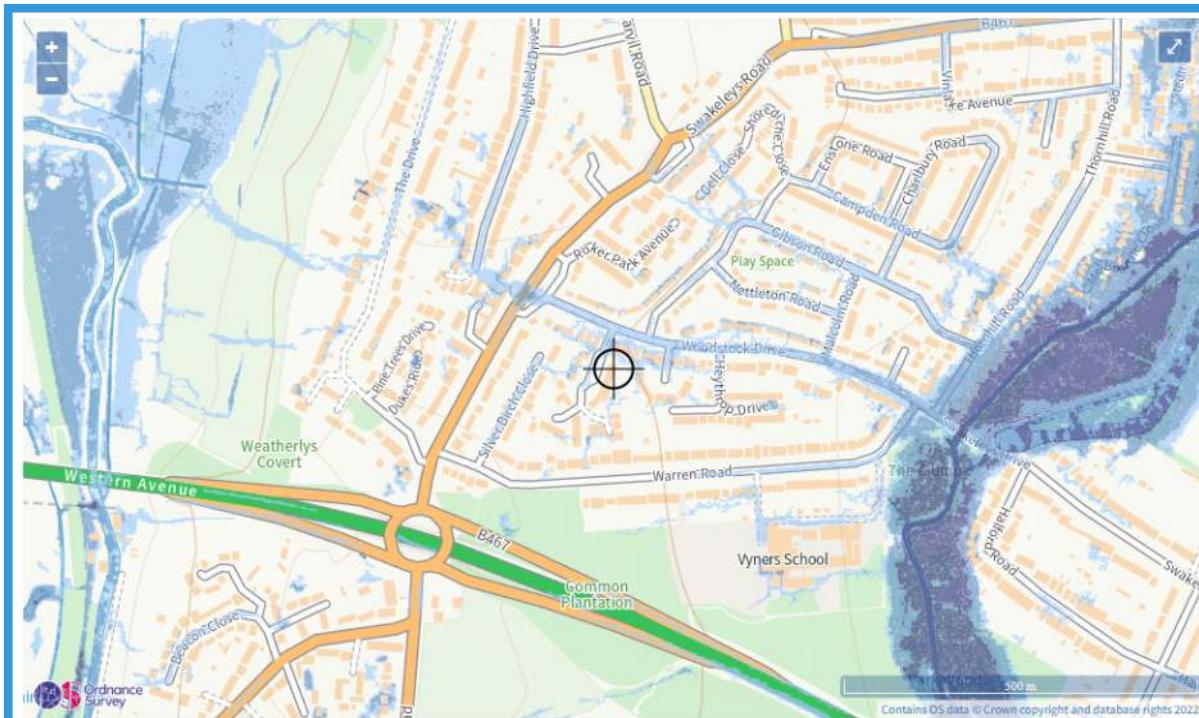
 Extent of flooding

High risk means a chance of flooding greater than 3.3% (1:30)
 Medium risk means a chance of flooding of btw 1% (1:100) and 3.3%
 Low risk means a chance of flooding of btw 0.1% (1:1000) and 1%
 Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding



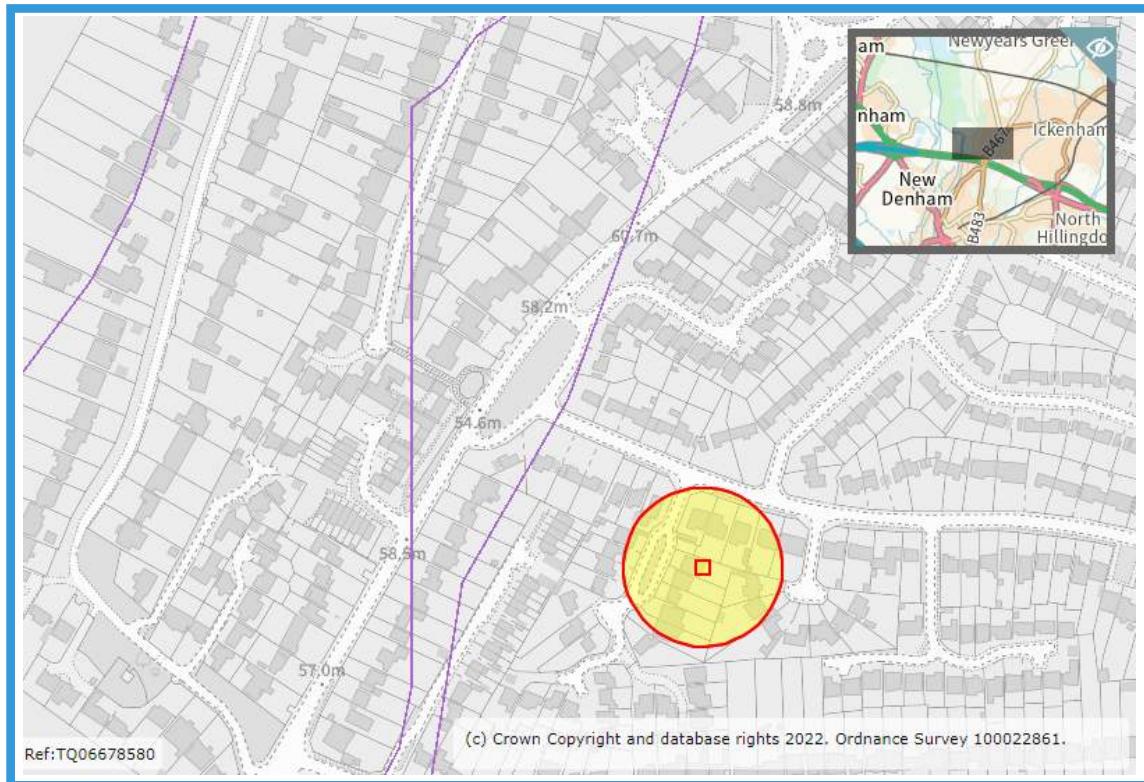
Flood risk

-  High
-  Medium
-  Low
-  Very low



 Over 900mm  300 to 900mm  Below 300mm

MAGIC RESULTS



Site Check Results

Site Check Report Report generated on Mon Jul 04 2022
You selected the location: Centroid Grid Ref: TQ06488577
 The following features have been found in your search area:

Aquifer Designation Map (Bedrock) (England)

Typology	Unproductive
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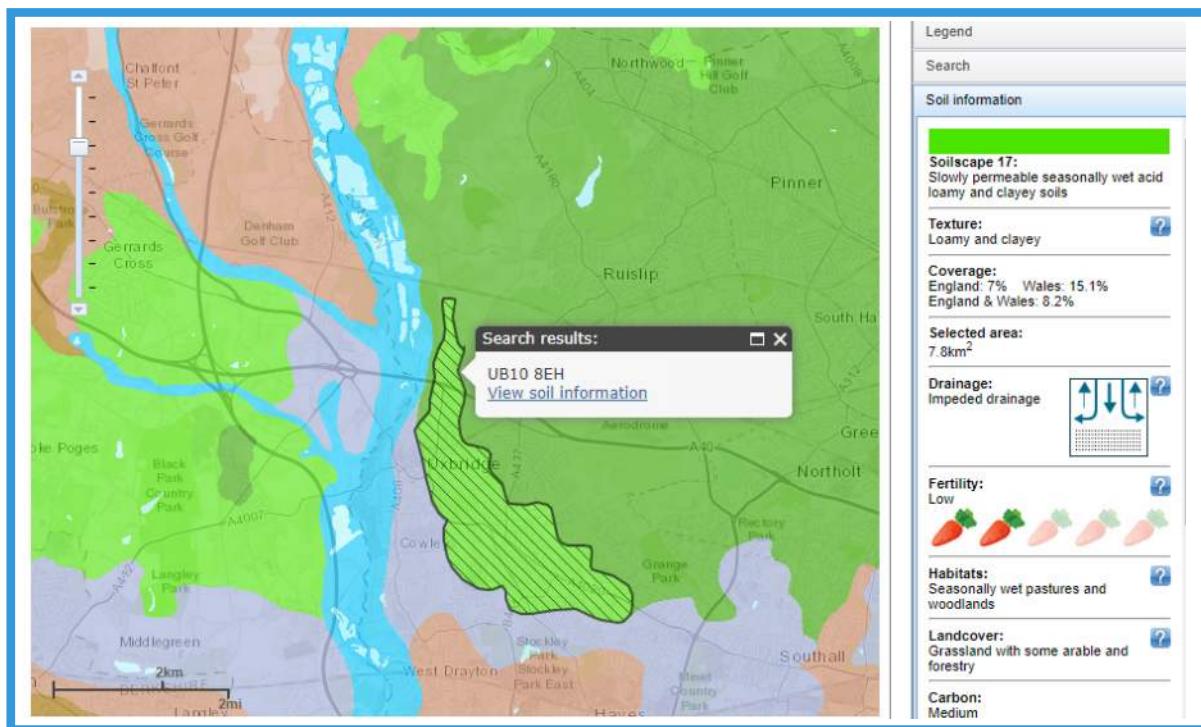
Aquifer Designation Map (Superficial Drift) (England)

