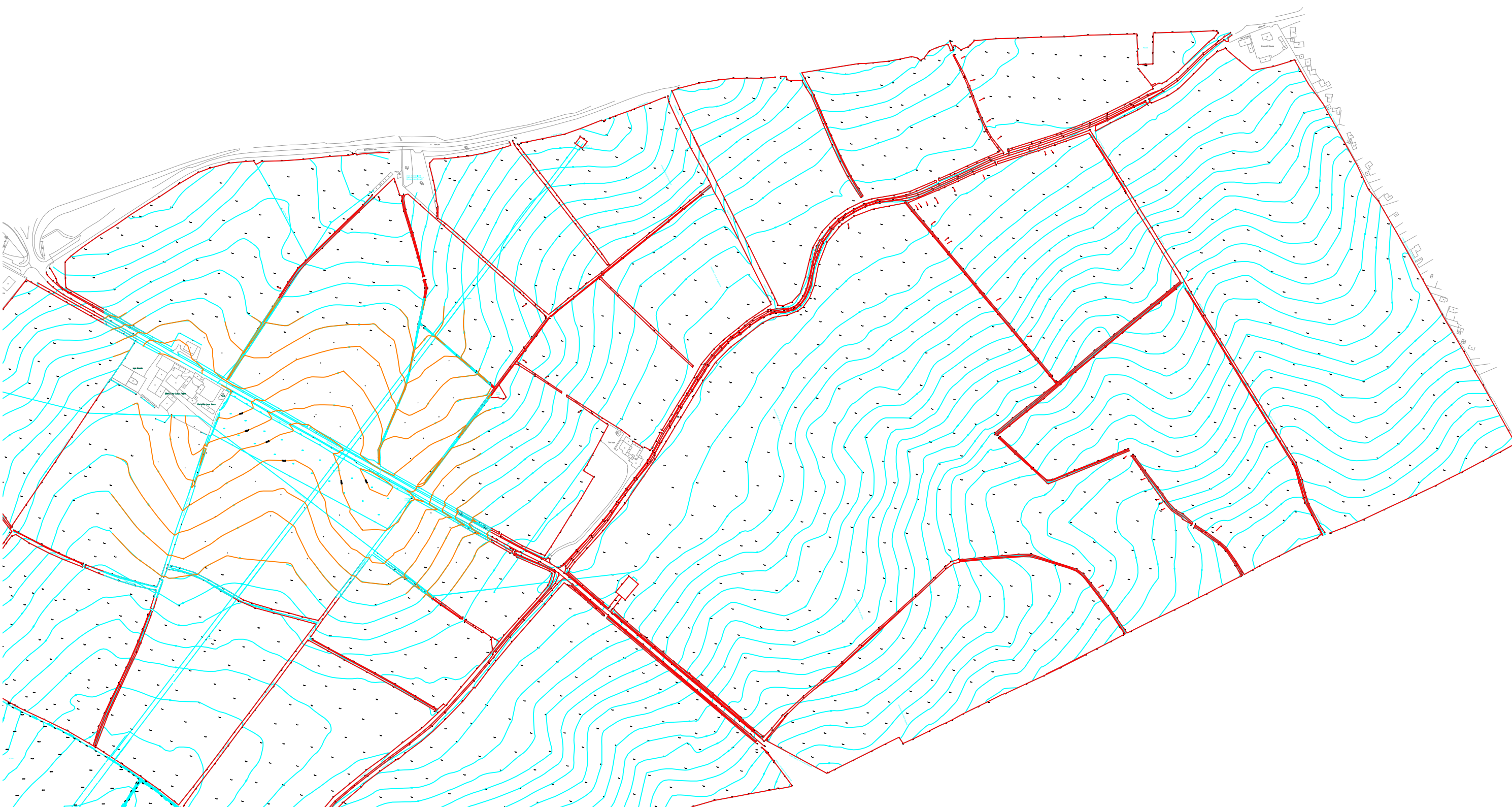


APPENDIX A
Topographic Survey



APPENDIX B

Aylesbury Vale District Council Correspondence

Helen

Beryl has recently retired and I now cover this work. I am unfamiliar with the previous scheme submitted, and would find it useful to read through the draft FRA also would it be possible to have a copy of Beryl's previous comments.

I will be out of the office until the 25th, but will look at it on my return.

Thanks

Em Chilton
Engineering Technician

AVDC Engineering Services
The Gateway
Gatehouse Road
Aylesbury
Buckinghamshire
HP19 8FF

Email: [EChilton@aylesburyvaledc.gov.uk](mailto:EmChilton@aylesburyvaledc.gov.uk)
Tel: 01296 585784



Please don't print this e-mail unless you really need to.

From: Newton, Terry
Sent: 13 March 2013 15:29
To: Chilton, Emma
Subject: FW: 130313 HM~BK FRA Milton Keynes South West

Emma

Can you deal with this? It seems to be your area of expertise.

Terry

From: Helen Montgomery [<mailto:HMontgomery@pellfrischmann.com>]
Sent: 13 March 2013 15:20
To: Newton, Terry
Subject: 130313 HM~BK FRA Milton Keynes South West

Beryl,

I am working on the Flood Risk Assessment for the Milton Keynes South West project. I believe you were contacted by previous consultants, Brookbank Consultants, and I have taken your contact details from previous correspondence. I hope you don't mind me contacting you directly.

The plans have now changed and incorporate a smaller site area (now 285 ha). Consequently only the north west corner of the site is located within Flood Zone 3 of the EA Flood Map. It is proposed that this area of the site will be used as green open space and consequently all built development will be situated outside of Flood Zone 3.

