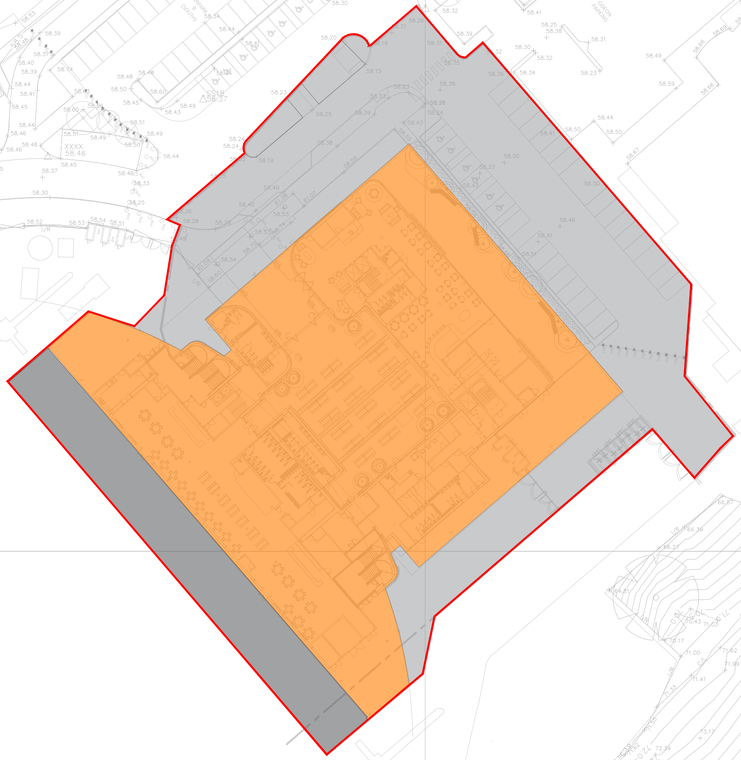
LEGEND:

EXISTING HARDSTANDING, DRAINAGE TO REMAIN AS EXISTING
AREA = 2797m²

EXISTING BUILDING DRAINAGE TO REMAIN AS EXISTING
AREA = 703m²

PROPOSED BUILDING
AREA = 3,824m²

TOTAL = 7324m²

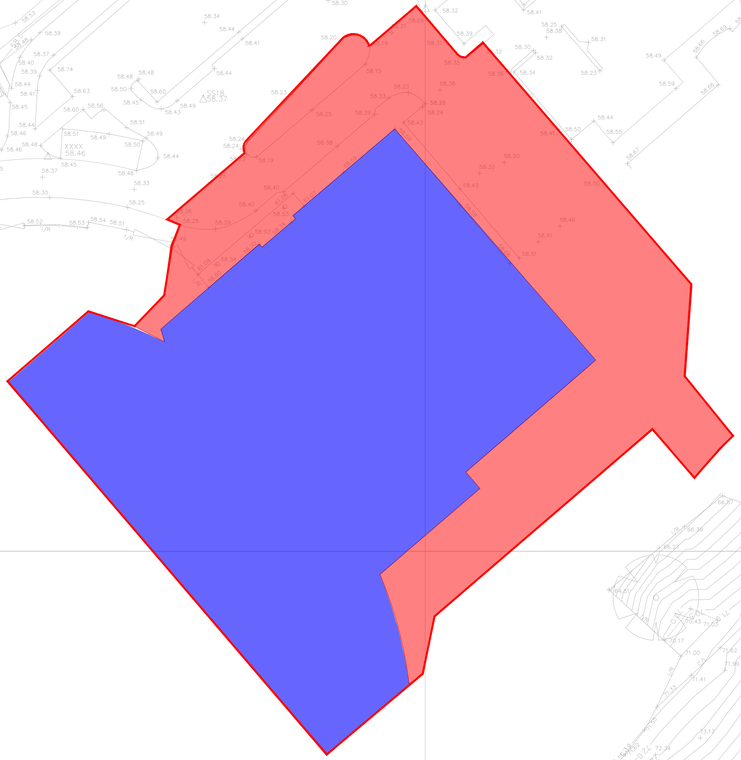


LEGEND:

EXISTING HARDSTANDING
AREA = 2840m²

EXISTING BUILDING
AREA = 4484m²

TOTAL = 7324m²



PRELIMINARY DRAWING

THIS DRAWING IS FOR PRELIMINARY INFORMATION PURPOSES ONLY AND MUST NOT BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

DRAWING REFERENCE LIST

DRAWING NUMBER	REV	DATE	CREATOR
KSTAD-BUT-HO-00-DR-A-04015	P05	18.06.2026	BUTTRESS ARCHITECTS
KSTAD-BUT-HO-04-DR-A-04005	P04	27.03.2026	BUTTRESS ARCHITECTS
14597 1000A	A	20.12.2017	THE HARRIS PARTNERSHIP
RP26-1354-00-M2-L-0104	P06	14.07.2026	RE-FORM

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ENGINEER'S AND ARCHITECT'S DRAWINGS, DETAILS AND SPECIFICATIONS
2. REFER TO THE ARCHITECT & SERVICES ENGINEER FOR FINAL SETTING OUT OF ALL BUILDINGS & INTERNAL DOWN PIPES & RWPS
3. REFER TO SERVICE ENGINEER FOR ABOVE GROUND PLUMBING ROUTES FROM APPLIANCES TO STUB STACKS ETC
4. EXISTING DRAINAGE THAT IS TO BE ABANDONED TO BE 'PLUGGED' IN WITH MASS CONCRETE (150mm MIN) OR REMOVED ENTIRELY
5. ANY EXISTING SERVICES TO BE LOCATED AND CLEARLY MARKED PRIOR TO EXCAVATIONS BY CONTRACTOR
6. ALL LEVELS ARE TO BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO CONSTRUCTION
7. IT IS ASSUMED THAT ALL RWPS, SINK AND TOILET DRAINAGE POINTS WILL HAVE RODDING ACCESS AT THE APPLIANCE BASE
8. CONTRACTOR TO AVOID UNDERMINING ANY EXISTING FOOTPATHS/BUILDINGS DURING WORKS BY ALLOWING ADEQUATE PROTECTION ADJACENT TO THESE AREAS
9. ALL BELOW GROUND DRAINAGE PIPES WITH LESS THAN 900mm COVER TO SOFFIT LEVEL IN TRAFFICKED AREAS I.E. CAR PARK AND SERVICE YARD, TO HAVE CLASS Z BEDDING SURROUND. REFER TO THE MANHOLE SCHEDULE AND DETAIL SHEETS FOR FURTHER DETAILS
10. ALL BELOW GROUND DRAINAGE WITHIN THE SITE BOUNDARY HAS BEEN DESIGNED TO BSEN 752:2008 AND BUILDING REGULATIONS - PART H 2015. THE OFF SITE DRAINAGE TO THE PUBLIC SEWER ARE DESIGNED TO THE SEWERAGE SECTOR GUIDANCE

