

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 1	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

History.

Revision	Date	Reason
p0	Dec 2017	Original for YW approval.

History	1
Background.	1
Predevelopment Land Usage.	1
Proposed Development Land Usage.	2
Pre-development Rainfall Runoff.....	2
Total Pre-development Run-off.....	3
Proposed SW Flood Attenuation System	3
Flood Storage Attenuation & Discharges.	4
100 Year Return Period.....	4
Proposed FW System.....	4
Appendix.	5
SW Attenuation Calculation for 1:100yr Rainfall Event.....	5
FW Peak Flow Estimation BS EN 752-4.....	9
Hydro-Brake Optimum Flow Control Hydraulics	10

Background.

The Development Site is formerly part of a single curtilage comprising a single detached residential dwelling and associated driveway and external hardstandings.

The site currently has planning permission (ref No: 2014/62/93584/W) for the erection of 10No. residential dwellings. However the site plan has since been revised to comprise 8 dwellings of detached & semi-detached layout.

This report will assess the existing dsite draingae and Yorkshire Water local infrastructure to come up with a proposed FW and SW site drainage system compatible with current regulation and guidelines.

Site investigations local to the site have revealed clay over shale bedrock, and the HR wallingford soil class estimator has indicated the site comprises soil class 4 (heavy clay); and thus is not suitable for infiltration techniques. The LPA drainage officer has been contacted and has agreed that infiltration is not an option for the site.

Due to the lack of watercourses locally, the final option is to attenuate and discharge to the Yorkshire Water public sewer.

Predevelopment Land Usage.

The existing site comprises positively drained areas around the immediate dwelling and roof which can be considere as brownfield and impermeable for the basis of the existing flow rate calculation.

It also comprises much soft landscaping and freestanding hardstanding which are not positively drained and that fall to soft landscaping. This will be considered as an impermeable part of the greenfield calculation.

The existing and proposed site areas are as follows:

Total brownfield areas:	0.023 Ha.	(0230 sqm)
Existing building area & positively drained surrounds:	0.023 Ha.	(0230 sqm)
Total greenfield areas:		
Overall greenfield area inc none positively drained H/S areas:	0.217 Ha.	(2170 sqm)

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 2	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

Access road, and concrete areas not positively drained: 0.048 Ha. (0485 sqm) (22% of overall greenfield)

Total Existing 0.240 Ha. (2400 sqm)

Proposed Development Land Usage.

Total proposed urban/paved area 0.133 Ha (1330 sqm)

Roofs 0.054 Ha (0540 sqm)

Roofs, driveways, access rd & pavements 0.078 Ha (0785 sqm)

Total proposed rural/permeable area 0.108 Ha (1075 sqm)

(gardens, path where falls to s.landscaping) 0.108 Ha (1075 sqm)

Total Proposed Site 0.240 Ha. (2400 sqm)

Pre-development Rainfall Runoff.

The greenfield and brownfield elements of the site will be individually calculated, added together, and reduced by 30% in line with current guidance for the extreme rainfall event.

EXISTING GREENFIELD RUN-OFF

EXISTING GREENFIELD RUN-OFF ESTIMATE

Attenuation design in accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.03

Allowable discharge method

Site characteristics

Location;	Other
Hydrological region;	3
Soil type (Wallingford Procedure W.R.A.P map);	4
Standard percentage runoff;	SPR = 0.47
Average annual rainfall;	SAAR = 1027 mm
5 year return period rainfall of 60 minute duration;	M5_60min = 20.0 mm
Ratio 60-minute to 2 day rainfalls of 5 year return;	r = 0.30
Rainfall intensity increase due to global warming;	p _{climate} = 30%

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%);	Impermeable. area (ha)
1;	Greenfield Area;	0.22;	22.0;	0.05;
Total		0.22;	22.0;	0.05;

Greenfield runoff rates

Catchment area;	AREA = 50.00 hectare
Greenfield runoff rate (50 hectare site);	$\bar{Q}_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} \times (\text{AREA}/1\text{km}^2)^{0.89} \times (\text{SAAR}/1\text{mm})^{1.17} \times \text{SPR}^{2.17} =$ 378.0 l / s
Greenfield runoff rate;	$\bar{Q} = \bar{Q}_{\text{rural}} / \text{AREA} \times A =$ 1.6 l / s
Greenfield runoff rate per unit area;	$\bar{Q}_A = \bar{Q} / A =$ 7.6 l / s / hectare

