STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	240
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	4

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	120
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 120 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.486	-0.089	0.000	0.35		5.8	OK
1.001	2	78.337	-0.082	0.000	0.43		6.7	OK
1.002	3	78.256	-0.076	0.000	0.31		6.7	OK
2.000	12	78.534	-0.116	0.000	0.11		1.9	OK
2.001	13	78.285	-0.102	0.000	0.22		3.7	OK
1.003	4	78.252	0.112	0.000	0.90		13.3	SURCHARGED
3.000	14	78.247	0.093	0.000	0.03		0.9	SURCHARGED
1.004	5	78.276	0.193	0.000	0.02		0.8	SURCHARGED
1.005	6	78.102	1.358	0.000	0.05		8.1	SURCHARGED
4.000	15	78.426	0.376	0.000	0.17		2.0	SURCHARGED
4.001	16	78.426	0.432	0.000	0.36		4.2	SURCHARGED
4.002	17	78.425	0.480	0.000	0.78		9.5	SURCHARGED
5.000	21	78.424	0.364	0.000	0.14		1.8	SURCHARGED
5.001	22	78.423	0.515	0.000	0.12		1.4	SURCHARGED
4.003	18	78.422	0.574	0.000	0.46		12.3	SURCHARGED
4.004	19	78.422	0.591	0.000	0.05		1.3	SURCHARGED
4.005	20	78.422	0.607	0.000	0.02		0.8	SURCHARGED
1.006	8	78.100	1.480	0.000	0.10		15.9	SURCHARGED
6.000	9	78.204	0.554	0.000	0.14		1.7	FLOOD RISK
6.001	10	78.203	0.699	0.000	0.48		6.0	FLOOD RISK
6.002	11	78.201	0.806	0.000	0.48		5.7	FLOOD RISK
7.000	27	78.200	0.550	0.000	0.10		1.4	FLOOD RISK
7.001	28	78.200	0.654	0.000	0.17		2.2	FLOOD RISK
6.003	23	78.199	0.865	0.000	0.95		10.0	FLOOD RISK
6.004	24	78.199	0.885	0.000	0.09		1.0	FLOOD RISK
6.005	25	78.198	0.904	0.000	0.04		0.8	FLOOD RISK
1.007	7	78.098	1.553	0.000	0.09		12.2	FLOOD RISK
1.008	26	78.095	1.846	0.000	0.02		5.1	FLOOD RISK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 15 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.914	0.339	0.000	0.93		15.2	SURCHARGED
1.001	2	78.774	0.355	0.000	1.12		17.4	SURCHARGED
1.002	3	78.661	0.330	0.000	0.83		17.6	SURCHARGED
2.000	12	78.623	-0.027	0.000	0.32		5.4	OK
2.001	13	78.594	0.207	0.000	0.58		9.6	SURCHARGED
1.003	4	78.529	0.388	0.000	2.32		34.1	SURCHARGED
3.000	14	78.096	-0.058	0.000	0.03		0.9	OK
1.004	5	78.205	0.122	0.000	0.02		0.8	SURCHARGED
1.005	6	77.085	0.341	0.000	0.18		29.3	SURCHARGED
4.000	15	78.501	0.451	0.000	0.53		6.2	SURCHARGED
4.001	16	78.480	0.486	0.000	1.08		12.5	SURCHARGED
4.002	17	78.425	0.480	0.000	2.30		28.3	SURCHARGED
5.000	21	77.977	-0.083	0.000	0.40		5.0	OK
5.001	22	77.910	0.002	0.000	0.45		5.3	SURCHARGED
4.003	18	77.892	0.044	0.000	1.40		37.8	SURCHARGED
4.004	19	77.878	0.047	0.000	0.06		1.7	SURCHARGED
4.005	20	77.936	0.121	0.000	0.02		0.8	SURCHARGED
1.006	8	77.085	0.465	0.000	0.33		50.6	SURCHARGED
6.000	9	77.898	0.248	0.000	0.39		4.9	SURCHARGED
6.001	10	77.871	0.367	0.000	1.38		17.1	SURCHARGED
6.002	11	77.661	0.266	0.000	1.43		17.0	SURCHARGED
7.000	27	77.570	-0.080	0.000	0.30		4.1	OK
7.001	28	77.553	0.007	0.000	0.48		6.1	SURCHARGED
6.003	23	77.534	0.200	0.000	2.77		29.3	SURCHARGED
6.004	24	77.429	0.115	0.000	0.14		1.4	SURCHARGED
6.005	25	77.428	0.134	0.000	0.04		0.8	SURCHARGED
1.007	7	77.084	0.539	0.000	0.26		34.2	SURCHARGED
1.008	26	77.082	0.833	0.000	0.02		4.1	SURCHARGED

