

PROJECT No.:- P3001502

DATE 12/12/22

PROJECT NAME:- Hyde Road School

TITLE:- Hydraulic Calculations and Sports Pitch Drainage rev 02

1.0 Introduction

The following design note outlines what site constraints may impact the ability of the Sports Pitches to drain and the solutions to mitigate these. It also contains the Final Construction Hydraulic Calculations which take into account ongoing updates during Construction Stage and the Sports Pitch Drainage design philosophy.

2.0 Topography

The original site topography in the pitch locations was relatively flat, due to the site's usage largely as a grade level carpark (reference should be made to Survey Operations topographical survey). There were some falls to achieve drainage of the carpark and a general upward slope from north to south.

However, as part of the site strip and cut and fill process to enable the new school project, the levels have been amended to ensure Sport England compliant gradients are achieved over both pitches. As such, coupled with a Sport England compliant build up, the topography of the pitches will not adversely affect their performance.

3.0 Ground Conditions

A Phase II intrusive site investigation has been undertaken for the site by Hydrock (18170-HYD-XX-XX-RP-GE-0001 June 2021). This included assessment of ground permeability and infiltration rates.

Results indicate poor infiltration performance (see chapter 6.7 of 18170-HYD-XX-XX-RP-GE-0001) thus direct infiltration of any sports pitch drainage was not deemed viable and an alternative solution was necessary to ensure suitable drainage rates and pitch performance.

4.0 Drainage Solution Criteria

Given the poor ground permeability and low infiltration rate, a positively drainage solution directly connected to the public sewer network was deemed the best solution to ensure acceptable drainage rates and therefore pitch performance.

The local drainage authority, United Utilities, allowed this connection if two criteria were met: -

- 1) The drainage system of the pitches was to be self-contained and not allow any potentially contaminated ground water or land drainage to enter the system. To achieve this, the pitch drainage and build up needed to be wrapped in an impermeable membrane.
- 2) A maximum discharge rate of 5l/s from each pitch was permitted. This led to the introduction of an attenuation layer below the pitches which allowed the pitches to drainage, whilst limiting the rate discharged to the system.

A discharge of 5l/s from each Sport Pitch has been incorporated into the Hydraulic Model (see attached calculations). The model has been updated in line with ongoing amendments and reflects the Final Construction Drawings

