12-0083

DRAINAGE CALCULATIONS

FOR

BACTON LOW RISE (DHO SITE) REDEVELOPMENT, CAMDEN

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Revision

Revision	Date	Reason for issue
/	27.02.2015	

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CONTENTS

1.0 INTRODUCTION

The Rolton Group have been commissioned by Rydon Construction to undertake the infrastructure and drainage design for a housing re-development site at Bacton for the London Borough of Camden. The predevelopment site consists of predominantly impermeable drained area.
A flood risk assessment was undertaken by Rolton Group in November 2012.

2.0 COMMENTARY ON PROPOSED DRAINAGE DESIGN

2.1 EXISTING DRAINAGE

From site drainage record drawings, Thames Water Asset information and the current topographical survey, the existing building has a positive outfall into the adjacent drainage system within Wellesley road and Vicars Road. Within Vicars Road and the northern section of Wellesley Road, the existing Thames Water sewer is a large culvert (1168 x 787) and is assumed to be relatively deep. The existing adopted drainage within the Highway is indicated as a combined sewer, as is the current private drainage network.

2.2 PROPOSED SITE

The proposed drainage is designed to be a separate system up to the connection point to the rear of the site. Surface water storage has been accommodated in a below ground cellular storage system within the landscaped area of the scheme. Flow restriction occurs further downstream and the entire system backs up to the storage tank where flow balancing occurs. The FRA identified the need to reduce the discharge from the site to the following, 1 1 in 1 year 28.5 l/s, 1 in 30yr 29.1 l/s and 1 in 100yr 33.3 l/s. Refer to Appendix A for the proposed drainage layout and calculations and Appendix B for the catchment area plan.

The calculations included in Appendix A identify that the above criteria is met.

2.3 SURFACE WATER DISCHARGE DURING A 360 MINUTE STORM

Included in Appendix C is a graph to identify that the inflow and outflow during a 360 minute storm (due to the generous discharge) is very similar. Therefore the system should fully discharge following this storm event.

3.0 DRAINAGE DESIGN PRINCIPLES

3.1 DESIGN GUIDANCE AND STANDARDS

The design of the Surface and Foul Water sewers have been designed in accordance with Sewers for Adoption 6th Edition (SfA6) and the requirements of the Building Regulations (Approved Document H - 2002).

4.0 SUMMARY

The drainage design for the site has been designed in accordance with Sewers for Adoption 6th standards, current Building Regulations and drainage design best practice. The foul drainage has been designed to discharge into the proposed combined Thames Water sewer. Surface water has been designed to discharge into the combined Thames Water sewer and restricted by a vortex flow control device to meet the restriction outlined in the approved FRA.

APPENDIX A

PROPOSED DRAINAGE LAYOUT AND CALCULATIONS

DO NOT SCALE

If there should be any doubt or query regarding the interpretation of the information given on this Drawing, please enquire directly to Rolton Group Ltd before executing such part of the works.

The contents of this drawing are strictly confidential and must not in any circumstances be copied, shown, published or otherwise disclosed to anyone, outside the Rolton Group without express consent in writing.

10mm 20mm 30mm 40mm 50mm 100mm

Sewer Type Key:

- Existing combined drainage
- Proposed Private Surface Water Sewer
- Proposed Private Foul Water Sewer
- Proposed Private Combined Water Sewer
- Proposed RWP Connection to Storm
- Proposed SVP Connection to Foul
- FG — Proposed Private FW Gully (floor gully)
- FYG — Proposed Private FW Gully (yard gully)
- Proposed Private SW Gully (yard gully)
- Proposed SW Linear Drainage with below ground connection for permeable paving

General Key:

- Network Rail Easement
- Proposed Services Easement

1.000/600Ø/1:50/27.00m
Drainage Model Pipe Reference
Sewer Diameter
Sewer Gradient
Sewer Length

Manhole/Inspection Chamber Type Key:

- Surface Water PPIC
- Foul Water PPIC
- Surface Water PCC MH/CP
- Combined Water PCC MH
- Surface Water Control Chamber
- Surface Water Catch-pit Manhole
- Proposed Private Cellular Storage Tank

General notes:

1. This drawing is to be read in conjunction with all the relevant contract documentation.
2. All dimensions are in mm unless otherwise stated.
3. Drawings marked Preliminary are for guidance/approval only.
4. The developer is responsible for locating any existing services, for making provision for access to lay service to serve adjacent sites and for protecting any services to the satisfaction of the relavent utility company.
5. The developer is to obtain all necessary licences/ permissions before making connecting to existing sewers.
6. Pipes to be connected soffit to soffit.
7. All invert levels are to be checked on site prior to work commencing and any discrepancies reported immediatly.
8. Levels indicated are Invert levels unless noted otherwise and are of lowest connection in manhole.
9. Drawing based on:
   a. Site Layout General Arrangement, 1952-GA-SP-L00, rev.P3, produced by Alan Camp Architect
   b. Block A General Arrangement Drawing, 1952-GA-P-A-L00, rev.P12, produced by Alan Camp Architect
   c. Block B1 General Arrangement Drawing, 1952_GA-B1-C-L00, rev.P9, produced by Alan Camp Architect
   d. Block B2 General Arrangement Drawing, 1952_GA-B2-C-L00, rev.P8, produced by Alan Camp Architect
   e. Block C General Arrangement Drawing, 1952_GA-P-C-L00, rev.P8, produced by Alan Camp Architect
   f. Landscape Design drawings: HO-439_DA_001_R00, HO-439_HL_CY105_R00, HO-439_HL_CY205_R00, dated 05/03/2014, produced by Hannah Oakden Landscape Design

Private drainage notes:

1. All specifications and installations are to comply with the latest edition of the Building Regulations approved documents (part H), relevant BS and manufacturers recommendations.
2. All connections below the slab and from the building to be at an approximate minimum gradient of 1:40.
3. Drawing to be read in conjunction with construction details drawings 12-0083/INF/30-32
4. Pipes to be 100mm dia. UPVC to BS4660 laid on class S granular bed and surround and backfilled in accordance with detail on drawing unless otherwise shown. Pipes with less than 0.6m cover in un-trafficked areas or 0.9m cover in trafficked areas to have min. of 100mm concrete surround class Z.
5. Pipes running under buildings to have a min. of 100mm granular surround.
6. Drainage run connecting into the adoptable manholes needs to be Class 120 concrete or Vitrified Clay as stated in the notes for the adoptable drainage.
7. Inspection chambers and manholes.
Brickwork Class B engineering to BS 3921, pre-cast concrete sections to BS 5911, plastic relevant BBA certificate.
8. Rodding eyes and access fittings to be in accordance with BS 4660 and relevant BBA certificate.
9. Inspection chambers and manholes to have removable non-ventilating covers to a load class as indicated on the manhole schedule.
10. All drainage adjacent to the Network Rail easement and above ground anchors to be encased in concrete (Class Z)

