

Brennan Consult		Page 1
Oak House, 2 Gatley Road	2982 Unicorn House	
Cheadle	Surface Water Calcs	
Stockport, SK8 1PY		
Date 22/01/2026	Designed by MM	
File 2982 SW Calcs 20.01.26.MDX	Checked by	
Innovyze	Network 2019.1	

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)	1	Maximum Time of Concentration (mins)	30	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	1.00
M5-60 (mm)	18.800	Foul Sewage (l/s/ha)	0.000	Minimum Backdrop Height (m)	0.200	Min Slope for Optimisation (1:X)	500
Ratio R	0.320	Volumetric Runoff Coeff.	0.750	Maximum Backdrop Height (m)	1.500		
Maximum Rainfall (mm/hr)	50	PIMP (%)	100	Min Design Depth for Optimisation (m)	1.200		

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
1.000	20.482	0.223	91.8	0.023	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	1.311	0.013	100.8	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	6.537	0.082	79.7	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	1.646	0.021	78.4	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	48.69	4.33	76.038	0.023	0.0	0.0	0.0	1.05	18.5	3.0
1.001	48.60	4.35	75.815	0.026	0.0	0.0	0.0	1.00	17.7	3.4
2.000	49.69	4.10	75.870	0.028	0.0	0.0	0.0	1.13	19.9	3.8
1.002	48.50	4.37	74.450	0.054	0.0	0.0	0.0	1.14	20.1	7.1

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)	Backdrop (mm)	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)	Backdrop (mm)
RE	76.930	0.892	Open Manhole	450	1.000	76.038	150					TANK	77.150	2.700	Open Manhole	150	1.002	74.450	150	1.001	75.802	150	1352
SW01	77.110	1.295	Open Manhole	450	1.001	75.815	150	1.000	75.815	150										2.000	75.788	150	1338
SW02	77.250	1.380	Open Manhole	450	2.000	75.870	150						77.150	2.721	Open Manhole	0		OUTFALL		1.002	74.429	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
RE	386572.612	405619.740	386572.612	405619.740	Required	
SW01	386554.958	405609.355	386554.958	405609.355	Required	
SW02	386549.762	405614.249	386549.762	405614.249	Required	
TANK	386555.213	405610.641	386555.213	405610.641	Required	
	386556.859	405610.641			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	RE	76.930	76.038	0.742	Open Manhole	450
1.001	o	150	SW01	77.110	75.815	1.145	Open Manhole	450
2.000	o	150	SW02	77.250	75.870	1.230	Open Manhole	450
1.002	o	150	TANK	77.150	74.450	2.550	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	20.482	91.8	SW01	77.110	75.815	1.145	Open Manhole	450
1.001	1.311	100.8	TANK	77.150	75.802	1.198	Open Manhole	150
2.000	6.537	79.7	TANK	77.150	75.788	1.212	Open Manhole	150
1.002	1.646	78.4		77.150	74.429	2.571	Open Manhole	0

Network Classifications for Storm

PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type	PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type
	Name	Dia	Depth	Depth		Dia	Width	Depth			Name	Dia	Depth	Depth		Dia	Width	Depth	
		(mm)	(m)	(m)		(mm)	(mm)	(m)				(mm)	(m)	(m)		(mm)	(mm)	(m)	
1.000	RE	150	0.742	1.145	Unclassified	450	0	0.742	Unclassified	2.000	SW02	150	1.212	1.230	Unclassified	450	0	1.230	Unclassified
1.001	SW01	150	1.145	1.198	Unclassified	450	0	1.145	Unclassified	1.002	TANK	150	2.550	2.571	Unclassified	150	0	2.550	Unclassified

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		
1.002		77.150	74.429	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750Hot Start Level (mm) 0Additional Flow - % of Total Flow 0.000Flow per Person per Day (l/per/day) 0.000

Areal Reduction Factor 1.000Manhole Headloss Coeff (Global) 0.500MADD Factor * 10m³/ha Storage 2.000Run Time (mins) 60

Hot Start (mins) 0Foul Sewage per hectare (l/s) 0.000Inlet Coeffiecient 0.800Output Interval (mins) 1