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 3	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

Estimated site discharges

FSR growth rate (2 year);	$FSR_{2yr} = 0.93$
Discharge (2 year);	$Q_{2yr} = \bar{Q} \times FSR_{2yr} = 1.5 \text{ l/s}$
FSR growth rate (30 year);	$FSR_{30yr} = 1.75$
Discharge (30 year);	$Q_{30yr} = \bar{Q} \times FSR_{30yr} = 2.9 \text{ l/s}$
FSR growth rate (100 year);	$FSR_{100yr} = 2.08$
Discharge (100 year);	$Q_{100yr} = \bar{Q} \times FSR_{100yr} = 3.4 \text{ l/s}$

EXISTING BROWNFIELD RUN-OFF 1:100YR (THE WALLINGFORD PROCEDURE)

EXISTING BROWNFIELD RUN-OFF ESTIMATE

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.00

Design rainfall intensity

Location of catchment area;	Other
Storm duration;	$D = 5 \text{ min}$
Return period;	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period;	$r = 0.300$
5-year return period rainfall of 60 minutes duration;	$M5_{60min} = 20.0 \text{ mm}$
Increase of rainfall intensity due to global warming;	$p_{climate} = 30 \%$
Factor Z1 (Wallingford procedure);	$Z1 = 0.34$
Rainfall for 5min storm with 5 year return period;	$M5_{5min} = Z1 \times M5_{60min} \times (1 + p_{climate}) = 8.8 \text{ mm}$
Factor Z2 (Wallingford procedure);	$Z2 = 1.88$
Rainfall for 5min storm with 100 year return period;	$M100_{5min} = Z2 \times M5_{5min} = 16.6 \text{ mm}$
Design rainfall intensity;	$1.I_{max} = M100_{5min} / D = 199.7 \text{ mm/hr}$

Maximum surface water runoff

Catchment area;	$A_{catch} = 230 \text{ m}^2$
Percentage of area that is impermeable;	$p = 100 \%$
Maximum surface water runoff;	$Q_{max} = A_{catch} \times p \times I_{max} = 12.8 \text{ l/s}$

Total Pre-development Run-off.

Considering the above greenfield and brownfield run-off rates combined gives:

Return Period (Tr)	Greenfield Area Run-off (l/s)	Brownfield Area Run-off (l/s)	Total Site Area (l/s)
1:100	3.4	12.8	16.2

Discharge of surface water will be to the Yorkshire Water public sewer via a new connection, and should be subject to a 30% reduction on the existing pre-development runoff/flow rate.

The post-development design flow rate is thus:

1:100 yr event	16.2×0.7	11.34 l/s
----------------	-------------------	------------------

Proposed SW Flood Attenuation System

The access road to the site is to be adopted and thus any drainage under the highway and associated attenuation system will have to be designed to adoptable standards.

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 4	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

Thus the attenuation system on site will comprise oversized pipes, controlled by a Hydrobrake Optimum vortex flow control device.

Flood Storage Attenuation & Discharges.

100 Year Return Period.

The following indicates the flow control and storage on site before discharge to the YW sewer.

Storage required ~29m³ max of attenuation storage
 Storage provided 20m total of 1350dia o/s pipes (including length in manholes) = ~29m³
 Refer to TJBA calculation spreadsheet in appendix. All calculation are run with a 30% allowance for climate change.

Critical storm	60 winter	
Max water level	48.85m aOD (1.3m)	
Time to peak	46 mins	
Control	Hydro-brake Optimum vortex flow control, 11.3l/s max at 1.35m head.	
Control discharge	11.3/s	
Allowable discharge	= 11.34 l/s	OK.

Proposed FW System

A check was undertaken as to the flow of foul water in the residential systems.

Each residential dwelling will be on a private 100dia system. Once the individual dwellings systems combine, the FW sewer will comprise 150dia piped system.

The FW check was undertaken in line with BS EN 752-4, inputting discharge units for each house type/sanitary services as in the tables below.

Concluding and using the worst case house type multiplied by the number of proposed dwellings gives a peak foul flow of 4.6l/s which is within the capacity of a 150dia sewer system.