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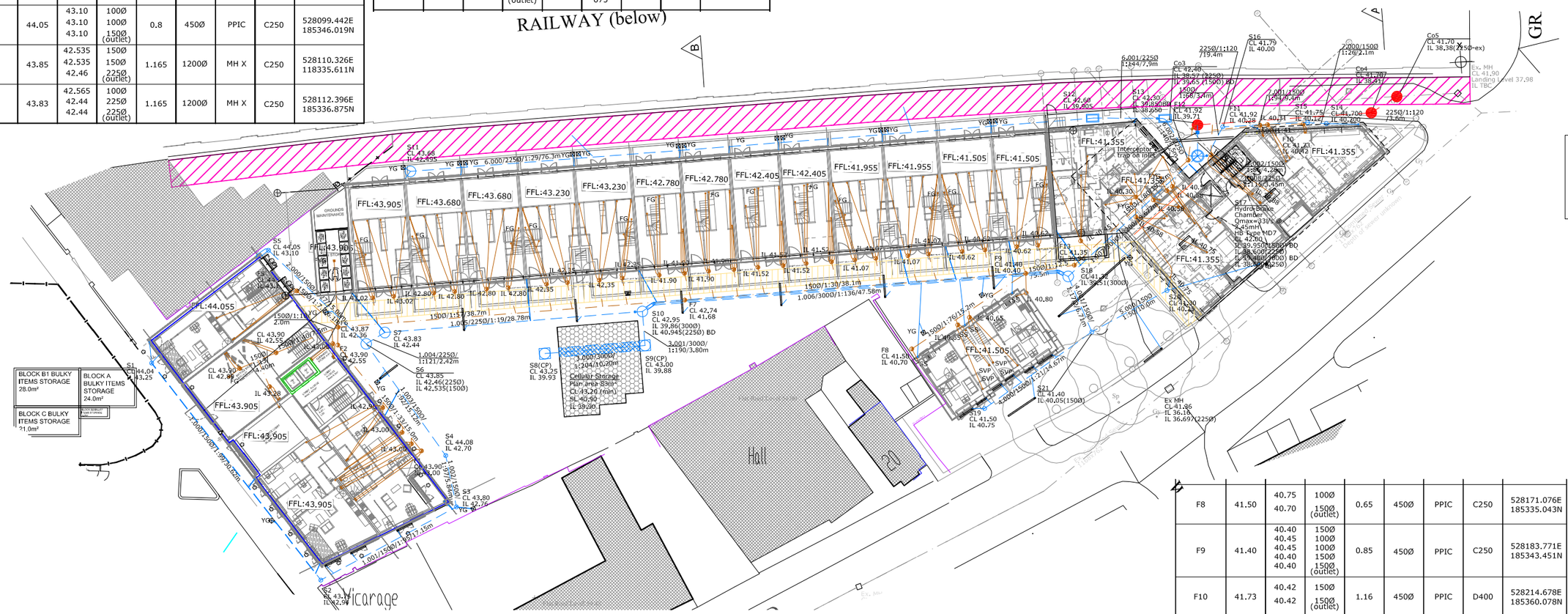
CONNECTION TO THE EXISTING SEWER SUBJECT TO THAMES WATER APPROVAL

Storm Water Manhole Schedule

Manhole No.	Cover Level	Inverts	Pipe Ø	MH depth to soffit of pipe	MH Ø	MH Type	Cover	Coordinates
S1	44.04	43.3 43.3 43.25	100Ø 100Ø 150Ø (outlet)	0.64	450Ø	PPIC	C250	528086.435E 185333.472N
S2	43.75	42.94 42.94	150Ø 150Ø (outlet)	0.66	450Ø	PPIC	C250	528105.272E 185309.321N
S3	43.80	42.81 42.76 42.76	100Ø 150Ø 150Ø (outlet)	0.89	450Ø	PPIC	C250	528120.368E 185317.464N
S4	44.08	42.70 42.70	150Ø 150Ø (outlet)	1.23	450Ø	PPIC	C250 # C250 #	528119.175E 185323.181N
S5	44.05	43.10 43.10 43.10	100Ø 100Ø 150Ø (outlet)	0.8	450Ø	PPIC	C250	528099.442E 185346.019N
S6	43.85	42.535 42.535 42.46	150Ø 150Ø 225Ø (outlet)	1.165	1200Ø	MH X	C250	528110.326E 118335.611N
S7	43.83	42.565 42.44 42.44	100Ø 225Ø 225Ø (outlet)	1.165	1200Ø	MH X	C250	528112.396E 185336.875N
S10	42.95	40.95 (BD) 39.86 39.86	225Ø 300Ø 300Ø (outlet)	2.79	1200Ø	MH B	C250	528141.078E 185339.216N
S11	43.68	42.62 42.62 42.495	100Ø 100Ø 225Ø (outlet)	0.96	1200Ø	MH X	C250	528115.254E 185354.800N
S12	42.60	39.905 39.905	225Ø 225Ø (outlet)	2.695	1200 x 675	MH B	C250	528191.204E 185360.733N

RAILWAY (below)



Manhole No.	Cover Level	Inverts	Pipe Ø	MH depth to soffit of pipe	MH Ø	MH Type	Cover	Coordinates
S13	42.30	39.850BD 38.650	225Ø 225Ø (outlet)	3.425	1200 x 675	MH B	D400	528199.270E 185360.702N
S14	41.700	40.250 40.200	100Ø 150Ø (outlet)	1.35	450Ø	PPIC	D400 #	528217.235E 185360.115N
S15	41.75	40.120 40.120	150Ø 150Ø (outlet)	1.38	450Ø	PPIC	D400 #	528215.143E 185360.227N
S16	41.79	40.00 40.00	150Ø 150Ø (outlet)	1.64	450Ø	PPIC	D400 #	528205.697E 185359.758N
S17 HYDROBRAKE CHAMBER	42.00	39.950 38.600 39.400 38.600	150Ø BD 225Ø 300Ø BD 225Ø (outlet)	3.10	1200Ø (Refer to INF/35 for detail)	HB Chamber	D400	528202.906E 185356.513N
S18	41.32	39.66 39.51 39.51	150Ø 300Ø 300Ø (outlet)	1.51	1200Ø	MH B	D400	528188.495E 185343.113N