No Features found

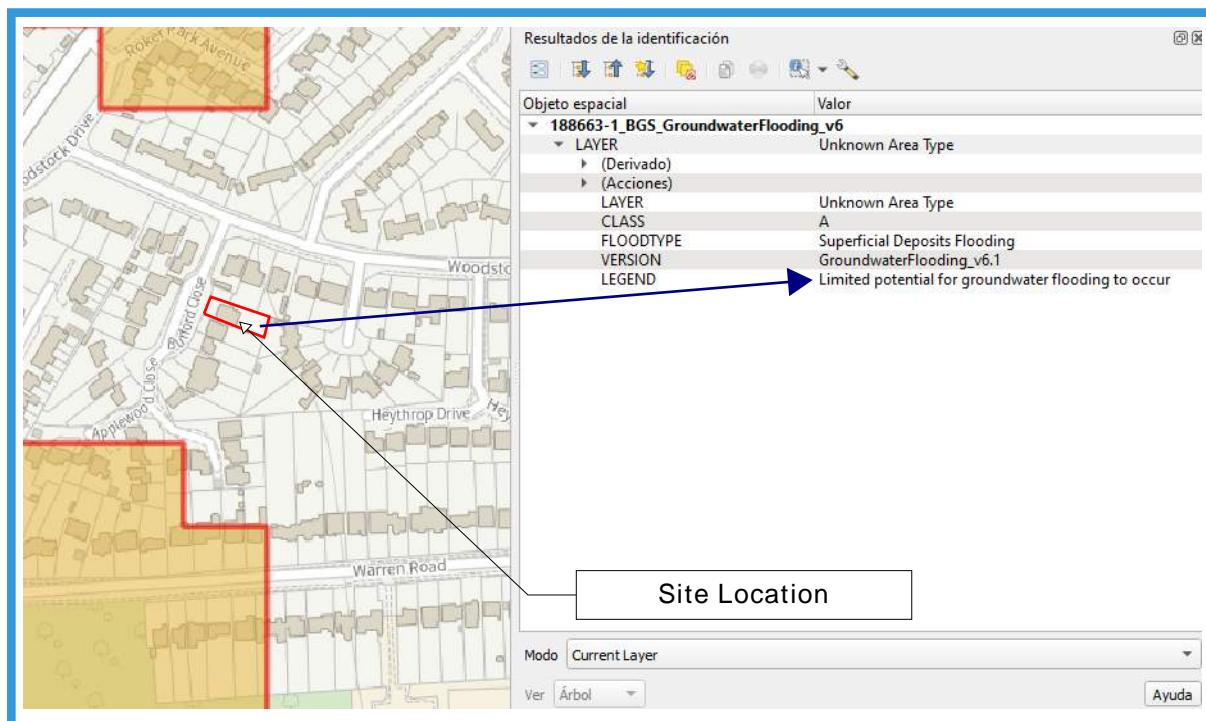
Source Protection Zones merged (England)

No Features found

OK Cancel Export to CSV Print



GROUND WATER FLOOD RISK



Flood map for planning

Your reference
UB10 8EH

Location (easting/northing)
506479/185773

Created
4 Jul 2022 16:13

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

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

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.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Environment
Agency

Flood map for planning

Your reference

UB10 8EH

Location (easting/northing)

506479/185773

Scale

1:2500

Created

4 Jul 2022 16:13



Selected point



Flood zone 3



Flood zone 3: areas
benefitting from flood
defences



Flood zone 2



Flood zone 1



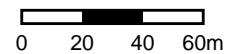
Flood defence



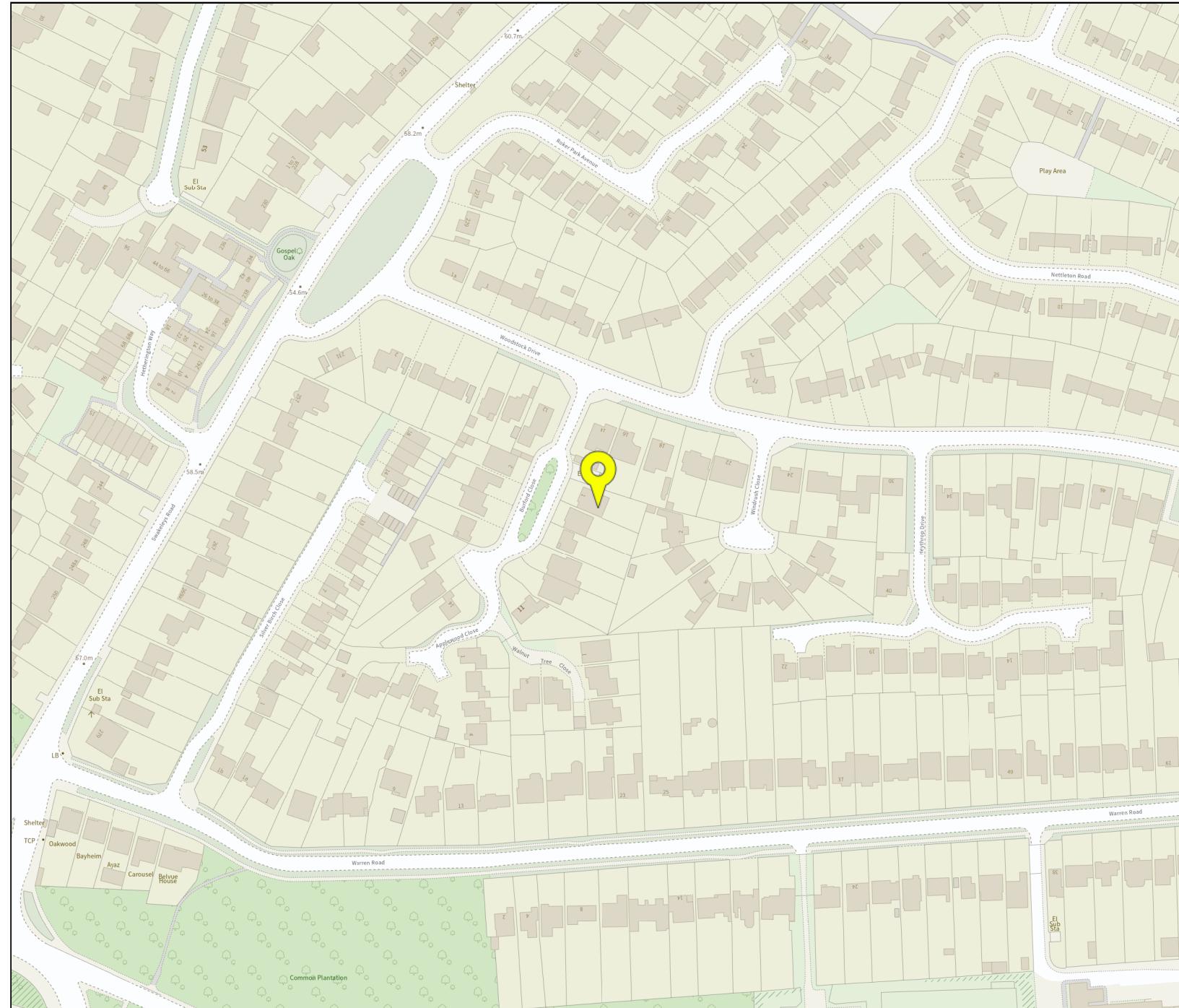
Main river



Water storage area



Page 2 of 2



SSSI Impact Risk Zones - to assess planning applications for likely impacts on SSSIs/SACs/SPAs & Ramsar sites (England)

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF 2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT THE CATEGORIES BELOW?

