Ashton Court, Camden Park Rd Camden NW1 9HDE		
Date 31.01.17 File 20.01.17 MD ALL NETWORK...	Designed by SG Checked by CJM	
CADS	Network 2016.1	

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)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.900	Minimum Backdrop Height (m)	0.200
Ratio R	0.444	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.073	4-8	0.018

Total Area Contributing (ha) = 0.091

Total Pipe Volume (m³) = 1.828

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
1.000	23.000	0.153	150.3	0.018	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	14.400	0.096	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	7.400	0.357	20.7	0.018	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	2.000	0.013	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	23.000	0.153	150.3	0.025	4.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	7.100	0.452	15.7	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	4.47	44.050	0.018	0.0	0.0	0.0	0.82	14.4	2.4
1.001	50.00	4.76	43.897	0.018	0.0	0.0	0.0	0.82	14.5	2.4
1.002	50.00	4.82	43.801	0.036	0.0	0.0	0.0	2.22	39.3	4.9
1.003	50.00	4.86	43.444	0.036	0.0	0.0	0.0	0.82	14.5	4.9
2.000	50.00	4.47	44.050	0.025	0.0	0.0	0.0	0.82	14.4	3.4
2.001	50.00	4.52	43.897	0.025	0.0	0.0	0.0	2.55	45.1	3.4

Ashton Court, Camden Park Rd
Camden
NW1 9HDE

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CADS | Network 2016.1

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
3.000	8.000	1.455	5.5	0.030	4.00	0.0	0.600	o	100	Pipe/Conduit	
2.002	2.000	0.015	130.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	1.000	0.007	142.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	20.000	0.133	150.0	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)
3.000	50.00	4.04	44.950	0.030	0.0	0.0	0.0	3.32	26.1	4.1
2.002	50.00	4.55	43.445	0.055	0.0	0.0	0.0	0.88	15.5	7.4
1.004	50.00	4.88	43.430	0.091	0.0	0.0	0.0	0.84	14.8	12.3
1.005	50.00	5.29	43.423	0.091	0.0	0.0	0.0	0.82	14.5	12.3

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)
1.005		44.760	43.289	0.000	0	0

Simulation Criteria for Storm

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 Coeffiecient	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	1	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	0.444
Return Period (years)	100	Profile Type	Summer
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.900	Cv (Winter)	0.840

Ashton Court, Camden Park Rd Camden NW1 9HDE		
Date 31.01.17 File 20.01.17 MD ALL NETWORK...	Designed by SG Checked by CJM	
CADS	Network 2016.1	

Synthetic Rainfall Details

Storm Duration (mins) 30

Ashton Court, Camden Park Rd Camden NW1 9HDE		
Date 31.01.17 File 20.01.17 MD ALL NETWORK...	Designed by SG Checked by CJM	
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Online Controls for Storm

Hydro-Brake Optimum® Manhole: tank, DS/PN: 1.004, Volume (m³): 0.2

Unit Reference	MD-SHE-0109-5000-0800-5000
Design Head (m)	0.800
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	43.430
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.0
Flush-Flo™	0.241	5.0
Kick-Flo®	0.537	4.2
Mean Flow over Head Range	-	4.3

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	6.0	3.000	9.3	7.000	13.9
0.200	5.0	1.400	6.5	3.500	10.0	7.500	14.4
0.300	5.0	1.600	6.9	4.000	10.6	8.000	14.8
0.400	4.8	1.800	7.3	4.500	11.3	8.500	15.2
0.500	4.5	2.000	7.7	5.000	11.8	9.000	15.7
0.600	4.4	2.200	8.0	5.500	12.4	9.500	16.1
0.800	5.0	2.400	8.4	6.000	12.9		
1.000	5.5	2.600	8.7	6.500	13.4		

Ashton Court, Camden Park Rd Camden NW1 9HDE		
Date 31.01.17	Designed by SG	
File 20.01.17 MD ALL NETWORK...	Checked by CJM	
CADS	Network 2016.1	

Storage Structures for Storm

Cellular Storage Manhole: tank, DS/PN: 1.004

Invert Level (m) 43.430 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	5.200	40.0	171.6
0.400	40.0	50.1	5.600	40.0	181.7
0.800	40.0	60.2	6.000	40.0	191.8
1.200	40.0	70.4	6.400	40.0	201.9
1.600	40.0	80.5	6.800	40.0	212.0
2.000	40.0	90.6	7.200	40.0	222.1
2.400	40.0	100.7	7.600	40.0	232.3
2.800	40.0	110.8	8.000	40.0	242.4
3.200	40.0	121.0	8.400	40.0	252.5
3.600	40.0	131.1	8.800	40.0	262.6
4.000	40.0	141.2	9.200	40.0	272.7
4.400	40.0	151.3	9.600	40.0	282.9
4.800	40.0	161.4	10.000	40.0	293.0

Ashton Court, Camden Park Rd Camden NW1 9HDE		
Date 31.01.17 File 20.01.17 MD ALL NETWORK...	Designed by SG Checked by CJM	
CADS	Network 2016.1	

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 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 Storage Structures	1
Number of Online Controls	1	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 0.444
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.900	Cv (Winter)	0.840

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, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	40, 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)
1.000	re1	60 Winter	100	+40%	100/15 Winter				44.235
1.001	1	60 Winter	100	+40%	100/15 Summer				44.229
1.002	2	60 Winter	100	+40%	30/30 Winter				44.225
1.003	3	60 Winter	100	+40%	1/15 Winter				44.220
2.000	re2	15 Winter	100	+40%	100/15 Summer				44.359
2.001	4	60 Winter	100	+40%	100/15 Summer				44.224
3.000	re3	15 Winter	100	+40%	100/15 Summer				45.097
2.002	5	60 Winter	100	+40%	1/15 Summer				44.221
1.004	tank	60 Winter	100	+40%	1/15 Summer				44.218
1.005	6	240 Winter	100	+40%					43.485

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	re1	0.035	0.000	0.45		6.1	SURCHARGED	
1.001	1	0.182	0.000	0.45		6.0	FLOOD RISK	
1.002	2	0.274	0.000	0.33		11.2	SURCHARGED	
1.003	3	0.626	0.000	1.00		10.9	SURCHARGED	
2.000	re2	0.159	0.000	1.23		16.8	FLOOD RISK	
2.001	4	0.177	0.000	0.21		8.1	SURCHARGED	

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NW1 9HDE

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File 20.01.17 MD ALL NETWORK... Checked by CJM
CADS Network 2016.1

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	re3	0.047	0.000	0.86		20.5	SURCHARGED	
2.002	5	0.626	0.000	1.66		18.0	SURCHARGED	
1.004	tank	0.638	0.000	0.46		5.0	FLOOD RISK	
1.005	6	-0.087	0.000	0.37		5.0	OK	