Rev	Date	Description	By	Check	App.
P03	16.07.2026	LANDSCAPE PLAN UPDATED	JC	KE	KE
P02	23.04.2026	PRELIMINARY ISSUE	HB	KE	KE
P01	02.04.2026	PRELIMINARY ISSUE	HB	JC	KE

Client: TOWN SPORTS & ENTERTAINMENT GROUP LTD

Project: THE ACCU STADIUM HOTEL, HUDDERSFIELD

Office: MANCHESTER - 0161 613 6000

Title: AREAS PLAN GENERAL ARRANGEMENT

Scale @ A1: 1:500 | Status: PRELIMINARY

clancy consulting
www.clancy.co.uk

Project Ref	Originator	Volume	Level
1/21793	CCL	XX	XX
File Type	**Discipline**	**Drawing No.**	**Revision**
DR	C	06000	P03

SCALE 1:500m
0m 10m 20m 30m 40m 50m

Date of Print = Jul 16 2026, File Name = KSTAD-CCL-XX-XX-DR-C-06000_P03_Areas Plan GA.dwg

Appendix G – Calculations and Drainage Modelling Reports

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	x
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	1.000		

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.001	28.555	120.0	225	Circular	58.600	57.640	0.735	58.600	57.402	0.973
1.000	14.273	198.2	225	Circular	58.600	57.538	0.837	58.600	57.466	0.909
1.001	12.054	200.9	225	Circular	58.600	57.466	0.909	58.600	57.406	0.969
1.002	18.164	199.6	300	Circular	58.600	57.331	0.969	58.600	57.240	1.060
1.003	9.432	200.7	300	Circular	58.600	57.240	1.060	58.600	57.193	1.107
1.004	21.374	199.8	300	Circular	58.600	57.193	1.107	58.600	57.086	1.214
1.005	16.231	200.4	450	Circular	58.600	56.936	1.214	58.600	56.855	1.295
2.002	15.199	47.2	300	Circular	58.600	57.327	0.973	58.600	57.005	1.295
1.006	9.168	14.0	450	Circular	58.600	56.855	1.295	58.250	56.200	1.600
1.007	2.712	129.1	225	Circular	58.250	56.200	1.825	58.200	56.179	1.796
3.000	2.514	251.4	300	Manifold	58.600	56.400	1.900	58.600	56.390	1.910

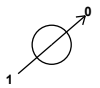
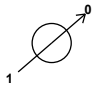
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.001	SW2.1	600	Manhole	Adoptable	SW2.2	600	Manhole	Adoptable
1.000	SW1.0	600	Manhole	Adoptable	SW1.1	600	Manhole	Adoptable
1.001	SW1.1	600	Manhole	Adoptable	SW1.2	600	Manhole	Adoptable
1.002	SW1.2	600	Manhole	Adoptable	SW1.3	600	Manhole	Adoptable
1.003	SW1.3	600	Manhole	Adoptable	SW1.4	600	Manhole	Adoptable
1.004	SW1.4	600	Manhole	Adoptable	SW1.5	600	Manhole	Adoptable
1.005	SW1.5	600	Manhole	Adoptable	SW1.6	1200	Manhole	Adoptable
2.002	SW2.2	600	Manhole	Adoptable	SW1.6	1200	Manhole	Adoptable
1.006	SW1.6	1200	Manhole	Adoptable	SW1.7	1800	Manhole	Adoptable
1.007	SW1.7	1800	Manhole	Adoptable	S12/2	1200	Manhole	Adoptable
3.000	Attenuation		Junction		SW3.0	1500	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	7.193	119.9	225	Circular	58.600	57.700	0.675	58.600	57.640	0.735
3.001	26.485	378.4	450	Circular	58.600	56.390	1.760	58.400	56.320	1.630
3.002	26.919	224.3	450	Circular	58.400	56.320	1.630	58.250	56.200	1.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	SW2.0	600	Manhole	Adoptable	SW2.1	600	Manhole	Adoptable
3.001	SW3.0	1500	Manhole	Adoptable	SW3.1	1500	Manhole	Adoptable
3.002	SW3.1	1500	Manhole	Adoptable	SW1.7	1800	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW2.1	415464.354	417639.371	58.600	0.960	600	1	2.000	57.640	225
									
						0	2.001	57.640	225
SW2.2	415485.982	417658.016	58.600	1.273	600	1	2.001	57.402	225
									
						0	2.002	57.327	300
SW1.6	415498.251	417668.594	58.600	1.745	1200	1	2.002	57.005	300
						2	1.005	56.855	450
									
						0	1.006	56.855	450
SW1.5	415508.849	417656.301	58.600	1.664	600	1	1.004	57.086	300
									
						0	1.005	56.936	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW1.4	415522.805	417640.113	58.600	1.407	600	1	1.003	57.193	300
						0	1.004	57.193	300
SW1.3	415529.617	417632.211	58.600	1.360	600	1	1.002	57.240	300
						0	1.003	57.240	300
SW1.2	415517.507	417618.112	58.600	1.269	600	1	1.001	57.406	225
						0	1.002	57.331	300
SW1.1	415511.879	417611.445	58.600	1.134	600	1	1.000	57.466	225
						0	1.001	57.466	225
SW1.0	415500.506	417601.641	58.600	1.062	600	0	1.000	57.538	225
SW1.7	415491.507	417674.885	58.250	2.050	1800	1	3.002	56.200	450
						2	1.006	56.200	450
						0	1.007	56.200	225
Attenuation	415493.643	417631.716	58.600	2.200		0	3.000	56.400	300
S12/2	415491.826	417677.578	58.200	2.021	1200	1	1.007	56.179	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW2.0	415458.906	417634.674	58.600	0.900	600				
						0	2.000	57.700	225
SW3.0	415492.135	417633.686	58.600	2.210	1500		1	3.000	56.390	300
							0	3.001	56.390	450
SW3.1	415474.841	417653.746	58.400	2.080	1500		1	3.001	56.320	450
						0	3.002	56.320	450

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)		100 year (l/s)	1.3
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	✓	Check Discharge Volume	x
Summer CV	1.000	Drain Down Time (mins)	240	1 year (l/s)	0.6		
Winter CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	1.1		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	0	0	0	100	45	0	0
30	45	0	0				

Pre-development Discharge Rate

Site Makeup	Brownfield	Host	1	Growth Factor 30 year	1.75	Q 1 year (l/s)	0.6
Brownfield Method	Greenfield	BFIHost	0.785	Growth Factor 100 year	2.08	Q 30 year (l/s)	1.1
Greenfield Method	FEH	Region	3	Betterment (%)	0	Q 100 year (l/s)	1.3
Positively Drained Area (ha)	0.382	QBar/QMed conversion factor	1.064	QMed	0.6		
SAAR (mm)	864	Growth Factor 1 year	0.86	QBar	0.6		