- 009433-BDP-01-ZZ-DR-C-520001 C14
- 009433-BDP-01-ZZ-DR-C-520002 C15
- 009433-BDP-01-ZZ-DR-C-520003 C15

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Innovyze	Network 2019.1	

Network Design Table for SW Net 01

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.000	6.267	0.042	149.2	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	10.800	0.314	34.4	0.115	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.005	7.492	0.038	199.0	0.018	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	67.552	0.267	253.0	0.201	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.009	13.618	0.050	272.4	0.072	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.010	21.612	0.040	540.3	0.024	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	12.129	0.150	80.9	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
S9.001	21.923	0.145	151.2	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.002	56.508	0.695	81.3	0.040	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.000	101.890#	0.680	149.8	0.000	5.00	5.0	0.600	o	150	Pipe/Conduit	
S9.003	20.355	0.100	203.6	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.004	22.224	0.111	200.2	0.060	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.005	9.917	0.050	198.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.006	17.830	0.089	200.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	20.940	0.796	26.3	0.106	8.00	0.0	0.600	o	150	Pipe/Conduit	
S9.007	43.558	0.208	209.4	0.102	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	15.467	0.773	20.0	0.000	5.00	5.0	0.600	o	150	Pipe/Conduit	
S13.000	18.911	0.042	450.3	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
S13.001	21.854	0.272	80.3	0.080	0.00	0.0	0.600	o	100	Pipe/Conduit	
S13.002	19.345	0.274	70.6	0.080	0.00	0.0	0.600	o	100	Pipe/Conduit	
S13.003	3.454	0.345	10.0	0.080	0.00	0.0	0.600	o	150	Pipe/Conduit	
S13.004	4.142	0.415	10.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.008	11.806	0.079	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.000	21.583	0.216	100.0	0.065	5.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	16.488	1.119	14.7	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.011	76.815	0.307	250.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul Flow (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.000	135.95	5.13	58.900	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S8.001	134.91	5.23	60.058	0.115	0.0	0.0	0.0	1.72	30.4«	42.0
S2.005	103.45	9.69	57.896	0.505	0.0	0.0	0.0	1.11	78.5«	141.5
S1.008	98.68	10.68	57.780	0.949	5.0	0.0	0.0	1.13	125.3«	258.6
S1.009	97.86	10.86	57.438	1.021	5.0	0.0	0.0	1.23	195.1«	275.6
S1.010	96.06	11.28	57.380	1.045	5.0	0.0	0.0	0.87	138.0«	276.9
S9.000	135.42	5.18	60.220	0.015	0.0	0.0	0.0	1.12	19.8	5.5
S9.001	131.13	5.63	60.070	0.021	0.0	0.0	0.0	0.81	14.4	7.5
S9.002	125.49	6.28	59.850	0.061	0.0	0.0	0.0	1.45	57.7	20.7
S10.000	119.33	7.07	59.910	0.000	5.0	0.0	0.0	0.82	14.5	5.0
S9.003	116.70	7.45	59.155	0.081	5.0	0.0	0.0	0.91	36.3	30.6
S9.004	114.01	7.85	59.055	0.141	5.0	0.0	0.0	0.92	36.6«	48.5
S9.005	112.87	8.03	58.944	0.141	5.0	0.0	0.0	0.92	36.8«	48.5
S9.006	110.87	8.35	58.894	0.141	5.0	0.0	0.0	0.92	36.6«	48.5
S11.000	111.93	8.18	59.600	0.106	0.0	0.0	0.0	1.97	34.8	32.1
S9.007	106.99	9.02	58.730	0.349	5.0	0.0	0.0	1.08	76.5«	106.1
S12.000	136.08	5.11	59.445	0.000	5.0	0.0	0.0	2.26	40.0	5.0
S13.000	128.83	5.88	60.806	0.000	0.0	0.0	0.0	0.36	2.8	0.0
S13.001	125.24	6.31	60.764	0.080	0.0	0.0	0.0	0.86	6.7«	27.1
S13.002	122.44	6.66	60.492	0.160	0.0	0.0	0.0	0.92	7.2«	53.1
S13.003	122.30	6.68	60.218	0.240	0.0	0.0	0.0	3.20	56.6«	79.5
S13.004	122.13	6.70	59.870	0.240	0.0	0.0	0.0	3.21	56.7«	79.5
S9.008	106.14	9.17	58.522	0.589	10.0	0.0	0.0	1.28	90.6«	179.3
S14.000	133.68	5.36	59.600	0.065	0.0	0.0	0.0	1.00	17.8«	23.5
S14.001	132.69	5.46	59.384	0.089	0.0	0.0	0.0	2.64	46.6	32.0
S1.011	92.04	12.28	57.340	1.723	15.0	0.0	0.0	1.28	203.7«	444.5

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Network Design Table for SW Net 01

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S15.000	40.712	0.550	74.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S15.001	40.139	0.460	87.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.002	42.151	0.280	150.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.003	96.324	1.202	80.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	11.227	0.458	24.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.000	16.421	0.066	250.0	0.000	5.00	0.0	0.600	o	450	Pipe/Conduit	
S16.001	69.229	0.277	250.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.002	14.622	0.058	252.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.013	25.187	0.325	77.5	0.000	0.00	0.0	0.600	o	450	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)
S15.000	132.84	5.45	59.750	0.000	0.0	0.0	0.0	1.52	60.5	0.0
S15.001	128.49	5.92	59.200	0.000	0.0	0.0	0.0	1.40	55.7	0.0
S15.002	123.03	6.58	58.740	0.000	0.0	0.0	0.0	1.06	42.3	0.0
S15.003	115.10	7.68	58.460	0.000	0.0	0.0	0.0	1.46	58.1	0.0
S1.012	91.87	12.32	57.033	1.723	15.0	0.0	0.0	4.12	655.2	444.5
S16.000	135.09	5.21	57.050	0.000	0.0	0.0	0.0	1.28	203.8	0.0
S16.001	126.85	6.11	56.984	0.000	0.0	0.0	0.0	1.28	203.8	0.0
S16.002	125.26	6.31	56.707	0.000	0.0	0.0	0.0	1.28	202.9	0.0
S1.013	91.19	12.51	56.575	1.723	15.0	0.0	0.0	2.31	367.6«	444.5