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
	Creative Developments - 120 Laund Rd, Salendine Nook,				calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section				Sheet no./rev.	
	Detailed Drainage Design				5	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	ds	22-Dec-17				

Appendix.

SW Attenuation Calculation for 1:100yr Rainfall Event.

T J Booth Associates			Page 1																																																																																	
104 Yorkshire St Rochdale Lancashire OL16 1JY		CDEVS Land at 120 Laund Road Salendine Nook Hudds																																																																																		
Date Dec 2017 File calc-tjba-120 laund rd-1350 pipes a...		Designed By DS Checked By																																																																																		
Micro Drainage		Source Control W.10.4																																																																																		
Summary of Results for 100 year Return Period (+30%)																																																																																				
Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status																																																																														
15 Summer	11.3	11.3	48.4258	0.8758	20.0	O K																																																																														
30 Summer	11.3	11.3	48.5883	1.0383	24.2	O K																																																																														
60 Summer	11.3	11.3	48.6498	1.0998	25.6	O K																																																																														
120 Summer	11.3	11.3	48.5608	1.0108	23.5	O K																																																																														
180 Summer	11.3	11.3	48.4048	0.8548	19.4	O K																																																																														
240 Summer	11.3	11.3	48.2433	0.6933	15.0	O K																																																																														
360 Summer	11.3	11.3	48.0038	0.4537	8.4	O K																																																																														
480 Summer	11.1	11.1	47.8553	0.3052	4.7	O K																																																																														
600 Summer	10.5	10.5	47.7713	0.2212	2.9	O K																																																																														
720 Summer	9.7	9.7	47.7368	0.1867	2.2	O K																																																																														
960 Summer	7.9	7.9	47.7018	0.1518	1.6	O K																																																																														
1440 Summer	5.9	5.9	47.6613	0.1113	1.0	O K																																																																														
2160 Summer	4.3	4.3	47.6318	0.0818	0.6	O K																																																																														
2880 Summer	3.5	3.5	47.6158	0.0658	0.4	O K																																																																														
4320 Summer	2.6	2.6	47.5988	0.0487	0.2	O K																																																																														
5760 Summer	2.1	2.1	47.5893	0.0392	0.1	O K																																																																														
7200 Summer	1.8	1.8	47.5833	0.0332	0.1	O K																																																																														
8640 Summer	1.6	1.6	47.5793	0.0292	0.1	O K																																																																														
10080 Summer	1.4	1.4	47.5763	0.0262	0.1	O K																																																																														
15 Winter	11.3	11.3	48.5473	0.9973	23.2	O K																																																																														
30 Winter	11.3	11.3	48.7668	1.2168	28.0	O K																																																																														
60 Winter	11.3	11.3	48.8503	1.3002	29.4	O K																																																																														
120 Winter	11.3	11.3	48.6383	1.0883	25.4	O K																																																																														
180 Winter	11.3	11.3	48.3708	0.8208	18.5	O K																																																																														
240 Winter	11.3	11.3	48.1158	0.5657	11.4	O K																																																																														
