

Coast Consulting Engineers Ltd

Suite 6, Vita House
Fish Quay
North Shields NE30 1JA

WATERS EDGE
STORY HOMES

Date 28/09/2021
File 210902 Waters Edge.MDX

Designed by RH
Checked by PL

Innovyze

Network 2020.1

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Micro Drainage

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for 210902 COAST.SWS

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	28.454	0.592	48.1	0.146	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	23.478	0.154	152.5	0.049	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	27.456	0.251	109.4	0.065	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	11.033	0.066	167.2	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	32.419	0.363	89.3	0.091	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	24.849	0.105	236.7	0.041	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	48.233	0.781	61.8	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	17.015	0.033	515.6	0.047	5.00	0.0	0.600	o	900	Pipe/Conduit	
4.001	10.120	0.033	306.7	0.019	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.003	30.214	0.045	671.4	0.052	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.004	6.917	0.125	55.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	21.476	0.689	31.2	0.000	0.00	0.0	0.600	o	300	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	0.00	5.25	93.112	0.146	0.0	0.0	0.0	1.89	75.2	0.0
2.000	0.00	5.37	93.103	0.049	0.0	0.0	0.0	1.06	42.0	0.0
3.000	0.00	5.37	93.200	0.065	0.0	0.0	0.0	1.25	49.7	0.0
2.001	0.00	5.55	92.949	0.120	0.0	0.0	0.0	1.01	40.1	0.0
2.002	0.00	5.94	92.883	0.211	0.0	0.0	0.0	1.38	55.0	0.0
1.001	0.00	6.35	92.445	0.398	0.0	0.0	0.0	1.02	71.9	0.0
1.002	0.00	6.75	92.340	0.462	0.0	0.0	0.0	2.00	141.7	0.0
4.000	0.00	5.21	91.025	0.047	0.0	0.0	0.0	1.37	873.4	0.0
4.001	0.00	5.30	90.992	0.066	0.0	0.0	0.0	1.78	1134.9	0.0
1.003	0.00	7.17	90.959	0.580	0.0	0.0	0.0	1.20	764.4	0.0
1.004	0.00	7.22	90.914	0.580	0.0	0.0	0.0	2.12	149.7	0.0
1.005	0.00	7.35	90.789	0.580	0.0	0.0	0.0	2.83	199.8	0.0

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Date 28/09/2021 File 210902 Waters Edge.MDX	Designed by RH Checked by PL																					
Innovyze Network 2020.1																						
Simulation Criteria for 210902 COAST.SWS <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>2</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>16.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.260</td><td></td><td></td></tr></table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	2	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	16.000	Storm Duration (mins)	30	Ratio R	0.260		
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Online Controls for 210902 COAST.SWS

Hydro-Brake® Optimum Manhole: G5HB, DS/PN: 1.004, Volume (m³): 25.1

Unit Reference	MD-SHE-0093-6000-2772-6000
Design Head (m)	2.772
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	93
Invert Level (m)	90.914
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.772	6.0	Kick-Flo®	0.828	3.4
Flush-Flo™	0.404	4.3	Mean Flow over Head Range	-	4.5

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	2.9	1.200	4.1	3.000	6.2	7.000	9.3
0.200	3.9	1.400	4.4	3.500	6.7	7.500	9.6
0.300	4.2	1.600	4.6	4.000	7.1	8.000	9.9
0.400	4.3	1.800	4.9	4.500	7.5	8.500	10.2
0.500	4.2	2.000	5.1	5.000	7.9	9.000	10.5
0.600	4.1	2.200	5.4	5.500	8.3	9.500	10.7
0.800	3.6	2.400	5.6	6.000	8.6		
1.000	3.7	2.600	5.8	6.500	9.0		

Hydro-Brake® Optimum Manhole: S14 HB, DS/PN: 1.008, Volume (m³): 5.3

Unit Reference	MD-SHE-0107-6200-1653-6200
Design Head (m)	1.653
Design Flow (l/s)	6.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	88.009
Minimum Outlet Pipe Diameter (mm)	150

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<u>Hydro-Brake® Optimum Manhole: S14 HB, DS/PN: 1.008, Volume (m³): 5.3</u>							
Suggested Manhole Diameter (mm) 1200							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		1.653	6.2	Kick-Flo®		0.955	4.8
Flush-Flo™		0.469	6.0	Mean Flow over Head Range		-	5.3
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	3.7	1.200	5.3	3.000	8.2	7.000	12.2
0.200	5.3	1.400	5.7	3.500	8.8	7.500	12.7
0.300	5.8	1.600	6.1	4.000	9.4	8.000	13.1
0.400	6.0	1.800	6.4	4.500	9.9	8.500	13.4
0.500	6.0	2.000	6.8	5.000	10.4	9.000	13.8
0.600	5.9	2.200	7.1	5.500	10.9	9.500	14.2
0.800	5.6	2.400	7.4	6.000	11.4		
1.000	4.9	2.600	7.7	6.500	11.8		
<u>Hydro-Brake® Optimum Manhole: S25 H-B, DS/PN: 1.014, Volume (m³): 6.6</u>							
Unit Reference MD-SHE-0144-1580-3510-1580							
Design Head (m) 3.510							
Design Flow (l/s) 15.8							
Flush-Flo™ Calculated							
Objective Minimise upstream storage							
Application Surface							
Sump Available Yes							
Diameter (mm) 144							
Invert Level (m) 77.971							
Minimum Outlet Pipe Diameter (mm) 225							
Suggested Manhole Diameter (mm) 1500							
Control Points		Head (m)	Flow (l/s)	Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		3.510	15.8	Kick-Flo®		1.287	9.8
Flush-Flo™		0.623	12.5	Mean Flow over Head Range		-	12.2
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	5.2	0.200	10.2	0.300	11.4	0.400	12.1
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Storage Structures for 210902 COAST.SWS

