

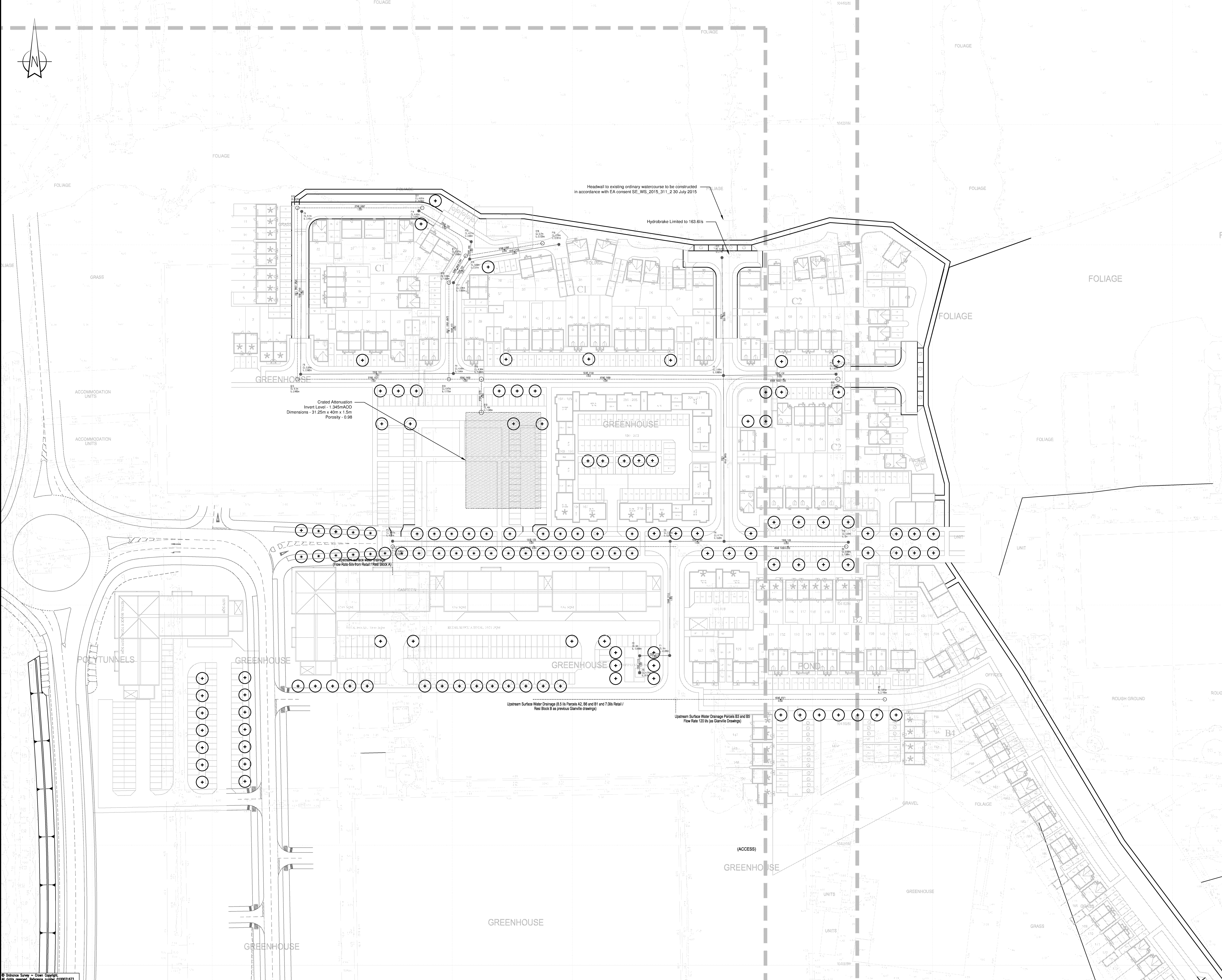
Land North of Toddington Lane, Littlehampton

Drainage Technical Note



APPENDIX C

PHASE 2 SURFACE AND FOUL WATER DRAINAGE STRATEGY



LEGEND	
	Proposed surface water system to be adopted under S104 Agreement
	Proposed surface water system to remain private and be maintained by Management Company
	Proposed foul sewer

B	Amended following Clients Comments	PG	MP	29.03.17
A	Amended to Mayer Brown Road Levels	PG	MP	24.03.17
REV	DETAILS	DRAWN BY	CHECKED BY	DATE

CLIENT:

PERSIMMON HOMES

PROJECT:

NORTH LITTLEHAMPTON

DRAWING TITLE:

PROPOSED FOUL AND SURFACE WATER DRAINAGE LAYOUT

SCALE:

1:500

SHEET SIZE:

A0

DRAWN:

PG

CHECKED:

MP

DATE:

13.03.17

DRAWING NUMBER:

A100789_500

REVISION:

B

WYG Transport

part of WYG group

5th Floor, Longcross Court
47 Newports Road, Cardiff, CF24 0AD
t: 029 2060 5000 f: 029 2060 5351 e: transport.cardiff@wyg.com

Land North of Toddington Lane, Littlehampton

Drainage Technical Note



APPENDIX D

SURFACE WATER DRAINAGE CALCULATIONS



WYG		Page 1																																																																																																																																																																																																																																																																																																																				
5th Floor, Longcross Court 47 Newport Road Cardiff CF24 0AD																																																																																																																																																																																																																																																																																																																						
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<u>STORM SEWER DESIGN by the Modified Rational Method</u> <u>Network Design Table for SURFACE.SWS</u> « - Indicates pipe capacity < flow <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. 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(mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design	1.000	52.001	0.175	297.1	0.280	5.00	0.0	0.600	o	375	⊗	1.001	71.345	0.195	365.9	0.170	0.00	0.0	0.600	o	375	⊗	1.002	63.122	0.285	221.5	0.100	0.00	0.0	0.600	o	375	⊗	2.000	32.418	0.090	360.2	0.380	5.00	0.0	0.600	o	375	⊗	2.001	13.174	0.030	439.1	0.170	0.00	0.0	0.600	o	525	⊗	2.002	40.212	0.080	502.7	0.100	0.00	0.0	0.600	o	525	⊗	1.003	13.494	0.030	449.8	0.000	0.00	0.0	0.600	o	525	⊗	3.000	13.810	0.050	276.2	0.330	5.00	0.0	0.600	o	375	⊗	1.004	103.224	0.110	938.4	0.000	0.00	0.0	0.600	o	375	⊗	4.000	87.098	0.235	370.6	0.180	5.00	0.0	0.600	o	450	⊗	4.001	63.614	0.110	578.3	0.000	0.00	135.5	0.600	o	600	⊗	5.000	117.899	1.120	105.3	0.280	5.00	5.0	0.600	o	450	⊗	4.002	22.257	0.025	890.3	0.200	0.00	0.0	0.600	o	375	⊗	PN	Rain (mm/hr)	T.C. 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WYG		Page 2
5th Floor, Longcross Court 47 Newport Road Cardiff CF24 0AD		
Date 31/03/2017 09:47 File SurfaceWater170331.mdx		
Designed by paul.graham		
Checked by		
Micro Drainage		Network 2015.1