<table><tr><td>Storm Duration (mins)</td><td>Rain (mm/hr)</td><td>Time-Peak (mins)</td></tr><tr><td>15 Summer</td><td>89.23</td><td>16</td></tr><tr><td>30 Summer</td><td>61.54</td><td>26</td></tr><tr><td>60 Summer</td><td>40.51</td><td>44</td></tr><tr><td>120 Summer</td><td>25.63</td><td>78</td></tr><tr><td>180 Summer</td><td>19.23</td><td>112</td></tr><tr><td>240 Summer</td><td>15.63</td><td>142</td></tr><tr><td>360 Summer</td><td>11.65</td><td>200</td></tr><tr><td>480 Summer</td><td>9.44</td><td>254</td></tr><tr><td>600 Summer</td><td>8.01</td><td>310</td></tr><tr><td>720 Summer</td><td>7.00</td><td>368</td></tr><tr><td>960 Summer</td><td>5.65</td><td>490</td></tr><tr><td>1440 Summer</td><td>4.17</td><td>734</td></tr><tr><td>2160 Summer</td><td>3.07</td><td>1100</td></tr><tr><td>2880 Summer</td><td>2.46</td><td>1468</td></tr><tr><td>4320 Summer</td><td>1.81</td><td>2184</td></tr><tr><td>5760 Summer</td><td>1.45</td><td>2920</td></tr><tr><td>7200 Summer</td><td>1.23</td><td>3624</td></tr><tr><td>8640 Summer</td><td>1.07</td><td>4400</td></tr><tr><td>10080 Summer</td><td>0.95</td><td>5072</td></tr><tr><td>15 Winter</td><td>89.23</td><td>16</td></tr><tr><td>30 Winter</td><td>61.54</td><td>28</td></tr><tr><td>60 Winter</td><td>40.51</td><td>46</td></tr><tr><td>120 Winter</td><td>25.63</td><td>84</td></tr><tr><td>180 Winter</td><td>19.23</td><td>120</td></tr><tr><td>240 Winter</td><td>15.63</td><td>148</td></tr></table>							Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)	15 Summer	89.23	16	30 Summer	61.54	26	60 Summer	40.51	44	120 Summer	25.63	78	180 Summer	19.23	112	240 Summer	15.63	142	360 Summer	11.65	200	480 Summer	9.44	254	600 Summer	8.01	310	720 Summer	7.00	368	960 Summer	5.65	490	1440 Summer	4.17	734	2160 Summer	3.07	1100	2880 Summer	2.46	1468	4320 Summer	1.81	2184	5760 Summer	1.45	2920	7200 Summer	1.23	3624	8640 Summer	1.07	4400	10080 Summer	0.95	5072	15 Winter	89.23	16	30 Winter	61.54	28	60 Winter	40.51	46	120 Winter	25.63	84	180 Winter	19.23	120	240 Winter	15.63	148
Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)																																																																																		
15 Summer	89.23	16																																																																																		
30 Summer	61.54	26																																																																																		
60 Summer	40.51	44																																																																																		
120 Summer	25.63	78																																																																																		
180 Summer	19.23	112																																																																																		
240 Summer	15.63	142																																																																																		
360 Summer	11.65	200																																																																																		
480 Summer	9.44	254																																																																																		
600 Summer	8.01	310																																																																																		
720 Summer	7.00	368																																																																																		
960 Summer	5.65	490																																																																																		
1440 Summer	4.17	734																																																																																		
2160 Summer	3.07	1100																																																																																		
2880 Summer	2.46	1468																																																																																		
4320 Summer	1.81	2184																																																																																		
5760 Summer	1.45	2920																																																																																		
7200 Summer	1.23	3624																																																																																		
8640 Summer	1.07	4400																																																																																		
10080 Summer	0.95	5072																																																																																		
15 Winter	89.23	16																																																																																		
30 Winter	61.54	28																																																																																		
60 Winter	40.51	46																																																																																		
120 Winter	25.63	84																																																																																		
180 Winter	19.23	120																																																																																		
240 Winter	15.63	148																																																																																		
(c)1982-2006 Micro Drainage																																																																																				

