



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.653	0.053	3.8	0.0518	0.0000	OK
15 minute summer	ic2	9	15.482	0.032	7.4	0.0587	0.0000	OK
15 minute summer	Sewer	9	14.381	0.031	7.4	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	3.8	0.925	0.233	0.0740	
15 minute summer	ic2	1.001	Sewer	7.4	2.732	0.095	0.0158	2.3



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.687	0.087	9.2	0.0848	0.0000	OK
15 minute summer	ic2	9	15.501	0.051	17.9	0.0935	0.0000	OK
15 minute summer	Sewer	9	14.399	0.049	17.9	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	9.2	1.163	0.565	0.1411	
15 minute summer	ic2	1.001	Sewer	17.9	3.478	0.230	0.0301	5.5



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.702	0.102	11.9	0.0999	0.0000	OK
15 minute summer	ic2	9	15.509	0.059	23.2	0.1081	0.0000	OK
15 minute summer	Sewer	9	14.406	0.056	23.2	0.0000	0.0000	OK
	Depth/Area 1							

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	11.9	1.232	0.731	0.1712	
15 minute summer	ic2	1.001	Sewer	23.2	3.720	0.298	0.0364	7.2



**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.717	0.117	14.3	0.1143	0.0000	OK
15 minute summer	ic2	9	15.516	0.066	27.9	0.1203	0.0000	OK
15 minute summer	Sewer	9	14.412	0.062	27.9	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	14.3	1.272	0.878	0.1973	
15 minute summer	ic2	1.001	Sewer	27.9	3.896	0.359	0.0419	8.6



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.735	0.135	16.7	0.1325	0.0000	OK
15 minute summer	ic2	9	15.522	0.072	32.6	0.1321	0.0000	OK
15 minute summer	Sewer	9	14.418	0.068	32.6	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	16.7	1.281	1.024	0.2237	
15 minute summer	ic2	1.001	Sewer	32.6	4.044	0.419	0.0471	10.1

# INFILTRATION



**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	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)	2.00	Enforce best practice design rules	✓

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
ic1	0.020	2.00	16.160	600	440	568869.272	182379.460	0.560
ic2	0.019	2.00	16.000	2100		568877.428	182363.662	0.550

**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	ic1	ic2	17.779	0.600	15.600	15.450	0.150	118.5	150	2.32	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	0.922	16.3	2.7	0.410	0.400	0.020	0.0	41	0.684

**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)	0.0
Summer CV	0.750	30 year (l/s)	0.1
Winter CV	0.840	100 year (l/s)	0.2
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	8

**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
30	0	0	0
100	0	0	0
100	20	0	0
100	40	0	0



**Pre-development Discharge Rate**

Site Makeup	Greenfield	Growth Factor 30 years	2.40
Greenfield Method	IH124	Growth Factor 100 years	3.19
Positively Drained Area (ha)	0.031	Betterment (%)	0
SAAR (mm)	599	QBar	0.0
Soil Index	2	Q 1 year (l/s)	0.0
SPR	0.30	Q 30 year (l/s)	0.1
Region	6	Q 100 year (l/s)	0.2
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	0.031	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.280
CWI	90.222	Runoff Volume (m <sup>3</sup> )	8

**Node ic2 Lined Soakaway Storage Structure**

Base Inf Coefficient (m/hr)	0.00003	Invert Level (m)	13.200	Pit Length (m)	3.500
Side Inf Coefficient (m/hr)	0.00003	Time to half empty (mins)	2058824	Depth (m)	
Safety Factor	2.0	Ring Diameter (m)	2.100	Inf Depth (m)	
Porosity	1.00	Pit Width (m)	3.500	Number Required	1





**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.79%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.650	0.050	3.8	0.0493	0.0000	OK
600 minute winter	ic2	600	13.905	-1.545	0.6	8.6376	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	3.8	0.741	0.232	0.0905
600 minute winter	ic2	Infiltration		0.0			



**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.79%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.684	0.084	9.2	0.0824	0.0000	OK
1440 minute winter	ic2	1410	15.109	-0.341	0.6	23.3913	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	9.2	0.930	0.565	0.1759
1440 minute winter	ic2	Infiltration		0.0			



**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.79%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.700	0.100	11.9	0.0981	0.0000	OK
1440 minute winter	ic2	1470	15.521	0.071	0.8	28.7255	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	11.9	0.982	0.731	0.2154
1440 minute winter	ic2	Infiltration		0.0			



**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.79%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
1440 minute winter	ic1	1470	15.736	0.136	0.5	0.1327	0.0000	OK
1440 minute winter	ic2	1410	15.735	0.285	1.0	32.2473	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )
1440 minute winter	ic1	1.000	ic2	0.5	0.415	0.031	0.3055
1440 minute winter	ic2	Infiltration		0.0			



**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.79%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
1440 minute winter	ic1	1560	16.000	0.400	0.6	0.3915	0.0000	FLOOD RISK
1440 minute winter	ic2	1410	16.000	0.550	1.1	36.5873	0.3648	FLOOD

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )
1440 minute winter	ic1	1.000	ic2	0.6	0.439	0.037	0.3130
1440 minute winter	ic2	Infiltration		0.0			