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	480
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	4

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	240
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 240 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.472	-0.103	0.000	0.21		3.5	OK
1.001	2	78.321	-0.098	0.000	0.26		4.1	OK
1.002	3	78.282	-0.049	0.000	0.19		4.1	OK
2.000	12	78.526	-0.124	0.000	0.07		1.2	OK
2.001	13	78.280	-0.107	0.000	0.13		2.2	OK
1.003	4	78.282	0.142	0.000	0.55		8.1	SURCHARGED
3.000	14	78.273	0.119	0.000	0.03		0.9	SURCHARGED
1.004	5	78.320	0.237	0.000	0.02		0.8	SURCHARGED
1.005	6	78.145	1.401	0.000	0.03		5.2	SURCHARGED
4.000	15	78.866	0.816	0.000	0.11		1.3	FLOOD RISK
4.001	16	78.865	0.871	0.000	0.22		2.5	FLOOD RISK
4.002	17	78.864	0.919	0.000	0.47		5.8	FLOOD RISK
5.000	21	78.862	0.802	0.000	0.08		1.1	FLOOD RISK
5.001	22	78.861	0.953	0.000	0.07		0.9	FLOOD RISK
4.003	18	78.861	1.013	0.000	0.27		7.3	FLOOD RISK
4.004	19	78.860	1.029	0.000	0.05		1.2	FLOOD RISK
4.005	20	78.860	1.045	0.000	0.02		0.9	FLOOD RISK
1.006	8	78.144	1.524	0.000	0.07		10.6	SURCHARGED
6.000	9	78.249	0.599	0.000	0.09		1.1	FLOOD RISK
6.001	10	78.248	0.744	0.000	0.29		3.7	FLOOD RISK
6.002	11	78.247	0.852	0.000	0.30		3.5	FLOOD RISK
7.000	27	78.248	0.598	0.000	0.06		0.9	FLOOD RISK
7.001	28	78.247	0.701	0.000	0.10		1.3	FLOOD RISK
6.003	23	78.246	0.912	0.000	0.58		6.2	FLOOD RISK
6.004	24	78.245	0.931	0.000	0.09		0.9	FLOOD RISK
6.005	25	78.244	0.950	0.000	0.04		0.8	FLOOD RISK
1.007	7	78.142	1.597	0.000	0.07		9.0	FLOOD RISK
1.008	26	78.140	1.891	0.000	0.02		5.1	FLOOD RISK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 30 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.686	0.111	0.000	0.78		12.8	SURCHARGED
1.001	2	78.591	0.172	0.000	0.94		14.7	SURCHARGED
1.002	3	78.512	0.181	0.000	0.69		14.7	SURCHARGED
2.000	12	78.552	-0.098	0.000	0.27		4.5	OK
2.001	13	78.466	0.079	0.000	0.49		8.2	SURCHARGED
1.003	4	78.421	0.280	0.000	1.97		29.1	SURCHARGED
3.000	14	78.149	-0.005	0.000	0.03		0.8	OK
1.004	5	78.195	0.112	0.000	0.02		0.8	SURCHARGED
1.005	6	77.587	0.843	0.000	0.13		21.0	SURCHARGED
4.000	15	78.262	0.212	0.000	0.42		4.9	SURCHARGED
4.001	16	78.245	0.251	0.000	0.87		10.1	SURCHARGED
4.002	17	78.208	0.263	0.000	1.86		22.9	SURCHARGED
5.000	21	77.969	-0.091	0.000	0.32		4.1	OK
5.001	22	77.960	0.052	0.000	0.35		4.1	SURCHARGED
4.003	18	77.959	0.111	0.000	1.13		30.4	SURCHARGED
4.004	19	77.959	0.128	0.000	0.06		1.5	SURCHARGED
4.005	20	77.973	0.159	0.000	0.02		0.8	SURCHARGED
1.006	8	77.586	0.966	0.000	0.20		30.7	SURCHARGED
6.000	9	77.737	0.087	0.000	0.30		3.8	SURCHARGED
6.001	10	77.716	0.212	0.000	1.12		13.9	SURCHARGED
6.002	11	77.582	0.187	0.000	1.17		13.9	SURCHARGED
7.000	27	77.550	-0.100	0.000	0.25		3.3	OK
7.001	28	77.521	-0.025	0.000	0.41		5.2	OK
6.003	23	77.519	0.185	0.000	2.21		23.3	SURCHARGED
6.004	24	77.519	0.205	0.000	0.12		1.3	SURCHARGED
6.005	25	77.520	0.226	0.000	0.04		0.8	SURCHARGED
1.007	7	77.584	1.039	0.000	0.17		23.2	SURCHARGED
1.008	26	77.583	1.334	0.000	0.02		4.4	SURCHARGED