Manhole Schedules for SW Net 01

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SEXS12	59.800	2.750	Open Manhole	1500	S16.000	57.050	450	S15.003	57.258	225	
S15.0	60.850	3.866	Open Manhole	1500	S16.001	56.984	450	S16.000	56.984	450	
S15.1	61.000	4.293	Open Manhole	1500	S16.002	56.707	450	S16.001	56.707	450	
S1.13	61.250	4.675	Open Manhole	1800	S1.013	56.575	450	S1.012	56.575	450	
								S16.002	56.649	450	75
S	61.100	4.850	Open Manhole	1500		OUTFALL		S1.013	56.250	450	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.1	387545.208	396232.188	387545.208	396232.188	Required	
S1.2	387538.273	396237.830	387538.273	396237.830	Required	
S1.3	387519.764	396272.707	387519.764	396272.707	Required	
S1.4	387544.674	396285.932	387544.674	396285.932	Required	
S1.5	387567.191	396297.886	387567.191	396297.886	Required	
S1.6	387603.062	396309.170	387603.062	396309.170	Required	
S1.7	387625.892	396321.123	387625.892	396321.123	Required	
S2.0	387577.581	396343.660	387577.581	396343.660	Required	
S2.1	387594.192	396332.600	387594.192	396332.600	Required	
S2.2	387603.102	396323.420	387603.102	396323.420	Required	
S2.3	387619.614	396329.560	387619.614	396329.560	Required	
S2.4	387631.357	396329.643	387631.357	396329.643	Required	
Sdummy	387682.163	396305.624	387682.163	396305.624	Required	
SPP	387674.591	396301.720	387674.591	396301.720	Required	
S4.0	387673.819	396284.581	387673.819	396284.581	Required	
S3.1	387667.018	396297.815	387667.018	396297.815	Required	
S5.0	387666.668	396262.669	387666.668	396262.669	Required	
SDummy2	387664.775	396282.558	387664.775	396282.558	Required	
SPP	387661.960	396288.156	387661.960	396288.156	Required	
S2.5	387651.270	396289.695	387651.270	396289.695	Required	
S1.8	387644.622	396286.240	387644.622	396286.240	Required	

Manhole Schedules for SW Net 01

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.9	387584.696	396255.063	387584.696	396255.063	Required	
S1.10	387591.135	396243.063	387591.135	396243.063	Required	
S7.0	387735.703	396137.118	387735.703	396137.118	Required	
S7.1	387724.223	396141.032	387724.223	396141.032	Required	
S7.2	387702.386	396139.083	387702.386	396139.083	Required	
S8.0	387562.210	396143.674	387562.210	396143.674	Required	
S7.3	387675.871	396188.984	387675.871	396188.984	Required	
S7.4	387670.639	396208.655	387670.639	396208.655	Required	
SJ1	387660.303	396228.329			No Entry	
SJ2	387655.808	396237.169			No Entry	
S6.0	387650.602	396273.805	387650.602	396273.805	Required	
S7.5	387647.727	396253.063	387647.727	396253.063	Required	
S12.0	387616.419	396219.013	387616.419	396219.013	Required	
SDUMMY	387645.576	396177.960	387645.576	396177.960	Required	
SPP	387637.433	396195.028			No Entry	
SPP	387626.922	396214.188			No Entry	
SPP	387616.465	396230.463			No Entry	
S14.0	387613.238	396231.695	387613.238	396231.695	Required	
S7.6	387609.221	396232.703	387609.221	396232.703	Required	
S13.0	387566.852	396207.823	387566.852	396207.823	Required	
S13.1	387585.956	396217.866	387585.956	396217.866	Required	
S1.11	387601.271	396223.975	387601.271	396223.975	Required	
SEXS9	387692.255	396297.752	387692.255	396297.752	Required	
SDSW1	387678.954	396259.274	387678.954	396259.274	Required	
SDSW2	387665.971	396221.293	387665.971	396221.293	Required	
SDSW3	387628.610	396201.777	387628.610	396201.777	Required	

Manhole Schedules for SW Net 01

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.12	387533.230	396188.324	387533.230	396188.324	Required	
SEXS12	387529.951	396284.860	387529.951	396284.860	Required	
S15.0	387517.533	396274.115	387517.533	396274.115	Required	
S15.1	387523.760	396205.167	387523.760	396205.167	Required	
S1.13	387522.241	396190.623	387522.241	396190.623	Required	
S	387497.191	396193.239			No Entry	

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PIPELINE SCHEDULES for SW Net 01