The surface water management strategy comprises using swales and attenuation ponds to restrict the discharge to existing Greenfield rates. The ponds will be designed to attenuate up to the 1 in 100 year storm event plus an allowance of 30% for climate change. It is proposed that the surface water runoff will discharge at restricted rates to the Tattenhoe Brook at the north of the site and to the brook to the south of the site.

Is there anything else you would want included in the flood risk assessment? Would you want to review a draft version of the FRA report?

If you have any queries please don't hesitate to give me a ring,

Helen Montgomery MA (Hons)

Graduate Engineer

P e l l F r i s c h m a n n

Burrator House, Peninsula Park, Rydon Lane, Exeter, EX2 7NT

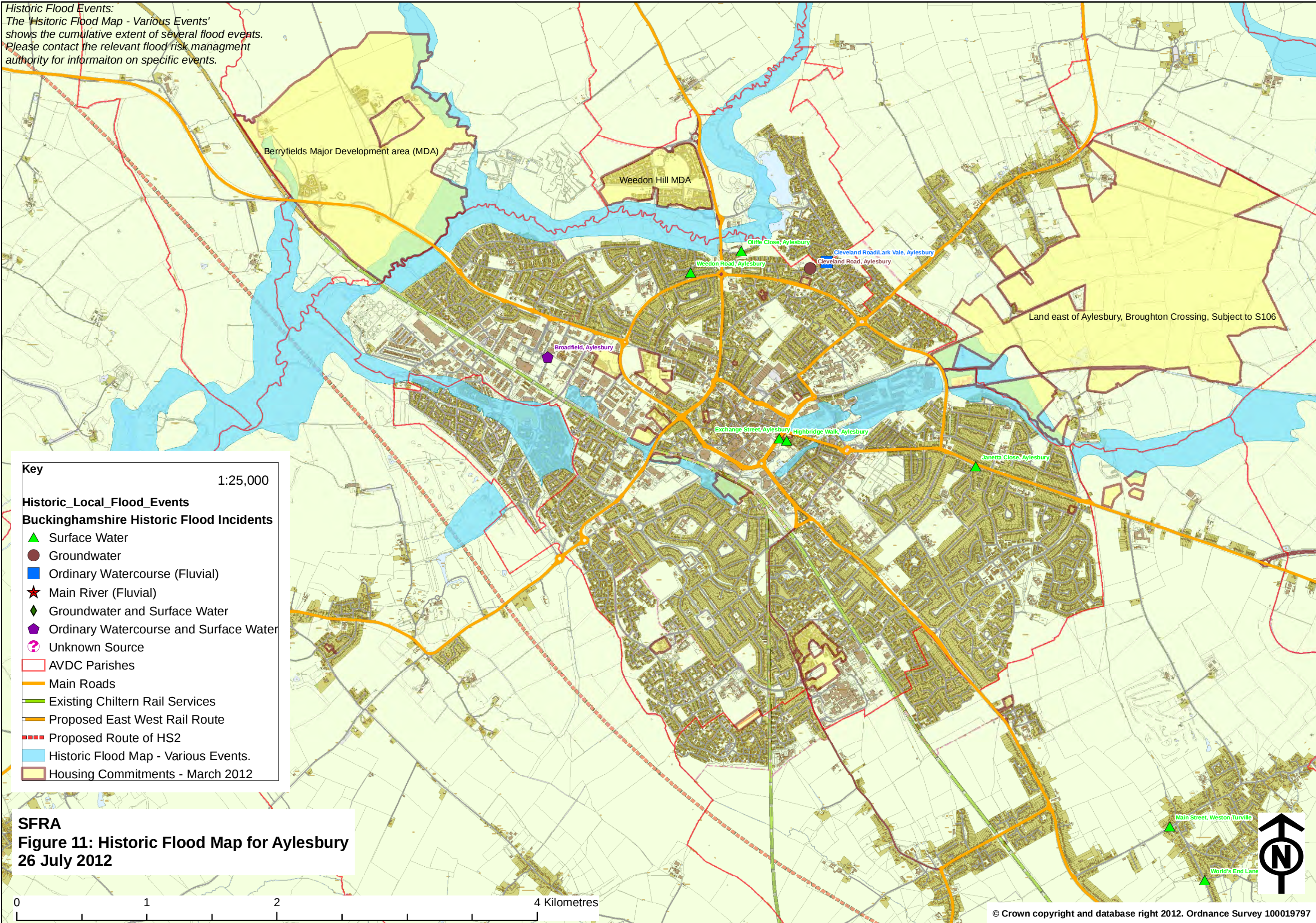
DDI: 01392 441504

M: 07891 123245

hmontgomery@pellfrischmann.com

www.pellfrischmann.com

Historic Flood Events:
The 'Historic Flood Map - Various Events'
shows the cumulative extent of several flood events.
Please contact the relevant flood risk management
authority for information on specific events.



Key

1:25,000

Historic_Local_Flood_Events

Buckinghamshire Historic Flood Incidents

▲ Surface Water

● Groundwater

■ Ordinary Watercourse (Fluvial)

★ Main River (Fluvial)

◆ Groundwater and Surface Water

◆ Ordinary Watercourse and Surface Water

❓ Unknown Source

□ AVDC Parishes

— Main Roads

— Existing Chiltern Rail Services

— Proposed East West Rail Route

--- Proposed Route of HS2

■ Historic Flood Map - Various Events.