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for SURFACE.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
6.000	48.787	0.195	250.2	0.200	5.00	0.0	0.600	o	450	
4.003	69.692	0.075	929.2	0.000	0.00	0.0	0.600	o	975	
7.000	45.299	0.090	503.3	0.240	5.00	0.0	0.600	o	900	
1.005	51.873	0.050	1037.5	0.000	0.00	0.0	0.600	o	1050	
1.006	14.107	0.060	235.1	0.000	0.00	0.0	0.600	o	525	

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)
6.000	46.71	5.63	1.980	0.200	0.0	0.0	0.0	1.28	203.7	25.3
4.003	37.64	8.86	1.260	0.860	140.5	0.0	0.0	1.07	800.1	228.2
7.000	47.04	5.54	1.950	0.240	0.0	0.0	0.0	1.39	884.1	30.6
1.005	34.23	10.60	1.110	2.630	140.5	0.0	0.0	1.06	919.0	384.3
1.006	33.95	10.76	1.080	2.630	140.5	0.0	0.0	1.46	315.3	384.3

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WYG								Page 3			
5th Floor, Longcross Court 47 Newport Road Cardiff CF24 0AD				Untitled							
Date 31/03/2017 09:47 File SurfaceWater170331.mdx				Designed by paul.graham Checked by							
Micro Drainage				Network 2015.1							
<u>Manhole Schedules for SURFACE.SWS</u>											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S11	4.610	1.575	Open Manhole	1500	1.000	3.035	375				455
S12	5.040	2.180	Open Manhole	1500	1.001	2.860	375	1.000	2.860	375	
S13	5.100	2.435	Open Manhole	1500	1.002	2.665	375	1.001	2.665	375	
S16	3.700	1.575	Open Manhole	1500	2.000	2.125	375				
S17	2.970	2.085	Open Manhole	1500	2.001	1.885	525	2.000	2.035	375	
S18	3.940	2.085	Open Manhole	1500	2.002	1.855	525	2.001	1.855	525	
S14	4.470	2.695	Open Manhole	1500	1.003	1.775	525	1.002	2.380	375	
								2.002	1.775	525	
S19	4.000	2.655	Open Manhole	1875	3.000	1.345	975				
S15	4.340	3.045	Open Manhole	1875	1.004	1.295	975	1.003	1.745	525	
								3.000	1.295	975	
S7	3.510	1.355	Open Manhole	1500	4.000	2.155	450				
S8	4.500	2.730	Open Manhole	1500	4.001	1.770	600	4.000	1.920	450	
S1	5.860	2.930	Open Manhole	1500	5.000	2.930	450				
S2	4.400	3.115	Open Manhole	1875	4.002	1.285	975	4.001	1.660	600	
								5.000	1.810	450	
S9	3.630	1.650	Open Manhole	1500	6.000	1.980	450				
S3	4.140	2.880	Open Manhole	1875	4.003	1.260	975	4.002	1.260	975	
								6.000	1.785	450	
S10	3.720	2.370	Open Manhole	1800	7.000	1.350	900				
S4	3.670	2.560	Open Manhole	1950	1.005	1.110	1050	1.004	1.185	975	
								4.003	1.185	975	
								7.000	1.260	900	
S5	3.750	2.690	Open Manhole	2100	1.006	1.060	525	1.005	1.060	1050	
S6	3.700	2.700	Open Manhole	1200		OUTFALL		1.006	1.000	525	
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<u>Setting Out Information - True Coordinates (SURFACE.SWS)</u>						
PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.000	S11	1500		503287.492	104315.376	
1.001	S12	1500		503235.491	104315.376	
1.002	S13	1500		503235.491	104244.031	
2.000	S16	1500		503337.596	104300.619	
2.001	S17	1500		503305.599	104295.413	
2.002	S18	1500		503298.613	104284.243	
1.003	S14	1500		503298.613	104244.031	
3.000	S19	1875		503312.107	104230.221	
1.004	S15	1875		503312.107	104244.031	
4.000	S7	1500		503480.172	104110.724	
4.001	S8	1500		503393.074	104110.724	
5.000	S1	1500		503275.175	104174.348	
4.002	S2	1875		503393.074	104174.339	
6.000	S9	1500		503464.118	104174.339	
4.003	S3	1875		503415.331	104174.339	
7.000	S10	1800		503460.630	104244.031	
1.005	S4	1950		503415.331	104244.031	
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Setting Out Information - True Coordinates (SURFACE.SWS)

PN

USMH

Dia/Len

Width

US Easting

US Northing

Layout

Name

(mm)

(mm)

(m)

(m)

(North)

1.006

S5

2100

503415.327

104295.904

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Micro Drainage Network 2015.1		

Online Controls for SURFACE.SWS

Hydro-Brake Optimum® Manhole: S5, DS/PN: 1.006, Volume (m³): 52.5

Unit Reference	MD-SHE-0467-1636-2400-1636
Design Head (m)	2.400
Design Flow (l/s)	163.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	467
Invert Level (m)	1.060
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	163.1	Kick-Flo®	1.704	138.1
Flush-Flo™	0.818	162.8	Mean Flow over Head Range	-	137.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	12.1	1.200	158.9	3.000	181.9	7.000	275.4
0.200	44.1	1.400	154.5	3.500	196.1	7.500	284.9
0.300	88.4	1.600	145.9	4.000	209.3	8.000	294.0
0.400	134.0	1.800	141.8	4.500	221.8	8.500	302.9
0.500	156.2	2.000	149.3	5.000	233.5	9.000	311.6
0.600	160.1	2.200	156.4	5.500	244.7	9.500	319.9
0.800	162.7	2.400	163.1	6.000	255.3		
1.000	161.7	2.600	169.6	6.500	265.6		

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Storage Structures for SURFACE.SWS

Cellular Storage Manhole: S19, DS/PN: 3.000

Invert Level (m) 1.345 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	1250.0	0.0	1.501	0.0	0.0
1.500	1250.0	0.0			