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1.1	60.700	59.600	0.950	Open Manhole	600
S1.001	o	225	S1.2	60.790	59.453	1.112	Open Manhole	600
S1.002	o	225	S1.3	60.720	59.220	1.275	Open Manhole	600
S1.003	o	225	S4	60.680	59.070	1.385	Open Manhole	600
S1.004	o	225	S1.4	60.640	58.910	1.505	Open Manhole	600
S1.005	o	225	S1.5	60.580	58.560	1.795	Open Manhole	600
S1.006	o	225	S1.6	60.670	58.407	2.038	Open Manhole	600
S1.007	o	225	S1.7	60.600	58.235	2.140	Open Manhole	1200
S2.000	o	225	S2.0	59.930	58.826	0.879	Open Manhole	600
S2.001	o	225	S2.1	60.270	58.660	1.385	Open Manhole	600
S3.000	o	225	Stank	60.523	58.515	1.783	Open Manhole	450
S2.002	o	225	S2.2	60.400	58.465	1.710	Open Manhole	1200
S2.003	o	225	S2.3	60.450	58.347	1.878	Open Manhole	600
S2.004	o	225	S2.4	60.500	58.269	2.006	Open Manhole	1200
S4.000	o	150	Sdummy	61.300	59.800	1.350	Open Manhole	450
S4.001	o	150	SPP	59.845	59.265	0.430	Open Manhole	450
S5.000	o	150	S4.0	61.140	59.300	1.690	Open Manhole	600
S6.000	o	150	S18	61.300	59.800	1.350	Open Manhole	450
S4.002	o	150	S3.1	60.940	58.880	1.910	Open Manhole	1200
S7.000	o	300	S5.0	60.760	58.900	1.560	Open Manhole	600
S8.000	o	150	Sdummy2	60.500	58.900	1.450	Open Manhole	450
S8.001	o	150	SPP	60.625	60.058	0.417	Open Manhole	450
S2.005	o	300	S2.5	60.470	57.896	2.274	Open Manhole	1500
S1.008	o	375	S1.8	60.590	57.780	2.435	Open Manhole	1500
S1.009	o	450	S1.9	60.740	57.438	2.852	Open Manhole	1500

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)
S1.000	8.940	125.0	S1.2	60.790	59.528	1.112	Open Manhole	600
S1.001	29.400#	126.2	S1.3	60.720	59.220	1.275	Open Manhole	600
S1.002	28.203#	188.0	S4	60.680	59.070	1.385	Open Manhole	600
S1.003	19.400#	121.3	S1.4	60.640	58.910	1.505	Open Manhole	600
S1.004	43.600#	124.6	S1.5	60.580	58.560	1.795	Open Manhole	600
S1.005	20.000#	125.0	S1.6	60.670	58.400	2.045	Open Manhole	600
S1.006	25.770	151.6	S1.7	60.600	58.237	2.138	Open Manhole	1200
S1.007	39.592	129.8	S1.8	60.590	57.930	2.435	Open Manhole	1500
S2.000	19.957	124.7	S2.1	60.270	58.666	1.379	Open Manhole	600
S2.001	12.792	65.6	S2.2	60.400	58.465	1.710	Open Manhole	1200
S3.000	6.800	136.0	S2.2	60.400	58.465	1.710	Open Manhole	1200
S2.002	17.616	149.7	S2.3	60.450	58.347	1.878	Open Manhole	600
S2.003	11.743	150.0	S2.4	60.500	58.269	2.006	Open Manhole	1200
S2.004	44.636	150.0	S2.5	60.470	57.971	2.274	Open Manhole	1500
S4.000	17.000#	31.8	SPP	59.845	59.265	0.430	Open Manhole	450
S4.001	8.520	100.2	S3.1	60.940	59.180	1.610	Open Manhole	1200
S5.000	14.879	35.4	S3.1	60.940	58.880	1.910	Open Manhole	1200
S6.000	17.038	18.5	S3.1	60.940	58.880	1.910	Open Manhole	1200
S4.002	17.718	21.2	S2.5	60.470	58.046	2.274	Open Manhole	1500
S7.000	13.800#	13.7	S2.5	60.470	57.896	2.274	Open Manhole	1500
S8.000	6.267	149.2	SPP	60.625	58.858	1.617	Open Manhole	450
S8.001	10.800	34.4	S2.5	60.470	59.744	0.576	Open Manhole	1500
S2.005	7.492	199.0	S1.8	60.590	57.858	2.432	Open Manhole	1500
S1.008	67.552	253.0	S1.9	60.740	57.513	2.852	Open Manhole	1500
S1.009	13.618	272.4	S1.10	60.700	57.388	2.862	Open Manhole	1200

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PIPELINE SCHEDULES for SW Net 01

