

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

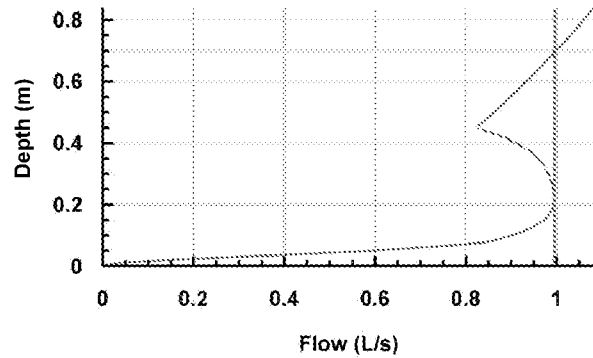
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		9.000	
Depth (m)		1.000	
Base Level (m)		8.000	
Freeboard (mm)		300	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		3.10	
Total Volume (m³)		331.110	
Depth (m)		Area (m²)	Volume (m³)
0.000		400.00	0.000
0.700		550.00	331.110
1.000		650.00	510.901

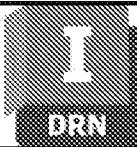
Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.000
Design Depth (m)	0.700
Design Flow (L/s)	1.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1000-0700-1000



Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
	Alistair			
Report Details: Type: Stormwater Controls Storm Phase: Phase		Company Address:		

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		Type: FEH
FEH		
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period	
Return Period (years)	Increase Rainfall (%)
2.0	45.000
Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 2 years: +45 % 15 mins: Summer	0.30	92.6	41.160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 2 years: +45 %: 960 mins: Winter	8.281	8.281	0.281	0.281	7.1	120.483	0.000	0.000	1.0	98.332	63.612	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				

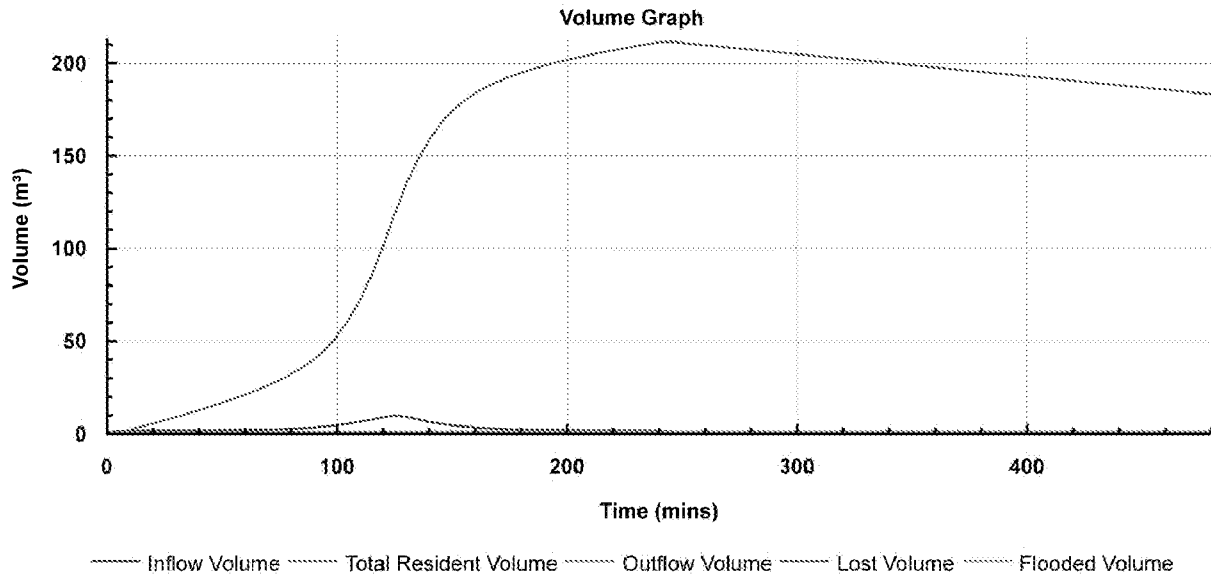
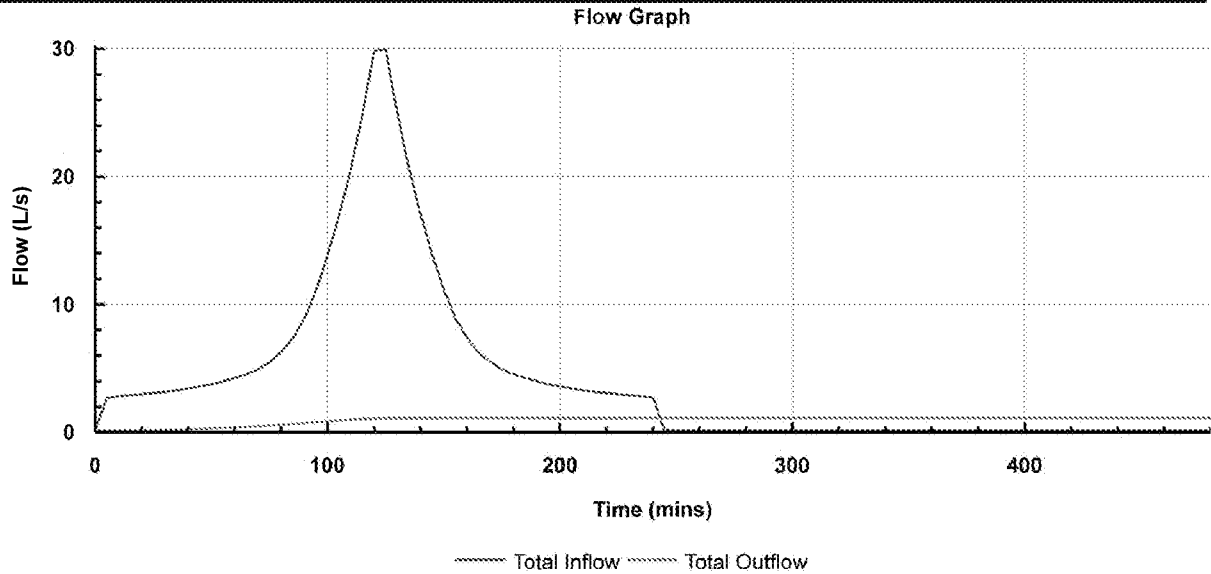


Phase
FEH: 2 years: Increase Rainfall (%): +45: 240 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.0	23.903
TOTAL	29.9	115.432	1.0	23.903

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			

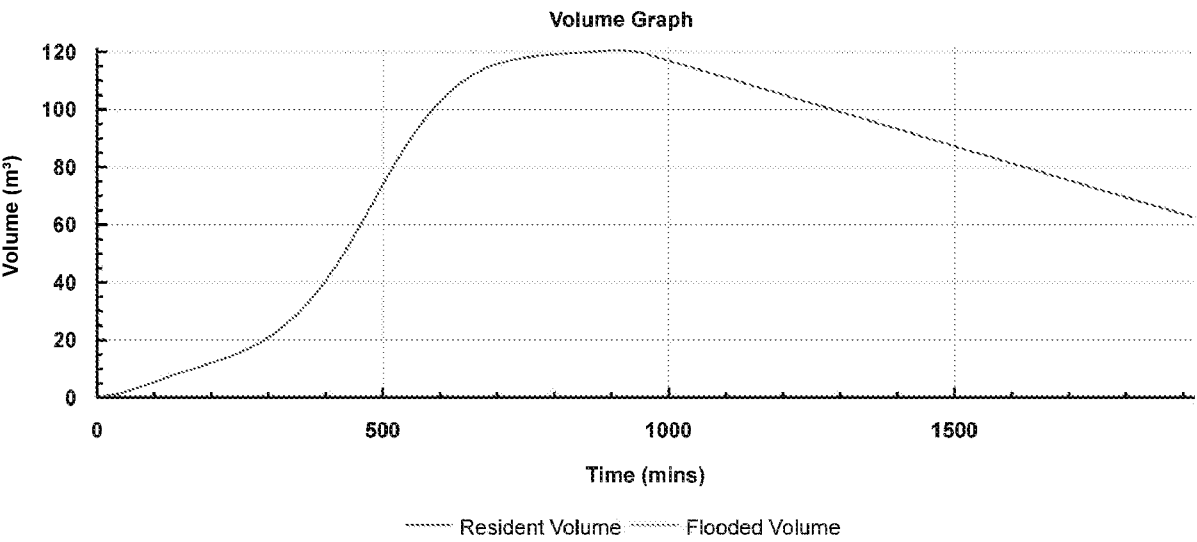
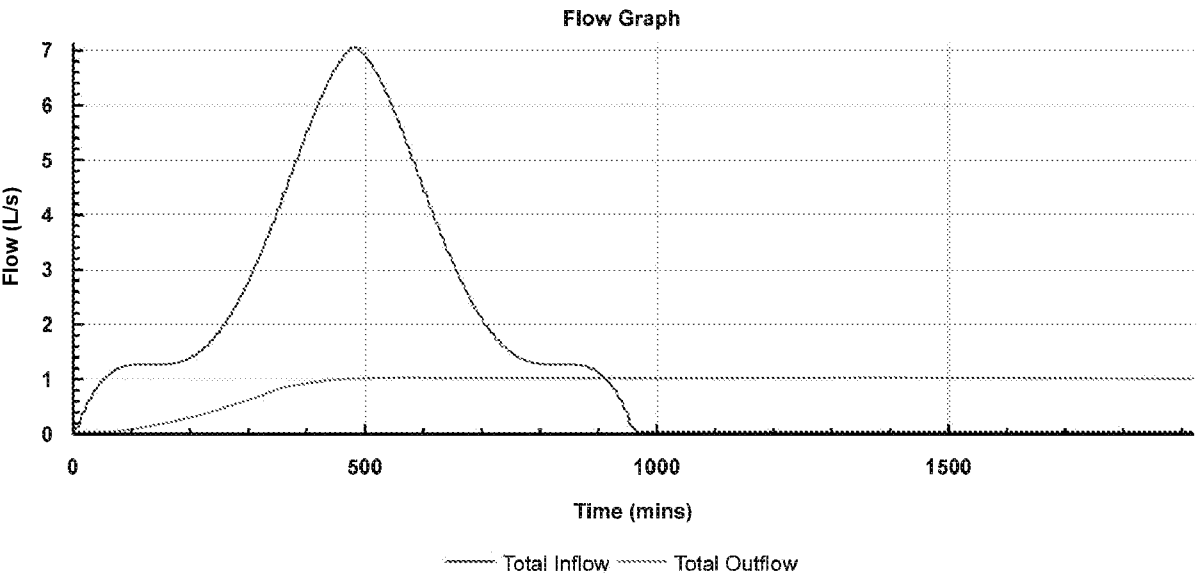


Pond

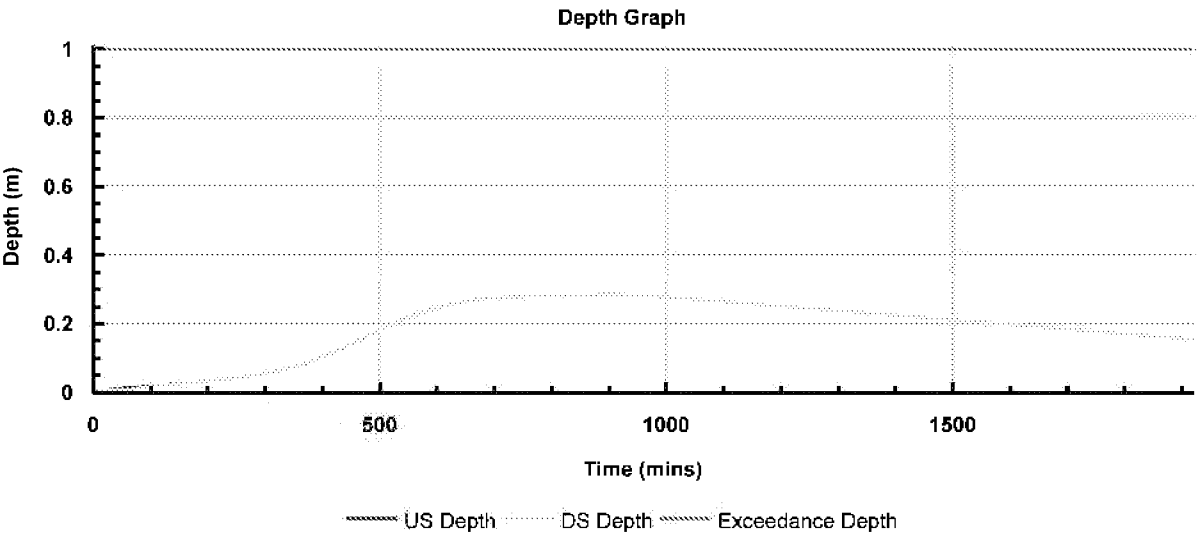
Critical Storm: FEH: 2 years: Increase Rainfall (%): +45: 960 mins: Winter

Type : Pond

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase: Phase				



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Inflows Storm Phase: Phase				



Catchment Area

Type : Catchment Area

Area (ha)	0.30
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Preliminary Sizing

Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

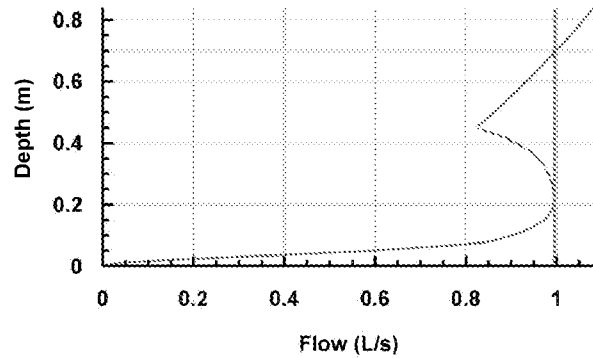
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		9.000	
Depth (m)		1.000	
Base Level (m)		8.000	
Freeboard (mm)		300	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		3.10	
Total Volume (m³)		331.110	
Depth (m)		Area (m²)	Volume (m³)
0.000		400.00	0.000
0.700		550.00	331.110
1.000		650.00	510.901

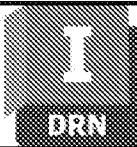
Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.000
Design Depth (m)	0.700
Design Flow (L/s)	1.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1000-0700-1000



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Stormwater Controls Storm Phase: Phase			
Company Address:				

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		
FEH	Type: FEH	
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period	
Return Period (years)	Increase Rainfall (%)
30.0	45.000
Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 30 years: +45 % 15 mins: Summer	0.30	199.9	88.116

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 30 years: +45 %: 960 mins: Winter	8.523	8.523	0.523	0.523	12.3	237.292	0.000	0.000	1.0	91.457	28.334	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				



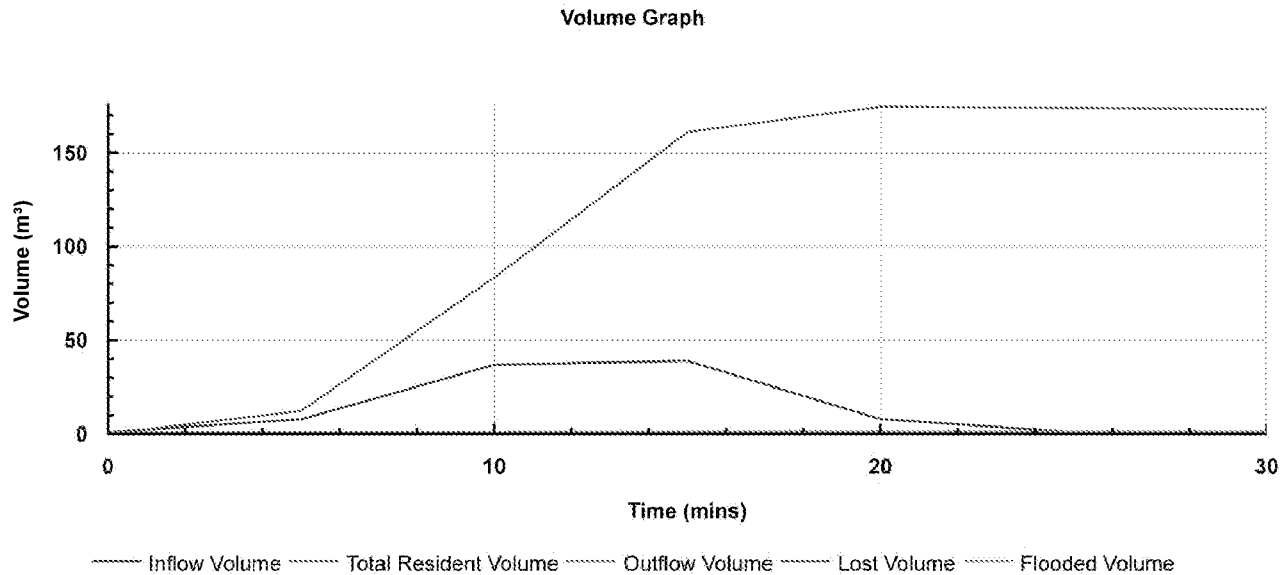
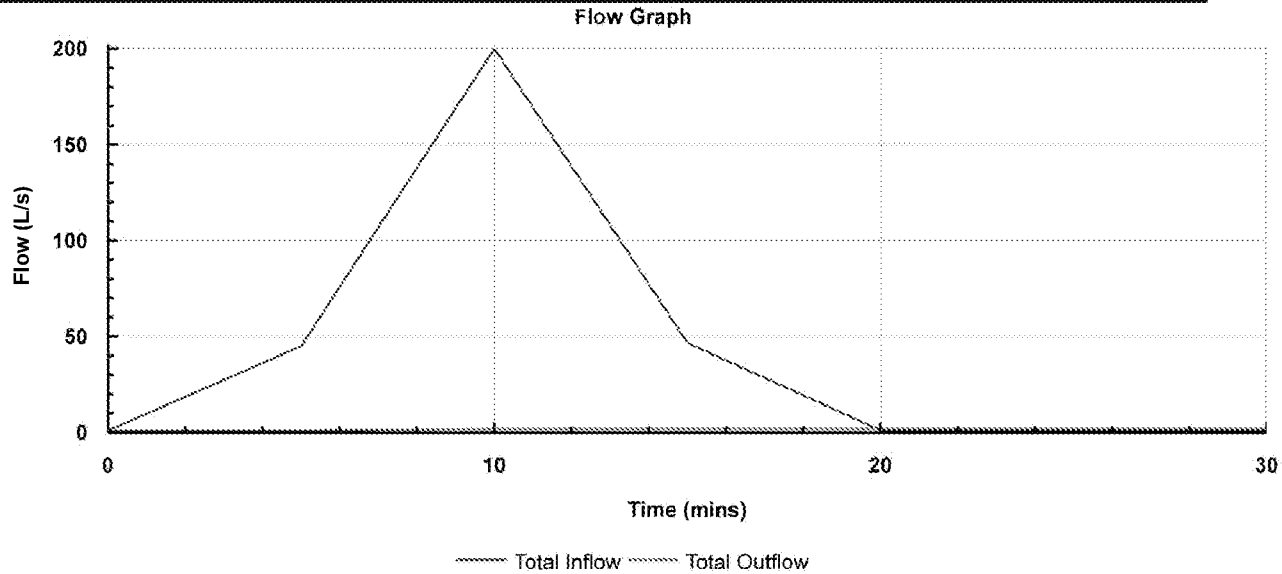
Phase

FEH: 30 years: Increase Rainfall (%): +45: 15 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.0	1.277
TOTAL	200.0	88.116	1.0	1.277

Graphs



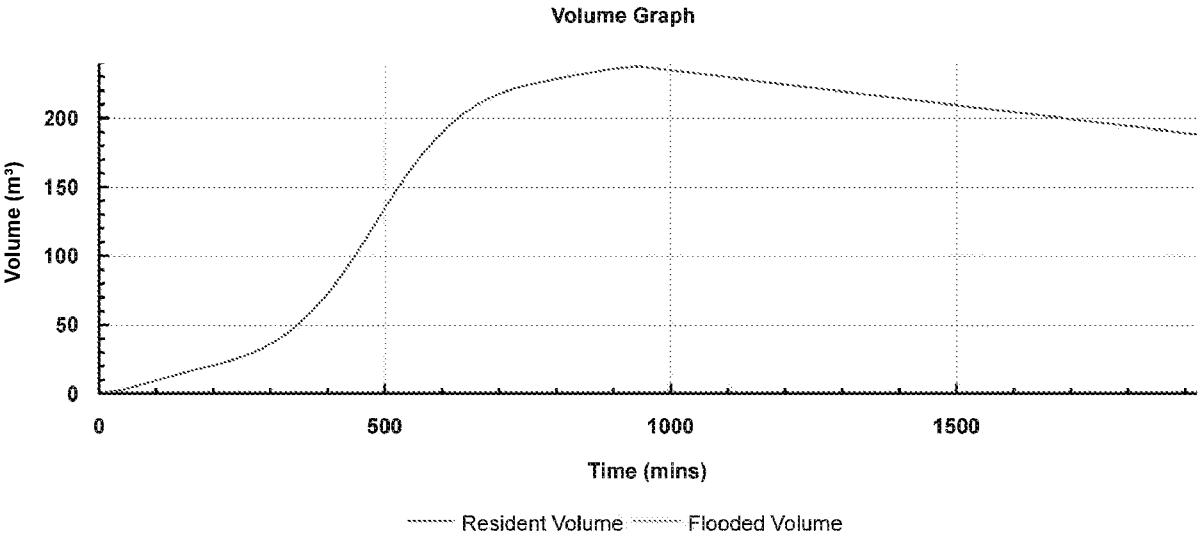
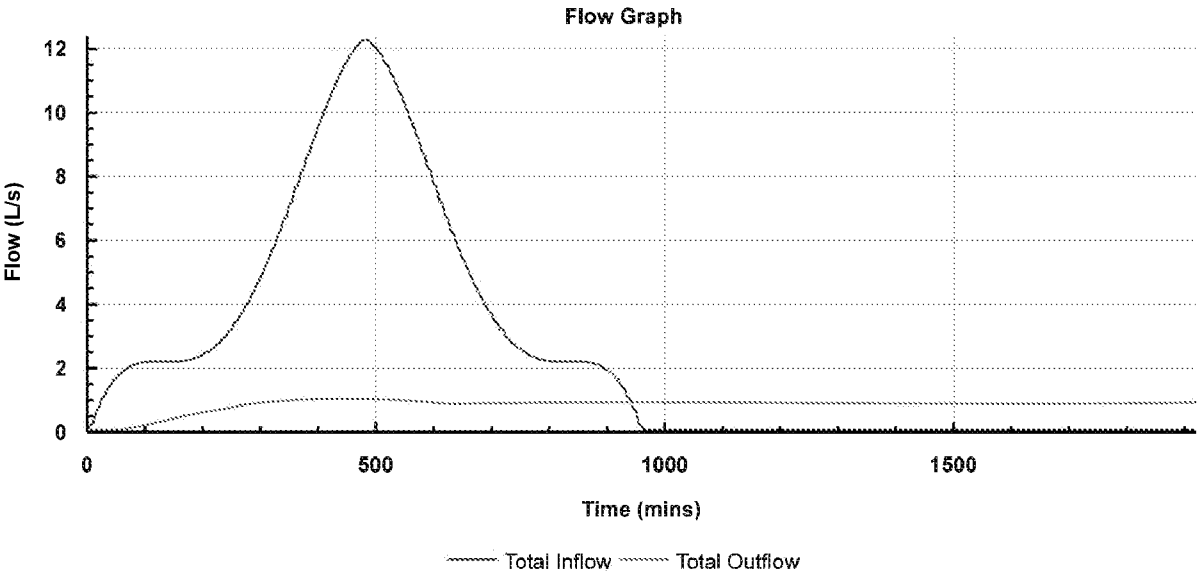
Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase: Phase				