Node SW1.7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	56.200	Product Number	CTL-SHE-0159-1500-2050-1500
Design Depth (m)	2.050	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.0	Min Node Diameter (mm)	1800

Node Attenuation Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	56.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	110

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	125.0	125.0	1.200	125.0	172.6	1.201	0.0	172.6

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	66.055	18.691	1 year 120 minute winter	15.050	5.986
1 year 15 minute winter	46.355	18.691	1 year 180 minute summer	19.341	4.977
1 year 30 minute summer	42.923	12.146	1 year 180 minute winter	12.572	4.977
1 year 30 minute winter	30.121	12.146	1 year 240 minute summer	16.336	4.317
1 year 60 minute summer	29.412	7.773	1 year 240 minute winter	10.853	4.317
1 year 60 minute winter	19.541	7.773	1 year 360 minute summer	13.516	3.478
1 year 120 minute summer	22.653	5.986	1 year 360 minute winter	8.785	3.478

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 480 minute summer	11.167	2.951	30 year 1440 minute summer	12.250	3.283
1 year 480 minute winter	7.419	2.951	30 year 1440 minute winter	8.233	3.283
1 year 600 minute summer	9.434	2.581	30 year +45% CC 15 minute summer	380.012	107.530
1 year 600 minute winter	6.446	2.581	30 year +45% CC 15 minute winter	266.675	107.530
1 year 720 minute summer	8.593	2.303	30 year +45% CC 30 minute summer	253.579	71.754
1 year 720 minute winter	5.775	2.303	30 year +45% CC 30 minute winter	177.950	71.754
1 year 960 minute summer	7.245	1.908	30 year +45% CC 60 minute summer	174.078	46.004
1 year 960 minute winter	4.799	1.908	30 year +45% CC 60 minute winter	115.654	46.004
1 year 1440 minute summer	5.404	1.448	30 year +45% CC 120 minute summer	106.560	28.161
1 year 1440 minute winter	3.632	1.448	30 year +45% CC 120 minute winter	70.796	28.161
30 year 15 minute summer	262.078	74.159	30 year +45% CC 180 minute summer	81.924	21.082
30 year 15 minute winter	183.914	74.159	30 year +45% CC 180 minute winter	53.253	21.082
30 year 30 minute summer	174.882	49.486	30 year +45% CC 240 minute summer	64.957	17.166
30 year 30 minute winter	122.724	49.486	30 year +45% CC 240 minute winter	43.156	17.166
30 year 60 minute summer	120.054	31.727	30 year +45% CC 360 minute summer	50.001	12.867
30 year 60 minute winter	79.761	31.727	30 year +45% CC 360 minute winter	32.502	12.867
30 year 120 minute summer	73.490	19.421	30 year +45% CC 480 minute summer	39.658	10.481
30 year 120 minute winter	48.825	19.421	30 year +45% CC 480 minute winter	26.348	10.481
30 year 180 minute summer	56.499	14.539	30 year +45% CC 600 minute summer	32.670	8.936
30 year 180 minute winter	36.726	14.539	30 year +45% CC 600 minute winter	22.322	8.936
30 year 240 minute summer	44.798	11.839	30 year +45% CC 720 minute summer	29.266	7.844
30 year 240 minute winter	29.763	11.839	30 year +45% CC 720 minute winter	19.668	7.844
30 year 360 minute summer	34.483	8.874	30 year +45% CC 960 minute summer	24.245	6.384
30 year 360 minute winter	22.415	8.874	30 year +45% CC 960 minute winter	16.060	6.384
30 year 480 minute summer	27.351	7.228	30 year +45% CC 1440 minute summer	17.763	4.761
30 year 480 minute winter	18.171	7.228	30 year +45% CC 1440 minute winter	11.938	4.761
30 year 600 minute summer	22.531	6.163	100 year 15 minute summer	333.501	94.369
30 year 600 minute winter	15.395	6.163	100 year 15 minute winter	234.036	94.369
30 year 720 minute summer	20.183	5.409	100 year 30 minute summer	225.051	63.682
30 year 720 minute winter	13.564	5.409	100 year 30 minute winter	157.931	63.682
30 year 960 minute summer	16.721	4.403	100 year 60 minute summer	155.677	41.141
30 year 960 minute winter	11.076	4.403	100 year 60 minute winter	103.428	41.141

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 120 minute summer	93.489	24.706	100 year +45% CC 30 minute winter	229.000	92.339
100 year 120 minute winter	62.112	24.706	100 year +45% CC 60 minute summer	225.732	59.654
100 year 180 minute summer	71.271	18.340	100 year +45% CC 60 minute winter	149.971	59.654
100 year 180 minute winter	46.328	18.340	100 year +45% CC 120 minute summer	135.559	35.824
100 year 240 minute summer	56.271	14.871	100 year +45% CC 120 minute winter	90.062	35.824
100 year 240 minute winter	37.385	14.871	100 year +45% CC 180 minute summer	103.343	26.594
100 year 360 minute summer	43.213	11.120	100 year +45% CC 180 minute winter	67.175	26.594
100 year 360 minute winter	28.090	11.120	100 year +45% CC 240 minute summer	81.592	21.562
100 year 480 minute summer	34.329	9.072	100 year +45% CC 240 minute winter	54.208	21.562
100 year 480 minute winter	22.807	9.072	100 year +45% CC 360 minute summer	62.659	16.124
100 year 600 minute summer	28.355	7.756	100 year +45% CC 360 minute winter	40.730	16.124
100 year 600 minute winter	19.374	7.756	100 year +45% CC 480 minute summer	49.777	13.155
100 year 720 minute summer	25.477	6.828	100 year +45% CC 480 minute winter	33.070	13.155
100 year 720 minute winter	17.122	6.828	100 year +45% CC 600 minute summer	41.115	11.246
100 year 960 minute summer	21.232	5.591	100 year +45% CC 600 minute winter	28.092	11.246
100 year 960 minute winter	14.065	5.591	100 year +45% CC 720 minute summer	36.941	9.901
100 year 1440 minute summer	15.667	4.199	100 year +45% CC 720 minute winter	24.827	9.901
100 year 1440 minute winter	10.529	4.199	100 year +45% CC 960 minute summer	30.787	8.107
100 year +45% CC 15 minute summer	483.576	136.835	100 year +45% CC 960 minute winter	20.394	8.107
100 year +45% CC 15 minute winter	339.352	136.835	100 year +45% CC 1440 minute summer	22.717	6.088
100 year +45% CC 30 minute summer	326.324	92.339	100 year +45% CC 1440 minute winter	15.267	6.088