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)
S1.010	o	450	S1.10	60.700	57.380	2.870	Open Manhole	1200
S9.000	o	150	S7.0	61.800	60.220	1.430	Open Manhole	450
S9.001	o	150	S7.1	61.700	60.070	1.480	Open Manhole	450
S9.002	o	225	S7.2	61.700	59.850	1.625	Open Manhole	1200
S10.000	o	150	S8.0	61.100	59.910	1.040	Open Manhole	600
S9.003	o	225	S7.3	61.300	59.155	1.920	Open Manhole	600
S9.004	o	225	S7.4	61.060	59.055	1.780	Open Manhole	600
S9.005	o	225	SJ1	60.950	58.944	1.781	Junction	
S9.006	o	225	SJ2	60.850	58.894	1.731	Junction	
S11.000	o	150	S6.0	60.530	59.600	0.780	Open Manhole	600
S9.007	o	300	S7.5	60.740	58.730	1.710	Open Manhole	1200
S12.000	o	150	S12.0	60.750	59.445	1.155	Open Manhole	600
S13.000	o	100	SDUMMY	61.156	60.806	0.250	Open Manhole	1200
S13.001	o	100	SPP	61.014	60.764	0.150	Junction	
S13.002	o	100	SPP	60.847	60.492	0.255	Junction	
S13.003	o	150	SPP	60.643	60.218	0.275	Junction	
S13.004	o	150	S14.0	60.643	59.870	0.623	Open Manhole	1200
S9.008	o	300	S7.6	60.600	58.522	1.778	Open Manhole	1500
S14.000	o	150	S13.0	60.600	59.600	0.850	Open Manhole	450
S14.001	o	150	S13.1	60.600	59.384	1.066	Open Manhole	450
S1.011	o	450	S1.11	60.600	57.340	2.810	Open Manhole	2100
S15.000	o	225	SEXS9	61.990	59.750	2.015	Open Manhole	1500
S15.001	o	225	SDSW1	60.700	59.200	1.275	Open Manhole	1350
S15.002	o	225	SDSW2	61.060	58.740	2.095	Open Manhole	1200
S15.003	o	225	SDSW3	60.700	58.460	2.015	Open Manhole	1200
S1.012	o	450	S1.12	61.300	57.033	3.817	Open Manhole	1800

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)
S1.010	21.612	540.3	S1.11	60.600	57.340	2.810	Open Manhole	2100
S9.000	12.129	80.9	S7.1	61.700	60.070	1.480	Open Manhole	450
S9.001	21.923	151.2	S7.2	61.700	59.925	1.625	Open Manhole	1200
S9.002	56.508	81.3	S7.3	61.300	59.155	1.920	Open Manhole	600
S10.000	101.890#	149.8	S7.3	61.300	59.230	1.920	Open Manhole	600
S9.003	20.355	203.6	S7.4	61.060	59.055	1.780	Open Manhole	600
S9.004	22.224	200.2	SJ1	60.950	58.944	1.781	Junction	
S9.005	9.917	198.3	SJ2	60.850	58.894	1.731	Junction	
S9.006	17.830	200.3	S7.5	60.740	58.805	1.710	Open Manhole	1200
S11.000	20.940	26.3	S7.5	60.740	58.804	1.786	Open Manhole	1200
S9.007	43.558	209.4	S7.6	60.600	58.522	1.778	Open Manhole	1500
S12.000	15.467	20.0	S7.6	60.600	58.672	1.778	Open Manhole	1500
S13.000	18.911	450.3	SPP	61.014	60.764	0.150	Junction	
S13.001	21.854	80.3	SPP	60.847	60.492	0.255	Junction	
S13.002	19.345	70.6	SPP	60.643	60.218	0.325	Junction	
S13.003	3.454	10.0	S14.0	60.643	59.873	0.620	Open Manhole	1200
S13.004	4.142	10.0	S7.6	60.600	59.455	0.995	Open Manhole	1500
S9.008	11.806	150.0	S1.11	60.600	58.443	1.857	Open Manhole	2100
S14.000	21.583	100.0	S13.1	60.600	59.384	1.066	Open Manhole	450
S14.001	16.488	14.7	S1.11	60.600	58.265	2.185	Open Manhole	2100
S1.011	76.815	250.2	S1.12	61.300	57.033	3.817	Open Manhole	1800
S15.000	40.712	74.0	SDSW1	60.700	59.200	1.275	Open Manhole	1350
S15.001	40.139	87.3	SDSW2	61.060	58.740	2.095	Open Manhole	1200
S15.002	42.151	150.5	SDSW3	60.700	58.460	2.015	Open Manhole	1200
S15.003	96.324	80.1	S1.12	61.300	57.258	3.817	Open Manhole	1800
S1.012	11.227	24.5	S1.13	61.250	56.575	4.225	Open Manhole	1800

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PIPELINE SCHEDULES for SW Net 01

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)
S16.000	o	450	SEXS12	59.800	57.050	2.300	Open Manhole	1500
S16.001	o	450	S15.0	60.850	56.984	3.416	Open Manhole	1500
S16.002	o	450	S15.1	61.000	56.707	3.843	Open Manhole	1500
S1.013	o	450	S1.13	61.250	56.575	4.225	Open Manhole	1800