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	720
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	6

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	360
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 360 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.465	-0.110	0.000	0.16		2.6	OK
1.001	2	78.313	-0.106	0.000	0.19		3.0	OK
1.002	3	78.271	-0.060	0.000	0.14		3.0	OK
2.000	12	78.522	-0.128	0.000	0.05		0.9	OK
2.001	13	78.270	-0.117	0.000	0.10		1.6	OK
1.003	4	78.271	0.130	0.000	0.40		5.9	SURCHARGED
3.000	14	78.263	0.109	0.000	0.03		0.9	SURCHARGED
1.004	5	78.296	0.213	0.000	0.02		0.8	SURCHARGED
1.005	6	78.068	1.324	0.000	0.03		4.1	SURCHARGED
4.000	15	78.778	0.728	0.000	0.08		0.9	FLOOD RISK
4.001	16	78.778	0.784	0.000	0.16		1.9	FLOOD RISK
4.002	17	78.777	0.832	0.000	0.35		4.2	FLOOD RISK
5.000	21	78.774	0.714	0.000	0.06		0.8	FLOOD RISK
5.001	22	78.774	0.866	0.000	0.05		0.6	FLOOD RISK
4.003	18	78.773	0.925	0.000	0.20		5.4	FLOOD RISK
4.004	19	78.773	0.942	0.000	0.04		1.2	FLOOD RISK
4.005	20	78.772	0.958	0.000	0.02		0.9	FLOOD RISK
1.006	8	78.067	1.447	0.000	0.05		8.3	SURCHARGED
6.000	9	78.247	0.597	0.000	0.06		0.8	FLOOD RISK
6.001	10	78.247	0.743	0.000	0.22		2.7	FLOOD RISK
6.002	11	78.244	0.849	0.000	0.22		2.6	FLOOD RISK
7.000	27	78.247	0.597	0.000	0.05		0.6	FLOOD RISK
7.001	28	78.246	0.700	0.000	0.08		1.0	FLOOD RISK
6.003	23	78.244	0.910	0.000	0.43		4.5	FLOOD RISK
6.004	24	78.243	0.929	0.000	0.09		1.0	FLOOD RISK
6.005	25	78.242	0.948	0.000	0.04		0.8	FLOOD RISK
1.007	7	78.065	1.520	0.000	0.06		7.4	FLOOD RISK
1.008	26	78.063	1.814	0.000	0.02		5.0	FLOOD RISK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1200
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	10