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW2.1	10	57.712	0.072	10.2	0.0205	0.0000	OK
15 minute summer	SW2.2	10	57.392	0.065	15.3	0.0183	0.0000	OK
15 minute summer	SW1.6	10	56.924	0.069	45.9	0.0784	0.0000	OK
15 minute summer	SW1.5	10	57.041	0.105	25.5	0.0297	0.0000	OK
15 minute summer	SW1.4	10	57.302	0.109	20.6	0.0308	0.0000	OK
15 minute summer	SW1.3	10	57.340	0.100	15.6	0.0284	0.0000	OK
15 minute summer	SW1.2	10	57.404	0.073	10.4	0.0206	0.0000	OK
15 minute summer	SW1.1	10	57.525	0.059	5.2	0.0168	0.0000	OK
15 minute summer	SW1.0	10	57.597	0.059	5.2	0.0167	0.0000	OK
15 minute summer	SW1.7	11	56.548	0.348	45.7	0.8862	0.0000	SURCHARGED
120 minute summer	Attenuation	74	56.456	0.056	10.5	6.9509	0.0000	OK
15 minute summer	S12/2	11	56.261	0.082	13.3	0.0000	0.0000	OK
15 minute summer	SW2.0	10	57.711	0.011	0.2	0.0032	0.0000	OK
15 minute summer	SW3.0	11	56.470	0.080	25.3	0.1406	0.0000	OK
15 minute summer	SW3.1	12	56.543	0.223	27.5	0.3933	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW2.1	2.001	SW2.2	10.1	0.942	0.214	0.3078	
15 minute summer	SW2.2	2.002	SW1.6	15.3	1.415	0.094	0.1642	
15 minute summer	SW1.6	1.006	SW1.7	45.7	1.146	0.053	0.6712	
15 minute summer	SW1.5	1.005	SW1.6	25.4	1.183	0.111	0.3531	
15 minute summer	SW1.4	1.004	SW1.5	20.3	0.916	0.259	0.4748	
15 minute summer	SW1.3	1.003	SW1.4	15.4	0.707	0.198	0.2062	
15 minute summer	SW1.2	1.002	SW1.3	10.4	0.615	0.132	0.3076	
15 minute summer	SW1.1	1.001	SW1.2	5.2	0.640	0.142	0.0976	
15 minute summer	SW1.0	1.000	SW1.1	5.2	0.631	0.141	0.1185	
15 minute summer	SW1.7	1.007	S12/2	13.3	0.915	0.291	0.0394	17.7
15 minute summer	Attenuation	3.000	SW3.0	-26.1	-1.168	-0.125	0.0675	
15 minute summer	SW2.0	2.000	SW2.1	-0.2	-0.050	-0.005	0.0423	
15 minute summer	SW3.0	3.001	SW3.1	-25.3	-0.545	-0.153	1.2816	
15 minute summer	SW3.1	3.002	SW1.7	-27.5	-0.277	-0.128	2.8113	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW2.1	10	57.809	0.169	40.4	0.0478	0.0000	OK
15 minute summer	SW2.2	10	57.467	0.140	60.8	0.0396	0.0000	OK
15 minute summer	SW1.6	10	57.014	0.159	181.2	0.1793	0.0000	OK
15 minute summer	SW1.5	10	57.152	0.216	100.2	0.0611	0.0000	OK
15 minute summer	SW1.4	10	57.464	0.271	80.5	0.0766	0.0000	OK
15 minute summer	SW1.3	10	57.507	0.267	60.5	0.0755	0.0000	OK
15 minute summer	SW1.2	10	57.530	0.199	40.8	0.0564	0.0000	OK
15 minute summer	SW1.1	10	57.596	0.130	20.5	0.0368	0.0000	OK
15 minute summer	SW1.0	10	57.668	0.130	20.5	0.0369	0.0000	OK
60 minute winter	SW1.7	55	56.912	0.712	83.9	1.8130	0.0000	SURCHARGED
60 minute winter	Attenuation	56	56.912	0.512	60.7	64.0028	0.0000	SURCHARGED
60 minute summer	S12/2	44	56.267	0.088	15.0	0.0000	0.0000	OK
15 minute summer	SW2.0	10	57.809	0.109	0.6	0.0310	0.0000	OK
60 minute winter	SW3.0	56	56.912	0.522	64.7	0.9224	0.0000	SURCHARGED
60 minute winter	SW3.1	55	56.912	0.592	68.0	1.0465	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW2.1	2.001	SW2.2	40.3	1.308	0.850	0.8797	
15 minute summer	SW2.2	2.002	SW1.6	60.8	2.018	0.375	0.4579	
15 minute summer	SW1.6	1.006	SW1.7	180.0	1.610	0.207	0.9548	
15 minute summer	SW1.5	1.005	SW1.6	99.9	1.672	0.439	1.0146	
15 minute summer	SW1.4	1.004	SW1.5	79.7	1.292	1.017	1.3083	
15 minute summer	SW1.3	1.003	SW1.4	60.0	0.902	0.768	0.6278	
15 minute summer	SW1.2	1.002	SW1.3	40.0	0.722	0.510	1.0523	
15 minute summer	SW1.1	1.001	SW1.2	20.3	0.897	0.556	0.2788	
15 minute summer	SW1.0	1.000	SW1.1	20.5	0.868	0.557	0.3398	
60 minute summer	SW1.7	1.007	S12/2	15.0	0.945	0.328	0.0431	121.6
15 minute summer	Attenuation	3.000	SW3.0	-157.2	-1.884	-0.751	0.5311	
15 minute summer	SW2.0	2.000	SW2.1	0.7	0.059	0.015	0.1838	
15 minute summer	SW3.0	3.001	SW3.1	-163.0	-1.328	-0.986	3.9585	
15 minute summer	SW3.1	3.002	SW1.7	-163.9	-1.035	-0.762	4.2651	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW2.1	10	57.988	0.348	58.6	0.0985	0.0000	SURCHARGED
15 minute summer	SW2.2	10	57.503	0.176	87.6	0.0498	0.0000	OK
60 minute winter	SW1.6	59	57.281	0.426	121.6	0.4815	0.0000	OK
60 minute winter	SW1.5	59	57.281	0.345	67.7	0.0975	0.0000	OK
15 minute summer	SW1.4	10	57.641	0.448	115.2	0.1267	0.0000	SURCHARGED
15 minute summer	SW1.3	10	57.738	0.498	86.2	0.1408	0.0000	SURCHARGED
15 minute summer	SW1.2	10	57.805	0.474	57.3	0.1341	0.0000	SURCHARGED
15 minute summer	SW1.1	10	57.856	0.390	28.4	0.1105	0.0000	SURCHARGED
15 minute summer	SW1.0	10	57.913	0.375	29.7	0.1062	0.0000	SURCHARGED
60 minute winter	SW1.7	59	57.280	1.080	121.6	2.7497	0.0000	SURCHARGED
60 minute winter	Attenuation	60	57.282	0.882	100.8	110.2944	0.0000	SURCHARGED
600 minute summer	S12/2	420	56.267	0.088	15.0	0.0000	0.0000	OK
15 minute summer	SW2.0	10	57.989	0.289	3.2	0.0818	0.0000	SURCHARGED
60 minute winter	SW3.0	60	57.282	0.892	102.3	1.5767	0.0000	SURCHARGED
60 minute winter	SW3.1	60	57.281	0.961	103.7	1.6985	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW2.1	2.001	SW2.2	57.9	1.460	1.222	1.0959	
15 minute summer	SW2.2	2.002	SW1.6	87.6	2.129	0.540	0.6721	
15 minute summer	SW1.6	1.006	SW1.7	250.2	1.651	0.288	1.3324	
15 minute summer	SW1.5	1.005	SW1.6	142.6	1.655	0.626	2.0620	
15 minute summer	SW1.4	1.004	SW1.5	114.7	1.635	1.463	1.4451	
15 minute summer	SW1.3	1.003	SW1.4	85.5	1.214	1.094	0.6642	
15 minute summer	SW1.2	1.002	SW1.3	56.5	0.802	0.720	1.2791	
15 minute summer	SW1.1	1.001	SW1.2	29.4	0.890	0.805	0.4794	
15 minute summer	SW1.0	1.000	SW1.1	28.4	0.908	0.773	0.5677	
600 minute summer	SW1.7	1.007	S12/2	15.0	0.945	0.328	0.0431	344.8
15 minute summer	Attenuation	3.000	SW3.0	-220.2	-1.849	-1.052	0.5311	
15 minute summer	SW2.0	2.000	SW2.1	-3.2	-0.080	-0.067	0.2861	
15 minute summer	SW3.0	3.001	SW3.1	-228.9	-1.566	-1.386	4.1964	
15 minute summer	SW3.1	3.002	SW1.7	-230.7	-1.456	-1.072	4.2651	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW2.1	10	57.879	0.239	51.5	0.0678	0.0000	SURCHARGED
15 minute summer	SW2.2	10	57.487	0.160	75.7	0.0453	0.0000	OK
60 minute winter	SW1.6	59	57.154	0.299	109.0	0.3387	0.0000	OK
15 minute summer	SW1.5	10	57.202	0.266	125.0	0.0754	0.0000	OK
15 minute summer	SW1.4	10	57.557	0.364	99.1	0.1031	0.0000	SURCHARGED
15 minute summer	SW1.3	10	57.628	0.388	73.4	0.1099	0.0000	SURCHARGED
15 minute summer	SW1.2	10	57.677	0.346	49.8	0.0978	0.0000	SURCHARGED
15 minute summer	SW1.1	10	57.711	0.245	25.3	0.0693	0.0000	SURCHARGED
15 minute summer	SW1.0	10	57.757	0.219	26.0	0.0619	0.0000	OK
60 minute winter	SW1.7	59	57.154	0.954	109.0	2.4290	0.0000	SURCHARGED
60 minute winter	Attenuation	60	57.156	0.756	87.1	94.4564	0.0000	SURCHARGED
240 minute summer	S12/2	212	56.267	0.088	15.0	0.0000	0.0000	OK
15 minute summer	SW2.0	10	57.882	0.182	1.1	0.0515	0.0000	OK
60 minute winter	SW3.0	59	57.156	0.766	89.8	1.3528	0.0000	SURCHARGED
60 minute winter	SW3.1	59	57.155	0.835	91.7	1.4752	0.0000	SURCHARGED

