Drainage Network SC1

Preliminary surface water drainage report for Sub-catchment SC1, of the Shredded Wheat Development site.

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Shredded Wheat Development

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Sign-off Sheet

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Executive Summary

The following report contains extracts from the drainage model of sub-catchment SC1 of the Shredded Wheat development which can be used for checking purposes. The software used for the surface water drainage network design is Microdrainage 2017.1.2.

It is believed that green roofs will be used in all of the buildings within the development. For the purpose of estimating the size of the attenuation structure from this sub-catchment and sizing the main carrier pipes, green roofs are ignored. As per the CIRIA SuDs guidance document, green roofs are considered to be capturing and attenuating small storm events, but in large storm events the green roof will be fully saturated and all flow is considered to be running of a normal impermeable roof surface.

The design criteria and assumptions used in the development of the model are outlined in the following sections.

Abbreviations

SC1	Sub-Catchment 1
SuDs	Sustainable Urban Drainage

Drainage Network SC1

Design Criteria

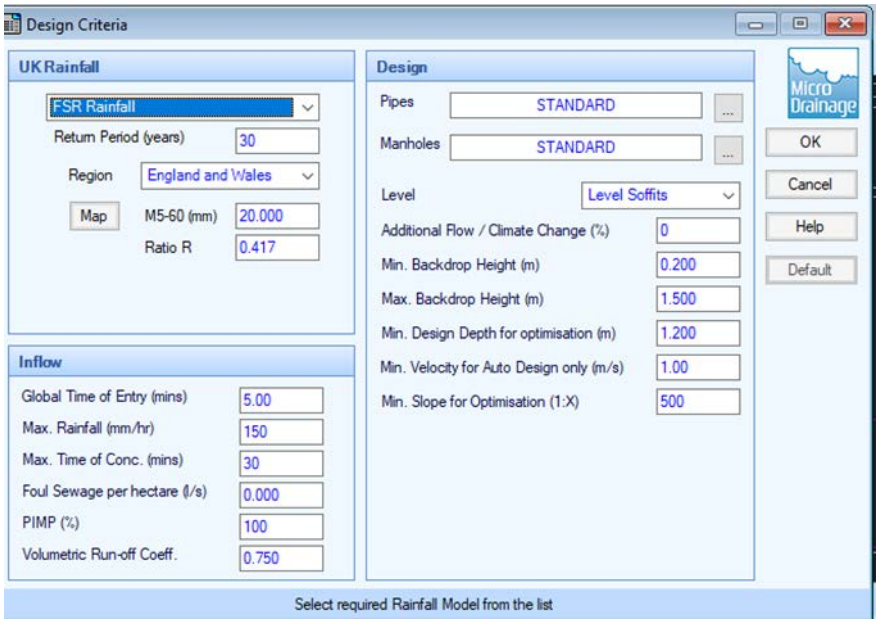
1.0 DESIGN CRITERIA

1.1 MODELLING PARAMETERS

The system has been designed to contain flows for a 1 in 30 year return period without climate change considerations. Exceedance is expected at greater return periods and any flooding is expected to be managed above ground. The impact of extreme storm events to the site is checked by modelling the 1 in 100 year return period storm with 40% uplift in flows to account for climate change.

The main carrier pipes around the site are designed as per 'Sewers for Adoption' 7th edition. An extract from Microdrainage can be found in Figure 1.

Figure 1 MicroDrainage model design parameters



1.2 TOPOGRAPHY

The ground levels for the site are assumed to match the existing topographical elevations. The existing ground levels were taken using reference drawing N6-2015-0294-PP_planning_1940 Sheet 6. The ground levels are based on a laser survey conducted in December 2013 and the existing utilities under and near the site which are indicated in the above drawing were collected in January 2014. The ground levels may be subject to change so there is a risk that low spots may be added along the line of the proposed surface water sewers.

1.3 CATCHMENTS

The catchment boundary for the SC1 network is based on the phasing plan for the development as shown in drawing P0-010 Revision P2 "Site Masterplan (Phasing)" produced by ColladoCollins Architects.