S19	41.50	40.80 40.75	100Ø 150Ø (outlet)	0.60	450Ø	PPIC	D400	528179.180E 185328.412N
S20	41.30	40.30 40.30 40.25	100Ø 100Ø 150Ø (outlet)	0.90	450Ø	PPIC	D400	528199.489E 185341.552N
S21	41.40	40.05 40.05 40.05	150Ø 150Ø 150Ø (outlet)	1.20	450Ø	PPIC	D400	528191.119E 185336.935N

Reduced access PPIC

Foul Water Manhole Schedule
Continued

Manhole No.	Cover Level	Inverts	Pipe Ø	MH depth to soffit of pipe	MH Ø	MH Type	Cover	Coordinates
F1	43.90	43.05 43.05 43.05 43.00	100Ø 100Ø 100Ø 150Ø (outlet)	0.75	450Ø	PPIC	C250	528116.483E 185323.702N
F2	43.90	42.55 42.55	150Ø 150Ø (outlet)	1.20	450Ø	PPIC	C250	528107.161E 185335.483N
F6	43.87	42.41 42.36 42.36 42.36 42.36	100Ø 150Ø 150Ø 150Ø 150Ø (outlet)	1.36	450Ø	PPIC	C250 # C250 #	528107.192E 185337.471N
F7	42.74	41.68 41.68	150Ø 150Ø (outlet)	0.91	450Ø	PPIC	C250	528145.804E 185340.486N
F8	41.50	40.75 40.70	100Ø 150Ø (outlet)	0.65	450Ø	PPIC	C250	528171.076E 185335.043N
F9	41.40	40.40 40.45 40.45 40.40 40.40	150Ø 100Ø 100Ø 150Ø 150Ø (outlet)	0.85	450Ø	PPIC	C250	528183.771E 185343.451N
F10	41.73	40.42 40.42	150Ø 150Ø (outlet)	1.16	450Ø	PPIC	D400	528214.678E 185360.078N
F11	41.92	40.25 40.25	150Ø 150Ø (outlet)	1.52	450Ø	PPIC	D400 #	528206.147E 185359.520N
F12	41.92	39.71 39.71	150Ø 150Ø (outlet)	2.08	450Ø	PPIC	D400 #	528201.850E 185356.055N
F13	41.35	39.96 39.96 39.96	150Ø 150Ø 150Ø (outlet)	1.24	450Ø	PPIC	D400 #	528189.167E 185344.371N
Co3	42.40	38.570 39.650 38.570	225Ø SW (from interceptor trap) 150Ø FW EO 225Ø (outlet)	3.605	1200Ø	MH A	D400	528202.890E 185359.966N
Co4	41.70	38.41 38.41	225Ø 225Ø (outlet)	3.065	1200Ø	MH A	D400	528222.249E 185361.329N
Co5	41.70	38.38 38.38 ex	225Ø 225Ø (outlet)	3.095	1200Ø	MH A	D400	528225.081E 185363.130N

Rev.	Date	Description of Issue	Chkd
C12	27.02.15	Co4 moved further north	SDP
C11	20.02.15	Co4 moved	SDP
C10	20.11.14	S20 moved, S17 details amended	SDP
C9	14.11.14	S13-S17 lowered. BD added to S13. Foul drainage to block C adjusted (F10-F13)	SDP
C8	29.10.14	Drainage to block C amended to assist with foundation crossings. Hydrobrake updated	SDP
C7	08.10.14	Foul drainage to block C revised Alternative outfall MH CO3 and CO4 added	SDP
C6	11.07.14	F7 and F9 Invert levels revised	SDP
C5	15.05.14	Manhole schedule added Block A SVP locations revised Drainage outfall location amended	SDP
C4	28.04.14	SW drainage layout revised between S13 and Co1, FW drainage revised between F10 & Co1	SDP
C3	07.04.14	New site layout and GF layouts attached. FFLs and drainage revised.	SDP
C2	17.02.14	Storage tank location and Hydrobrake details adjusted. Interceptor trap moved.Pipe references 3.000,3.001,4.000,4.001,1.006 adjusted	SDP
C1	28.11.13	Construction issue. Drainage layout revised following changes to proposed site & building layouts	SDP
T1	03.06.13	Detailed storm & foul drainage details added for TENDER purposes only.	SWF
P3	16.05.13	Proposed surface water drainage added.	SDP
P2	26.03.13	Risk Assessment Reference amended	SDP
P1	18.09.12	Preliminary issue	SDP

Revisions

Issue Purpose:
CONSTRUCTION

Project
Bacton Low Rise
Camden

Drawing Title:
Proposed Drainage Layout

DHO site

Designer's Risk Assessment Reference:
12-0083 XDRA 001

Specification Reference:

Drawn By: AJM
Checked By: SDP

Scales: 1:250@A1 1:500@A3
Date: Sept 12

Drawing No. 12-0083/INF/11 C12
Rev.

