

Appendix C
United Utilities Sewer Records



Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
7003	113.97	FO	111.57	225			VC	36.40055	1 in 91
7901	117.5	SW	115.05	225			VC	75.15318	1 in 26
1803	116.05	CO	109.83	300			VC	27.20294	1 in 30
7612	114.99	CO	113.8	150			BR	6.082763	1 in 87
9706	109.52	CO	105.78	1100			VC	11.40175	1 in 100
9701	111.2	CO	108.93	225			VC	24.41311	1 in 72
7502	114.81	FO	115.7	150			VC	14.03567	1 in 175
7613	114.92	CO	114.03	150			VC	14.03567	1 in 61
2701	118.25	CO	114.07	100			VC	5.365511	1 in 120
7007	113.46	SW	112.14	225			VC	54.06327	1 in 120
0004	112.48	CO	110.4	225			VC	39	1 in 32
7604		SW	0	150			VC	22.02271	1 in 53
7609	114.97	SW	114.28	150			VC	12.74053	1 in 55
7611	113.6	CO	112.36	150			VC	20.02498	1 in 111
0038		CO		150			VC	4.11388	1 in 100
2819		CO		150			VC	5.359675	1 in 50
7506	115.1	CO	113.08	150			VC	4	1 in 50
0805	111.95	CO	103.82	400			CO	38.13862	1 in 102
7101		FO		100			VC	2.859337	1 in 88
2907	112.84	FO	110.2	225			VC	18.47937	1 in 27
9504	109.65	GO	106.74	825			BR	5.830952	1 in 27
1901	112.39	CO	110.9	150			VC	34.33979	1 in 48
7707	114.9	CO	113.61	225			VC	19.10497	1 in 66
1801	117.15	CO	110.75	500			VC	20.06975	1 in 30
6805	117.84	FO	115.88	150			VC	5	1 in 100
1002	112.9	CO	100.86	500			BR	41.01219	1 in 684
0103	112.05	CO	109.47	225			VC	60.48788	1 in 45.8300011
8902	111.8	CO	110.92	150			VC	15.13275	1 in 23
0015		CO		225			VC	26.91169	1 in 72
7004	113.4	FO	106.71	525			VC	41.62932	1 in 72
8901	111.94	CO	102.52	225			VC	42.32322	1 in 70
2805		FO		500			CO	33.13608	1 in 50
7607	117.29	SW	115.87	150			VC	34.0147	1 in 282
0102	112.17	CO	109.74	225			VC	31.01812	1 in 77
1903		FO		150			VC	17.75085	1 in 43
6812	118.08	FO	116.88	150			VC	49.98	1 in 102
0801		CO		450			VC	24.18609	1 in 40
0901	113	CO	108.63	450			VC	11.83232	1 in 74
0010		FO		100			VC	5.09902	1 in 102
6816	118.77	FO	117.81	150			VC	37.01351	1 in 40
7507	113.98	CO	110.81	150			VC	4	1 in 77
8905	112.11	FO	110.81	150			VC	11.04536	1 in 74
7608	114.97	CO	113.98	150			VC	31.28882	1 in 77
2905		FO		450			VC	6.483631	1 in 77
6010		CO		150			VC	109.6038	1 in 105
1605	119.09	CO	116.44	375			VC	25.05993	1 in 41
0803	116.88	CO	115.19	150			VC	21.0598	1 in 24
8503	112.53	FO	109.95	225			VC	11.99967	1 in 70
7103	118.55	FO	117.15	225			VC	67.02985	1 in 70
7003	112.4	CO	110.01	300			VC	53.16014	1 in 14
8501	114.69	CO	112.89	225			VC	3.405026	1 in 90
7011	112.92	FO	111.41	225			VC	74.90231	1 in 105
7002	113	CO	106.07	525			CO	59.64099	1 in 90
0804	118.16	CO	114.98	375			VC	60.74537	1 in 37
8607	111.7	SW	109.95	225			VC	53.03943	1 in 30
7603	118.77	CO	114.34	375			VC	32.01562	1 in 19
0602	111.01	CO	108.31	450			VC	31.09502	1 in 105
1902		CO		150			VC	11.74039	1 in 105
2908	113.54	CO	109.99	225			VC	101.825	1 in 101
6007	114.16	FO	111.13	225			VC	53.48832	1 in 101
8707	112.72	CO	110.21	225			VC	36.05551	1 in 17
7509	115.32	CO	112.32	225			VC	7	1 in 39
7503	113.42	CO	112.16	150			VC	9	1 in 56
7504	113.39	CO	111.05	225			VC	6	1 in 50
7102		CO		150			VC	30.55965	1 in 28
8708	113.44	SW	111.24	150			VC	15	1 in 87
0901	113.27	CO	109.29	450			CO	9.84858	1 in 28
6008	114.16	SW	112.14	150			VC	43.32438	1 in 36
8705	110.67	CO	108.56	225			VC	55.715	1 in 27
7902	117.05	CO	114.48	225			VC	27.16615	1 in 27
8502		CO		225			VC	53.23532	1 in 27
0502	115.46	CO	114.28	300			VC	20.59126	1 in 27
0113		CO		150			VC	19.427303	1 in 48
8820	111.87	SW	107.94	1350			CO	44.79308	1 in 225
9702	109.69	CO	108.25	1275			VC	18.34478	1 in 38
6819	118.73	FO	117.76	150			VC	33	1 in 21
7605	117.44	SW	115.72	225			VC	22.02271	1 in 24
0011		CO		150			VC	3.771389	1 in 24
8701	114.14	CO	113.46	150			VC	24	1 in 24
0501	109.49	CO	108.62	900			BR	12	1 in 120
7510	114.98	CO	112.05	225			VC	27	1 in 67
9704	113.28	FO	112.12	150			VC	23.0173	1 in 87
7610	113.78	SW	112.55	150			VC	12.04159	1 in 67
8906	112.11	CO	110	150			VC	7.58678	1 in 36
8718		CO		150			VC	15.10624	1 in 36
7511	113.43	CO	112.3	150			VC	6.082763	1 in 96
8804	112.24	CO	110.78	150			VC	5.05386	1 in 29
7508	113.15	CO	111.81	225			VC	21.0238	1 in 96
8801	111.61	CO	109.69	600			VC	1.20913	1 in 26
8816		CO		150			VC	14.48032	1 in 99
1802	116.78	CO	109.99	500			VC	18.43909	1 in 117
8903	121.16	CO	110.25	150			VC	9.486833	1 in 93
7602	115.27	CO	113.89	225			VC	17.69181	1 in 93
8803	117.77	FO	116.12	150			VC	12.04159	1 in 60
0001	113.3	CO	111.05	225			VC	14.03567	1 in 13
7608		CO		150			VC	21.8556	1 in 117
0707		FO		100			VC	5.173857	1 in 117
6901	117.43	CO	114.75	225			VC	28.07134	1 in 93
8705	114.91	CO	113.28	225			VC	11.18034	1 in 93
8003	112.29	SW	110.64	225			VC	56.5899	1 in 34
8804	117.85	SW	116.39	150			VC	18.80776	1 in 38
7501	115.28	CO	113.61	150			VC	12	1 in 200
0003	112.53	CO	109.95	225			VC	13.0384	1 in 100
8602	109.95	CO	107.88	225			VC	7.29011	1 in 17
0606		CO		150			VC	7.917779	1 in 150
7505	115.68	CO	110.25	150			VC	9.219544	1 in 6
1804	117.18	CO	114.07	375			VC	11	1 in 11
0501	115.37	CO	114.47	225			VC	1.414214	1 in 66
7706	118.68	CO	117.5	225			VC	19.0203	1 in 19
1812		CO		100			VC	6.62094	1 in 66
0804	114.36	CO	106.71	500			VC	53.60307	1 in 19
0705	118.51	CO	115.66	450			VC	80.1561	1 in 66
9703	111.59	CO	109.13	150			VC	10.63015	1 in 106
0008	114.19	CO	111.68	225			VC	56.30275	1 in 169
8002	110.52	CO	108.44	225			VC	25	1 in 27
7702	117.4	CO	113.98	900			BR	9.219544	1 in 44
8603	113.83	CO	112.77	150			VC	17	1 in 177
7701	117.11	CO	112.81	630			BR	60.00833	1 in 24
2705	119.17	CO	116.16	375			VC	16.20001	1 in 188
8605	109.17	CO	106.27	630			BR	30.01666	1 in 53
8804	114.01	CO	111.55	225			VC	11.02816	1 in 49
9101	112	CO	101.16	700			VC	56.97133	1 in 111
2002	111.81	CO	101.81	500			BR	105.019	1 in 46
8001	111.34	CO	108.02	300			VC	18.80776	1 in 46
2001	111.8	CO	108.27	225			VC	6	1 in 48
8703	114.91	CO	111.02	375			VC	12	1 in 48
7601	115.3	CO	111	300			VC	8.052528	1 in 77
9505	109.65	CO	108.76	225			VC	5.391949	1 in 77
9722		CO		100			VC	31.55303	1 in 77
8607	109.34	CO	106.03	1275			VC	97.60118	1 in 6
0721		CO		150			VC	4.751269	1 in 6
8604	113.95	CO	112.38	225			VC	14.03567	1 in 177
8601	109.08	CO	107.02	450			VC	1.414214	1 in 63
0610		CO		150			VC	18.28543	1 in 50
0702	114.89	CO	110.24	600			BR	71.55959	1 in 77
0004	111.73	CO	107.77	1600			CO	115.5749	1 in 100
0718		CO		100			VC	5.40128	1 in 100
7624		CO		100			VC	24.70702	1 in 100
8901	111.56	SW	0				UN	0.555507	1 in 40
8007	111.05	CO	109.25	150			VC	4.795771	1 in 125
2901	113.13	CO	111.39	225			VC	80.895	1 in 119
8605	114.68	CO	111.61	150			VC	19	1 in 52
8802	111.91	CO	108.69	640			BR	26.18234	1 in 70
7804	118.63	CO	114.29	375			VC	36.05551	1 in 30
2602	118.14	CO	116.2	300			VC	36.87818	1 in 70
2815		CO		150			VC	8.21709	1 in 49
1701	118.51	SW	115.03	375					