Micro Drainage®

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
360 Winter	10.9	10.9	47.8238	0.2737	4.0	O K
480 Winter	9.5	9.5	47.7333	0.1832	2.2	O K
600 Winter	8.1	8.1	47.7058	0.1558	1.7	O K
720 Winter	7.1	7.1	47.6858	0.1358	1.3	O K
960 Winter	5.8	5.8	47.6593	0.1093	0.9	O K
1440 Winter	4.3	4.3	47.6303	0.0803	0.5	O K
2160 Winter	3.1	3.1	47.6093	0.0592	0.3	O K
2880 Winter	2.5	2.5	47.5978	0.0477	0.2	O K
4320 Winter	1.9	1.9	47.5853	0.0352	0.1	O K
5760 Winter	1.5	1.5	47.5788	0.0287	0.1	O K
7200 Winter	1.3	1.3	47.5743	0.0242	0.1	O K
8640 Winter	1.1	1.1	47.5713	0.0212	0.0	O K
10080 Winter	1.0	1.0	47.5693	0.0192	0.0	O K

(c)1982-2006 Micro Drainage

T J Booth Associates		Page 3																																									
104 Yorkshire St Rochdale Lancashire OL16 1JY	CDEVS Land at 120 Laund Road Salendine Nook Hudds																																										
Date Dec 2017 File calc-tjba-120 laund rd-1350 pipes a...	Designed By DS Checked By																																										
Micro Drainage Source Control W.10.4																																											
<u>Rainfall Details</u> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 35%;">Region</td> <td style="width: 15%;">ENG+WAL</td> <td style="width: 30%;">Shortest Storm (mins)</td> <td style="width: 20%; text-align: right;">15</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Longest Storm (mins)</td> <td style="text-align: right;">10080</td> </tr> <tr> <td>M5-60 (mm)</td> <td>20.000</td> <td>Summer Storms</td> <td style="text-align: right;">Yes</td> </tr> <tr> <td>Ratio-R</td> <td>0.300</td> <td>Winter Storms</td> <td style="text-align: right;">Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> <td>Climate Change %</td> <td style="text-align: right;">+30</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> <td></td> <td></td> </tr> </table> <u>Pipe Network</u> <table style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 40%;">Volume in Pipe Network (m³)</td> <td style="width: 10%; text-align: center;">1</td> <td style="width: 30%;">Dia of Outfall Pipe (m)</td> <td style="width: 20%; text-align: right;">0.100</td> </tr> <tr> <td>Slope of Outfall Pipe (1:x)</td> <td>100.0</td> <td>Roughness of Outfall Pipe</td> <td style="text-align: right;">0.600</td> </tr> </table> <u>Time / Area Diagram</u> Total Area (ha) = 0.133 <table style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Time</th> <th style="text-align: left;">(mins)</th> <th style="text-align: left;">Area</th> </tr> <tr> <th style="text-align: left;">from:</th> <th style="text-align: left;">to:</th> <th style="text-align: left;">(ha)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">4</td> <td style="text-align: right;">0.133</td> </tr> </tbody> </table>			Region	ENG+WAL	Shortest Storm (mins)	15	Return Period (years)	100	Longest Storm (mins)	10080	M5-60 (mm)	20.000	Summer Storms	Yes	Ratio-R	0.300	Winter Storms	Yes	Cv (Summer)	0.750	Climate Change %	+30	Cv (Winter)	0.840			Volume in Pipe Network (m³)	1	Dia of Outfall Pipe (m)	0.100	Slope of Outfall Pipe (1:x)	100.0	Roughness of Outfall Pipe	0.600	Time	(mins)	Area	from:	to:	(ha)	0	4	0.133
Region	ENG+WAL	Shortest Storm (mins)	15																																								
Return Period (years)	100	Longest Storm (mins)	10080																																								
M5-60 (mm)	20.000	Summer Storms	Yes																																								
Ratio-R	0.300	Winter Storms	Yes																																								
Cv (Summer)	0.750	Climate Change %	+30																																								
Cv (Winter)	0.840																																										
Volume in Pipe Network (m³)	1	Dia of Outfall Pipe (m)	0.100																																								
Slope of Outfall Pipe (1:x)	100.0	Roughness of Outfall Pipe	0.600																																								
Time	(mins)	Area																																									
from:	to:	(ha)																																									
0	4	0.133																																									
(c)1982-2006 Micro Drainage																																											

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
	Creative Developments - 120 Laund Rd, Salendine Nook,				calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section				Sheet no./rev.	
	Detailed Drainage Design				8	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	ds	22-Dec-17				

T J Booth Associates		Page 4							
104 Yorkshire St Rochdale Lancashire OL16 1JY	CDEVS Land at 120 Laund Road Salendine Nook Hudds								
Date Dec 2017	Designed By DS								
File calc-tjba-120 laund rd-1350 pipes a...	Checked By								
Micro Drainage	Source Control W.10.4								
<u>Circular Pipe Details</u>									
Diameter (m)	1.350	Length (m)	20.000	Cover Level (m)	50.100				
Slope (1:x)	500.0	Invert Level (m)	47.550						
<u>Depth / Flow Outflow Control</u>									
Invert Level of Control 47.550									
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	5.3	0.80	9.9	2.00	12.3	4.00	12.3	7.00	12.3
0.20	10.4	1.00	9.8	2.20	12.3	4.50	12.3	7.50	12.3
0.30	11.1	1.20	10.7	2.40	12.3	5.00	12.3	8.00	12.3
0.40	11.3	1.40	11.5	2.60	12.3	5.50	12.3	8.50	12.3
0.50	11.2	1.60	12.3	3.00	12.3	6.00	12.3	9.00	12.3
0.60	11.0	1.80	12.3	3.50	12.3	6.50	12.3	9.50	12.3
(c)1982-2006 Micro Drainage									

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 9	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

FW Peak Flow Estimation BS EN 752-4.

