APPENDIX E

GREENFIELD RUNOFF RATE CALCULATIONS

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Castle Lane	Job No.	L9861	Initial	AW
		Garstang	Date	Feb-21	Checked	JP
		PR3 1RB	Page	1 of 4	Revision	RevA
	Title	Peak Rate of Run-Off Calculation				

Calculation Brief

This spreadsheet has been produced to calculations the peak rate of run-off for surface water. The calculation helps determine changes in peak flow resulting from the development of a greenfield or brownfield site.

Baseline Information & References

The site area is less than 50ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments, 1994 (IoH 124), D.B. Boorman et al, Institute of Hydrology, Report No. 126, Hydrology of Soil Types, 1995 (IoH) and DEFRA/EA Report No. SC030219, Rainfall Runoff Management for Developments, 2013.

The below references have been used in the preparation of these calculations:

- Marshall & Bayliss, IoH Report No. 124, Flood Estimation for Small Catchments, 1994
- D.B. Boorman et al, Institute of Hydrology, Report No. 126, Hydrology of Soil Types, 1995
- DEFRA/EA Report No. SC030219, Rainfall Runoff Management for Developments, 2013.
- IoH, Flood Estimation Handbook (FEH)
- IoH, Flood Studies Report (FSR)
- CIRIA, Report C753, The SuDS Manual Version 6, 2015
- The UK SuDS Online Tool
- NERC, FSSR 2, The Estimation of Low Return Period Flows, IoH, 1977
- NERC, FSSR 14, Review of Regional Growth Curves, IoH, 1983

Proposed Land Use Changes

Changes to the existing site are as follows: Greenfield Site to Brownfield Site

Results Summary

Rate of Run-Off (l/s)			
Event	Greenfield		Proposed Restricted Post-Development Brownfield
Q1	4.9		5.7
QBAR	5.7		5.7
Q10	7.8		5.7
Q30	9.7		5.7
Q100	11.8		5.7
Q100 + 30% CC	15.4		5.7

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SITE AREAS

Existing Impermeable & Permeable Land Cover

Total Site Area: **0.7553** **ha** **7553** **m²**

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	0.0	0.000	0%
Remaining permeable area	7553.0	0.755	100%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Total housing roof area + 10%	1310.0	0.131	17%
Total parking and paved area	849.0	0.085	11%
Total road area	472.0	0.047	6%
Garden & landscaped areas	4922.0	0.492	65%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	2631.0	0.263	35%
Remaining permeable area	4922.0	0.492	65%

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ESTIMATION OF QBAR (GREENFIELD RUNOFF RATE)

IoH Report No. 124 is based on research on small catchments < 25 km2

Their methodology is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For SOIL refer to IoH Report No. 126

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	

SAAR = **1022** mm From UKSuds website (point data)

Soil index based on soil type, SOIL

$$= \frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$$

Where:			
S1	=		%
S2	=		%
S3	=		%
S4	=	**100**	%
S5	=		%
		100	%

UK Suds website provides a value of 4 based on the equivalent Host value. This seems reasonable based on ground investigation.

So, SOIL = **0.47**

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.376	m^3/s
	=	375.9	l/s

Small rural catchments less than 50 ha

The Environment Agency recommends that this method should be used for development sizes from
0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**7553**	m^2
	=	0.008	km^2
	=	0.755	ha
$QBAR_{rural\ site}$	=	0.00568	m^3/s
	=	**5.68**	l/s

Excluding significant open space which would remain disconnected from the positive drainage system during flood events.

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GREENFIELD RETURN PERIODS

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Figure A.1.2 of the DEFRA/EA 2013 guide for UK growth curves from FSSR 14

Region = **10**

Use Figure A1.1 of the DEFRA/EA 2013 guide to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	4.94
2	0.93	5.28
5	1.19	6.76
10	1.38	7.84
25	1.64	9.31
30	1.7	9.65
50	1.85	10.50
100	2.08	11.81
200	2.32	13.17
500	2.73	15.50
1000	3.04	17.26

Interpolation taken from Figure 24.2 (Page 515) SuDS Manual with derives the FSSR14 ordinates

APPENDIX F

SURFACE WATER DRAINAGE CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW01	0.031	5.00	18.962	1200	349608.026	444888.176	1.525
SW03	0.031	5.00	18.710	1200	349617.392	444885.987	1.513
SW04	0.031	5.00	17.965	1200	349627.400	444893.489	1.081
SW05	0.031	5.00	17.937	1200	349629.703	444902.899	1.370
SW09			17.250	1200	349646.071	444898.094	0.927
Inlet			17.250		349651.076	444895.541	1.000
SW02	0.031	5.00	19.049	1200	349614.707	444876.962	1.612
SW06	0.031	5.00	17.711	1200	349635.981	444925.530	0.813
SW07	0.031	5.00	17.796	1200	349632.583	444918.856	0.973
SW08	0.031	5.00	17.841	1200	349630.358	444911.255	1.106
Outlet		5.00	17.250		349691.422	444907.590	1.000
Flow Control			17.250	1800	349693.178	444911.769	1.023
Outfall			17.250		349693.760	444916.466	1.070

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
1.000	SW01	SW03	9.618	0.600	17.437	17.197	40.0	225	50.0
1.001	SW03	SW04	12.508	0.600	17.197	16.884	40.0	225	50.0
1.002	SW04	SW05	9.688	0.600	16.884	16.642	40.0	225	50.0
1.003	SW05	SW09	17.059	0.600	16.567	16.323	70.0	300	49.8
1.004	SW09	Inlet	5.619	0.600	16.323	16.250	77.0	300	49.6
2.000	SW02	SW03	9.416	0.600	17.437	17.317	78.5	225	50.0
3.000	SW06	SW07	7.489	0.600	16.898	16.823	100.0	225	50.0
3.001	SW07	SW08	7.920	0.600	16.823	16.735	90.0	225	50.0
3.002	SW08	SW05	8.382	0.600	16.735	16.642	90.0	225	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)
1.000	2.074	82.5	4.2	1.300	1.288	0.031
1.001	2.074	82.5	12.6	1.288	0.856	0.093
1.002	2.074	82.5	16.8	0.856	1.070	0.124
1.003	1.881	133.0	33.5	1.070	0.627	0.248
1.004	1.794	126.8	33.4	0.627	0.700	0.248
2.000	1.477	58.7	4.2	1.387	1.168	0.031
3.000	1.307	52.0	4.2	0.588	0.748	0.031
3.001	1.379	54.8	8.4	0.748	0.881	0.062
3.002	1.379	54.8	12.6	0.881	1.070	0.093