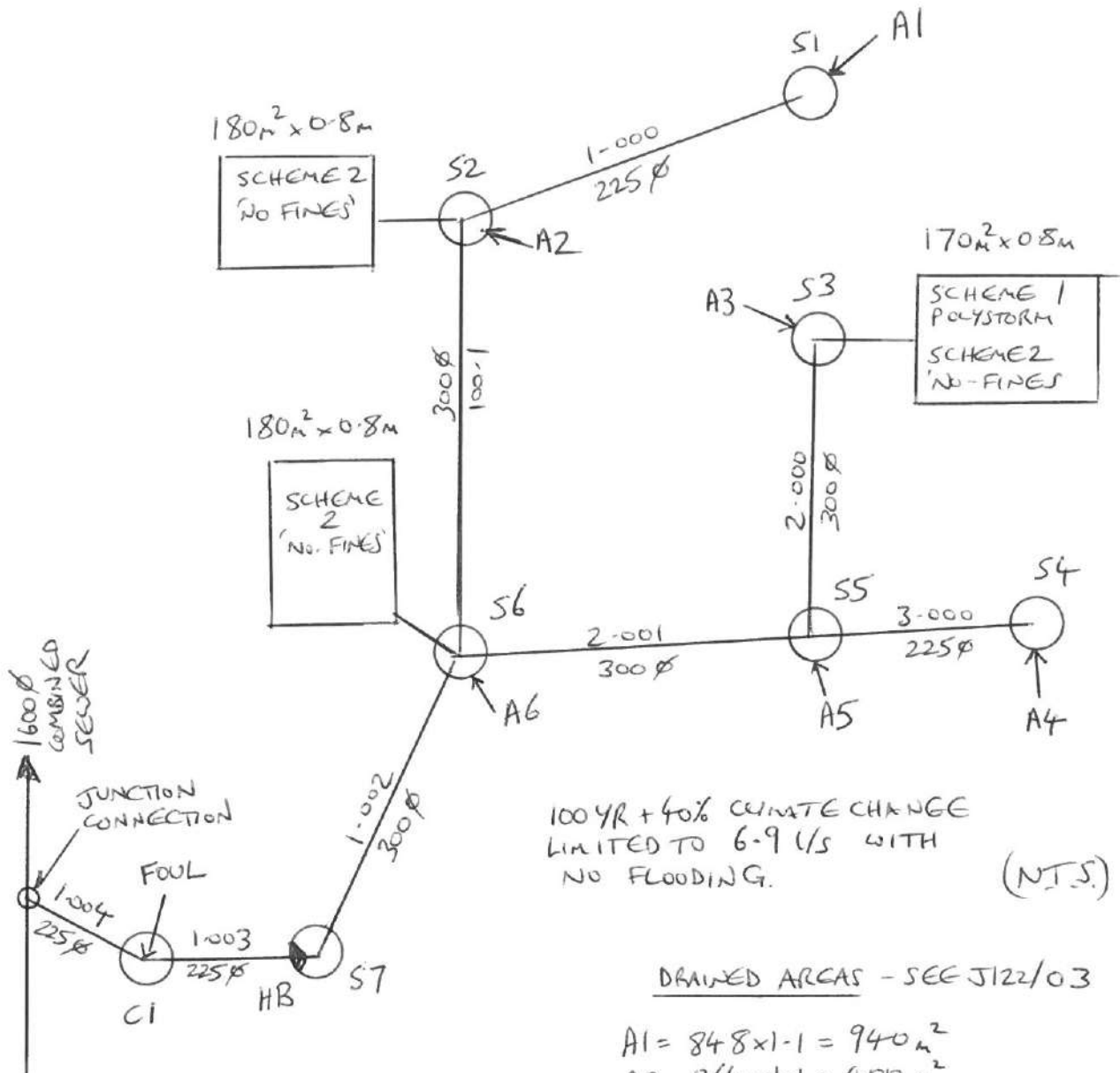
Appendix D
Drainage Design Calculations

D and D Consulting Engineers Ltd		Page 1
Labyrinth Business Centre 45 Middle Hillgate Stockport SK1 3DG		
Date 20/12/2021 23:12 File	Designed by jsd Checked by	
Innovyze		Source Control 2020.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.450 Area (ha) 0.898 Urban 0.000 SAAR (mm) 1129 Region Number Region 10 Results l/s QBAR Rural 6.9 QBAR Urban 6.9 Q100 years 14.4 Q1 year 6.0 Q30 years 11.7 Q100 years 14.4		
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Job Title

GEORGE STREET, HEYWOOD

DRAINAGE SCHEME



DRAINED AREAS - SEE J122/03

$$\begin{aligned}
 A1 &= 848 \times 1.1 = 940 \text{ m}^2 \\
 A2 &= 364 \times 1.1 = 400 \text{ m}^2 \\
 A3 &= 357 \times 1.1 = 390 \text{ m}^2 \\
 A4 &= 585 \times 1.1 = 640 \text{ m}^2 \\
 A5 &= 403 \times 1.1 = 440 \text{ m}^2 \\
 A6 &= 382 \times 1.1 = 420 \text{ m}^2 \\
 \text{TOTAL} &= 3230 \text{ m}^2
 \end{aligned}$$

STORAGE

SCHEME 1 = 1 No. POLYSTORM
CRATE TO S3

SCHEME 2 = 3 No. 'NO-FINES'
TANKS TO S2, S3 & S6

HYDROBRAKE

SCHEME 1 = MD-SHE-0109-6900-1950-6900
SCHEME 2 = MD-SHE-0111-6900-1800-6900

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Date 21/12/2021 12:38 File SCHEME1.MDX	Designed by jsd Checked by	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.285	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	43.000	0.450	95.6	0.094	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	58.000	0.600	96.7	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	38.000	0.400	95.0	0.039	5.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	21.000	0.960	21.9	0.064	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	27.000	0.300	90.0	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	28.000	0.300	93.3	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	5.000	0.100	50.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	5.000	0.250	20.0	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)
S1.000	50.00	5.54	109.950	0.094	0.0	0.0	0.0	1.34	53.2	12.7
S1.001	50.00	6.14	109.500	0.134	0.0	0.0	0.0	1.60	113.1	18.1
S2.000	50.00	5.39	109.600	0.039	0.0	0.0	0.0	1.61	114.0	5.3
S3.000	50.00	5.12	110.160	0.064	0.0	0.0	0.0	2.81	111.7	8.7
S2.001	50.00	5.66	109.200	0.147	0.0	0.0	0.0	1.66	117.2	19.9
S1.002	50.00	6.43	108.900	0.323	0.0	0.0	0.0	1.63	115.1	43.7
S1.003	50.00	6.47	108.600	0.323	0.0	0.0	0.0	1.85	73.7	43.7
S1.004	50.00	6.50	108.500	0.323	0.0	0.0	0.0	2.94	116.9	43.7

Manhole Schedules for Storm

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)
SS01	111.760	1.810	Open Manhole	1200	S1.000	109.950	225				
SS02	111.430	1.930	Open Manhole	1350	S1.001	109.500	300	S1.000	109.500	225	
SS03	111.880	2.280	Open Manhole	1350	S2.000	109.600	300				
SS04	112.160	2.000	Open Manhole	1200	S3.000	110.160	225				
SS05	111.890	2.690	Open Manhole	1350	S2.001	109.200	300	S2.000	109.200	300	
								S3.000	109.200	225	
SS06	111.440	2.540	Open Manhole	1350	S1.002	108.900	300	S1.001	108.900	300	
								S2.001	108.900	300	
SS07	111.150	2.550	Open Manhole	1500	S1.003	108.600	225	S1.002	108.600	300	
SC01	111.200	2.700	Open Manhole	1200	S1.004	108.500	225	S1.003	108.500	225	
SJUNCTION	111.300	3.050	Open Manhole	1		OUTFALL		S1.004	108.250	225	

No coordinates have been specified, layout information cannot be produced.