# ATTENUATION



**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	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)	2.00	Enforce best practice design rules	✓

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
ic1	0.020	2.00	16.160	600	440	568869.272	182379.460	0.560
ic2	0.019	2.00	16.000	1800		568877.428	182363.662	0.550
Sewer			15.620			568880.003	182358.418	1.270
Depth/Area 1						568877.345	182363.993	

**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	ic1	ic2	17.779	0.600	15.600	15.450	0.150	118.5	150	2.32	50.0
1.001	ic2	Sewer	5.842	0.600	15.450	14.350	1.100	5.3	60	2.36	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)
1.000	0.922	16.3	2.7	0.410	0.400	0.020	0.0
1.001	2.405	6.8	5.3	0.490	1.210	0.039	0.0

**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)	5.0
Summer CV	0.750	30 year (l/s)	5.0
Winter CV	0.840	100 year (l/s)	5.0
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	15

**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
30	0	0	0
100	0	0	0
100	20	0	0
100	40	0	0



**Pre-development Discharge Rate**

Site Makeup	Greenfield	Growth Factor 30 years	2.40
Greenfield Method	IH124	Growth Factor 100 years	3.19
Positively Drained Area (ha)	0.060	Betterment (%)	0
SAAR (mm)	599	QBar	0.1
Soil Index	2	Q 1 year (l/s)	0.1
SPR	0.30	Q 30 year (l/s)	0.2
Region	6	Q 100 year (l/s)	0.3
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	0.060	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.280
CWI	90.222	Runoff Volume (m <sup>3</sup> )	15

**Node ic2 Online Pump Control**

Flap Valve	x	Invert Level (m)	11.000	Switch off depth (m)	0.250
Replaces Downstream Link	✓	Switch on depth (m)	4.000		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.050	0.000	0.500	5.000	4.500	5.000

**Node ic2 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	11.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	40

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	2.5	0.0	4.500	2.5	0.0	4.501	0.0	0.0





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Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.650	0.050	3.8	0.0493	0.0000	OK
600 minute winter	ic2	600	14.455	-0.995	0.6	8.6387	0.0000	OK
15 minute summer	Sewer	1	14.350	0.000	0.0	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	3.8	0.741	0.232	0.0905	
600 minute winter	ic2	Pump	Sewer	0.0				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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.684	0.084	9.2	0.0824	0.0000	OK
60 minute winter	ic2	59	15.000	-0.450	7.0	10.0009	0.0000	OK
15 minute summer	Sewer	1	14.350	0.000	0.0	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	9.2	0.930	0.565	0.1759	
60 minute winter	ic2	Pump	Sewer	5.0				9.3



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.700	0.100	11.9	0.0981	0.0000	OK
60 minute winter	ic2	40	15.031	-0.419	9.3	10.0767	0.0000	OK
15 minute summer	Sewer	1	14.350	0.000	0.0	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	11.9	0.982	0.731	0.2154	
60 minute winter	ic2	Pump	Sewer	5.0				12.6



**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.716	0.116	14.3	0.1135	0.0000	OK
60 minute winter	ic2	42	15.428	-0.022	11.1	11.0705	0.0000	OK
15 minute summer	Sewer	1	14.350	0.000	0.0	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	14.3	1.010	0.876	0.2509	
60 minute winter	ic2	Pump	Sewer	5.0				15.3



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
60 minute winter	ic1	42	15.755	0.155	6.7	0.1511	0.0000	SURCHARGED
60 minute winter	ic2	43	15.751	0.301	13.0	12.2255	0.0000	FLOOD RISK
15 minute summer	Sewer	1	14.350	0.000	5.0	0.0000	0.0000	OK
Depth/Area 1								

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
60 minute winter	ic1	1.000	ic2	6.7	0.861	0.409	0.3130	
60 minute winter	ic2	Pump	Sewer	5.0				17.9

# PUMP SOLUTION



**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	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)	2.00	Enforce best practice design rules	✓

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
ic1	0.020	2.00	16.160	600	440	568869.272	182379.460	0.560
ic2	0.019	2.00	16.000	1800		568877.428	182363.662	0.550
Sewer			15.620			568880.003	182358.418	1.270

**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	ic1	ic2	17.779	0.600	15.600	15.450	0.150	118.5	150	2.32	50.0
1.001	ic2	Sewer	5.842	0.600	15.450	14.350	1.100	5.3	60	2.36	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	0.922	16.3	2.7	0.410	0.400	0.020	0.0	41	0.684
1.001	2.405	6.8	5.3	0.490	1.210	0.039	0.0	40	2.660

**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)	2.5
Summer CV	0.750	30 year (l/s)	2.5
Winter CV	0.840	100 year (l/s)	2.5
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	7

**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
30	0	0	0
100	0	0	0
100	20	0	0
100	40	0	0



**Pre-development Discharge Rate**

Site Makeup	Greenfield	Growth Factor 30 years	2.40
Greenfield Method	IH124	Growth Factor 100 years	3.19
Positively Drained Area (ha)	0.030	Betterment (%)	0
SAAR (mm)	599	QBar	0.0
Soil Index	2	Q 1 year (l/s)	0.0
SPR	0.30	Q 30 year (l/s)	0.1
Region	6	Q 100 year (l/s)	0.1
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	0.030	Storm Duration (mins)	360
Soil Index	2	Betterment (%)	0
SPR	0.30	PR	0.280
CWI	90.222	Runoff Volume (m <sup>3</sup> )	7