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
4.000	Outlet	Flow Control	4.533	0.600	16.250	16.227	200.0	300	50.0
4.001	Flow Control	Outfall	4.733	0.600	16.227	16.180	100.0	150	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)
4.000	1.108	78.3	0.0	0.700	0.723	0.000
4.001	1.005	17.8	0.0	0.873	0.920	0.000

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Detailed		

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 %)
2	0	0	0
30	0	0	0
100	40	0	0

Node Flow Control Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	16.227	Product Number	CTL-SHE-0112-5700-1000-5700
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.7	Min Node Diameter (mm)	1200

Node Outlet Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	45.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.250	Main Channel Slope (1:X)	100000.0
Safety Factor	2.0	Time to half empty (mins)	0	Main Channel n	0.600

Inlets

Inlet

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	480.0	0.0	0.500	647.9	0.0	1.000	840.9	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.471	0.034	4.1	0.0523	0.0000	OK
15 minute summer	SW03	10	17.256	0.059	12.3	0.0914	0.0000	OK
15 minute summer	SW04	10	16.957	0.073	16.3	0.1241	0.0000	OK
15 minute summer	SW05	10	16.674	0.107	32.4	0.1690	0.0000	OK
15 minute summer	SW09	10	16.429	0.106	32.4	0.1197	0.0000	OK
180 minute summer	Inlet	112	16.338	0.088	12.8	0.0000	0.0000	OK
15 minute summer	SW02	10	17.479	0.042	4.1	0.0632	0.0000	OK
15 minute summer	SW06	10	16.942	0.044	4.1	0.0825	0.0000	OK
15 minute summer	SW07	10	16.886	0.063	8.2	0.1114	0.0000	OK
15 minute summer	SW08	10	16.813	0.078	12.2	0.1314	0.0000	OK
600 minute summer	Outlet	390	16.325	0.075	4.3	0.0000	0.0000	OK
600 minute summer	Flow Control	390	16.325	0.098	2.0	0.2496	0.0000	OK
600 minute summer	Outfall	390	16.214	0.034	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	4.1	0.689	0.050	0.0581
15 minute summer	SW03	1.001	12.2	1.259	0.148	0.1215
15 minute summer	SW04	1.002	16.2	1.542	0.197	0.1020
15 minute summer	SW05	1.003	32.4	1.455	0.244	0.3808
15 minute summer	SW09	1.004	32.5	2.993	0.256	0.0721
180 minute summer	Inlet	Flow through pond	5.7	0.009	0.141	31.8363
15 minute summer	SW02	2.000	4.1	0.832	0.069	0.0461
15 minute summer	SW06	3.000	4.1	0.569	0.078	0.0541
15 minute summer	SW07	3.001	8.1	0.768	0.148	0.0840
15 minute summer	SW08	3.002	12.1	1.059	0.222	0.0962
600 minute summer	Outlet	4.000	2.0	0.118	0.025	0.0765
600 minute summer	Flow Control	4.001	2.0	0.653	0.112	0.0144

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.483	0.046	7.8	0.0714	0.0000	OK
15 minute summer	SW03	10	17.282	0.085	23.3	0.1305	0.0000	OK
15 minute summer	SW04	10	16.990	0.106	30.9	0.1799	0.0000	OK
15 minute summer	SW05	10	16.723	0.156	61.3	0.2474	0.0000	OK
15 minute summer	SW09	11	16.468	0.145	60.9	0.1640	0.0000	OK
120 minute summer	Inlet	76	16.387	0.137	31.1	0.0000	0.0000	OK
15 minute summer	SW02	10	17.495	0.058	7.8	0.0882	0.0000	OK
15 minute summer	SW06	10	16.960	0.062	7.8	0.1165	0.0000	OK
15 minute summer	SW07	10	16.916	0.093	15.5	0.1643	0.0000	OK
15 minute summer	SW08	10	16.848	0.113	23.2	0.1905	0.0000	OK
480 minute summer	Outlet	312	16.371	0.121	9.3	0.0000	0.0000	OK
480 minute summer	Flow Control	312	16.371	0.144	3.7	0.3667	0.0000	OK
480 minute summer	Outfall	312	16.226	0.046	3.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	7.8	0.808	0.094	0.0940
15 minute summer	SW03	1.001	23.1	1.448	0.280	0.1996
15 minute summer	SW04	1.002	30.6	1.798	0.371	0.1649
15 minute summer	SW05	1.003	60.9	1.726	0.458	0.6025
15 minute summer	SW09	1.004	61.0	3.409	0.481	0.1232
120 minute summer	Inlet	Flow through pond	15.3	0.015	0.376	53.0875
15 minute summer	SW02	2.000	7.7	0.991	0.131	0.0733
15 minute summer	SW06	3.000	7.7	0.641	0.149	0.0908
15 minute summer	SW07	3.001	15.4	0.870	0.280	0.1399
15 minute summer	SW08	3.002	22.9	1.238	0.418	0.1552
480 minute summer	Outlet	4.000	3.7	0.137	0.047	0.1362
480 minute summer	Flow Control	4.001	3.7	0.776	0.208	0.0226