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Private Storm 2a.sws

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	30.629	0.310	98.8	0.034	5.00	0.0	0.600	o	150	
1.001	17.152	0.180	95.3	0.004	0.00	0.0	0.600	o	150	
1.002	5.840	0.060	97.3	0.003	0.00	0.0	0.600	o	150	
1.003	15.258	0.165	92.5	0.025	0.00	0.0	0.600	o	150	
2.000	15.060	0.565	26.7	0.013	5.00	0.0	0.600	o	150	
1.004	2.425	0.020	121.3	0.000	0.00	0.0	0.600	o	225	
1.005	28.778	1.495	19.2	0.035	0.00	0.0	0.600	o	225	
3.000	10.200	0.050	204.0	0.000	5.00	0.0	0.600	o	300	
3.001	3.801	0.020	190.1	0.000	0.00	0.0	0.600	o	300	
1.006	47.577	0.350	135.9	0.097	0.00	0.0	0.600	o	300	
4.000	14.669	0.700	21.0	0.020	5.00	0.0	0.600	o	150	
5.000	9.993	0.200	50.0	0.021	5.00	0.0	0.600	o	150	
4.001	6.712	0.390	17.2	0.005	0.00	0.0	0.600	o	150	
1.007	19.677	0.110	178.9	0.011	0.00	0.0	0.600	o	300	
6.000	76.291	2.590	29.5	0.085	5.00	0.0	0.600	o	225	
6.001	6.119	0.037	165.4	0.014	0.00	0.0	0.600	o	225	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	25.00	5.50	43.250	0.034	0.0	0.0	0.0	1.01	17.9	2.3
1.001	25.00	5.78	42.940	0.038	0.0	0.0	0.0	1.03	18.2	2.6
1.002	25.00	5.88	42.760	0.041	0.0	0.0	0.0	1.02	18.0	2.8
1.003	25.00	6.12	42.700	0.066	0.0	0.0	0.0	1.05	18.5	4.5
2.000	25.00	5.13	43.100	0.013	0.0	0.0	0.0	1.96	34.6	0.9
1.004	25.00	6.16	42.460	0.079	0.0	0.0	0.0	1.19	47.2	5.3
1.005	25.00	6.32	42.440	0.114	0.0	0.0	0.0	3.00	119.1	7.7
3.000	25.00	5.15	39.930	0.000	0.0	0.0	0.0	1.10	77.5	0.0
3.001	25.00	5.21	39.880	0.000	0.0	0.0	0.0	1.14	80.4	0.0
1.006	25.00	6.90	39.860	0.211	0.0	0.0	0.0	1.35	95.2	14.3
4.000	25.00	5.11	40.750	0.020	0.0	0.0	0.0	2.21	39.1	1.4
5.000	25.00	5.12	40.250	0.021	0.0	0.0	0.0	1.43	25.2	1.4
4.001	25.00	5.16	40.050	0.046	0.0	0.0	0.0	2.44	43.1	3.1
1.007	25.00	7.18	39.510	0.268	0.0	0.0	0.0	1.17	82.9	18.1
6.000	25.00	5.53	42.495	0.085	0.0	0.0	0.0	2.42	96.2	5.8
6.001	25.00	5.63	39.905	0.099	0.0	0.0	0.0	1.01	40.3	6.7

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Private Storm 2a.sws

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
6.002	6.717	0.048	139.9	0.010	0.00	0.0	0.600	o	225	
7.000	2.095	0.080	26.2	0.017	5.00	0.0	0.600	o	150	
7.001	9.370	0.120	78.1	0.006	0.00	0.0	0.600	o	150	
7.002	4.280	0.050	85.6	0.010	0.00	0.0	0.600	o	150	
1.008	3.453	0.030	115.1	0.000	0.00	0.0	0.600	o	225	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.002	25.00	5.73	39.868	0.109	0.0	0.0	0.0	1.10	43.9	7.4
7.000	25.00	5.02	40.200	0.017	0.0	0.0	0.0	1.98	34.9	1.2
7.001	25.00	5.15	40.120	0.023	0.0	0.0	0.0	1.14	20.1	1.6
7.002	25.00	5.22	40.000	0.033	0.0	0.0	0.0	1.09	19.2	2.2
1.008	25.00	7.23	38.600	0.410	0.0	0.0	0.0	1.22	48.4	27.8

Manhole Schedules for Private Storm 2a.sws

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	44.050	0.800	Open Manhole	450	1.000	43.250	150				
S2	43.650	0.710	Open Manhole	450	1.001	42.940	150	1.000	42.940	150	
S3	43.800	1.040	Open Manhole	450	1.002	42.760	150	1.001	42.760	150	
S4	44.080	1.380	Open Manhole	450	1.003	42.700	150	1.002	42.700	150	
S5	44.050	0.950	Open Manhole	450	2.000	43.100	150				
S6	43.850	1.390	Open Manhole	1200	1.004	42.460	225	1.003	42.535	150	
								2.000	42.535	150	
S7	43.830	1.390	Open Manhole	1200	1.005	42.440	225	1.004	42.440	225	
S8	43.250	3.320	Open Manhole	1200	3.000	39.930	300				
S9	43.000	3.120	Open Manhole	1200	3.001	39.880	300	3.000	39.880	300	
S10	42.950	3.090	Open Manhole	1200	1.006	39.860	300	1.005	40.945	225	1010
								3.001	39.860	300	
S19	41.500	0.750	Open Manhole	450	4.000	40.750	150				
S20	41.300	1.050	Open Manhole	450	5.000	40.250	150				
S21	41.400	1.350	Open Manhole	450	4.001	40.050	150	4.000	40.050	150	
								5.000	40.050	150	
S18	41.350	1.840	Open Manhole	1500	1.007	39.510	300	1.006	39.510	300	
								4.001	39.660	150	
S11	43.680	1.185	Open Manhole	1200	6.000	42.495	225				
S12	42.600	2.695	Open Manhole	1200	6.001	39.905	225	6.000	39.905	225	
S13	42.300	2.432	Open Manhole	1200	6.002	39.868	225	6.001	39.868	225	
S14	41.700	1.500	Open Manhole	450	7.000	40.200	150				
S15	41.750	1.630	Open Manhole	450	7.001	40.120	150	7.000	40.120	150	
S16	41.790	1.790	Open Manhole	450	7.002	40.000	150	7.001	40.000	150	
S17	42.000	3.400	Open Manhole	1500	1.008	38.600	225	1.007	39.400	300	875
								6.002	39.820	225	1220
								7.002	39.950	150	1275
C03	42.400	3.830	Open Manhole	1200		OUTFALL		1.008	38.570	225	