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	600
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 600 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.458	-0.117	0.000	0.11		1.8	OK
1.001	2	78.305	-0.114	0.000	0.13		2.0	OK
1.002	3	78.243	-0.088	0.000	0.10		2.0	OK
2.000	12	78.518	-0.132	0.000	0.03		0.6	OK
2.001	13	78.262	-0.125	0.000	0.07		1.1	OK
1.003	4	78.248	0.108	0.000	0.27		4.0	SURCHARGED
3.000	14	78.240	0.086	0.000	0.03		0.8	SURCHARGED
1.004	5	78.271	0.188	0.000	0.02		0.8	SURCHARGED
1.005	6	77.816	1.072	0.000	0.02		3.2	SURCHARGED
4.000	15	78.500	0.450	0.000	0.05		0.6	SURCHARGED
4.001	16	78.500	0.506	0.000	0.11		1.3	SURCHARGED
4.002	17	78.499	0.554	0.000	0.24		2.9	SURCHARGED
5.000	21	78.497	0.437	0.000	0.04		0.5	SURCHARGED
5.001	22	78.496	0.588	0.000	0.04		0.4	SURCHARGED
4.003	18	78.496	0.648	0.000	0.14		3.7	SURCHARGED
4.004	19	78.495	0.664	0.000	0.04		1.0	SURCHARGED
4.005	20	78.495	0.681	0.000	0.02		0.9	SURCHARGED
1.006	8	77.815	1.195	0.000	0.04		6.2	SURCHARGED
6.000	9	78.117	0.467	0.000	0.04		0.5	FLOOD RISK
6.001	10	78.116	0.612	0.000	0.15		1.9	FLOOD RISK
6.002	11	78.114	0.719	0.000	0.15		1.8	FLOOD RISK
7.000	27	78.113	0.463	0.000	0.03		0.4	FLOOD RISK
7.001	28	78.113	0.567	0.000	0.05		0.7	FLOOD RISK
6.003	23	78.112	0.778	0.000	0.29		3.1	FLOOD RISK
6.004	24	78.111	0.797	0.000	0.09		0.9	FLOOD RISK
6.005	25	78.110	0.816	0.000	0.04		0.8	FLOOD RISK
1.007	7	77.814	1.269	0.000	0.05		6.0	SURCHARGED
1.008	26	77.812	1.563	0.000	0.02		4.7	SURCHARGED

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for KERSAL AVE.SWS

Pipe Sizes KERSAL AVE Manhole Sizes KERSAL AVE

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	35
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for KERSAL AVE.SWS

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
1.000	15.580	0.156	99.9	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	8.775	0.088	100.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	10.878	0.191	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
2.000	26.337	0.263	100.1	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	19.652	0.197	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit
1.003	5.739	0.057	100.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit
3.000	3.194	0.021	152.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit
1.004	8.186	0.055	149.9	0.000	0.00	0.0	0.600	o	225	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	5.26	78.425	0.033	0.0	0.0	1.6	1.01	17.8	6.0
1.001	50.00	5.40	78.269	0.038	0.0	0.0	1.8	1.00	17.8	6.9
1.002	50.00	5.54	78.181	0.038	0.0	0.0	1.8	1.34	23.6	6.9
2.000	50.00	5.44	78.500	0.011	0.0	0.0	0.5	1.00	17.7	2.0
2.001	50.00	5.76	78.237	0.021	0.0	0.0	1.0	1.00	17.8	3.8
1.003	50.00	5.86	77.990	0.076	0.0	0.0	3.6	1.00	17.8	13.9
3.000	50.00	5.05	77.929	0.000	0.0	0.0	0.0	1.06	42.1	0.0
1.004	50.00	5.99	77.858	0.076	0.0	0.0	3.6	1.07	42.4	13.9

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Network Design Table for KERSAL AVE.SWS