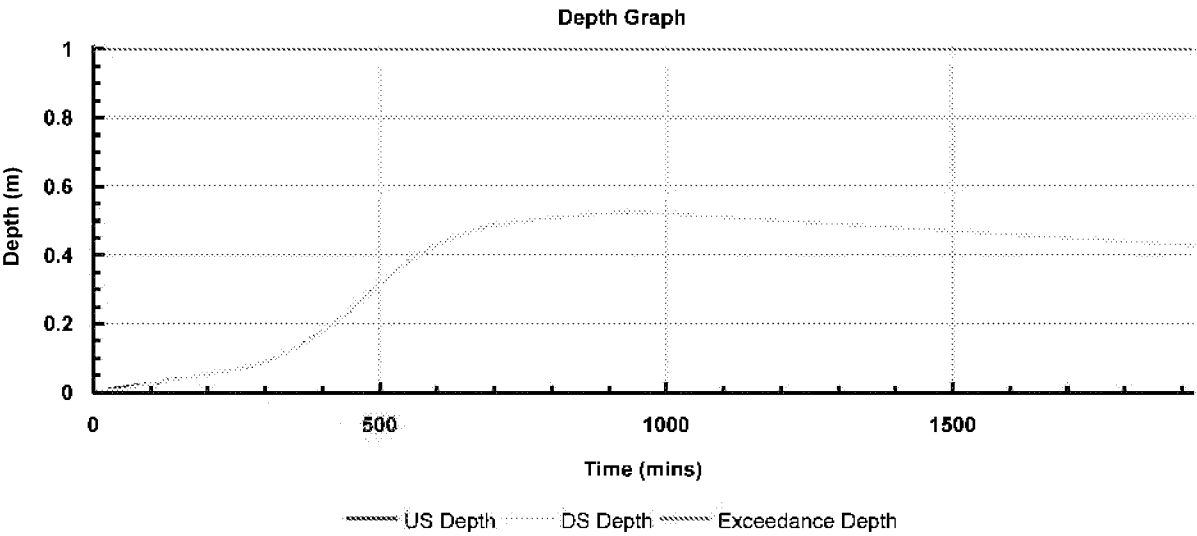
Pond
Critical Storm: FEH: 30 years: Increase Rainfall (%): +45: 960 mins: Winter

Type : Pond

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Inflows Storm Phase: Phase				



Catchment Area

Type : Catchment Area

Area (ha)	0.30
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Preliminary Sizing

Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

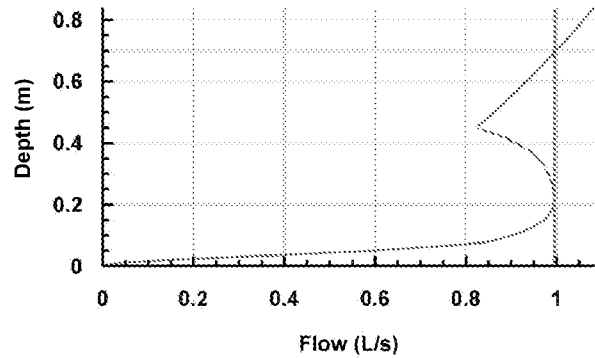
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		9.000	
Depth (m)		1.000	
Base Level (m)		8.000	
Freeboard (mm)		300	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		3.10	
Total Volume (m³)		331.110	
Depth (m)		Area (m²)	Volume (m³)
0.000		400.00	0.000
0.700		550.00	331.110
1.000		650.00	510.901

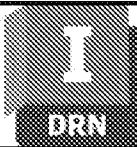
Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.000
Design Depth (m)	0.700
Design Flow (L/s)	1.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1000-0700-1000



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Stormwater Controls Storm Phase: Phase			
		Company Address:		

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		Type: FEH
FEH		
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 100 years: +45 % 15 mins: Summer	0.30	251.9	110.719

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 100 years: +45 %: 1440 mins: Winter	8.655	8.655	0.655	0.655	11.0	306.768	0.000	0.000	1.0	147.608	7.351	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				

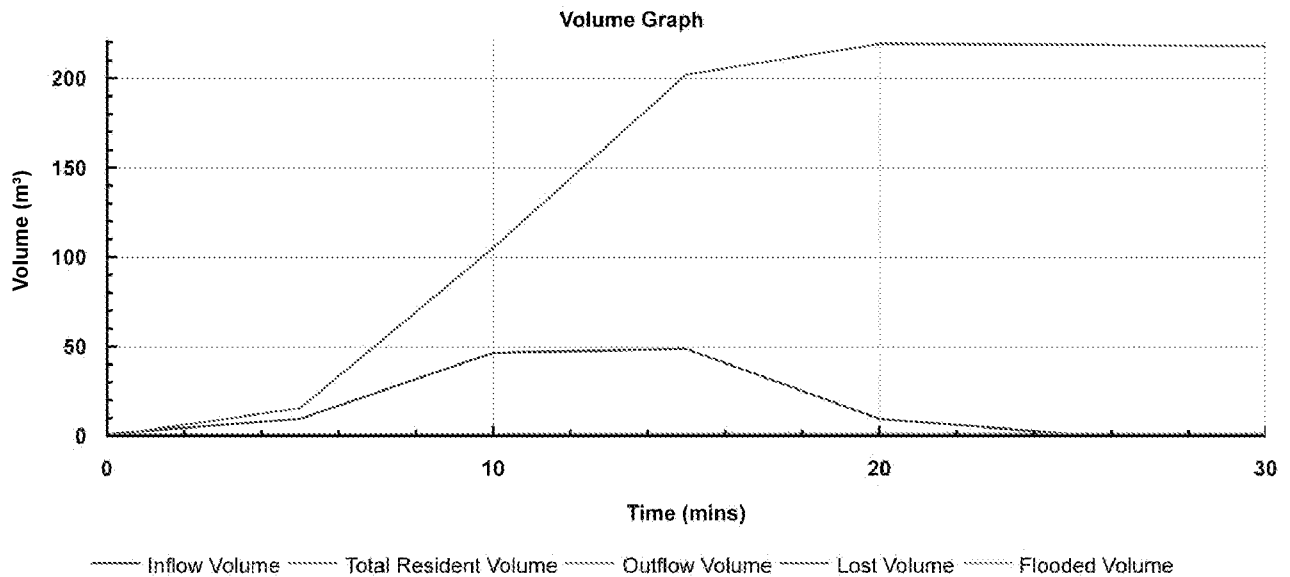
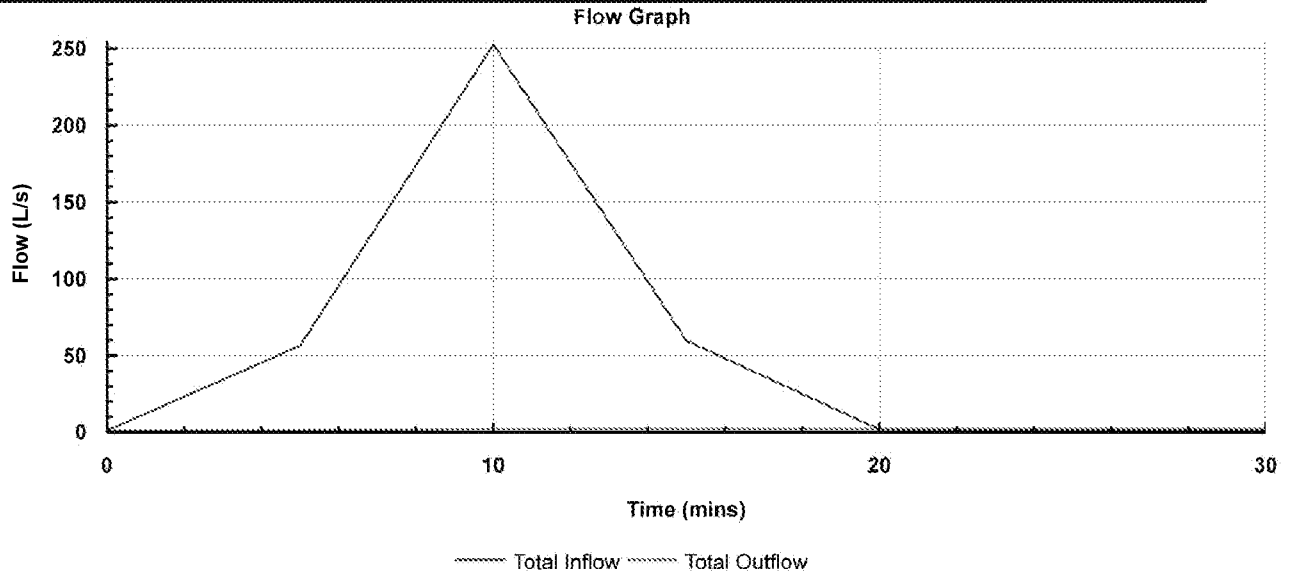


Phase
FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.0	1.308
TOTAL	252.6	110.719	1.0	1.308

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			

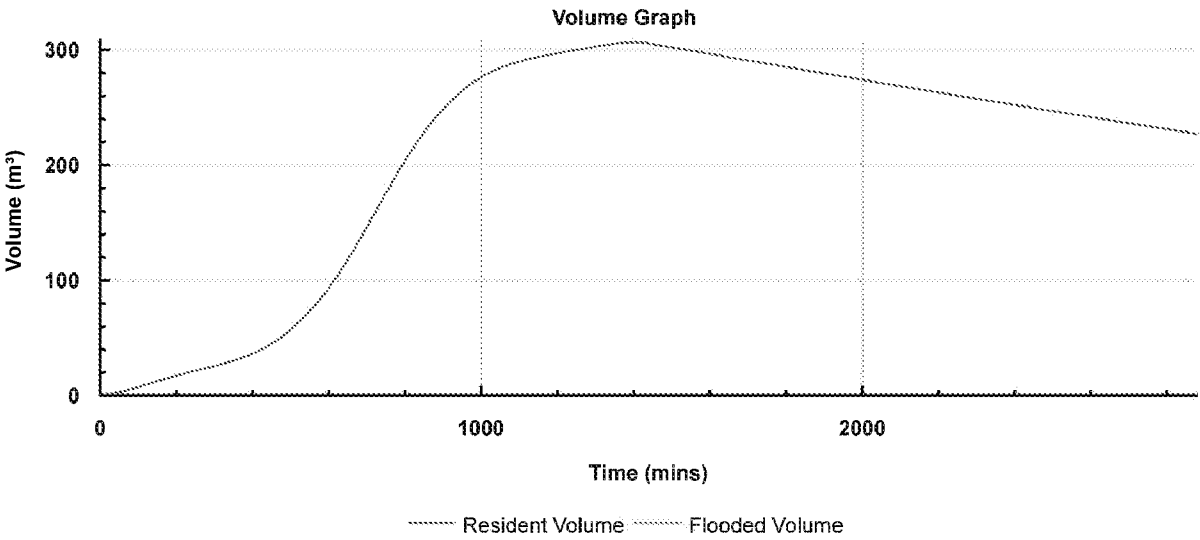
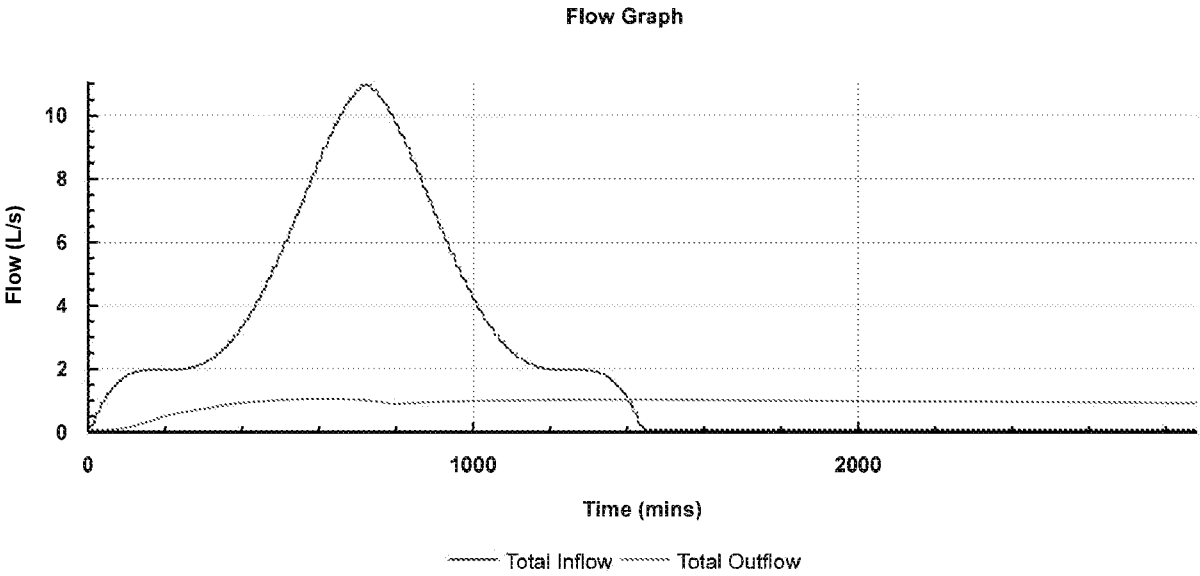


Pond

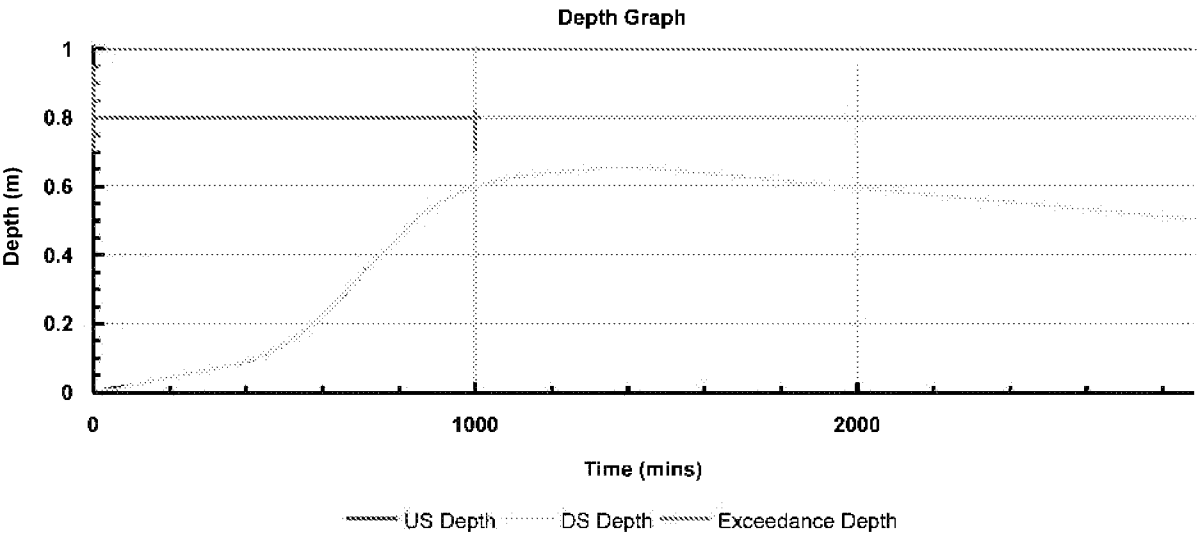
Critical Storm: FEH: 100 years: Increase Rainfall (%): +45: 1440 mins: Winter

Type : Pond

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase: Phase				



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Storm Phase: Phase	Company Address:			



Catchment Area

Type : Catchment Area

Area (ha)	2.30
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Preliminary Sizing	
Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing	
Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

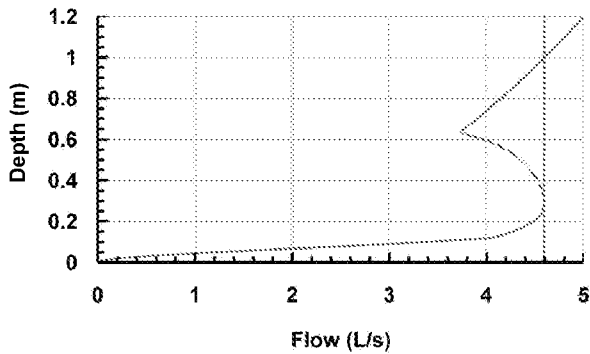
Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		10.000	
Depth (m)		1.250	
Base Level (m)		8.750	
Freeboard (mm)		250	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		4.00	
Total Volume (m³)		3138.677	
Depth (m)		Area (m²)	Volume (m³)
0.000		2750.12	0.000
1.000		3543.99	3138.677
1.250		3758.16	4051.315

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.750
Design Depth (m)	1.000
Design Flow (L/s)	4.6
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0101-4600-1000-4600



Advanced	
Perimeter	Circular
Length (m)	20.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Inflow Summary Storm Phase: Phase			
Company Address:				

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Pond		Time of Concentration	2.30	100	0	100	2.30
TOTAL		0.0		2.30				2.30

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

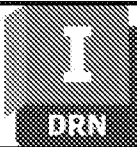
Rainfall		
Rainfall Details FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
2.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
	Alistair			
Report Title: Rainfall Analysis Criteria	Company Address:			

FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period	
Return Period (years)	Increase Rainfall (%)
2.0	45.000

Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	Rainfall Details FEH: 2 years: +45 %: 15 mins: Summer	2.30	714.7	314.736

Project:	Date: 10/06/2024		
	Designed by: Alistair	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		





Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	Rainfall Details FEH: 2 years: +45 %: 10080 mins: Summer	9.184	9.184	0.434	0.434	17.6	1265.946	0.000	0.000	4.6	2695.134	59.666	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				



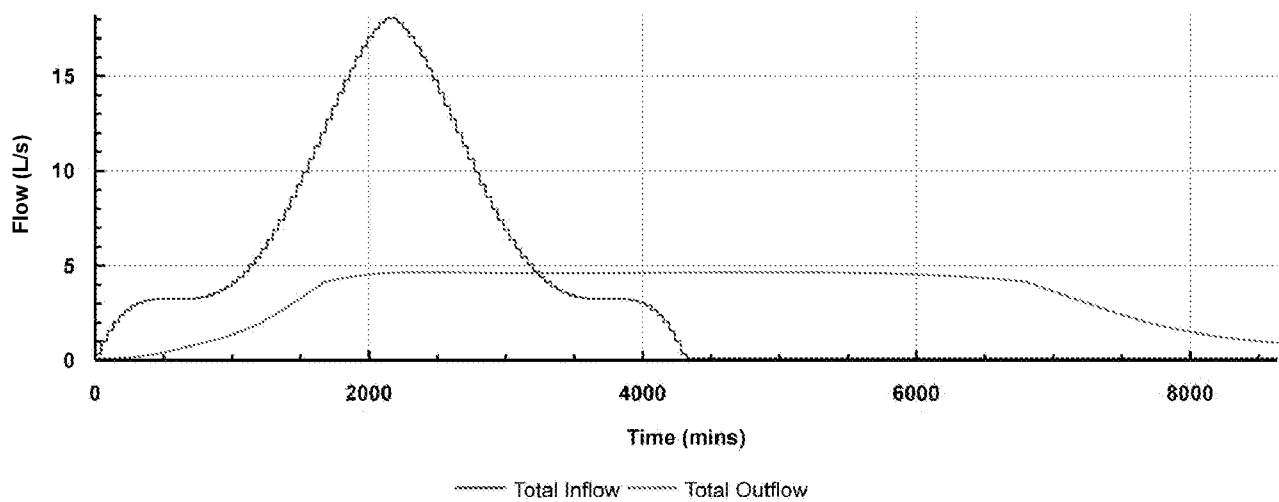
Phase
Rainfall Details FEH: 2 years: Increase Rainfall (%): +45: 4320 mins: Winter

Tables

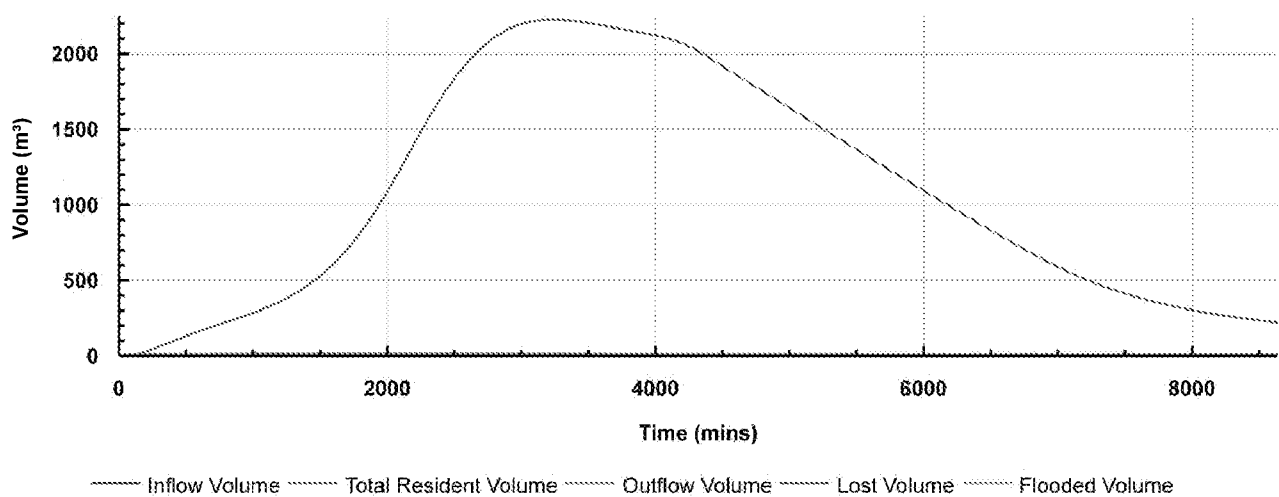
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			4.6	1741.419
TOTAL	18.1	1851.830	4.6	1741.419

Graphs

Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
Report Details:	Alistair			
Type: Inflow Results	Company Address:			
Storm Phase: Phase				



Catchment Area

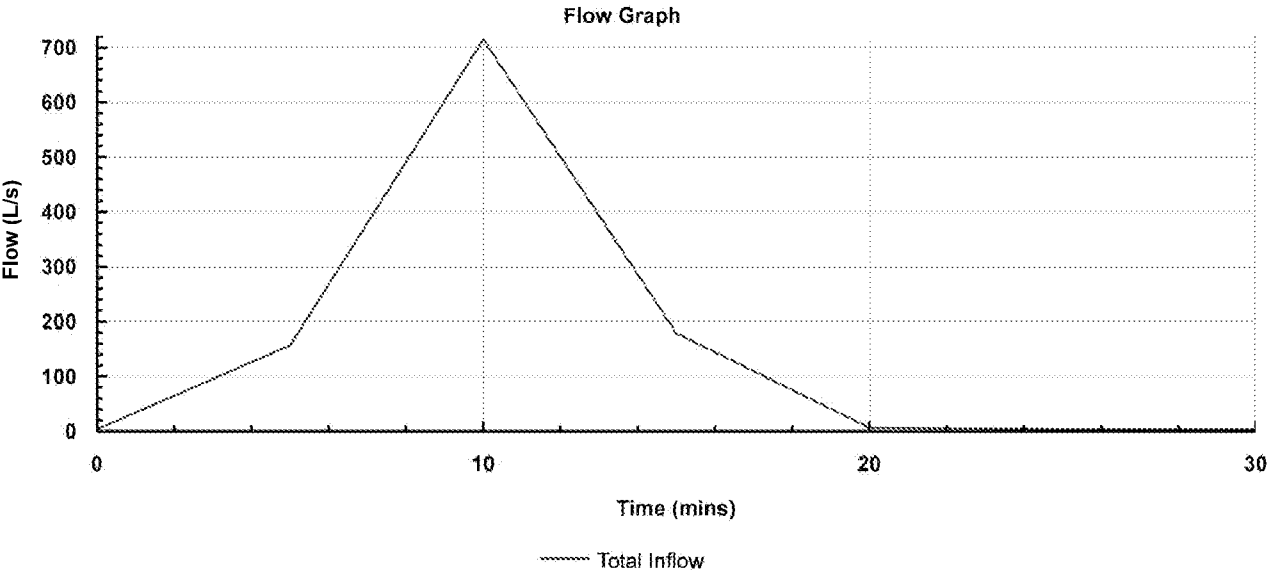
Critical Storm: Rainfall Details FEH: 2 years: Increase Rainfall (%): +45: 15 mins: Summer

Type : Catchment Area

Inflow

Max. Inflow (L/s)	714.7
Total Inflow Volume (m³)	314.736

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Inflows Storm Phase: Phase				



Catchment Area

Type : Catchment Area

Area (ha)	2.30
-----------	------

Preliminary Sizing

Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

 **Pond**

Type : Pond

Dimensions

Exceedance Level (m)	10.000
Depth (m)	1.250
Base Level (m)	8.750
Freeboard (mm)	250
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:X)	4.00
Total Volume (m³)	3138.677