**Node ic2 Online Pump Control**

Flap Valve	x	Invert Level (m)	11.000	Switch off depth (m)	0.250
Replaces Downstream Link	✓	Switch on depth (m)	4.000		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.050	0.000	0.500	2.500	4.500	2.500

**Node ic2 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	11.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	78

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	2.5	0.0	4.500	2.5	0.0	4.501	0.0	0.0





**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.650	0.050	3.8	0.0493	0.0000	OK
600 minute winter	ic2	600	14.455	-0.995	0.6	8.6387	0.0000	OK
15 minute summer	Sewer	1	14.350	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 (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	3.8	0.741	0.232	0.0905	
600 minute winter	ic2	Pump	Sewer	0.0				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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.684	0.084	9.2	0.0824	0.0000	OK
240 minute winter	ic2	144	15.001	-0.449	2.5	10.0015	0.0000	OK
15 minute summer	Sewer	1	14.350	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 (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	9.2	0.930	0.565	0.1759	
240 minute winter	ic2	Pump	Sewer	2.5				13.9



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute summer	ic1	9	15.700	0.100	11.9	0.0981	0.0000	OK
120 minute winter	ic2	82	15.449	-0.001	5.6	11.1239	0.0000	OK
15 minute summer	Sewer	1	14.350	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 (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute summer	ic1	1.000	ic2	11.9	0.982	0.731	0.2154	
120 minute winter	ic2	Pump	Sewer	2.5				15.5



**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
120 minute winter	ic1	84	15.852	0.252	3.4	0.2467	0.0000	SURCHARGED
120 minute winter	ic2	84	15.851	0.401	6.7	12.5513	0.0000	FLOOD RISK
15 minute summer	Sewer	1	14.350	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 (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
120 minute winter	ic1	1.000	ic2	3.4	0.721	0.209	0.3130	
120 minute winter	ic2	Pump	Sewer	2.5				18.6



**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 (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
120 minute winter	ic1	72	16.007	0.407	4.0	0.3984	0.0000	FLOOD RISK
120 minute winter	ic2	72	16.000	0.550	7.8	13.0327	1.7365	FLOOD
15 minute summer	Sewer	1	14.350	0.000	2.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
120 minute winter	ic1	1.000	ic2	4.0	0.754	0.246	0.3130	
120 minute winter	ic2	Pump	Sewer	2.5				20.2

# APPENDIX E

## FOUL WATER CALCULATIONS

	PROJECT	CALCULATION SHEET			
	47a Lower Mortlake Road		JOB No.		
	CALCULATION	PAGE			
	Proposed Foul Water Flow Estimate		DATE	29/10/2019	
		BY	JMB	CHECKED	

Foul water discharge rates are to be calculated in accordance with Sewers for Adoption and Urban Drainage (*Butler & Davies, 2nd Ed, 2004*):

**RESIDENTIAL** (Note that minimum design flow of 4000 l/s/unit applies, after recommendations given in SfA)

Description	Units	Persons	G l/hd.day	Infiltration Factor	Peak Flow Factor	Volume l/day/unit	Volume l/day
1 Bed 1 person	16	1	200	1.10	6	4000	21120
1 bed 2 person	0	0	200	1.10	6	4000	0
2 bed 4 person	0	0	200	1.10	6	4000	0
3 bed 6 person			200	1.10	6	4000	0
			200	1.10	6	4000	0
	16					<b>TOTAL:</b>	<b>21120</b>

Anticipated Usage Hours: 24 hrs = 86400 s Estimated Flow (Q<sub>f</sub>): 0.24 l/s