D and D Consulting Engineers Ltd		Page 3
Labyrinth Business Centre 45 Middle Hillgate Stockport SK1 3DG		
Date 21/12/2021 12:38 File SCHEME1.MDX	Designed by jsd Checked by	
Innovyze	Network 2020.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SS01	111.760	109.950	1.585	Open Manhole	1200
S1.001	o	300	SS02	111.430	109.500	1.630	Open Manhole	1350
S2.000	o	300	SS03	111.880	109.600	1.980	Open Manhole	1350
S3.000	o	225	SS04	112.160	110.160	1.775	Open Manhole	1200
S2.001	o	300	SS05	111.890	109.200	2.390	Open Manhole	1350
S1.002	o	300	SS06	111.440	108.900	2.240	Open Manhole	1350
S1.003	o	225	SS07	111.150	108.600	2.325	Open Manhole	1500
S1.004	o	225	SC01	111.200	108.500	2.475	Open Manhole	1200

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	43.000	95.6	SS02	111.430	109.500	1.705	Open Manhole	1350
S1.001	58.000	96.7	SS06	111.440	108.900	2.240	Open Manhole	1350
S2.000	38.000	95.0	SS05	111.890	109.200	2.390	Open Manhole	1350
S3.000	21.000	21.9	SS05	111.890	109.200	2.465	Open Manhole	1350
S2.001	27.000	90.0	SS06	111.440	108.900	2.240	Open Manhole	1350
S1.002	28.000	93.3	SS07	111.150	108.600	2.250	Open Manhole	1500
S1.003	5.000	50.0	SC01	111.200	108.500	2.475	Open Manhole	1200
S1.004	5.000	20.0	SJUNCTION	111.300	108.250	2.825	Open Manhole	1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.094	0.094	0.094
1.001	-	-	100	0.040	0.040	0.040
2.000	-	-	100	0.039	0.039	0.039
3.000	-	-	100	0.064	0.064	0.064
2.001	-	-	100	0.044	0.044	0.044
1.002	-	-	100	0.042	0.042	0.042
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.323	0.323	0.323

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.004	SJUNCTION	111.300	108.250	108.250	1	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.285		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SS07, DS/PN: S1.003, Volume (m³): 6.4

Unit Reference	MD-SHE-0109-6900-1950-6900
Design Head (m)	1.950
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	108.600
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)	1.950	6.9	Kick-Flo®	0.969	5.0
Flush-Flo™	0.475	6.3	Mean Flow over Head Range	-	5.7

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)
0.100	3.7	0.800	5.8	2.000	7.0	4.000	9.7	7.000	12.6
0.200	5.5	1.000	5.1	2.200	7.3	4.500	10.2	7.500	13.1
0.300	6.0	1.200	5.5	2.400	7.6	5.000	10.8	8.000	13.5
0.400	6.2	1.400	5.9	2.600	7.9	5.500	11.3	8.500	13.9
0.500	6.3	1.600	6.3	3.000	8.4	6.000	11.7	9.000	14.2
0.600	6.2	1.800	6.6	3.500	9.1	6.500	12.2	9.500	14.6

Storage Structures for Storm

Cellular Storage Manhole: SS03, DS/PN: S2.000

Invert Level (m) 109.650 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	170.0	0.0	0.799	170.0	0.0	0.801	0.0	0.0

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

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	1
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	19.000 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.285 Cv (Winter)
			0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status			ON
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			100
Climate Change (%)			40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	SS01	15 Winter	100	+40%	100/15	Summer			111.082	0.907	0.000
S1.001	SS02	15 Winter	100	+40%	100/15	Summer			110.746	0.946	0.000
S2.000	SS03	480 Winter	100	+40%	100/15	Summer			110.347	0.447	0.000
S3.000	SS04	15 Summer	100	+40%	100/15	Summer			110.492	0.107	0.000
S2.001	SS05	15 Winter	100	+40%	100/15	Summer			110.387	0.887	0.000
S1.002	SS06	15 Winter	100	+40%	100/15	Summer			110.550	1.350	0.000
S1.003	SS07	15 Winter	100	+40%	100/15	Summer			110.542	1.717	0.000
S1.004	SC01	15 Winter	100	+40%					108.547	-0.178	0.000

Half Drain Pipe							
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS01	0.85			43.3	SURCHARGED	
S1.001	SS02	0.55			58.7	SURCHARGED	
S2.000	SS03	0.14		244	14.6	SURCHARGED	
S3.000	SS04	0.33			34.0	SURCHARGED	
S2.001	SS05	0.24			25.5	SURCHARGED	
S1.002	SS06	0.25			26.4	SURCHARGED	
S1.003	SS07	0.15			6.9	SURCHARGED	
S1.004	SC01	0.10			6.9	OK	

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

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	1
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	19.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R	0.285
		Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5	Second Increment (Extended)	
DTS Status			ON
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			100
Climate Change (%)			40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	SS01	15 Winter	100	+40%	100/15	Summer			111.082	0.907	0.000
S1.001	SS02	15 Winter	100	+40%	100/15	Summer			110.746	0.946	0.000
S2.000	SS03	180 Winter	100	+40%	100/15	Summer			110.411	0.511	0.000
S3.000	SS04	15 Summer	100	+40%	100/15	Summer			110.492	0.107	0.000
S2.001	SS05	180 Winter	100	+40%	100/15	Summer			110.412	0.912	0.000
S1.002	SS06	15 Winter	100	+40%	100/15	Summer			110.550	1.350	0.000
S1.003	SS07	15 Winter	100	+40%	100/15	Summer			110.542	1.717	0.000
S1.004	SC01	15 Winter	100	+40%					108.547	-0.178	0.000

Half Drain Pipe							
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS01	0.85			43.3	SURCHARGED	
S1.001	SS02	0.55			58.7	SURCHARGED	
S2.000	SS03	0.14		185	14.3	SURCHARGED	
S3.000	SS04	0.33			34.0	SURCHARGED	
S2.001	SS05	0.11			11.4	SURCHARGED	
S1.002	SS06	0.25			26.4	SURCHARGED	
S1.003	SS07	0.15			6.9	SURCHARGED	
S1.004	SC01	0.10			6.9	OK	

D and D Consulting Engineers Ltd		Page 1
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.285	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	43.000	0.450	95.6	0.094	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	58.000	0.600	96.7	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	38.000	0.400	95.0	0.039	5.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	21.000	0.960	21.9	0.064	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	27.000	0.300	90.0	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	28.000	0.300	93.3	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	5.000	0.100	50.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	5.000	0.250	20.0	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)
S1.000	50.00	5.54	109.950	0.094	0.0	0.0	0.0	1.34	53.2	12.7
S1.001	50.00	6.14	109.500	0.134	0.0	0.0	0.0	1.60	113.1	18.1
S2.000	50.00	5.39	109.600	0.039	0.0	0.0	0.0	1.61	114.0	5.3
S3.000	50.00	5.12	110.160	0.064	0.0	0.0	0.0	2.81	111.7	8.7
S2.001	50.00	5.66	109.200	0.147	0.0	0.0	0.0	1.66	117.2	19.9
S1.002	50.00	6.43	108.900	0.323	0.0	0.0	0.0	1.63	115.1	43.7
S1.003	50.00	6.47	108.600	0.323	0.0	0.0	0.0	1.85	73.7	43.7
S1.004	50.00	6.50	108.500	0.323	0.0	0.0	0.0	2.94	116.9	43.7

Manhole Schedules for Storm

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)
SS01	111.760	1.810	Open Manhole	1200	S1.000	109.950	225				
SS02	111.430	1.930	Open Manhole	1350	S1.001	109.500	300	S1.000	109.500	225	
SS03	111.880	2.280	Open Manhole	1350	S2.000	109.600	300				
SS04	112.160	2.000	Open Manhole	1200	S3.000	110.160	225				
SS05	111.890	2.690	Open Manhole	1350	S2.001	109.200	300	S2.000	109.200	300	
								S3.000	109.200	225	
SS06	111.440	2.540	Open Manhole	1350	S1.002	108.900	300	S1.001	108.900	300	
								S2.001	108.900	300	
SS07	111.150	2.550	Open Manhole	1500	S1.003	108.600	225	S1.002	108.600	300	
SC01	111.200	2.700	Open Manhole	1200	S1.004	108.500	225	S1.003	108.500	225	
SJUNCTION	111.300	3.050	Open Manhole	1		OUTFALL		S1.004	108.250	225	

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SS01	111.760	109.950	1.585	Open Manhole	1200
S1.001	o	300	SS02	111.430	109.500	1.630	Open Manhole	1350
S2.000	o	300	SS03	111.880	109.600	1.980	Open Manhole	1350
S3.000	o	225	SS04	112.160	110.160	1.775	Open Manhole	1200
S2.001	o	300	SS05	111.890	109.200	2.390	Open Manhole	1350
S1.002	o	300	SS06	111.440	108.900	2.240	Open Manhole	1350
S1.003	o	225	SS07	111.150	108.600	2.325	Open Manhole	1500
S1.004	o	225	SC01	111.200	108.500	2.475	Open Manhole	1200

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	43.000	95.6	SS02	111.430	109.500	1.705	Open Manhole	1350
S1.001	58.000	96.7	SS06	111.440	108.900	2.240	Open Manhole	1350
S2.000	38.000	95.0	SS05	111.890	109.200	2.390	Open Manhole	1350
S3.000	21.000	21.9	SS05	111.890	109.200	2.465	Open Manhole	1350
S2.001	27.000	90.0	SS06	111.440	108.900	2.240	Open Manhole	1350
S1.002	28.000	93.3	SS07	111.150	108.600	2.250	Open Manhole	1500
S1.003	5.000	50.0	SC01	111.200	108.500	2.475	Open Manhole	1200
S1.004	5.000	20.0	SJUNCTION	111.300	108.250	2.825	Open Manhole	1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.094	0.094	0.094
1.001	-	-	100	0.040	0.040	0.040
2.000	-	-	100	0.039	0.039	0.039
3.000	-	-	100	0.064	0.064	0.064
2.001	-	-	100	0.044	0.044	0.044
1.002	-	-	100	0.042	0.042	0.042
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.323	0.323	0.323

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.004	SJUNCTION	111.300	108.250	108.250	1	0
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Simulation Criteria for Storm

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.285		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SS07, DS/PN: S1.003, Volume (m³): 6.4

Unit Reference	MD-SHE-0111-6900-1800-6900
Design Head (m)	1.800
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	111
Invert Level (m)	108.600
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)	1.800	6.9	Kick-Flo®	0.989	5.2
Flush-Flo™	0.483	6.6	Mean Flow over Head Range	-	5.9

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)	Depth (m)	Flow (l/s)
0.100	3.8	0.800	6.2	2.000	7.2	4.000	10.0	7.000	13.1
0.200	5.8	1.000	5.2	2.200	7.6	4.500	10.6	7.500	13.6
0.300	6.3	1.200	5.7	2.400	7.9	5.000	11.2	8.000	14.0
0.400	6.5	1.400	6.1	2.600	8.2	5.500	11.7	8.500	14.4
0.500	6.6	1.600	6.5	3.000	8.8	6.000	12.2	9.000	14.8
0.600	6.5	1.800	6.9	3.500	9.4	6.500	12.7	9.500	15.2