All Planning Applications

Infrastructure

Wind & Solar Energy

Minerals, Oil & Gas

Rural Non Residential

Residential

Rural Residential

Air Pollution

Combustion

Waste

Composting

Discharges

Water Supply

Notes 1

Notes 2

GUIDANCE - How to use the Impact Risk Zones

[/Metadata_for_magic/SSSI_IRZ_User_Guidance_MAGIC.pdf](#)

Aquifer Designation Map (Bedrock) (England)

Typology

Unproductive

Soilscape (England)

Reference

17

SLOWLY PERMEABLE SEASONALLY WET ACID LOAMY AND CLAYEY SOILS

Name

LOAMY

Main Surface Texture Class

IMPEDED DRAINAGE

Natural Drainage Type

LOW

Natural Fertility

SEASONALLY WET PASTURES AND WOODLANDS MAINLY, BUT NOT EXCLUSIVELY, ON THE UPLAND FRINGE

Characteristic Semi-natural Habitats

GRASSLAND WITH SOME ARABLE AND FORESTRY

Main Land Cover

[/Metadata_for_magic/soilscape_summary.pdf](#)

Reference

18

SLOWLY PERMEABLE SEASONALLY WET SLIGHTLY ACID BUT BASE-RICH LOAMY AND CLAYEY SOILS

Name

LOAMY

Main Surface Texture Class

IMPEDED DRAINAGE

Natural Drainage Type

MODERATE

Natural Fertility

LOWLAND SEASONALLY WET PASTURES AND WOODLANDS

Characteristic Semi-natural Habitats

GRASSLAND AND ARABLE SOME WOODLAND

Main Land Cover

[/Metadata_for_magic/soilscape_summary.pdf](#)

Aquifer Designation Map (Superficial Drift) (England)

No Features found

Areas of Outstanding Natural Beauty (England)

No Features found

Limestone Pavement Orders (England)

No Features found

Local Nature Reserves (England) - points

No Features found

Local Nature Reserves (England)

No Features found

Moorland Line (England)

No Features found

National Nature Reserves (England) - points

No Features found

National Nature Reserves (England)

No Features found

National Parks (England)

No Features found

Ramsar Sites (England) - points

No Features found

Ramsar Sites (England)

No Features found

Proposed Ramsar Sites (England) - points

No Features found

Proposed Ramsar Sites (England)

No Features found

Sites of Special Scientific Interest Units (England) - points

No Features found

Sites of Special Scientific Interest Units (England)

No Features found

Sites of Special Scientific Interest (England) - points

No Features found

Sites of Special Scientific Interest (England)

No Features found

Special Areas of Conservation (England) - points

No Features found

Special Areas of Conservation (England)

No Features found

Possible Special Areas of Conservation (England) - points

No Features found

Possible Special Areas of Conservation (England)

No Features found

Special Protection Areas (England) - points

No Features found

Special Protection Areas (England)

No Features found

Potential Special Protection Areas (England) - points

No Features found

Potential Special Protection Areas (England)

No Features found

Biosphere Reserves (England) - points

No Features found

Biosphere Reserves (England)

No Features found

Less Favoured Areas (England)

No Features found

Nitrate Vulnerable Zones 2017 Designations (England)

No Features found

Wild Bird General Licence Protected Sites Condition Zone (England)

No Features found

Source Protection Zones merged (England)

No Features found



Appendix C



Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	0.1
Summer CV	0.750	2 year (l/s)	0.1
Winter CV	0.840	30 year (l/s)	0.3
Analysis Speed	Normal	100 year (l/s)	0.4
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.027	Betterment (%)	0
SAAR (mm)	639	QBar	0.1
Soil Index	4	Q 1 year (l/s)	0.1
SPR	0.47	Q 2 year (l/s)	0.1
Region	6	Q 30 year (l/s)	0.3
Growth Factor 1 year	0.85	Q 100 year (l/s)	0.4
Growth Factor 2 year	0.88		

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	1.9
Summer CV	0.750	2 year (l/s)	2.5
Winter CV	0.840	30 year (l/s)	4.6
Analysis Speed	Normal	100 year (l/s)	5.8
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Betterment (%)	0
Brownfield Method	MRM	Q 1 year (l/s)	1.9
Contributing Area (ha)	0.014	Q 2 year (l/s)	2.5
PIMP (%)	100	Q 30 year (l/s)	4.6
CV	0.750	Q 100 year (l/s)	5.8
Time of Concentration (mins)	6.00		

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	6.00	Enforce best practice design rules	✓

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
House		0.013	6.00	50.000	450	-0.041	0.008	0.500
Storage Tank				50.000		4.979	-0.054	1.000
Outfall				50.000	450	10.030	-0.023	1.085
Permeable Surface		6.00		50.000		2.562	3.169	0.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	House	Storage Tank	5.020	0.600	49.500	49.000	0.500	10.0	100	6.03	50.0
1.001	Storage Tank	Outfall	5.051	0.600	49.000	48.915	0.085	59.4	100	6.12	50.0
2.000	Permeable Surface	Storage Tank	4.029	0.600	49.500	49.000	0.500	8.1	100	6.02	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.453	19.3	1.8	0.400	0.900	0.013	0.0	21	1.537
1.001	1.001	7.9	1.8	0.900	0.985	0.013	0.0	32	0.810
2.000	2.740	21.5	0.0	0.400	0.900	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.020	10.0	100	Circular	50.000	49.500	0.400	50.000	49.000	0.900
1.001	5.051	59.4	100	Circular	50.000	49.000	0.900	50.000	48.915	0.985
2.000	4.029	8.1	100	Circular	50.000	49.500	0.400	50.000	49.000	0.900
Link	US Node		Dia (mm)	Node Type	MH Type		DS Node	Dia (mm)	Node Type	MH Type
1.000	House		450	Manhole	Adoptable		Storage Tank		Junction	
1.001	Storage Tank			Junction			Outfall	450	Manhole	Adoptable
2.000	Permeable Surface			Junction			Storage Tank		Junction	

Node Storage Tank Online Orifice Control

Flap Valve	x	Invert Level (m)	49.000	Diameter (m)	0.021
Downstream Link	1.001	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.0		

Node Storage Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	123
Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	4.0	0.0	0.400	4.0	0.0
				0.401	0.0
					0.0