Total flow 0.24 l/s

**APPENDIX F**  
**ENVIRONMENT AGENCY**  
**FLOOD MAP**











### Flood map for planning

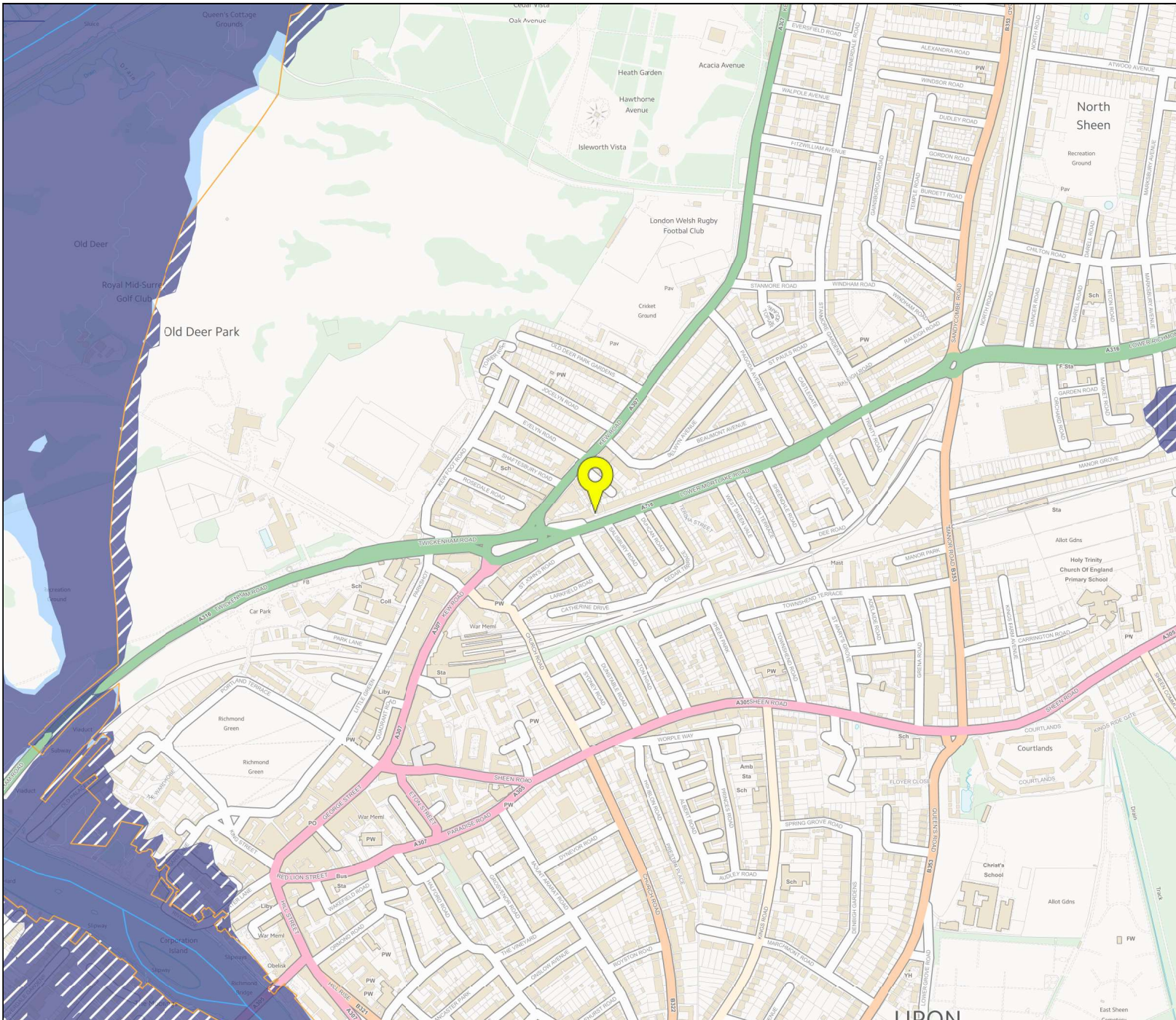
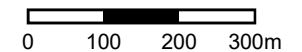
Your reference  
**47a Lower Mor**

Location (easting/northing)  
**518343/175419**

Scale  
**1:10000**

Created  
**9 Sep 2019 16:00**

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



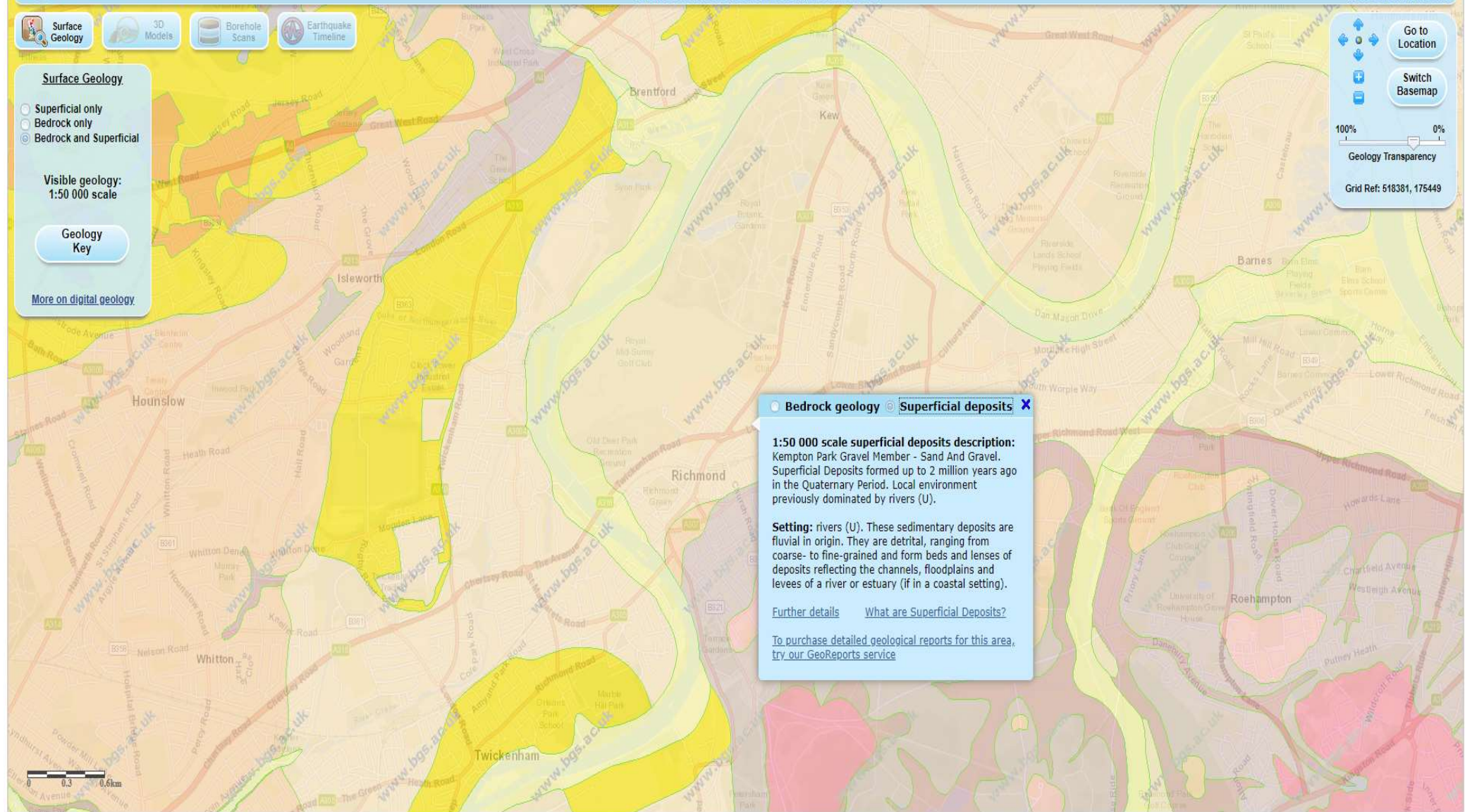
APPENDIX G  
BRITISH GEOLOGICAL SURVEY  
SOILS MAP