The sub-catchment 1 is shown in the below figure:

Figure 2 Site Masterplan

The total contributing areas for the SC1 sub-catchment are listed in the following table:

Table 1 Contributing Areas

	Roof	Roads & Parking	Podium	Landscaping
Area (ha)	0.165	0.293	0.034	0.315

When the table above is compared to the table found in the drainage report by Pitman Associates, the podium area is about 0.08ha smaller in size. The area considered as podium in this memo is the courtyard in the middle of the two building complexes which consists of hardstanding areas. A large part of the courtyard area is proposed to be landscaped with grass and shrubs and is considered as part of the landscaping.

The assumed percentage runoffs for each surface type within the development sub-catchment are as follows:

- Roofs, Road & Carpark Areas = 100 %
- Podium Surfacing = 80%
- Landscape areas and footpaths = 20%

The screen capture in Figure 3 illustrates how the percentage runoffs were inserted into the Microdrainage modelling. The area allocated as draining in each pipe is illustrated in Figure 4 in green and is attached to the corresponding upstream manholes.

Figure 3 Percentage Impermeable (PIMP) Areas

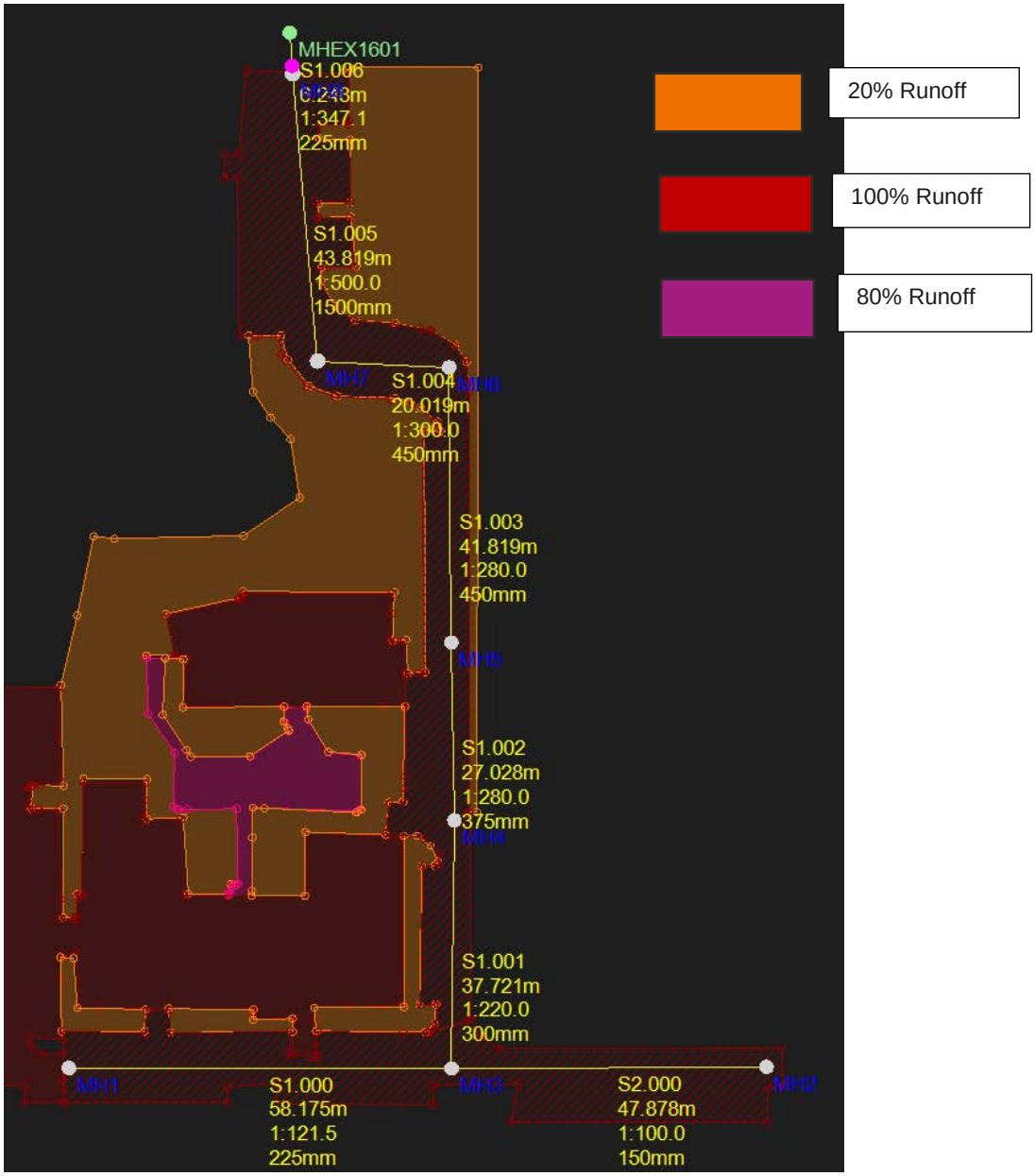


Figure 4 Catchment Areas allocated to each manhole

1.4 OUTFALL DETAILS

1.4.1 Connection to Existing Surface Water Sewer:

Refer to Topographical Survey Drawing N6-2015-0294-PP_planning_1940 Sheet 6. The connection point to the existing public surface water drainage system will be between existing manholes MH1501 and MH1601. The location of the existing manhole is marked on the drawing below with a zoom in location shown in Figure 6. The size of the public sewer within the carriageway cartilage is unknown. A free discharge to the public sewer system is assumed at this stage. There is a risk that if the public sewer is surcharged during extreme rainfall

events, an increased risk of flooding is likely within the development boundary for the 1 in 100 year (+40%CC) event.

Figure 5 Survey Drawing N6-2015-0294-PP_planning_1940 Sheet 6 (Location of connection to public sewer)