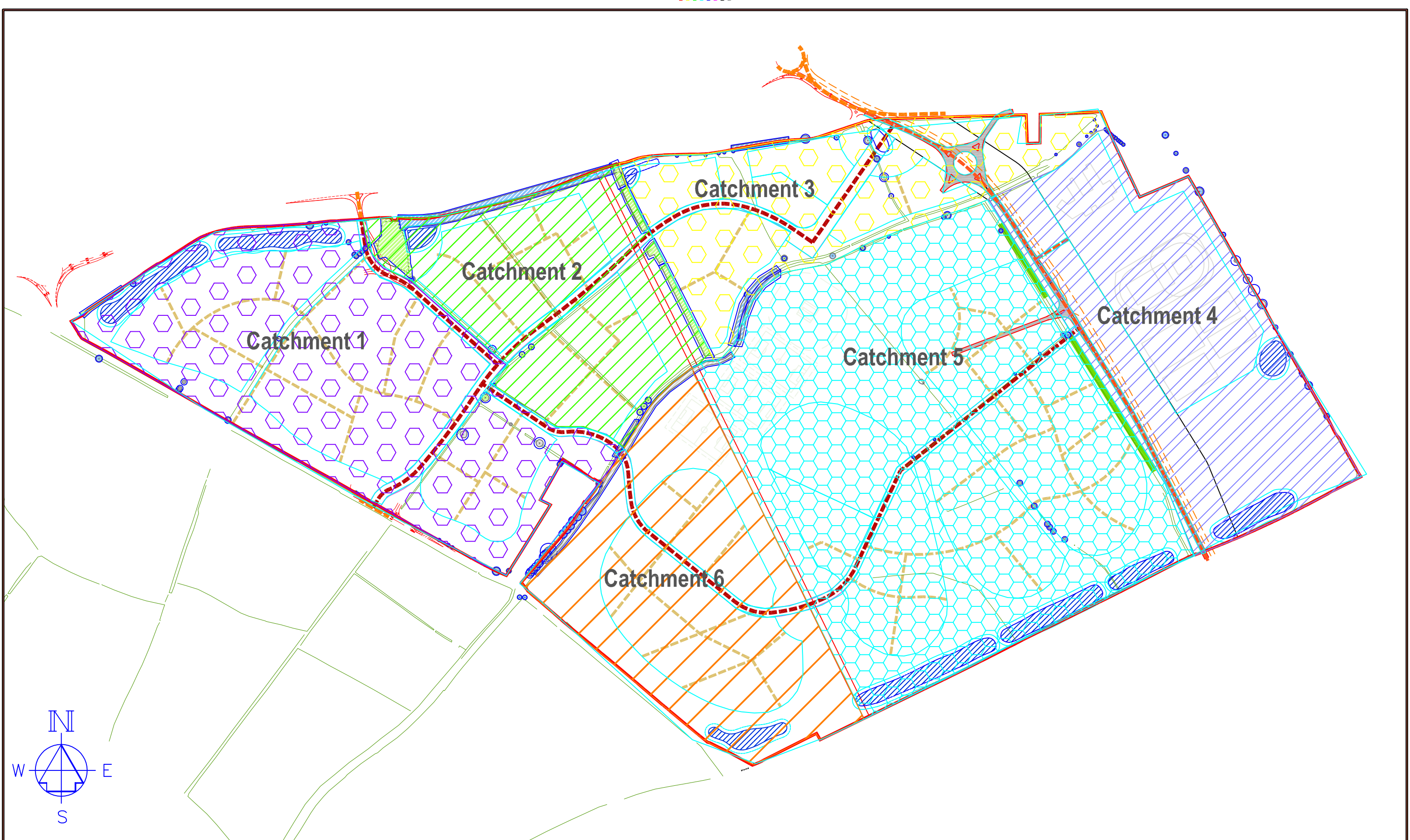
■ Housing Commitments - March 2012

SFRA
Figure 11: Historic Flood Map for Aylesbury
26 July 2012

0 1 2 4 Kilometres

APPENDIX C

Plan of Sub-Catchments



1. This drawing should only be relied upon by the copyright holder. Pell Frischmann will not accept liability if this drawing is used for any purpose other than that for which it has been produced. 2. Where this is an as-built drawing, it shall be based on Pell Frischmann's construction drawings with site changes as supplied and checked by the contractor. Pell Frischmann in no way accepts any liability for the accuracy of the information supplied by the contractor nor for any issues related to changes made on site. © Pell Frischmann

Pell Frischmann PENINSULA PARK RYDON LANE EXETER EX2 7NT Tel: +44(0) 1392 444345 Fax: +44(0) 1392 444880 Email: pfexeter@pellfrischmann.com www.pellfrischmann.com	Project	South West Milton Keynes				Name	Date	Scale	Size
	Drawing Title	Outline Surface Water Drainage			Drawn	HM	04.02.14	File No. M53295 Milton Keynes South West	A3
					Designed	HM	04.02.14		
					Checked	DT	04.02.14	Drawing Status For Information	
					Approved	DT	04.02.14		
					Drawing No. M53295C002			Revision D	

APPENDIX D

Existing Surface Water Runoff Rates

CALCULATIONS

Project

South West Milton Keynes

Date
22.01.14

Subject

To calculate existing Greenfield runoff rates

Bv Chkd
HM SS

Ref.

Output

As the site is Greenfield the IH 124 Method (ICP SuDS) was used to determine the runoff rates.

The below parameters were input into Micro Drainage.

Return Period = 100 years

Area = 143 ha

SAAR (mm) = 650

Soil = 0.4

Region = 6

Area	Discharge Rate (l/s)		
	1 year	30 year	100 year
Entire Site (143 ha)	344	949	1406
Scaled to 1 ha	2.42	6.68	9.90
Southern Section (83.69 ha)	215	593	878
Scaled to 1 ha	2.57	7.09	10.49
Northern Section (59.03 ha)	157	434	643.7
Scaled to 1 ha	2.66	7.35	10.90

The site has been split into 6 sub-catchments based on the existing topography.