# British Geological Survey

## Geology of Britain viewer

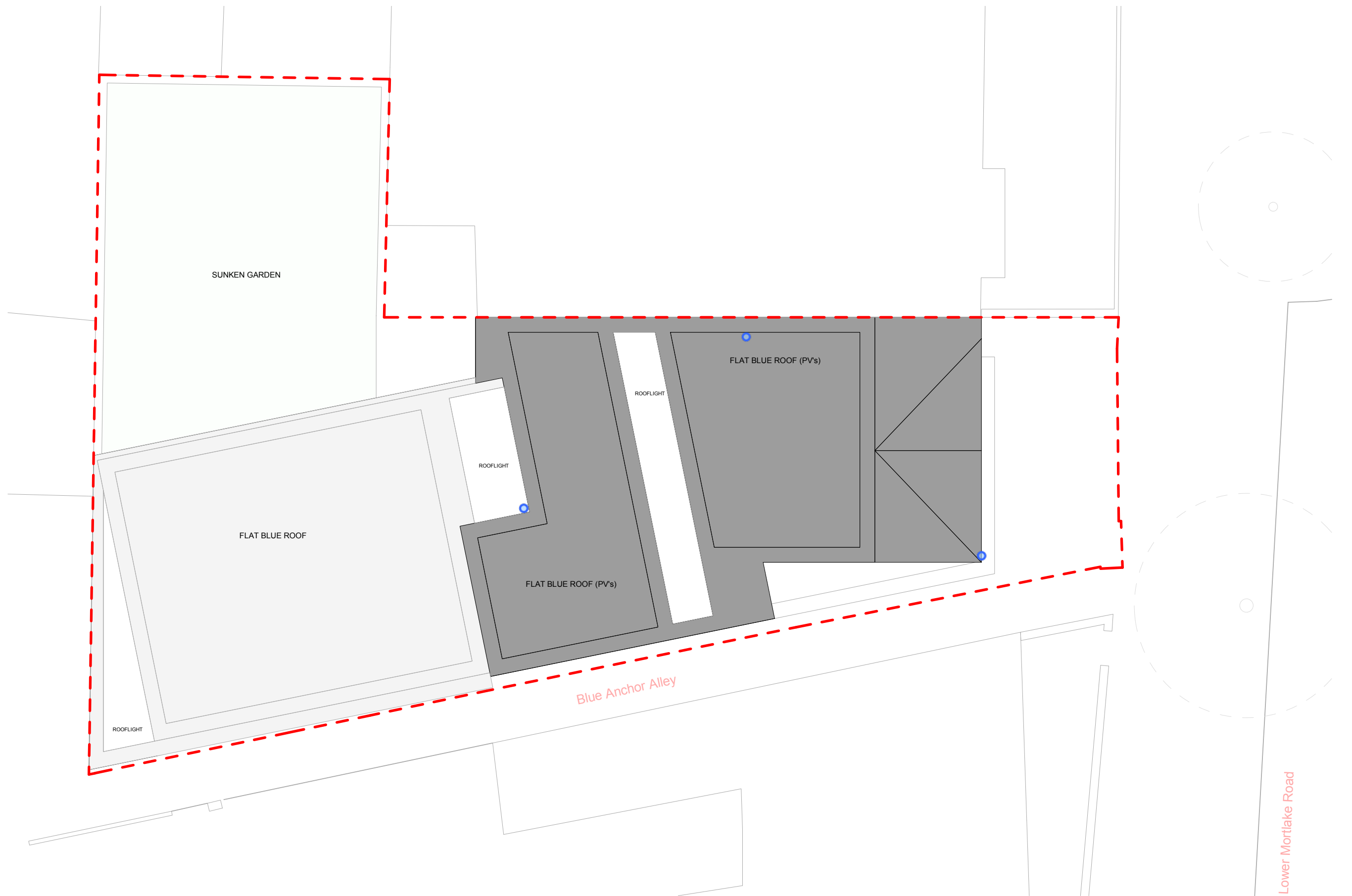
Try the Beta version of our 3D Geology of Britain viewer