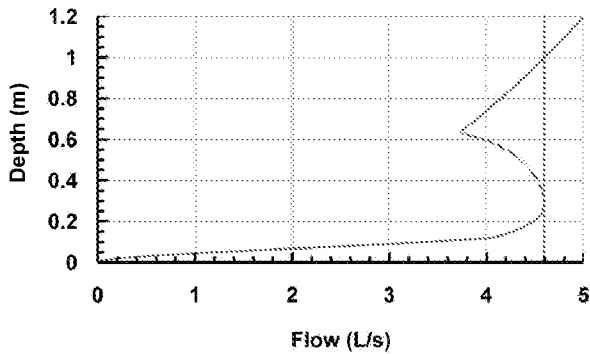
Depth (m)	Area (m²)	Volume (m³)
0.000	2750.12	0.000
1.000	3543.99	3138.677
1.250	3758.16	4051.315

Outlets

Outlet

Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.750
Design Depth (m)	1.000
Design Flow (L/s)	4.6
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒

Unit Reference	SHE-0101-4600-1000-4600
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Advanced

Perimeter	Circular
Length (m)	20.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Inflow Summary Storm Phase: Phase			
			Company Address:	

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Pond		Time of Concentration	2.30	100	0	100	2.30
TOTAL		0.0		2.30				2.30

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

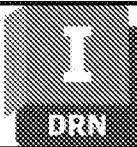
Rainfall		
Rainfall Details FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
30.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer		
Winter		

Return Period	
Return Period (years)	Increase Rainfall (%)
30.0	45.000

Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	Rainfall Details FEH: 30 years: +45 %: 15 mins: Summer	2.30	1538.4	674.370

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	Rainfall Details FEH: 30 years: +45 %: 10080 mins: Summer	9.476	9.476	0.726	0.726	25.6	2199.514	0.000	0.000	4.6	3887.923	29.922	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				

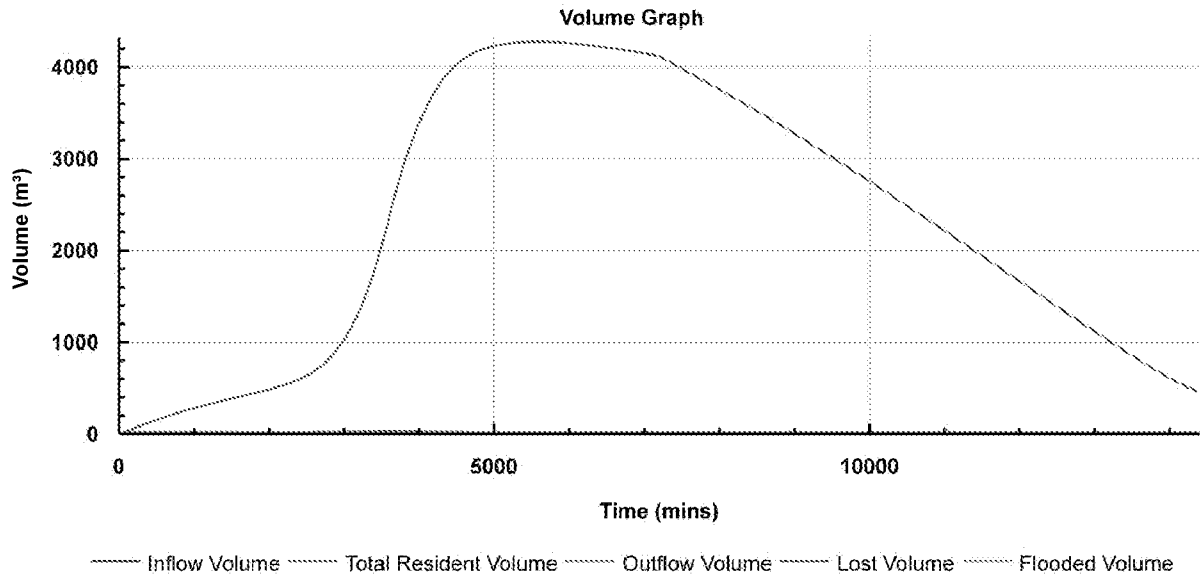
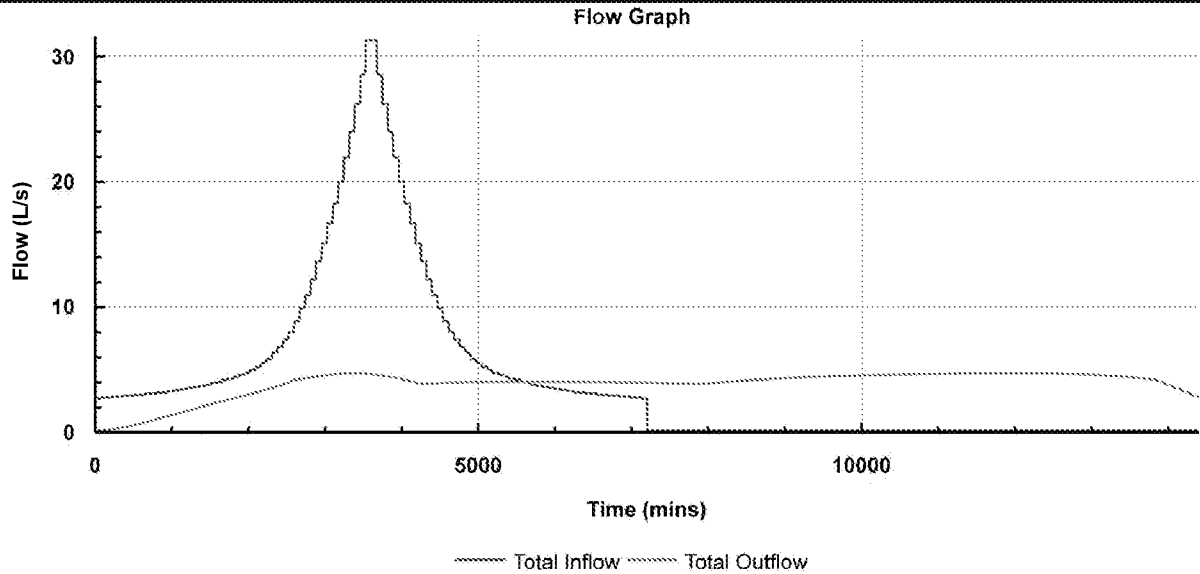


Phase
Rainfall Details FEH: 30 years: Increase Rainfall (%): +45: 7200 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			4.6	3222.593
TOTAL	31.3	3450.493	4.6	3222.593

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflow Results Storm Phase: Phase	Company Address:			



Catchment Area

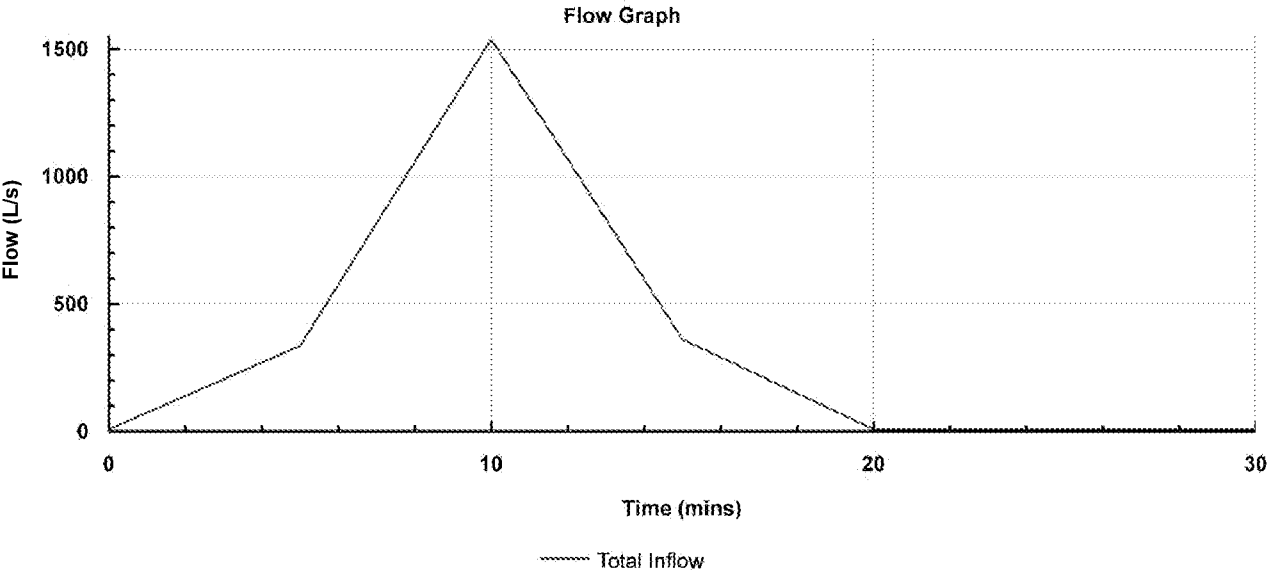
Critical Storm: Rainfall Details FEH: 30 years: Increase Rainfall (%): +45: 15 mins: Summer

Type : Catchment Area

Inflow

Max. Inflow (L/s)	1538.4
Total Inflow Volume (m³)	674.370

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Storm Phase: Phase	Company Address:			



Catchment Area

Type : Catchment Area

Area (ha)	2.30
-----------	------

Preliminary Sizing	
Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing	
Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

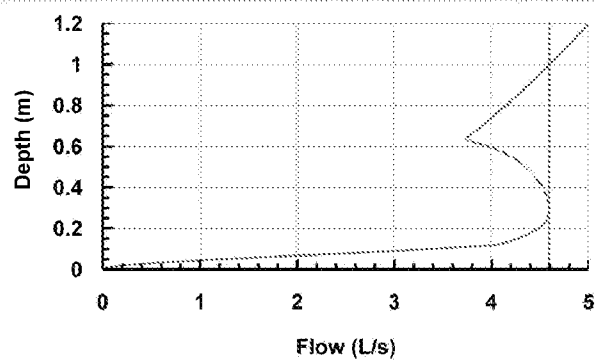
Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
Report Details:	Alistair			
	Company Address:			
Type: Stormwater Controls				
Storm Phase: Phase				

 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		10.000	
Depth (m)		1.250	
Base Level (m)		8.750	
Freeboard (mm)		250	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		4.00	
Total Volume (m³)		3138.677	
Depth (m)		Area (m²)	Volume (m³)
0.000		2750.12	0.000
1.000		3543.99	3138.677
1.250		3758.16	4051.315

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	8.750
Design Depth (m)	1.000
Design Flow (L/s)	4.6
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0101-4600-1000-4600



Advanced	
Perimeter	Circular
Length (m)	20.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Inflow Summary Storm Phase: Phase			
			Company Address:	

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	Pond		Time of Concentration	2.30	100	0	100	2.30
TOTAL		0.0		2.30				2.30

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		
Rainfall Details FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

FEH		Type: FEH
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer		
Winter		

Return Period	
Return Period (years)	Increase Rainfall (%)
100.0	45.000

Storm Durations	
Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	Rainfall Details FEH: 100 years: +45 %: 15 mins: Summer	2.30	1936.8	848.636

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	Rainfall Details FEH: 100 years: +45 %: 10080 mins: Summer	9.626	9.626	0.876	0.876	30.0	2706.691	0.000	0.000	4.6	4500.348	13.763	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				

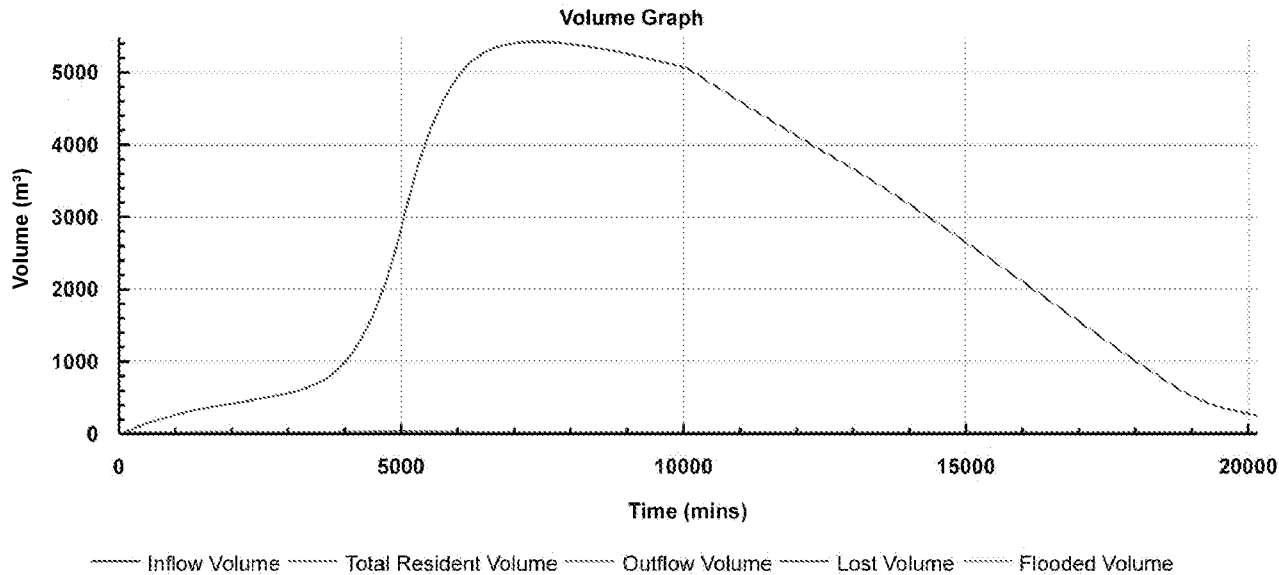
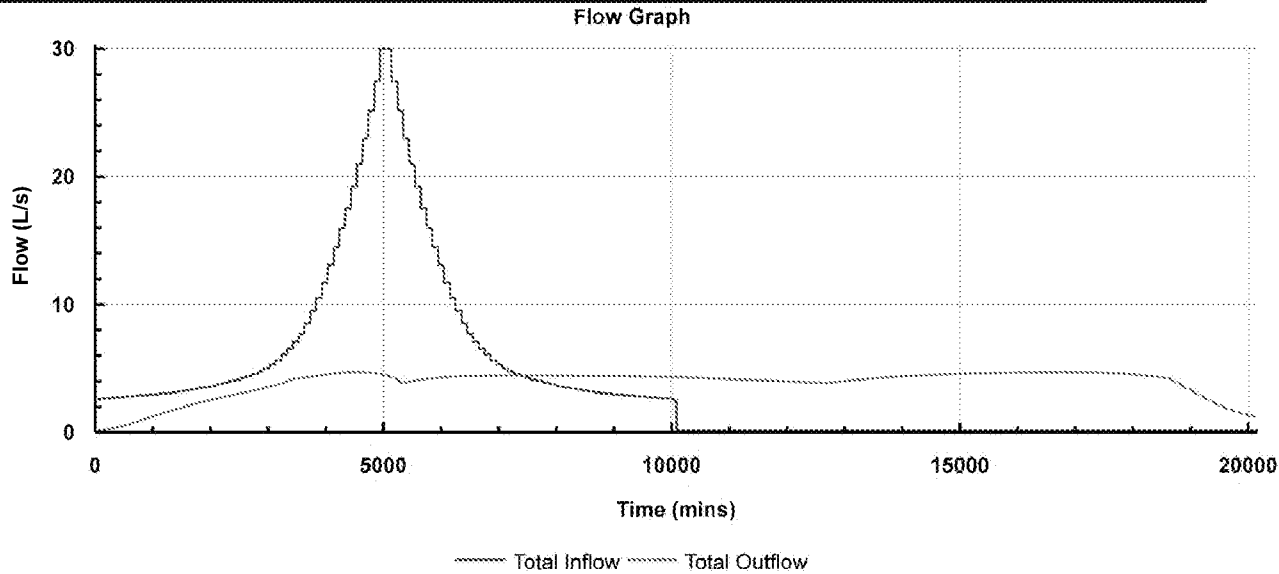


Phase
Rainfall Details FEH: 100 years: Increase Rainfall (%): +45: 10080 mins: Summer

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			4.6	4500.348
TOTAL	30.0	4629.226	4.6	4500.348

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflow Results Storm Phase: Phase	Company Address:			



Catchment Area

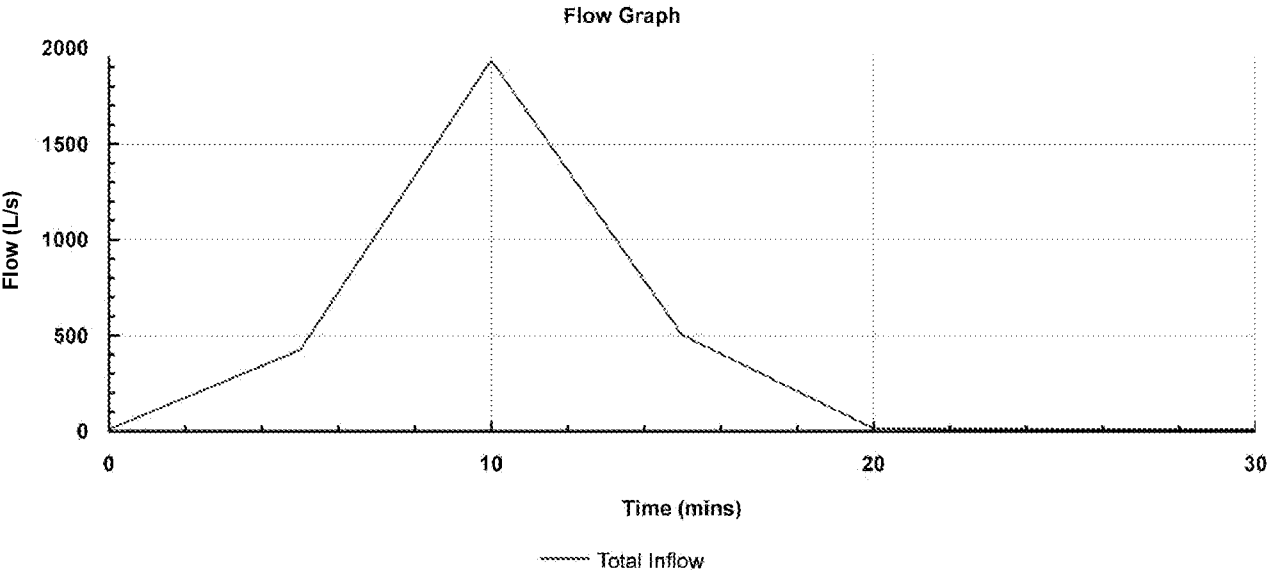
Critical Storm: Rainfall Details FEH: 100 years: Increase Rainfall (%): +45: 15 mins: Summer

Type : Catchment Area

Inflow

Max. Inflow (L/s)	1936.8
Total Inflow Volume (m³)	848.636

Graphs



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Storm Phase: Phase	Company Address:			



Catchment Area

Type : Catchment Area

Area (ha)	0.60
-----------	------

Preliminary Sizing	
Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing	
Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

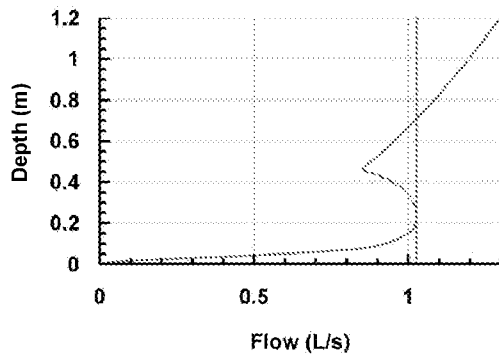
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		8.700	
Depth (m)		1.000	
Base Level (m)		7.700	
Freeboard (mm)		250	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		5.197	
Total Volume (m³)		372.600	
Depth (m)		Area (m²)	Volume (m³)
0.000		361.30	0.000
0.700		624.08	340.717
1.000		796.28	553.248

Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	7.700
Design Depth (m)	1.000
Design Flow (L/s)	1.2
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1200-1000-1200



Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
	Alistair			
Report Details: Type: Stormwater Controls Storm Phase: Phase		Company Address:		

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		Type: FEH
FEH		
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
2.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 2 years: +45 % 15 mins: Summer	0.60	186.9	82.440

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 2 years: +45 %: 10080 mins: Summer	8.372	8.372	0.672	0.672	4.6	323.262	0.000	0.000	1.0	709.394	13.242	OK

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				

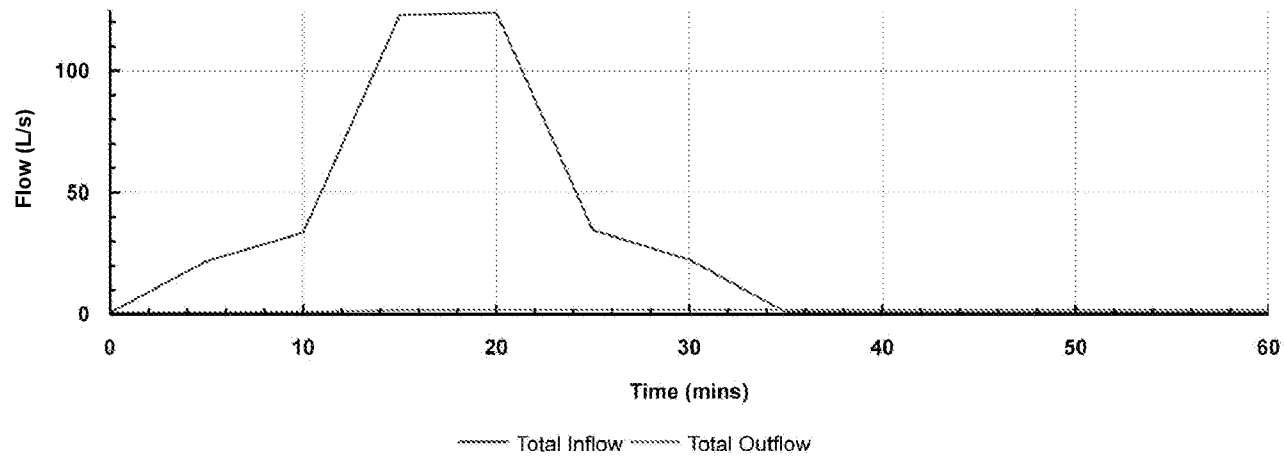
 **Phase**
FEH: 2 years: Increase Rainfall (%): +45: 30 mins: Summer

Tables

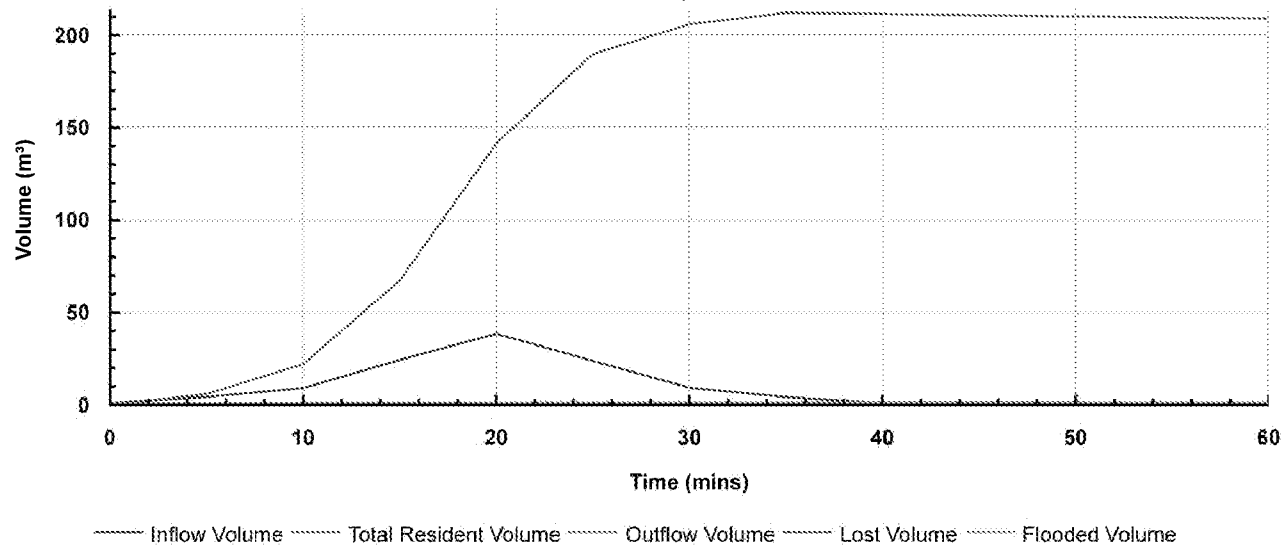
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.0	2.899
TOTAL	123.9	107.114	1.0	2.899