Node Permeable Surface Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00360	Invert Level (m)	49.500	Slope (1:X)	400.0
Side Inf Coefficient (m/hr)	0.00360	Time to half empty (mins)	33	Depth (m)	0.400
Safety Factor	2.0	Width (m)	4.000	Inf Depth (m)	
Porosity	0.30	Length (m)	10.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 600 minute summer	9.182	2.511
1 year 15 minute winter	76.857	30.991	1 year 600 minute winter	6.274	2.511
1 year 30 minute summer	71.439	20.215	1 year 720 minute summer	8.203	2.199
1 year 30 minute winter	50.133	20.215	1 year 720 minute winter	5.513	2.199
1 year 60 minute summer	48.435	12.800	1 year 960 minute summer	6.768	1.782
1 year 60 minute winter	32.179	12.800	1 year 960 minute winter	4.483	1.782
1 year 120 minute summer	30.053	7.942	1 year 1440 minute summer	4.949	1.326
1 year 120 minute winter	19.966	7.942	1 year 1440 minute winter	3.326	1.326
1 year 180 minute summer	23.233	5.979	2 year 15 minute summer	141.566	40.058
1 year 180 minute winter	15.102	5.979	2 year 15 minute winter	99.345	40.058
1 year 240 minute summer	18.475	4.882	2 year 30 minute summer	91.753	25.963
1 year 240 minute winter	12.274	4.882	2 year 30 minute winter	64.388	25.963
1 year 360 minute summer	14.169	3.646	2 year 60 minute summer	61.301	16.200
1 year 360 minute winter	9.210	3.646	2 year 60 minute winter	40.727	16.200
1 year 480 minute summer	11.185	2.956	2 year 120 minute summer	37.449	9.897
1 year 480 minute winter	7.431	2.956	2 year 120 minute winter	24.880	9.897

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 180 minute summer	28.672	7.378	100 year 60 minute summer	153.288	40.510
2 year 180 minute winter	18.637	7.378	100 year 60 minute winter	101.841	40.510
2 year 240 minute summer	22.636	5.982	100 year 120 minute summer	92.562	24.461
2 year 240 minute winter	15.039	5.982	100 year 120 minute winter	61.496	24.461
2 year 360 minute summer	17.235	4.435	100 year 180 minute summer	69.806	17.964
2 year 360 minute winter	11.203	4.435	100 year 180 minute winter	45.376	17.964
2 year 480 minute summer	13.550	3.581	100 year 240 minute summer	54.269	14.342
2 year 480 minute winter	9.003	3.581	100 year 240 minute winter	36.055	14.342
2 year 600 minute summer	11.088	3.033	100 year 360 minute summer	40.484	10.418
2 year 600 minute winter	7.576	3.033	100 year 360 minute winter	26.315	10.418
2 year 720 minute summer	9.878	2.647	100 year 480 minute summer	31.414	8.302
2 year 720 minute winter	6.639	2.647	100 year 480 minute winter	20.871	8.302
2 year 960 minute summer	8.113	2.136	100 year 600 minute summer	25.431	6.956
2 year 960 minute winter	5.374	2.136	100 year 600 minute winter	17.376	6.956
2 year 1440 minute summer	5.891	1.579	100 year 720 minute summer	22.452	6.017
2 year 1440 minute winter	3.959	1.579	100 year 720 minute winter	15.089	6.017
30 year 15 minute summer	268.706	76.035	100 year 960 minute summer	18.166	4.784
30 year 15 minute winter	188.566	76.035	100 year 960 minute winter	12.033	4.784
30 year 30 minute summer	174.929	49.499	100 year 1440 minute summer	12.896	3.456
30 year 30 minute winter	122.757	49.499	100 year 1440 minute winter	8.667	3.456
30 year 60 minute summer	116.589	30.811	100 year +40% CC 15 minute summer	488.233	138.153
30 year 60 minute winter	77.459	30.811	100 year +40% CC 15 minute winter	342.620	138.153
30 year 120 minute summer	70.438	18.615	100 year +40% CC 30 minute summer	320.551	90.705
30 year 120 minute winter	46.797	18.615	100 year +40% CC 30 minute winter	224.948	90.705
30 year 180 minute summer	53.298	13.715	100 year +40% CC 60 minute summer	214.603	56.713
30 year 180 minute winter	34.645	13.715	100 year +40% CC 60 minute winter	142.577	56.713
30 year 240 minute summer	41.604	10.995	100 year +40% CC 120 minute summer	129.587	34.246
30 year 240 minute winter	27.641	10.995	100 year +40% CC 120 minute winter	86.094	34.246
30 year 360 minute summer	31.221	8.034	100 year +40% CC 180 minute summer	97.729	25.149
30 year 360 minute winter	20.295	8.034	100 year +40% CC 180 minute winter	63.526	25.149
30 year 480 minute summer	24.324	6.428	100 year +40% CC 240 minute summer	75.977	20.078
30 year 480 minute winter	16.160	6.428	100 year +40% CC 240 minute winter	50.477	20.078
30 year 600 minute summer	19.756	5.404	100 year +40% CC 360 minute summer	56.677	14.585
30 year 600 minute winter	13.498	5.404	100 year +40% CC 360 minute winter	36.841	14.585
30 year 720 minute summer	17.490	4.687	100 year +40% CC 480 minute summer	43.979	11.622
30 year 720 minute winter	11.754	4.687	100 year +40% CC 480 minute winter	29.219	11.622
30 year 960 minute summer	14.215	3.743	100 year +40% CC 600 minute summer	35.604	9.738
30 year 960 minute winter	9.416	3.743	100 year +40% CC 600 minute winter	24.327	9.738
30 year 1440 minute summer	10.161	2.723	100 year +40% CC 720 minute summer	31.433	8.424
30 year 1440 minute winter	6.829	2.723	100 year +40% CC 720 minute winter	21.125	8.424
100 year 15 minute summer	348.738	98.681	100 year +40% CC 960 minute summer	25.432	6.697
100 year 15 minute winter	244.728	98.681	100 year +40% CC 960 minute winter	16.847	6.697
100 year 30 minute summer	228.965	64.789	100 year +40% CC 1440 minute summer	18.055	4.839
100 year 30 minute winter	160.677	64.789	100 year +40% CC 1440 minute winter	12.134	4.839

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	House	11	49.520	0.020	1.7	0.0137	0.0000	OK
60 minute winter	Storage Tank	45	49.176	0.176	0.9	0.6684	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.915	0.000	0.3	0.0000	0.0000	OK
15 minute summer	Permeable Surface	1	49.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	House	1.000	Storage Tank	1.7	1.233	0.088	0.0222	
60 minute winter	Storage Tank	Orifice	Outfall	0.4				1.4
15 minute summer	Permeable Surface	2.000	Storage Tank	0.0	0.000	0.000	0.0158	
15 minute summer	Permeable Surface	Infiltration		0.0				

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	House	11	49.523	0.023	2.2	0.0156	0.0000	OK
60 minute winter	Storage Tank	46	49.236	0.236	1.2	0.8958	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.915	0.000	0.4	0.0000	0.0000	OK
15 minute summer	Permeable Surface	1	49.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	House	1.000	Storage Tank	2.2	1.233	0.114	0.0230	
60 minute winter	Storage Tank	Orifice	Outfall	0.4				1.8
15 minute summer	Permeable Surface	2.000	Storage Tank	0.0	0.000	0.000	0.0158	
15 minute summer	Permeable Surface	Infiltration		0.0				

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	House	47	49.532	0.032	2.3	0.0215	0.0000	OK
60 minute winter	Storage Tank	47	49.532	0.532	2.3	1.5219	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.915	0.000	0.6	0.0000	0.0000	OK
60 minute winter	Permeable Surface	47	49.532	0.032	0.9	0.2336	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	House	1.000	Storage Tank	2.3	1.117	0.119	0.0250	
60 minute winter	Storage Tank	Orifice	Outfall	0.7				3.3
60 minute winter	Permeable Surface	2.000	Storage Tank	-0.9	-0.181	-0.042	0.0201	
60 minute winter	Permeable Surface	Infiltration		0.0				

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	House	48	49.588	0.088	3.0	0.0598	0.0000	OK
60 minute winter	Storage Tank	49	49.587	0.587	3.0	1.5219	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.915	0.000	0.7	0.0000	0.0000	OK
60 minute winter	Permeable Surface	49	49.588	0.088	2.0	0.9013	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	House	1.000	Storage Tank	3.0	1.117	0.156	0.0380	
60 minute winter	Storage Tank	Orifice	Outfall	0.7				4.4
60 minute winter	Permeable Surface	2.000	Storage Tank	-2.0	-0.345	-0.092	0.0304	
60 minute winter	Permeable Surface	Infiltration		0.0				