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.500	0.063	14.0	0.0966	0.0000	OK
15 minute summer	SW03	10	17.320	0.123	41.8	0.1892	0.0000	OK
15 minute summer	SW04	10	17.041	0.157	55.6	0.2684	0.0000	OK
15 minute summer	SW05	10	16.806	0.239	110.4	0.3785	0.0000	OK
15 minute summer	SW09	11	16.536	0.213	109.7	0.2404	0.0000	OK
60 minute summer	Inlet	40	16.458	0.208	83.6	0.0000	0.0000	OK
15 minute summer	SW02	10	17.517	0.080	14.0	0.1216	0.0000	OK
15 minute summer	SW06	10	16.987	0.089	14.0	0.1677	0.0000	OK
15 minute summer	SW07	10	16.960	0.137	27.9	0.2428	0.0000	OK
15 minute summer	SW08	10	16.908	0.173	41.6	0.2925	0.0000	OK
600 minute summer	Outlet	390	16.457	0.207	12.3	0.0000	0.0000	OK
600 minute summer	Flow Control	390	16.457	0.230	5.4	0.5852	0.0000	SURCHARGED
600 minute summer	Outfall	390	16.237	0.057	5.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	13.9	0.903	0.169	0.1499
15 minute summer	SW03	1.001	41.6	1.600	0.504	0.3240
15 minute summer	SW04	1.002	55.2	1.864	0.669	0.2939
15 minute summer	SW05	1.003	109.7	1.934	0.825	0.9659
15 minute summer	SW09	1.004	110.0	3.604	0.867	0.2166
60 minute summer	Inlet	Flow through pond	36.8	0.024	0.905	81.4044
15 minute summer	SW02	2.000	13.9	1.156	0.236	0.1132
15 minute summer	SW06	3.000	13.9	0.696	0.267	0.1493
15 minute summer	SW07	3.001	27.6	0.946	0.504	0.2301
15 minute summer	SW08	3.002	41.2	1.346	0.751	0.2671
600 minute summer	Outlet	4.000	5.4	0.133	0.069	0.2489
600 minute summer	Flow Control	4.001	5.4	0.858	0.304	0.0297

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW01	0.031	5.00	18.962	1200	349608.026	444888.176	1.525
SW03	0.031	5.00	18.710	1200	349617.392	444885.987	1.513
SW04	0.031	5.00	17.965	1200	349627.400	444893.489	1.081
SW05	0.031	5.00	17.937	1200	349629.703	444902.899	1.370
SW09			17.250	1200	349646.071	444898.094	0.927
Inlet			17.250		349651.076	444895.541	1.000
SW02	0.031	5.00	19.049	1200	349614.707	444876.962	1.612
SW06	0.031	5.00	17.711	1200	349635.981	444925.530	0.813
SW07	0.031	5.00	17.796	1200	349632.583	444918.856	0.973
SW08	0.031	5.00	17.841	1200	349630.358	444911.255	1.106
Outlet		5.00	17.250		349691.422	444907.590	1.000
Flow Control			17.250	1800	349693.178	444911.769	1.023
Outfall			17.250		349693.760	444916.466	1.070

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
1.000	SW01	SW03	9.618	0.600	17.437	17.197	40.0	225	50.0
1.001	SW03	SW04	12.508	0.600	17.197	16.884	40.0	225	50.0
1.002	SW04	SW05	9.688	0.600	16.884	16.642	40.0	225	50.0
1.003	SW05	SW09	17.059	0.600	16.567	16.323	70.0	300	49.8
1.004	SW09	Inlet	5.619	0.600	16.323	16.250	77.0	300	49.6
2.000	SW02	SW03	9.416	0.600	17.437	17.317	78.5	225	50.0
3.000	SW06	SW07	7.489	0.600	16.898	16.823	100.0	225	50.0
3.001	SW07	SW08	7.920	0.600	16.823	16.735	90.0	225	50.0
3.002	SW08	SW05	8.382	0.600	16.735	16.642	90.0	225	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)
1.000	2.074	82.5	4.2	1.300	1.288	0.031
1.001	2.074	82.5	12.6	1.288	0.856	0.093
1.002	2.074	82.5	16.8	0.856	1.070	0.124
1.003	1.881	133.0	33.5	1.070	0.627	0.248
1.004	1.794	126.8	33.4	0.627	0.700	0.248
2.000	1.477	58.7	4.2	1.387	1.168	0.031
3.000	1.307	52.0	4.2	0.588	0.748	0.031
3.001	1.379	54.8	8.4	0.748	0.881	0.062
3.002	1.379	54.8	12.6	0.881	1.070	0.093

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
4.000	Outlet	Flow Control	4.533	0.600	16.250	16.227	200.0	300	50.0
4.001	Flow Control	Outfall	4.733	0.600	16.227	16.180	100.0	150	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)
4.000	1.108	78.3	0.0	0.700	0.723	0.000
4.001	1.005	17.8	0.0	0.873	0.920	0.000

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Detailed		

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0
100	41	0	0

Node Outfall Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to 100yr+41% CC 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320 minute storms

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	1.070	780	1.070	1560	1.070	2340	1.070	3120	1.070	3900	1.070
60	1.070	840	1.070	1620	1.070	2400	1.070	3180	1.070	3960	1.070
120	1.070	900	1.070	1680	1.070	2460	1.070	3240	1.070	4020	1.070
180	1.070	960	1.070	1740	1.070	2520	1.070	3300	1.070	4080	1.070
240	1.070	1020	1.070	1800	1.070	2580	1.070	3360	1.070	4140	1.070
300	1.070	1080	1.070	1860	1.070	2640	1.070	3420	1.070	4200	1.070
360	1.070	1140	1.070	1920	1.070	2700	1.070	3480	1.070	4260	1.070
420	1.070	1200	1.070	1980	1.070	2760	1.070	3540	1.070	4320	1.070
480	1.070	1260	1.070	2040	1.070	2820	1.070	3600	1.070		
540	1.070	1320	1.070	2100	1.070	2880	1.070	3660	1.070		
600	1.070	1380	1.070	2160	1.070	2940	1.070	3720	1.070		
660	1.070	1440	1.070	2220	1.070	3000	1.070	3780	1.070		
720	1.070	1500	1.070	2280	1.070	3060	1.070	3840	1.070		