Graphs

Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase: Phase				

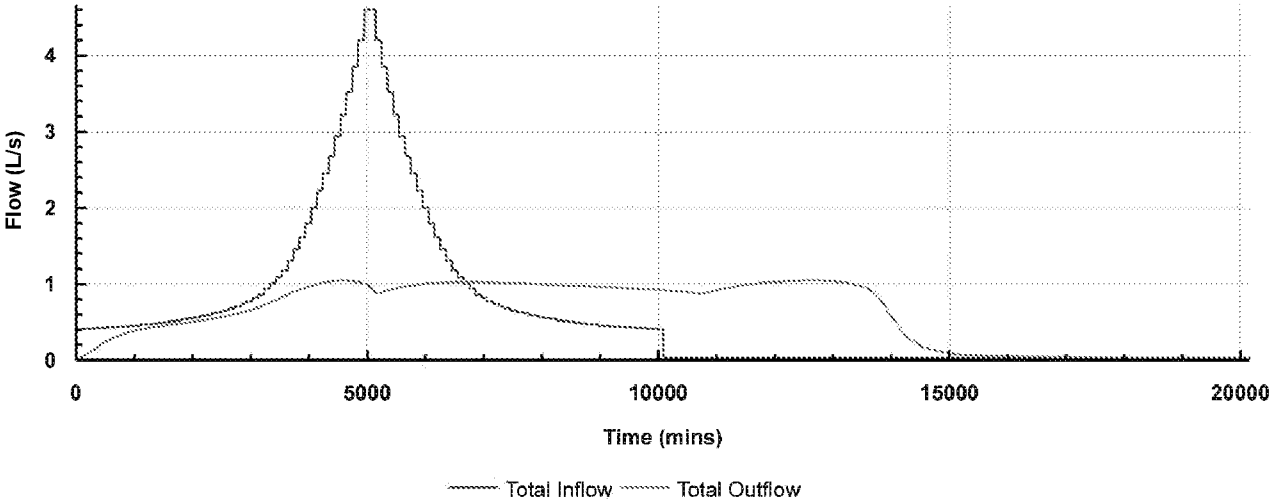


Pond
Critical Storm: FEH: 2 years: Increase Rainfall (%): +45: 10080 mins: Summer

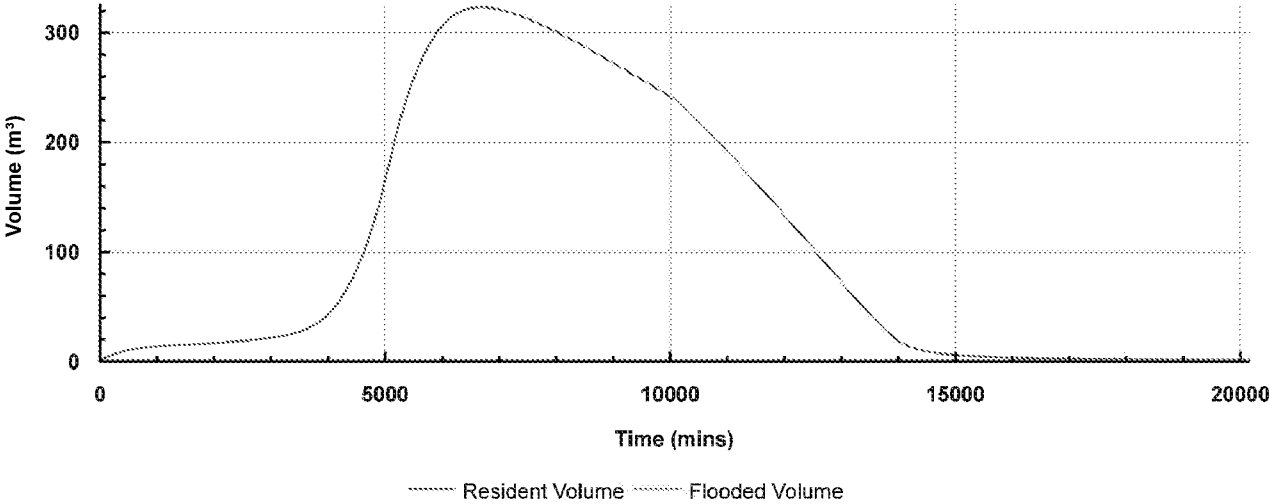
Type : Pond

Graphs

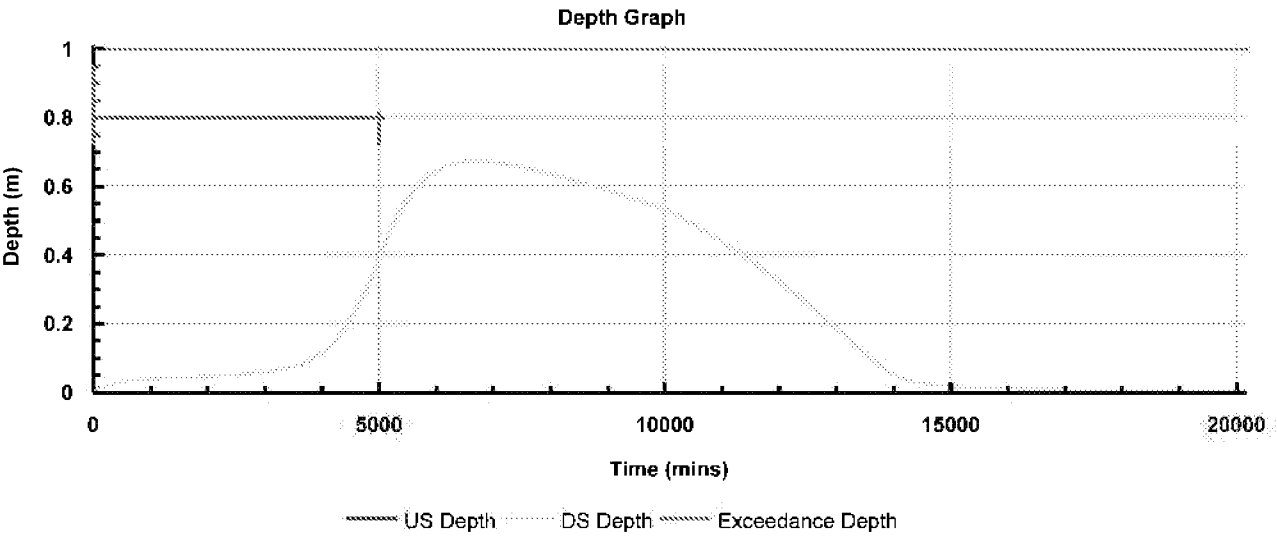
Flow Graph



Volume Graph



Project	Date 10/06/2024			
	Designed by Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase Phase				



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Inflows Storm Phase: Phase				



Catchment Area

Type : Catchment Area

Area (ha)	0.60
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Preliminary Sizing

Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

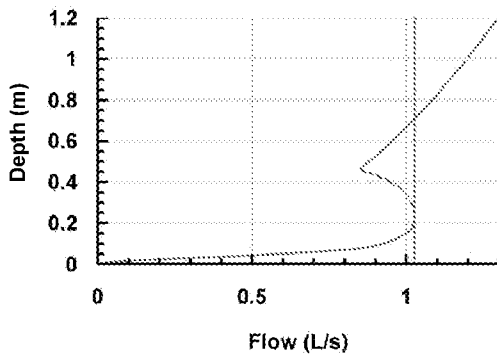
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		8.700	
Depth (m)		1.000	
Base Level (m)		7.700	
Freeboard (mm)		250	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		5.197	
Total Volume (m³)		372.600	
Depth (m)		Area (m²)	Volume (m³)
0.000		361.30	0.000
0.700		624.08	340.717
1.000		796.28	553.248

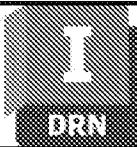
Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	7.700
Design Depth (m)	1.000
Design Flow (L/s)	1.2
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1200-1000-1200



Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
	Alistair			
Report Details:		Company Address:		
Type: Stormwater Controls Storm Phase: Phase				

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		Type: FEH
FEH		
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period

Return Period (years)	Increase Rainfall (%)
30.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 30 years: +45 % 15 mins: Summer	0.60	402.0	176.223

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 30 years: +45 %: 10080 mins: Summer	8.684	8.684	0.984	0.984	6.7	540.249	0.000	0.000	1.2	1027.889	-44.994	Flood Risk

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				



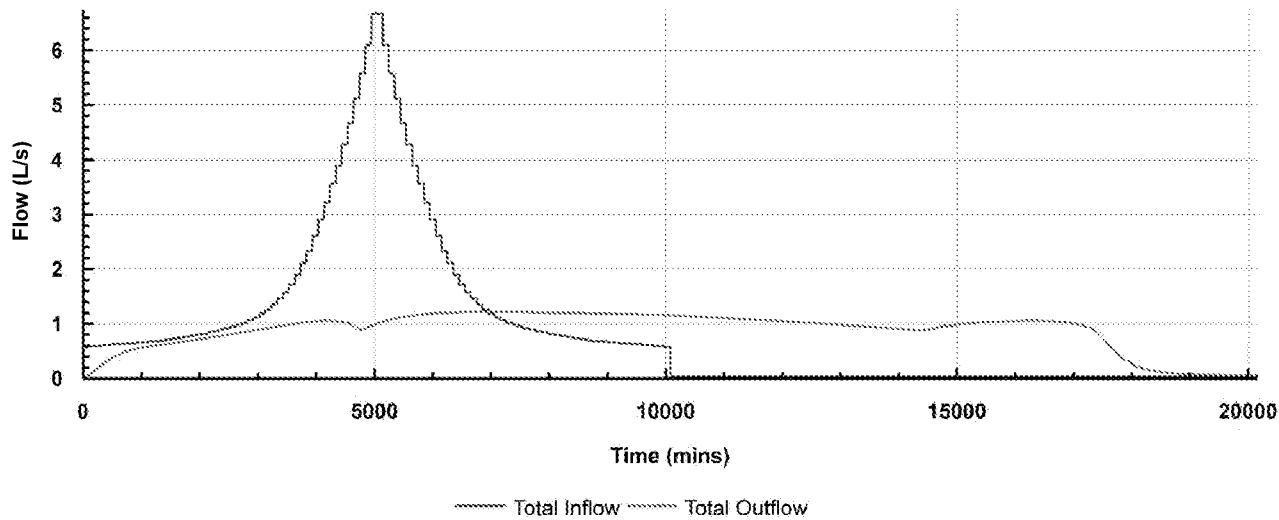
Phase
FEH: 30 years: Increase Rainfall (%): +45: 10080 mins: Summer

Tables

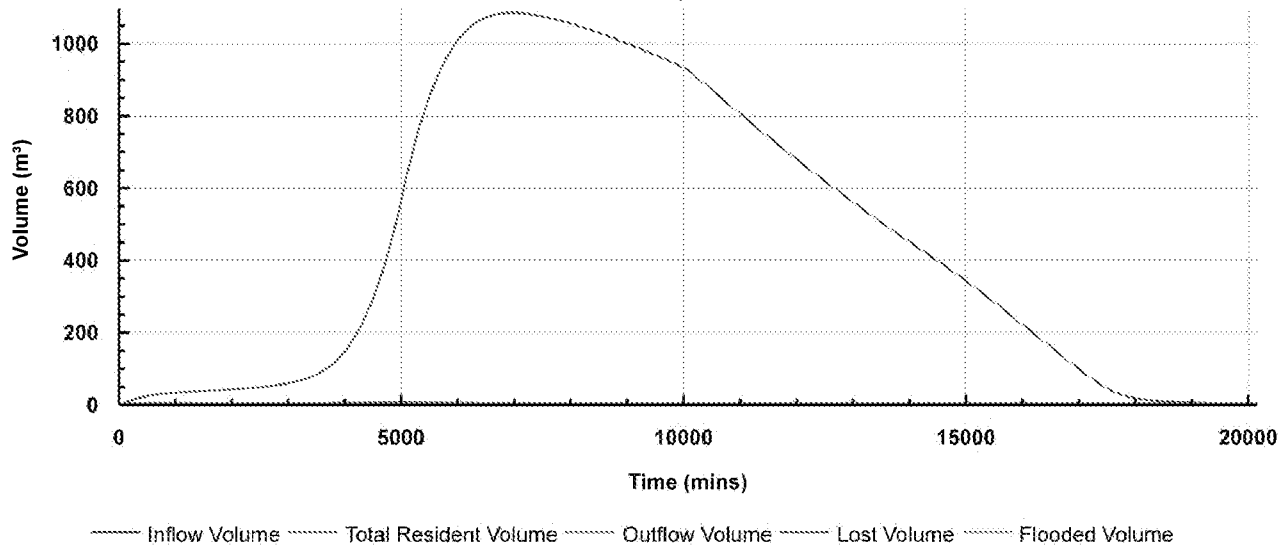
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.2	1027.889
TOTAL	6.7	1029.493	1.2	1027.889

Graphs

Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Control Results Storm Phase: Phase				

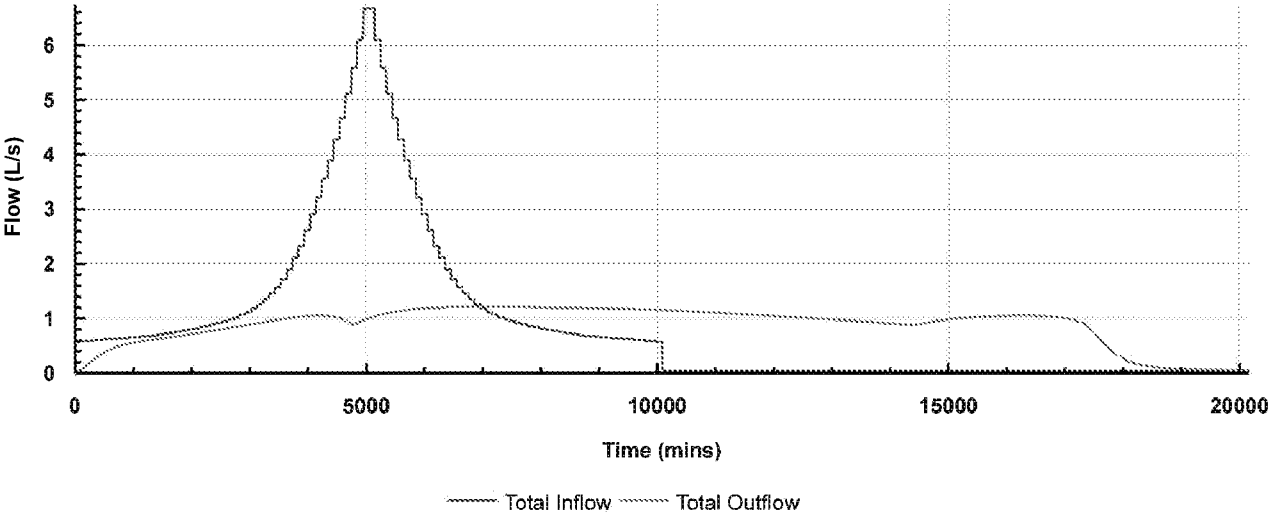


Pond
Critical Storm: FEH: 30 years: Increase Rainfall (%): +45: 10080 mins: Summer

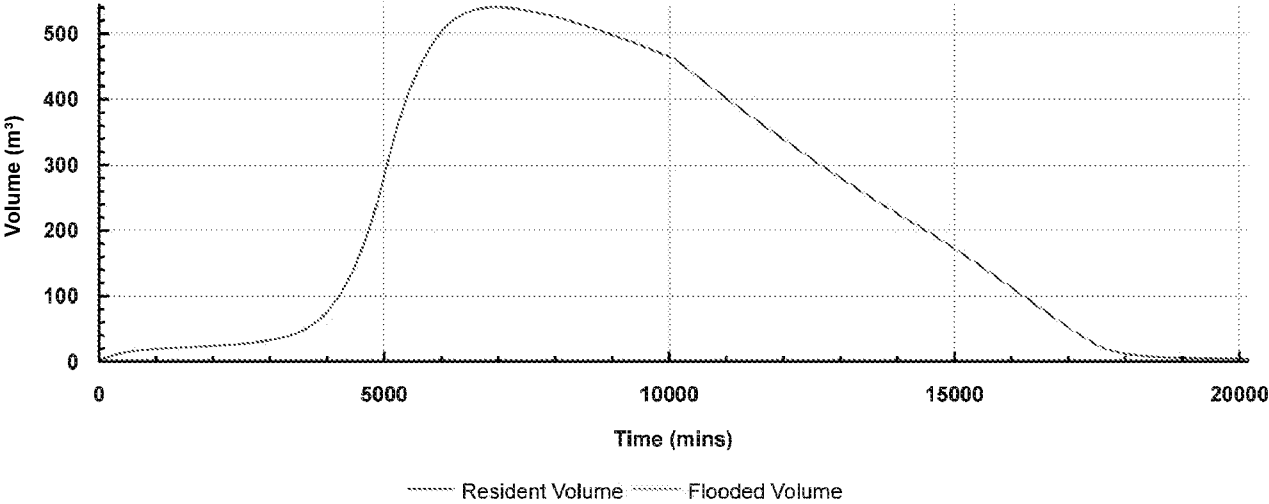
Type : Pond

Graphs

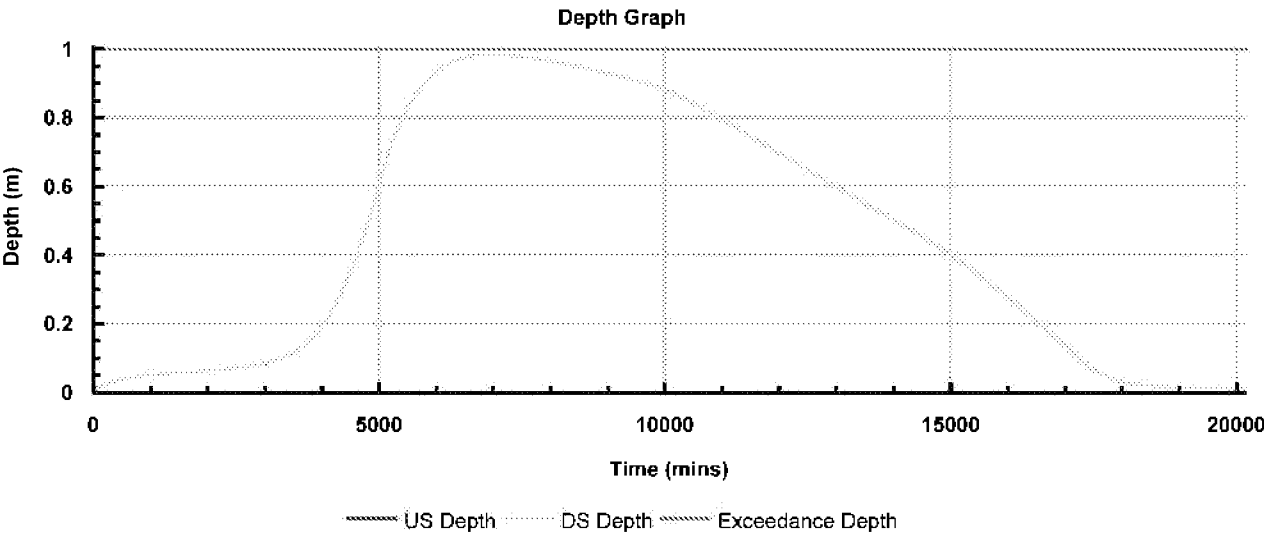
Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Inflows Storm Phase: Phase				



Catchment Area

Type : Catchment Area

Area (ha)	0.60
-----------	------

Preliminary Sizing	
Volumetric Runoff Coefficient	1.000
Percentage Impervious (%)	100
Time of Concentration (mins)	5

Dynamic Sizing	
Runoff Method	Time of Concentration
Summer Volumetric Runoff	1.000
Winter Volumetric Runoff	1.000
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				

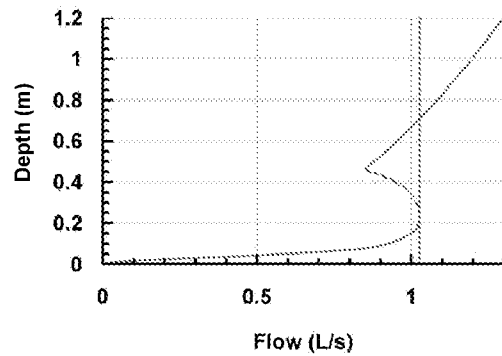
 **Pond**

Type : Pond

Dimensions			
Exceedance Level (m)		8.700	
Depth (m)		1.000	
Base Level (m)		7.700	
Freeboard (mm)		250	
Initial Depth (m)		0.000	
Porosity (%)		100	
Average Slope (1:X)		5.197	
Total Volume (m³)		372.600	
Depth (m)		Area (m²)	Volume (m³)
0.000		361.30	0.000
0.700		624.08	340.717
1.000		796.28	553.248

Inlets	
Inlet	
Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets	
Outlet	
Outgoing Connection	(None)
Outlet Type	Hydro-Brake®
Invert Level (m)	7.700
Design Depth (m)	1.000
Design Flow (L/s)	1.2
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☒
Unit Reference	SHE-0051-1200-1000-1200



Project:	Date: 10/06/2024			
	Designed by:	Checked by:	Approved By:	
	Alistair			
Report Details: Type: Stormwater Controls Storm Phase: Phase		Company Address:		

Advanced	
Perimeter	Circular
Length (m)	10.000
Friction Scheme	Manning's n
n	0.3

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	0
Perform No Discharge Analysis	☐

Rainfall		Type: FEH
FEH		
Site Location	GB 493499 103762 SU 93499 03762	
Rainfall Version	2022	
Summer	☒	
Winter	☒	

Return Period				
<table border="1"> <thead> <tr> <th>Return Period (years)</th> <th>Increase Rainfall (%)</th> </tr> </thead> <tbody> <tr> <td>100.0</td> <td>45.000</td> </tr> </tbody> </table>	Return Period (years)	Increase Rainfall (%)	100.0	45.000
Return Period (years)	Increase Rainfall (%)			
100.0	45.000			
Storm Durations				

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
180	360
240	480
360	720
480	960
600	1200
720	1440
960	1920
1440	2880
2160	4320
2880	5760
4320	8640
5760	11520
7200	14400
8640	17280
10080	20160

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
	Report Details: Type: Inflows Summary Storm Phase: Phase			
			Company Address:	



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 100 years: +45 % 15 mins: Summer	0.60	506.2	221.494

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:			



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 100 years: +45 %: 2880 mins: Winter	8.855	8.855	1.155	1.155	12.4	676.548	123.300	0.000	1.3	384.055	-81.575	Flood

Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Phase Management Storm Phase: Phase				



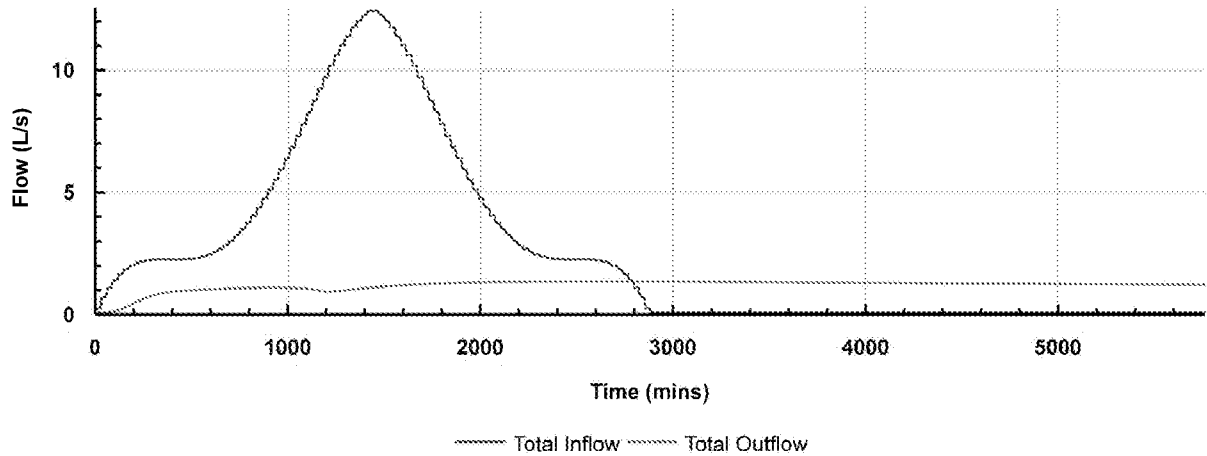
Phase
FEH: 100 years: Increase Rainfall (%): +45: 2880 mins: Winter