Storage Structures for Storm

Cellular Storage Manhole: SS02, DS/PN: S1.001

Invert Level (m) 109.550 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	180.0	0.0	0.799	180.0	0.0	0.801	0.0	0.0

Cellular Storage Manhole: SS03, DS/PN: S2.000

Invert Level (m) 109.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	170.0	0.0	0.799	170.0	0.0	0.801	0.0	0.0

Cellular Storage Manhole: SS06, DS/PN: S1.002

Invert Level (m) 108.950 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	180.0	0.0	0.799	180.0	0.0	0.801	0.0	0.0

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

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	3
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	19.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R	0.285
		Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5	Second Increment (Extended)	
DTS Status			ON
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			100
Climate Change (%)			40

									Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)
S1.000	SS01	15 Winter	100	+40%	100/60 Winter				110.127	-0.048	0.000
S1.001	SS02	15 Winter	100	+40%	100/30 Summer				109.739	-0.061	0.000
S2.000	SS03	120 Summer	100	+40%	100/30 Winter				110.150	0.250	0.000
S3.000	SS04	15 Winter	100	+40%	100/180 Winter				110.249	-0.136	0.000
S2.001	SS05	15 Summer	100	+40%	100/15 Summer				109.684	0.184	0.000
S1.002	SS06	15 Winter	100	+40%	100/15 Summer				109.736	0.536	0.000
S1.003	SS07	180 Winter	100	+40%	100/15 Summer				110.490	1.665	0.000
S1.004	SC01	180 Winter	100	+40%					108.547	-0.178	0.000

		Half Drain		Pipe				
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded	
S1.000	SS01	0.95			48.0	OK		
S1.001	SS02	0.54		50	58.5	OK		
S2.000	SS03	0.20		82	21.5	SURCHARGED		
S3.000	SS04	0.33			33.4	OK		
S2.001	SS05	0.63			66.8	SURCHARGED		
S1.002	SS06	0.21		129	21.3	SURCHARGED		
S1.003	SS07	0.16			6.9	SURCHARGED		
S1.004	SC01	0.10			6.9	OK		

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

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	3
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	19.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R	0.285
		Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5	Second Increment (Extended)	
DTS Status			ON
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			100
Climate Change (%)			40

						Water Level	Surcharged Depth	Flooded Volume
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) First (Y) First (Z) Overflow Surcharge Flood Overflow Act.	(m)	(m)	(m³)
S1.000	SS01	180 Winter	100	+40%	100/60 Winter	110.404	0.229	0.000
S1.001	SS02	180 Winter	100	+40%	100/30 Summer	110.420	0.620	0.000
S2.000	SS03	180 Winter	100	+40%	100/30 Winter	110.362	0.462	0.000
S3.000	SS04	180 Winter	100	+40%	100/180 Winter	110.426	0.041	0.000
S2.001	SS05	240 Winter	100	+40%	100/15 Summer	110.437	0.937	0.000
S1.002	SS06	240 Winter	100	+40%	100/15 Summer	110.489	1.289	0.000
S1.003	SS07	240 Winter	100	+40%	100/15 Summer	110.499	1.674	0.000
S1.004	SC01	240 Winter	100	+40%		108.547	-0.178	0.000

Half Drain Pipe							
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS01	0.28			14.4	SURCHARGED	
S1.001	SS02	0.16		137	17.3	SURCHARGED	
S2.000	SS03	0.20		116	21.3	SURCHARGED	
S3.000	SS04	0.10			9.8	SURCHARGED	
S2.001	SS05	0.14			14.9	SURCHARGED	
S1.002	SS06	0.17		350	18.1	SURCHARGED	
S1.003	SS07	0.16			6.9	SURCHARGED	
S1.004	SC01	0.10			6.9	OK	

Appendix E

Drainage Drawings:-

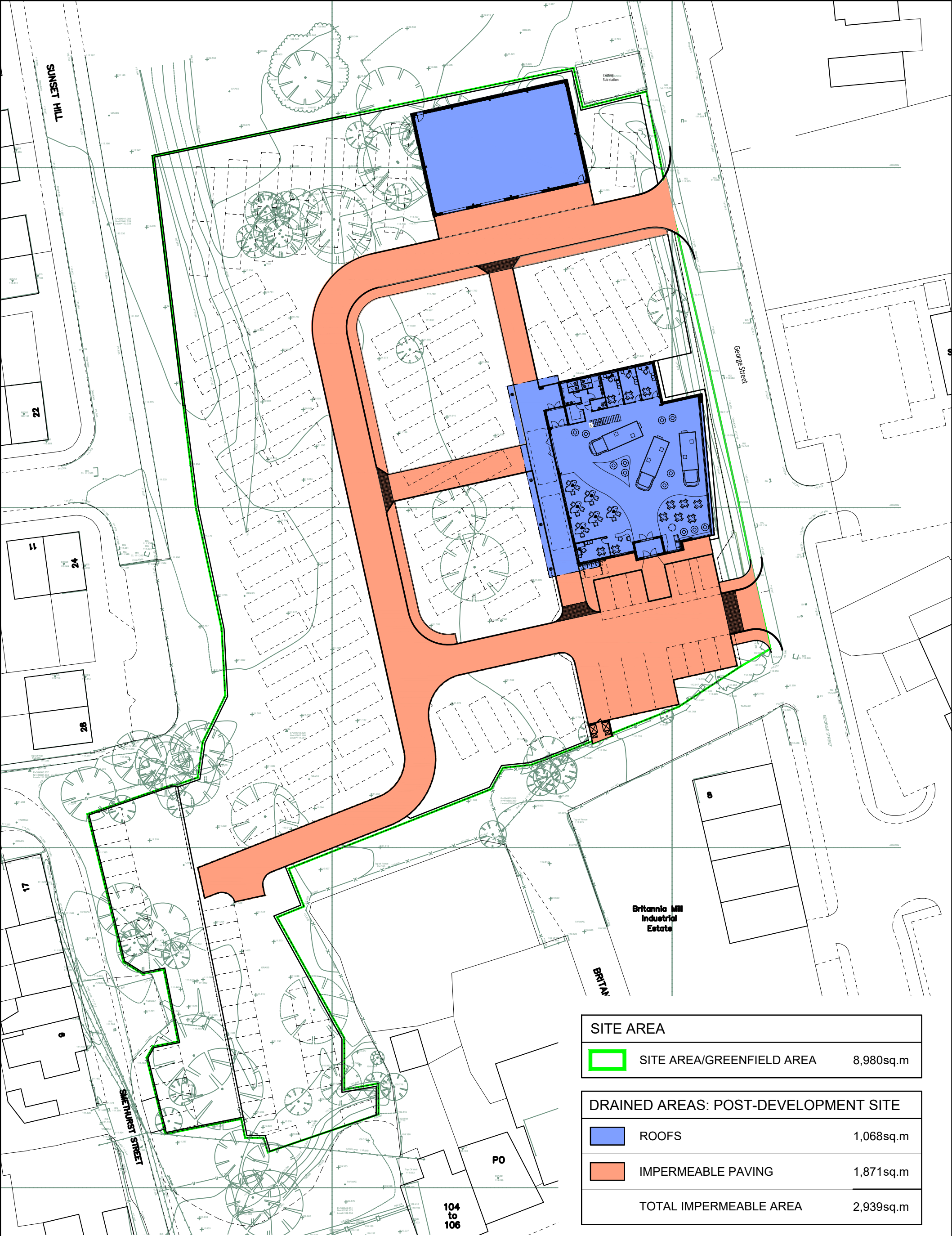
J122/01 – ‘Drained Area Assessment’

J122/02 – ‘Drainage Scheme with Indicative Levels’

J122/03 – ‘Individual Surface Water Areas’

J122/04 – ‘Storage and Hydrobrake Details’

J122/05 - ‘Overland Exceedance Flow Routes’