Node Flow Control Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	16.227	Product Number	CTL-SHE-0112-5700-1000-5700
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.7	Min Node Diameter (mm)	1200

Node Outlet Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	45.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.250	Main Channel Slope (1:X)	100000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.600

Inlets

Inlet

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	480.0	0.0	0.500	647.9	0.0	1.000	840.9	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.471	0.034	4.1	0.0523	0.0000	OK
15 minute summer	SW03	10	17.256	0.059	12.3	0.0914	0.0000	OK
15 minute summer	SW04	10	16.957	0.073	16.3	0.1241	0.0000	OK
15 minute summer	SW05	10	16.674	0.107	32.4	0.1690	0.0000	OK
15 minute summer	SW09	10	16.429	0.106	32.4	0.1197	0.0000	OK
180 minute summer	Inlet	112	16.338	0.088	12.8	0.0000	0.0000	OK
15 minute summer	SW02	10	17.479	0.042	4.1	0.0632	0.0000	OK
15 minute summer	SW06	10	16.942	0.044	4.1	0.0825	0.0000	OK
15 minute summer	SW07	10	16.886	0.063	8.2	0.1114	0.0000	OK
15 minute summer	SW08	10	16.813	0.078	12.2	0.1314	0.0000	OK
600 minute summer	Outlet	390	16.325	0.075	4.3	0.0000	0.0000	OK
600 minute summer	Flow Control	390	16.325	0.098	2.0	0.2496	0.0000	OK
600 minute summer	Outfall	390	16.214	0.034	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	4.1	0.689	0.050	0.0581
15 minute summer	SW03	1.001	12.2	1.259	0.148	0.1215
15 minute summer	SW04	1.002	16.2	1.542	0.197	0.1020
15 minute summer	SW05	1.003	32.4	1.455	0.244	0.3808
15 minute summer	SW09	1.004	32.5	2.993	0.256	0.0721
180 minute summer	Inlet	Flow through pond	5.7	0.009	0.141	31.8363
15 minute summer	SW02	2.000	4.1	0.832	0.069	0.0461
15 minute summer	SW06	3.000	4.1	0.569	0.078	0.0541
15 minute summer	SW07	3.001	8.1	0.768	0.148	0.0840
15 minute summer	SW08	3.002	12.1	1.059	0.222	0.0962
600 minute summer	Outlet	4.000	2.0	0.118	0.025	0.0765
600 minute summer	Flow Control	4.001	2.0	0.653	0.112	0.0144

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.483	0.046	7.8	0.0714	0.0000	OK
15 minute summer	SW03	10	17.282	0.085	23.3	0.1305	0.0000	OK
15 minute summer	SW04	10	16.990	0.106	30.9	0.1799	0.0000	OK
15 minute summer	SW05	10	16.723	0.156	61.3	0.2474	0.0000	OK
15 minute summer	SW09	11	16.468	0.145	60.9	0.1640	0.0000	OK
120 minute summer	Inlet	76	16.387	0.137	31.1	0.0000	0.0000	OK
15 minute summer	SW02	10	17.495	0.058	7.8	0.0882	0.0000	OK
15 minute summer	SW06	10	16.960	0.062	7.8	0.1165	0.0000	OK
15 minute summer	SW07	10	16.916	0.093	15.5	0.1643	0.0000	OK
15 minute summer	SW08	10	16.848	0.113	23.2	0.1905	0.0000	OK
480 minute summer	Outlet	312	16.371	0.121	9.3	0.0000	0.0000	OK
480 minute summer	Flow Control	312	16.371	0.144	3.7	0.3667	0.0000	OK
480 minute summer	Outfall	312	16.226	0.046	3.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	7.8	0.808	0.094	0.0940
15 minute summer	SW03	1.001	23.1	1.448	0.280	0.1996
15 minute summer	SW04	1.002	30.6	1.798	0.371	0.1649
15 minute summer	SW05	1.003	60.9	1.726	0.458	0.6025
15 minute summer	SW09	1.004	61.0	3.409	0.481	0.1232
120 minute summer	Inlet	Flow through pond	15.3	0.015	0.376	53.0875
15 minute summer	SW02	2.000	7.7	0.991	0.131	0.0733
15 minute summer	SW06	3.000	7.7	0.641	0.149	0.0908
15 minute summer	SW07	3.001	15.4	0.870	0.280	0.1399
15 minute summer	SW08	3.002	22.9	1.238	0.418	0.1552
480 minute summer	Outlet	4.000	3.7	0.137	0.047	0.1362
480 minute summer	Flow Control	4.001	3.7	0.776	0.208	0.0226