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Micro Drainage		Network 2015.1							
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SURFACE.SWS</u>									
<u>Simulation Criteria</u>									
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000									
Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>									
Rainfall Model FSR Ratio R 0.350 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.300 Cv (Winter) 0.840									
Margin for Flood Risk Warning (mm) 300.0 DVD Status ON Analysis Timestep Fine Inertia Status ON DTS Status ON									
<u>Profile(s)</u>									
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 30									
Water									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
1.000	S11	15 Winter	1	+0%	30/15 Winter				3.185
1.001	S12	15 Winter	1	+0%	30/15 Summer				3.055
1.002	S13	15 Winter	1	+0%	100/15 Summer				2.842
2.000	S16	15 Winter	1	+0%	30/15 Summer				2.319
2.001	S17	15 Winter	1	+0%	30/15 Summer				2.206
2.002	S18	15 Winter	1	+0%	30/15 Summer				2.195
1.003	S14	15 Winter	1	+0%	30/15 Summer				2.154
3.000	S19	960 Winter	1	+0%	100/240 Winter				1.653
1.004	S15	30 Winter	1	+0%	100/15 Summer				1.735
4.000	S7	15 Winter	1	+0%	100/15 Summer	100/960 Winter			2.270
4.001	S8	15 Winter	1	+0%	100/15 Summer				2.109
5.000	S1	15 Winter	1	+0%					3.040
4.002	S2	30 Winter	1	+0%	100/15 Summer				1.822
6.000	S9	15 Winter	1	+0%	100/15 Summer				2.092
4.003	S3	30 Winter	1	+0%	100/15 Summer				1.788
7.000	S10	30 Winter	1	+0%	100/15 Summer				1.757
1.005	S4	30 Winter	1	+0%	100/15 Summer	100/960 Winter			1.756
1.006	S5	30 Winter	1	+0%	1/15 Summer	100/960 Winter			1.728
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Micro Drainage		Network 2015.1						
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SURFACE.SWS</u>								
PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S11	-0.225	0.000	0.32		34.7	OK	
1.001	S12	-0.180	0.000	0.49		48.5	OK	
1.002	S13	-0.198	0.000	0.45		57.2	OK	
2.000	S16	-0.181	0.000	0.51		47.7	OK	
2.001	S17	-0.204	0.000	0.46		61.5	OK	
2.002	S18	-0.185	0.000	0.35		66.1	OK	
1.003	S14	-0.146	0.000	0.87		115.4	OK	
3.000	S19	-0.667	0.000	0.01		8.2	OK	
1.004	S15	-0.535	0.000	0.05		33.5	OK	
4.000	S7	-0.335	0.000	0.13		20.9	OK	
4.001	S8	-0.261	0.000	0.61		155.3	OK	
5.000	S1	-0.340	0.000	0.14		41.1	OK	
4.002	S2	-0.438	0.000	0.52		201.2	OK	
6.000	S9	-0.338	0.000	0.14		25.7	OK	
4.003	S3	-0.447	0.000	0.31		213.0	OK	
7.000	S10	-0.493	0.000	0.03		22.3	OK	
1.005	S4	-0.404	0.000	0.25		185.0	OK	
1.006	S5	0.143	0.000	0.71		161.2	SURCHARGED	
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<u>Simulation Criteria</u> Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000																																																																																																																																																																																																						
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5.000	S1	15 Winter	30	+0%					3.102																																																																																																																																																																																													
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SURFACE.SWS <table><tr><th rowspan="2">PN</th><th rowspan="2">US/MH Name</th><th colspan="2">Surcharged Flooded</th><th rowspan="2">Flow / Cap.</th><th rowspan="2">Overflow (l/s)</th><th rowspan="2">Pipe Flow (l/s)</th><th rowspan="2">Status</th><th rowspan="2">Level Exceeded</th></tr><tr><th>Depth (m)</th><th>Volume (m³)</th></tr><tr><td>1.000</td><td>S11</td><td>0.031</td><td>0.000</td><td>0.73</td><td></td><td>78.5</td><td>SURCHARGED</td><td></td></tr><tr><td>1.001</td><td>S12</td><td>0.104</td><td>0.000</td><td>1.17</td><td></td><td>115.3</td><td>SURCHARGED</td><td></td></tr><tr><td>1.002</td><td>S13</td><td>-0.032</td><td>0.000</td><td>1.00</td><td></td><td>125.9</td><td>OK</td><td></td></tr><tr><td>2.000</td><td>S16</td><td>0.128</td><td>0.000</td><td>1.19</td><td></td><td>111.3</td><td>SURCHARGED</td><td></td></tr><tr><td>2.001</td><td>S17</td><td>0.092</td><td>0.000</td><td>1.15</td><td></td><td>155.3</td><td>SURCHARGED</td><td></td></tr><tr><td>2.002</td><td>S18</td><td>0.087</td><td>0.000</td><td>0.93</td><td></td><td>174.9</td><td>SURCHARGED</td><td></td></tr><tr><td>1.003</td><td>S14</td><td>0.094</td><td>0.000</td><td>2.23</td><td></td><td>295.6</td><td>SURCHARGED</td><td></td></tr><tr><td>3.000</td><td>S19</td><td>-0.394</td><td>0.000</td><td>0.02</td><td></td><td>16.6</td><td>OK</td><td></td></tr><tr><td>1.004</td><td>S15</td><td>-0.245</td><td>0.000</td><td>0.11</td><td></td><td>76.6</td><td>OK</td><td></td></tr><tr><td>4.000</td><td>S7</td><td>-0.263</td><td>0.000</td><td>0.33</td><td></td><td>51.5</td><td>OK</td><td></td></tr><tr><td>4.001</td><td>S8</td><td>-0.061</td><td>0.000</td><td>0.69</td><td></td><td>176.7</td><td>OK</td><td></td></tr><tr><td>5.000</td><td>S1</td><td>-0.278</td><td>0.000</td><td>0.30</td><td></td><td>90.0</td><td>OK</td><td></td></tr><tr><td>4.002</td><td>S2</td><td>-0.034</td><td>0.000</td><td>0.71</td><td></td><td>272.5</td><td>OK</td><td></td></tr><tr><td>6.000</td><td>S9</td><td>-0.225</td><td>0.000</td><td>0.27</td><td></td><td>50.0</td><td>OK</td><td></td></tr><tr><td>4.003</td><td>S3</td><td>-0.040</td><td>0.000</td><td>0.44</td><td></td><td>297.5</td><td>OK</td><td></td></tr><tr><td>7.000</td><td>S10</td><td>-0.112</td><td>0.000</td><td>0.08</td><td></td><td>54.8</td><td>OK</td><td></td></tr><tr><td>1.005</td><td>S4</td><td>-0.069</td><td>0.000</td><td>0.30</td><td></td><td>222.4</td><td>OK</td><td></td></tr><tr><td>1.006</td><td>S5</td><td>0.433</td><td>0.000</td><td>0.71</td><td></td><td>162.5</td><td>SURCHARGED</td><td></td></tr></table>				PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	Depth (m)	Volume (m³)	1.000	S11	0.031	0.000	0.73		78.5	SURCHARGED		1.001	S12	0.104	0.000	1.17		115.3	SURCHARGED		1.002	S13	-0.032	0.000	1.00		125.9	OK		2.000	S16	0.128	0.000	1.19		111.3	SURCHARGED		2.001	S17	0.092	0.000	1.15		155.3	SURCHARGED		2.002	S18	0.087	0.000	0.93		174.9	SURCHARGED		1.003	S14	0.094	0.000	2.23		295.6	SURCHARGED		3.000	S19	-0.394	0.000	0.02		16.6	OK		1.004	S15	-0.245	0.000	0.11		76.6	OK		4.000	S7	-0.263	0.000	0.33		51.5	OK		4.001	S8	-0.061	0.000	0.69		176.7	OK		5.000	S1	-0.278	0.000	0.30		90.0	OK		4.002	S2	-0.034	0.000	0.71		272.5	OK		6.000	S9	-0.225	0.000	0.27		50.0	OK		4.003	S3	-0.040	0.000	0.44		297.5	OK		7.000	S10	-0.112	0.000	0.08		54.8	OK		1.005	S4	-0.069	0.000	0.30		222.4	OK		1.006	S5	0.433	0.000	0.71		162.5	SURCHARGED	
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Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000									
Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>									
Rainfall Model FSR Ratio R 0.350 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.300 Cv (Winter) 0.840									
Margin for Flood Risk Warning (mm) 300.0 DVD Status ON Analysis Timestep Fine Inertia Status ON DTS Status ON									
<u>Profile(s)</u>									
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 30									
Water									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
1.000	S11	15 Winter	100	+30%	30/15 Winter				4.513
1.001	S12	15 Winter	100	+30%	30/15 Summer				4.280
1.002	S13	15 Winter	100	+30%	100/15 Summer				3.575
2.000	S16	30 Winter	100	+30%	30/15 Summer				3.297
2.001	S17	15 Winter	100	+30%	30/15 Summer				3.101
2.002	S18	15 Winter	100	+30%	30/15 Summer				3.107
1.003	S14	15 Winter	100	+30%	30/15 Summer				3.146
3.000	S19	960 Winter	100	+30%	100/240 Winter				2.446
1.004	S15	15 Winter	100	+30%	100/15 Summer				2.877
4.000	S7	15 Winter	100	+30%	100/15 Summer	100/960 Winter			3.428
4.001	S8	15 Winter	100	+30%	100/15 Summer				3.353
5.000	S1	30 Winter	100	+30%					3.317
4.002	S2	15 Winter	100	+30%	100/15 Summer				3.329
6.000	S9	30 Summer	100	+30%	100/15 Summer				3.207
4.003	S3	15 Winter	100	+30%	100/15 Summer				3.291
7.000	S10	15 Winter	100	+30%	100/15 Summer				3.355
1.005	S4	360 Winter	100	+30%	100/15 Summer	100/960 Winter			3.357
1.006	S5	15 Winter	100	+30%	1/15 Summer	100/960 Winter			3.374
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<u>100 year Return Period Summary of Critical Results by Maximum Level</u> <u>(Rank 1) for SURFACE.SWS</u>								