Tables

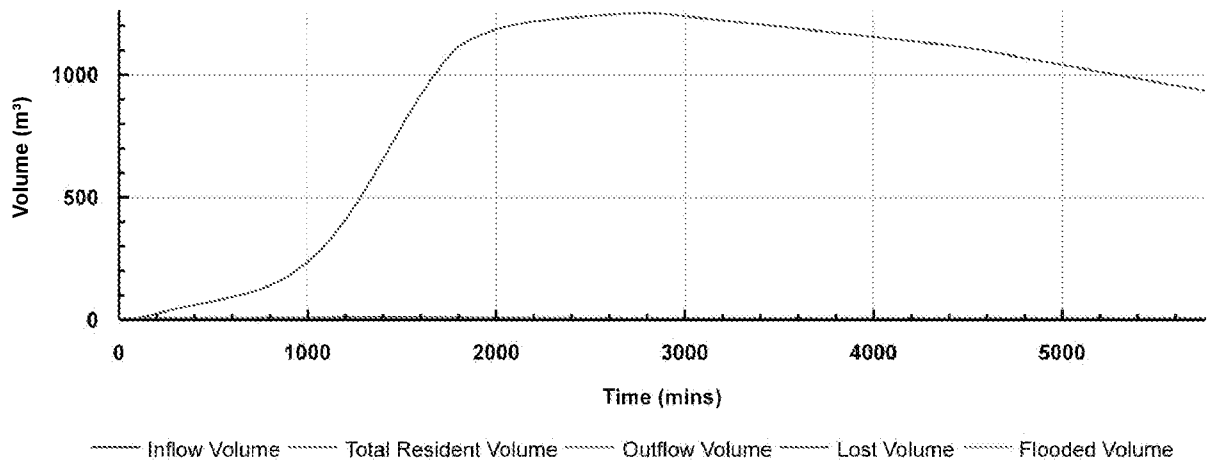
Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
Pond			1.3	384.055
TOTAL	12.4	848.991	1.3	384.055

Graphs

Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			

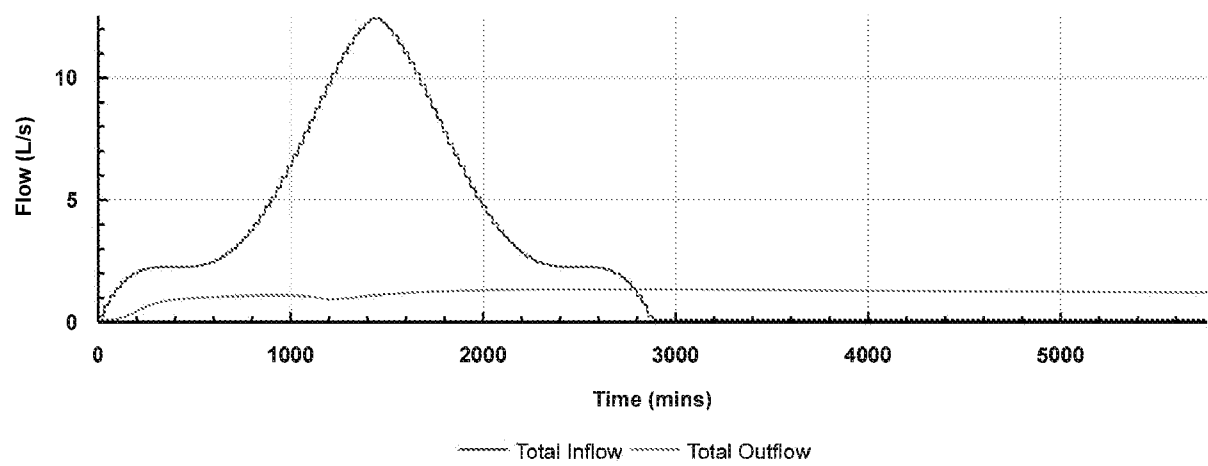


Pond
Critical Storm: FEH: 100 years: Increase Rainfall (%): +45: 2880 mins: Winter

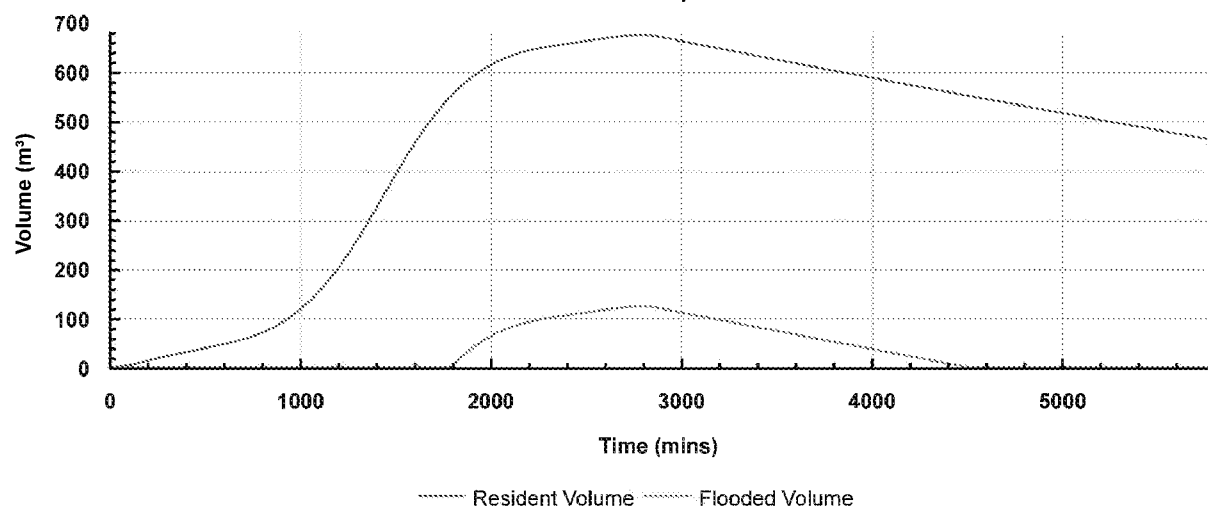
Type : Pond

Graphs

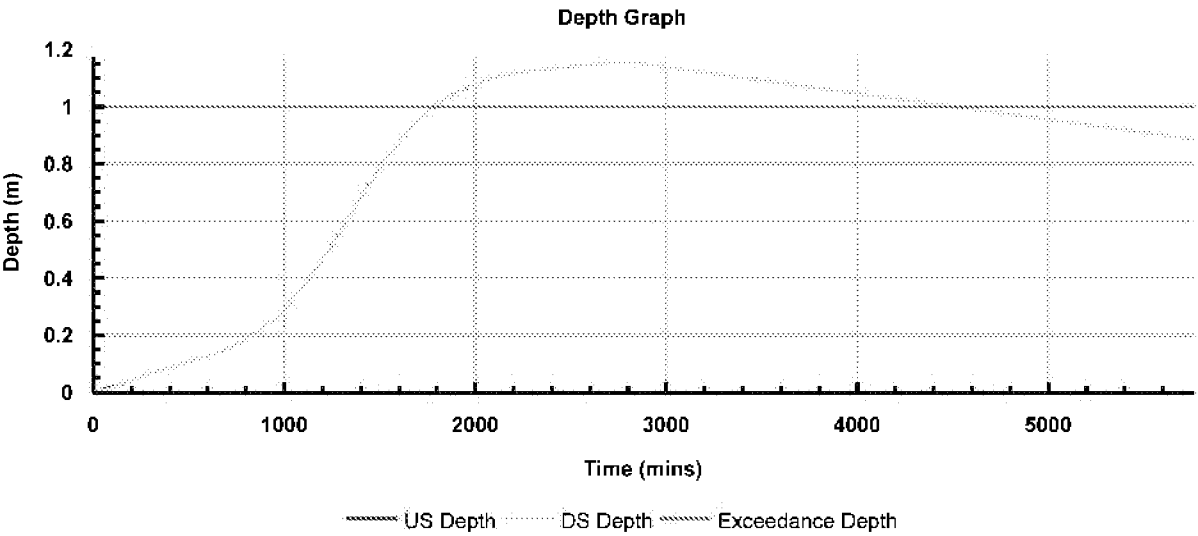
Flow Graph



Volume Graph



Project:	Date: 10/06/2024			
	Designed by: Alistair	Checked by:	Approved By:	
Report Details: Type: Stormwater Control Results Storm Phase: Phase	Company Address:			



Appendix 5

Sewer Records – utility search



(c) Crown copyright and database rights 2020 Ordnance Survey 100031673 Date: 10/12/20 Scale: 1:2700 Map Centre: 493556,104084 Data updated: 16/11/20 Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



Appendix 6

Foul water and surface water drainage strategies

Storage Summary - AREA 1

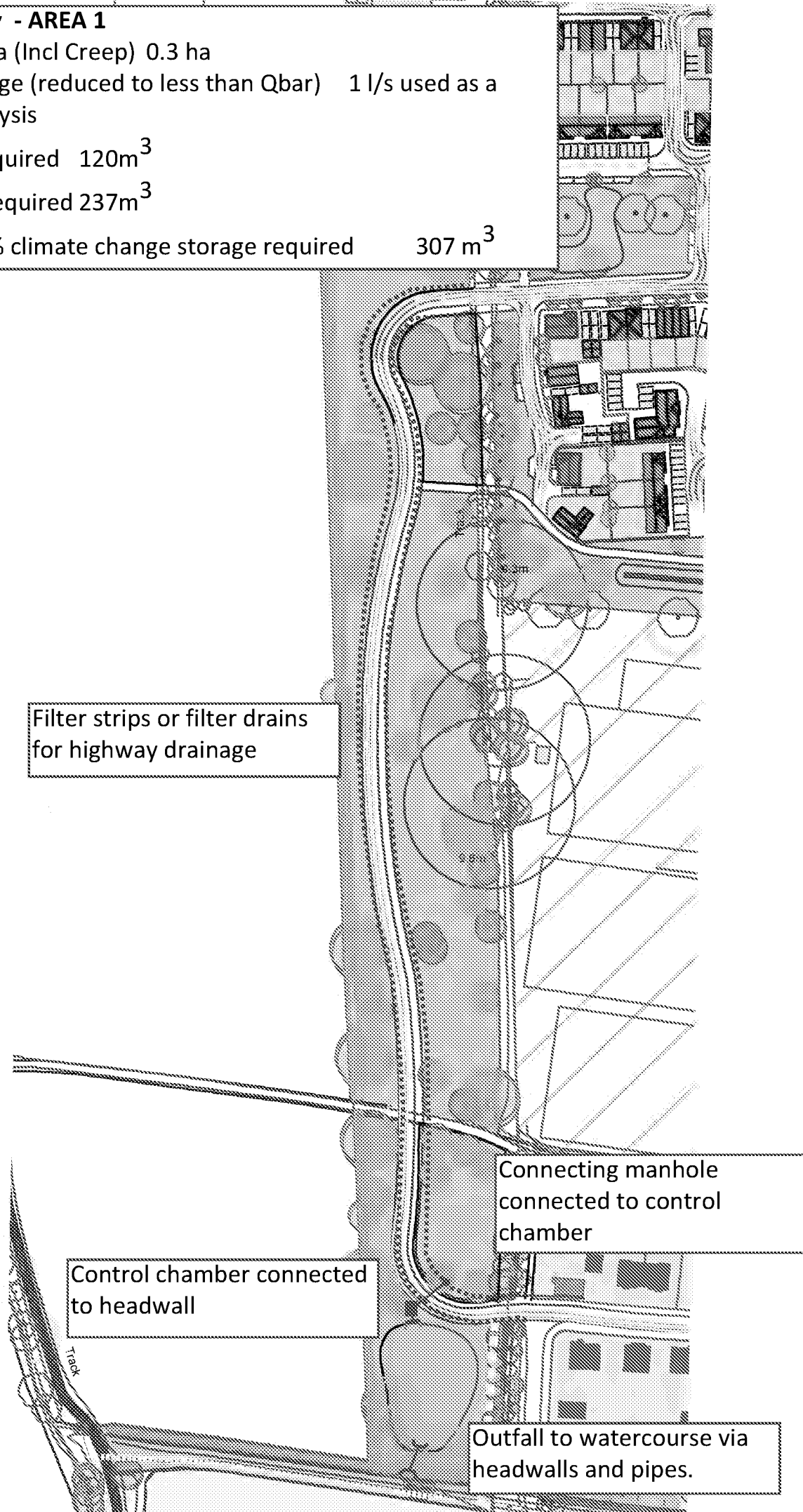
Impermeable Area (Incl Creep) 0.3 ha

Permitted discharge (reduced to less than Q_{bar}) 1 l/s used as a minimum for analysis

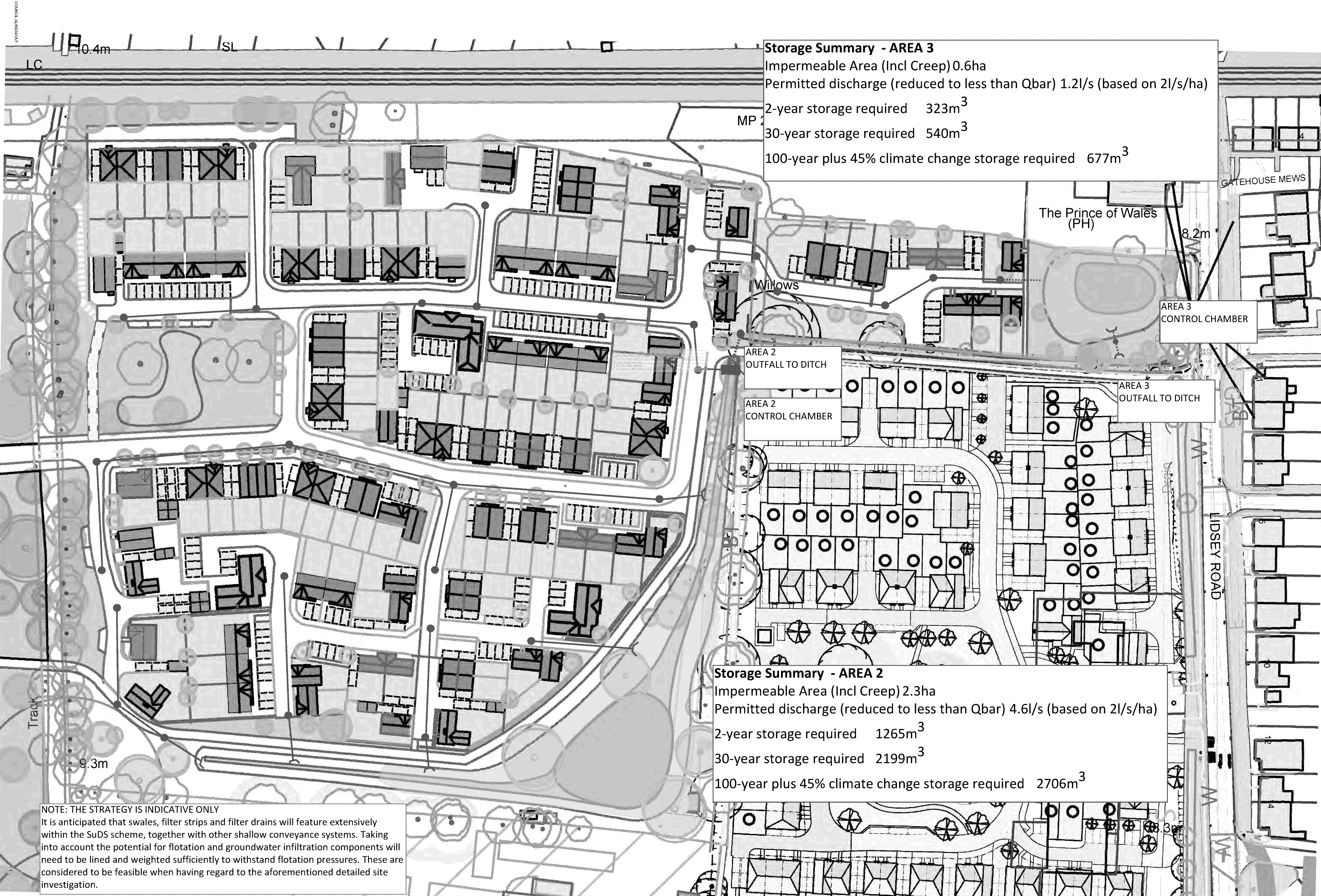
2-year storage required 120m^3

30-year storage required 237m^3

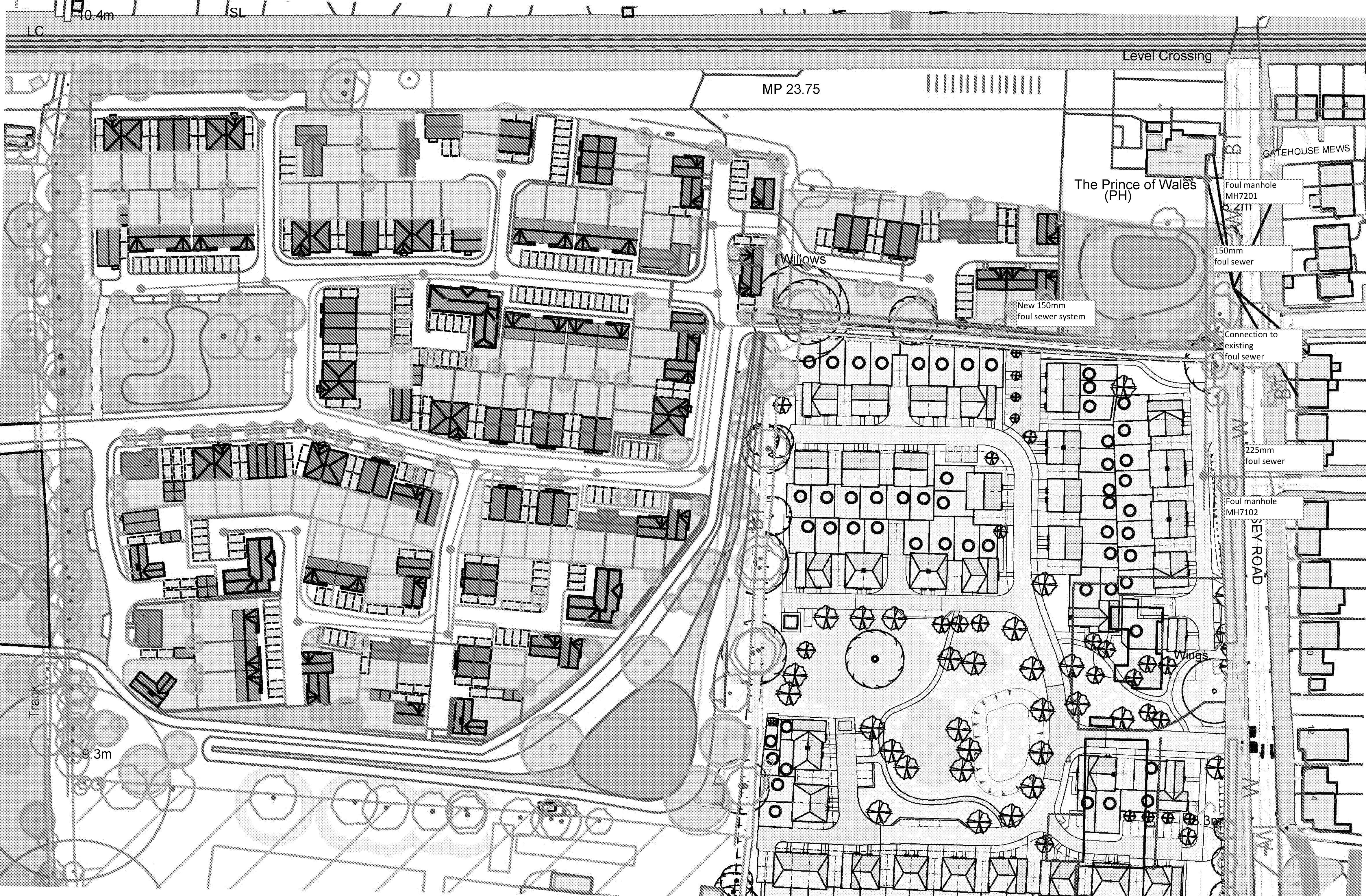
100-year plus 45% climate change storage required 307m^3



SURFACE WATER DRAINAGE STRATEGY AREA 1



SURFACE WATER DRAINAGE STRATEGY AREAS 2&3



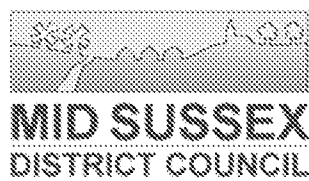
FOUL DRAINAGE STRATEGY

Appendix 7

West Sussex County Council Developer's Guidance Note and other guidance

West Sussex LLFA Policy for the Management of Surface Water

Updated November 2018.



Planning Context

West Sussex County Council (WSCC), as Lead Local Flood Authority (LLFA) is the risk management authority responsible for local flood risk defined as flooding from surface water, groundwater and ordinary watercourses (2.1.1). Hereafter we will refer to either West Sussex LLFA or more simply as the LLFA.

The LLFA is required to provide consultation responses on the surface water drainage provisions associated with major development (2.2.2). This policy statement sets out the requirements that the LLFA has for drainage strategies and surface water management provisions associated with applications for development.

For all developments, even small, we would expect the principles of this policy & drainage strategy to be considered. For all major developments, we would expect adherence to the full scope of this policy; the drainage strategy is to consider the topics set out in the table below and be consistent with the Sustainable Drainage Systems (SuDS) policies in Sections 5 and 6 of this document.

Scope for Drainage Strategy	Relevant sections of document
Drainage Catchment & Impermeable area (pre- and post-development)	5.2.1
Discharge location	5.2.1; 5.2.5
Infiltration capacity	5.2.2-5.2.3
Design calculations for peak flow, volume control and greenfield runoff, and/or brownfield runoff where appropriate	5.3
Inclusion of climate change & future development allowances	5.2.2; 5.3.2; 5.3.5;; 5.4.4; Policy 5; 5.6.1
Topographical survey of the site	5.3.1; 5.4.1
Details of any adjacent watercourse	5.3.1;5.4.1
Areas of flood risk	4.2; 5.5
Quantification of any surface water flows on-site from off-site locations	5.3

Exceedance routes	5.3.5; Policy 2
Offsite works	5.3.1; 5.5.2
Consents	3.2; 4.3
Any constraints which affect the proposed development	5.3.8; 6.1
Locations of sensitive receptors, including source protection zones, habitat designations or archaeological features	6.1.7
Principles of temporary drainage during construction	6.1.2
Proposed extent of adoption strategy	5.7.6
A Strategic Surface Water Management Strategy for large sites for which the development is to be phased.	5.3.11
Correspondence from any receiving authority or permitting authority	Section 4; 5.2.5

Section 2 provides the regulatory context for this policy and Section 3 summarises specific guidance that informs LLFA consideration of surface water management.

Section 4 describes the consultation process and LLFA expectations for how developers should engage in this process.

This policy statement is consistent with the National Planning Policy Framework (NPPF) National Planning Practice Guidance and Defra Non-Technical Standards for Sustainable Drainage. However, it does not supplant this or any other non-statutory best practice guidance to which this document refers.

Input to the development management process by the LLFA is not restricted to major development applications. LLFA advice should be sought on other planning applications which raise surface water or other local flood risk issues; the basis of consultation between the LLFA and planning authorities can be the subject of pre-arranged protocols (see also planning practice guidance paragraph: 045 reference ID: 7-045-20150323).

Section 7 of this policy relates to management of surface water flood risk for developments smaller developments including homeowner extensions and alterations and commercial developments less than 0.5ha or comprising fewer than 10 properties.

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1 Role of this Policy Statement

1.1 This policy statement sets out how West Sussex LLFA, as a statutory consultee, will review drainage strategies and surface water management provisions associated with applications for development. It is consistent with the Non-Statutory Technical Standards for Sustainable Drainage (as published by Defra in March 2015), and sets out the policy requirements West Sussex County Council has for sustainable drainage. It should be read in conjunction with:

- the NPPF;
- Gov.UK Guidance for the Preparation of Flood Risk Assessments; <https://www.gov.uk/guidance/flood-risk-assessment-standing-advice>; and
- any specific policy set out by the relevant Local Planning Authority in their Local Plan.