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
1.005	36.675	0.124	295.8	0.056	0.00	0.0	0.600	o	450	Pipe/Conduit
4.000	10.101	0.056	180.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
4.001	8.775	0.049	179.1	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit
4.002	17.416	0.097	179.9	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit
5.000	27.346	0.152	179.9	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
5.001	10.881	0.060	181.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
4.003	3.000	0.017	176.5	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit
4.004	3.000	0.017	179.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
4.005	7.925	0.108	73.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.006	22.247	0.075	296.6	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit
6.000	26.337	0.146	180.4	0.010	5.00	0.0	0.600	o	150	Pipe/Conduit
6.001	19.652	0.109	180.3	0.027	0.00	0.0	0.600	o	150	Pipe/Conduit
6.002	10.878	0.061	178.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
7.000	15.580	0.104	149.8	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit
7.001	8.775	0.059	148.7	0.005	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)
1.005	50.00	6.51	76.294	0.132	0.0	0.0	6.3	1.18	187.2	24.1
4.000	50.00	5.23	77.900	0.012	0.0	0.0	0.6	0.75	13.2	2.2
4.001	50.00	5.42	77.844	0.025	0.0	0.0	1.2	0.75	13.2	4.6
4.002	50.00	5.81	77.795	0.057	0.0	0.0	2.7	0.75	13.2	10.4
5.000	50.00	5.61	77.910	0.010	0.0	0.0	0.5	0.75	13.2	1.8
5.001	50.00	5.85	77.758	0.010	0.0	0.0	0.5	0.74	13.1	1.8
4.003	50.00	5.91	77.623	0.077	0.0	0.0	3.6	0.98	39.0	14.1
4.004	50.00	5.96	77.606	0.077	0.0	0.0	3.6	0.97	38.7	14.1
4.005	50.00	6.04	77.589	0.077	0.0	0.0	3.6	1.53	60.7	14.1
1.006	50.00	6.82	76.170	0.278	0.0	0.0	13.2	1.18	186.9	50.8
6.000	50.00	5.59	77.500	0.010	0.0	0.0	0.5	0.75	13.2	1.8
6.001	50.00	6.03	77.354	0.037	0.0	0.0	1.8	0.75	13.2	6.8
6.002	50.00	6.27	77.245	0.037	0.0	0.0	1.8	0.75	13.2	6.8
7.000	50.00	5.32	77.500	0.008	0.0	0.0	0.4	0.82	14.5	1.5
7.001	50.00	5.50	77.396	0.013	0.0	0.0	0.6	0.82	14.5	2.4

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Network Design Table for KERSAL AVE.SWS

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
6.003	3.000	0.020	150.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit
6.004	3.000	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
6.005	25.799	0.299	86.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.007	30.242	0.071	425.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.008	28.685	5.737	5.0	0.000	0.00	0.0	0.600	o	225	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)
6.003	50.00	6.33	77.184	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.004	50.00	6.39	77.164	0.064	0.0	0.0	3.0	0.82	14.5	11.7
6.005	50.00	6.79	77.144	0.064	0.0	0.0	3.0	1.08	19.1	11.7
1.007	50.00	7.34	76.095	0.342	0.0	0.0	16.2	0.98	155.7	62.5
1.008	50.00	7.42	76.024	0.342	0.0	0.0	16.2	5.89	234.3	62.5

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Manhole Schedules for KERSAL AVE.SWS