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.100	Minimum Backdrop Height (m)	0.200
Ratio R	0.350	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

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	110.000	1.758	62.6	0.146	5.00	0.0	0.600	o	225	⊗
1.001	126.000	5.819	21.7	0.166	0.00	0.0	0.600	o	225	⊗
1.002	103.954	0.139	750.0	0.128	0.00	0.0	0.600	o	1350	⊗
1.003	115.000	0.153	750.0	0.162	0.00	0.0	0.600	o	1350	⊗
1.004	42.565	0.033	1289.8	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)
1.000	44.84	6.11	12.544	0.146	0.0	0.0	0.0	1.66	65.9	17.7
1.001	42.52	6.85	10.785	0.312	0.0	0.0	0.0	2.82	112.3	35.9
1.002	39.35	8.04	3.842	0.440	0.0	0.0	0.0	1.46	2090.6	46.9
1.003	36.42	9.35	3.793	0.602	0.0	0.0	0.0	1.46	2090.6	59.4
1.004	32.86	11.34	3.550	0.602	0.0	0.0	0.0	0.36	14.14	59.4

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<u>Simulation Criteria for Surface Network 1</u> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (l/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 0 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Summer</td> </tr> <tr> <td>Return Period (years)</td> <td>1</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.100</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td></td> <td></td> </tr> </table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	1	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.100	Storm Duration (mins)	30	Ratio R	0.350		
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Region	England and Wales	Cv (Winter)	0.840																			
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Surface Network 1

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.100 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	Storm	Return Climate Period	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	120 Winter	1	0%	100/360 Winter				
1.003	120 Winter	1	0%	100/240 Winter				
1.004	120 Winter	1	0%	1/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	S1	12.626	-0.143	0.000	0.27	0.0	17.5	OK
1.001	S2	10.872	-0.138	0.000	0.32	0.0	34.8	OK
1.002	S3	4.036	-1.156	0.000	0.01	0.0	19.1	OK
1.003	S4	4.035	-1.018	0.000	0.01	0.0	20.1	OK
1.004	S5	4.035	0.260	0.000	0.33	0.0	4.6	SURCHARGED

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.100 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	Storm	Return Climate Period	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	240 Winter	30	0%	100/360 Winter				
1.003	240 Winter	30	0%	100/240 Winter				
1.004	240 Winter	30	0%	1/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Flow (l/s)	
1.000	S1	12.685	-0.084	0.000	0.67	0.0	43.0	OK
1.001	S2	10.949	-0.061	0.000	0.86	0.0	94.9	OK
1.002	S3	4.454	-0.738	0.000	0.02	0.0	27.9	OK
1.003	S4	4.454	-0.599	0.000	0.01	0.0	23.2	OK
1.004	S5	4.454	0.679	0.000	0.33	0.0	4.6	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.100 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surge	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	360 Winter	100	+30%	100/360 Winter				
1.003	360 Winter	100	+30%	100/240 Winter				
1.004	360 Winter	100	+30%	1/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	S1	13.411	0.642	0.000	0.92	0.0	59.7	SURCHARGED
1.001	S2	11.894	0.884	0.000	1.07	0.0	118.5	SURCHARGED
1.002	S3	5.362	0.170	0.000	0.02	0.0	34.9	SURCHARGED
1.003	S4	5.362	0.309	0.000	0.01	0.0	26.8	SURCHARGED
1.004	S5	5.362	1.587	0.000	0.37	0.0	5.2	SURCHARGED