Cellular Storage Manhole: G5HB, DS/PN: 1.004

Invert Level (m) 90.914 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	0.0	0.0	2.221	232.0	0.0
0.620	0.0	0.0	2.222	0.0	0.0
0.621	232.0	0.0			

Cellular Storage Manhole: S14 HB, DS/PN: 1.008

Invert Level (m) 88.209 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	0.0	0.0	1.100	108.0	0.0
0.299	0.0	0.0	1.101	0.0	0.0
0.300	108.0	0.0			

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Summary of Critical Results by Maximum Level (Rank 1) for 210902 COAST.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.259
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	16.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	G1	15 Winter	100	+40%	100/15 Summer				93.521
2.000	G8	15 Winter	100	+40%	100/15 Summer				93.873
3.000	G11	15 Winter	100	+40%	100/15 Summer				93.894
2.001	G9	15 Winter	100	+40%	100/15 Summer				93.841
2.002	G10	15 Winter	100	+40%	100/15 Summer				93.770
1.001	G2	15 Winter	100	+40%	100/15 Summer				93.203
1.002	G3	15 Winter	100	+40%	100/15 Summer				92.797
4.000	G6	360 Winter	100	+40%	100/30 Summer				92.696
4.001	G7	360 Winter	100	+40%	100/30 Summer				92.696
1.003	G4	360 Winter	100	+40%	100/30 Summer				92.696
1.004	G5HB	360 Winter	100	+40%	100/15 Summer				92.696
1.005	S8	360 Winter	100	+40%					90.822
1.006	S9	15 Summer	100	+40%					90.214

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Summary of Critical Results by Maximum Level (Rank 1) for 210902 COAST.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		
1.000	G1	0.184	0.000	0.77			54.2	SURCHARGED	
2.000	G8	0.545	0.000	0.43			16.4	SURCHARGED	
3.000	G11	0.469	0.000	0.47			21.5	SURCHARGED	
2.001	G9	0.667	0.000	1.21			41.0	SURCHARGED	
2.002	G10	0.662	0.000	1.24			64.1	SURCHARGED	
1.001	G2	0.458	0.000	1.97			126.8	SURCHARGED	
1.002	G3	0.157	0.000	1.09			145.0	SURCHARGED	
4.000	G6	0.771	0.000	0.01			3.5	SURCHARGED	
4.001	G7	0.804	0.000	0.01			4.8	SURCHARGED	
1.003	G4	0.837	0.000	0.09			46.4	SURCHARGED	
1.004	G5HB	1.482	0.000	0.06			4.9	SURCHARGED	
1.005	S8	-0.267	0.000	0.03			4.9	OK	
1.006	S9	-0.186	0.000	0.30			34.0	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for 210902 COAST.SWS										
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.		
1.007	S10	360 Winter	100	+40%	100/360 Winter					
1.008	S14 HB	360 Winter	100	+40%	100/15 Summer	100/360 Winter				
5.000	S1	15 Winter	100	+40%	100/15 Summer	100/15 Winter				
6.000	S6	15 Winter	100	+40%	100/15 Summer					
6.001	S7	15 Winter	100	+40%	100/15 Summer					
5.001	S2	15 Winter	100	+40%	100/15 Winter					
1.009	S3	15 Winter	100	+40%						
7.000	S11	15 Winter	100	+40%	100/15 Summer					
7.001	S12	15 Winter	100	+40%	100/15 Summer					
1.010	S4	15 Winter	100	+40%						
1.011	S15	15 Winter	100	+40%						
1.012	SBD	360 Winter	100	+40%	100/360 Winter					
1.013	S17A	360 Winter	100	+40%	100/15 Summer					
1.014	S25 H-B	360 Winter	100	+40%	100/15 Summer					
1.015	S18	360 Winter	100	+40%						
1.016	S19	360 Winter	100	+40%						
1.017	S20	360 Winter	100	+40%						
1.018	35	360 Winter	100	+40%						
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.007	S10	89.671	0.116	0.000	0.06			15.9	SURCHARGED	
1.008	S14 HB	89.664	1.355	2.478	0.02			6.2	FLOOD	1
5.000	S1	92.778	1.304	0.160	1.69			58.7	FLOOD	1
6.000	S6	92.530	0.883	0.000	1.12			25.2	FLOOD RISK	
6.001	S7	92.016	0.776	0.000	1.63			37.1	SURCHARGED	
5.001	S2	90.799	0.017	0.000	1.00			121.3	SURCHARGED	
1.009	S3	87.239	-0.083	0.000	0.86			161.3	OK	
7.000	S11	87.903	0.419	0.000	0.92			24.7	SURCHARGED	
7.001	S12	87.625	0.532	0.000	1.58			71.7	SURCHARGED	
1.010	S4	86.577	-0.178	0.000	0.54			232.0	OK	
1.011	S15	83.564	-0.212	0.000	0.39			232.1	OK	
1.012	SBD	81.393	0.379	0.000	0.00			63.3	SURCHARGED	
1.013	S17A	81.393	2.690	0.000	0.07			21.9	FLOOD RISK	
1.014	S25 H-B	81.391	3.195	0.000	0.23			15.6	FLOOD RISK	
1.015	S18	77.283	-0.161	0.000	0.18			15.6	OK	
1.016	S19	74.458	-0.169	0.000	0.14			15.6	OK	
1.017	S20	70.000	-0.133	0.000	0.36			15.6	OK	
1.018	35	69.905	-0.131	0.000	0.37			15.6	OK	
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