The runoff rate for each sub-catchment is summarised below.

Sub-Catchment	Area (ha)	1 in 1 year	1 in 30 year	1 in 100 year
Sub-Catchment 1	26.05	63.11	174.09	257.90
Sub-Catchment 2	15.07	36.51	100.71	149.19
Sub-Catchment 3	14.90	36.10	99.58	147.51
Sub-Catchment 4	20.67	50.07	138.14	204.63
Sub-Catchment 5	43.47	105.31	290.51	430.35
Sub-Catchment 6	19.22	46.56	128.45	190.28

The areas have been taken from drawing number SWMK03-073 Development Framework Plan

Pell Frischmann Consultants Ltd		Page 1																																										
Burrator House Peninsula Park Exeter, EX2 7NT																																												
Date 15/04/2013 10:55 File 130214 HM GREENF...	Designed by hmontgomery Checked by																																											
Micro Drainage	Source Control 2013.1.1																																											
<u>IH 124 Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.400</td> </tr> <tr> <td>Area (ha)</td> <td>59.030</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>650</td> <td>Region Number</td> <td>Region 5</td> </tr> </table> Results l/s <table> <tr> <td>QBAR Rural</td> <td>180.8</td> </tr> <tr> <td>QBAR Urban</td> <td>180.8</td> </tr> <tr> <td>Q100 years</td> <td>643.7</td> </tr> <tr> <td>Q1 year</td> <td>157.3</td> </tr> <tr> <td>Q2 years</td> <td>161.6</td> </tr> <tr> <td>Q5 years</td> <td>233.3</td> </tr> <tr> <td>Q10 years</td> <td>299.3</td> </tr> <tr> <td>Q20 years</td> <td>378.1</td> </tr> <tr> <td>Q25 years</td> <td>409.0</td> </tr> <tr> <td>Q30 years</td> <td>434.4</td> </tr> <tr> <td>Q50 years</td> <td>513.9</td> </tr> <tr> <td>Q100 years</td> <td>643.7</td> </tr> <tr> <td>Q200 years</td> <td>757.7</td> </tr> <tr> <td>Q250 years</td> <td>793.8</td> </tr> <tr> <td>Q1000 years</td> <td>1041.5</td> </tr> </table>			Return Period (years)	100	Soil	0.400	Area (ha)	59.030	Urban	0.000	SAAR (mm)	650	Region Number	Region 5	QBAR Rural	180.8	QBAR Urban	180.8	Q100 years	643.7	Q1 year	157.3	Q2 years	161.6	Q5 years	233.3	Q10 years	299.3	Q20 years	378.1	Q25 years	409.0	Q30 years	434.4	Q50 years	513.9	Q100 years	643.7	Q200 years	757.7	Q250 years	793.8	Q1000 years	1041.5
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©1982-2013 Micro Drainage Ltd																																												

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Q250 years	1083.0																																											
Q1000 years	1421.0																																											
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APPENDIX E

Soakaway Test Results

Soakaway Test Results

08rm611: Salden Chase, Bletchley



Test Pit IT01

Readings Recorded By: Nina Jeniec

Date Recorded: 26th August 2008

Pit Dimensions: **2.3m(l) x 1m(w) x 2.5m(d)**
Start Water Level: **0.62m**

Actual Storage Volume: **5.75 m³**
Effective Depth: **0.01 m**

Time (mins)	Depth BGL (m)
0	0.620
1	0.620
2	0.620
3	0.620
4	0.620
6	0.620
8	0.620
9	0.620
10	0.620
12	0.620
14	0.620
16	0.620
180	0.630