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.500	0.063	14.0	0.0966	0.0000	OK
15 minute summer	SW03	10	17.320	0.123	41.8	0.1892	0.0000	OK
15 minute summer	SW04	10	17.041	0.157	55.6	0.2684	0.0000	OK
15 minute summer	SW05	10	16.806	0.239	110.4	0.3785	0.0000	OK
15 minute summer	SW09	11	16.536	0.213	109.7	0.2404	0.0000	OK
60 minute summer	Inlet	40	16.458	0.208	83.6	0.0000	0.0000	OK
15 minute summer	SW02	10	17.517	0.080	14.0	0.1216	0.0000	OK
15 minute summer	SW06	10	16.987	0.089	14.0	0.1677	0.0000	OK
15 minute summer	SW07	10	16.960	0.137	27.9	0.2428	0.0000	OK
15 minute summer	SW08	10	16.908	0.173	41.6	0.2925	0.0000	OK
600 minute summer	Outlet	390	16.457	0.207	12.3	0.0000	0.0000	OK
600 minute summer	Flow Control	390	16.457	0.230	5.4	0.5852	0.0000	SURCHARGED
600 minute summer	Outfall	390	16.237	0.057	5.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	13.9	0.903	0.169	0.1499
15 minute summer	SW03	1.001	41.6	1.600	0.504	0.3240
15 minute summer	SW04	1.002	55.2	1.864	0.669	0.2939
15 minute summer	SW05	1.003	109.7	1.934	0.825	0.9659
15 minute summer	SW09	1.004	110.0	3.604	0.867	0.2166
60 minute summer	Inlet	Flow through pond	36.8	0.024	0.905	81.4044
15 minute summer	SW02	2.000	13.9	1.156	0.236	0.1132
15 minute summer	SW06	3.000	13.9	0.696	0.267	0.1493
15 minute summer	SW07	3.001	27.6	0.946	0.504	0.2301
15 minute summer	SW08	3.002	41.2	1.346	0.751	0.2671
600 minute summer	Outlet	4.000	5.4	0.133	0.069	0.2489
600 minute summer	Flow Control	4.001	5.4	0.858	0.304	0.0297

Results for 100 year +41% CC Critical Storm Duration. Lowest mass balance: 99.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW01	10	17.500	0.063	14.1	0.0970	0.0000	OK
15 minute summer	SW03	10	17.320	0.123	42.1	0.1901	0.0000	OK
15 minute summer	SW04	10	17.042	0.158	56.0	0.2700	0.0000	OK
4320 minute summer	SW05	4440	16.810	0.243	4.8	0.3854	0.0000	OK
4320 minute summer	SW09	4260	16.810	0.487	6.9	0.5511	0.0000	SURCHARGED
4320 minute summer	Inlet	4560	16.810	0.560	4.8	0.0000	0.0000	OK
15 minute summer	SW02	10	17.518	0.081	14.1	0.1221	0.0000	OK
15 minute summer	SW06	10	16.987	0.089	14.1	0.1685	0.0000	OK
15 minute summer	SW07	10	16.961	0.138	28.1	0.2442	0.0000	OK
15 minute summer	SW08	10	16.909	0.174	41.9	0.2946	0.0000	OK
4320 minute summer	Outlet	4560	16.810	0.560	2.4	0.0000	0.0000	SURCHARGED
4320 minute summer	Flow Control	4260	16.810	0.583	0.0	1.4842	0.0000	SURCHARGED
15 minute summer	Outfall	1	17.250	1.070	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	SW01	1.000	14.0	0.904	0.170	0.1509
15 minute summer	SW03	1.001	41.9	1.601	0.508	0.3261
15 minute summer	SW04	1.002	55.6	1.866	0.674	0.2964
4320 minute summer	SW05	1.003	4.8	0.512	0.036	1.1228
4320 minute summer	SW09	1.004	4.8	0.832	0.038	0.3957
4320 minute summer	Inlet	Flow through pond	2.4	0.003	0.059	321.7564
15 minute summer	SW02	2.000	14.0	1.158	0.238	0.1138
15 minute summer	SW06	3.000	14.0	0.696	0.269	0.1503
15 minute summer	SW07	3.001	27.8	0.946	0.507	0.2318
15 minute summer	SW08	3.002	41.5	1.344	0.757	0.2695
4320 minute summer	Outlet	4.000	0.0	0.101	0.001	0.3192
4320 minute summer	Flow Control	4.001	0.0	0.000	0.000	0.0833

APPENDIX G

PROPOSED OUTLINE DRAINAGE LAYOUT PLAN

KEY

Roof Area + 10% Urban Creep = 1310m²

Paved Area = 849m²

Road Area = 472m²

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REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY

DRAWING STATUS:

FOR PLANNING

THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS
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CLIENT:

MS C. COONEY

PROJECT:

CASTLE LANE
GARSTANG

DRAWING TITLE:

CATCHMENT PLAN

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
09/06/21	1:250	JP	MJ	1

DRAWING REF: | REV:

TC / L9861 / 21 / 100

KEY

- Exceedence Routing
- Pre-Cast Concrete Headwall
- Surface Water Pipe
- Surface Water Pre-Cast Manhole
- Foul Water Pipe
- Foul Water Pre-Cast Manhole

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DRAWING STATUS:
FOR PLANNING

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MS C. COONEY

PROJECT:
CASTLE LANE
GARSTANG

DRAWING TITLE:
PROPOSED OUTLINE DRAINAGE LAYOUT

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
09/06/21	1:250	JP	MJ	1

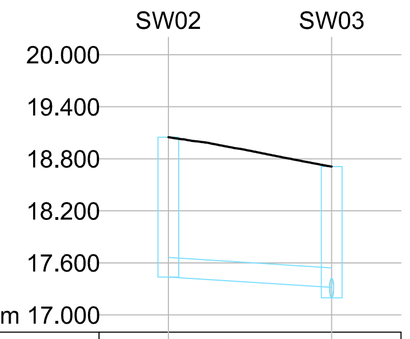
DRAWING REF: TC / L9861 / 21 / 101 | REV:

Pipeline Schedule

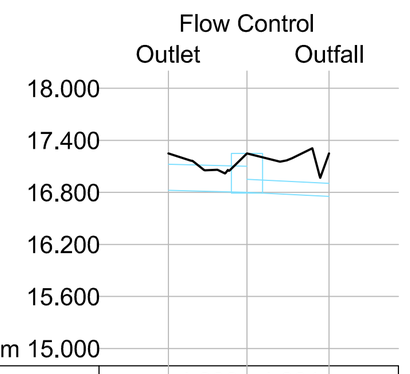
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth	DS CL (m)	DS IL (m)	DS Depth	US Node	Dia (mm)	Sump (m)	Node Type	MH Type	DS Node	Dia (mm)	Sump (m)	Node Type	MH Type
1.000	9.618	40.1	225	Circular	18.962	17.437	1.300	18.710	17.197	1.288	SW01	1200		Manhole	Adoptable	SW03	1200		Manhole	Adoptable
1.001	12.508	40.0	225	Circular	18.710	17.197	1.288	17.965	16.884	0.856	SW03	1200		Manhole	Adoptable	SW04	1200		Manhole	Adoptable
1.002	9.688	40.0	225	Circular	17.965	16.884	0.856	17.937	16.642	1.070	SW04	1200		Manhole	Adoptable	SW05	1200		Manhole	Adoptable
1.003	17.059	69.9	300	Circular	17.937	16.567	1.070	17.250	16.323	0.627	SW05	1200		Manhole	Adoptable	SW09	1200		Manhole	Adoptable
1.004	5.619	77.0	300	Circular	17.250	16.323	0.627	17.250	16.250	0.700	SW09	1200		Manhole	Adoptable	Inlet			Junction	
2.000	9.416	78.5	225	Circular	19.049	17.437	1.387	18.710	17.317	1.168	SW02	1200		Manhole	Adoptable	SW03	1200		Manhole	Adoptable
3.000	7.489	99.9	225	Circular	17.711	16.898	0.588	17.796	16.823	0.748	SW06	1200		Manhole	Adoptable	SW07	1200		Manhole	Adoptable
3.001	7.920	90.0	225	Circular	17.796	16.823	0.748	17.841	16.735	0.881	SW07	1200		Manhole	Adoptable	SW08	1200		Manhole	Adoptable
3.002	8.382	90.1	225	Circular	17.841	16.735	0.881	17.937	16.642	1.070	SW08	1200		Manhole	Adoptable	SW05	1200		Manhole	Adoptable
4.000	4.533	197.1	300	Circular	17.250	16.825	0.125	17.250	16.802	0.148	Outlet			Junction		Flow Control	1800	0.300	Manhole	Adoptable
4.001	4.733	100.7	150	Circular	17.250	16.802	0.298	17.250	16.755	0.345	Flow Control	1800	0.300	Manhole	Adoptable	Outfall			Junction	

Manhole Schedule

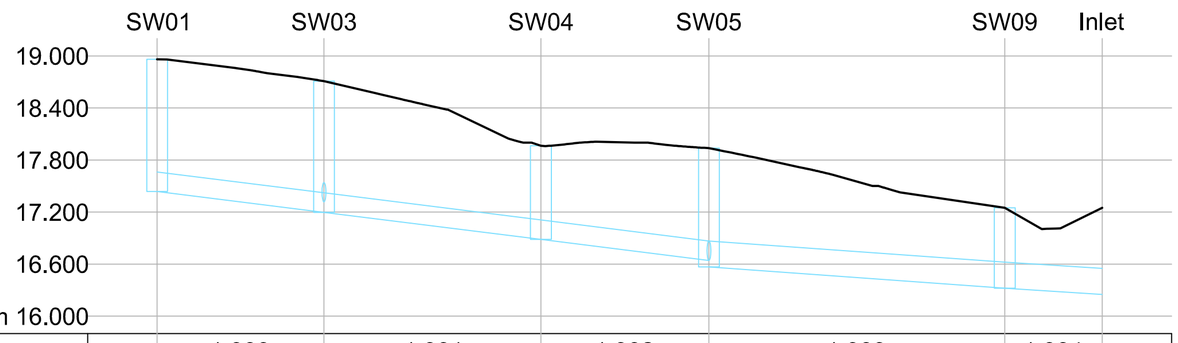
Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Sump (m)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
SW01	349608.026	444888.176	18.962	1.525	1200		Manhole	Adoptable	0	1.000	17.437	225	Circular
SW03	349617.392	444885.987	18.710	1.513	1200		Manhole	Adoptable	1	2.000	17.317	225	Circular
									2	1.000	17.197	225	Circular
									0	1.001	17.197	225	Circular
SW04	349627.400	444893.489	17.965	1.081	1200		Manhole	Adoptable	1	1.001	16.884	225	Circular
									0	1.002	16.884	225	Circular
SW05	349629.703	444902.899	17.937	1.370	1200		Manhole	Adoptable	1	3.002	16.642	225	Circular
									2	1.002	16.642	225	Circular
									0	1.003	16.567	300	Circular
SW09	349646.071	444898.094	17.250	0.927	1200		Manhole	Adoptable	1	1.003	16.323	300	Circular
									0	1.004	16.323	300	Circular
Inlet	349651.076	444895.541	17.250	1.000			Junction		1	1.004	16.250	300	Circular
SW02	349614.707	444876.962	19.049	1.612	1200		Manhole	Adoptable	0	2.000	17.437	225	Circular
SW06	349635.981	444925.530	17.711	0.813	1200		Manhole	Adoptable	0	3.000	16.898	225	Circular
SW07	349632.583	444918.856	17.796	0.973	1200		Manhole	Adoptable	1	3.000	16.823	225	Circular
									0	3.001	16.823	225	Circular
SW08	349630.358	444911.255	17.841	1.106	1200		Manhole	Adoptable	1	3.001	16.735	225	Circular
									0	3.002	16.735	225	Circular
Outlet	349691.422	444907.590	17.250	0.425			Junction		0	4.000	16.825	300	Circular
Flow Control	349693.178	444911.769	17.250	0.448	1800	0.300	Manhole	Adoptable	1	4.000	16.802	300	Circular
									0	4.001	16.802	150	Circular
Outfall	349693.760	444916.466	17.250	0.495			Junction		1	4.001	16.755	150	Circular