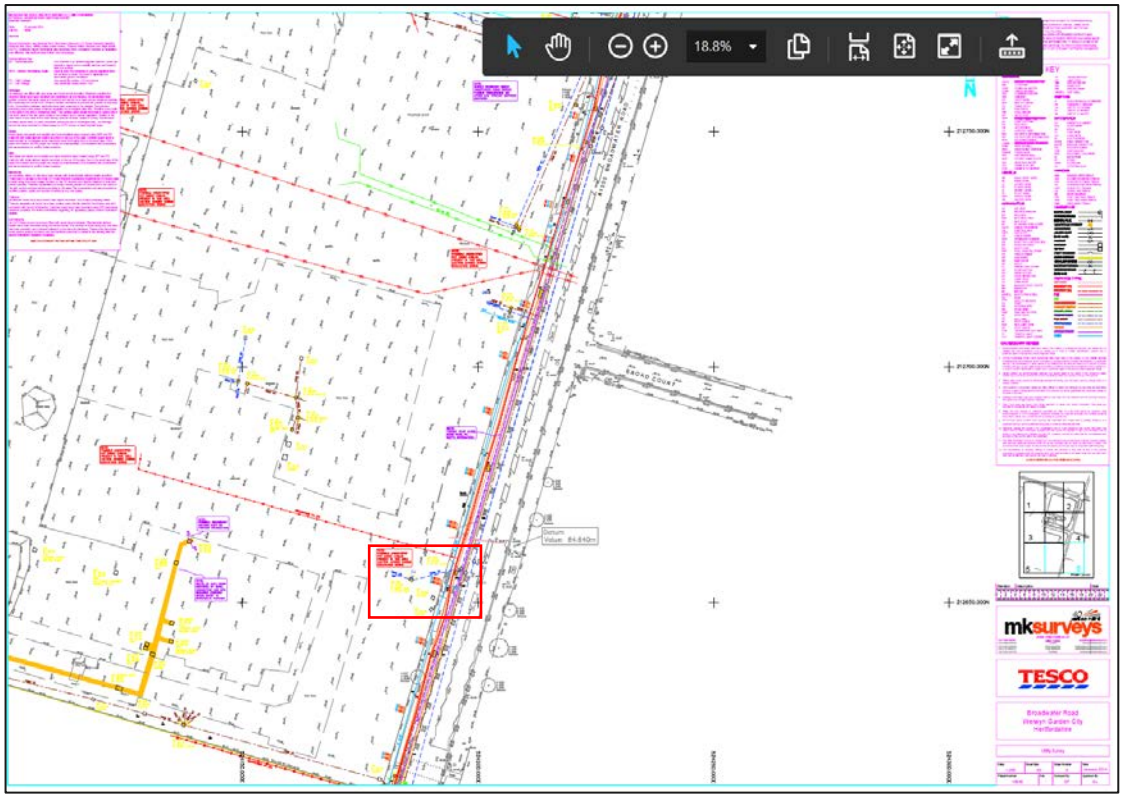
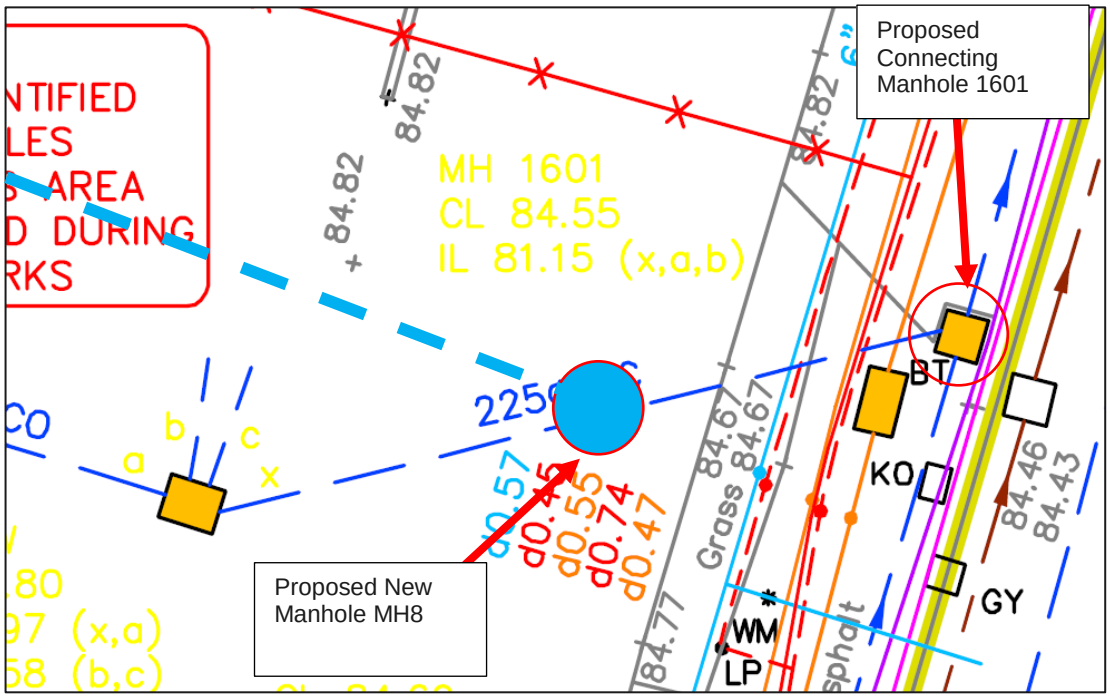