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.3m x 1m x 0.01m**

V : **0.023 m³**

V_{p75-25} : **0.012 m³**

Effective Internal Surface Area, a_{p50} : **0.023m² + 0.01m² + 2.3m²**

a_{p50} : **2.333 m²**

Time of water level fall, t_{p75-25} : **140 - 60 mins**

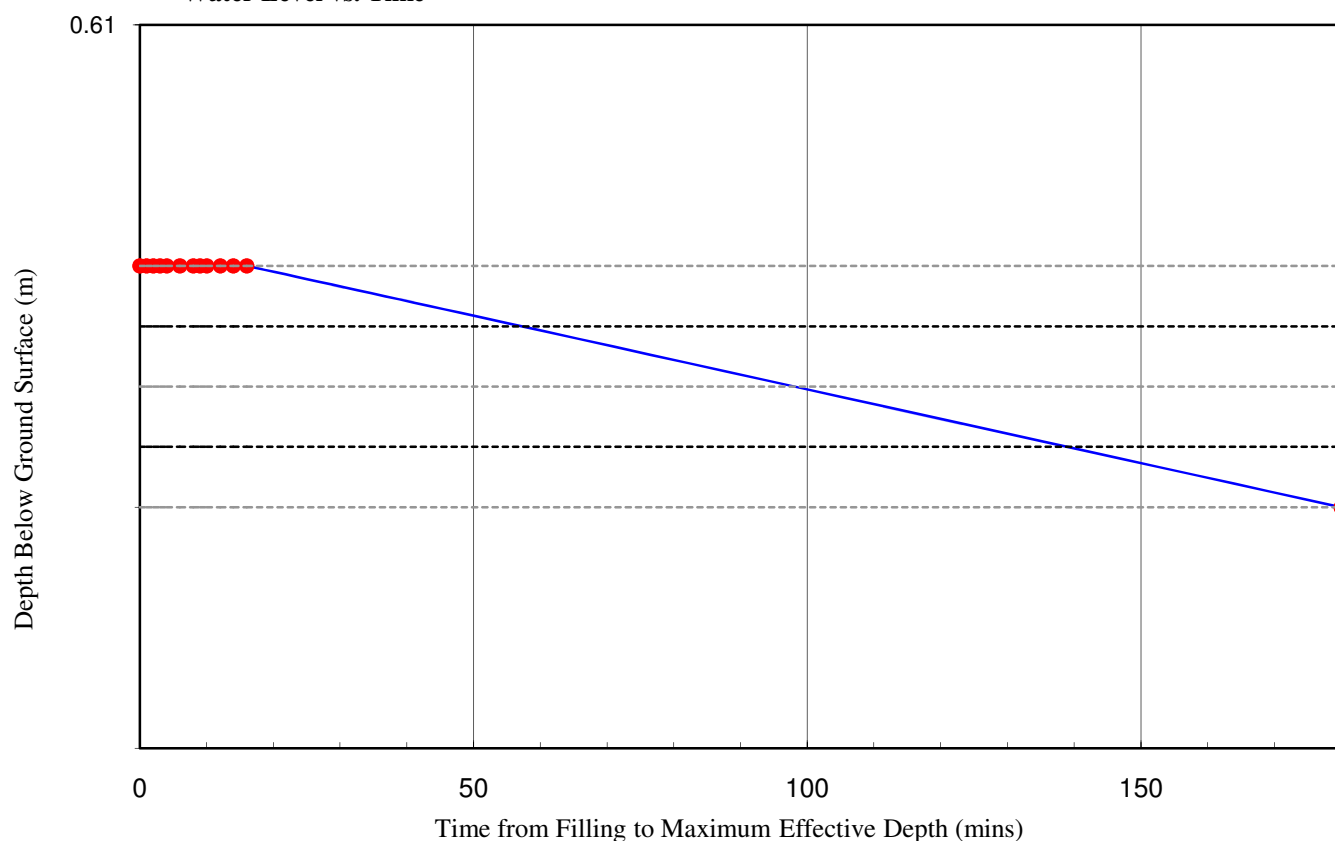
t_{p75-25} : **80 mins**

t_{p75-25} : **4800 secs**

Soil infiltration rate, f : **0.0115/(2.333 x 4800)**

f : **1.03E-06 ms⁻¹**

Water Level vs. Time



Soakaway Test Results

08rm611: Salden Chase, Bletchley



Test Pit IT02

Readings Recorded By: Nina Jeniec

Date Recorded: 27th August 2008

Pit Dimensions: **2.3m(l) x 1m(w) x 2.5m(d)**
Start Water Level: **0.62m**

Actual Storage Volume: **5.75 m³**
Effective Depth: **0 m**

Time (mins)	Depth BGL (m)
0	0.620
1	0.620
2	0.620
3	0.620
4	0.620
6	0.620
8	0.620
9	0.620
10	0.620
12	0.620
14	0.620
16	0.620
180	0.620