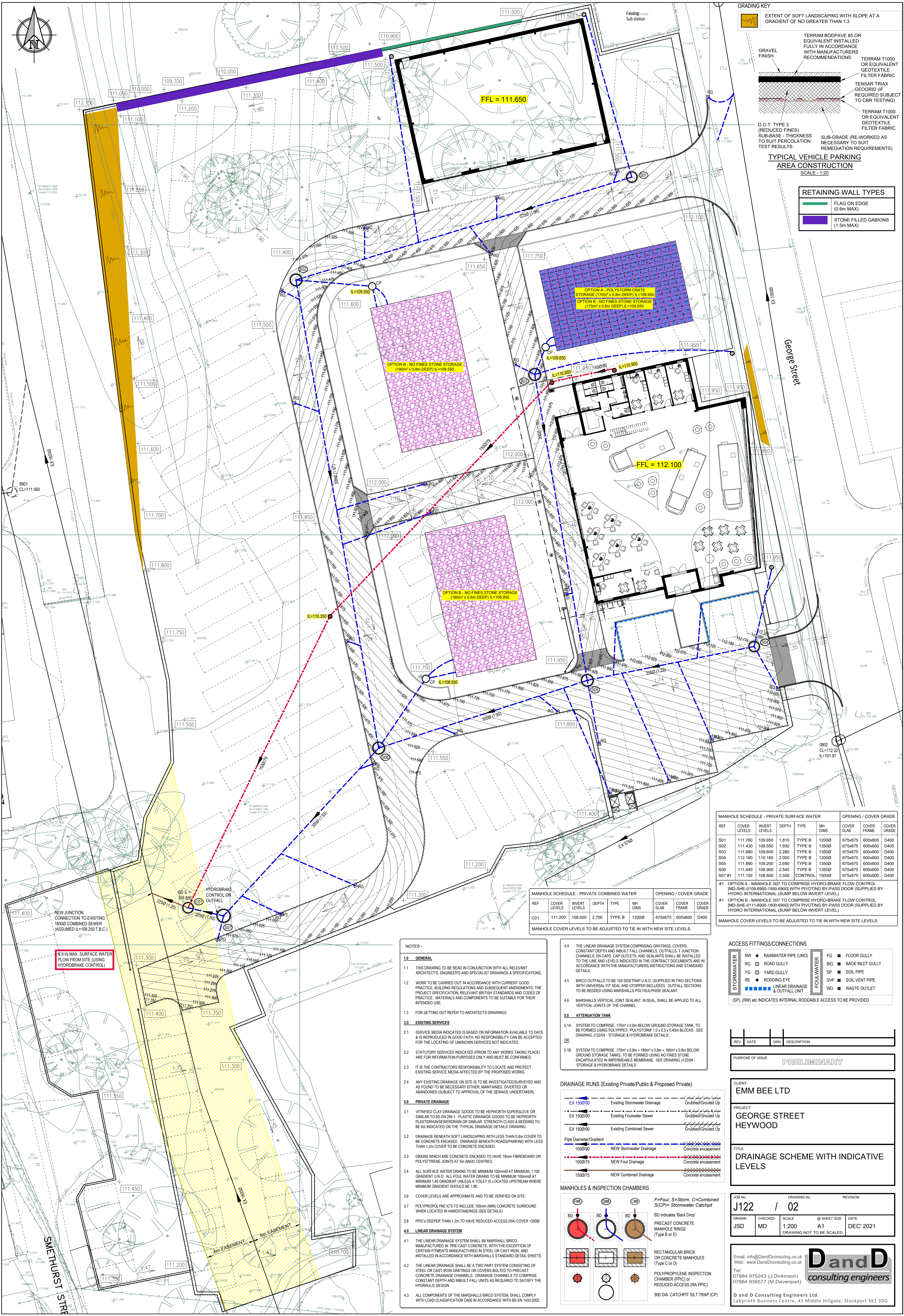
PROJECT:- GEORGE STREET, HEYWOOD						
TITLE:- SURFACE WATER DRAINED AREAS						
Job No.	Drawing No.	Rev.	Drawn	Checked	Scale @ Sheet Size	DATE
J122	01		JSD	MD	1:500 @ A3	DEC' 21

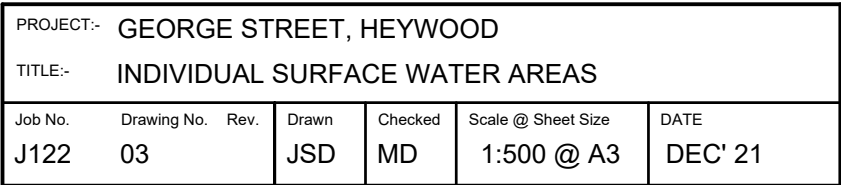
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Tel:
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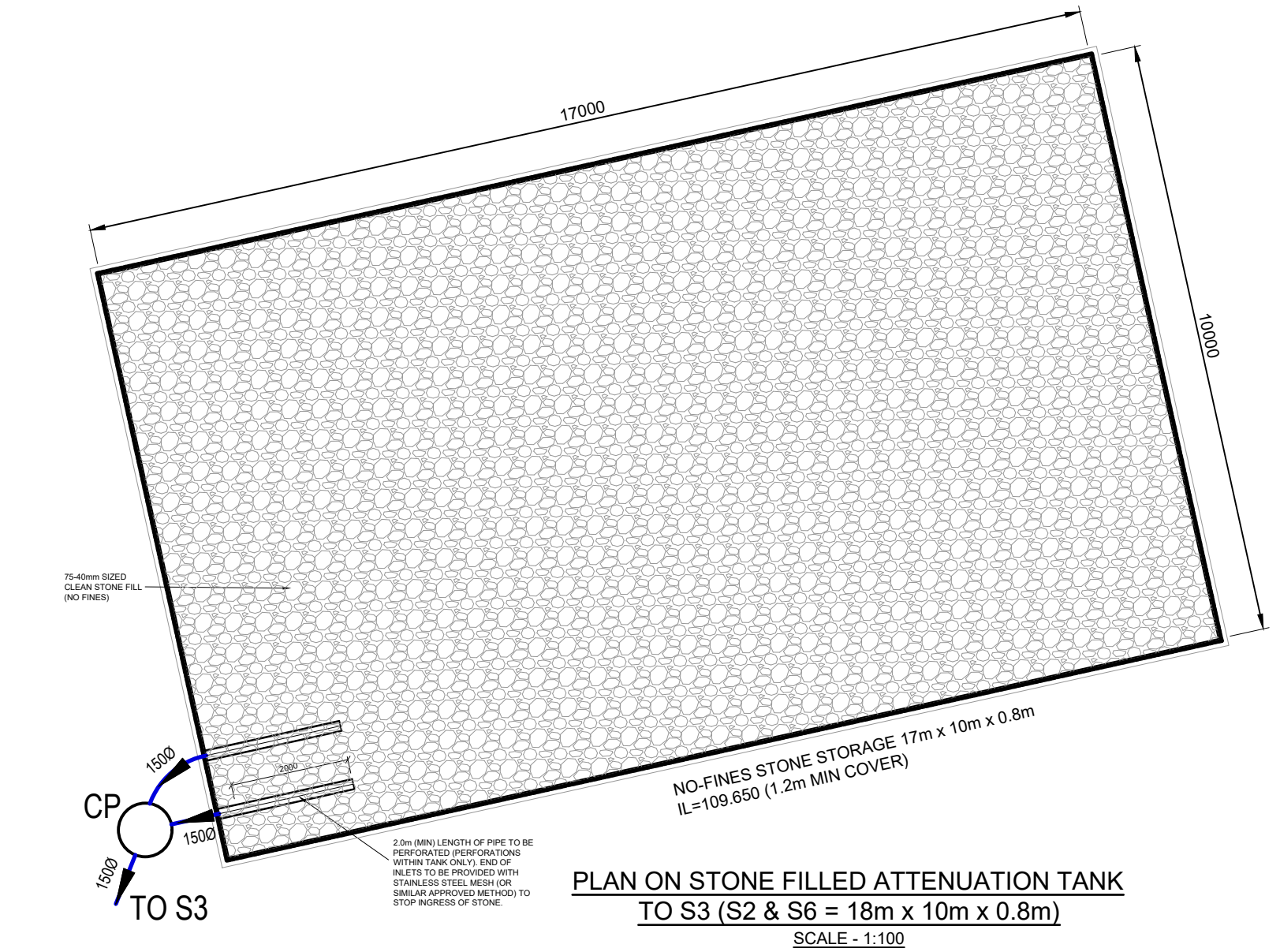