Where Local Plan policies have stronger requirements in terms of need for FRA/drainage strategy or restricting runoff rates, they will take precedence over this policy.

1.2 This policy statement should be used by:

- Developers when considering their approach to the development of new sites or redevelopment of brownfield sites;
- Developers or their consultants when preparing drainage submissions to support a planning application for development;
- Homeowners when considering alterations / extensions to their home that affect surface water run-off (Section 7);
- Professionals involved in developing drainage schemes including engineering, urban and landscape professionals;
- Development Management officers when considering development applications; and
- Local Authorities when developing local planning and land-use policy.

2 Introduction

2.1 Background

2.1.1 West Sussex County Council was made LLFA for West Sussex by the Flood and Water Management Act 2010 (the Act). As LLFA, West Sussex County Council has a strategic overview of 'local flooding.' Local flooding is defined by the Act as flooding which is caused by:

- Surface water; and/or
- Groundwater; and/or
- Ordinary Watercourses.

The management of surface water for new developments is a key factor in managing local flood risk.

2.2 Use of Sustainable Drainage Systems: Policy and Legislative Requirements

- 2.2.1 National planning policy directs new development wherever possible away from areas at risk of flooding. This notwithstanding, new development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems (SuDS). When considering major development, SuDS should be provided unless demonstrated to be inappropriate (Planning Practice Guidance paragraph 079 ID: 7-079-20150415).
- 2.2.2 As the LLFA, West Sussex County Council is required under Article 18 of the Town and Country Planning (Development Management Procedure) (England) Order 2015 (the Development Management Procedure Order) to provide consultation response on the surface water drainage provisions associated with major development.
- 2.2.3 Major development is defined within the Development Management Procedure Order as development that involves any one or more of the following:
- (a) the winning and working of minerals or the use of land for mineral-working deposits;
 - (b) waste development;
 - (c) the provision of dwelling houses where:
 - (i) the number of dwelling houses to be provided is 10 or more; or
 - (ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
 - (d) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
 - (e) development carried out on a site having an area of 1 hectare or more.

2.2.4 Input to the development management process by the LLFA is not restricted to major development applications. LLFA advice should be sought on other planning applications which raise surface water or other local flood risk issues; consultation can be on the basis of pre-arranged protocols (see also planning practice guidance paragraph: 045 reference ID: 7-045-20150323).

2.3 Sustainable Drainage in Planning

2.3.1 SuDS are designed to control surface water as close to its source as possible. They should also aim to closely mimic the natural, pre-development drainage across a site, wherever possible. Well-designed SuDS also provide opportunities to:

- reduce the causes and impacts of flooding;
- remove pollutants from urban run-off at source; and
- combine water management with green space yielding benefits for amenity, recreation and wildlife.

2.4 Drainage Strategies

2.4.1 Development has the potential to change surface water and groundwater flows, depending upon how the surface water is managed within the development proposal.

Planning applications for development should therefore be accompanied by a site-specific drainage strategy that demonstrates that the drainage scheme proposed is in compliance with West Sussex County Council's sustainable drainage policies, as outlined within this document.

The drainage strategy must also demonstrate that the proposed surface water management proposal is consistent and integrated with any other appropriate planning policy and flood risk management measures that are required.

2.5 Strategic Consultation

2.5.1 As the LLFA, West Sussex County Council has a consultation role in relation to the preparation of local plans, neighbourhood plans, strategic flood risk assessments and other planning instruments produced by Local Planning Authorities. West Sussex County Council will provide advice and guidance on local flood risks and appropriate policy for the plan area upon request.

2.5.2 Upon request, West Sussex County Council will provide information with respect to drainage and local flood risk for individuals and other organisations to utilise in preparation of planning documents.

3 Planning policy and regulatory guidance for drainage

3.0 This section sets out the sources of planning policy relevant to the management of surface water. These will form the basis of West Sussex County Council's assessment of any submitted drainage strategy. The drainage strategy will need to demonstrate how the development meets these requirements.

3.1 National Planning Policy Framework (NPPF)

3.1.1 The National Planning Policy Framework (NPPF) was published on 27 March 2012; it sets out the Government planning policies for England and how these are expected to be applied. Planning law requires that applications for planning permission must be determined in accordance with the relevant Local Development Plan, following public consultation and with due regard to other material considerations. Flooding and drainage policy within the NPPF is a material consideration which states that planning authorities should:

- direct development away from areas at highest flood risk;
- take the impacts of climate change into account;
- use opportunities offered by new development to reduce the causes and impacts of flooding;
- ensure flood risk is not increased elsewhere;
- give priority to the use of sustainable drainage systems;
- enhance the natural and local environment; and,
- look to improve discharged water quality.

3.1.2 Paragraphs 155 to 165 of the NPPF have particular relevance to flooding and drainage.

3.1.3 The NPPF is supported by the Planning Practice Guidance¹ which provides further advice on how planning can take account of the risks associated with flooding in plan-making and the application process.

3.2 Watercourse Regulation

3.2.1 Under Section 23 of the Land Drainage Act, 1991 No person shall—

- (a) erect any mill, dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or
- (b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert in a manner that would be likely to affect any such flow,

¹ The Planning Practice Guidance is a web-based resources which can be accessed from the Planning Portal at: http://planningguidance.planningportal.gov.uk/?s=Drainage&post_type=guidance

without obtaining the consent of the Internal Drainage Board (where one exists), the Environment Agency (if the watercourse is designated as a Main River) or the LLFA.

3.2.2 Where Section 23 of the Land Drainage Act 1991 applies to a development, grant of planning permission, in itself, does not allow construction to commence without grant of an Ordinary Watercourse Consent (OWC) or Environmental Permit (EP) where development affects Main Rivers.

3.2.3 For further details see: <https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/dealing-with-flooding/flood-risk-management/ordinary-watercourse-land-drainage-consent/>

3.3 Non-statutory technical standards for sustainable drainage

3.3.1 To support the LLFA consultee role, Defra published the Non-Statutory Technical Standards for Sustainable Drainage Systems on 23 March 2015. These standards provide advice and guidance for the design, maintenance and operation of sustainable drainage systems².

3.3.2 Further guidance on the application of the Non-Statutory Technical Standards will be provided by Defra and associated stakeholders.

3.3.3 The policies in this policy statement are consistent with the Non-Statutory Technical Standards.

3.4 Local Authority Guidance

Local Planning Authorities are ultimately responsible for determining planning applications and have numerous statutory and non-statutory planning policy documents to support the delivery of sustainable development within their districts.

3.4.1 Local Plans

National planning policy places Local Plans at the heart of the planning system. Local Plans set out a vision and a framework for future development of the area. Local Plans should be based upon and reflect the presumption in favour of sustainable development. The Local Plans will address housing, the economy, community infrastructure and environmental issues such as adapting to climate change and ensuring high quality design.

² The Non-statutory Technical Standards are published at:
<https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards>

The management of flood risk and surface water can be dealt with through policies for sustainable construction, flood risk, open space, landscape character and green infrastructure. These policies may be supported by further Supplementary Planning Documents (SPD) or guidance notes.

Any drainage strategy should make reference to the relevant Local Plan policy and may also have to provide evidence which supports delivery of biodiversity, amenity and other benefits.

3.4.2 Strategic Flood Risk Assessments (SFRA)

Strategic Flood Risk Assessments are required to inform the development of Local Plans, as stated within the NPPF. A SFRA assesses the risk to an area from flooding from all sources, now and in the future, taking into account climate change and assesses the impact that land use changes and development in the area will have on flood risk. Each Local Planning Authority within West Sussex has prepared and referenced a SFRA within their planning documents. These documents provide key information on sources of flooding and may provide information for specific site allocations.

3.5 West Sussex County Council Guidance

The Local Flood Risk Management Strategy sets out how we as a LLFA will work alongside other risk management authorities to deliver improvements together to reduce flood risks. The strategy acknowledges that it is currently surface water flooding that causes the most regular impact to communities across West Sussex.

When considering surface water drainage within new developments in West Sussex, it is recommended that reference is made to:

3.5.1 Water. People. Places a guide for master planning sustainable drainage into developments

available at:

https://www.westsussex.gov.uk/media/2270/suds_design_guidance.pdf

This guidance outlines the process for integrating sustainable drainage systems into the master planning of large and small developments. This guidance should be used as part of the initial planning and design process for all types of development.

3.5.2 The Updated Flood Map for Surface Water & Long term flood risk information

available at: <https://www.gov.uk/government/publications/flood-maps-for-surface-water-how-they-were-produced>

Long term flood risk information is provided via the following link;

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

3.5.3 Surface Water Management Plans

Surface water management plans outline how surface water will be managed in a given area that experiences flooding from surface water runoff. Existing plans can be viewed via the following link:

<https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/dealing-with-flooding/flood-risk-management/flood-reports-projects-and-policies/>

Any drainage strategy should incorporate data from the updated Flood Map for Surface Water and if the site falls within an area covered by a SWMP the drainage strategy should include consideration of any relevant findings and recommendations.

3.5.4 Culvert Policy

West Sussex Local Authorities are in general opposed to the culverting of watercourses because of the adverse effect on flood defence and ecology. Approval, therefore, will only be granted for an application to culvert an ordinary watercourse if there is no reasonably practicable alternative or if the detrimental effects of culverting would be so minor that they would not justify a more costly alternative. The West Sussex Culvert Policy can be viewed [here](#):

3.5.5 Land Drainage & Consenting Enforcement Policies

WSCC LLFA's Land Drainage & Consenting Enforcement Policies are currently awaiting final approval. The guiding principle of these policies is to inform and educate landowners, developers, farmers, and other businesses to facilitate a greater level of compliance. WSCC LLFA recognises that a collaborative approach to prevention is better than cure. However, it will take action where it is suspected that an offence has occurred or is reasonably foreseeable. This may range from providing advice and guidance; serving notices; through to prosecution for failure to comply with notices; or any combination that achieves the desired outcome. In order to improve land drainage and seek 'betterment', WSCC LLFA will use its powers of enforcement under the Flood & Water Management Act and LDA91 to require a watercourse to be cleared if matters cannot be resolved by the provision of advice and guidance.

3.6 Other Guidance

In approaching or reviewing design, technical aspects may need further clarification and detailed specification in order to satisfy the LLFA that the design meets the required standard.

West Sussex LLFA will make reference to good practice presented within the following documents, and would recommend that any designer also refers to:

3.6.1 CIRIA SuDS Manual (C753), 2015

This guidance document provides comprehensive information on all aspects of the life cycle of sustainable drainage from initial planning, design through to construction and future management including landscaping, waste management and costs. It reinforces the multi-functional nature of SuDS in meeting a range of policy goals within different regulatory areas: planning; flood risk management; water quality management; and water resource management. This interrelationship between SuDS and key regulatory frameworks is further depicted in Figure 1 below.

3.6.2 BS 8585:2013 Code of practice for surface water management for development sites

The British Standard gives recommendation on the planning, design, construction and maintenance of surface water management systems for new development and redevelopment sites. It gives recommendations for minimizing and/or mitigating flooding and maximizing the social and environmental benefits of development.

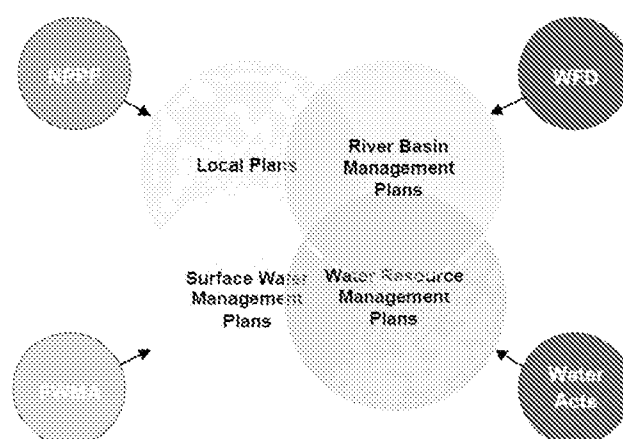


Figure 1: Inter-relationships between different areas of water policy (Planning Advice for Integrated Water Management, Cambridge Natural Capital Leaders Platform, 2014).

3.6.3 Building Research Establishment, Soakaway Design – Digest 365 (BRE DG 365 (2016))

Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period at the location and depth of the

proposed structures. The percolation tests must be carried out in accordance with DG 365 (or similar approved method) and the test pits should be above an agreed maximum annual groundwater level based upon best available data.

3.7 Wider Duties as a Public Body under other Environmental Regulatory Mechanisms

West Sussex LLFA as a public body has a duty under other regulatory mechanisms to raise environmental issues with the Local Planning Authority.

3.7.1 Water Framework Directive (WFD)

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (SI 3242) (WFD) became UK law in December 2003. The aim of the WFD is to provide the opportunity to plan and deliver a better water environment, focusing on ecology. The WFD aimed for the water environment to reach good chemical and ecological status in inland and coastal waters by 2015. Planning and improvement programmes are continuing in six year cycles until 2027.

3.7.2 The WFD drives water quality improvement planning along total river catchment areas, through the production of River Basin Management Plans by the Environment Agency. The directive puts a duty on public bodies to have regard to River Basin Management Plans (and associated supplementary plans) when exercising their functions where it may affect a river basin catchment.

3.7.3 Controlling water is inherent in the WFD's objectives as uncontrolled surface flow or flooding can cause unmanageable quality problems. Sustainable drainage principles are a major contributor in meeting the objectives of the WFD in its continuing cycles.

3.7.4 The Conservation of Habitats and Species Regulations 2010

The Conservation of Habitats and Species Regulations 2010 transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law consolidating all amendments made to the earlier 1994 regulations.

3.7.5 Under section 9(5) of the above regulations, a LLFA, in exercising any of their functions, must have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of those functions.

3.7.6 The Countryside and Rights of Way Act 2000

This act (section 74) places a duty on public authorities to have regard for the conservation of biodiversity³ and on government departments to maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity.

³ Amended by section 40,41 and 42 of the Natural Environment and Rural Communities (NERC) Act, 2006.

4 Drainage Consultation

4.1 Introduction

A drainage strategy should be submitted to the relevant Local Planning Authority along with the planning application for any development.

- 4.1.1 It is important that the consultation reflects the level of risk. Consequently consultation may also occur for development, other than major development in areas of local flood risk, as described in Section 4.2 and Section 7.
- 4.1.2 Irrespective of whether or not formal consultation is required, all Developers are encouraged to consider the policies outlined in this document with respect to their site drainage design.
- 4.1.3 Consultation on flood risk will also occur with other risk management authorities. For example, the management of tidal and fluvial flood risk and the prevention of inappropriate development in the flood-plain remains the responsibility of the Environment Agency. The Environment Agency is also responsible for the management of permitting regulations which may affect discharge to water bodies or the ground. Similarly, if any drainage scheme requires connection to a public sewer, approval will be required from the appropriate sewerage undertaker.

4.2 Critical Drainage Areas and Areas of High Local Flood Risk

The Town and Country Planning (General Development Procedure Amendment No. 2, England) Order 2006 introduces the concept of Critical Drainage Areas as *an area within Flood Zone 1 which has critical drainage problems and which has been notified [to] the local planning authority by the Environment Agency*.

- 4.2.1 West Sussex LLFA will work with the Local Planning Authorities to identify Areas of High Local Flood Risk for their districts. These areas will be based upon the Surface Water Management Plans that it has developed in partnership with other risk management authorities and on the Surface Water Flood Maps (see paragraphs 3.5.2 and 3.5.3). Where these areas are identified, all planning applications with potential surface water management implications will need to be submitted with a more rigorous justification of the chosen drainage system and an assessment of its associated impact.

Any drainage strategy submitted to accompany a planning application for major development should make full reference to the Surface Water Flood Map and the most recent available Surface Water Management plan for the area in which the development is planned.

4.3 Ordinary Watercourses

An 'ordinary watercourse' is defined as any channel capable of conveying water that is not part of a 'main river'; it may not have a permanent water level. Small rivers, streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) can all be classified 'ordinary watercourses'

When considering the development/redevelopment of any site, existing ordinary watercourses should be identified and accommodated within any drainage strategy design. Culverting (piping) a watercourse is not advised unless there is no alternative. The resulting reduction in storage volume, flow capacity and habitat potential would be unacceptable.

Access to facilitate future maintenance of drainage infrastructure and ordinary watercourses must be incorporated in the drainage strategy irrespective of whether the watercourses are culverted or not.

4.3.1 Existing watercourses should preferably be retained as open features within a designated corridor, and ideally as public open space. It is recommended that any discharge to an ordinary watercourse or any modification to an ordinary watercourse be identified and agreed in principle with West Sussex LLFA prior to submission of any planning application. The ability of a watercourse to convey water (and to function as an effective exceedance flow route, where appropriate) will always need to be maintained.

4.3.2 For ordinary watercourses, Ordinary Watercourse Consent (Land Drainage Consent) must be sought from the LLFA (West Sussex County Council) or its agent, prior to starting any works (temporary or permanent) that affect the flow of water in the watercourse. Such works may include culverting, channel diversion, the construction of new surface water outfalls and the installation of trash screens. If the watercourse affected is a main river, this would require an Environmental Permit under the Environmental Permitting Regulations and guidance should be sought from the Environment Agency in the first instance.

4.4 Consultation on Planning Applications

4.4.1 Overview

Consultation with West Sussex LLFA will occur through the planning process. West Sussex LLFA will be notified of the submission of a major planning application by the Local Planning Authorities within West Sussex. A substantive response to the LPA is legally required from West Sussex LLFA within 21 days of consultation.

4.4.2 Pre Application Advice

Incorporating appropriate drainage is easier and more sustainable if it is planned and designed from the start of a development. Pre-application advice on drainage is strongly encouraged by the LLFA and should normally be arranged with the District / Borough Drainage Engineer via the Local Planning Authority. If an application is submitted which does not comply with the Non-Statutory Technical Standards , NPPF, and / or this policy West Sussex LLFA may object to the application. Pre-application discussions are advocated to avoid this situation. The SuDS Manual, in particular Table B1, provides further guidance for the content of pre-application discussions.

4.4.3 Planning Application Submission

Major applications and other development applications in areas at risk from flooding will, once validated by the Local Planning Authority, be referred for technical review to the District / Borough Drainage Engineer who will identify site specific land use considerations that affect surface water management. West Sussex LLFA will also be reviewing these applications for compliance with this policy statement, considering the implications of flood risk and any Surface Water Management Plan that may apply; and will consider adherence to wider environmental principles of the NPPF that may have a bearing on drainage design (for example, water quality, biodiversity and landscape). Consultation responses from both the District / Borough Engineer and the LLFA will be returned via the Local Planning Authority within the required 21 days following receipt of a suitably detailed submission. Consultation responses may result in a request for further information or for planning conditions for subsequent determination.

4.5 Drainage Strategy Development

The drainage strategy will need to incorporate the policies set out in Section 5.

- 4.5.1** The required scope for a Drainage Strategy is set out in Table 1 below. Amplifying detailed notes follow Table 2 so a developer is left in no doubt as to the requirements.

Scope for Drainage Strategy	Relevant sections of document
Drainage Catchment & Impermeable area (pre- and post-development)	5.2.1; 5.6.4; 5.3.1
Discharge location(s)	5.2.1; 5.2.5
Infiltration capacity	5.2.2-5.2.3
Design calculations for peak flow, volume control and greenfield runoff, and/or brownfield runoff where appropriate	5.3
Inclusion of climate change & future development allowances	5.2.2; 5.3.2; 5.3.4; 5.3.6; Policy 5; 5.6.1
Topographical survey of the site	5.3.1; 5.4.1
Details of any adjacent watercourse	5.3.1; 5.4.1
Areas of flood risk	4.2; 5.5
Quantification of any surface water flows on-site from off-site locations	5.3
Exceedance routes	5.3.4; Policy 2
Offsite works	5.3.1; 5.5.2
Consents	3.2; 4.3
Any constraints which affect the proposed development	5.3.8; 6.1
Locations of sensitive receptors, including source protection zones, habitat designations or archaeological features	6.1.7
Principles of temporary drainage during construction	6.1.2
Proposed extent of adoption strategy	5.7.6
A Strategic Surface Water Management Strategy for large sites for which the development is to be phased.	5.3.9
Correspondence from any receiving authority or permitting authority	Section 4; 5.2.5

4.5.2 Proportionality in compiling a drainage strategy

The drainage strategy needs to follow the above guidance but should be proportionate to the size of the development. A residential development of several houses will be expected to provide appropriate modelled run-off and detailed drawings for how run-off is being attenuated; for a small home-owner extension, architect's drawings annotated with proposed drainage arrangements may suffice.

5 Policies for Sustainable Drainage

5.1 Introduction

- 5.1.1 West Sussex LLFA has adopted the policies summarised in Table 5.1 to conform to statutory policy and best practice. Policies 1 to 6 set out the requirements for a drainage strategy to be compliant with the NPPF and Non-Statutory Technical Standards for Sustainable Drainage. Policies 7 to 10 set out expectations to be considered within a drainage strategy in response to environmental legislation and guidance that West Sussex County Council and the Local Planning Authorities have a duty to comply with.
- 5.1.2 All the policies reflect the requirements of the Local Flood Risk Management Strategy, Surface Water Management Plans and Local Planning Authority Local Plans. Sufficient information must be submitted to demonstrate compliance.

Table 5.1: West Sussex LLFA SuDS Policies

Policy	Summary
SuDS Policy 1	Follow the drainage hierarchy
SuDS Policy 2	Manage Flood Risk Through Design
SuDS Policy 3	Mimic Natural Flows and Drainage Flow Paths
SuDS Policy 4	Seek to Reduce Existing Flood Risk
SuDS Policy 5	Maximise Resilience
SuDS Policy 6	Design to be Maintainable
SuDS Policy 7	Safeguard Water Quality
SuDS Policy 8	Design for Amenity and Multi-Functionality
SuDS Policy 9	Enhance Biodiversity
SuDS Policy 10	Link to Wider Landscape Objectives

SuDS Policy 1: Follow the drainage hierarchy

- 1. Surface runoff not collected for use must be discharged according to the following discharge hierarchy:**
 - **to ground,**
 - **to a surface water body,**
 - **to a surface water sewer, highway drain, or another drainage system, or**
 - **to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.**
- 2. The selection of a discharge point should be clearly demonstrated and evidenced.**

5.2 SuDS Policy 1: Discharge Hierarchy

5.2.1 When development occurs, the urbanisation process within a catchment affects the natural hydrology; if the destination of the water is altered this may result in:

- a reduced supply of rainfall to groundwater;
- an accelerated passage of flow to the receiving watercourses; and
- water directed away from existing receiving catchments.

In order to maintain the natural balance of the water cycle, the above discharge hierarchy⁴ must be observed. Where development results in changes in runoff destinations, the design must account for how the surface flows are managed and demonstrate it does not exacerbate off-site flood risk.

5.2.2 Infiltration structures (to ground) include soakaways, basins, swales and permeable paving. Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period at the location and depth of the proposed structures. The percolation tests must be carried out in accordance with BRE DG 365, CIRIA R156 or a similar approved method, and cater for the 1 in 10 year design storm event⁵ between the invert of the lowest entry pipe into the infiltration structure and the base. Tests should be undertaken during winter / early spring when ground water levels are typically highest; if groundwater levels are influenced by the tide then tests should be undertaken over a high-water spring tide.

⁴ SuDS selection hierarchy based on: CIRIA C753 - The SuDS Manual; BS8582:2013 – Code of Practice for Surface Water Management for Development Sites; and Approved Document H of the Building Regulations.

⁵ The design event will vary according to the storage design and the contribution the storage component makes to the overall SuDS for the site; as a minimum for traditional soakaways the design event will be for a 1:10 year event plus allowance for climate change.