PIPELINE SCHEDULES for Private Storm 2a.sws

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	44.050	43.250	0.650	Open Manhole	450
1.001	o	150	S2	43.650	42.940	0.560	Open Manhole	450
1.002	o	150	S3	43.800	42.760	0.890	Open Manhole	450
1.003	o	150	S4	44.080	42.700	1.230	Open Manhole	450
2.000	o	150	S5	44.050	43.100	0.800	Open Manhole	450
1.004	o	225	S6	43.850	42.460	1.165	Open Manhole	1200
1.005	o	225	S7	43.830	42.440	1.165	Open Manhole	1200
3.000	o	300	S8	43.250	39.930	3.020	Open Manhole	1200
3.001	o	300	S9	43.000	39.880	2.820	Open Manhole	1200
1.006	o	300	S10	42.950	39.860	2.790	Open Manhole	1200
4.000	o	150	S19	41.500	40.750	0.600	Open Manhole	450
5.000	o	150	S20	41.300	40.250	0.900	Open Manhole	450
4.001	o	150	S21	41.400	40.050	1.200	Open Manhole	450
1.007	o	300	S18	41.350	39.510	1.540	Open Manhole	1500
6.000	o	225	S11	43.680	42.495	0.960	Open Manhole	1200
6.001	o	225	S12	42.600	39.905	2.470	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)
1.000	30.629	98.8	S2	43.650	42.940	0.560	Open Manhole	450
1.001	17.152	95.3	S3	43.800	42.760	0.890	Open Manhole	450
1.002	5.840	97.3	S4	44.080	42.700	1.230	Open Manhole	450
1.003	15.258	92.5	S6	43.850	42.535	1.165	Open Manhole	1200
2.000	15.060	26.7	S6	43.850	42.535	1.165	Open Manhole	1200
1.004	2.425	121.3	S7	43.830	42.440	1.165	Open Manhole	1200
1.005	28.778	19.2	S10	42.950	40.945	1.780	Open Manhole	1200
3.000	10.200	204.0	S9	43.000	39.880	2.820	Open Manhole	1200
3.001	3.801	190.1	S10	42.950	39.860	2.790	Open Manhole	1200
1.006	47.577	135.9	S18	41.350	39.510	1.540	Open Manhole	1500
4.000	14.669	21.0	S21	41.400	40.050	1.200	Open Manhole	450
5.000	9.993	50.0	S21	41.400	40.050	1.200	Open Manhole	450
4.001	6.712	17.2	S18	41.350	39.660	1.540	Open Manhole	1500
1.007	19.677	178.9	S17	42.000	39.400	2.300	Open Manhole	1500
6.000	76.291	29.5	S12	42.600	39.905	2.470	Open Manhole	1200
6.001	6.119	165.4	S13	42.300	39.868	2.207	Open Manhole	1200

PIPELINE SCHEDULES for Private Storm 2a.sws

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.002	o	225	S13	42.300	39.868	2.207	Open Manhole	1200
7.000	o	150	S14	41.700	40.200	1.350	Open Manhole	450
7.001	o	150	S15	41.750	40.120	1.480	Open Manhole	450
7.002	o	150	S16	41.790	40.000	1.640	Open Manhole	450
1.008	o	225	S17	42.000	38.600	3.175	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.002	6.717	139.9	S17	42.000	39.820	1.955	Open Manhole	1500
7.000	2.095	26.2	S15	41.750	40.120	1.480	Open Manhole	450
7.001	9.370	78.1	S16	41.790	40.000	1.640	Open Manhole	450
7.002	4.280	85.6	S17	42.000	39.950	1.900	Open Manhole	1500
1.008	3.453	115.1	C03	42.400	38.570	3.605	Open Manhole	1200

Online Controls for Private Storm 2a.sws

Hydro-Brake® Manhole: S17, DS/PN: 1.008, Volume (m³): 7.6

Design Head (m) 2.450 Hydro-Brake® Type Md7 Invert Level (m) 38.600
Design Flow (l/s) 33.0 Diameter (mm) 176

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	22.9	3.000	36.2	7.000	55.3
0.200	10.9	1.400	24.7	3.500	39.1	7.500	57.3
0.300	11.7	1.600	26.4	4.000	41.8	8.000	59.1
0.400	13.2	1.800	28.0	4.500	44.3	8.500	61.0
0.500	14.8	2.000	29.6	5.000	46.7	9.000	62.7
0.600	16.2	2.200	31.0	5.500	49.0	9.500	64.4
0.800	18.7	2.400	32.4	6.000	51.2		
1.000	20.9	2.600	33.7	6.500	53.3		

Storage Structures for Private Storm 2a.sws

Cellular Storage Manhole: S9, DS/PN: 3.001

Invert Level (m) 33.900 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)
0.000	83.0	0.0	1.001	0.0	0.0
1.000	83.0	0.0			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

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 Coeffiecient	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 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	M5-60 (mm)	20.000
Region	England and Wales	Ratio R	0.400
Cv (Summer)	0.750		
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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	100/15 Summer				
1.001	15 Winter	1	0%	100/15 Summer				
1.002	15 Winter	1	0%	30/15 Summer				
1.003	15 Winter	1	0%	30/15 Summer				
2.000	15 Winter	1	0%					
1.004	15 Winter	1	0%	100/15 Summer				
1.005	15 Winter	1	0%					
3.000	120 Winter	1	0%	100/30 Winter				
3.001	15 Winter	1	0%	100/30 Winter				
1.006	15 Winter	1	0%	30/15 Summer				
4.000	15 Winter	1	0%	100/15 Summer				
5.000	15 Winter	1	0%	30/15 Summer				
4.001	15 Winter	1	0%	30/15 Summer				
1.007	15 Winter	1	0%	1/15 Summer				
6.000	15 Winter	1	0%					
6.001	15 Winter	1	0%	30/15 Summer				
6.002	15 Winter	1	0%	30/15 Summer				
7.000	15 Winter	1	0%	30/15 Summer				
7.001	15 Winter	1	0%	30/15 Summer				
7.002	15 Winter	1	0%	30/15 Summer				
1.008	15 Winter	1	0%	1/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	S1	43.304	-0.096	0.000	0.27	0.0	4.6	OK
1.001	S2	42.997	-0.093	0.000	0.30	0.0	5.1	OK
1.002	S3	42.823	-0.087	0.000	0.37	0.0	5.5	OK
1.003	S4	42.774	-0.076	0.000	0.49	0.0	8.4	OK
2.000	S5	43.123	-0.127	0.000	0.06	0.0	1.8	OK

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.004	S6	42.553	-0.132	0.000	0.36	0.0	10.1	OK
1.005	S7	42.493	-0.172	0.000	0.13	0.0	14.1	OK
3.000	S8	39.930	-0.300	0.000	0.00	0.0	0.0	OK
3.001	S9	33.932	-6.248	0.000	0.00	0.0	0.0	OK
1.006	S10	40.051	-0.109	0.000	0.26	0.0	23.1	OK
4.000	S19	40.778	-0.122	0.000	0.08	0.0	2.8	OK
5.000	S20	40.286	-0.114	0.000	0.13	0.0	2.9	OK
4.001	S21	40.092	-0.108	0.000	0.17	0.0	6.2	OK
1.007	S18	40.040	0.230	0.000	0.30	0.0	21.7	SURCHARGED
6.000	S11	42.548	-0.172	0.000	0.12	0.0	11.6	OK
6.001	S12	40.040	-0.090	0.000	0.45	0.0	13.3	OK
6.002	S13	40.033	-0.060	0.000	0.47	0.0	14.5	OK
7.000	S14	40.236	-0.114	0.000	0.13	0.0	2.4	OK
7.001	S15	40.162	-0.108	0.000	0.17	0.0	3.1	OK
7.002	S16	40.057	-0.093	0.000	0.30	0.0	4.2	OK
1.008	S17	40.024	1.199	0.000	0.83	0.0	24.9	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