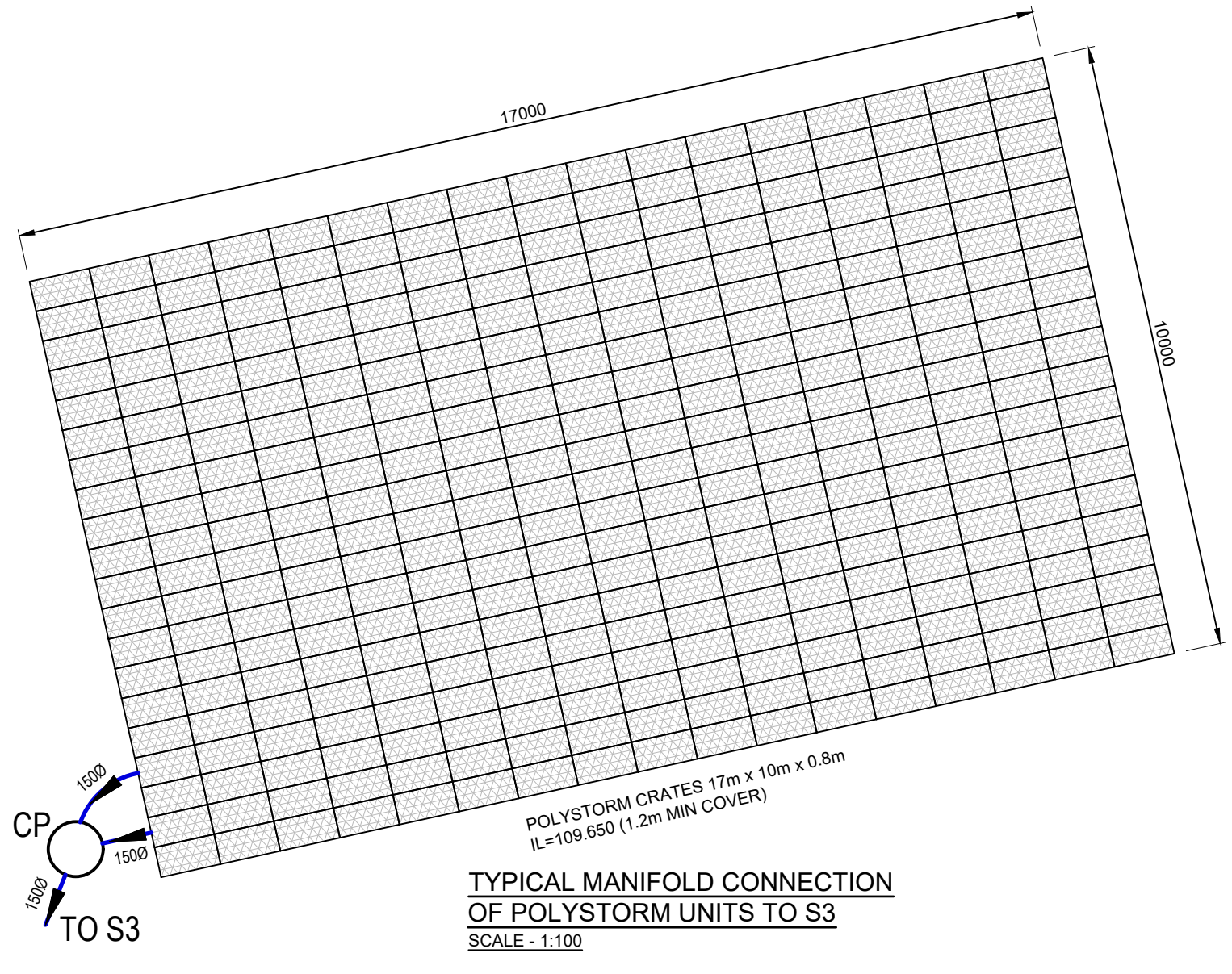
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- 1.0 GENERAL
- 1.1 THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S, ENGINEERS & SPECIALIST'S DRAWINGS & SPECIFICATIONS.
- 1.2 WORK TO BE CARRIED OUT IN ACCORDANCE WITH CURRENT GOOD PRACTICE, BUILDING REGULATIONS AND SUBSEQUENT AMENDMENTS, THE PROJECT SPECIFICATION, RELEVANT BRITISH STANDARDS AND CODES OF PRACTICE. MATERIALS AND COMPONENTS TO BE SUITABLE FOR THEIR INTENDED USE.
- 2.0 POLYSTORM ATTENUATION SYSTEM
- 2.1 SYSTEM TO COMPRISE 17m x 10m x 0.8m BELOW GROUND STORAGE TANK, TO BE FORMED USING POLYPIPES 'POLYSTORM' 1.0m x 0.5m x 0.40m BLOCKS.
- 3.0 TYPICAL INSTALLATION PROCEDURE
- 3.1 INSTALLATION PROCEDURES SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE HEALTH AND SAFETY AT WORK ETC. ACT (1974) AND ANY OTHER RELEVANT LEGISLATION. SPECIAL ATTENTION SHOULD BE PAID TO TEMPORARY WORK REQUIREMENTS IN EXCAVATIONS. TYPICAL INSTALLATION PROCEDURE TO BE AS FOLLOWS:-
- A EXCAVATION AND PREPARATION
- EXCAVATE TO THE REQUIRED PLAN DIMENSIONS & LEVEL. CONSIDERATION SHOULD BE GIVEN TO MAINTAINING CONSTRUCTION PLANT ACCESS FOR REINSTATING AROUND THE INSTALLED POLYSTORM UNITS.
- ENSURE THAT THE GROUND BEARING CAPACITY AT THE FORMATION LEVEL IS SUFFICIENT FOR THE PROPOSED OPERATIONAL LOADS. THE BASE OF THE EXCAVATION SHOULD BE SMOOTH AND LEVEL, FREE OF LARGE STONES AND SOFT SPOTS. ANY SOFT SPOTS SHOULD BE EXCAVATED AND REPLACED WITH SUITABLE COMPACTED GRANULAR MATERIAL.
- PLACE AND COMPACT A 100mm THICK LAYER OF BEDDING MATERIAL (TYPICALLY COARSE SAND), IF REQUIRED, LINE THE BASE AND SIDES OF THE EXCAVATION WITH A PROTECTIVE GEOTEXTILE BEFORE PLACEMENT OF THE IMPERMEABLE GEOMEMBRANE.
- B INSTALLATION OF GEOMEMBRANE LAYER (IMPERMEABLE)
- INSTALL THE IMPERMEABLE GEOMEMBRANE OVER THE BASE OF THE TANK, FORMING JOINTS IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS (TYPICALLY WELDING).
- BEFORE WELDING, THE SHEET MUST BE CHECKED FOR ANY DAMAGE INCLUDING PUNCTURES OR TEARS. IF DAMAGE HAS OCCURRED RE-PATCH THE DAMAGED AREA WITH ADDITIONAL GEOMEMBRANE MATERIAL AND WELD OVER DAMAGED AREA. ENSURE THE DAMAGED AREA IS OVERLAPPED BY A MINIMUM OF 400mm.
- THE SHEET OF GEOMEMBRANE SHOULD BE LARGE ENOUGH SUCH THAT IT CAN OVERLAP OVER THE EDGE OF THE MODULES BY 200mm. THE GEOMEMBRANE SHOULD BE CHOSEN TO SATISFY THE PHYSICAL AND MECHANICAL PROPERTIES INCLUDED ON TABLE 'B', WHILST ALSO ENSURING THAT ANY PROPRIETARY REQUIREMENTS ARE MET.
- C POLYSTORM CELL INSTALLATION
- PLACE THE POLYSTORM CELLS ON THE GEOMEMBRANE IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND CONNECT TOGETHER USING POLYPIPE CLIP AND SHEAR CONNECTION AS DETAILED:-
- CLIP CONNECTORS
POLYPIPE CLIPS CONNECT HORIZONTALLY ADJACENT CELLS.
 - SHEAR CONNECTORS
VERTICAL CONNECTIONS FOR A MULTIPLE LAYER STRUCTURE ARE FORMED WITH THE POLYPIPE SHEAR CONNECTOR.
- ENSURE CELLS ARE ARRANGED SO THAT THEY ARE IN THE CORRECT ALIGNMENT FOR CONNECTION OF THE ADJOINING PIPEWORK (SEE PLAN), WHERE POSSIBLE MINIMISE THE AMOUNT OF WALKING ON THE GEOMEMBRANE TO REDUCE THE CHANCE OF PUNCTURES OR TEARS.
- D CONNECTION OF ADJOINING PIPEWORK TO POLYSTORM CELLS
- 160mm EN 1401-1 PIPES CONNECT DIRECTLY INTO THE CONVENIENT KNOCK-OUT INCORPORATED IN THE END OF EACH CELL. CONNECTION TO 100mm EN 1401-1 PIPES OR OTHER PRODUCTS IS ACCOMMODATED THROUGH THE USE OF STANDARD POLYPIPE ADAPTERS. POLYSTORM CELLS ARE ALSO AVAILABLE WITH EITHER A 225mm OR 300mm FABRICATED RIDGIDRAIN FLANGED ADAPTOR.
- E VENTILATION
- POLYSTORM ATTENUATION STRUCTURES WILL REQUIRE VENTILATION TO ENSURE MAXIMUM HYDRAULIC PERFORMANCE AND AVOID PLACING ADDITIONAL STRESS ON THE ENCAPSULATING GEOMEMBRANE. VENTILATION CAN BE EITHER A VERTICAL PIPE (WITH A COVE) OR A HORIZONTAL PIPE CONNECTING TO AN ADJACENT CATCHPIT.
- FOR A VERTICAL VENT PIPE, ATTACH A 110/160mm FLANGE ADAPTOR TO THE UPPER POLYSTORM CELL USING CABLE TIES ON ALL FOUR CORNERS OF THE ADAPTOR BASE AND SEAL GEOMEMBRANE AROUND THE FLANGE (THE SAME WAY AS MAKING AN INLET OR OUTLET CONNECTION). INSERT A 110/160mm DIA VERTICAL VENT PIPE INTO THE FLANGE AND MAKE CONNECTION.
- LARGE ATTENUATION TANKS NEED A VENT FOR EVERY 7500sq.m OF DRAINED CATCHMENT.
- F INSTALLATION OF ENCASING GEOMEMBRANE
- COMPLETE THE GEOMEMBRANE ENCAPSULATION OF THE ENTIRE POLYSTORM STRUCTURE, FORMING JOINTS WHERE APPROPRIATE. RE-EXAMINE THE GEOMEMBRANE FOR DAMAGE AND JOINT INTEGRITY. ALL PIPES ENTERING AND LEAVING THE STRUCTURE MUST BE SEALED.
- G LATERAL BACKFILLING
- BACKFILL AROUND THE SIDES OF THE ENCAPSULATED CELLS, FORMING A 100mm THICK LAYER OF COARSE SAND OR CLASS 8H SELECTED GRANULAR MATERIAL, IMMEDIATELY ADJACENT TO THE CELLS WHERE REQUIRED, REMAINING EXCAVATED AREAS AROUND THE CELLS SHOULD BE BACKFILLED WITH CLASS 8H OR 6P SELECTED GRANULAR MATERIAL, IN ACCORDANCE WITH MCHW, VOLUME 1, OR SIMILARLY APPROVED SPECIFICATION.
- H COVER BACKFILLING
- ABOVE THE WRAPPED POLYSTORM CELLS, PLACE AND LIGHTLY COMPACT A MINIMUM 100mm THICK LAYER OF EITHER COARSE SAND OR CLASS 8H SELECTED GRANULAR MATERIAL (WITH 100% PASSING THE 5mm SIEVE), IN ACCORDANCE WITH MCHW, VOLUME 1, SERIES 600.
- FINAL BACKFILLING OF THE INSTALLATION AND SURFACING IS DEPENDENT ON THE EXPECTED OPERATIONAL LOADS AS NOTED BELOW:-
- FIELD CONDITIONS (e.g. LANDSCAPED AREAS)
THE BACKFILL MATERIAL THAT LIES WITHIN 300mm ABOVE THE POLYSTORM CELLS SHOULD BE FREE FROM PARTICLES EXCEEDING 40mm IN DIAMETER, IN ACCORDANCE WITH CLASS 8 MATERIAL TO SERIES 600, VOLUME 1, MCHW. FINAL BACKFILLING UP TO FINISHED GROUND LEVEL MAY BE ACHIEVED USING SELECTED AS-DUG MATERIAL. BACKFILL MATERIAL SHOULD BE PLACED AND COMPACTED IN LAYERS NO GREATER THAN 300mm. COMPLETE LANDSCAPING OVER THE POLYSTORM SYSTEM.
 - LIGHTLY TRAFFICKED (e.g. RESTRICTED ACCESS CAR PARK)
BACKFILL WITH CLASS 1 OR 2 MATERIAL IN ACCORDANCE WITH MCHW, VOLUME 1, SERIES 600. BACKFILL MATERIAL SHOULD BE PLACED AND COMPACTED IN LAYERS NOT GREATER THAN 150mm. WHERE THE POLYSTORM CELLS ARE INSTALLED BENEATH A PAVED AREA, THE PAVEMENT SUB-BASE MAY FORM PART OF THE BACKFILL MATERIAL PROVIDED THAT MINIMUM COVER DEPTHS ARE MAINTAINED. COMPLETE PAVEMENT CONSTRUCTION OVER THE POLYSTORM SYSTEM.
- TO ENSURE ADEQUATE PROTECTION TO POLYSTORM SYSTEM MINIMUM COVER OF 600mm AND 500mm TO BE PROVIDED OVER 'POLYSTORM' AND 'POLYSTORM LITE' CELLS RESPECTIVELY. ADDITIONAL PROTECTION TO BE PROVIDED DURING CONSTRUCTION STAGE WORKS AS APPROPRIATE. COMPACTION PLANT OVER AND IMMEDIATELY ADJACENT TO THE POLYSTORM CELLS SHALL NOT EXCEED 2300 Kg/m WIDTH.
- I INSPECTION
- AFTER INSTALLATION AND PRIOR TO HANDOVER, ANY SILT COLLECTION CHAMBERS OR CONTROL MANHOLES SHOULD BE EXAMINED TO ENSURE THEY ARE FREE FROM DEBRIS OR CONTAMINATION.
- 3.2 FOR FURTHER INFORMATION REFER TO 'THE 'POLYSTORM LITE AND POLYSTORM TECHNICAL GUIDE' PRODUCED BY POLYPIPE.