Number of Input Hydrographs 0Number of Online Controls 1Number of Offline Controls 0Number of Storage Structures 1Number of Time/Area Diagrams 0Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSRRegion England and WalesRatio R 0.320Cv (Summer) 0.750Storm Duration (mins) 30

Return Period (years) 1M5-60 (mm) 18.800Profile Type Summer Cv (Winter) 0.840

Online Controls for Storm

Pump Manhole: TANK, DS/PN: 1.002, Volume (m³): 0.2

Invert Level (m) 74.850

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000	3.400	0.1000	4.200	0.1000	5.000	0.1000	5.800	0.1000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000	3.600	0.1000	4.400	0.1000	5.200	0.1000	6.000	0.1000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.1000	3.800	0.1000	4.600	0.1000	5.400	0.1000		
0.800	0.0000	1.600	0.0000	2.400	0.0000	3.200	0.1000	4.000	0.1000	4.800	0.1000	5.600	0.1000		

Brennan Consult		Page 6
Oak House, 2 Gatley Road Cheadle Stockport, SK8 1PY	2982 Unicorn House Surface Water Calcs	
Date 22/01/2026 File 2982 SW Calcs 20.01.26.MDX	Designed by MM Checked by	
Innovyze	Network 2019.1	

Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.002

Invert Level (m) 74.850 Infiltration Coefficient Side (m/hr) 0.22320 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.22320 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	16.0	16.0	1.600	16.0	41.6	1.601	0.0	41.6

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

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840

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

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, 45, 45

									Water	Surcharged	Flooded	Pipe					
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.000	RE	15	Winter	1	+0%	100/60	Winter			76.079	-0.109	0.000	0.17		3.0	OK	
1.001	SW01	15	Winter	1	+0%	30/15	Summer			75.871	-0.094	0.000	0.30		3.3	OK	
2.000	SW02	15	Winter	1	+0%	30/120	Winter			75.917	-0.103	0.000	0.22		3.6	OK	
1.002	TANK	120	Winter	1	+0%	1/15	Summer			75.116	0.516	0.000	0.00		0.0	SURCHARGED	

Brennan Consult		Page 8
Oak House, 2 Gatley Road	2982 Unicorn House	
Cheadle	Surface Water Calcs	
Stockport, SK8 1PY		
Date 22/01/2026	Designed by MM	
File 2982 SW Calcs 20.01.26.MDX	Checked by	
Innovyze	Network 2019.1	

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

Simulation Criteria
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800
Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details
Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep 2.5 Second Increment (Extended) DVD Status OFF

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, 45, 45

									Water	Surcharged	Flooded			Pipe		
	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded
1.000	RE	15	Winter	30	+45%	100/60	Winter		76.122	-0.066	0.000	0.61		10.6		OK
1.001	SW01	240	Winter	30	+45%	30/15	Summer		76.060	0.095	0.000	0.23		2.5	SURCHARGED	
2.000	SW02	240	Winter	30	+45%	30/120	Winter		76.061	0.041	0.000	0.16		2.7	SURCHARGED	
1.002	TANK	240	Winter	30	+45%	1/15	Summer		76.060	1.460	0.000	0.00		0.0	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000

Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 1 Number of Offline Controls 0 Number of Storage Structures 1 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Region England and Wales M5-60 (mm) 18.800 Ratio R 0.320 Cv (Summer) 0.750 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF

Analysis Timestep 2.5 Second Increment (Extended) DVD Status OFF

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, 45, 45

									Water	Surcharged	Flooded	Pipe					
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(1/s)	(1/s)	Status	Exceeded
1.000	RE	240	Winter	100	+45%	100/60	Winter			76.465	0.277	0.000	0.16		2.9	SURCHARGED	
1.001	SW01	240	Winter	100	+45%	30/15	Summer			76.450	0.485	0.000	0.30		3.2	SURCHARGED	
2.000	SW02	240	Winter	100	+45%	30/120	Winter			76.459	0.439	0.000	0.21		3.5	SURCHARGED	
1.002	TANK	240	Winter	100	+45%	1/15	Summer			76.450	1.850	0.000	0.00		0.0	SURCHARGED	