Figure 6 Details of existing public surface water drainage manhole



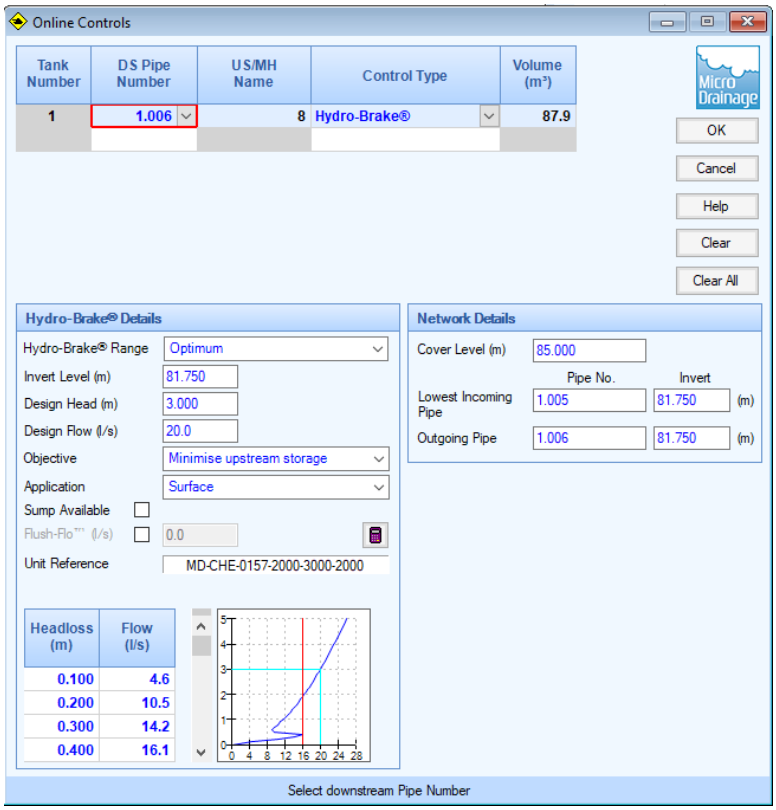
1.4.2 Type of Connection Proposed

A 225mm pipe is proposed for the outfall connection from the Shredded Wheat SC1 site to the existing sewer.

1.5 FLOW CONTROLS

A hydrobrake is proposed at the downstream end of the oversized attenuation pipe which will restrict the peak discharge flow to ~20.8L/s for all storm events including 1:100 year event with climate change allowance.

Extract of the Hydro-Break selected is shown below:



1.6 ADDITIONAL DESIGN CONSIDERATIONS

Due to the size of the last pipe in the system which will act as attenuation storage, self-cleansing velocities for low storm events cannot be achieved. Maximum velocity for a 1 in 1 year storm event is 0.5m/s. A silt trap up stream of this section of pipe/tank should be considered as well as the use of road gullies or channel sumps with a silt trap sump should be considered in detailed design.

2.0 RESULTS

The full results of the network sizing, including the required size of the attenuation structure can be found in **Appendix A**. The required attenuation storage is modelled as a 1.5m diameter tank/pipe for a length of approximately 44m.

The simulation results for the 1 in 100 year storm event plus climate change indicate an overland flooded volume of approximately 62m^3 for the two manholes upstream of the public sewer connection. The car park or the surrounding green areas should be designed/ profiled to incorporate the storage of these exceedance flows.

3.0 REFERENCES

N6-2015-0294-PP_planning_1940 Sheet 6 Survey Drawing

P0-010 Revision P2 “Site Masterplan (Phasing)” produced by ColladoCollins Architects

Sewers for Adoption (7th Edition)

APPENDICES

Appendix A MicroDrainage SC1 - Results

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)	30	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.417	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	150	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

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdro (mm)
MH1	85.300	1.225	Open Manhole	1200	S1.000	84.075	225				
MH2	85.300	1.150	Open Manhole	1200	S2.000	84.150	150				
MH3	85.300	1.779	Open Manhole	1200	S1.001	83.521	300	S1.000	83.596	225	
								S2.000	83.671	150	
MH4	85.300	2.025	Open Manhole	1350	S1.002	83.275	375	S1.001	83.350	300	
MH5	85.300	2.197	Open Manhole	1350	S1.003	83.103	450	S1.002	83.178	375	
MH6	85.300	2.346	Open Manhole	1350	S1.004	82.954	450	S1.003	82.954	450	
MH7	85.000	3.163	Open Manhole	2400	S1.005	81.837	1500	S1.004	82.887	450	
MH8	85.000	3.250	Open Manhole	2400	S1.006	81.750	225	S1.005	81.750	1500	
MHEX1601	84.550	2.818	Open Manhole	1200		OUTFALL		S1.006	81.732	225	

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)
S1.006	MHEX1601	84.550	81.732	81.150	1200	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	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)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.417		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: MH8, DS/PN: S1.006, Volume (m³): 87.9

Unit Reference	MD-CHE-0157-2000-3000-2000
Design Head (m)	3.000
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	No
Diameter (mm)	157
Invert Level (m)	81.750
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.000	20.0
Flush-Flo™	0.392	16.1
Kick-Flo®	0.549	8.9
Mean Flow over Head Range	-	14.2