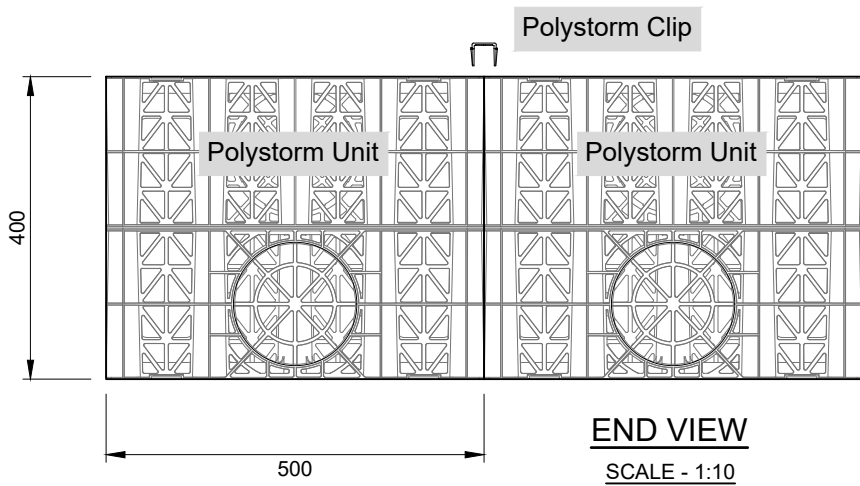
Table 'B' - IMPERMEABLE GEOMEMBRANE REQUIREMENTS		
PHYSICAL PROPERTIES		
THICKNESS	MIN 0.75 to 1.0mm	ASTM D5199
DENSITY	900 kg/m ³	ASTM D1505
MECHANICAL PROPERTIES		
TENSILE STRENGTH, AT YIELD	MIN 1600N/m ²	ASTM D4885
ELONGATION AT BREAK	>500%	ASTM D4885
PUNCTURE RESISTANCE	MIN 170N	ASTM D4833
TEAR RESISTANCE	MIN 67N	ASTM D1004 Die C
IMPACT RESISTANCE	MIN 15 JOULES	ASTM 3998 MOD
STRESS CRACK RESISTANCE	MIN 200 hrs	ASTM D5391 (SP-NCTL)
PERMEABILITY COEFFICIENT	MAX 2.0 x 10 ⁻¹²	ASTM D
pH	RESISTANCE TO ALL NATURALLY OCCURRING ACIDS AND ALKALIS	
CHEMICAL/BIOLOGICAL RESISTANCE	RESISTANCE TO ALL SUBSTANCES FOUND TO NATURALLY OCCUR IN SOILS AND RAINWATER. DETAILED INFORMATION WOULD NEED TO BE PROVIDED TO GEOSYNTHETIC MANUFACTURER IN INSTANCES OF CONTAMINATED LAND.	



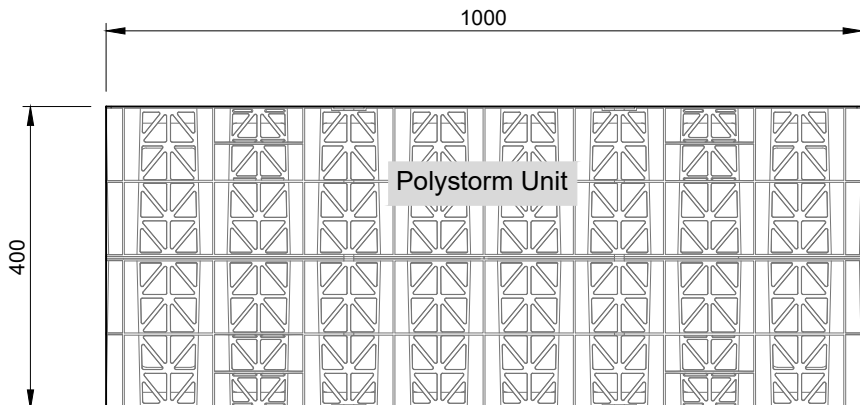
PLAN ON STONE FILLED ATTENUATION TANK
TO S3 (S2 & S6 = 18m x 10m x 0.8m)
SCALE - 1:100