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW2.1	2.001	SW2.2	49.7	1.320	1.049	1.0678	
15 minute summer	SW2.2	2.002	SW1.6	75.3	2.116	0.464	0.5409	
15 minute summer	SW1.6	1.006	SW1.7	221.4	1.638	0.255	1.1292	
15 minute summer	SW1.5	1.005	SW1.6	123.2	1.622	0.541	1.5059	
15 minute summer	SW1.4	1.004	SW1.5	99.0	1.427	1.264	1.4086	
15 minute summer	SW1.3	1.003	SW1.4	73.1	1.038	0.935	0.6642	
15 minute summer	SW1.2	1.002	SW1.3	48.9	0.732	0.624	1.2791	
15 minute summer	SW1.1	1.001	SW1.2	25.9	0.878	0.710	0.4794	
15 minute summer	SW1.0	1.000	SW1.1	25.3	0.892	0.689	0.5653	
240 minute summer	SW1.7	1.007	S12/2	15.0	0.945	0.328	0.0431	228.4
15 minute summer	Attenuation	3.000	SW3.0	-192.6	-1.804	-0.920	0.5311	
15 minute summer	SW2.0	2.000	SW2.1	-1.1	0.052	-0.023	0.2668	
15 minute summer	SW3.0	3.001	SW3.1	-202.6	-1.459	-1.226	4.1964	
15 minute summer	SW3.1	3.002	SW1.7	-204.5	-1.291	-0.950	4.2651	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW2.1	10	58.310	0.670	74.6	0.1896	0.0000	FLOOD RISK
120 minute winter	SW2.2	116	58.127	0.800	32.0	0.2264	0.0000	SURCHARGED
120 minute winter	SW1.6	116	58.127	1.272	96.2	1.4383	0.0000	SURCHARGED
120 minute winter	SW1.5	116	58.127	1.191	53.7	0.3370	0.0000	SURCHARGED
120 minute winter	SW1.4	116	58.128	0.935	43.0	0.2645	0.0000	SURCHARGED
15 minute summer	SW1.3	11	58.173	0.933	100.2	0.2640	0.0000	SURCHARGED
15 minute summer	SW1.2	11	58.264	0.933	66.7	0.2639	0.0000	SURCHARGED
15 minute summer	SW1.1	11	58.337	0.871	33.3	0.2466	0.0000	FLOOD RISK
15 minute summer	SW1.0	11	58.413	0.875	37.7	0.2476	0.0000	FLOOD RISK
120 minute winter	SW1.7	116	58.126	1.926	92.4	4.9025	0.0000	FLOOD RISK
120 minute winter	Attenuation	114	58.126	1.726	72.8	150.0625	0.0000	SURCHARGED
180 minute summer	S12/2	88	56.267	0.088	15.0	0.0000	0.0000	OK
15 minute summer	SW2.0	10	58.310	0.610	3.7	0.1727	0.0000	FLOOD RISK
120 minute winter	SW3.0	116	58.126	1.736	73.9	3.0679	0.0000	SURCHARGED
120 minute winter	SW3.1	116	58.126	1.806	75.3	3.1920	0.0000	FLOOD RISK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW2.1	2.001	SW2.2	68.3	1.718	1.441	1.1357	
15 minute summer	SW2.2	2.002	SW1.6	103.8	2.099	0.640	1.0703	
15 minute summer	SW1.6	1.006	SW1.7	306.4	1.934	0.353	1.4526	
15 minute summer	SW1.5	1.005	SW1.6	166.5	1.526	0.731	2.5717	
15 minute summer	SW1.4	1.004	SW1.5	131.8	1.872	1.682	1.5051	
15 minute summer	SW1.3	1.003	SW1.4	99.4	1.411	1.271	0.6642	
15 minute summer	SW1.2	1.002	SW1.3	66.8	0.948	0.852	1.2791	
15 minute summer	SW1.1	1.001	SW1.2	35.8	0.919	0.980	0.4794	
15 minute summer	SW1.0	1.000	SW1.1	33.3	0.928	0.906	0.5677	
180 minute summer	SW1.7	1.007	S12/2	15.0	0.945	0.328	0.0431	304.7
15 minute summer	Attenuation	3.000	SW3.0	-272.1	-1.797	-1.300	0.5311	
15 minute summer	SW2.0	2.000	SW2.1	9.7	0.244	0.204	0.2861	
15 minute summer	SW3.0	3.001	SW3.1	-281.9	-1.819	-1.706	4.1964	
15 minute summer	SW3.1	3.002	SW1.7	-287.5	-1.815	-1.336	4.2651	