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Land North of Toddington Lane, Littlehampton

Drainage Technical Note

APPENDIX E

EA DISCHARGE CONSENT



Flood Defence Consent

Section 23 of the Land Drainage Act 1991

Persimmons Homes Ltd
(Thames Valley)
Persimmon House
Knoll road
Camberley
Surrey
GU15 3TQ

**Consent applying to the
construction of 1 no.
surface water outfall to
take discharge from new
development into
Ordinary Watercourse
(within the River Arun
Internal Drainage
District)**

Land south of Black Ditch,
North Littlehampton, West
Sussex

NGR: 503413, 104302

Consent number
SE_WS_2015_311_2

Effective from
30th July 2015

Environment Agency West Sussex

Disclaimer

The Environment Agency does not accept any responsibility for the design and construction of the works referred hereto and any liability for any loss or damage which may arise out of their design, construction, maintenance or use.

Our approval is given solely on river morphology, flow, ecology, and other land drainage criteria. It should not be regarded by the applicant as in any way approving the design and soundness of the proposed structure, other than in relation to its impact on flows in the watercourse and its flood plain

This Consent does not free you from the need to obtain other licences, consents, approvals (including bye-law consents) or permissions (including planning permission) which may be required in law or in order to comply with any duties or responsibilities for conservation or protection of the environment. You should ensure that the works are carried out in a proper manner so as not to adversely affect the watercourse. A copy of the Special Requirements issued by the Environment Agency is available upon request. Work should be completed as quickly as possible once started.

The works shall be carried out at your own risk and responsibility. We accept no responsibility for any loss or damage howsoever caused arising from the carrying out or construction of the works. We may occasionally make observations on health and safety aspects of the work, however this should not be taken in any way whatsoever to imply that we have a role in ensuring site safety, nor that we have approved any contractors plans.

Land ownership is not a material consideration in determining this consent. Where you are not the owner of the land (including riverbeds and other water bodies) referred to in this consent, you must obtain suitable permission from the landowner prior to the commencement of works. This Consent does not confer any rights of entry or rights over property.

If you undertake works in contravention of Section 109 of the Water Resources Act, 1991 (Restriction on erection of structures in, over or under main river), or of the terms of this consent, we may remove, alter or pull down the works and recover from you the expenses incurred in doing so.

The responsibility to ascertain the location of any services, which may be affected by the proposed works, lies solely with the Applicant/Agent.

The contents of this consent must be brought to the attention of your contractor.

If you believe that conditions have been unreasonably imposed then you have a right of appeal.

Environment Agency Consent

Consent

Section 23 of the Land Drainage Act 1991



Flood Defence Consent

Control of works affecting watercourses and/or flood defences

Consent number **SE_WS_2015_311_2**

To Persimmon Homes Ltd (Thames Valley)
of Persimmon House, Knoll Road, Camberley, Surrey GU15 3TQ

The Environment Agency, in exercise of its powers under Section 23 of the Land Drainage Act 1991 and subject to the conditions overleaf, hereby grants its consent in relation to the works or operations described in this Consent.

Watercourse: Ordinary Watercourse within the River Arun Internal Drainage District

Location: Land south of Black Ditch, North Littlehampton, West Sussex

NGR: 503413, 104302

Description of works: Construction of 1 no. precast concrete surface water outfall (with railings and flapvalve) to take discharge from new development through 525mm diameter pipe.

For the following activities:

Construction of 1 no. surface water outfall

(1) Construction of 1 no. permanent precast concrete surface water outfall (with railings and flapvalve) to take discharge from new development through 525mm diameter pipe

As detailed on Drawings: 8140927/SK12, CV8140927/SK09 and SFA 10C Headwall Plan

The Agency does not accept any responsibility for the design and construction of the works referred hereto and any liability for any loss or damage which may arise out of their design, construction, maintenance or use.

This Consent shall come into effect on **30th July 2015**

Signed on behalf of the Environment Agency



Partnerships and Strategic Overview Team Leader

Date of signing

30th July 2015

Environment Agency Consent SE_WS_2015_311_2
Effective date 30th July 2015

Conditions

This consent is granted subject to the following conditions:

- 1. That the headwalls are adequately keyed into the banks and bed of the watercourse to prevent erosion.**
- 2. No excavated material or debris arising from the construction of the works shall be disposed of on the site or in the floodplain without our prior agreement. Any materials, debris etc that fall into the river channel, or onto the banks of the watercourse shall be removed immediately.**
- 3. There should be no storage of materials (or chemicals/fuels) within (EIGHT) metres of the watercourse.**
- 4. No refuelling of any machinery shall take place within (EIGHT) metres of any watercourse**
- 5. No dredging of the riverbed shall take place during the construction period.**
- 6. The banks and/or bed of the watercourse where disturbed shall be restored to our reasonable satisfaction.**
- 7. We shall be afforded access to the works at all reasonable times for the purpose of inspection during construction of the works and after completion of the works.**
- 8. The construction of the works described in this consent must be completed within three years from the date of issue of this consent. Works not completed within this time, additional works and/or amendments will require a new consent.**

Informatives

- Although the ditches involved were dry when the water vole survey/report was carried out, there are water vole populations in close proximity to this site.
- It is recommended that an ecologist looks over the works footprint prior to starting the work, to ensure no burrows are disturbed.
- Water vole burrows can normally extend up to 5 metres into the river banks.
- It is a legal offence to disturb water vole and their burrows so you should be aware of the legal implications when undertaking your work.

Other information

This Note does not form part of the Certificate of Authorisation.

Pollution Prevention

You are reminded that it is an offence under Regulation 38 of The Environmental Permitting (England and Wales) Regulations 2010 to cause or knowingly permit a water discharge activity or ground water activity. Care must be taken to ensure that neither the watercourse nor groundwater becomes polluted, particularly by, for example diesel fuel, petrol and oil from machinery. All fuels, oils and chemicals must be stored securely and any large containers left on site must be bunded. Care should also be taken when filling machinery to ensure that diesel/petrol/oil is not spilt on the ground. Spillages must not be washed away, but absorbed by some medium and then removed from site to a suitable licensed waste facility. Any such incidents must be reported to the Environment Agency immediately (Emergency Tel No 0800 807060). Copies of the Environment Agency's Pollution Prevention Guidelines (PPG5) and (PPG6) are either attached for your information or if not available upon request.