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)
1	79.300	0.875	Open Manhole	450	1.000	78.425	150				
2	79.450	1.181	Open Manhole	450	1.001	78.269	150	1.000	78.269	150	
3	79.300	1.119	Open Manhole	450	1.002	78.181	150	1.001	78.181	150	
12	79.300	0.800	Open Manhole	450	2.000	78.500	150				
13	79.300	1.063	Open Manhole	450	2.001	78.237	150	2.000	78.237	150	
4	79.300	1.310	Open Manhole	450	1.003	77.990	150	1.002	77.990	150	
								2.001	78.041	150	50
14	79.450	1.521	Open Manhole	1200	3.000	77.929	225				
5	79.450	1.592	Open Manhole	1200	1.004	77.858	225	1.003	77.933	150	
								3.000	77.908	225	50
6	79.703	3.409	Open Manhole	1800	1.005	76.294	450	1.004	77.803	225	1284
15	78.950	1.050	Open Manhole	450	4.000	77.900	150				
16	78.950	1.106	Open Manhole	450	4.001	77.844	150	4.000	77.844	150	
17	78.950	1.155	Open Manhole	450	4.002	77.795	150	4.001	77.795	150	
21	78.950	1.040	Open Manhole	450	5.000	77.910	150				
22	78.950	1.192	Open Manhole	450	5.001	77.758	150	5.000	77.758	150	
18	78.950	1.327	Open Manhole	450	4.003	77.623	225	4.002	77.698	150	
								5.001	77.698	150	
19	79.000	1.394	Open Manhole	1200	4.004	77.606	225	4.003	77.606	225	
20	79.000	1.411	Open Manhole	1200	4.005	77.589	225	4.004	77.589	225	
8	78.789	2.619	Open Manhole	1800	1.006	76.170	450	1.005	76.170	450	
								4.005	77.482	225	1087
9	78.250	0.750	Open Manhole	450	6.000	77.500	150				
10	78.250	0.896	Open Manhole	450	6.001	77.354	150	6.000	77.354	150	
11	78.250	1.005	Open Manhole	450	6.002	77.245	150	6.001	77.245	150	
27	78.400	0.900	Open Manhole	450	7.000	77.500	150				
28	78.400	1.004	Open Manhole	450	7.001	77.396	150	7.000	77.396	150	
23	78.400	1.216	Open Manhole	450	6.003	77.184	150	6.002	77.184	150	
								7.001	77.337	150	153
24	78.357	1.193	Open Manhole	1200	6.004	77.164	150	6.003	77.164	150	
25	78.326	1.182	Open Manhole	1200	6.005	77.144	150	6.004	77.144	150	
7	78.214	2.119	Open Manhole	1800	1.007	76.095	450	1.006	76.095	450	
								6.005	76.845	150	450
26	78.342	2.318	Open Manhole	3000	1.008	76.024	225	1.007	76.024	450	
29	71.100	0.813	Open Manhole	0		OUTFALL		1.008	70.287	225	

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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	1	79.300	78.425	0.725	Open Manhole	450
1.001	o	150	2	79.450	78.269	1.031	Open Manhole	450
1.002	o	150	3	79.300	78.181	0.969	Open Manhole	450
2.000	o	150	12	79.300	78.500	0.650	Open Manhole	450
2.001	o	150	13	79.300	78.237	0.913	Open Manhole	450
1.003	o	150	4	79.300	77.990	1.160	Open Manhole	450
3.000	o	225	14	79.450	77.929	1.296	Open Manhole	1200
1.004	o	225	5	79.450	77.858	1.367	Open Manhole	1200
1.005	o	450	6	79.703	76.294	2.959	Open Manhole	1800
4.000	o	150	15	78.950	77.900	0.900	Open Manhole	450
4.001	o	150	16	78.950	77.844	0.956	Open Manhole	450
4.002	o	150	17	78.950	77.795	1.005	Open Manhole	450
5.000	o	150	21	78.950	77.910	0.890	Open Manhole	450
5.001	o	150	22	78.950	77.758	1.042	Open Manhole	450

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	15.580	99.9	2	79.450	78.269	1.031	Open Manhole	450
1.001	8.775	100.1	3	79.300	78.181	0.969	Open Manhole	450
1.002	10.878	57.0	4	79.300	77.990	1.160	Open Manhole	450
2.000	26.337	100.1	13	79.300	78.237	0.913	Open Manhole	450
2.001	19.652	100.0	4	79.300	78.041	1.110	Open Manhole	450
1.003	5.739	100.0	5	79.450	77.933	1.367	Open Manhole	1200
3.000	3.194	152.1	5	79.450	77.908	1.317	Open Manhole	1200
1.004	8.186	149.9	6	79.703	77.803	1.675	Open Manhole	1800
1.005	36.675	295.8	8	78.789	76.170	2.169	Open Manhole	1800
4.000	10.101	180.4	16	78.950	77.844	0.956	Open Manhole	450
4.001	8.775	179.1	17	78.950	77.795	1.005	Open Manhole	450
4.002	17.416	179.9	18	78.950	77.698	1.102	Open Manhole	450
5.000	27.346	179.9	22	78.950	77.758	1.042	Open Manhole	450
5.001	10.881	181.4	18	78.950	77.698	1.102	Open Manhole	450