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.3m x 1m x 0m**

V : **0 m³**

V_{p75-25} : **0.000 m³**

Effective Internal Surface Area, a_{p50} : **0m² + 0m² + 2.3m²**

a_{p50} : **2.300 m²**

Time of water level fall, t_{p75-25} : **n/a - n/a mins**

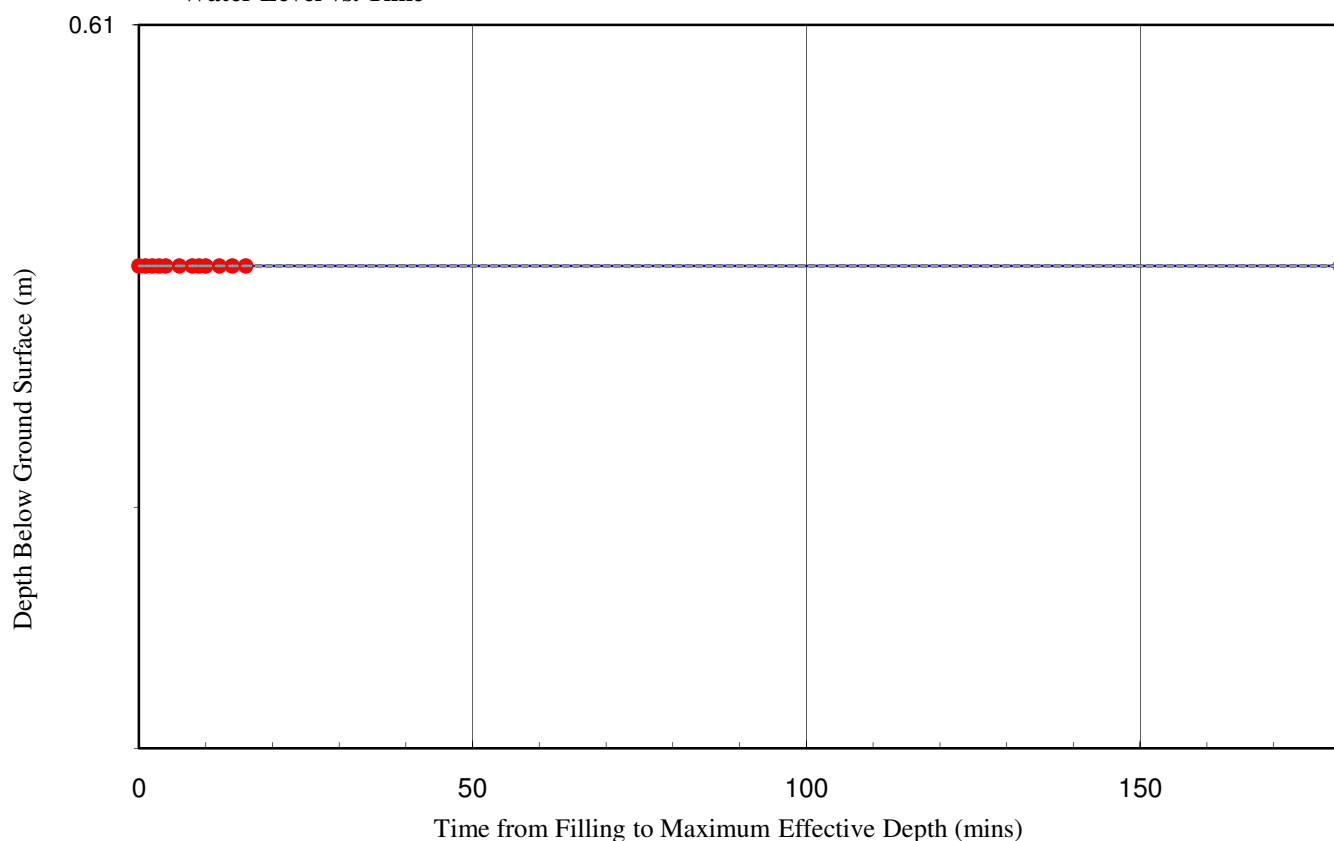
t_{p75-25} : **no infiltration mins**

t_{p75-25} : **no infiltration secs**

Soil infiltration rate, f : **0/(2.3 x no infiltration)**

f : **no infiltration ms⁻¹**

Water Level vs. Time



Soakaway Test Results

08rm611: Salden Chase, Bletchley



Test Pit IT03

Readings Recorded By: Nina Jeniec

Date Recorded: 27th August 2008

Pit Dimensions: **2.3m(l) x 0.5m(w) x 2.5m(d)**
Start Water Level: **0.62m**

Actual Storage Volume: **2.88 m³**
Effective Depth: **0.015 m**

Time (mins)	Depth BGL (m)
0	0.620
1	0.620
2	0.620
3	0.620
4	0.630
6	0.630
8	0.630
9	0.635
10	0.635
12	0.635
14	0.635
16	0.635
180	0.635

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.3m x 0.5m x 0.015m**
 V : **0.0175 m³**