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 Coeffiecient	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 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	M5-60 (mm) 20.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.400	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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%	100/15 Summer				
1.001	15 Winter	30	0%	100/15 Summer				
1.002	15 Winter	30	0%	30/15 Summer				
1.003	15 Winter	30	0%	30/15 Summer				
2.000	15 Winter	30	0%					
1.004	15 Winter	30	0%	100/15 Summer				
1.005	15 Winter	30	0%					
3.000	120 Winter	30	0%	100/30 Winter				
3.001	30 Winter	30	0%	100/30 Winter				
1.006	15 Winter	30	0%	30/15 Summer				
4.000	15 Winter	30	0%	100/15 Summer				
5.000	15 Winter	30	0%	30/15 Summer				
4.001	15 Winter	30	0%	30/15 Summer				
1.007	15 Winter	30	0%	1/15 Summer				
6.000	15 Winter	30	0%					
6.001	15 Winter	30	0%	30/15 Summer				
6.002	15 Winter	30	0%	30/15 Summer				
7.000	15 Winter	30	0%	30/15 Summer				
7.001	15 Winter	30	0%	30/15 Summer				
7.002	15 Winter	30	0%	30/15 Summer				
1.008	15 Winter	30	0%	1/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	S1	43.341	-0.059	0.000	0.66	0.0	11.4	OK
1.001	S2	43.070	-0.020	0.000	0.74	0.0	12.5	OK
1.002	S3	42.976	0.066	0.000	0.94	0.0	14.0	SURCHARGED
1.003	S4	42.932	0.082	0.000	1.22	0.0	20.8	SURCHARGED
2.000	S5	43.137	-0.113	0.000	0.14	0.0	4.4	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.004	S6	42.626	-0.059	0.000	0.89	0.0	25.0	OK
1.005	S7	42.530	-0.135	0.000	0.33	0.0	36.1	OK
3.000	S8	39.930	-0.300	0.000	0.00	0.0	0.0	OK
3.001	S9	34.391	-5.789	0.000	0.00	0.0	0.0	OK
1.006	S10	40.378	0.218	0.000	0.43	0.0	38.8	SURCHARGED
4.000	S19	40.794	-0.106	0.000	0.19	0.0	6.8	OK
5.000	S20	40.608	0.208	0.000	0.32	0.0	7.1	SURCHARGED
4.001	S21	40.582	0.382	0.000	0.42	0.0	15.5	SURCHARGED
1.007	S18	40.507	0.697	0.000	0.33	0.0	24.0	SURCHARGED
6.000	S11	42.581	-0.139	0.000	0.30	0.0	28.4	OK
6.001	S12	40.720	0.590	0.000	1.12	0.0	33.5	SURCHARGED
6.002	S13	40.639	0.546	0.000	1.23	0.0	38.0	SURCHARGED
7.000	S14	40.605	0.255	0.000	0.32	0.0	5.6	SURCHARGED
7.001	S15	40.599	0.329	0.000	0.42	0.0	7.6	SURCHARGED
7.002	S16	40.573	0.423	0.000	0.75	0.0	10.6	SURCHARGED
1.008	S17	40.543	1.718	0.000	0.97	0.0	29.1	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

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 Coeffiecient	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 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	M5-60 (mm)	20.000
Region	England and Wales	Ratio R	0.400
Cv (Summer)	0.750		
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
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	100/15 Summer				
1.001	15 Winter	100	+30%	100/15 Summer				
1.002	15 Winter	100	+30%	30/15 Summer				
1.003	15 Winter	100	+30%	30/15 Summer				
2.000	15 Winter	100	+30%					
1.004	15 Winter	100	+30%	100/15 Summer				
1.005	15 Winter	100	+30%					
3.000	60 Winter	100	+30%	100/30 Winter				
3.001	60 Winter	100	+30%	100/30 Winter				
1.006	15 Winter	100	+30%	30/15 Summer				
4.000	15 Winter	100	+30%	100/15 Summer				
5.000	15 Winter	100	+30%	30/15 Summer				
4.001	15 Winter	100	+30%	30/15 Summer				
1.007	15 Winter	100	+30%	1/15 Summer				
6.000	15 Winter	100	+30%					
6.001	15 Winter	100	+30%	30/15 Summer				
6.002	15 Winter	100	+30%	30/15 Summer				
7.000	15 Winter	100	+30%	30/15 Summer				
7.001	15 Winter	100	+30%	30/15 Summer				
7.002	15 Winter	100	+30%	30/15 Summer				
1.008	15 Winter	100	+30%	1/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	S1	43.914	0.514	0.000	0.98	0.0	16.9	FLOOD RISK
1.001	S2	43.611	0.521	0.000	1.10	0.0	18.7	FLOOD RISK
1.002	S3	43.403	0.493	0.000	1.34	0.0	20.1	SURCHARGED
1.003	S4	43.303	0.453	0.000	1.83	0.0	31.2	SURCHARGED
2.000	S5	43.149	-0.101	0.000	0.24	0.0	7.5	OK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Private Storm 2a.sws

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.004	S6	42.732	0.047	0.000	1.36	0.0	38.1	SURCHARGED
1.005	S7	42.557	-0.108	0.000	0.51	0.0	57.0	OK
3.000	S8	40.373	0.143	0.000	0.02	0.0	1.1	SURCHARGED
3.001	S9	40.373	0.193	0.000	0.07	0.0	3.5	SURCHARGED
1.006	S10	40.733	0.573	0.000	0.45	0.0	39.9	SURCHARGED
4.000	S19	41.216	0.316	0.000	0.30	0.0	10.7	FLOOD RISK
5.000	S20	41.204	0.804	0.000	0.49	0.0	11.1	FLOOD RISK
4.001	S21	41.150	0.950	0.000	0.66	0.0	24.2	FLOOD RISK
1.007	S18	40.970	1.160	0.000	0.35	0.0	25.4	SURCHARGED
6.000	S11	42.612	-0.108	0.000	0.51	0.0	47.9	OK
6.001	S12	41.385	1.255	0.000	1.78	0.0	53.2	SURCHARGED
6.002	S13	41.236	1.143	0.000	1.91	0.0	59.0	SURCHARGED
7.000	S14	41.212	0.862	0.000	0.51	0.0	9.1	SURCHARGED
7.001	S15	41.199	0.929	0.000	0.68	0.0	12.1	SURCHARGED
7.002	S16	41.139	0.989	0.000	1.23	0.0	17.3	SURCHARGED
1.008	S17	41.059	2.234	0.000	1.09	0.0	32.6	SURCHARGED

APPENDIX B

CATCHMENT AREA PLAN

10mm 20mm 30mm 40mm 50mm 100mm

General notes:

1. This drawing is to be read in conjunction with all the relevant contract documentation.
2. All dimensions are in mm unless otherwise stated.
3. Drawings marked Preliminary are for guidance/approval only.