Pipeline Schedule

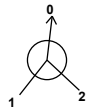
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.001	28.555	120.0	225	Circular	58.600	57.640	0.735	58.600	57.402	0.973
1.000	14.273	198.2	225	Circular	58.600	57.538	0.837	58.600	57.466	0.909
1.001	12.054	200.9	225	Circular	58.600	57.466	0.909	58.600	57.406	0.969
1.002	18.164	199.6	300	Circular	58.600	57.331	0.969	58.600	57.240	1.060
1.003	9.432	200.7	300	Circular	58.600	57.240	1.060	58.600	57.193	1.107
1.004	21.374	199.8	300	Circular	58.600	57.193	1.107	58.600	57.086	1.214
1.005	16.231	200.4	450	Circular	58.600	56.936	1.214	58.600	56.855	1.295
2.002	15.199	47.2	300	Circular	58.600	57.327	0.973	58.600	57.005	1.295
1.006	9.168	14.0	450	Circular	58.600	56.855	1.295	58.250	56.200	1.600
1.007	2.712	129.1	225	Circular	58.250	56.200	1.825	58.200	56.179	1.796
3.000	2.514	251.4	300	Manifold	58.600	56.400	1.900	58.600	56.390	1.910
2.000	7.193	119.9	225	Circular	58.600	57.700	0.675	58.600	57.640	0.735
3.001	26.485	378.4	450	Circular	58.600	56.390	1.760	58.400	56.320	1.630
3.002	26.919	224.3	450	Circular	58.400	56.320	1.630	58.250	56.200	1.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.001	SW2.1	600	Manhole	Adoptable	SW2.2	600	Manhole	Adoptable
1.000	SW1.0	600	Manhole	Adoptable	SW1.1	600	Manhole	Adoptable
1.001	SW1.1	600	Manhole	Adoptable	SW1.2	600	Manhole	Adoptable
1.002	SW1.2	600	Manhole	Adoptable	SW1.3	600	Manhole	Adoptable
1.003	SW1.3	600	Manhole	Adoptable	SW1.4	600	Manhole	Adoptable
1.004	SW1.4	600	Manhole	Adoptable	SW1.5	600	Manhole	Adoptable
1.005	SW1.5	600	Manhole	Adoptable	SW1.6	1200	Manhole	Adoptable
2.002	SW2.2	600	Manhole	Adoptable	SW1.6	1200	Manhole	Adoptable
1.006	SW1.6	1200	Manhole	Adoptable	SW1.7	1800	Manhole	Adoptable
1.007	SW1.7	1800	Manhole	Adoptable	S12/2	1200	Manhole	Adoptable
3.000	Attenuation		Junction		SW3.0	1500	Manhole	Adoptable
2.000	SW2.0	600	Manhole	Adoptable	SW2.1	600	Manhole	Adoptable
3.001	SW3.0	1500	Manhole	Adoptable	SW3.1	1500	Manhole	Adoptable
3.002	SW3.1	1500	Manhole	Adoptable	SW1.7	1800	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW2.1	415464.354	417639.371	58.600	0.960	600		1	2.000	57.640	225
							0	2.001	57.640	225
SW2.2	415485.982	417658.016	58.600	1.273	600		1	2.001	57.402	225
							0	2.002	57.327	300
SW1.6	415498.251	417668.594	58.600	1.745	1200		1	2.002	57.005	300
							2	1.005	56.855	450
							0	1.006	56.855	450
SW1.5	415508.849	417656.301	58.600	1.664	600		1	1.004	57.086	300
							0	1.005	56.936	450
SW1.4	415522.805	417640.113	58.600	1.407	600		1	1.003	57.193	300
							0	1.004	57.193	300
SW1.3	415529.617	417632.211	58.600	1.360	600		1	1.002	57.240	300
							0	1.003	57.240	300
SW1.2	415517.507	417618.112	58.600	1.269	600		1	1.001	57.406	225
							0	1.002	57.331	300
SW1.1	415511.879	417611.445	58.600	1.134	600		1	1.000	57.466	225
							0	1.001	57.466	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW1.0	415500.506	417601.641	58.600	1.062	600				
						0	1.000	57.538	225
SW1.7	415491.507	417674.885	58.250	2.050	1800		1	3.002	56.200	450
							2	1.006	56.200	450
							0	1.007	56.200	225
Attenuation	415493.643	417631.716	58.600	2.200					
						0	3.000	56.400	300
S12/2	415491.826	417677.578	58.200	2.021	1200		1	1.007	56.179	225
SW2.0	415458.906	417634.674	58.600	0.900	600				
						0	2.000	57.700	225
SW3.0	415492.135	417633.686	58.600	2.210	1500		1	3.000	56.390	300
							0	3.001	56.390	450
SW3.1	415474.841	417653.746	58.400	2.080	1500		1	3.001	56.320	450
							0	3.002	56.320	450

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.840	40.0	150	Circular	58.600	57.800	0.650	58.600	57.554	0.896
1.001	6.468	99.5	150	Circular	58.600	57.554	0.896	58.600	57.489	0.961
1.002	9.810	100.1	150	Circular	58.600	57.489	0.961	58.600	57.391	1.059
1.003	41.982	42.8	150	Circular	58.600	57.391	1.059	58.300	56.411	1.739
1.004	2.300	1.2	150	Circular	58.300	56.411	1.739	58.250	54.568	3.532
2.000	15.468	99.8	150	Circular	58.600	56.750	1.700	58.600	56.595	1.855
2.001	5.396	99.9	150	Circular	58.600	56.595	1.855	58.600	56.541	1.909
3.000	7.077	99.7	150	Circular	58.600	57.163	1.287	58.600	57.092	1.358
3.001	1.331	102.4	150	Circular	58.600	57.092	1.358	58.600	57.079	1.371
3.002	6.709	100.1	150	Circular	58.600	57.079	1.371	58.600	57.012	1.438
3.003	5.000	100.0	150	Circular	58.600	57.012	1.438	58.600	56.962	1.488
3.004	7.096	4.1	150	Circular	58.600	56.962	1.488	58.600	55.225	3.225
3.001a	1.837	8.8	150	Circular	58.600	57.300	1.150	58.600	57.092	1.358
1.003a	1.328	22.5	150	Circular	58.600	57.450	1.000	58.600	57.391	1.059
9.000	52.855	155.9	225	Circular	58.600	55.150	3.225	58.500	54.811	3.464