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	4.6	1.200	12.8	3.000	20.0	7.000	30.3
0.200	10.5	1.400	13.8	3.500	21.6	7.500	31.4
0.300	14.2	1.600	14.7	4.000	23.0	8.000	32.4
0.400	16.1	1.800	15.6	4.500	24.4	8.500	33.4
0.500	9.6	2.000	16.4	5.000	25.7	9.000	34.3
0.600	9.1	2.200	17.2	5.500	26.9	9.500	35.2
0.800	10.5	2.400	17.9	6.000	28.1		
1.000	11.7	2.600	18.6	6.500	29.2		

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 * 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	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 0.418
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	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, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	MH1	15 minute 1 year Winter I+0%	85.300	84.160	-0.140	0.000	0.30
S2.000	MH2	15 minute 1 year Winter I+0%	85.300	84.216	-0.084	0.000	0.40
S1.001	MH3	15 minute 1 year Winter I+0%	85.300	83.658	-0.163	0.000	0.42
S1.002	MH4	15 minute 1 year Winter I+0%	85.300	83.450	-0.200	0.000	0.44
S1.003	MH5	15 minute 1 year Winter I+0%	85.300	83.276	-0.277	0.000	0.31
S1.004	MH6	15 minute 1 year Winter I+0%	85.300	83.144	-0.260	0.000	0.37
S1.005	MH7	30 minute 1 year Winter I+0%	85.000	82.437	-0.900	0.000	0.02
S1.006	MH8	30 minute 1 year Winter I+0%	85.000	82.437	0.462	0.000	0.71

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	MH1		1.0	13.4	OK
S2.000	MH2		0.9	6.9	OK
S1.001	MH3		0.9	29.1	OK
S1.002	MH4		0.9	45.6	OK
S1.003	MH5		1.0	52.8	OK

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

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.004	MH6		0.9	56.2	OK
S1.005	MH7		0.3	50.6	OK
S1.006	MH8		0.7	15.5	SURCHARGED

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 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	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 0.418
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	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, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	MH1	15 minute 30 year Winter I+0%	85.300	84.222	-0.078	0.000	0.73
S2.000	MH2	15 minute 30 year Winter I+0%	85.300	84.272	-0.028	0.000	0.94
S1.001	MH3	15 minute 30 year Winter I+0%	85.300	83.854	0.032	0.000	1.05
S1.002	MH4	15 minute 30 year Winter I+0%	85.300	83.659	0.009	0.000	1.10
S1.003	MH5	15 minute 30 year Winter I+0%	85.300	83.412	-0.142	0.000	0.79
S1.004	MH6	60 minute 30 year Winter I+0%	85.300	83.393	-0.011	0.000	0.55
S1.005	MH7	60 minute 30 year Winter I+0%	85.000	83.386	0.049	0.000	0.04
S1.006	MH8	60 minute 30 year Winter I+0%	85.000	83.386	1.411	0.000	0.71

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	MH1		1.2	33.0	OK
S2.000	MH2		1.1	16.2	OK
S1.001	MH3		1.1	72.3	SURCHARGED
S1.002	MH4		1.1	114.6	SURCHARGED
S1.003	MH5		1.2	135.0	OK

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

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.004	MH6		1.0	82.6	OK
S1.005	MH7		0.3	87.2	SURCHARGED
S1.006	MH8		0.7	15.6	SURCHARGED

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 * 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	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	0.418
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	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, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	MH1	60 minute 100 year Winter I+40%	85.300	85.301	1.001	0.508	0.68
S2.000	MH2	60 minute 100 year Winter I+40%	85.300	85.301	1.001	0.762	0.88
S1.001	MH3	60 minute 100 year Winter I+40%	85.300	85.223	1.402	0.000	0.97
S1.002	MH4	60 minute 100 year Winter I+40%	85.300	85.148	1.498	0.000	1.05
S1.003	MH5	60 minute 100 year Winter I+40%	85.300	85.092	1.538	0.000	0.75
S1.004	MH6	60 minute 100 year Winter I+40%	85.300	85.048	1.644	0.000	0.86
S1.005	MH7	60 minute 100 year Winter I+40%	85.000	85.030	1.693	30.367	0.05
S1.006	MH8	60 minute 100 year Winter I+40%	85.000	85.030	3.055	30.401	0.94

