



SURFACE WATER DRAINAGE CALCULATIONS

**Bradford Road
Birkenshaw**

Reference

JE/4729.1

Date

12 May 2016

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1.0 DRAINAGE SUMMARY

Surface water from this site shall be restricted to a rate of 5.0 litres/second to suit the minimum discharge rate to Yorkshire Water apparatus.

Surface water will discharge off-site via a new 150mm diameter combined water pipe into an existing adopted 375mm diameter combined water drain. The resulting maximum discharge is 5.0 litres/second which has been restricted using a flow control device located within the attenuation tank under the proposed car park.

As a restriction is applied surface water attenuation will be provided in the form of a corrugated steel storage structure consisting of 1No. 1.4m diameter culvert with a length of 20.0m giving a total storage volume of 30.8m³ for the 1 in 100 year + 20% climate change storm event.

In accordance with NPPF the Microdrainage calculation results indicate:

No above ground flooding for the 1:30 year return period event

No above ground flooding occurs for the 1:100 year (+20% cc) return period event



SIMULATION RESULTS

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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	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.330	Maximum Backdrop Height (m)	2.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	0.750
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

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)	Auto Design
1.000	23.670	0.163	145.0	0.020	5.00	0.0	0.600	o	150	
2.000	5.611	0.037	150.0	0.037	5.00	0.0	0.600	o	150	
1.001	7.331	0.049	149.6	0.000	0.00	0.0	0.600	o	225	
1.002	20.000	0.026	769.2	0.000	0.00	0.0	0.600	o	-1	
3.000	2.375	0.016	150.0	0.042	6.00	0.0	0.600	o	150	
4.000	23.000	0.235	98.0	0.020	5.00	0.0	0.600	o	150	

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	5.47	181.250	0.020	0.0	0.0	0.0	0.83	14.7	2.7
2.000	50.00	5.11	181.123	0.037	0.0	0.0	0.0	0.82	14.5	5.0
1.001	50.00	5.59	181.011	0.057	0.0	0.0	0.0	1.07	42.4	7.7
1.002	50.00	5.81	179.787	0.057	0.0	0.0	0.0	1.47	2269.5	7.7
3.000	50.00	6.05	181.123	0.042	0.0	0.0	0.0	0.82	14.5	5.7
4.000	50.00	5.38	181.250	0.020	0.0	0.0	0.0	1.02	17.9	2.7

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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)	Auto Design
1.003	3.012	0.020	150.6	0.000	0.00	0.0	0.600	o	150	
1.004	6.300	0.042	150.0	0.000	0.00	0.0	0.600	o	150	
1.005	10.000	0.200	50.0	0.000	0.00	0.0	0.600	o	150	

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)
1.003	50.00	6.11	179.761	0.119	0.0	0.0	0.0	0.82	14.4«	16.1
1.004	50.00	6.24	179.666	0.119	0.0	0.0	0.0	0.82	14.5«	16.1
1.005	50.00	6.36	179.624	0.119	0.0	0.0	0.0	1.43	25.2	16.1

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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	0
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	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.330		

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Online Controls for Storm

Hydro-Brake® Manhole: 7, DS/PN: 1.003, Volume (m³): 44.5

Design Head (m) 0.900 Hydro-Brake® Type Md4 Invert Level (m) 179.761
Design Flow (l/s) 5.0 Diameter (mm) 82

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5	1.200	5.7	3.000	9.1	7.000	13.9
0.200	3.7	1.400	6.2	3.500	9.8	7.500	14.3
0.300	3.2	1.600	6.6	4.000	10.5	8.000	14.8
0.400	3.4	1.800	7.0	4.500	11.1	8.500	15.3
0.500	3.7	2.000	7.4	5.000	11.7	9.000	15.7
0.600	4.1	2.200	7.8	5.500	12.3	9.500	16.2
0.800	4.7	2.400	8.1	6.000	12.8		
1.000	5.2	2.600	8.4	6.500	13.4		

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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 0
 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 0.333
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 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, 180, 240, 360, 480, 600,
 720, 960, 1440, 2160, 2880, 4320, 5760,
 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 20

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+20%					
2.000	15 Winter	100	+20%	100/15 Summer				
1.001	15 Winter	100	+20%					
1.002	120 Winter	100	+20%					
3.000	15 Winter	100	+20%	30/15 Winter				
4.000	15 Winter	100	+20%					
1.003	120 Winter	100	+20%	1/15 Summer				
1.004	120 Winter	100	+20%					
1.005	120 Winter	100	+20%					

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m ³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	181.341	-0.059	0.000	0.66	0.0	9.3	OK
2.000	2	181.310	0.037	0.000	1.44	0.0	17.2	SURCHARGED
1.001	3	181.173	-0.063	0.000	0.86	0.0	26.7	OK
1.002	4	180.813	-0.373	0.000	0.01	0.0	6.5	OK
3.000	5	181.336	0.063	0.000	1.69	0.0	18.3	SURCHARGED
4.000	6	181.330	-0.070	0.000	0.55	0.0	9.3	OK
1.003	7	180.813	0.902	0.000	0.51	0.0	5.4	SURCHARGED
1.004	8	179.736	-0.080	0.000	0.44	0.0	5.4	OK

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

PN	US/MH Name	Water Level (m)	Surch'd Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.005	9	179.674	-0.100	0.000	0.24	0.0	5.4	OK

SW ATTENUATION TANK WITH
FLOW CONTROL. RESTRICTED TO
5.0 L/S 30.8m₃ VOL REQ'D.
DISCHARGE RATE TO BE AGREED
WITH YWS. TUBOSIDER 1.4Ø x
20m LONG.
CL:182.300
SL:181.185 - 181.165
IL:179.791 - 179.765