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PIPELINE SCHEDULES for KERSAL AVE.SWS

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)
4.003	o	225	18	78.950	77.623	1.102	Open Manhole	450
4.004	o	225	19	79.000	77.606	1.169	Open Manhole	1200
4.005	o	225	20	79.000	77.589	1.186	Open Manhole	1200
1.006	o	450	8	78.789	76.170	2.169	Open Manhole	1800
6.000	o	150	9	78.250	77.500	0.600	Open Manhole	450
6.001	o	150	10	78.250	77.354	0.746	Open Manhole	450
6.002	o	150	11	78.250	77.245	0.855	Open Manhole	450
7.000	o	150	27	78.400	77.500	0.750	Open Manhole	450
7.001	o	150	28	78.400	77.396	0.854	Open Manhole	450
6.003	o	150	23	78.400	77.184	1.066	Open Manhole	450
6.004	o	150	24	78.357	77.164	1.043	Open Manhole	1200
6.005	o	150	25	78.326	77.144	1.032	Open Manhole	1200
1.007	o	450	7	78.214	76.095	1.669	Open Manhole	1800
1.008	o	225	26	78.342	76.024	2.093	Open Manhole	3000

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)
4.003	3.000	176.5	19	79.000	77.606	1.169	Open Manhole	1200
4.004	3.000	179.6	20	79.000	77.589	1.186	Open Manhole	1200
4.005	7.925	73.6	8	78.789	77.482	1.082	Open Manhole	1800
1.006	22.247	296.6	7	78.214	76.095	1.669	Open Manhole	1800
6.000	26.337	180.4	10	78.250	77.354	0.746	Open Manhole	450
6.001	19.652	180.3	11	78.250	77.245	0.855	Open Manhole	450
6.002	10.878	178.3	23	78.400	77.184	1.066	Open Manhole	450
7.000	15.580	149.8	28	78.400	77.396	0.854	Open Manhole	450
7.001	8.775	148.7	23	78.400	77.337	0.913	Open Manhole	450
6.003	3.000	150.0	24	78.357	77.164	1.043	Open Manhole	1200
6.004	3.000	150.0	25	78.326	77.144	1.032	Open Manhole	1200
6.005	25.799	86.3	7	78.214	76.845	1.219	Open Manhole	1800
1.007	30.242	425.9	26	78.342	76.024	1.868	Open Manhole	3000
1.008	28.685	5.0	29	71.100	70.287	0.588	Open Manhole	0

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Free Flowing Outfall Details for KERSAL AVE.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	29	71.100	70.287	0.000	0	0

Simulation Criteria for KERSAL AVE.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	120
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	2

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	60
Ratio R	0.360		

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Online Controls for KERSAL AVE.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.0

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.858
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.589
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: 20, DS/PN: 4.005, Volume (m³): 1.7

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	1.200	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Unit Reference	MD-SHE-0047-1000-1000-1000
Design Head (m)	1.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	77.144
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.0	Kick-Flo®	0.415	0.7
Flush-Flo™	0.205	0.8	Mean Flow over Head Range	-	0.8

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	0.8	0.600	0.8	1.600	1.2	2.600	1.5
0.200	0.8	0.800	0.9	1.800	1.3	3.000	1.6
0.300	0.8	1.000	1.0	2.000	1.4	3.500	1.8
0.400	0.7	1.200	1.1	2.200	1.4	4.000	1.9
0.500	0.7	1.400	1.2	2.400	1.5	4.500	2.0

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Hydro-Brake® Optimum Manhole: 25, DS/PN: 6.005, Volume (m³): 1.4

