Appendix C

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Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	0.1
Summer CV	0.950	2 year (l/s)	0.1
Winter CV	0.950	30 year (l/s)	0.1
Analysis Speed	Normal	100 year (l/s)	0.1
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	IH124	Growth Factor 100 year	2.08
Positively Drained Area (ha)	0.011	Betterment (%)	0
SAAR (mm)	879	QBar	0.1
Soil Index	4	Q 1 year (l/s)	0.1
SPR	0.47	Q 2 year (l/s)	0.1
Region	10	Q 30 year (l/s)	0.1
Growth Factor 1 year	0.87	Q 100 year (l/s)	0.1
Growth Factor 2 year	0.93		

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Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	0.9
Summer CV	0.950	2 year (l/s)	1.1
Winter CV	0.950	30 year (l/s)	2.1
Analysis Speed	Normal	100 year (l/s)	2.6
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Brownfield	Betterment (%)	0
Brownfield Method	MRM	Q 1 year (l/s)	0.9
Contributing Area (ha)	0.006	Q 2 year (l/s)	1.1
PIMP (%)	100	Q 30 year (l/s)	2.1
CV	0.950	Q 100 year (l/s)	2.6
Time of Concentration (mins)	6.00		

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Inverts
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.950	Include Intermediate Ground	✓
Time of Entry (mins)	6.00	Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

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

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Drainage Channel	0.004	6.00	48.394	150	3.459	-5.072	1.300
S01			48.422	450	10.046	0.029	1.577
SO1	0.004	6.00	48.426	450	9.936	11.855	0.532
Flow Control			48.345	450	10.102	-4.791	1.620
Outfall			48.228	450	10.067	-10.021	1.553

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SO1	S01	5.000	0.600	47.894	46.845	1.049	4.8	100	6.02	50.0
1.001	S01	Flow Control	12.000	0.600	46.845	46.725	0.120	100.0	100	6.28	50.0
1.002	Flow Control	Outfall	5.000	0.600	46.725	46.675	0.050	100.0	100	6.39	50.0
2.000	Drainage Channel	Flow Control	6.649	0.600	47.094	46.981	0.113	58.8	100	6.11	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.566	28.0	0.7	0.432	1.477	0.004	0.0	11	1.457
1.001	0.769	6.0	0.7	1.477	1.520	0.004	0.0	23	0.511
1.002	0.769	6.0	1.4	1.520	1.453	0.008	0.0	32	0.621
2.000	1.006	7.9	0.7	1.200	1.264	0.004	0.0	20	0.613

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.000	4.8	100	Circular	48.426	47.894	0.432	48.422	46.845	1.477
1.001	12.000	100.0	100	Circular	48.422	46.845	1.477	48.345	46.725	1.520
1.002	5.000	100.0	100	Circular	48.345	46.725	1.520	48.228	46.675	1.453
2.000	6.649	58.8	100	Circular	48.394	47.094	1.200	48.345	46.981	1.264

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SO1	450	Manhole	Adoptable	S01	450	Manhole	Adoptable
1.001	S01	450	Manhole	Adoptable	Flow Control	450	Manhole	Adoptable
1.002	Flow Control	450	Manhole	Adoptable	Outfall	450	Manhole	Adoptable
2.000	Drainage Channel	150	Manhole	Adoptable	Flow Control	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Drainage Channel	3.459	-5.072	48.394	1.300	150	0	2.000	47.094	100
S01	10.046	0.029	48.422	1.577	450	1	1.000	46.845	100
						0	1.001	46.845	100
SO1	9.936	11.855	48.426	0.532	450	0	1.000	47.894	100
Flow Control	10.102	-4.791	48.345	1.620	450	1	2.000	46.981	100
						2	1.001	46.725	100
						0	1.002	46.725	100
Outfall	10.067	-10.021	48.228	1.553	450	1	1.002	46.675	100

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
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Ratio-R	0.400	1 year (l/s)	0.9
Summer CV	0.950	2 year (l/s)	1.1
Winter CV	0.950	30 year (l/s)	2.1
Analysis Speed	Normal	100 year (l/s)	2.6
Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	6.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	0.006	Q 1 year (l/s)	
PIMP (%)	100	Q 30 year (l/s)	
CV	0.950	Q 100 year (l/s)	