More BGS map viewers



# APPENDIX H

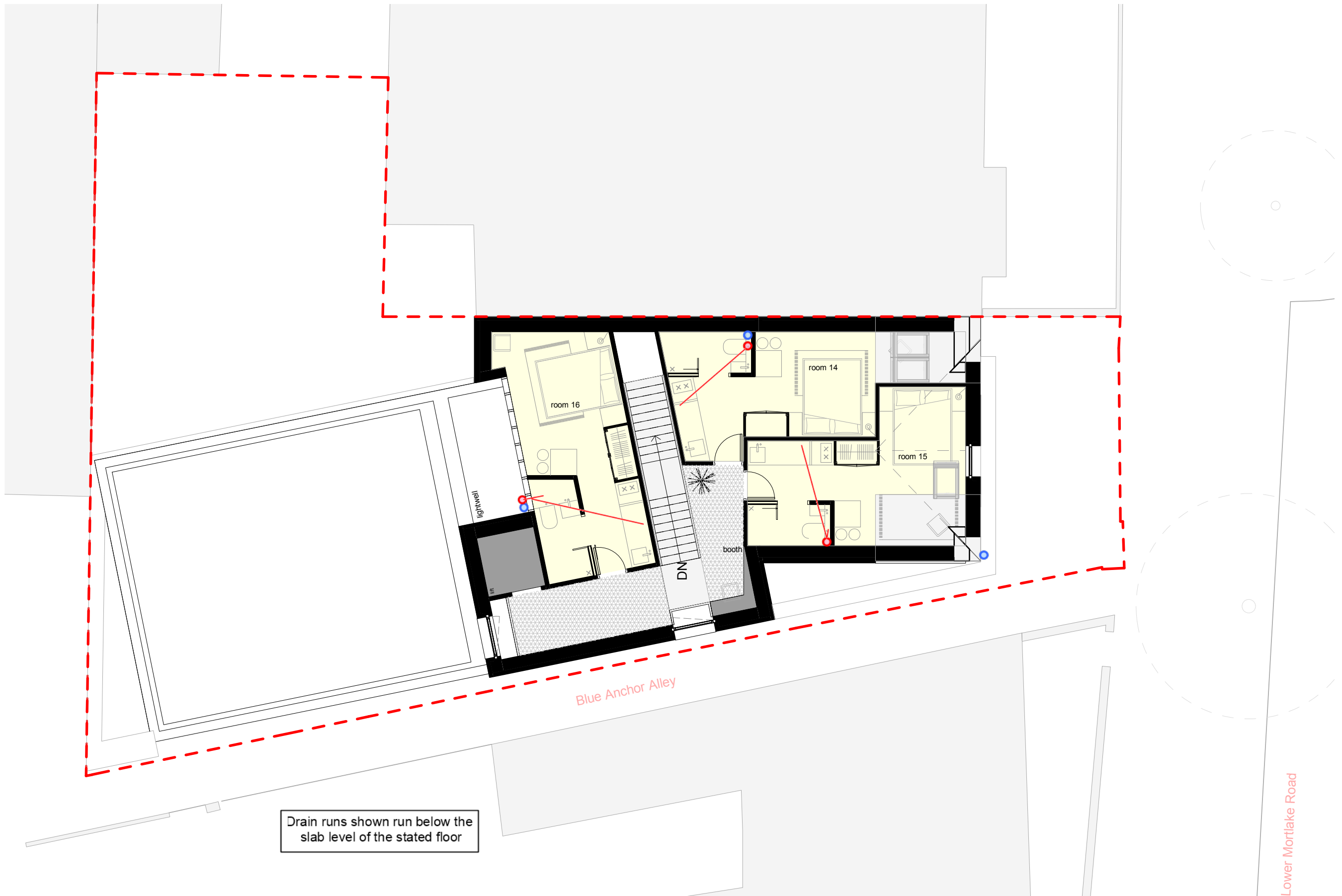
## POSSIBLE DRAINAGE LAYOUT



Roof Level



constructure			
Project 47A LOWER MORTLAKE ROAD			
Project No. 1899	Sheet SK-D01	Rev. P2	
Date 24.10.19	Eng. PRH	Chk.	



Drain runs shown run below the slab level of the stated floor

2nd Floor Level



constructure		
Project 47A LOWER MORTLAKE ROAD		
Project No. 1899	Sheet SK-D01	Rev. P2
Date 24.10.19	Eng. PRH	Chk.