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
5.000	2.1	6.500	2.3	8.000	2.6	9.500	2.8
5.500	2.2	7.000	2.4	8.500	2.7		
6.000	2.3	7.500	2.5	9.000	2.7		

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.008, Volume (m³): 20.8

Unit Reference	MD-SHE-0092-5000-2000-5000
Design Head (m)	2.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	76.024
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	5.0	Kick-Flo®	0.816	3.3
Flush-Flo™	0.398	4.1	Mean Flow over Head Range	-	3.9

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	2.9	1.200	3.9	3.000	6.0	7.000	9.0
0.200	3.8	1.400	4.2	3.500	6.5	7.500	9.3
0.300	4.1	1.600	4.5	4.000	6.9	8.000	9.6
0.400	4.1	1.800	4.8	4.500	7.3	8.500	9.9
0.500	4.1	2.000	5.0	5.000	7.7	9.000	10.2
0.600	4.0	2.200	5.2	5.500	8.0	9.500	10.4
0.800	3.4	2.400	5.4	6.000	8.4		
1.000	3.6	2.600	5.6	6.500	8.7		

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Storage Structures for KERSAL AVE.SWS

Tank or Pond Manhole: 14, DS/PN: 3.000

Invert Level (m) 77.929

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	100.0	0.500	100.0	0.501	0.0

Tank or Pond Manhole: 19, DS/PN: 4.004

Invert Level (m) 77.606

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.500	60.0	0.501	0.0

Tank or Pond Manhole: 24, DS/PN: 6.004

Invert Level (m) 77.164

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.500	50.0	0.501	0.0

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Summary of Results for 60 minute 100 year Winter (KERSAL AVE.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	78.505	-0.070	0.000	0.55		9.1	OK
1.001	2	78.379	-0.040	0.000	0.67		10.4	OK
1.002	3	78.340	0.009	0.000	0.49		10.4	SURCHARGED
2.000	12	78.543	-0.107	0.000	0.18		3.0	OK
2.001	13	78.322	-0.065	0.000	0.35		5.8	OK
1.003	4	78.294	0.154	0.000	1.42		20.9	SURCHARGED
3.000	14	78.200	0.046	0.000	0.03		0.9	SURCHARGED
1.004	5	78.226	0.143	0.000	0.02		0.8	SURCHARGED
1.005	6	77.949	1.205	0.000	0.08		13.2	SURCHARGED
4.000	15	78.059	0.009	0.000	0.28		3.3	SURCHARGED
4.001	16	78.057	0.063	0.000	0.58		6.7	SURCHARGED
4.002	17	78.054	0.109	0.000	1.25		15.4	SURCHARGED
5.000	21	78.049	-0.011	0.000	0.22		2.8	OK
5.001	22	78.047	0.139	0.000	0.20		2.4	SURCHARGED
4.003	18	78.047	0.199	0.000	0.73		19.7	SURCHARGED
4.004	19	78.046	0.215	0.000	0.05		1.2	SURCHARGED
4.005	20	78.056	0.242	0.000	0.02		0.8	SURCHARGED
1.006	8	77.947	1.327	0.000	0.15		23.4	SURCHARGED
6.000	9	77.640	-0.010	0.000	0.22		2.7	OK
6.001	10	77.640	0.136	0.000	0.73		9.1	SURCHARGED
6.002	11	77.640	0.245	0.000	0.75		8.9	SURCHARGED
7.000	27	77.640	-0.010	0.000	0.16		2.2	OK
7.001	28	77.640	0.094	0.000	0.28		3.5	SURCHARGED
6.003	23	77.640	0.306	0.000	1.49		15.7	SURCHARGED
6.004	24	77.640	0.326	0.000	0.11		1.1	SURCHARGED
6.005	25	77.641	0.347	0.000	0.04		0.8	SURCHARGED
1.007	7	77.945	1.400	0.000	0.13		18.0	FLOOD RISK
1.008	26	77.943	1.694	0.000	0.02		4.9	SURCHARGED

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