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

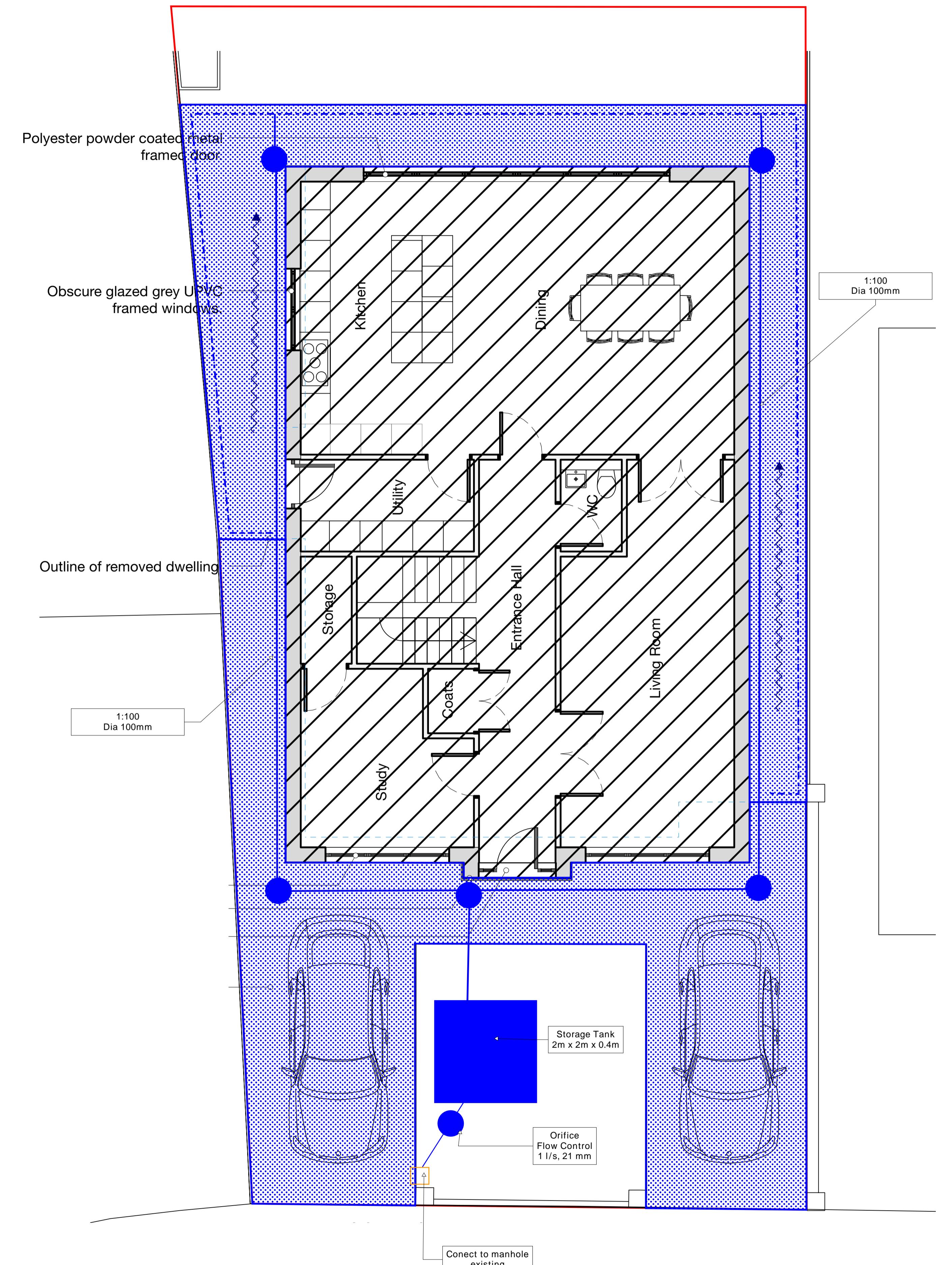
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	House	56	49.692	0.192	4.2	0.1306	0.0000	SURCHARGED
60 minute winter	Storage Tank	56	49.691	0.691	4.0	1.5219	0.0000	SURCHARGED
15 minute summer	Outfall	1	48.915	0.000	0.7	0.0000	0.0000	OK
60 minute winter	Permeable Surface	56	49.691	0.191	3.2	2.1455	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	House	1.000	Storage Tank	4.0	1.233	0.210	0.0393	
60 minute winter	Storage Tank	Orifice	Outfall	0.8				6.1
60 minute winter	Permeable Surface	2.000	Storage Tank	-3.2	-0.483	-0.149	0.0315	
60 minute winter	Permeable Surface	Infiltration		0.0				



Appendix D





Do not scale from this drawing. Refer to figured dimensions only. RIDA Reports Ltd registered in England and Wales No. 10590566. This drawing is copyright of RIDA Reports Ltd.

Drawing Scale Bar	
Drawing scale	Line length
1:5	= 0.25 metres
1:10	= 0.5 metres
1:20	= 1.0 metres
1:25	= 1.25 metres
1:50	= 2.5 metres
1:100	= 5.0 metres
1:100	= 10.0 metres
1:250	= 12.5 metres
1:500	= 25.0 metres
1:1000	= 50.0 metres
1:1250	= 62.5 metres
1:2500	= 125.0 metres
Measure length of line above for checking of scale	

GENERAL NOTES

- All dimensions are in millimetres and levels in m AOD unless stated otherwise.
- Do not scale. If in any doubt, consult Engineer.
- Read in conjunction with the architects and engineers schedule drawings.
- Check inverts and sizes of existing pipes prior to the commencement of any work. Report any discrepancies to the engineer and await instructions.
- The location of services is shown as indicative. This drawing should be read in conjunction with the utilities drawings. Note that the engineer can give. The contractor shall take all necessary measures to satisfy himself as to the location of the existing services and connection points. Excavation should be undertaken in compliance with HSG47.
- Concrete structures design sulphate class and ACEC concrete class unknown.
- Pipework to be 110mm Thermoplastics U-PVC (Polypipe or similar) installed at levels marked on this drawing. Pipe bedding should be class Z in pipes within 1.5m of the building or shallower than 700mm below ground level. For all other areas the pipe bedding should be class Z.
- Joints and fittings for gravity sewers shall comply with the relevant provisions of BS EN 1401-1, BS EN 1852 and BS EN 12666-1. Pipes shall have a limit of 6% deformation. Pipes shall be SN8 ring stiffness and stamped accordingly. Pipe sections shall not be longer than 3m.
- Plastic chambers and rings, including demarcation chambers, shall comply with BS EN 3598-1 or BS EN 13598-2 as appropriate.
- Inspection chamber covers and frames shall comply with the relevant provisions of BS EN 124 and should be double sealed.
- All inspection chamber covers shall be the non-ventilating type and shall have closed keyways.
- Testing of pipelines should be as follow:
- Gravity Pipework: Air pipe testing. Pipework should withstand a pressure of 100mm water gauge and this should not fall by more than 25mm in a 5 minute period. Hand where the air will not escape. Pipework should withstand a pressure of 50mm water gauge and this should not fall by more than 12mm in a 5 minute period. It is recommended that pipework installations are tested in sections rather than waiting to complete in one operation.
- Manhole covers to be set square to the building. Covers of existing manholes to be adjusted to match final ground levels.
- Granular Bedding for pipes shall be constructed by spreading and compacting granular bedding material over the area of the pipe bed. After bedding has been laid, additional granular material shall, if required, be placed and compacted equally on each side of the pipes and, where practicable, this shall be done in sequence with the removal of the trench supports.