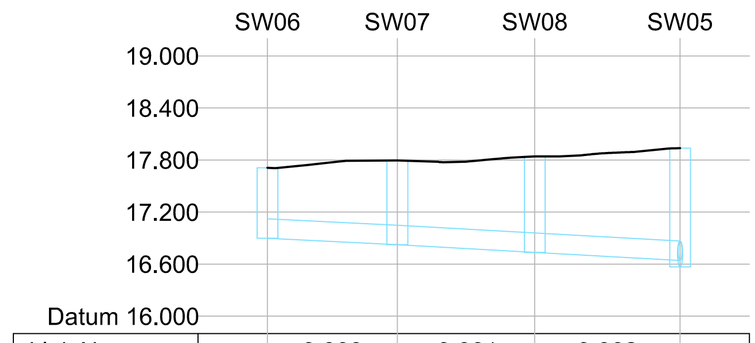
Link Name	2.000	
Section Type	225mm	
Slope (1:X)	78.5	
Cover Level	19.049	18.710
Invert Level	17.437	17.317
Length	9.416	



Link Name	4.000	4.001	
Section Type	300mm	150mm	
Slope (1:X)	197.1	100.7	
Cover Level	17.250	17.250	17.250
Invert Level	16.825 / 16.802	16.802 / 16.755	
Length	4.533	4.733	



Link Name	1.000	1.001	1.002	1.003	1.004	
Section Type	225mm	225mm	225mm	300mm	300mm	
Slope (1:X)	40.1	40.0	40.0	69.9	77.0	
Cover Level	18.962	18.710	17.965	17.937	17.250	17.250
Invert Level	17.437 / 17.197	17.197 / 16.884	16.884 / 16.642	16.567 / 16.323	16.323 / 16.250	
Length	9.618	12.508	9.688	17.059	5.619	



Link Name	3.000	3.001	3.002	
Section Type	225mm	225mm	225mm	
Slope (1:X)	99.9	90.0	90.1	
Cover Level	17.711	17.796	17.841	17.937
Invert Level	16.898 / 16.823	16.823 / 16.735	16.735 / 16.642	
Length	7.489	7.920	8.382	

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REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY

DRAWING STATUS: FOR PLANNING

THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS
*Offices in Chorley, **Lancaster** & Shrewsbury*
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CLIENT: Ms C. Cooney

PROJECT: Castle Lane Garstang

DRAWING TITLE: Surface Water Pipe and Manhole Schedules + Longitudinal Sections

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
09/06/2021	1:250	JP	MJ	1

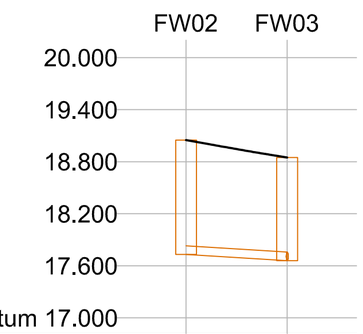
DRAWING REF: TC / L9861 / 21 / 102 | REV:

Pipeline Schedule

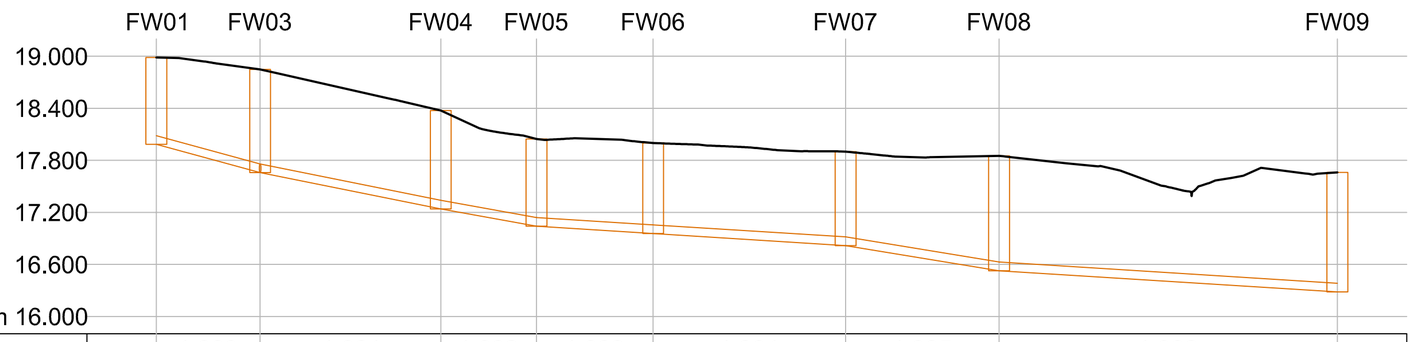
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth	DS CL (m)	DS IL (m)	DS Depth	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	5.985	18.3	100	Circular	18.985	17.985	0.900	18.848	17.658	1.090	FW01	1200	Manhole	Adoptable	FW03	1200	Manhole	Adoptable
1.001	10.418	24.9	100	Circular	18.848	17.658	1.090	18.374	17.240	1.034	FW03	1200	Manhole	Adoptable	FW04	1200	Manhole	Adoptable
1.002	5.517	27.7	100	Circular	18.374	17.240	1.034	18.047	17.041	0.905	FW04	1200	Manhole	Adoptable	FW05	1200	Manhole	Adoptable
1.003	6.726	79.1	100	Circular	18.047	17.041	0.905	18.000	16.956	0.944	FW05	1200	Manhole	Adoptable	FW06	1200	Manhole	Adoptable
1.004	11.098	79.8	100	Circular	18.000	16.956	0.944	17.901	16.817	0.983	FW06	1200	Manhole	Adoptable	FW07	1200	Manhole	Adoptable
1.005	8.847	30.5	100	Circular	17.901	16.817	0.983	17.852	16.527	1.225	FW07	1200	Manhole	Adoptable	FW08	1200	Manhole	Adoptable
1.006	19.505	79.9	100	Circular	17.852	16.527	1.225	17.662	16.283	1.279	FW08	1200	Manhole	Adoptable	FW09	1200	Manhole	Adoptable
2.000	5.830	79.9	100	Circular	19.048	17.731	1.217	18.848	17.658	1.090	FW02	1200	Manhole	Adoptable	FW03	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
FW01	349608.382	444886.257	18.985	1.000	1200	Manhole	Adoptable	0				
									0	1.000	100	Circular
FW03	349614.266	444885.167	18.848	1.190	1200	Manhole	Adoptable	1				
									1	2.000	100	Circular
								2	2	1.000	100	Circular
									0	1.001	100	Circular
FW04	349622.693	444891.293	18.374	1.134	1200	Manhole	Adoptable	1				
									1	1.001	100	Circular
									0	1.002	100	Circular
FW05	349626.655	444895.132	18.047	1.005	1200	Manhole	Adoptable	1				
									1	1.002	100	Circular
									0	1.003	100	Circular
FW06	349628.369	444901.636	18.000	1.044	1200	Manhole	Adoptable	1				
									1	1.003	100	Circular
									0	1.004	100	Circular
FW07	349629.265	444912.698	17.901	1.083	1200	Manhole	Adoptable	1				
									1	1.004	100	Circular
									0	1.005	100	Circular
FW08	349632.090	444921.082	17.852	1.325	1200	Manhole	Adoptable	1				
									1	1.005	100	Circular
									0	1.006	100	Circular
FW09	349641.058	444938.403	17.662	1.379	1200	Manhole	Adoptable	1				
									1	1.006	100	Circular
FW02	349613.854	444879.351	19.048	1.317	1200	Manhole	Adoptable	0				
									0	2.000	100	Circular