Key:

180m²
12.000 Contrlbutlng surface catchments area
Surface water sewer reference for catchment

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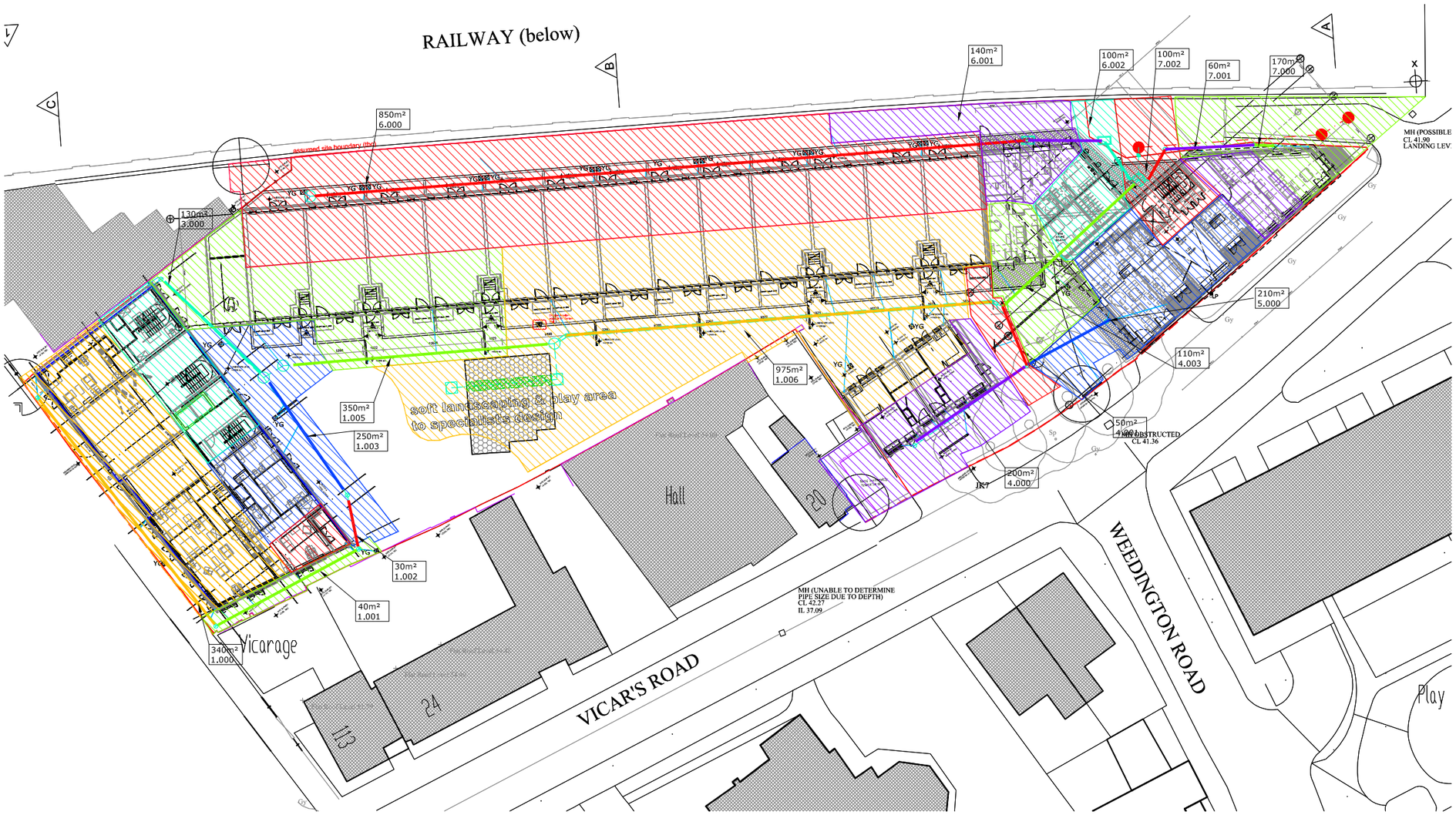


Rev.	Date	Description of Issue	Chkd
P2	27.02.15	Preliminary issue	SDP
P1	17.02.14	Preliminary issue	SDP

Revisions

Issue Purpose:
PRELIMIARY

Project
Bacton Low Rise
Camden

Drawing Title:
Proposed Catchment
Area Plan
DHO site

Designer's Risk Assessment Reference:
12-0083 XDRA 001

Specification Reference:

Drawn By: AJM
Checked By: SDP

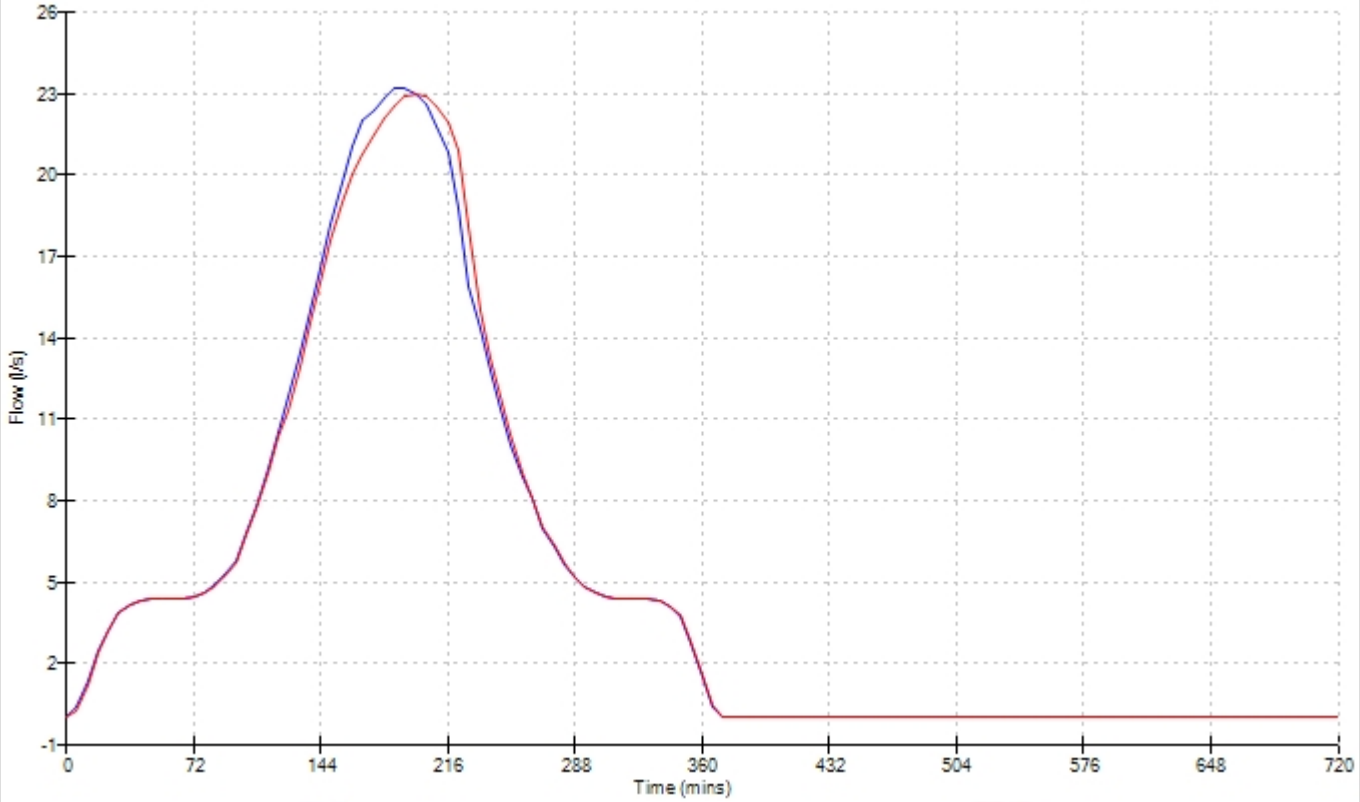
Scales: 1:250@A1
1:500@A3
Date: Feb.14

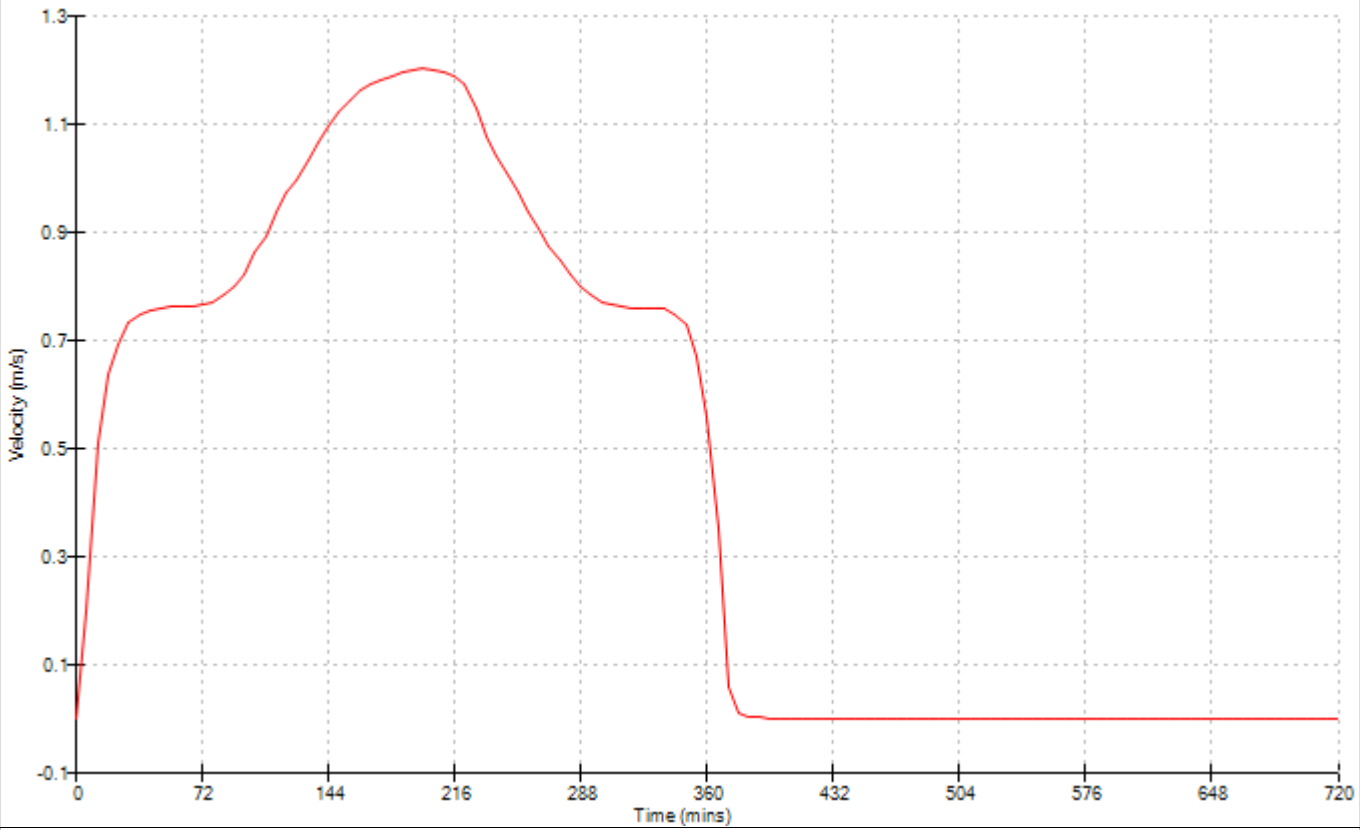
Drawing No. 12-0083/INF/19 P2
Rev.

APPENDIX C

PROPOSED 360 MINUTE STORM DURATION GRAPH

Graphs for Pipe 1.008 US/MH S17 (Private Storm 2a.sws)
360 minute 100 year Winter
Status: SURCHARGED





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