Rev	Details	Date	By	Chkd
Drawing Status:				

PRELIMINARY



KEY

- Proposed Surface Water Sewer Pipe
- Exceedance Flows
- Permeable Paving 60mm Block Paving, 50mm Grids, 350mm Type 3
- Silt Trap
- Perforated Pipe

Client:

Project:

1 Burford Close, Ickenham, Uxbridge, UB10 8EH

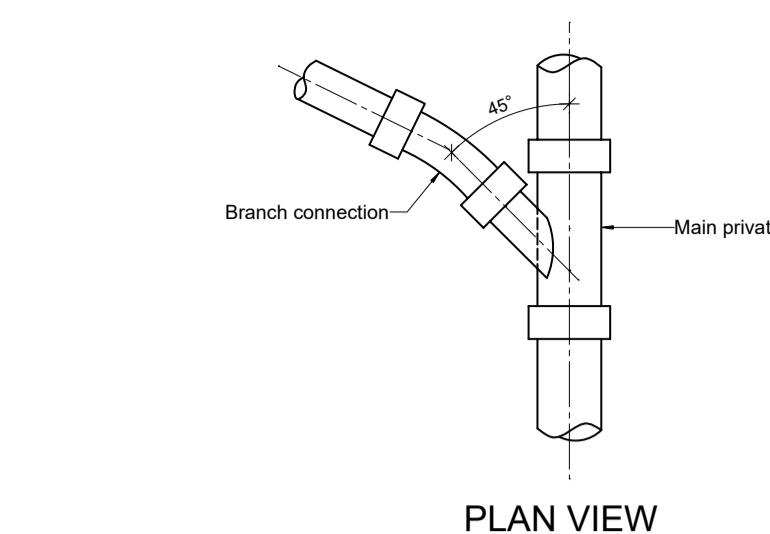
Drawing:

Proposed Drainage Strategy

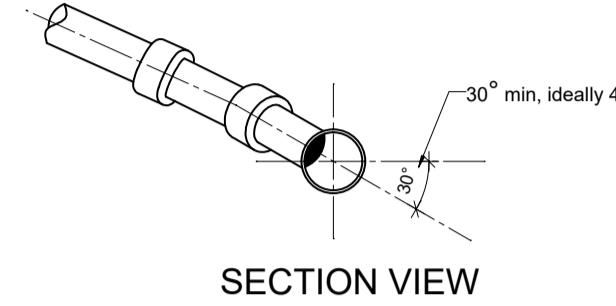
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Print Size: Project No: Drawing No: Revision:

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PLAN VIEW

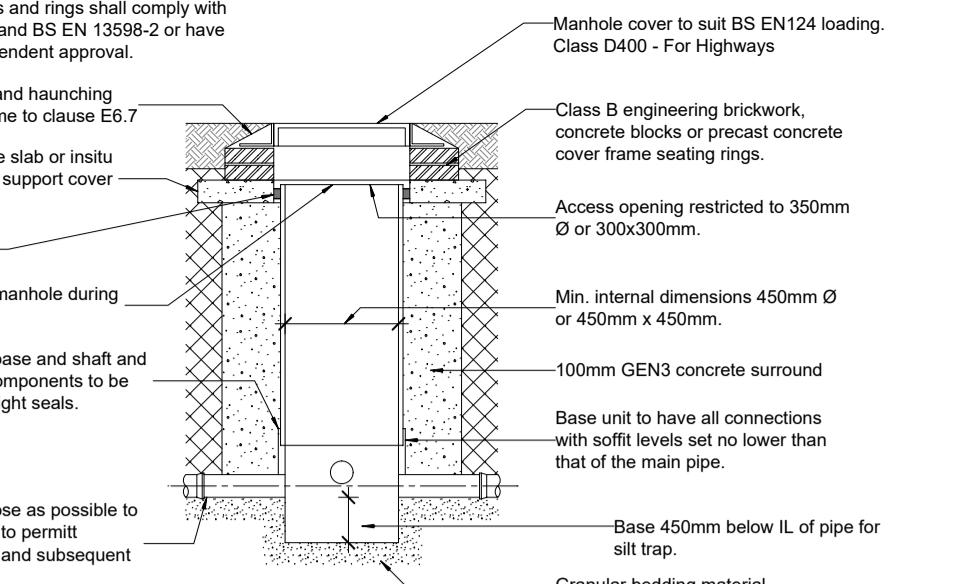
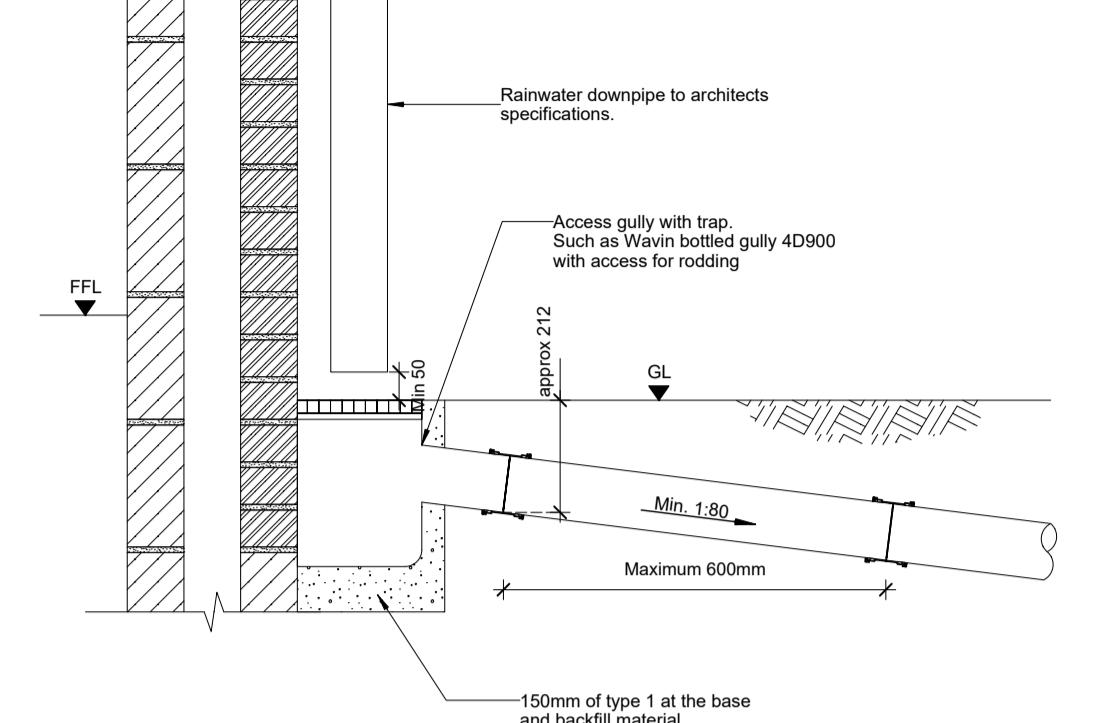


SECTION VIEW

NOTES:

1. The vertical angle between the connecting pipe and the horizontal should be greater than 0° and not more than 60°.
2. Where the connection is being made to a sewer with a nominal internal diameter of 300 mm or less, connections should be made using 45° angle, or 90° angle, curved square junctions.
3. Connections made with junction fittings should be made by cutting the existing pipe, inserting the junction fitting and jointing with flexible repair couplings or slip couplers.