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)
S16.000	16.421	250.0	S15.0	60.850	56.984	3.416	Open Manhole	1500
S16.001	69.229	250.0	S15.1	61.000	56.707	3.843	Open Manhole	1500
S16.002	14.622	252.1	S1.13	61.250	56.649	4.151	Open Manhole	1800
S1.013	25.187	77.5	S	61.100	56.250	4.400	Open Manhole	1500

Free Flowing Outfall Details for SW Net 01

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.013	S	61.100	56.250	0.000	1500	0
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Simulation Criteria for SW Net 01

Volumetric Runoff Coeff	0.750	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	12	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000	Cv (Summer)	0.750
Return Period (years)	2	Ratio R	0.359	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer Storm	Duration (mins)	30

Online Controls for SW Net 01

Orifice Manhole: SPP, DS/PN: S4.001, Volume (m³): 0.4

Diameter (m) 0.015 Discharge Coefficient 0.600 Invert Level (m) 59.265

Orifice Manhole: SPP, DS/PN: S8.001, Volume (m³): 0.2

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 60.058

Orifice Manhole: S14.0, DS/PN: S13.004, Volume (m³): 0.9

Diameter (m) 0.054 Discharge Coefficient 0.600 Invert Level (m) 59.870

Hydro-Brake® Optimum Manhole: S1.11, DS/PN: S1.011, Volume (m³): 15.4

Unit Reference	MD-SHE-0378-1050-2900-1050
Design Head (m)	2.900
Design Flow (l/s)	105.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	378
Invert Level (m)	57.340
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.900	104.9	Kick-Flo®	1.882	85.1
Flush-Flo™	0.860	104.9	Mean Flow over Head Range	-	90.5

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.6	0.600	102.6	1.600	96.8	2.600	99.5	5.000	136.7	7.500	166.7
0.200	37.6	0.800	104.8	1.800	89.6	3.000	106.6	5.500	143.3	8.000	172.0
0.300	71.4	1.000	104.5	2.000	87.6	3.500	114.9	6.000	149.5	8.500	177.2
0.400	95.3	1.200	103.1	2.200	91.7	4.000	122.7	6.500	155.4	9.000	182.3
0.500	99.8	1.400	100.7	2.400	95.7	4.500	129.9	7.000	161.2	9.500	187.1

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Storage Structures for SW Net 01 Filter Drain Manhole: S1.2, DS/PN: S1.001 Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.00000 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.850 Trench Width (m) 0.5 Trench Length (m) 85.0 Pipe Diameter (m) 0.150 Pipe Depth above Invert (m) 0.000 Number of Pipes 1 Slope (1:X) 1000.0 Cap Volume Depth (m) 0.550 Cap Infiltration Depth (m) 0.000 Filter Drain Manhole: S2.0, DS/PN: S2.000 Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.00000 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.150 Trench Width (m) 0.5 Trench Length (m) 49.0 Pipe Diameter (m) 0.150 Pipe Depth above Invert (m) 0.000 Number of Pipes 1 Slope (1:X) 70.0 Cap Volume Depth (m) 0.550 Cap Infiltration Depth (m) 0.000 Cellular Storage Manhole: Stank, DS/PN: S3.000 Invert Level (m) 58.515 Infiltration Coefficient Side (m/hr) 0.00000 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Safety Factor 2.0 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>15.0</td><td>0.0</td><td>0.800</td><td>15.0</td><td>0.0</td><td>0.801</td><td>0.0</td><td>0.0</td></tr></table> Porous Car Park Manhole: SPP, DS/PN: S4.001 Infiltration Coefficient Base (m/hr) 0.00000 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 104.2 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.265 Width (m) 10.0 Length (m) 37.5 Slope (1:X) 150.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Cap Volume Depth (m) 0.400 Porous Car Park Manhole: SPP, DS/PN: S8.001 Infiltration Coefficient Base (m/hr) 0.00000 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 192.5 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 60.058 Width (m) 11.0 Length (m) 63.0 Slope (1:X) 150.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Cap Volume Depth (m) 0.400 Filter Drain Manhole: S6.0, DS/PN: S11.000 Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.00000 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.850 Trench Width (m) 0.5 Trench Length (m) 47.0 Pipe Diameter (m) 0.150 Pipe Depth above Invert (m) 0.000 Number of Pipes 1 Slope (1:X) 1000.0 Cap Volume Depth (m) 0.550 Cap Infiltration Depth (m) 0.000 Porous Car Park Manhole: SPP, DS/PN: S13.001 Infiltration Coefficient Base (m/hr) 0.00000 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 142.5 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 60.764 Width (m) 28.5 Length (m) 18.0 Slope (1:X) 116.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Cap Volume Depth (m) 0.175 Porous Car Park Manhole: SPP, DS/PN: S13.002 Infiltration Coefficient Base (m/hr) 0.00000 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 142.5 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 60.492 Width (m) 28.5 Length (m) 18.0 Slope (1:X) 116.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Cap Volume Depth (m) 0.280 Porous Car Park Manhole: SPP, DS/PN: S13.003 Infiltration Coefficient Base (m/hr) 0.00000 Membrane Percolation (mm/hr) 1000 Max Percolation (l/s) 142.5 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 60.218 Width (m) 28.5 Length (m) 18.0 Slope (1:X) 116.0 Depression Storage (mm) 5 Evaporation (mm/day) 3 Cap Volume Depth (m) 0.350 Filter Drain Manhole: S7.6, DS/PN: S9.008 Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.00000 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.750 Trench Width (m) 0.5 Trench Length (m) 52.5 Pipe Diameter (m) 0.150 Pipe Depth above Invert (m) 0.000 Number of Pipes 1 Slope (1:X) 1000.0 Cap Volume Depth (m) 0.550 Cap Infiltration Depth (m) 0.000 Filter Drain Manhole: S13.0, DS/PN: S14.000 Infiltration Coefficient Base (m/hr) 0.00000 Infiltration Coefficient Side (m/hr) 0.00000 Safety Factor 2.0 Porosity 0.30 Invert Level (m) 59.850 Trench Width (m) 0.5 Pipe Depth above Invert (m) 0.000 Trench Length (m) 46.5 Pipe Diameter (m) 0.150			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	15.0	0.0	0.800	15.0	0.0	0.801	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	15.0	0.0	0.800	15.0	0.0	0.801	0.0	0.0												