Disturbance of bed and bank material in watercourses should be minimised, including when carrying out excavations. An appropriate silt control system should also be considered if material is likely to be disturbed. In-river vehicle tracking should be kept to an absolute minimum.

Any waste generated in the course of the works must be disposed of in accordance with the provision of the Environmental Protection Act 1990. Persons carrying waste are required by law to register with the Environment Agency as a Waste Carrier (subject to certain exceptions). The deposit, keeping, treating or disposal of waste should only take place at premises licensed by the Environment Agency to receive the waste (subject to certain exceptions and exemptions). When you give waste to someone else, details of the transfer of waste should be described on a document called a Duty of Care Transfer Note.

If the waste contains any properties that are hazardous to health or the environment, the waste will be classed as 'Hazardous Waste' as defined in the Hazardous Waste Regulations 2005. These Regulations place specific requirements on the producer and carrier of such waste. Further information can be found on the Agency's website (www.environment-agency.gov.uk) or by contacting the National Customer Contact Centre on 03708 506506.

The activity of importing waste into the site for use as part of the construction process, for example hardcore, must be registered by Environment Agency as an exempt activity under the Waste Management Licensing Regulations 1994.

Flood Risk Management

The structure(s) must be removed immediately, for any reason, at the request of the Area Flood Risk Manager.

Environment Agency Consent SE_WS_2015_311_2
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You must ensure that any structure is clear and free of rubbish, silt and debris at all times. Regular inspections of the structure should also be carried out and the appropriate maintenance work undertaken.

Fisheries

You are strongly advised to inform the appropriate Angling Association/Interests of your proposals (where applicable), before commencing work, since the issue of a Flood Defence Consent by this Agency will not protect you from any claim for nuisance or damage which may be attributed to your works.

The free passage of fish must be maintained at all times, unless otherwise agreed in advance with the Agency.

Under the terms of the Salmon and Freshwater Fisheries Act 1975, it is an offence to cause or knowingly permit to flow, or put, into any waters containing fish, any liquid or solid matter to such an extent as to cause the water to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish.

Biodiversity

Natural environments such as watercourses are important as habitats in their own right and for the plants and animals they support. There are several Acts and Regulations that ensure these special features are protected and you should be aware of and comply with this legislation. A list of relevant legislation can be found in our working method guidance.

The list of species and actions below are not exhaustive and the applicant should consult the relevant legislation regarding other concerns.

A licence for works affecting protected species may be required from Natural England. You should consult their standing advice for more information on this.

Otters and their places of rest are protected. Otters are widespread and significant tree works or works to the banks have the risk of disturbing otters and damaging their Holts. You should make an assessment of the risk to otters and where required a survey should be undertaken by a suitably qualified ecologist. Note otters sometimes lie up in drains/small watercourses so wherever possible drain entrances should be kept clear.

Bats and their habitats are protected. Bats are often found in structures and trees on or adjacent to watercourses. If your works are likely to affect structures such as bridges, walls, culverts or buildings you must consider impacts on bats. An appropriate assessment of risk and, where required a survey should be undertaken by a suitably qualified ecologist.

Water voles and their habitat are protected. If water voles are present on your site you need to consider the impacts of your work on them and an appropriate assessment of risk and where required survey should be undertaken by a suitably qualified ecologist.

Native Crayfish are protected. When undertaking works where native crayfish are present you need to consider the impacts of your works and an appropriate assessment of risk and where required survey should be undertaken by a suitably qualified ecologist.

Vegetation

No bankside vegetation within 7m of the watercourse is to be removed unless strictly necessary. In such cases, trees/shrubs should be limbed or coppiced, and the root base to be left intact. Scrub vegetation as possible should be retained, as this provides valuable wildlife habitat.

Trees should be protected from the works in accordance with British Standard 5837, "Trees in relation to construction", and contractors' working areas shall be clearly marked out and boundaries adhered to.

Any bankside trees or vegetation damaged or removed during the works should be replaced with native species of local provenance appropriate to the local habitat.

Birds

Breeding birds and their nests are protected under the Wildlife and Countryside Act 1981. If your work is taking place within or close to the main bird breeding season (1st March to 31st July) you should consider the impacts of your works and an appropriate assessment of risk should be undertaken.

Invasive Non-native species

The Wildlife and Countryside Act makes it an offence to cause certain species to spread in the wild. If these species are present on your site you need to have a plan for how you will manage them and any waste containing them during your work.

Bio security

When travelling or working between watercourses there is a high risk of transferring problem species or diseases between watercourses.

This can be avoided by following the advice of the 'check, clean, dry' campaign. Simple measures such as checking for and cleaning mud and bits of vegetation from boots, equipment and machines and allowing them to dry (ideally in sunlight) can prevent the spread of problem species.

Land North of Toddington Lane, Littlehampton

Drainage Technical Note



APPENDIX F

SURFACE WATER MAINTENANCE REGIME



Land North of Toddington Lane, Littlehampton

Drainage Technical Note

Surface Water Drainage Maintenance

Sustainable urban drainage systems (SUDS) have been incorporated into the design of the development including areas of geocellular attenuation tanks. The drainage on the site has been designed to cater for a 1 in 100 year storm event with a 30% allowance for climate change.

At present the Flood Water Management Act 2010 has yet to be fully implemented and water companies will not adopt SUDS features. Maintenance of shared SUDS features will be therefore be transferred to a Management Company to be set up by the Developer. Maintenance of any features serving a single property, and which are located within the curtilage of that property, such as domestic geocellular soakaways serving only the rear roof areas and pervious driveways, will be maintained by the property owner.

The Management Company will be funded through a service charge paid by property owners. This service charge will be made a legal requirement as part of the sale of any property on the site and funding is therefore guaranteed for the lifetime of the development.

This following table provides guidance on the anticipated level of maintenance of the drainage features by the Management Company. Maintenance of adopted drainage systems will be undertaken by Southern Water in accordance with their own policies.