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	92.521	26.180	2 year 240 minute winter	12.649	5.032
1 year 15 minute winter	64.927	26.180	2 year 360 minute summer	14.516	3.735
1 year 30 minute summer	60.022	16.984	2 year 360 minute winter	9.436	3.735
1 year 30 minute winter	42.121	16.984	2 year 480 minute summer	11.436	3.022
1 year 60 minute summer	40.398	10.676	2 year 480 minute winter	7.598	3.022
1 year 60 minute winter	26.839	10.676	2 year 600 minute summer	9.363	2.561
1 year 120 minute summer	24.980	6.602	2 year 600 minute winter	6.398	2.561
1 year 120 minute winter	16.596	6.602	2 year 720 minute summer	8.339	2.235
1 year 180 minute summer	19.271	4.959	2 year 720 minute winter	5.605	2.235
1 year 180 minute winter	12.527	4.959	2 year 960 minute summer	6.846	1.803
1 year 240 minute summer	15.301	4.043	2 year 960 minute winter	4.535	1.803
1 year 240 minute winter	10.165	4.043	2 year 1440 minute summer	4.967	1.331
1 year 360 minute summer	11.775	3.030	2 year 1440 minute winter	3.338	1.331
1 year 360 minute winter	7.654	3.030	30 year 15 minute summer	226.195	64.005
1 year 480 minute summer	9.342	2.469	30 year 15 minute winter	158.733	64.005
1 year 480 minute winter	6.207	2.469	30 year 30 minute summer	147.452	41.724
1 year 600 minute summer	7.682	2.101	30 year 30 minute winter	103.475	41.724
1 year 600 minute winter	5.249	2.101	30 year 60 minute summer	98.615	26.061
1 year 720 minute summer	6.859	1.838	30 year 60 minute winter	65.517	26.061
1 year 720 minute winter	4.609	1.838	30 year 120 minute summer	59.946	15.842
1 year 960 minute summer	5.653	1.489	30 year 120 minute winter	39.827	15.842
1 year 960 minute winter	3.745	1.489	30 year 180 minute summer	45.598	11.734
1 year 1440 minute summer	4.127	1.106	30 year 180 minute winter	29.640	11.734
1 year 1440 minute winter	2.773	1.106	30 year 240 minute summer	35.759	9.450
2 year 15 minute summer	119.760	33.888	30 year 240 minute winter	23.758	9.450
2 year 15 minute winter	84.042	33.888	30 year 360 minute summer	26.939	6.932
2 year 30 minute summer	77.518	21.935	30 year 360 minute winter	17.511	6.932
2 year 30 minute winter	54.399	21.935	30 year 480 minute summer	20.981	5.545
2 year 60 minute summer	51.720	13.668	30 year 480 minute winter	13.940	5.545
2 year 60 minute winter	34.361	13.668	30 year 600 minute summer	17.039	4.661
2 year 120 minute summer	31.549	8.338	30 year 600 minute winter	11.642	4.661
2 year 120 minute winter	20.961	8.338	30 year 720 minute summer	15.093	4.045
2 year 180 minute summer	24.133	6.210	30 year 720 minute winter	10.143	4.045
2 year 180 minute winter	15.687	6.210	30 year 960 minute summer	12.278	3.233
2 year 240 minute summer	19.039	5.032	30 year 960 minute winter	8.133	3.233