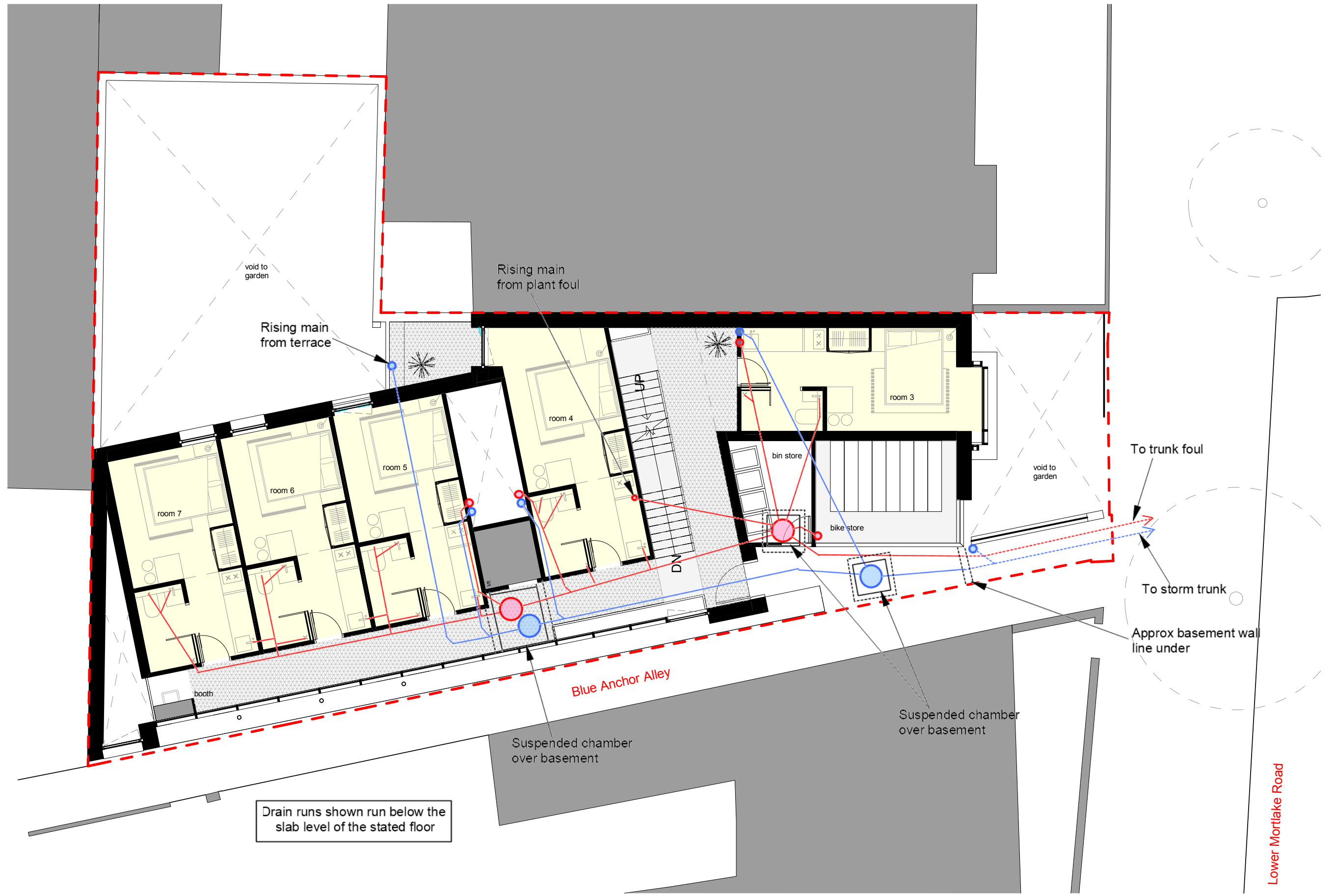


Drain runs shown run below the slab level of the stated floor

1st Floor Level



constructure		
Project 47A LOWER MORTLAKE ROAD		
Project No. 1899	Sheet SK-D01	Rev. P2
Date 24.10.19	Eng. PRH	Chk.