Traditional Surface Water Drainage Features

The following provides details of the proposed levels of maintenance to be undertaken by the Management Company in relation to traditional drainage features including manholes, pipes and gullies:



Land North of Toddington Lane, Littlehampton

Drainage Technical Note

Maintenance Activity	Action	Frequency
Check gully pots/catch pits	Check, clean and empty gully pots as required to ensure that debris collected does not flow block the pipe network and obstruct Hydrobrakes.	Typically annually or as required.
Check manholes and inspection chambers	Inspect manholes and inspection chambers for any signs of blockages. Clean, jet and empty as required.	Typically annually or as required.
CCTV survey and jetting of drains	Check the integrity of drains, jet and clean as required. Remove collected debris as required.	Typically annually or as required.
Hydrobrake chambers	Hydrobrake chambers. Check and remove any silt build up or blockages in accordance with the Manufacturers recommendations.	Typically biannually or as required.



Land North of Toddington Lane, Littlehampton

Drainage Technical Note

Cellular Attenuation System

The proposed scheme incorporates a cellular crate storage tank. The following provides details of the recommended maintenance for this feature:

Maintenance Activity	Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Typically Monthly for 3 months, then six monthly
Remedial Actions	Inspect manholes and inspection chambers for any signs of blockages. Clean, jet and empty as required.	Typically annually or as required
Monitoring	Check the integrity of drains, jet and clean as required. Remove collected debris as required.	Typically annually or as required



Land North of Toddington Lane, Littlehampton

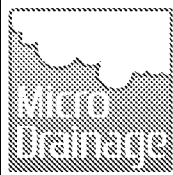
Drainage Technical Note

APPENDIX G

FOUL DRAINAGE CALCULATIONS

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Micro Drainage						Network 2015.1				
FOUL SEWERAGE DESIGN										
Network Design Table for Foul Network 1										
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	67.759	0.455	148.9	0.000	18	0.0	1.500	o	150	
1.001	63.605	1.555	40.9	0.000	8	0.0	1.500	o	150	
2.000	37.633	0.251	150.0	0.000	4	0.0	1.500	o	150	
3.000	25.302	0.410	61.7	0.000	5	0.0	1.500	o	150	
3.001	7.262	0.150	48.4	0.000	0	0.0	1.500	o	150	
2.001	11.918	0.545	21.9	0.000	0	0.0	1.500	o	150	
2.002	37.838	0.525	72.1	0.000	4	0.0	1.500	o	150	
1.002	112.506	0.755	149.0	0.000	16	0.0	1.500	o	150	
4.000	49.086	1.415	34.7	0.000	10	0.0	1.500	o	150	
5.000	46.885	1.295	36.2	0.000	22	0.0	1.500	o	150	
1.003	69.059	0.465	148.5	0.000	1	0.0	1.500	o	150	
6.000	51.740	1.780	29.1	0.000	32	0.0	1.500	o	150	
1.004	22.473	0.150	149.8	0.000	0	0.0	1.500	o	150	
Network Results Table										
PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse Add	Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	3.450	0.000	0.0	18	0.0	0	0.00	0.72	12.7	0.0
1.001	2.995	0.000	0.0	26	0.0	0	0.00	1.37	24.3	0.0
2.000	2.761	0.000	0.0	4	0.0	0	0.00	0.71	12.6	0.0
3.000	3.970	0.000	0.0	5	0.0	0	0.00	1.12	19.7	0.0
3.001	2.660	0.000	0.0	5	0.0	0	0.00	1.26	22.3	0.0
2.001	2.510	0.000	0.0	9	0.0	0	0.00	1.88	33.2	0.0
2.002	1.965	0.000	0.0	13	0.0	0	0.00	1.03	18.2	0.0
1.002	1.440	0.000	0.0	55	0.0	0	0.00	0.72	12.7	0.0
4.000	2.100	0.000	0.0	10	0.0	0	0.00	1.49	26.3	0.0
5.000	1.980	0.000	0.0	22	0.0	0	0.00	1.46	25.8	0.0
1.003	0.685	0.000	0.0	88	0.0	0	0.00	0.72	12.7	0.0
6.000	2.000	0.000	0.0	32	0.0	0	0.00	1.63	28.8	0.0
1.004	0.220	0.000	0.0	120	0.0	0	0.00	0.71	12.6	0.0
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<u>FOUL SEWERAGE DESIGN</u> <u>Network Design Table for Foul Network 1</u> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>Area (ha)</th><th>Houses</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Auto Design</th></tr><tr><td>7.000</td><td>115.612</td><td>4.150</td><td>27.9</td><td>0.000</td><td>44</td><td>0.0</td><td>1.500</td><td>o</td><td>150</td><td></td></tr><tr><td>1.005</td><td>47.543</td><td>0.425</td><td>111.9</td><td>0.000</td><td>0</td><td>0.0</td><td>1.500</td><td>o</td><td>150</td><td></td></tr><tr><td>1.006</td><td>12.494</td><td>0.083</td><td>150.0</td><td>0.000</td><td>59</td><td>0.0</td><td>1.500</td><td>o</td><td>150</td><td></td></tr><tr><td>1.007</td><td>7.054</td><td>0.062</td><td>114.3</td><td>0.000</td><td>0</td><td>0.0</td><td>1.500</td><td>o</td><td>150</td><td></td></tr></table> <u>Network Results Table</u> <table><tr><th>PN</th><th>US/IL (m)</th><th>Σ Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Σ Hse Add Flow (l/s)</th><th>P.Dep (mm)</th><th>P.Vel (m/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>7.000</td><td>4.220</td><td>0.000</td><td>0.0</td><td>44</td><td>0.0</td><td>0</td><td>0.00</td><td>1.66</td><td>29.4</td><td>0.0</td></tr><tr><td>1.005</td><td>0.076</td><td>0.000</td><td>0.0</td><td>164</td><td>0.0</td><td>0</td><td>0.00</td><td>0.83</td><td>14.6</td><td>0.0</td></tr><tr><td>1.006</td><td>-0.355</td><td>0.000</td><td>0.0</td><td>223</td><td>0.0</td><td>0</td><td>0.00</td><td>0.71</td><td>12.6</td><td>0.0</td></tr><tr><td>1.007</td><td>-0.435</td><td>0.000</td><td>0.0</td><td>223</td><td>0.0</td><td>0</td><td>0.00</td><td>0.82</td><td>14.5</td><td>0.0</td></tr></table>											PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design	7.000	115.612	4.150	27.9	0.000	44	0.0	1.500	o	150		1.005	47.543	0.425	111.9	0.000	0	0.0	1.500	o	150		1.006	12.494	0.083	150.0	0.000	59	0.0	1.500	o	150		1.007	7.054	0.062	114.3	0.000	0	0.0	1.500	o	150		PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	7.000	4.220	0.000	0.0	44	0.0	0	0.00	1.66	29.4	0.0	1.005	0.076	0.000	0.0	164	0.0	0	0.00	0.83	14.6	0.0	1.006	-0.355	0.000	0.0	223	0.0	0	0.00	0.71	12.6	0.0	1.007	-0.435	0.000	0.0	223	0.0	0	0.00	0.82	14.5	0.0
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<u>Manhole Schedules for Foul Network 1</u>											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F4	5.100	1.650	Open Manhole	1200	1.000	3.450	150				
F5	5.080	2.085	Open Manhole	1200	1.001	2.395	150	1.000	2.995	150	
F18	3.650	0.889	Open Manhole	1200	2.000	2.761	150				
F14	4.420	1.350	Open Manhole	1200	3.000	3.070	150				
F15	4.010	1.350	Open Manhole	1200	3.001	2.660	150	3.000	2.660	150	
F16	3.930	1.420	Open Manhole	1200	2.001	2.510	150	2.000	2.510	150	
								3.001	2.510	150	
F17	3.940	1.975	Open Manhole	1200	2.002	1.965	150	2.001	1.965	150	
F6	4.440	3.000	Open Manhole	1200	1.002	1.440	150	1.001	1.440	150	
								2.002	1.440	150	
F13	3.750	1.650	Open Manhole	1200	4.000	2.100	150				
F12	3.630	1.650	Open Manhole	1200	5.000	1.980	150				
F7	3.660	2.975	Open Manhole	1200	1.003	0.685	150	1.002	0.685	150	
								4.000	0.685	150	
								5.000	0.685	150	
F10	3.650	1.650	Open Manhole	1200	6.000	2.000	150				
F8	4.170	3.950	Open Manhole	1200	1.004	0.220	150	1.003	0.220	150	
								6.000	0.220	150	
F11	5.870	1.650	Open Manhole	1200	7.000	4.220	150				
F9	4.450	4.380	Open Manhole	1200	1.005	0.070	150	1.004	0.070	150	
								7.000	0.070	150	
F1	4.000	4.355	Open Manhole	1200	1.006	-0.355	150	1.005	-0.355	150	
F2	4.000	4.438	Open Manhole	1200	1.007	-0.438	150	1.006	-0.438	150	
F3	4.750	5.250	Open Manhole	1200		OUTFALL		1.007	-0.500	150	
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Micro Drainage				Network 2015.1				
<u>PIPELINE SCHEDULES for Foul Network 1</u> <u>Upstream Manhole</u>								
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	F4	5.100	3.450	1.500	Open Manhole	1200
1.001	o	150	F5	5.080	2.995	1.935	Open Manhole	1200
2.000	o	150	F18	3.650	2.761	0.739	Open Manhole	1200
3.000	o	150	F14	4.420	3.079	1.200	Open Manhole	1200
3.001	o	150	F15	4.010	2.660	1.200	Open Manhole	1200
2.001	o	150	F16	3.930	2.510	1.270	Open Manhole	1200
2.002	o	150	F17	3.940	1.965	1.825	Open Manhole	1200
1.002	o	150	F6	4.440	1.440	2.850	Open Manhole	1200
4.000	o	150	F13	3.750	2.100	1.500	Open Manhole	1200
5.000	o	150	F12	3.630	1.980	1.500	Open Manhole	1200
1.003	o	150	F7	3.660	0.685	2.825	Open Manhole	1200
6.000	o	150	F10	3.650	2.000	1.500	Open Manhole	1200
1.004	o	150	F8	4.170	0.220	3.800	Open Manhole	1200
<u>Downstream Manhole</u>								
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	67.759	148.9	F5	5.080	2.995	1.935	Open Manhole	1200
1.001	63.605	40.9	F6	4.440	1.440	2.850	Open Manhole	1200
2.000	37.633	150.0	F16	3.930	2.510	1.270	Open Manhole	1200
3.000	25.302	61.7	F15	4.010	2.660	1.200	Open Manhole	1200
3.001	7.262	48.4	F16	3.930	2.510	1.270	Open Manhole	1200
2.001	11.918	21.9	F17	3.940	1.965	1.825	Open Manhole	1200
2.002	37.838	72.1	F6	4.440	1.440	2.850	Open Manhole	1200
1.002	112.506	149.0	F7	3.660	0.685	2.825	Open Manhole	1200
4.000	49.086	34.7	F7	3.660	0.685	2.825	Open Manhole	1200
5.000	46.885	36.2	F7	3.660	0.685	2.825	Open Manhole	1200
1.003	69.059	148.5	F8	4.170	0.220	3.800	Open Manhole	1200
6.000	51.740	29.1	F8	4.170	0.220	3.800	Open Manhole	1200
1.004	22.473	149.8	F9	4.450	0.070	4.230	Open Manhole	1200
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PIPELINE SCHEDULES for Foul Network 1