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 1440 minute summer	8.788	2.355
30 year 1440 minute winter	5.906	2.355
30 year +40% CC 15 minute summer	316.673	89.607
30 year +40% CC 15 minute winter	222.226	89.607
30 year +40% CC 30 minute summer	206.433	58.413
30 year +40% CC 30 minute winter	144.865	58.413
30 year +40% CC 60 minute summer	138.061	36.485
30 year +40% CC 60 minute winter	91.724	36.485
30 year +40% CC 120 minute summer	83.924	22.179
30 year +40% CC 120 minute winter	55.757	22.179
30 year +40% CC 180 minute summer	63.837	16.427
30 year +40% CC 180 minute winter	41.495	16.427
30 year +40% CC 240 minute summer	50.063	13.230
30 year +40% CC 240 minute winter	33.261	13.230
30 year +40% CC 360 minute summer	37.715	9.705
30 year +40% CC 360 minute winter	24.516	9.705
30 year +40% CC 480 minute summer	29.374	7.763
30 year +40% CC 480 minute winter	19.515	7.763
30 year +40% CC 600 minute summer	23.854	6.525
30 year +40% CC 600 minute winter	16.299	6.525
30 year +40% CC 720 minute summer	21.130	5.663
30 year +40% CC 720 minute winter	14.201	5.663
30 year +40% CC 960 minute summer	17.189	4.526
30 year +40% CC 960 minute winter	11.387	4.526
30 year +40% CC 1440 minute summer	12.303	3.297
30 year +40% CC 1440 minute winter	8.269	3.297
100 year 15 minute summer	291.766	82.560
100 year 15 minute winter	204.748	82.560
100 year 30 minute summer	191.982	54.324
100 year 30 minute winter	134.724	54.324
100 year 60 minute summer	129.253	34.158
100 year 60 minute winter	85.873	34.158
100 year 120 minute summer	78.836	20.834
100 year 120 minute winter	52.377	20.834
100 year 180 minute summer	59.966	15.431
100 year 180 minute winter	38.980	15.431
100 year 240 minute summer	46.975	12.414
100 year 240 minute winter	31.209	12.414
100 year 360 minute summer	35.264	9.075
100 year 360 minute winter	22.923	9.075
100 year 480 minute summer	27.350	7.228
100 year 480 minute winter	18.171	7.228
100 year 600 minute summer	22.137	6.055
100 year 600 minute winter	15.126	6.055
100 year 720 minute summer	19.562	5.243
100 year 720 minute winter	13.147	5.243
100 year 960 minute summer	15.851	4.174
100 year 960 minute winter	10.500	4.174
100 year 1440 minute summer	11.278	3.023
100 year 1440 minute winter	7.579	3.023
100 year +40% CC 15 minute summer	408.473	115.584
100 year +40% CC 15 minute winter	286.647	115.584
100 year +40% CC 30 minute summer	268.775	76.054
100 year +40% CC 30 minute winter	188.614	76.054
100 year +40% CC 60 minute summer	180.954	47.821
100 year +40% CC 60 minute winter	120.222	47.821
100 year +40% CC 120 minute summer	110.370	29.168
100 year +40% CC 120 minute winter	73.327	29.168
100 year +40% CC 180 minute summer	83.953	21.604
100 year +40% CC 180 minute winter	54.572	21.604
100 year +40% CC 240 minute summer	65.765	17.380
100 year +40% CC 240 minute winter	43.693	17.380
100 year +40% CC 360 minute summer	49.370	12.705
100 year +40% CC 360 minute winter	32.092	12.705
100 year +40% CC 480 minute summer	38.291	10.119
100 year +40% CC 480 minute winter	25.439	10.119
100 year +40% CC 600 minute summer	30.992	8.477
100 year +40% CC 600 minute winter	21.176	8.477
100 year +40% CC 720 minute summer	27.387	7.340
100 year +40% CC 720 minute winter	18.406	7.340
100 year +40% CC 960 minute summer	22.191	5.844
100 year +40% CC 960 minute winter	14.700	5.844
100 year +40% CC 1440 minute summer	15.789	4.232
100 year +40% CC 1440 minute winter	10.611	4.232

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	12	47.111	0.017	0.5	0.0014	0.0000	OK
15 minute summer	S01	12	46.864	0.019	0.5	0.0031	0.0000	OK
15 minute summer	SO1	11	47.903	0.009	0.5	0.0029	0.0000	OK
15 minute summer	Flow Control	12	46.754	0.029	1.0	0.0046	0.0000	OK
15 minute summer	Outfall	12	46.703	0.027	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	0.5	0.555	0.063	0.0060	
15 minute summer	S01	1.001	Flow Control	0.5	0.348	0.083	0.0175	
15 minute summer	SO1	1.000	S01	0.5	0.974	0.018	0.0036	
15 minute summer	Flow Control	1.002	Outfall	1.0	0.555	0.165	0.0090	0.5