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Filter Drain Manhole: S13.0, DS/PN: S14.000 Number of Pipes1Cap Volume Depth (m) 0.550 Slope (1:X) 1000.0 Cap Infiltration Depth (m) 0.000 Cellular Storage Manhole: S1.11, DS/PN: S1.011 Invert Level (m) 57.340 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.00000Safety Factor2.0 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>132.0</td><td>133.0</td><td>1.600</td><td>132.0</td><td>206.8</td><td>1.601</td><td>0.0</td><td>206.8</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	132.0	133.0	1.600	132.0	206.8	1.601	0.0	206.8
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	132.0	133.0	1.600	132.0	206.8	1.601	0.0	206.8												
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW Net 01

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.1	OK	1
S1.001	S1.2	OK	
S1.002	S1.3	OK	
S1.003	S4	OK	
S1.004	S1.4	OK	
S1.005	S1.5	OK	
S1.006	S1.6	OK	
S1.007	S1.7	OK	
S2.000	S2.0	OK	1
S2.001	S2.1	OK	
S3.000	Stank	OK	
S2.002	S2.2	OK	
S2.003	S2.3	OK	
S2.004	S2.4	OK	
S4.000	Sdummy	OK	
S4.001	SPP	SURCHARGED	
S5.000	S4.0	OK	
S6.000	S18	OK	
S4.002	S3.1	OK	
S7.000	S5.0	OK	
S8.000	SDummy2	FLOOD RISK	
S8.001	SPP	SURCHARGED	
S2.005	S2.5	OK	
S1.008	S1.8	OK	
S1.009	S1.9	OK	
S1.010	S1.10	OK	
S9.000	S7.0	OK	
S9.001	S7.1	OK	
S9.002	S7.2	OK	
S10.000	S8.0	OK	
S9.003	S7.3	OK	
S9.004	S7.4	OK	
S9.005	SJ1	OK*	
S9.006	SJ2	OK*	
S11.000	S6.0	OK	
S9.007	S7.5	OK	
S12.000	S12.0	OK	
S13.000	SDUMMY	OK	
S13.001	SPP	FLOOD RISK*	
S13.002	SPP	FLOOD RISK*	
S13.003	SPP	FLOOD RISK*	
S13.004	S14.0	FLOOD RISK	
S9.008	S7.6	OK	
S14.000	S13.0	OK	
S14.001	S13.1	OK	
S1.011	S1.11	OK	
S15.000	SEXS9	OK	
S15.001	SDSW1	OK	
S15.002	SDSW2	OK	
S15.003	SDSW3	OK	
S1.012	S1.12	OK	
S16.000	SEXS12	OK	
S16.001	S15.0	OK	
S16.002	S15.1	OK	
S1.013	S1.13	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW Net 01