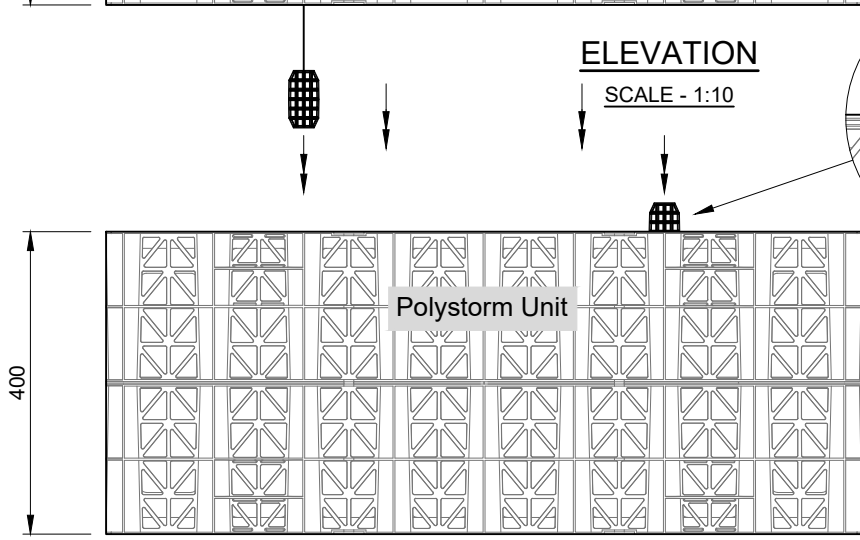
TYPICAL MANIFOLD CONNECTION
OF POLYSTORM UNITS TO S3
SCALE - 1:100



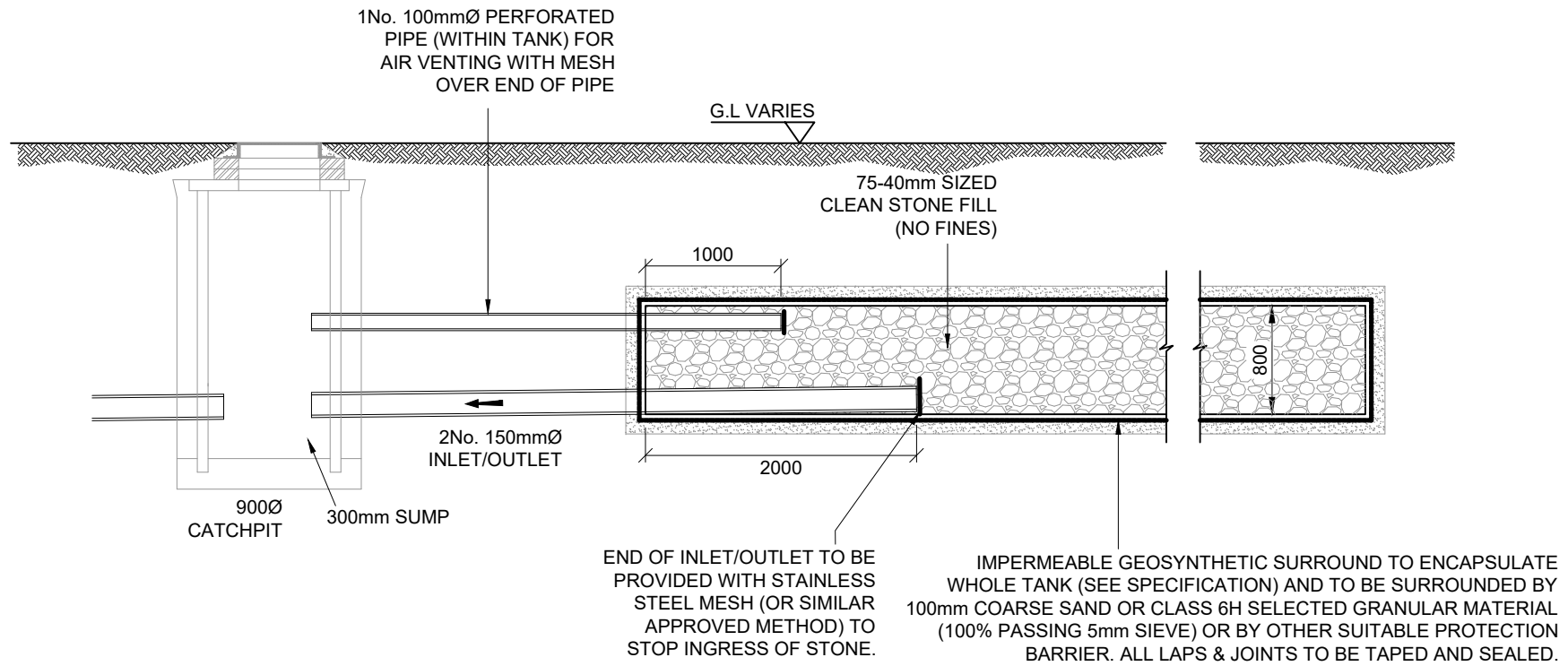
END VIEW
SCALE - 1:10



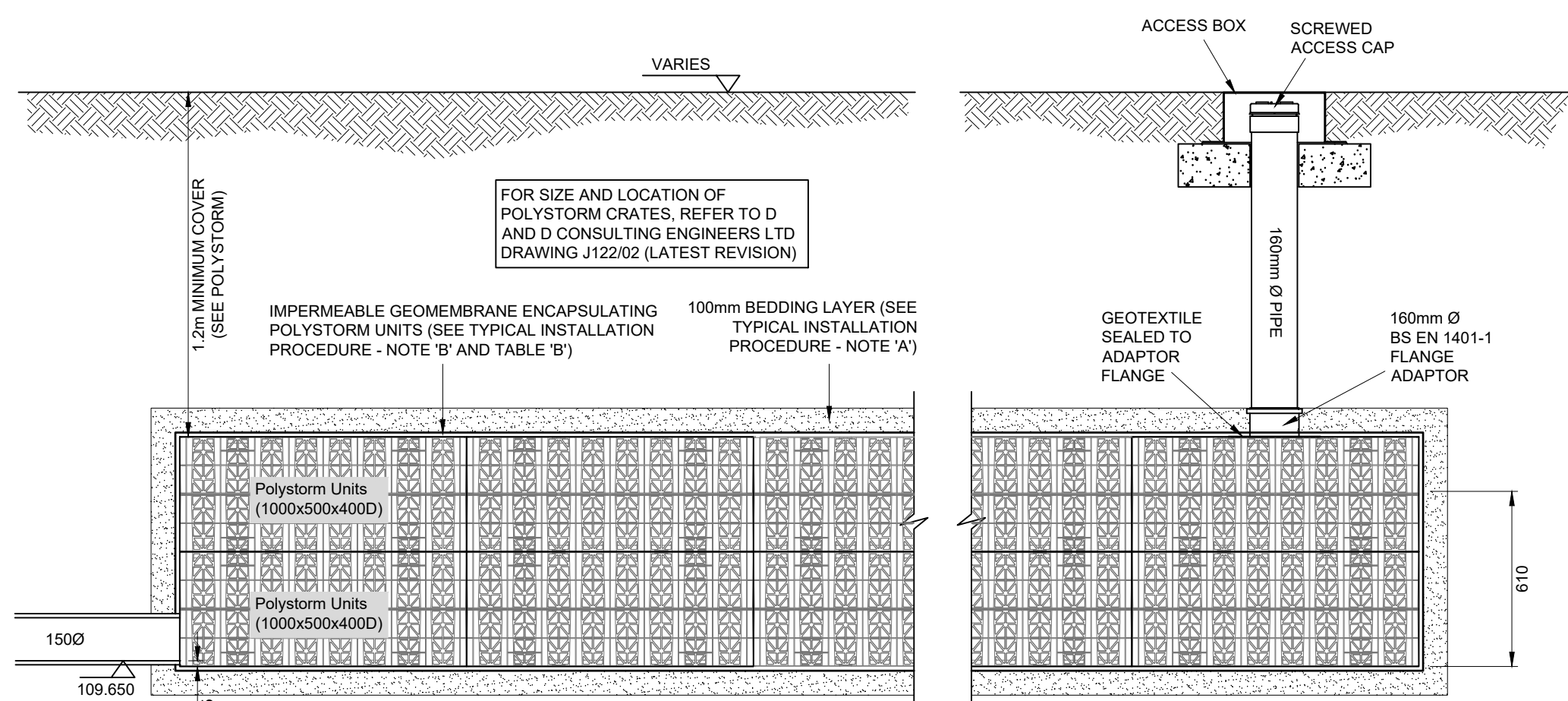
ELEVATION
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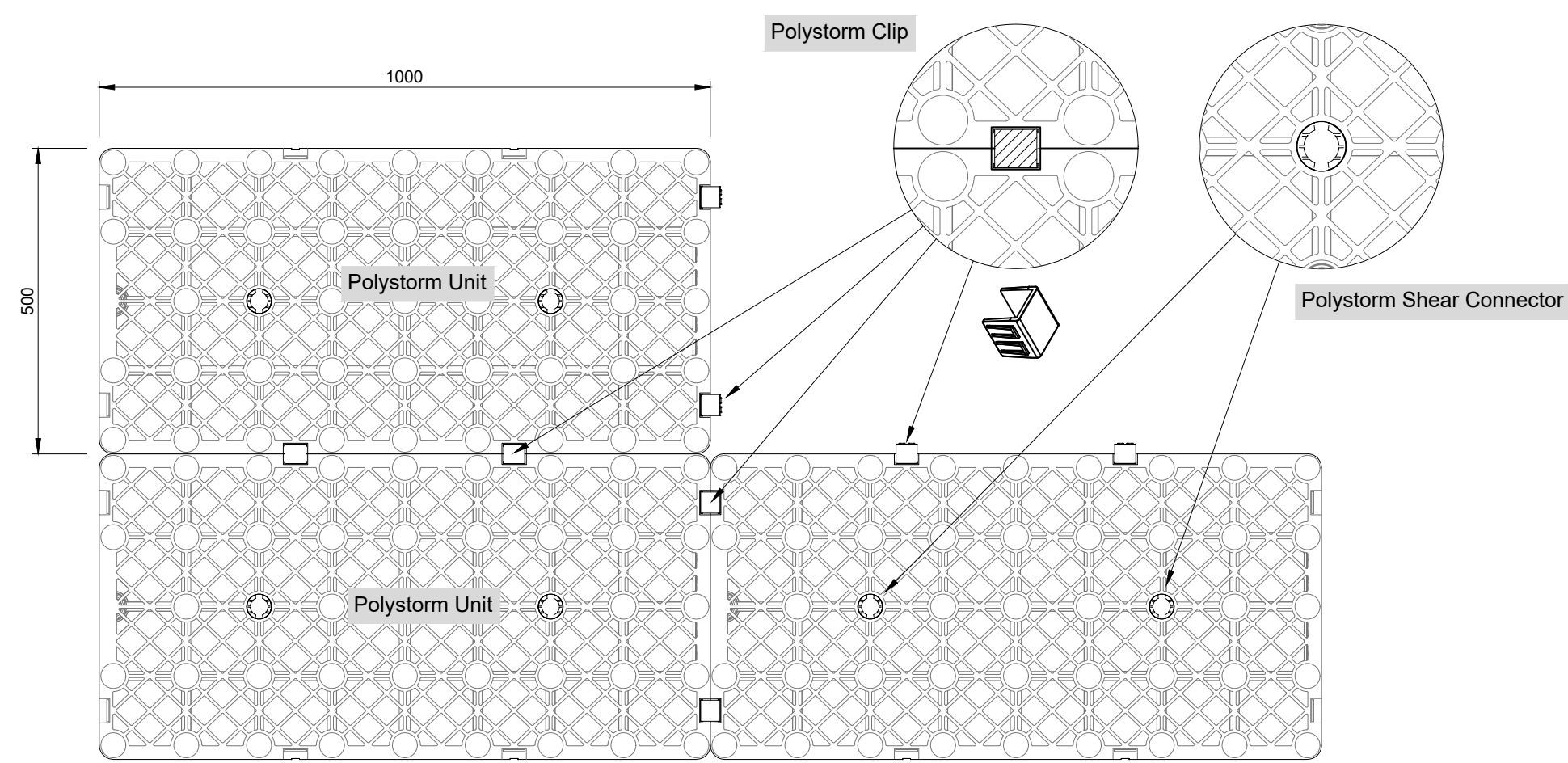
POLYSTORM CONNECTORS
SCALE - 1:10



TYPICAL SECTION THROUGH STONE FILLED ATTENUATION TANK
SCALE - 1:50



PART SECTION THROUGH POLYSTORM CRATE STORAGE SYSTEM
SCALE - 1:20



PLAN VIEW
SCALE - 1:10

REV	DATE	DRN	DESCRIPTION
PURPOSE OF ISSUE			
PRELIMINARY			
CLIENT			
EMM BEE LTD			
PROJECT			
GEORGE STREET HEYWOOD			
TITLE			
STORAGE AND HYDROBRAKE DETAILS			

JOB No.	DRAWING No.	REVISION
J122	/ 04	
DRAWN	CHECKED	@ SHEET SIZE
JSD	MD	AS NOTED A1
		DRAWING NOT TO BE SCALED
DATE		
DEC' 2021		

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PROJECT:- GEORGE STREET, HEYWOOD						
TITLE:- EXCEEDENCE FLOW ROUTES						
Job No.	Drawing No.	Rev.	Drawn	Checked	Scale @ Sheet Size	DATE
J122	05		JSD	MD	1:500 @ A3	DEC' 21

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