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	11	47.115	0.021	0.7	0.0016	0.0000	OK
15 minute summer	S01	11	46.868	0.023	0.7	0.0036	0.0000	OK
15 minute summer	SO1	11	47.905	0.011	0.7	0.0034	0.0000	OK
15 minute summer	Flow Control	11	46.759	0.034	1.4	0.0054	0.0000	OK
15 minute summer	Outfall	11	46.707	0.032	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	0.7	0.612	0.088	0.0076	
15 minute summer	S01	1.001	Flow Control	0.7	0.378	0.115	0.0221	
15 minute summer	SO1	1.000	S01	0.7	0.974	0.025	0.0045	
15 minute summer	Flow Control	1.002	Outfall	1.4	0.602	0.226	0.0113	0.6

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	11	47.121	0.027	1.2	0.0022	0.0000	OK
15 minute summer	S01	12	46.875	0.030	1.2	0.0048	0.0000	OK
15 minute summer	SO1	10	47.908	0.014	1.2	0.0044	0.0000	OK
15 minute summer	Flow Control	12	46.772	0.047	2.4	0.0074	0.0000	OK
15 minute summer	Outfall	12	46.719	0.044	2.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	1.2	0.711	0.152	0.0112	
15 minute summer	S01	1.001	Flow Control	1.2	0.433	0.199	0.0335	
15 minute summer	SO1	1.000	S01	1.2	0.974	0.043	0.0067	
15 minute summer	Flow Control	1.002	Outfall	2.4	0.697	0.398	0.0172	1.2

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	11	47.127	0.033	1.7	0.0026	0.0000	OK
15 minute summer	S01	11	46.881	0.036	1.7	0.0058	0.0000	OK
15 minute summer	SO1	11	47.911	0.017	1.7	0.0052	0.0000	OK
15 minute summer	Flow Control	11	46.783	0.058	3.4	0.0092	0.0000	OK
15 minute summer	Outfall	11	46.728	0.053	3.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	1.7	0.781	0.215	0.0145	
15 minute summer	S01	1.001	Flow Control	1.7	0.469	0.281	0.0435	
15 minute summer	SO1	1.000	S01	1.7	1.040	0.061	0.0085	
15 minute summer	Flow Control	1.002	Outfall	3.4	0.756	0.561	0.0224	1.7

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	11	47.126	0.032	1.6	0.0025	0.0000	OK
15 minute summer	S01	11	46.880	0.035	1.6	0.0056	0.0000	OK
15 minute summer	SO1	11	47.910	0.016	1.6	0.0050	0.0000	OK
15 minute summer	Flow Control	11	46.781	0.056	3.2	0.0089	0.0000	OK
15 minute summer	Outfall	11	46.727	0.052	3.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	1.6	0.769	0.202	0.0138	
15 minute summer	S01	1.001	Flow Control	1.6	0.463	0.265	0.0416	
15 minute summer	SO1	1.000	S01	1.6	1.128	0.057	0.0082	
15 minute summer	Flow Control	1.002	Outfall	3.2	0.745	0.527	0.0214	1.5

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Drainage Channel	11	47.132	0.038	2.2	0.0030	0.0000	OK
15 minute summer	S01	11	46.887	0.042	2.2	0.0066	0.0000	OK
15 minute winter	SO1	11	47.913	0.019	2.2	0.0059	0.0000	OK
15 minute summer	Flow Control	11	46.794	0.069	4.4	0.0110	0.0000	OK
15 minute summer	Outfall	11	46.738	0.063	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Drainage Channel	2.000	Flow Control	2.2	0.836	0.278	0.0175	
15 minute summer	S01	1.001	Flow Control	2.2	0.496	0.364	0.0532	
15 minute winter	SO1	1.000	S01	2.2	1.128	0.079	0.0103	
15 minute summer	Flow Control	1.002	Outfall	4.4	0.798	0.726	0.0275	2.2

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