V_{p75-25} : **0.009 m³**

Effective Internal Surface Area, a_{p50} : **0.0345m² + 0.0075000000000**

a_{p50} : **1.192 m²**

Time of water level fall, t_{p75-25} : **50 - 5 mins**

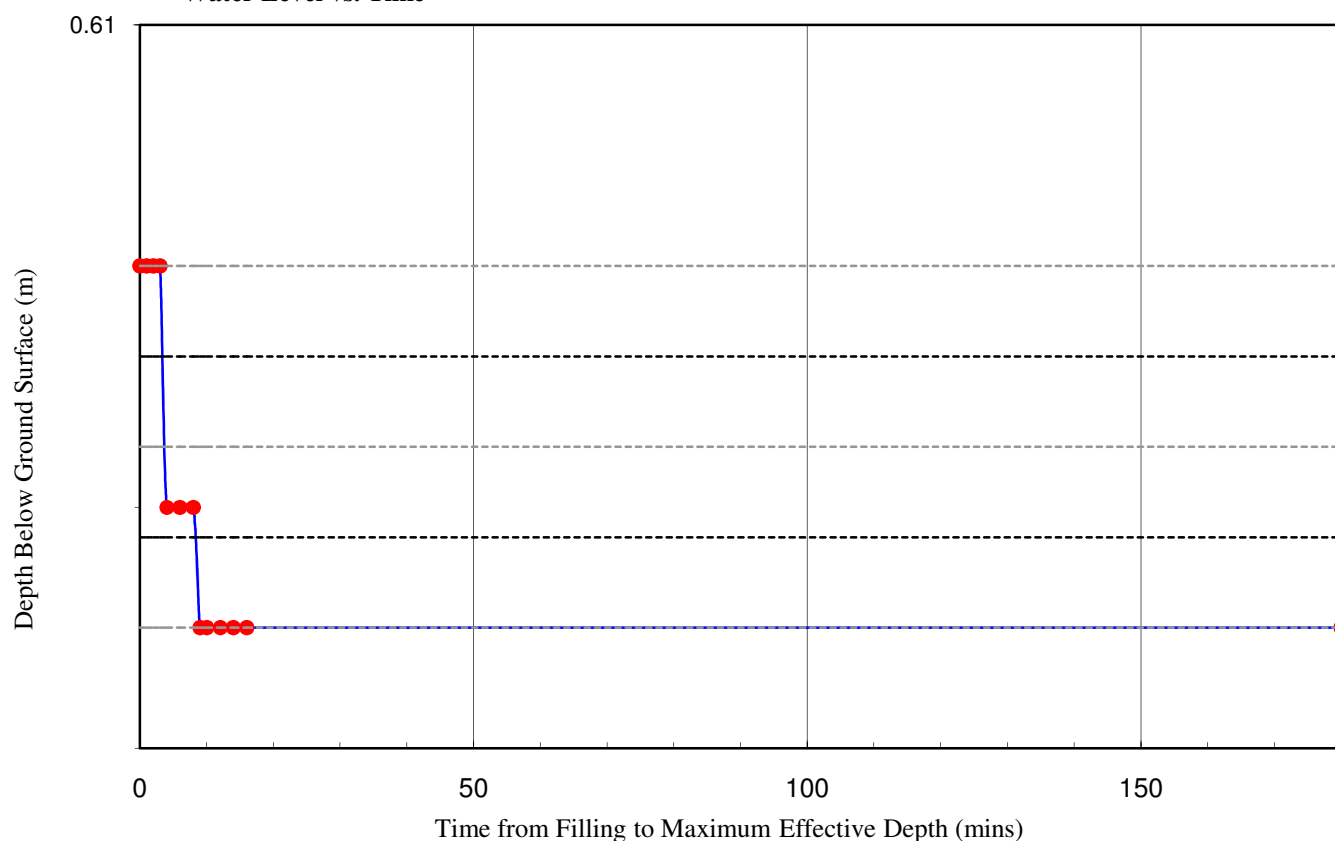
t_{p75-25} : **45 mins**

t_{p75-25} : **2700 secs**

Soil infiltration rate, f : **0.00875/(1.192 x 2700)**

f : **2.72E-06 ms⁻¹**

Water Level vs. Time



Soakaway Test Results

08rm611: Salden Chase, Bletchley

Test Pit IT04

Readings Recorded By: Nina Jeniec

Date Recorded: 27th August 2008

Pit Dimensions: **2.3m(l) x 0.5m(w) x 2.5m(d)**
Start Water Level: **0.83m**

Actual Storage Volume: **2.88 m³**
Effective Depth: **0 m**

Time (mins)	Depth BGL (m)
0	0.830
1	0.830
2	0.830
3	0.830
4	0.830
6	0.830
8	0.830
9	0.830
10	0.830
12	0.830
14	0.830
16	0.830
180	0.830

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.3m x 0.5m x 0m**
 V : **0 m³**

V_{p75-25} : **0.000 m³**

Effective Internal Surface Area, a_{p50} : **0m² + 0m² + 1.15m²**

a_{p50} : **1.150 m²**

Time of water level fall, t_{p75-25} : **n/a - n/a mins**

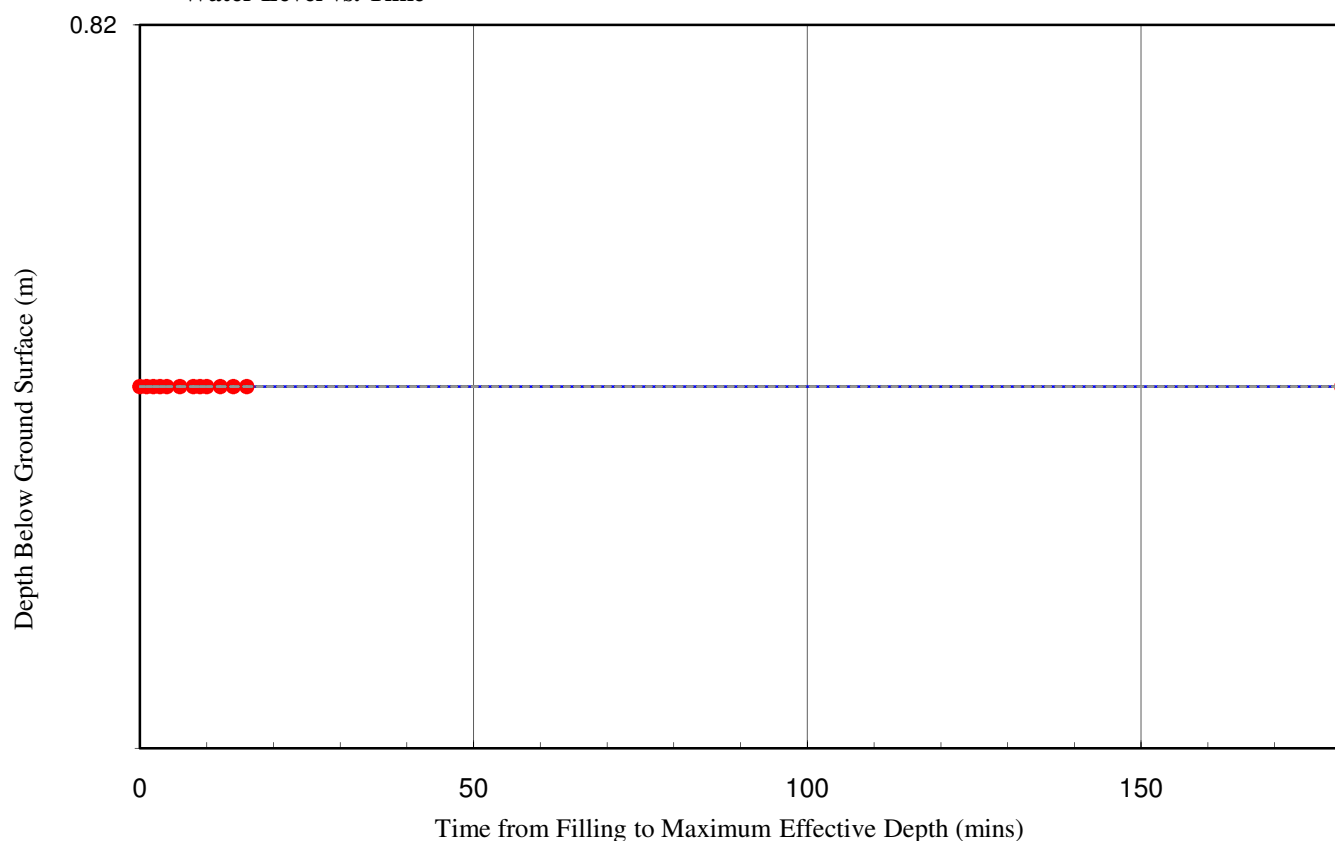
t_{p75-25} : **no infiltration mins**

t_{p75-25} : **no infiltration secs**

Soil infiltration rate, f : **0/(1.15 x no infiltration)**

f : **no infiltration ms⁻¹**

Water Level vs. Time



Soakaway Test Results

08rm611: Salden Chase, Bletchley



Test Pit IT05

Readings Recorded By: Nina Jeniec

Date Recorded: 26th August 2008

Pit Dimensions: **2.33m(l) x 1m(w) x 2.5m(d)**
Start Water Level: **0.62m**

Actual Storage Volume: **5.83 m³**
Effective Depth: **0.01 m**

Time (mins)	Depth BGL (m)
0	0.620
1	0.620
2	0.620
3	0.620
4	0.620
6	0.620
8	0.620
9	0.620
10	0.620
12	0.620
14	0.620
16	0.620
180	0.630