Link Name	2.000	
Section Type	100mm	
Slope (1:X)	79.9	
Cover Level	19.048	18.848
Invert Level	17.731	17.658
Length	5.830	



Link Name	1.000	1.001	1.002	1.003	1.004	1.005	1.006	
Section Type	100mm	100mm	100mm	100mm	100mm	100mm	100mm	
Slope (1:X)	18.3	24.9	27.7	79.1	79.8	30.5	79.9	
Cover Level	18.985	18.848	18.374	18.047	18.000	17.901	17.852	17.662
Invert Level	17.985 / 17.658	17.658 / 17.240	17.240 / 17.041	17.041 / 16.956	16.956 / 16.817	16.817 / 16.527	16.527 / 16.283	
Length	5.985	10.418	5.517	6.726	11.098	8.847	19.505	

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REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY

DRAWING STATUS: FOR PLANNING

THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS
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CLIENT: Ms C. Cooney

PROJECT: Castle Lane
Garstang

DRAWING TITLE: Foul Water Pipe and Manhole Schedules + Longitudinal Sections

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
10/06/2021	1:250	JP	MJ	1

DRAWING REF: TC / L9861 / 21 / 103 | REV:

APPENDIX H

SURFACE WATER TREATMENT CALCULATION

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Castle Lane	Job No.	L9861	Initial	JP
		Garstang	Date	Jun-21	Checked	MJ
		PR3 1RB	Page	1 of 3	Revision	-
	Title	Drainage Treatment				

DESIGN FOR SUSTAINABLE DRAINAGE TREATMENT OF SURFACE WATER

Brief

The following calculations outline the recommended treatment requirements for a sustaionable drainage system as outlined in the CIRIA Report C753 - The SuDS Manual. The method used is the simple index approach outlined in Section 26.

Treatment within SuDS components is affected by the flow rate and volume of water which passes through the component. It is not reasonable or practical to treat the entirety of the runoff for infrequent greater intensity design storms. In any case the majority of the pollutants are removed from surfaces by the more frequent rainfall events and in the first flush resulting from the initial runoff from the larger events.
and to a certain capacity.

The following references have been used in the preparation of these calculations:

- CIRIA, Report C753, The SuDS Manual Version 6, 2015

Results Summary

Roof Area:

Treatment component 1 Pond or wetland

Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.2	0.2	0.05
Pollution Mitigation	0.7	0.7	0.5
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

Residential Roads:

Treatment component 1 Pond or wetland

Treatment component 2 None

Indices	Suspended Solids	Metals	Hydrocarbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.7	0.5
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Castle Lane	Job No.	L9861	Initial	JP
		Garstang	Date	Jun-21	Checked	MJ
		PR3 1RB	Page	2 of 3	Revision	-
	Title	Drainage Treatment				

POLLUTION HAZARD INDEX

Source of Runoff	Pollution Hazard	Pollution Hazard Indices: Suspended Solids	Metals	Hydro-carbons
Residential roofing	Very low	0.2	0.2	0.05

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

	Suds Component	Pollution Mitigation Indices: Suspended Solids	Metals	Hydro-carbons
1	Pond or wetland	0.7	0.7	0.5
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
	Total Pollution Mitigation Index	**0.7**	**0.7**	**0.5**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.2	0.2	0.05
Pollution Mitigation	0.7	0.7	0.5
	Adequate	**Adequate**	**Adequate**

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Castle Lane	Job No.	L9861	Initial	JP
		Garstang	Date	Jun-21	Checked	MJ
		PR3 1RB	Page	3 of 3	Revision	-
	Title	Drainage Treatment				

POLLUTION HAZARD INDEX

Source of Runoff	Pollution Hazard	Pollution Hazard Indices: Suspended Solids	Metals	Hydro-carbons
Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)	Low	0.5	0.4	0.4

POLLUTION MITIGATION INDEX

The receiving water body shall be: Surface Water

	Suds Component	Pollution Mitigation Indices: Suspended Solids	Metals	Hydro-carbons
1	Pond or wetland	0.7	0.7	0.5
2	None	0	0	0
3	None	0	0	0
4	None	0	0	0
	Total Pollution Mitigation Index	**0.7**	**0.7**	**0.5**

ASSESSMENT OF TREATMENT PROPOSAL

Indices	Suspended Solids	Metals	Hydro-carbons
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.7	0.5
	Adequate	**Adequate**	**Adequate**