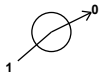
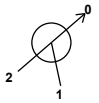
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	FW1.0	450	Manhole	Adoptable	FW1.1	1200	Manhole	Adoptable
1.001	FW1.1	1200	Manhole	Adoptable	FW1.2	300	Manhole	Adoptable
1.002	FW1.2	300	Manhole	Adoptable	FW1.3	450	Manhole	Adoptable
1.003	FW1.3	450	Manhole	Adoptable	FW1.4	450	Manhole	Adoptable
1.004	FW1.4	450	Manhole	Adoptable	FW1.5	1200	Manhole	Adoptable
2.000	FW2.0	450	Manhole	Adoptable	FW2.1	450	Manhole	Adoptable
2.001	FW2.1	450	Manhole	Adoptable	FW2.2	450	Manhole	Adoptable
3.000	FW3.0	1200	Manhole	Adoptable	FW3.1	450	Manhole	Adoptable
3.001	FW3.1	450	Manhole	Adoptable	FW3.2	450	Manhole	Adoptable
3.002	FW3.2	450	Manhole	Adoptable	FW3.3	1200	Manhole	Adoptable
3.003	FW3.3	1200	Manhole	Adoptable	FW3.4	450	Manhole	Adoptable
3.004	FW3.4	450	Manhole	Adoptable	F8	1200	Manhole	Adoptable
3.001a	FW3.1a	300	Manhole	Adoptable	FW3.1	450	Manhole	Adoptable
1.003a	FW1.3a	450	Manhole	Adoptable	FW1.3	450	Manhole	Adoptable
9.000	F8	1200	Manhole	Adoptable	F9/1	1200	Manhole	Adoptable

Pipeline Schedule

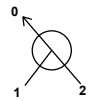
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
9.001	56.934	179.0	225	Circular	58.500	54.811	3.464	58.250	54.493	3.532
9.002	17.302	178.4	225	Circular	58.250	54.493	3.532	58.200	54.396	3.579
2.002	13.034	100.3	150	Circular	58.600	56.541	1.909	58.300	56.411	1.739

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
9.001	F9/1	1200	Manhole	Adoptable	FW1.5	1200	Manhole	Adoptable
9.002	FW1.5	1200	Manhole	Adoptable	F9/2	1200	Manhole	Adoptable
2.002	FW2.2	450	Manhole	Adoptable	FW1.4	450	Manhole	Adoptable

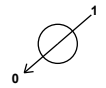
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FW1.0	415446.810	417627.346	58.600	0.800	450		0	1.000	57.800	150
FW1.1	415454.263	417633.771	58.600	1.046	1200		1	1.000	57.554	150
							0	1.001	57.554	150
FW1.2	415460.065	417636.631	58.600	1.111	300		1	1.001	57.489	150
							0	1.002	57.489	150
FW1.3	415467.495	417643.036	58.600	1.209	450		1	1.003a	57.391	150
							2	1.002	57.391	150
							0	1.003	57.391	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FW1.3a	415467.774	417641.738	58.600	1.150	450				
						0	1.003a	57.450	150
FW1.4	415499.292	417670.449	58.300	1.889	450		1	2.002	56.411	150
							2	1.003	56.411	150
						0	1.004	56.411	150
FW1.5	415500.688	417672.276	58.250	3.757	1200		1	1.004	54.568	150
							2	9.001	54.493	225
						0	9.002	54.493	225
FW2.1	415511.326	417656.490	58.600	2.005	450		1	2.000	56.595	150
						0	2.001	56.595	150
FW2.0	415521.426	417644.776	58.600	1.850	450				
						0	2.000	56.750	150
FW3.0	415507.694	417604.371	58.600	1.437	1200				
						0	3.000	57.163	150
FW3.1	415502.334	417599.750	58.600	1.508	450		1	3.001a	57.092	150
							2	3.000	57.092	150
						0	3.001	57.092	150
FW3.1a	415501.426	417601.348	58.600	1.300	300				
						0	3.001a	57.300	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FW3.2	415501.326	417598.881	58.600	1.521	450	1	3.001	57.079	150
									
						0	3.002	57.079	150
FW3.3	415496.244	417594.500	58.600	1.588	1200	1	3.002	57.012	150
									
						0	3.003	57.012	150
FW3.4	415499.509	417590.713	58.600	1.638	450	1	3.003	56.962	150
									
						0	3.004	56.962	150
F8	415505.687	417587.223	58.600	3.450	1200	1	3.004	55.225	150
									
						0	9.000	55.150	225
F9/1	415537.864	417629.155	58.500	3.689	1200	1	9.000	54.811	225
									
						0	9.001	54.811	225
F9/2	415489.390	417685.381	58.200	3.804	1200	1	9.002	54.396	225
									
FW2.2	415507.803	417660.578	58.600	2.059	450	1	2.001	56.541	150
									
						0	2.002	56.541	150

Appendix H – Drainage O&M Manual

Manholes and Inspection Chambers

Description

Manholes providing rodding and jetting access to pipe work.

Normally manholes, in similarity to inspection chambers, are designed for access by operatives. Manholes must only be accessed after a risk assessment, and the implementation of a safe system of work, which identifies the specific risk to confined space.

Maintenance Issues

It is not likely that Manholes will present maintenance issues. However, they allow both the access to the drainage infrastructure and allow visual inspection from the surface of any key maintenance issues.

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Remove covers and ensure that there are no blockages. Inspect and ascertain any parts that are not operating correctly and resolve.	For 3 months after installation
	Check covers do not need repairing.	Monthly
	Check drainage is running freely by inspecting manholes and inspection chambers.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Suction jetting and cleansing (to Water Jetting Association standards) and CCTV where appropriate.	2 – 4 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System recovery following a pollution event • Manhole Cover replacement • Repairs to brickwork or concrete • Chanel repair	When required (tasks to repair problems due to wear, damage or vandalism)

Catchpits

Description

Catchpits are similar to manholes, however, they include a sump to the base which is designed to capture silt and prevent it reaching other parts of the drainage network. Catchpits provide a useful location to remove silt for drainage networks. Catchpits must only be accessed after a risk assessment, and the implementation of a safe system of work, which identifies the specific risk to confined space.