Lateral Connection to private sewer

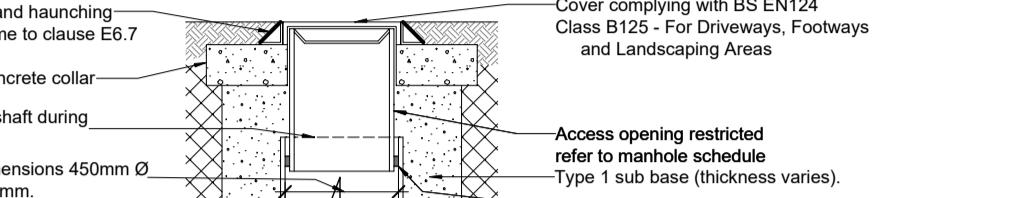


Typical Section in areas subject to vehicle loading

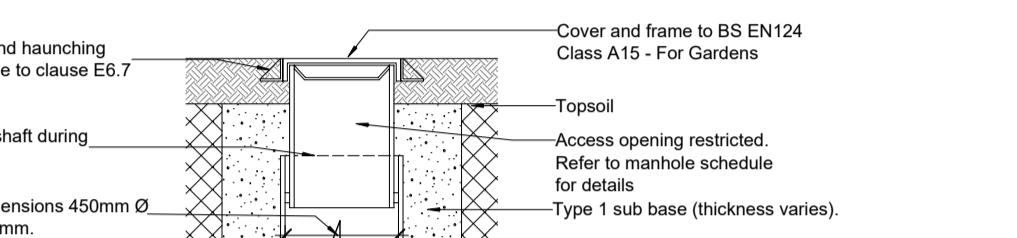
NOTES:

1. This details shows the standard generic arrangement.
2. The pipe and connector details will be different for each manufacturer of the components. They are to be installed in accordance with the manufacturers recommendations.

8250 - External Rainwater (High Level)



Sited in domestic driveways or footways

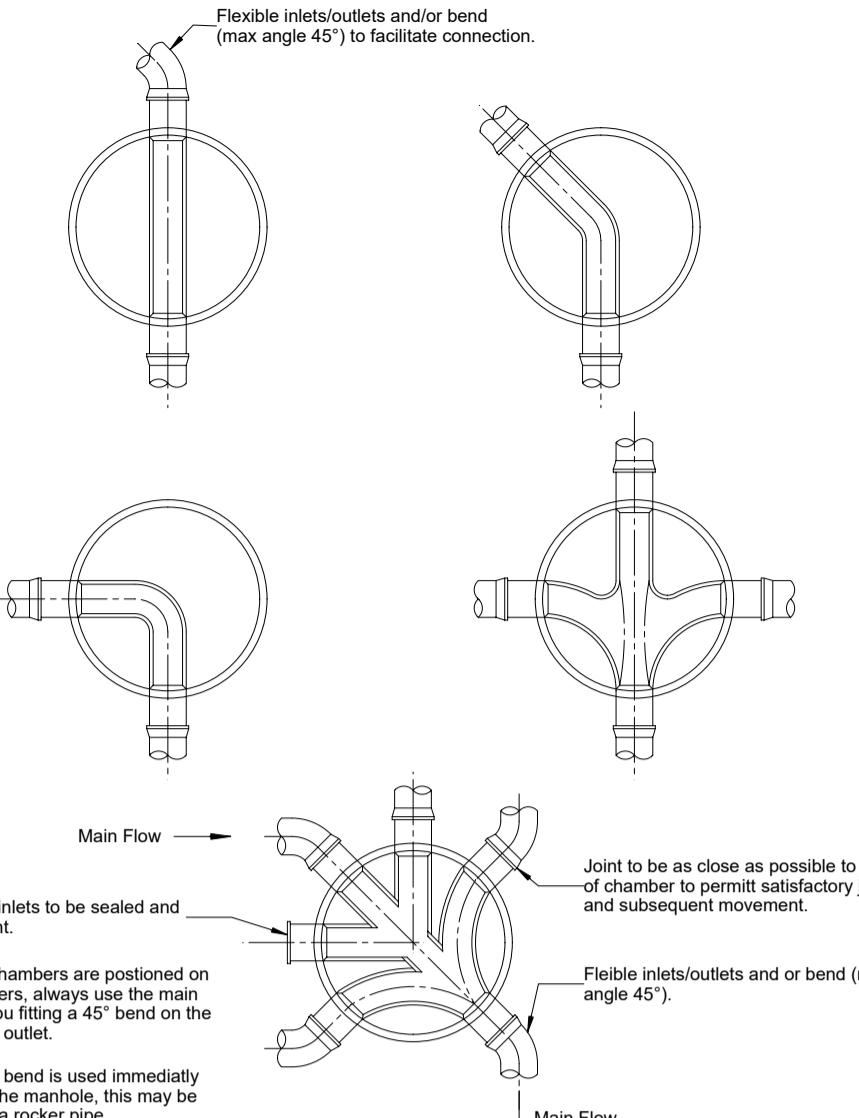


Sited in private garden - No loading

NOTES:

1. Refer to drawing 8193 for base layouts.

Silt Trap Plastic

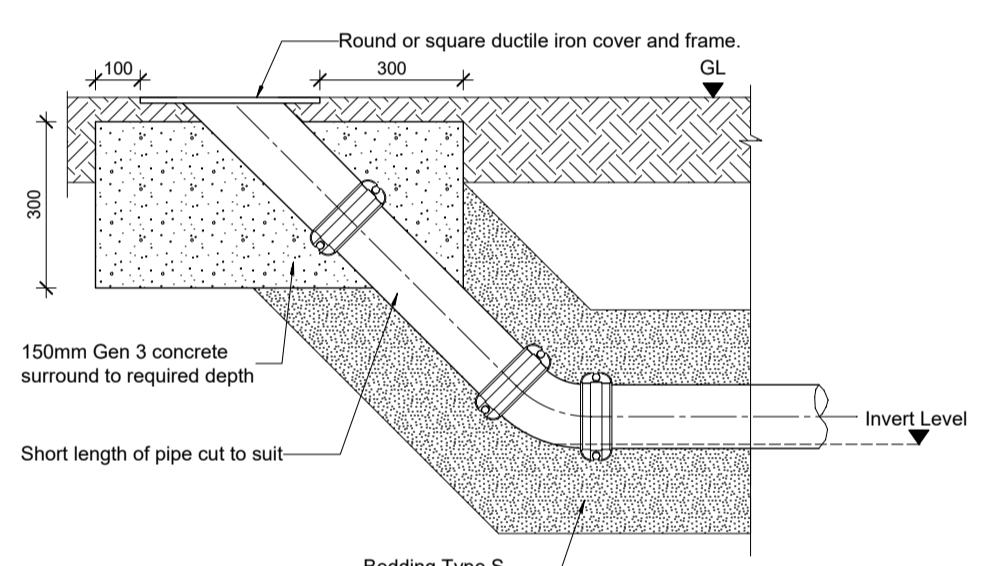


Chamber Type 3 Base Layouts

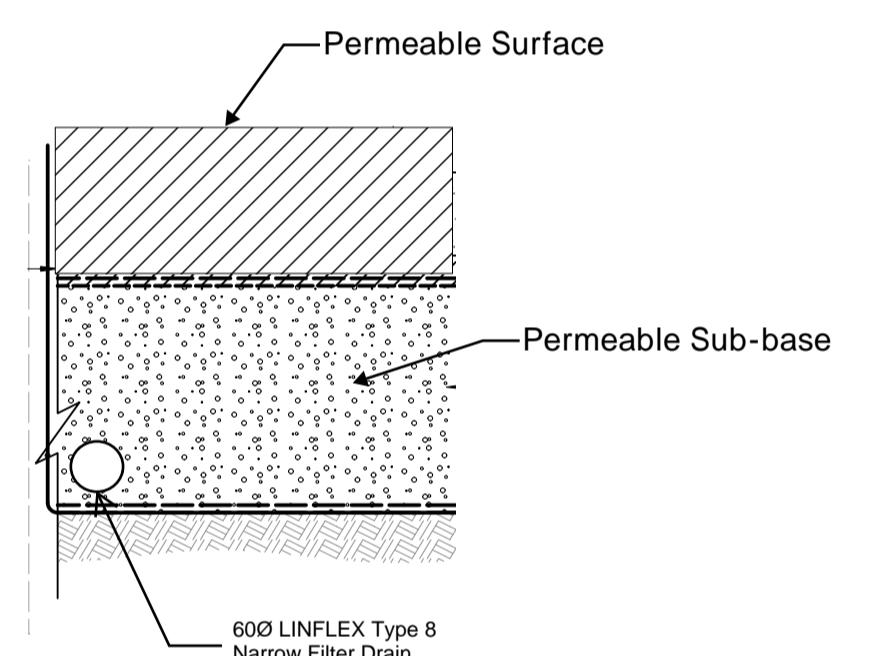
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Drawing Scale Bar	
Drawing scale	Line length
1:5 = 0.25 metres	1:200 = 10.0 metres
1:10 = 0.5 metres	1:250 = 12.5 metres
1:20 = 1.25 metres	1:500 = 25.0 metres
1:25 = 1.25 metres	1:1000 = 50.0 metres
1:50 = 2.5 metres	1:1250 = 62.5 metres
1:100 = 5.0 metres	1:2500 = 125.0 metres
Measure length of line above for checking of scale	