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.1	OK	1
S1.001	S1.2	OK	
S1.002	S1.3	SURCHARGED	
S1.003	S4	SURCHARGED	
S1.004	S1.4	SURCHARGED	
S1.005	S1.5	SURCHARGED	
S1.006	S1.6	SURCHARGED	
S1.007	S1.7	SURCHARGED	
S2.000	S2.0	OK	1
S2.001	S2.1	OK	
S3.000	Stank	OK	
S2.002	S2.2	SURCHARGED	
S2.003	S2.3	SURCHARGED	
S2.004	S2.4	SURCHARGED	
S4.000	Sdummy	OK	
S4.001	SPP	FLOOD RISK	
S5.000	S4.0	OK	
S6.000	S18	OK	
S4.002	S3.1	OK	
S7.000	S5.0	OK	
S8.000	SDummy2	FLOOD RISK	
S8.001	SPP	FLOOD RISK	
S2.005	S2.5	SURCHARGED	
S1.008	S1.8	SURCHARGED	
S1.009	S1.9	SURCHARGED	
S1.010	S1.10	SURCHARGED	
S9.000	S7.0	OK	
S9.001	S7.1	OK	
S9.002	S7.2	OK	
S10.000	S8.0	OK	
S9.003	S7.3	SURCHARGED	
S9.004	S7.4	SURCHARGED	
S9.005	SJ1	SURCHARGED*	
S9.006	SJ2	SURCHARGED*	
S11.000	S6.0	OK	
S9.007	S7.5	SURCHARGED	
S12.000	S12.0	OK	
S13.000	SDUMMY	FLOOD RISK	
S13.001	SPP	FLOOD RISK*	
S13.002	SPP	FLOOD RISK*	
S13.003	SPP	FLOOD RISK*	
S13.004	S14.0	FLOOD RISK	
S9.008	S7.6	SURCHARGED	
S14.000	S13.0	SURCHARGED	
S14.001	S13.1	OK	
S1.011	S1.11	SURCHARGED	
S15.000	SEXS9	OK	
S15.001	SDSW1	OK	
S15.002	SDSW2	OK	
S15.003	SDSW3	OK	
S1.012	S1.12	OK	
S16.000	SEXS12	OK	
S16.001	S15.0	OK	
S16.002	S15.1	OK	
S1.013	S1.13	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW Net 01

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.1	FLOOD	1
S1.001	S1.2	FLOOD RISK	
S1.002	S1.3	FLOOD RISK	
S1.003	S4	FLOOD RISK	
S1.004	S1.4	FLOOD RISK	
S1.005	S1.5	FLOOD RISK	
S1.006	S1.6	SURCHARGED	
S1.007	S1.7	SURCHARGED	
S2.000	S2.0	FLOOD	1
S2.001	S2.1	SURCHARGED	
S3.000	Stank	SURCHARGED	
S2.002	S2.2	SURCHARGED	
S2.003	S2.3	SURCHARGED	
S2.004	S2.4	SURCHARGED	
S4.000	Sdummy	OK	
S4.001	SPP	FLOOD RISK	
S5.000	S4.0	SURCHARGED	
S6.000	S18	OK	
S4.002	S3.1	SURCHARGED	
S7.000	S5.0	SURCHARGED	
S8.000	SDummy2	FLOOD RISK	
S8.001	SPP	FLOOD RISK	
S2.005	S2.5	SURCHARGED	
S1.008	S1.8	SURCHARGED	
S1.009	S1.9	SURCHARGED	
S1.010	S1.10	SURCHARGED	
S9.000	S7.0	SURCHARGED	
S9.001	S7.1	SURCHARGED	
S9.002	S7.2	SURCHARGED	
S10.000	S8.0	SURCHARGED	
S9.003	S7.3	SURCHARGED	
S9.004	S7.4	SURCHARGED	
S9.005	SJ1	SURCHARGED*	
S9.006	SJ2	SURCHARGED*	
S11.000	S6.0	FLOOD RISK	
S9.007	S7.5	SURCHARGED	
S12.000	S12.0	SURCHARGED	
S13.000	SDUMMY	FLOOD RISK	
S13.001	SPP	FLOOD RISK*	
S13.002	SPP	FLOOD RISK*	
S13.003	SPP	FLOOD RISK*	
S13.004	S14.0	FLOOD RISK	
S9.008	S7.6	SURCHARGED	
S14.000	S13.0	SURCHARGED	
S14.001	S13.1	SURCHARGED	
S1.011	S1.11	SURCHARGED	
S15.000	SEXS9	OK	
S15.001	SDSW1	OK	
S15.002	SDSW2	OK	
S15.003	SDSW3	OK	
S1.012	S1.12	OK	
S16.000	SEXS12	OK	
S16.001	S15.0	OK	
S16.002	S15.1	OK	
S1.013	S1.13	OK	