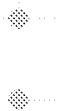
Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	o	150	F11	5.876	4.220	1.500	Open Manhole	1200
1.005	o	150	F9	4.450	0.070	4.230	Open Manhole	1200
1.006	o	150	F1	4.000	-0.355	4.205	Open Manhole	1200
1.007	o	150	F2	4.000	-0.438	4.288	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)
7.000	115.612	27.9	F9	4.450	0.070	4.230	Open Manhole	1200
1.005	47.543	111.9	F1	4.000	-0.355	4.205	Open Manhole	1200
1.006	12.494	150.0	F2	4.000	-0.438	4.288	Open Manhole	1200
1.007	7.054	114.3	F3	4.750	-0.500	5.100	Open Manhole	1200

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<u>Setting Out Information - True Coordinates (Foul Network 1)</u>						
PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
1.000	F4	1200		503237.291	104313.880	
1.001	F5	1200		503236.844	104246.122	
2.000	F18	1200		503344.386	104300.142	
3.000	F14	1200		503286.074	104314.143	
3.001	F15	1200		503307.872	104301.296	
2.001	F16	1200		503307.248	104294.061	
2.002	F17	1200		503300.501	104284.237	
1.002	F6	1200		503300.448	104246.399	
4.000	F13	1200		503412.348	104294.683	
5.000	F12	1200		503459.833	104246.119	
1.003	F7	1200		503412.951	104245.601	
6.000	F10	1200		503464.960	104176.157	
1.004	F8	1200		503413.221	104176.543	
7.000	F11	1200		503275.136	104176.588	
1.005	F9	1200		503390.748	104176.516	
1.006	F1	1200		503390.552	104128.974	
1.007	F2	1200		503378.058	104128.880	
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