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28 Castle Street Carlisle CA3 8TP	Nethertown Rd, St Bees Access road soakaway	
Date 31/03/2022 17:04 File ACCESS TURNING HEAD.MDX	Designed by SM Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm



Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	40
Ratio R	0.274	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500


Designed with Level Soffits

Network Design Table for Storm

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
S1.000	5.000	0.013	384.6	0.027	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	5.000	0.013	384.6	0.000	0.00	0.0	0.600	o	150	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)
S1.000	50.00	5.16	37.600	0.027	0.0	0.0	1.9	0.51	9.0	6.8
S1.001	50.00	5.33	37.600	0.027	0.0	0.0	1.9	0.51	9.0	6.8

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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	0.027	0.027	0.027
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.027	0.027	0.027

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.850	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.850
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	16.000	Storm Duration (mins)	30
Ratio R	0.274		


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Storage Structures for Storm

Cellular Storage Manhole: S2, DS/PN: S1.001

Invert Level (m) 36.800 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.06050 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.06050

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	40.0	33.0	0.401	0.0	44.2
0.400	40.0	44.2			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins)                    0                    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm)                0                    Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model                                FSR                Ratio R 0.274  
Region England and Wales Cv (Summer) 0.850  
M5-60 (mm)                                    16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0                DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status                ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years)                                1, 30, 100  
Climate Change (%)    0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	30/15 Winter				37.659
S1.001	S2	240 Winter	1	+0%					36.863

PN	US/MH Name	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.091	0.000	0.33			3.0	OK	
S1.001	S2	-0.887	0.000	0.00		124	0.0	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins)                    0                    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm)                0                    Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model                                FSR                Ratio R 0.274  
Region England and Wales Cv (Summer) 0.850  
M5-60 (mm)                                    16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0                DVD Status OFF  
Analysis Timestep                    Fine Inertia Status OFF  
DTS Status                                ON

Profile(s)    Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years)                                1, 30, 100  
Climate Change (%)    0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+40%	30/15 Winter				37.752
S1.001	S2	360 Winter	30	+40%					37.085

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.002	0.000	1.06		9.6	FLOOD RISK	
S1.001	S2	-0.665	0.000	0.00	336	0.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins)                    0                    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm)                0                    Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 0    Number of Time/Area Diagrams 0  
Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model                        FSR                Ratio R 0.274  
Region England and Wales Cv (Summer) 0.850  
M5-60 (mm)                            16.000 Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0                DVD Status OFF  
Analysis Timestep    Fine Inertia Status OFF  
DTS Status                ON

Profile(s)                                Summer and Winter  
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360  
Return Period(s) (years)                1, 30, 100  
Climate Change (%)                        0, 40, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+40%	30/15 Winter				37.773
S1.001	S2	360 Winter	100	+40%					37.198

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.023	0.000	1.41		12.7	FLOOD RISK	
S1.001	S2	-0.552	0.000	0.00	396	0.0	OK	