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Midpoint Alencon Link Basingstoke, RG21 7PP		
Date 22/04/2026 09:51 File 9.7 DRAINAGE.MDX	Designed by Thomas.Bellas Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 529200 120700 TQ 29200 20700	
C (1km)	-0.027
D1 (1km)	0.383
D2 (1km)	0.289
D3 (1km)	0.420
E (1km)	0.316
F (1km)	2.478
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	300

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	4.224	0.140	30.2	0.053	5.00	0.0	0.600	o	100	Pipe/Conduit	
2.000	9.323	0.433	21.5	0.038	5.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	18.458	0.062	297.7	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	319.29	5.05	28.305	0.053	0.0	0.0	0.0	1.41	11.1«	61.1
2.000	317.29	5.09	28.598	0.038	0.0	0.0	0.0	1.67	13.1«	43.5
2.001	309.67	5.26	27.365	0.038	0.0	0.0	0.0	1.81	1152.0	43.5

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
MH09-704	29.824	1.519	Open Manhole	1200	1.000	28.305	100				
TP09-702	30.117	1.519	Open Manhole	1200	2.000	28.598	100				
MH09-707	30.191	2.826	Open Manhole	1800	2.001	27.365	900	2.000	28.165	100	
MH09-705	29.455	1.853	Open Manhole	1200	3.000	27.602	100				
MH09-703	29.920	2.617	Open Manhole	1800	1.001	27.303	900	1.000	28.165	100	
								2.001	27.303	900	
								3.000	27.349	100	
MH09-702	29.694	2.428	Open Manhole	1800	1.002	27.266	900	1.001	27.266	900	62
MH09-701	29.356	2.132	Open Manhole	1800	1.003	27.224	225	1.002	27.224	900	
OUTFALL	29.140	1.971	Open Manhole	0		OUTFALL		1.003	27.169	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
MH09-704	530731.956	120855.191	530731.956	120855.191	Required	
TP09-702	530715.373	120840.843	530715.373	120840.843	Required	
MH09-707	530714.590	120850.133	530714.590	120850.133	Required	
MH09-705	530732.387	120840.355	530732.387	120840.355	Required	
MH09-703	530733.023	120851.104	530733.023	120851.104	Required	
MH09-702	530744.043	120848.949	530744.043	120848.949	Required	
MH09-701	530752.385	120839.460	530752.385	120839.460	Required	
OUTFALL	530760.270	120837.097			No Entry	

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.053	0.053	0.053
2.000	-	-	100	0.038	0.038	0.038
2.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.101	0.101	0.101
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.192	0.192	0.192

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
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1.003	OUTFALL	29.140	27.169	27.169	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	5.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	20160
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 529200 120700 TQ 29200 20700
C (1km)	-0.027
D1 (1km)	0.383
D2 (1km)	0.289
D3 (1km)	0.420
E (1km)	0.316
F (1km)	2.478
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	10080

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: MH09-703, DS/PN: 1.001, Volume (m³): 17.3

Unit Reference	MD-SHE-0080-2600-0800-2600
Design Head (m)	0.800
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	27.303
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	2.6
Flush-Flo™	0.240	2.6
Kick-Flo®	0.514	2.1
Mean Flow over Head Range	-	2.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	3.1	3.000	4.8	7.000	7.1
0.200	2.6	1.400	3.4	3.500	5.1	7.500	7.4
0.300	2.6	1.600	3.6	4.000	5.5	8.000	7.6
0.400	2.5	1.800	3.8	4.500	5.8	8.500	7.8
0.500	2.2	2.000	4.0	5.000	6.1	9.000	8.0
0.600	2.3	2.200	4.1	5.500	6.4	9.500	8.3
0.800	2.6	2.400	4.3	6.000	6.6		
1.000	2.9	2.600	4.5	6.500	6.9		

Hydro-Brake® Optimum Manhole: MH09-701, DS/PN: 1.003, Volume (m³): 12.3

Unit Reference	MD-SHE-0080-2600-0800-2600
Design Head (m)	0.800
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	80
Invert Level (m)	27.224
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

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Storage Structures for Storm Bio-Retention Area Manhole: MH09-704, DS/PN: 1.000 Invert Level (m)28.305Infiltration Coefficient Side (m/hr)0.00000 Porosity0.30Safety Factor2.0 Infiltration Coefficient Base (m/hr)0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th></tr></thead><tbody><tr><td>0.000</td><td>154.0</td><td>119.000</td><td>1.000</td><td>154.0</td><td>119.000</td></tr></tbody></table> Bio-Retention Area Manhole: TP09-702, DS/PN: 2.000 Invert Level (m)28.598Infiltration Coefficient Side (m/hr)0.00000 Porosity0.30Safety Factor2.0 Infiltration Coefficient Base (m/hr)0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th></tr></thead><tbody><tr><td>0.000</td><td>95.0</td><td>66.000</td><td>1.000</td><td>95.0</td><td>66.000</td></tr></tbody></table> Bio-Retention Area Manhole: MH09-705, DS/PN: 3.000 Invert Level (m)27.602Infiltration Coefficient Side (m/hr)0.00000 Porosity0.30Safety Factor2.0 Infiltration Coefficient Base (m/hr)0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th><th>Depth (m)</th><th>Area (m²)</th><th>Perimeter (m)</th></tr></thead><tbody><tr><td>0.000</td><td>98.0</td><td>62.000</td><td>1.000</td><td>98.0</td><td>62.000</td></tr></tbody></table>			Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)	0.000	154.0	119.000	1.000	154.0	119.000	Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)	0.000	95.0	66.000	1.000	95.0	66.000	Depth (m)	Area (m²)	Perimeter (m)	Depth (m)	Area (m²)	Perimeter (m)	0.000	98.0	62.000	1.000	98.0	62.000
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	MH09-704	29.365	0.960	0.000	0.47		4.5	SURCHARGED
2.000	TP09-702	29.366	0.668	0.000	0.35	282	4.3	SURCHARGED
2.001	MH09-707	29.361	1.096	0.000	0.00		3.7	SURCHARGED
3.000	MH09-705	29.377	1.675	0.000	0.74		6.5	FLOOD RISK
1.001	MH09-703	29.361	1.158	0.000	0.01		3.6	SURCHARGED
1.002	MH09-702	28.201	0.035	0.000	0.00		3.0	SURCHARGED
1.003	MH09-701	28.201	0.752	0.000	0.09		2.8	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	MH09-704	
2.000	TP09-702	
2.001	MH09-707	
3.000	MH09-705	
1.001	MH09-703	
1.002	MH09-702	
1.003	MH09-701	