Maintenance Issues

If the silt captured in catchpits does not get removed regularly it will cause silt to move downstream to other part of the drainage network, some of which may be difficult to access, or totally inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Remove manhole covers and ensure that there are no blockages. Inspect and identify any parts that are not operating correctly and resolve. Inspect silt storage in sump. Remove silt as appropriate using subcontractor with vacuum extraction plant.	For 3 months after installation
	Check covers do not need repairing. Repair/replace as required.	Monthly
	Inspect catchpits to ensure that the drainage is running freely, and free of debris. Inspect silt storage in sump. Remove silt as appropriate using subcontractor with vacuum extraction plant.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Suction sweeping and cleansing (to Water Jetting Association standards) and CCTV where appropriate. Resolve any chamber structural defects, or any defects that could reduce the free flow of water.	2 – 4 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System recovery following a pollution event • Manhole Cover Replacement • Repairs to brickwork or concrete	When required (tasks to repair problems due to wear, damage or vandalism)

Gullies

Description

Surface Water is drained over impermeable areas towards grated gullies at low points and water is carried to below ground pipework.

Maintenance Issues

Gullies can become blocked by silt or debris, causing flooding.

Gullies include integral silt traps which can cause siltation of downstream drainage infrastructure if the appropriate maintenance is not undertaken.

Gullies frequently include a trapped outlet which prevents liquids lighter than water (ie oil and fuel) departing the gully. If silt and light liquids do not get removed regularly silt and oil will move downstream to other areas of the drainage network, some of which may be difficult to access, or totally inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Inspect to ensure that there are no blockages at surface level, and that the outfall is operating efficiently. Inspect and identify any parts that are not operating correctly and resolve.	For 3 months after installation
	Check that there are no blockages at surface level.	Monthly
	Remove covers to check for blockages or siltation.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Remove oil and silt using specialist vacuum extraction plant.	1 – 2 Years
Remedial maintenance	• Silt removal • Inlet/outlet repair • Erosion repairs • System rehabilitation following a pollution event • Cover replacement • Structural failure of gully pot • Ensure that impermeable surfaces surrounding linear drains have not settled below top of gully cover level, causing ponding	When required (tasks to repair problems due to wear, damage or vandalism)

Pipework

Description

Below ground drainage pipework connects drainage inlets (gullies, linear drains etc) to manholes as well as providing connections between manholes.

Maintenance Issues

Pipes could become blocked by silt, debris fat, grease, or collapse. In addition, it's possible for pipe joints to become displaced or for roots to grow from the surrounding ground into the pipes.

These factors can cause a reduction in, or loss of, the hydraulic capability of the pipes which could cause flooding to land and buildings.

Defects in pipes could cause a reduction in stability to ground underlying foundations, thus, causing settlement and damage to buildings and external surfaces.

The material of pipes and associated couplings can be damaged if aggressive liquids are passed through the pipes.

It is recommended that trees are not planted within 3m of pipes to reduce the risk of root ingress.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Inspect and identify any parts that are not operating correctly and resolve.	For 3 months after installation.
	Monitor working of drainage at ground level. The indications damaged pipework's may include localised flooding or emission of smells.	Monthly
	Remove manholes covers to check for blockages.	Every 6 months
Occasional maintenance	CCTV pipework, clean to WRC Sewer Jetting Code of Practice. Resolve issues as appropriate.	1 – 2 Years
Remedial maintenance	• Silt removal. • Fat and Grease removal. • Erosion repairs. • Joint displacement. • Structural failure, cracking or collapse. • System rehabilitation following a pollution event.	When required (tasks to repair problems due to wear, damage or vandalism)

Vortex Controls

Description

Vortex controls, often called Hydrobrakes, are installed in some manholes to limit the rate of flow. Vortex controls are normally constructed in steel and installed in a manhole with a sump.

Maintenance Issues

Vortex controls could become blocked by debris, plastic bags or other sheet material. If silt is allowed to build up in the sump the operation of the device could be impeeded causing flooding upstream.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Check manufacturer's specification. Inspect and identify any parts that are not operating, consult supplier and remediate as required.	For 3 months after installation
	Monitor working of drainage at ground level. Where localised flooding occurs, check the condition of all system elements.	Monthly
	Remove manholes covers to check for blockages. Remove sediment from pre-treatment structures, gullies, catchpits etc.	Every 6 months and following the leaf fall in autumn.
Occasional maintenance	Clean to WRC Sewer Jetting Code of Practice. Resolve issues as appropriate.	1 – 2 Years
Remedial maintenance	Inspect, and remedy to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Fat and Grease Separators

Description

Fat and Grease separators, separate fat and grease from oil emitting facilities such as kitchens and factories, preventing fat and grease entering the public sewerage network. This is a requirement of Building Regulations (Part H), The Water Industry Act (1991).

Maintenance Issues

For a fat and grease separator to operate efficiently, and prevent pollutants leaving a site, the contained fat and grease must be removed on a regular basis. It is recommended that maintenance is proactive, rather than reactive. The party responsible for maintenance, usually the owner or occupier, should consult the manufacturer to identify a suitable maintenance regime. Fat and Grease must only be removed by a licenced contractor.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (inc. inspections and monitoring)	Check manufacturer's specification. Inspect and identify any parts that are not operating correctly and remediate as appropriate.	For 3 months after installation
	Monitor working of drainage at ground level. Where localised flooding occurs, check the condition of all system elements.	Monthly
	Check to identify the volume of fat and grease collected, and if appropriate, arrange for removal by a licenced contractor.	Every 6 months or as recommended by the supplier.
Occasional maintenance	Consult manufacturer to obtain details of an approved maintenance contractor. Resolve issues as appropriate.	1 – 2 Years
Remedial maintenance	Inspect, and remedy to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Geocellular Attenuation Storage

Description

Attenuation storage tanks are used to create a below-ground space for the temporary storage of surface water before infiltration, controlled release or use. Geocellular storage crates are advantageous as they allow for spatial versatility as opposed to in situ concrete tanks.

Maintenance Issues

For Geocellular attenuation tanks typical issues relate to the build-up of silt within the tank, causing a decrease in capacity over time.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. Take remedial action as appropriate	For 3 months after installation, then annually.
	Remove debris from the catchment surface (where it may cause a risk to performance)	Monthly
	For systems where rainfall infiltrate into the tank from above, check surface of filter for blockage by sediment, algae or other matter. Remove blockage and replace surface infiltration medium as appropriate.	Annually
	Remove Sediment from pre-treatment structures and/or internal forebays.	Annual, or as needed
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As needed
Monitoring	Check all inlets, outlets, vents and overflows to ensure that they are working as designed.	Annually
	Survey inside of tank for sediment build-up and remove as appropriate.	Every 5 years or as needed.