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	MH1		1.2	30.8	FLOOD
S2.000	MH2		1.1	15.2	FLOOD
S1.001	MH3		1.1	67.2	FLOOD RISK
S1.002	MH4		1.1	109.3	FLOOD RISK
S1.003	MH5		1.2	128.7	FLOOD RISK

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

PN	US/MH Name	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.004	MH6		1.1	129.2	FLOOD RISK
S1.005	MH7		0.3	127.1	FLOOD
S1.006	MH8		0.8	20.6	FLOOD

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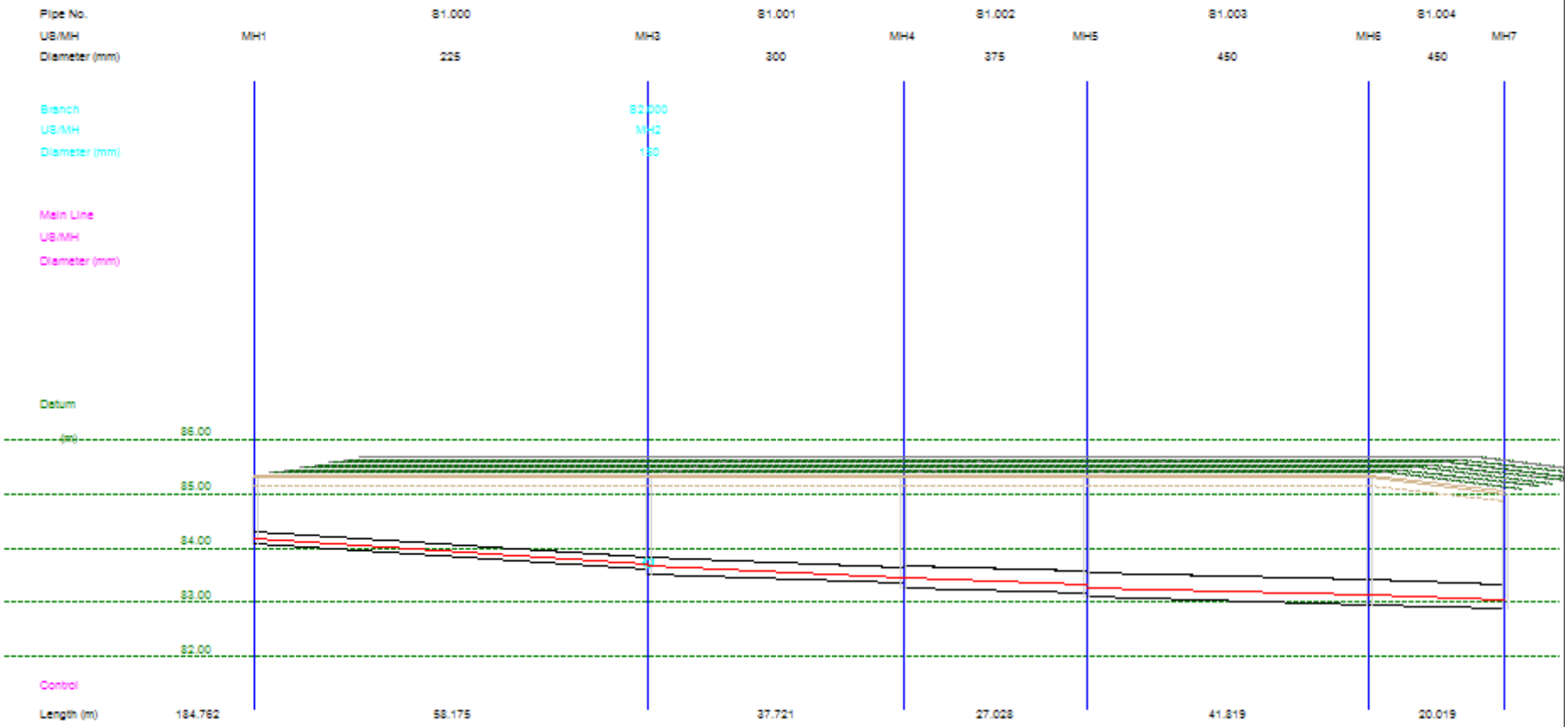
Micro Drainage	Network 2017.1.2	



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