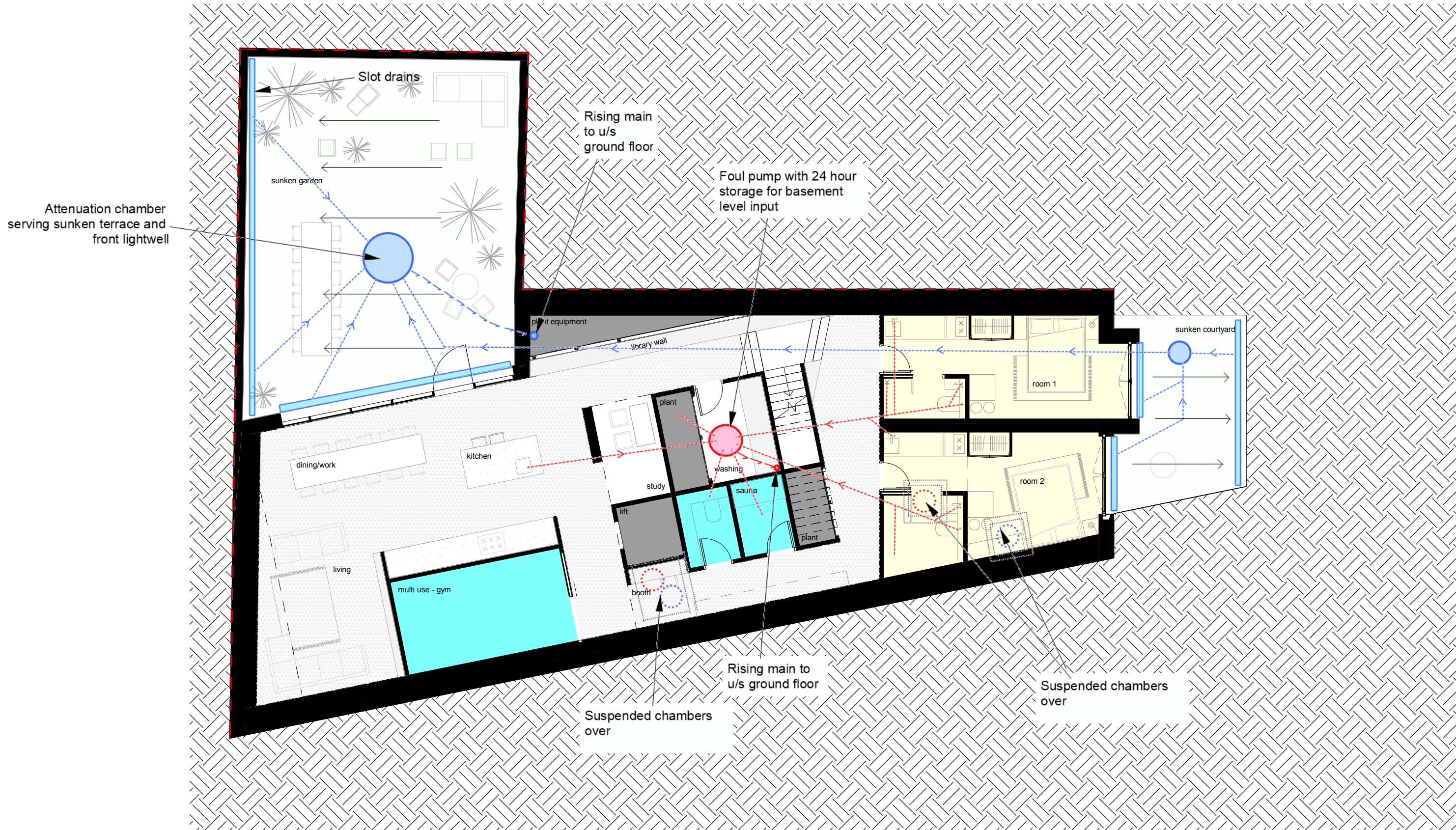
Drain runs shown run below the slab level of the stated floor

Ground Floor Level



constructure		
Project 47A LOWER MORTLAKE ROAD		
Project No. 1899	Sheet SK-D01	Rev. P2
Date 24.10.19	Eng. PRH	Chk.





Drain runs shown run below the slab level of the stated floor

Lower Ground Floor Level



constructure		
Project 47A LOWER MORTLAKE ROAD		
Project No. 1899	Sheet SK-D01	Rev. P2
Date 24.10.19	Eng. PRH	Chk.

# APPENDIX I STORAGE VOLUME CALCULATIONS

Calculated by:

Site name: 47a Lower Mortlake Rd

Site location: Richmond

Site coordinates

Latitude: 51.46540° N

Longitude: 0.29767° W

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Reference:

Date: 2019-08-12 10:43

Methodology	IH124
-------------	-------

## Site characteristics

Total site area (ha)	0.06
Significant public open space (ha)	0
Area positively drained (ha)	0.06
Pervious area contribution (%)	30
Impermeable area (ha)	0.06
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.06
Net impermeable area for storage volume design (ha)	0.06

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

## Design criteria

Volume control approach	Use long term storage	
	Default	Edited
Climate change allowance factor	1.4	1.4
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	5	5
Qbar estimation method	Calculate from SPR and SAAR	
SPR estimation method	Calculate from SOIL type	
	Default	Edited
Qbar total site area (l/s)	0.09	--
SOIL type	2	2
HOST class	N/A	N/A
SPR	0.3	0.3

## Hydrology

	Default	Edited
SAAR (mm)	599	599
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.4	0.4
Rainfall 100 yrs 6 hrs	63	
Rainfall 100 yrs 12 hrs	97.79	
FEH/FSR conversion factor	1.27	1.27
Hydrological region	6	
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 10 year	1.62	1.62
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

## Site discharge rates

	Default	Edited
Qbar total site area (l/s)	0.09	0.09
Qbar net site area (l/s)	0.09	0.09
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	5	5
1 in 100 years (l/s)	5	5

## Estimated storage volumes

	Default	Edited
Interception storage (m <sup>3</sup> )	2	2
Attenuation storage (m <sup>3</sup> )	13	13
Long term storage (m <sup>3</sup> )	0	0
Treatment storage (m <sup>3</sup> )	7	7
Total storage (excluding treatment) (m <sup>3</sup> )	15	15