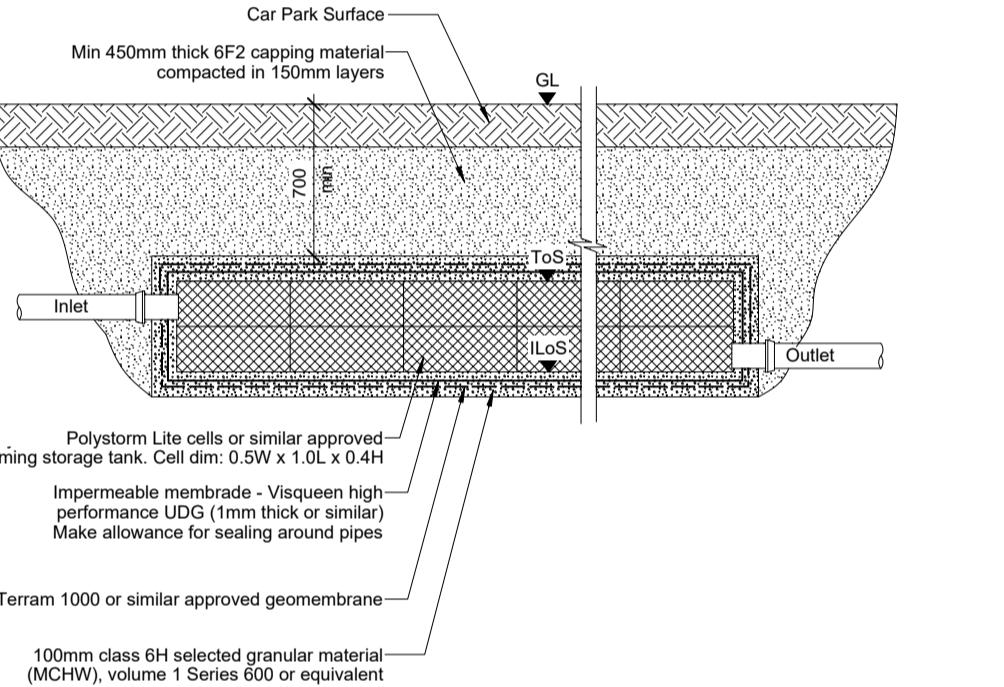
GENERAL NOTES



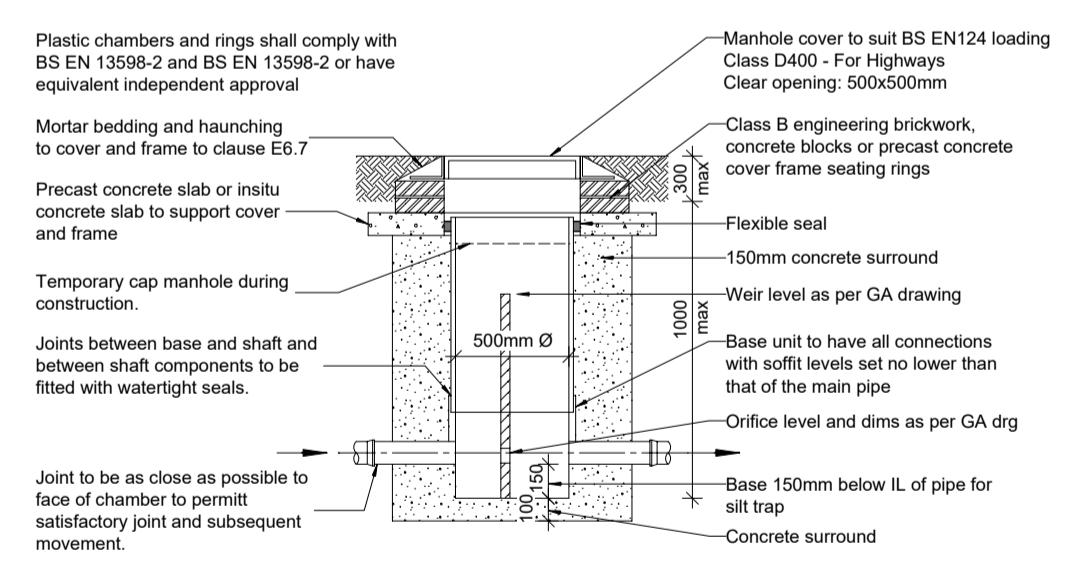
External Rodding Eye Detail



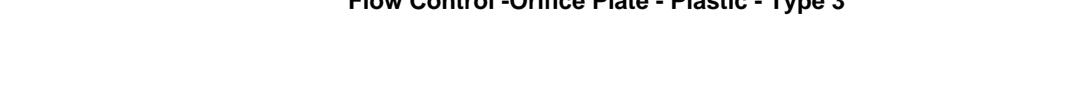
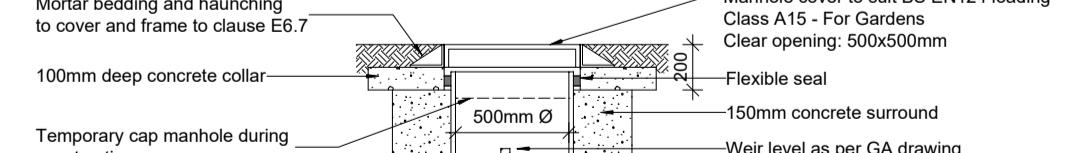
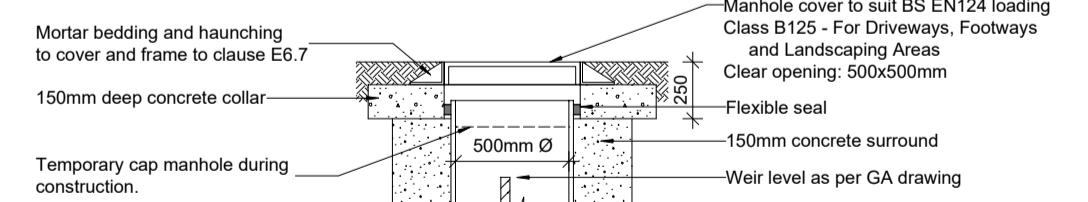
Perforated Pipe within sub-base



Cellular Attenuation System - Landscape Area



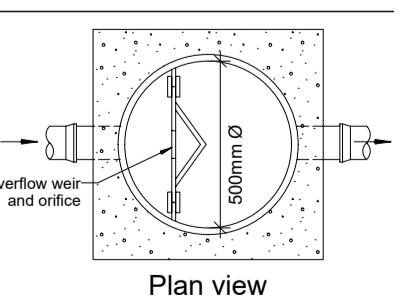
Typical Section in areas subject to vehicle loading



NOTES:

1. Refer to GA drg for pipe layout.
2. Chamber can be fabricated by Selef Environmental UK.

Flow Control -Orifice Plate - Plastic - Type 3



Drawing Status: PRELIMINARY



Client: _____

Project: _____

1 Burford Close, Ickenham, Uxbridge, UB10 8EH

Drawing: _____

Standard Details

Print Size: _____ Project No: _____ Drawing No: _____ Revision: _____

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