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10 Bankside, The Watermark Gateshead NE11 9SY	Caterpillar UK Ltd Desford Car Park 2	
Date 05/09/2025 10:37 File Car Park 2.MDX	Designed by MQ Checked by SH	
Micro Drainage		Network 2020.1

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)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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.	0.750	Min Slope for Optimisation (1:X)	500

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	52.455	0.100	524.6	0.148	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	16.000	0.100	160.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	52.456	0.100	524.6	0.109	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	12.965	0.330	39.3	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)
1.000	50.00	7.02	126.190	0.148	0.0	0.0	0.0	0.43	7.6«	20.0
1.001	50.00	7.36	126.090	0.148	0.0	0.0	0.0	0.79	14.0«	20.0
2.000	50.00	7.02	126.090	0.109	0.0	0.0	0.0	0.43	7.6«	14.8
1.002	50.00	7.49	125.990	0.257	0.0	0.0	0.0	1.61	28.5«	34.8

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<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/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 2 Number of Online Controls 0 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <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>20.000</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.400</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)	20.000	Storm Duration (mins)	30	Ratio R	0.400		
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Storage Structures for Storm

Porous Car Park Manhole: 1, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	138.9	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	126.900	Membrane Depth (mm)	0

Porous Car Park Manhole: 3, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	138.9	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	126.750	Membrane Depth (mm)	0

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Micro Drainage

Network 2020.1

Micro Drainage

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

Simulation Criteria

Areal Reduction Factor 1.000
Hot Start (mins) 0
Hot Start Level (mm) 0
Manhole Headloss Coeff (Global) 0.500
Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000
MADD Factor * 10m³/ha Storage 2.000
Inlet Coefficient 0.800
Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0
Number of Online Controls 0
Number of Offline Controls 0

Number of Storage Structures 2
Number of Time/Area Diagrams 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000

Ratio R 0.400
Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

Water

Level

(m)

US/MH

Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

PN

1.000

1.001

2.000

1.002

1 15 Winter

2 15 Winter

3 15 Winter

4 15 Winter

1

1

1

1

+0%

+0%

+0%

+0%

1/15 Summer

1/15 Winter

1/15 Summer

30/15 Summer

126.702

126.254

126.422

126.107

Surcharged

Flooded

Half Drain

Pipe

Level

Exceeded

US/MH

Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Time (mins)

Flow (l/s)

Status

PN

1.000

1.001

2.000

1.002

1

2

3

4

0.362

0.014

0.182

-0.033

0.000

0.000

0.000

2.07

1.10

1.59

0.96

4

5

24.9

SURCHARGED

SURCHARGED

SURCHARGED

OK

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Micro Drainage

Network 2020.1

Micro Drainage

Network 2020.1

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 * 10m³/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 2

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 0.400

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 20.000

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 45

PN

US/MH Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

Water Level (m)

1.000

1 15 Winter

30

+0%

1/15 Summer

127.003

1.001

2 15 Winter

30

+0%

1/15 Winter

126.564

2.000

3 15 Winter

30

+0%

1/15 Summer

126.823

1.002

4 15 Winter

30

+0%

30/15 Summer

126.386

PN

US/MH Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Half Drain Time (mins)

Pipe Flow (l/s)

Status

Level Exceeded

1.000

1

0.663

0.000

2.55

8

19.0

SURCHARGED

1.001

2

0.324

0.000

1.39

18.0

SURCHARGED

2.000

3

0.583

0.000

2.45

6

18.3

SURCHARGED

1.002

4

0.246

0.000

1.32

34.2

SURCHARGED

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