For the purpose of design, the percolation rate must be applied to the sides of the infiltration structure only and the rate for the base must be zero, unless otherwise agreed with the LPA engineer. This does not apply to infiltration basins or permeable pavements, whereby the percolation rate is applied to the base only. The infiltration structure should drain 50% of its total volume in 24 hours or less for the 1 in 10 year event and for the 1 in 100 year event (unless otherwise agreed with the LPA engineer) in order to provide spare capacity for subsequent storms. Flood risk assessments: climate change allowances can be viewed via the following link:

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

- 5.2.3 Any infiltration drainage design must include adequate winter groundwater monitoring data in areas of known groundwater issues, to determine the highest winter groundwater table. Residential developments in excess of five properties will require ground water monitoring to be carried out between October and March inclusive. The extent of monitoring required for smaller developments will be subject to agreement with the District or Borough Council Engineers. Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded groundwater level identified in that location; ideally this should be 1m where possible.
- 5.2.4 Deep bore soakaways should only be considered after other forms of infiltration attenuation have been explored and in all cases, the applicant will be required to consult the EA hydrogeologist before their inclusion in a drainage strategy.
- 5.2.5 Infiltration is not always appropriate, and the advice of the drainage engineer should be sought: for developments in or close to source protection zones (SPZs); in areas with a known history of land contamination; or in areas with known high seasonal groundwater levels.
- 5.2.6 Surface water must not be discharged into the foul sewer system. Discharge to a watercourse or surface water sewer must be restricted to the estimated mean greenfield runoff rate (Q1) by means of a controlled outflow (but see paragraph 5.4.4 regarding restrictions on runoff rates for brownfield sites). Flood Estimation Handbook (FEH) methods should be the preferred approach for developing runoff estimates used in surface water design⁶. There is also a tool available on www.ukSuDS.com that allows calculation of Q1 by both FEH and IH124. Both the point of connection and discharge rate must be agreed with the relevant owner or

⁶ SuDS Manual paragraph 24.3.

responsible body including internal drainage boards, highway authorities, sewerage undertakers, riparian owner, Environment Agency, Canals and River Trust and others (see also paragraph 4.3 Ordinary Watercourses).

SuDS Policy 2: Manage Flood Risk Through Design

- 1. The drainage scheme proposed is to:**
 - a. protect people and property on the development site from flooding; and,**
 - b. avoid creating any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.**
- 2. Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.**
- 3. For large sites where development is to be phased, there will need to be a strategic site surface water management system that allows different parts of the site to be developed at different times while ensuring that each of the design criteria can be met.**

5.3 SuDS Policy 2: Manage Flood Risk through Design

- 5.3.1 The natural drainage catchment for the site needs to be mapped including the water that drains down into / through the site from outside the site boundary. The pre and post development drainage is to be based upon the whole catchment demonstrating how off-site drainage is being managed within the proposed strategy.
- 5.3.2 The drainage system must be designed to operate without any flooding occurring during any rainfall event up to (and including) the critical 1 in 30 year storm (3.33% AEP). The system must also be able to accommodate the rainfall generated by events of varying durations and intensities up to (and including) the critical, climate change adjusted 1 in 100 year storm (1% AEP) without any on-site property flooding and without exacerbating the off-site flood-risk. Sufficient steps are to be taken to ensure that any surface flows between the 1 in 30 and 1 in 100 year events are retained on site. Storage should be based upon analyses of a range of winter and summer storm profiles to determine a critical storm event.
- 5.3.3 The LLFA will wish to review the input values and calculations for storage design and the greenfield run-off rates upon which they are based. Where computer models have been used to underpin design, the drainage strategy should be accompanied by the full results and design criteria.

Where calculations involve use of the **Coefficient for Volumetric Run-off (Cv)** Sewers for Adoption (7th Edition) recommends that a Cv of 1.0 should be used whenever calculating runoff from impermeable surfaces (roofs and paved areas should have an impermeability of 100%). When making an application the designer should demonstrate to the LLFA that Cv has been suitably determined.

5.3.4 The choice of where storage volumes are accommodated may be within the drainage system itself or within other areas designated within the site for conveyance and storage.

5.3.5 The drainage design should show flow routes through the proposed development, demonstrating where surface water will be conveyed for three types of flow:

1. Low flow routes

Regular flow from source control features such as permeable pavements should travel in low flow channels through the development in a controlled way contributing to landscape quality.

2. Overflows

In the event of local blockages or surcharge a simple overflow arrangement should allow water to bypass the obstruction and return to the main SuDS drainage system when conditions return to normal.

3. Exceedance routes

Should SuDS be overwhelmed by exceptional rainfall (1:100 + allowance for climate change) then exceedance routes are required to protect people and property. These provide unobstructed overland flow routes from the development and should be considered for all drainage schemes. Exceedance routes should also be protected from future changes in land use.

5.3.6 The primary consideration shall be risks to people and property on and off site.

5.3.7 Wholesale land raising should not be undertaken, for example, by the spreading of excavated material on site or the importation of additional fill. Such action increases the possibility of changing natural flows and increasing flood risk beyond the development area.

5.3.8 Access should be maintained into and through the site for emergency vehicles. The drainage application must give consideration to flood risk vulnerability classifications (as defined through Planning Practice Guidance to the NPPF), as specific measures or protections may be necessary and need to be agreed with the appropriate authority.

5.3.9 The time required for the storage to accept further storm flows should be considered, especially if downstream flood levels can affect the outfall. Attenuation storage volume provided by any drainage area should half empty within 24 hours so that it can receive runoff from subsequent storms. If the drain down time (full to empty) is more than 24 hours, then long duration events should be assessed to ensure that drainage is not compromised by inundation.

5.3.10 If the proposed system connects to an existing drainage system, whether it is a sewer, highway drain, water body or sustainable drainage system, consideration must be given to the operational capacity and functionality of the existing system to ensure that no adverse impacts result or flood risk is increased either on-site or off-site.

5.3.11 For large sites involving phased development, the strategic surface water management system will need to be designed to manage the flows from the final developed site, and specific conditions will need to be set for each development plot so that the original design assumptions are not invalidated⁷.

SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

- 1. Drainage schemes should be designed to match greenfield discharge rates and follow natural drainage routes as far as possible; pumps should therefore not form part of drainage schemes.**
- 2. Greenfield runoff should be calculated from FEH or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.**

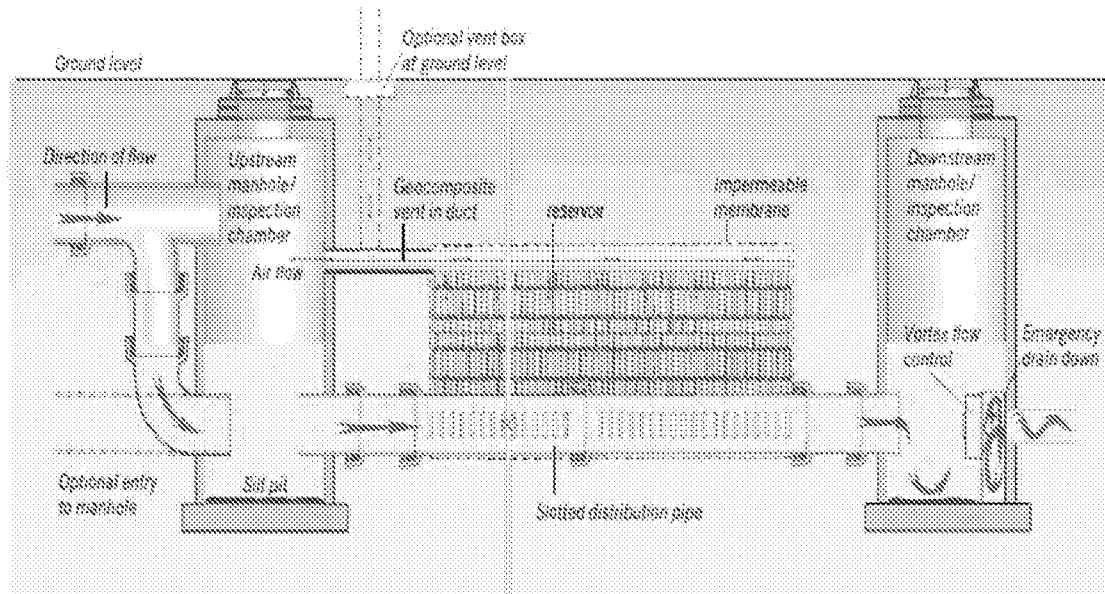
5.4 SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

5.4.1 Runoff rates should match Greenfield runoff rates, follow natural or existing drainage routes, utilise existing natural low-lying areas or conveyance pathways, and match infiltration rates and discharges as far as possible for all events up to and including the climate-change adjusted 1 in 100 year (1% AEP) design event.

⁷ For further details on this subject, see chapter 7 of the SuDS manual.

- 5.4.2 By mimicking the natural drainage flow paths and working within the landscape, more effective and cost-efficient design can be developed and drainage systems can be kept shallower.
- 5.4.3 Working with existing natural gradients also avoids any reliance on pumped drainage, with its associated energy use and failure risk. The natural environment including woods, trees and hedgerows can play a part in water management.
- 5.4.4 Redevelopment on brownfield land has the potential to rectify or reduce flood risk. In all cases, including on brownfield sites, runoff should where possible be restricted to the greenfield 1 in 1 year runoff rate during all events up to and including the 1 in 100 year rainfall event with climate change. An alternative approach would be for discharge rates to be limited to a range of greenfield rates, based on the 1 in 1, 1 in 30 and 1 in 100 year storm events. However, the use of this method to restrict discharge rates requires the inclusion of on-line long-term storage, sized to take account of the increased post development volumes, discharging at no greater than 2l/s/ha. While discharging at no greater than 2 l/s/ha is acceptable, it is still the LLFA's preference that the former approach is used wherever possible. If it is deemed that this is not achievable, evidence must be provided and developers should still seek to achieve no increase in runoff from greenfield sites and a 50% betterment of existing run off rates on brownfield sites (provided this does not result in a runoff rate less than greenfield). For further guidance see Susdrain Fact sheet on Designing attenuation storage for redeveloped sites:
http://www.susdrain.org/files/resources/fact_sheets/01_15_fact_sheet_at_tenuation_for_redeveloped.pdf
- 5.4.5 Storage, where space permits, should be on or as close to the surface as possible. Where cellular storage is opted for then the system should be designed in such a way as to minimise the risk of siltation e.g. by incorporating silt traps and to be filled via a distribution pipe to stop silt entering the units or by incorporating the storage tank off line whereby it only fills when the system surcharges. The cellular units should be manufactured from a recycled material such as PVC.

Long Section



Cross Section

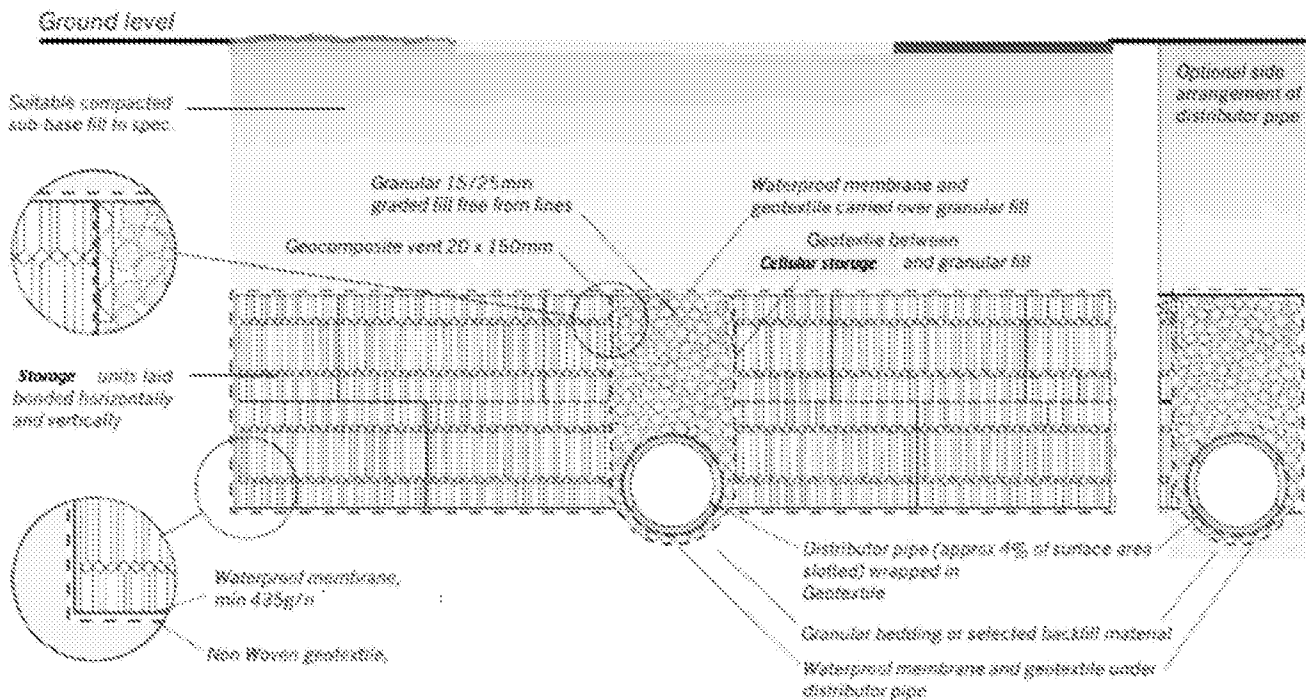


Figure 5.1 Consumer Recycled PVC Storage System minimising risk of siltation.

SuDS Policy 4: Seek to Reduce Existing Flood Risk

- 1. New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding.**
- 2. Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at an early stage and subsequently incorporated at the detailed design stage.**

5.5 SuDS Policy 4: Seek to Reduce Existing Flood Risk

- 5.5.1 Paragraph 157 of the NPPF outlines how flood risk management bodies should seek to manage flood risk through using opportunities offered by new development to reduce the causes and impacts of flooding, taking the predicted effects of climate change into account.
- 5.5.2 As LLFA, West Sussex County Council will endeavour to ensure that this principle is applied across the County. Where a developer's Surface Water Management Strategy has identified that there are existing flood risks affecting a site or its surroundings, there would be an expectation that the developer manages the identified risk appropriately to ensure that there are no on-/off -site impacts as a result of any development. Similarly, where there are opportunities to reduce the off-site flood risk through carefully considered on-site (or off-site) surface water management, the LLFA will encourage developers to explore these fully.

SuDS Policy 5: Maximise Resilience

- 1. The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.**
- 2. A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be explored prior to other design solutions.**
- 3. Culverting an existing watercourse should only be considered if there is no feasible alternative.**

5.6 SuDS Policy 5: Maximise Resilience

- 5.6.1 The Environment Agency published updated Flood risk assessments: climate change allowances in February 2016. Further advice on the interpretation of these allowances is available via the following link:

Flood risk assessments: climate change allowances

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

- 5.6.2 Design of drainage systems utilising a sustainable drainage design and reducing reliance on below ground systems such as pipes and tanks, provides greater flexibility to accommodate changes in surface water peak flows and volumes. Sustainable measures that control flow rates near to the source and maximise natural losses through infiltration and evaporation are preferred. Surface systems are preferred as their function can be more easily observed and maintenance is generally easier. If underground storage tanks are used, they should have easily accessible surface inspection points to allow maintenance checks / silt removal (see also Section 5.4.5).
- 5.6.3 Culverting (piping) a watercourse is not advised unless it is for access purposes or there is no reasonable alternative; the resulting reduction in storage volume, flow capacity, habitat potential and ease of access for maintenance is likely to be unacceptable (see also Section 3.5.4).
- 5.6.4 Development results in the conversion of permeable surfaces to impermeable over time (e.g. surfacing of front gardens to provide additional parking spaces, extensions to existing buildings, creation of large patio areas). The consideration of urban creep should be assessed on a site by site basis but is limited to residential development only. The allowances set out in Table 5.2 must be applied to the impermeable area within the property curtilage according to the proposed development density.

Table 5.2: Impermeable Area Allowances for Urban Creep

Residential development density (Dwellings per hectare)	Change allowance (% of impermeable area)
≤ 25	10
30	8
35	6
45	4
≥ 50	2
Flats & Apartments	0

SuDS Policy 6: Design to be Maintainable

- 1. No building is to be occupied until a Verification Report pertaining to the surface water drainage system, carried out by a Chartered Engineer, has been submitted to the Local Planning Authority which demonstrates the suitable operation of the drainage system such that flood risk is appropriately managed, as approved by the Lead Local Flood Authority. The Report shall contain information and evidence (including photographs) of earthworks; details and locations of inlets, outlets and control structures; extent of planting; details of materials utilised in construction including subsoil, topsoil, aggregate and membrane liners; full as built drawings; and topographical survey of 'as constructed' features..**
- 2. The Verification Report should also include an indication of the adopting or maintaining authority or organisation and may require inclusion within a register of drainage features.**

5.7 SuDS Policy 6: Design to be Maintainable

5.7.1 The drainage system must be designed to take account of the construction, operation and maintenance requirements of both surface and subsurface components, allowing for any personnel, vehicle or machinery access required to undertake this work. Standard 10 of the Defra Non-Statutory Technical Standards states: *S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.*

Ditches and watercourses (including culverts) should retain as a minimum a three and a half metre⁸ easement with access that allows for its future maintenance by people / equipment in perpetuity. Without maintenance, the function of drainage systems may alter. Increased leaf litter, sediments and colonisation of vegetation may clog drainage measures or impact the characteristics of operational controls. Consideration should also be given to the Construction Design and Management regulations for health and safety purposes.

5.7.2 Design considerations will need to address the practicalities and funding arrangements for lifetime maintenance, identifying the body responsible and ensuring that financial mechanisms are in place such as bonded maintenance arrangements via S106 agreements and planning conditions. The Verification Report shall include details of the financial management and arrangements for the replacement of components at the end of the manufacturers recommended design life.

⁸ Paragraph 23.12 of the SuDS Manual (2015).

- 5.7.3 Wherever possible, it is preferable that drainage schemes should be designed at the surface to allow easy inspection and maintenance. Drainage maintenance can usually be incorporated as part of a typical landscape maintenance specification.
- 5.7.4 With surface water drainage systems, a careful balance must be struck between functionality and the creation of habitats. The encouragement of certain protected species or creation of protected habitats may conflict with the regular maintenance works essential to ensuring long term functionality of the drainage measures. An awareness of any biodiversity objectives should be considered as part of a Management & Maintenance Plan for the drainage measures; specifically timing of vegetation cuts and silt removal to ensure no conflict with nesting or specific life stages of biota.
- 5.7.5 The Verification Report to be provided should indicate schedules and times of activities, as well as critical controls or components of the drainage scheme. This plan should include an indication of the roles and responsibilities for each authority or organisation which may have a responsibility for maintenance activities. Any interconnectivity with or reliance upon other drainage systems should be indicated. Where automatic systems form part of the operational functionality of a drainage system, then processes should be in place to allow immediate action in terms of restoration of performance.
- 5.7.6 As LLFA, West Sussex County Council has a duty to maintain a register of structures or features which are likely to have a significant effect on flood risk. SuDS features where they have a significant effect on flood risk would be designated under Section 21 of the Flood and Water Management Act 2010. Drainage schemes within new developments may include structures or features that will be required to be included within the register.

6 Environmental Policies

The policies in this section provide local interpretation of the environmental legislation and guidance that West Sussex County Council and the Local Planning Authorities have a duty to comply with, including the regulations referred to in Section 3.7 of this document.

SuDS Policy 7: Safeguard Water Quality

- 1. When designing a surface water management scheme, full consideration should be given to the system's capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.**
- 2. Interception of small rainfall events should be incorporated into the design of the drainage system.**

6.1 SuDS Policy 7: Safeguard Water Quality

- 6.1.1 Paragraph 170 of the NPPF states that the planning system should contribute to/enhance the natural and local environment by preventing both new and existing development from contributing to (or being put at unacceptable risk from) unacceptable levels of soil, air, water or noise pollution or land instability. The Water Framework Directive Regulations (see paragraph 3.7.1) is the principle statutory instrument that applies.
- 6.1.2 The design of any drainage proposal should therefore ensure that surface water discharges do not adversely impact the water quality of receiving water bodies, both during construction and when operational. Sustainable drainage design principles have the potential to reduce the risk of pollution, particularly through managing the surface water runoff close to the source and on the surface. Below ground pipes and tanks which are efficient for drainage purposes may not provide appropriate water quality treatment.
- 6.1.3 Runoff from small rainfall events can pose a particular problem for water quality. The 'first flush' of runoff contains the initial flush of pollutants that has built-up on surfaces during the preceding dry period. It is, therefore, possible to get a high initial pollution concentration for relatively small rainfall events.
- 6.1.4 Rainfall events that are less than or equal to 5mm in depth also comprise more than half of the rainfall events across the UK. The volume of runoff from these small events therefore can cumulatively contribute significantly to total pollutant loadings from a site over a specified period of time. Interception of an initial rainfall depth of 5 mm would mimic greenfield response characteristics in that small rainfall events do not generally produce any run-off.

- 6.1.5 West Sussex LLFA expects developers to demonstrate that the first 5 mm of any rainfall event can be accommodated and disposed of on-site, rather than being discharged to any receiving watercourse or surface water sewer. This can frequently be achieved through the inclusion of sustainable drainage measures such as infiltration systems, rain gardens, bioretention systems, swales, and permeable pavement.
- 6.1.6 Where it proves exceptionally difficult to achieve this principle, it must be demonstrated that any water leaving the site has been appropriately treated to remove potential pollutants.
- 6.1.7 When discharging to the ground, ground conditions and locations of any source protection zones should be confirmed.

SuDS Policy 8: Design for Amenity and Multi-Functionality

Drainage design should from the outset consider opportunities for inclusion of amenity and biodiversity objectives and thus provide multi-functional use of open space with appropriate design for drainage measures within the public realm.

6.2 SuDS Policy 8: Design for Amenity and Multi-functionality

- 6.2.1 Multi-functional use of land constitutes best practice and is underpinned by paragraph 10.1.1 of The SuDS Manual (2015):

The challenge for designers and planners is to create integrated urban spaces that include SuDS in creative and innovative ways, taking into consideration their potential contribution to a range of functions such as flood risk management, water supply, green infrastructure, habitat provision, transport corridors, climate proofing, community identity, recreation and tourism.

- 6.2.2 Applications of this policy include:
- the use of park areas as temporary flood storage during heavy rainfall events;
 - wetlands being used to deliver amenity value and habitat as well as water treatment;
 - use of permeable paving, rain gardens and tree pits to improve the design quality of the public realm, while improving permeability.
- 6.2.3 SuDS should form an integral component of networks of high quality open space which adapt for attenuation of surface water, sports and play and enhancement of biodiversity. A range of other considerations apply to creation of wetland areas / features which can generally be addressed through careful design. Refer to the SuDS Manual for detailed guidance.

SuDS Policy 9: Enhance Biodiversity

Drainage design should from the outset consider opportunities for biodiversity enhancement, through optimising the scope for surface systems, consideration of connectivity to adjacent water bodies or natural habitats, and appropriate planting specification.

6.3 SuDS Policy 9: Enhance Biodiversity

- 6.3.1 All public authorities have a duty to conserve biodiversity under the Countryside and Rights of Way Act (CROW) 2000 (see paragraph 3.7.4 of this document). The NPPF requires that Local Planning Authorities set out a strategic approach to plan positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure (NPPF para 171). Maximising the ecological value of drainage systems is consistent with national and local policies which aim to conserve and enhance biodiversity.
- 6.3.2 Drainage Strategies should draw upon best practice guidance clearly signposted in chapter 6 of The SuDS Manual.

SuDS Policy 10: Link to Wider Landscape Objectives

Drainage design should from the outset consider opportunities to contribute to the wider landscape and ensure proposals are coherent with the surrounding landscape character area.

6.4 SuDS Policy 10: Link to Wider Landscape Objectives

- 6.4.1 The landscape character of West Sussex is defined by its topography, flora and fauna, land use and cultural associations. The West Sussex Landscape Strategy, 2005 aims to protect and enhance the landscape of West Sussex as an asset for future generations. Integral to this is ensuring that new development is well designed and fits sympathetically with the differing character of localities and ensures that natural and historic landscape features are conserved and enhanced.
- 6.4.2 The form of drainage provision for any new development within or adjacent to any of these areas has the potential to contribute to or detract from the wider landscape. Working with the landscape to provide drainage may promote other opportunities to deliver benefits for biodiversity and also enhance the aesthetic character of these areas. The linear nature of many SuDS features can help create green corridors through

developments; these are important for wildlife and ensure that the associated development is connected with its surrounding environment.

- 6.4.3 When assessing drainage design, particularly surface systems, it is important to consider the drainage scheme in the context of the surrounding landscape character area. Landscape Character Assessments are valuable in understanding how to create a landscape with its proposed sustainable drainage scheme for a development so it fits into the landscape and townscape of the area. Effective integration will also require carefully researched and selected plants, which work to improve the local green infrastructure.