FOUL DRAINAGE MANHOLE SCHEDULE							
Client				Cdevs			
Site Name & Location				120 Laund Road, Huddersfield			
Route Description				Proposed Foul Water Only			
House Types 1, 5, 6, 7, 8				House Types 2,3,4			
BS EN 752-4				BS EN 752-4			
Appliance Type	No of Appliances	DU	DU Tot	Appliance Type	No of Appliances	DU	DU Tot
Basin	1	0.6	0.6	Basin	2	0.6	1.2
Kitchen sink	2	1.3	2.6	Kitchen sink	3	1.3	3.9
Shower	2	0.6	1.2	Shower	3	0.6	1.8
Toilet	1	2.5	2.5	Toilet	1	2.5	2.5
Bath	2	1.3	2.6	Bath	2	1.3	2.6
		Tot DU tot	9.5			Tot DU tot	12
		ave DU tot/house	10.4375				
BS EN 752-4							
No of Dwellings		8					
Discharge Units / dwelling		10.44					
Total DU's		83.52					
Freq Factor		0.5					
Peak Foul flow l/s		4.6					
Average Foul flow l/s		0.6					
Pipe full velocity =		0.355CD ^{0.63} (hf/L) ^{0.54}					
Hazen Williams C =		150					

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Creative Developments - 120 Laund Rd, Salendine Nook,				Job Ref. calc-tjba-cdevs-120 laund rd-detailed drainage design-081217.docx	
	Section Detailed Drainage Design				Sheet no./rev. 10	
	Calc. by ds	Date 22-Dec-17	Chk'd by	Date	App'd by	Date

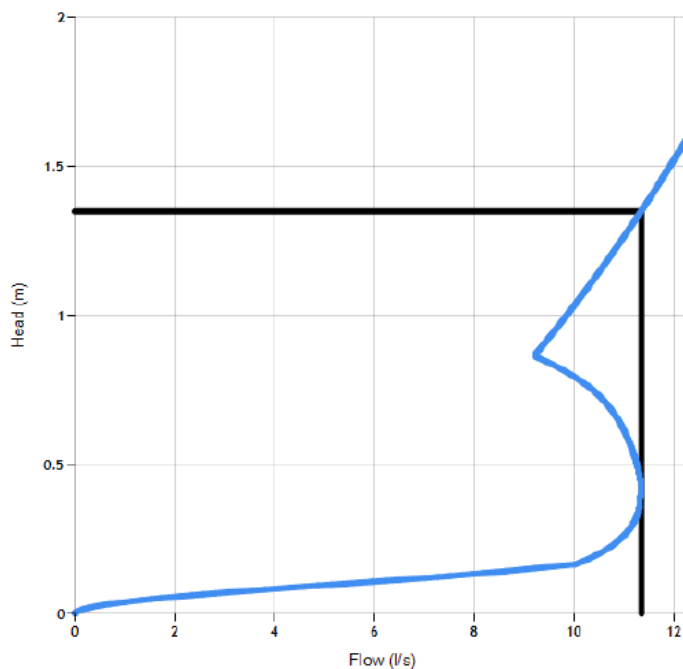
Hydro-Brake Optimum Flow Control Hydraulics

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.350	11.336
Flush-Flo™	0.400	11.333
Kick-Flo®	0.863	9.185
Mean Flow		9.839



PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.047	1.400
0.093	4.792
0.140	8.426
0.186	10.309
0.233	10.791
0.279	11.087
0.326	11.252
0.372	11.323
0.419	11.328
0.466	11.289
0.512	11.218
0.559	11.125
0.605	11.008
0.652	10.859
0.698	10.663
0.745	10.396
0.791	10.030
0.838	9.535
0.884	9.292
0.931	9.519
0.978	9.739
1.024	9.954
1.071	10.164
1.117	10.369
1.164	10.570
1.210	10.767
1.257	10.960
1.303	11.150
1.350	11.336

DESIGN ADVICE



The head/flow characteristics of this SHE-0149-1134-1350-1134 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International

DATE	22/12/2017 11:37:04
SITE	120 Laund Rd, Hudds
DESIGNER	Daniel Slattery
REF	CDEVs

SHE-0149-1134-1350-1134
Hydro-Brake Optimum®