7 Flood Risk / Surface Water Management: Standing Guidance for Smaller Developments

7.1 Introduction

7.1.1 All development, regardless of its size, has the potential to be affected by surface water run-off or have an impact upon existing surface water flow routes. Surface water flooding, as distinct from other sources of flooding, currently causes the most regular impact to communities across West Sussex as evidenced by the extensive property flooding that occurred during 2012. This section provides guidance on managing surface water for smaller developments to minimise flood risk; guidance is directed both at home owners considering extensions / alterations and to developers for smaller (non-major) commercial developments. Sections 7.2 and 7.3 provide guidance to home-owners and commercial developers, respectively.

7.2 Homeowners

- 7.2.1 The following paragraphs set out what you as a home-owner are legally required to do if you make changes to your home or garden that will affect the management of surface water and also what measures you can take to mitigate the management of surface water issues and the reduction of flood risk. Two flow charts to summarise the guidance for homeowners are provided at the end of this section.

What do you want / intend to do?

7.2.2 *Paving of a front garden / driveway;*

If you intend to pave your front garden or driveway involving an area of more than 5m², you will require planning permission if free draining ground is being replaced with an impermeable material that will create run off. One of the main reasons for the new legislation is that the conversion of gardens to driveways in urban areas has increased the amount of water that goes into the storm drains when it rains, and this has contributed to the increase in flooding.

- 7.2.3 From a flood risk and drainage perspective, planning permission is not required if you are creating a driveway from a semi-permeable or permeable material, or if the water is directed to a lawn, border or soakaway to drain naturally with no increase in flow resulting to highway drainage. If you are in any doubt about whether or not planning permission is required, contact your LPA.

- 7.2.4 In order to help and advise householders of the options for achieving permeability and meeting the condition for permitted development status the Department for Communities and Local Government (CLG) has produce guidance on permeable paving which can be found on the following link <https://www.gov.uk/government/publications/permeable-surfacing-of-front-gardens-guidance>

7.2.5 *Install a subterranean/basement extension*

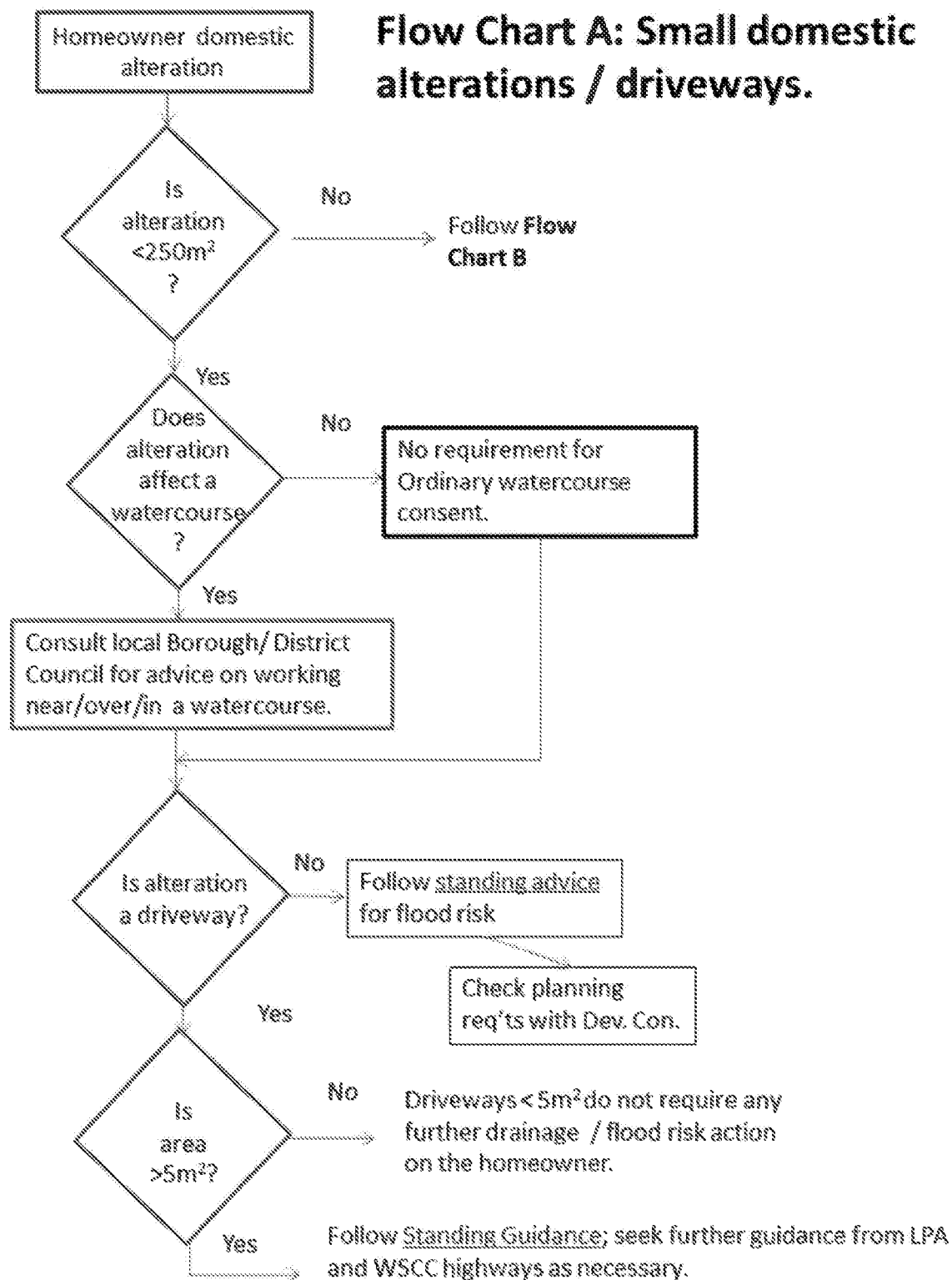
Due to the risk of rapid inundation by floodwater basements should be avoided in areas at risk of flooding. Self-contained basement dwellings are 'highly vulnerable' developments and should not be permitted in Flood Zone 3. The Environment Agency is opposed to these developments unless there is adequate protection from flooding and safe means of escape. Detailed technical advice should be sought from your District / Borough planning authority before considering an application in an area at increased risk of flooding.

7.2.6 *Extend my home by no more than 250m²*

LLFA standing advice (adapted from government guidance) on managing flood risk for minor extensions of less than 250m² that can be found in **Appendix B**. This advice is additional to any requirement for obtaining planning permission and the guidance of the local planning authority should always be sought at the outset of the process. If an existing property is located within flood zones 2 or 3 or in a flood pathway, the extension unless designed to be flood resilient as opposed to flood resistant, has the potential to remove floodwater storage. In this scenario, specific guidance from the District Engineer should be sought before finalising a design.

7.2.7 *Alter the nature of a watercourse running through or adjacent to my property.*

No alteration should be made to an existing watercourse running through or adjacent to your property without first consulting the Borough or District Council. This includes the bridging of an existing watercourse (and any associated culverting) to provide access to / from your property (see also Section 4.3.1 of the West Sussex LLFA Policy for the Management of Surface Water).



7.3 Developers

Minor developments of more than 250m² but not categorised as major development.

7.3.1 Developments up to 250m² is covered by the above paragraphs.

7.3.2 Major development is defined in paragraph 2.2.3 of this policy.

7.3.3 Currently, there appears to be no government guidance specifically informing the management of flood risk for developments greater than 250m² but less than 0.5 ha in area or less than 10 houses in total⁹. Given the scarcity of suitable development sites within West Sussex, a high proportion of planning applications are submitted for development that falls within this category, usually referred to as incremental development. Collectively, and over time, incremental development can have a very significant impact upon flood risk from surface water run-off. For this reason, the Lead Local Flood Authority is stipulating local requirements that need to be met by developers to minimise flood risk both to the development itself and to surrounding areas.

7.3.4 The key requirements are:

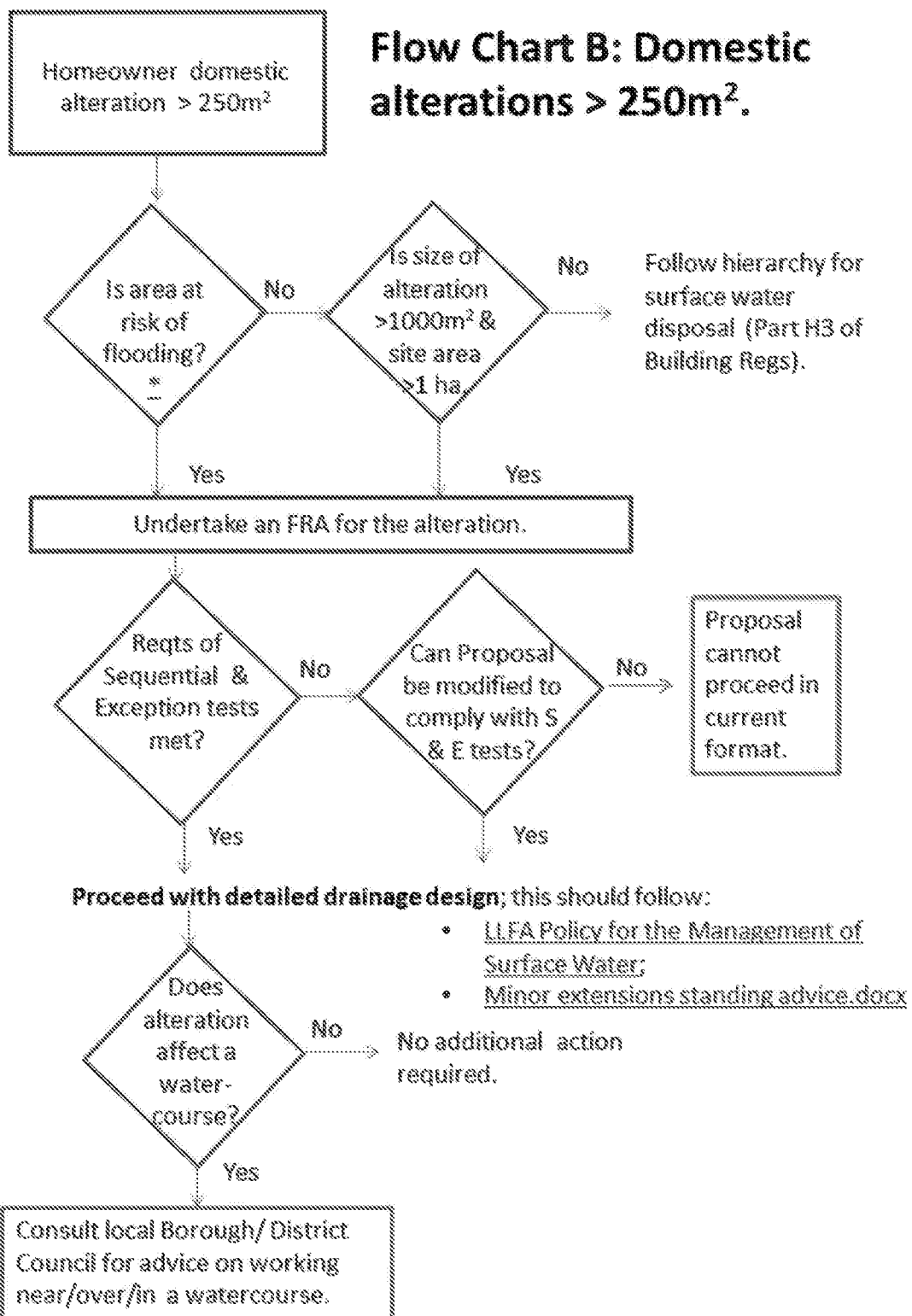
1. Establish the existing flood risk from all sources;
A suggested starting point is: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>
Nb. Selecting the detailed view on the map yields information on depths and flow velocities of flood water. Reference should also be made to any surface water management plans (SWMPs published by the Lead Local Flood Authority – see Section 4.5 of the main document) and to relevant SFRAs published by the District / Borough that include the proposed area of development.
2. If the area is at significant (medium or high) risk of flooding undertake a Flood Risk Assessment;
<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities> This will need to demonstrate that the sequential and exception tests have been completed and needs to incorporate a drainage strategy for the site. Section 5.1 of the West Sussex LLFA Policy for the Management of Surface Water provides detailed guidance but contact the planning or drainage staff at your local authority if you require further clarification.

⁹ The LLFA Policy for the Management of Surface Water requires all major development to be accompanied by a Drainage Strategy. The LLFA view is that a meaningful Drainage Strategy needs to be informed by a Flood Risk Assessment, notwithstanding that there are circumstances under which major development **may not** require an FRA if site size thresholds is <1ha and in flood zone 2 according to current government guidance.

3. Is the new development on the site of an existing development, i.e. brownfield?

If the development constitutes redevelopment of an existing brownfield site, the detailed guidance provided in paragraph 5.4.4 of this policy should be adhered to.

7.3.5 The flow chart below summarises the guidance to developers.



References

The Building Regulations 2000 Drainage and waste disposal
Approved document H ISBN: 1-859462-08-1

Building Research Establishment, Soakaway Design – Digest 365 (BRE 365)
ISBN: 1 86081 604 5, 1991

Centre for Ecology and Hydrology Flood Estimation for Small Catchments - IH
Report 124 Marshall, D.C.W. & Bayliss, A.C. ISBN: 0948540621, 1994

CIRIA C697 The SUDs Manual Woods-Ballard, B.; Kellagher, R. et al
ISBN: 978-0-86017-697-8, 2007

CIRIA R156 Infiltration Drainage – Manual of Good Practice Bettess, R.
ISBN: 0 86017 457 3

British Standards Institution BS8582:2013 – Code of Practice for Surface Water
Management for Development Sites ISBN: 978 0 580 76700 5

Glossary

AEP Annual Exceedance Probability	This is the probability of a flood event being exceeded within a given year. Expressed in percentage terms it is the inverse of the maximum return period. For example, the 100-year flood can be expressed as the 1% AEP flood, which has a 1% chance of being exceeded in any year.
Attenuation	Attenuation is the process of water retention on site and slowly releasing it in a controlled discharge to a surface water or combined drain or watercourse. The amount of discharge will vary depending whether it is a brown or Greenfield site. For brownfield sites the developer must determine the likely run off and agree an acceptable discharge with the LLFA, environment agency or water authority.
Biodiversity	The diversity of plant and animal life in the world, an area or a particular habitat – a high level of which is considered to be important or desirable.
Biota	The animal and plant life of a particular region or habitat.
Brownfield site	Any land or site that has been previously developed.
Catchment	The area contributing surface water flow to a point on a drainage or river system.
CIRIA	Construction Industry Research and Information Association. www.ciria.org
Climate change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity (anthropogenic) such as greenhouse gas emissions
Culvert	A structure which fully contains a watercourse as it passes through an embankment or below ground.
Development	The undertaking of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.
EA	Environment Agency. Government Agency responsible for flooding issues from Main River, and strategic overview of flooding.
Easement	The right to use the real property of another for a specific purpose. The easement is itself a real property interest, but legal title to the underlying land is retained by the original owner for all other purposes.

Exceedance Route	A pre-determined route for flows that exceeds the flood event that the drainage system has been designed to accommodate.
FEH	The Flood Estimation Handbook, produced by the Institute of Hydrology in 1999; an accepted method for estimating runoff.
Flood event	A flooding incident usually in response to severe weather or a combination of flood generating characteristics.
Flood risk	The combination of the flood probability and the magnitude of the potential consequences of the flood event.
Flood Risk Assessment	An appraisal of the flood risks that may affect development or increase flood risk elsewhere.
Freeboard	A vertical distance that allows for a margin of safety to account for uncertainties.
Flood and Water Management Act	The Flood and Water Management Act clarifies the legislative framework for managing surface water flood risk in England.
Greenfield	Undeveloped land.
Greenfield runoff rate	The rate of runoff which would occur from a site that was undeveloped and undisturbed.
Groundwater	Water that exists beneath the ground in underground aquifers and streams.
Groundwater flooding	Flooding caused by groundwater rising and escaping due to sustained periods of higher than average rainfall (years) or a reduction in abstraction for water supply.
IH124	A report published by the Institute of Hydrology in 1994 that was specifically produced to address the runoff from small catchments; it provides an accepted method for estimating runoff from catchments.
Impermeable	Will not allow water to pass through it.
Infiltration	Infiltration or soakaway is the temporary storage of water to allow it to naturally soak away into the ground. Because water soaks into the ground gradually, reduces the risk of flooding downstream. Infiltration may be used where there is no surface water sewer or where existing systems are at full capacity. Infiltration helps to recharge natural ground water levels.
Internal Drainage Board (IDB)	Internal drainage boards (IDB) are public bodies that Boards manage water levels in some areas where there is a special

need for drainage. These areas are known as internal drainage districts (IDD). IDBs undertake works to reduce flood risk to people and property, and manage water levels for agricultural and environmental needs.

LLFA	Lead Local Flood Authority is the risk management authority responsible for local flood risk defined as flooding from surface water, groundwater and ordinary watercourses. In West Sussex, the LLFA is West Sussex County Council.
Local Flood Risk Management Strategy	Strategy outlining the Lead Local Authority's approach to local flood risk management as well as recording how this approach has been developed and agreed.
Main River	A watercourse designated on a statutory map of Main rivers, maintained by Department for Environment, Food and Rural Affairs (Defra).
Mean Annual Flood	Referred to as QBAR, or the mean annual flood, is the value of the average annual flood event recorded in a river. This flow rate is used to provide a measure of the Greenfield runoff performance of a site in its natural state to enable flow rate criteria to be set for post development surface water discharges for various return periods.
On-line	A part of the drainage system that receives flows during all frequent events.
Ordinary Watercourse	An ordinary watercourse is a watercourse that is not part of a main river.
Overland Flow	Flooding caused by surface water runoff when rainfall intensity exceeds the infiltration capacity of the ground, or when the soil is so saturated that it cannot accept any more water.
Percolation	The passing of water (or other liquid) through a porous substance or small holes e.g. soil or geotextile fabric. A percolation (or infiltration) test is used to assess the rate of flow through the soil; see chapter 25 of SuDS Manual.
Qbar	(See Mean Annual Flood)
Q1	The Greenfield runoff for a 1:1 year flood event. This is derived from standard growth curves being applied to Qbar.
Permeability	A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium.

Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
SAAR	Standard Annual Average Rainfall; SAAR is the standard average annual rainfall for the period 1941 to 1970 in mm ¹⁰ .
Source Protection Zone	Defined areas showing the risk of contamination to selected groundwater sources used for public drinking water supply.
Strategic Flood Risk Assessment	A study to examine flood risk issues on a sub-regional scale, typically for a river catchment or local authority area during the preparation of a development plan.
Supplementary Planning Documents (SPD)	Documents which add further detail to the policies in the Local Plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design. Supplementary planning documents are capable of being a material consideration in planning decisions but are not part of the development plan.
Surface water flooding	Flooding caused by the combination of pluvial flooding, sewer flooding, flooding from open channels and culverted urban watercourses and overland flows from groundwater springs
Surface Water Management Plan	A study undertaken in consultation with key local partners to understand the causes and effects of surface water flooding and agree the most cost effective way of managing surface water flood risk for the long term.
SuDS	Sustainable drainage systems. A sequence of management practices and control structures that are designed to drain surface water in a more sustainable manner.
Topography	The topography of a place or region is the description of its physical features, both geographical and man-made. It is usually represented on a topographical map.
Urban creep	The increasing density of development due to extensions, paving over of gardens, and other permeable area, and the addition or extension of roads or buildings, which increases the impermeability of developed areas and causes rates and volumes of runoff to increase.
Watercourse	A term including all rivers, streams, ditches drains cuts culverts dykes sluices and passages through which water flows.

¹⁰ SAAR 61-90, which was analysed for the Flood Estimation Handbook (FEH) for rainfall from 1961 - 1990, is virtually the same and can also be used in runoff calculations.

Appendix A to West Sussex Lead Local Flood Authority Policy for the Management of Surface Water dated July 2017

Links to Further Information

Introduction

West Sussex County Council as the Lead Local Flood Authority (LLFA) benefits from working in partnership with Drainage Engineers within the Districts and Boroughs throughout the County. These engineers undertake technical review of drainage proposals and act as Agents to the LLFA for the review / granting of Ordinary Watercourse Consents under the Flood and Water Management Act, 2010.

Technical queries relating to individual developments should in the first instance be directed to these officers as they have a greater level of local knowledge than staff at the LLFA. Contact Details for the Engineering staff at respective authorities are set out below, together with links to standing advice (where appropriate) which may serve to answer initial queries).

Adur-Worthing Councils - Drainage Engineer

Contact Tel No

Contact email:

Standing advice is available via the following web link: <https://www.adur-worthing.gov.uk/severe-weather/flooding-and-heavy-rain/>

Arun District Council - Drainage Engineer : Contact Tel No

Contact email:

Standing advice is available via the following web link:

<http://www.arun.gov.uk/drainage>

<http://www.arun.gov.uk/surfacewater>

<http://www.arun.gov.uk/planning-obligations>

<http://www.arun.gov.uk/making-a-planning-application>

Chichester District Council - Drainage Engineer

Contact Tel No: [REDACTED]

Contact email: [REDACTED]

Standing advice is available via the following web link:

Surface Water and Foul Drainage SPD

<http://www.chichester.gov.uk/CHttpHandler.ashx?id=26891&p=0>

Crawley Borough Council

Contact Tel No: [REDACTED]

Standing advice is available via the council's planning portal following web link:

http://www.crawley.gov.uk/pw/Planning_and_Development/index.htm

Policies pertinent to surface water management – Local Plan policies: Policies ENV8 (Development and Flood Risk) and ENV9 (Tackling Water Stress)

<http://www.crawley.gov.uk/pw/web/pub271853>

Strategic Flood Risk Assessment

<http://www.crawley.gov.uk/pw/web/PUB228566>

Horsham District Council

Contact Tel No: [REDACTED]

Contact email: [REDACTED]

Standing advice is available via the following web link:

<https://www.horsham.gov.uk/planning/development-management>

- Surface Water Drainage Advice Note;
- Surface Water Drainage Statement;
- Adoption and Maintenance of SuDS.

Mid Sussex District Council - Drainage Engineer(s)

Contact Tel No: [REDACTED]

Contact email: [REDACTED]

Mid Sussex District Council Strategic Flood Risk Assessment and a guide to master planning sustainable drainage into developments can be found via the following link:

<https://www.midsussex.gov.uk/planning-building/evidence-supporting-documents/>

Development Contributions

<https://www.midsussex.gov.uk/planning-building/development-contributions/>

Local List giving validation requirements for planning applications:

<https://www.midsussex.gov.uk/media/1976/validation-criteria-for-planning-applications.pdf>

South Downs National Park Authority

Contact Tel

Contact em

Standing advice is available via the following web link:

Water Cycle Study and SFRA Level 1

<https://www.southdowns.gov.uk/planning/planning-policy/national-park-local-plan/evidence-and-supporting-documents/water-cycle-study/>

Local List giving validation requirements for planning applications:

<https://www.southdowns.gov.uk/planning/making-an-application/local-validation-list/>

Appendix B

Minor extensions standing advice

[advice adapted from www.gov.uk/guidance]

You need to provide a plan showing the finished floor levels and the estimated flood levels.

Make sure that floor levels are either no lower than existing floor levels or 300 millimeters (mm) above the estimated flood level. If your floor levels aren't going to be 300mm above existing flood levels, you need to check with your local planning authority if you also need to take flood **resilience** measures.

State in your assessment all levels in relation to Ordnance Datum (the height above average sea level). You may be able to get this information from the [Ordnance Survey](#). If not, you'll need to get a land survey carried out by a qualified surveyor.

Your plans need to show how flood risk for the development is minimized and that there is no increase in flood risk for people / property outside of the development. If the proposed extension to your property is in an area that is affected by surface water flooding or is on a flood plain, the avoidance of increased flood risk should consider how flows can be routed through / under the extension to avoid loss of flood storage capacity in the immediate vicinity by incorporating flood **resilience** measures. These measures allow water to pass through the property to avoid structural damage by:

- using materials that are flood resilient not flood resistant;
- making it easy for water to drain away after flooding;
- making sure there's access to all spaces to enable drying and cleaning.

Specific guidance on flood **resilience** can be found in [improving the flood performance of new buildings](#). Flood resistance for new extensions in areas prone to flooding should be avoided. Further advice on this issue can be sought from the Drainage Engineer at your local authority.