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.33m x 1m x 0.01m**
 V : **0.0233 m³**

V_{p75-25} : **0.012 m³**

Effective Internal Surface Area, a_{p50} : **0.0233m² + 0.01m² + 2.33m²**

a_{p50} : **2.363 m²**

Time of water level fall, t_{p75-25} : **140 - 55 mins**

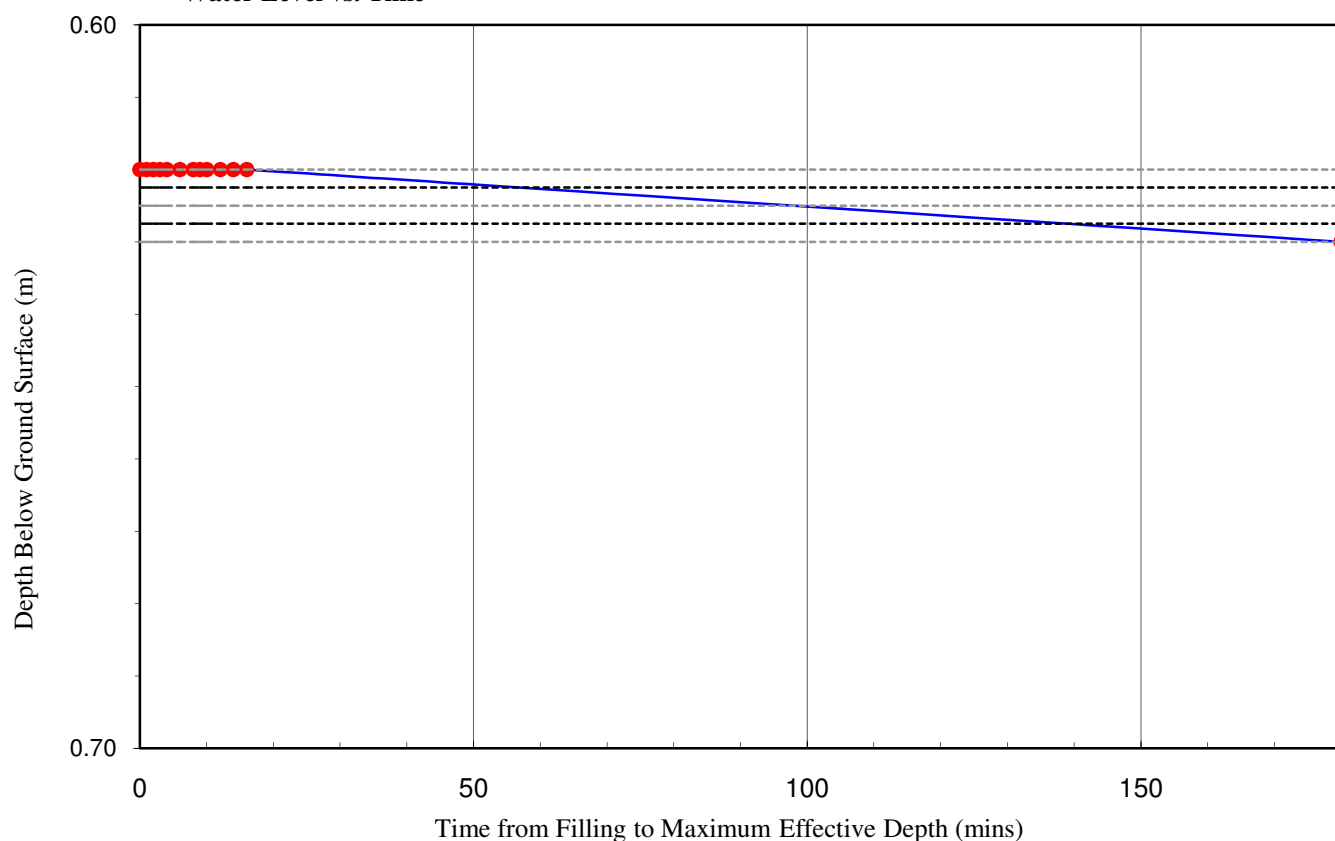
t_{p75-25} : **85 mins**

t_{p75-25} : **5100 secs**

Soil infiltration rate, f : **0.01165/(2.3633 x 5100)**

f : **9.67E-07 ms⁻¹**

Water Level vs. Time



Soakaway Test Results

08rm611: Salden Chase, Bletchley



Test Pit IT06

Readings Recorded By: Nina Jeniec

Date Recorded: 26th August 2008

Pit Dimensions: **2.3m(l) x 1m(w) x 2.35m(d)**
Start Water Level: **1.03m**

Actual Storage Volume: **5.41 m³**
Effective Depth: **0.01 m**

Time (mins)	Depth BGL (m)
0	1.030
1	1.030
2	1.030
3	1.030
4	1.030
6	1.030
8	1.040
9	1.040
10	1.040
12	1.040
14	1.040
16	1.040
180	1.040

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Effective Storage Volume, V : **2.3m x 1m x 0.01m**

V : **0.023 m³**

V_{p75-25} : **0.012 m³**

Effective Internal Surface Area, a_{p50} : **0.023m² + 0.01m² + 2.3m²**

a_{p50} : **2.333 m²**

Time of water level fall, t_{p75-25} : **15 - 2 mins**

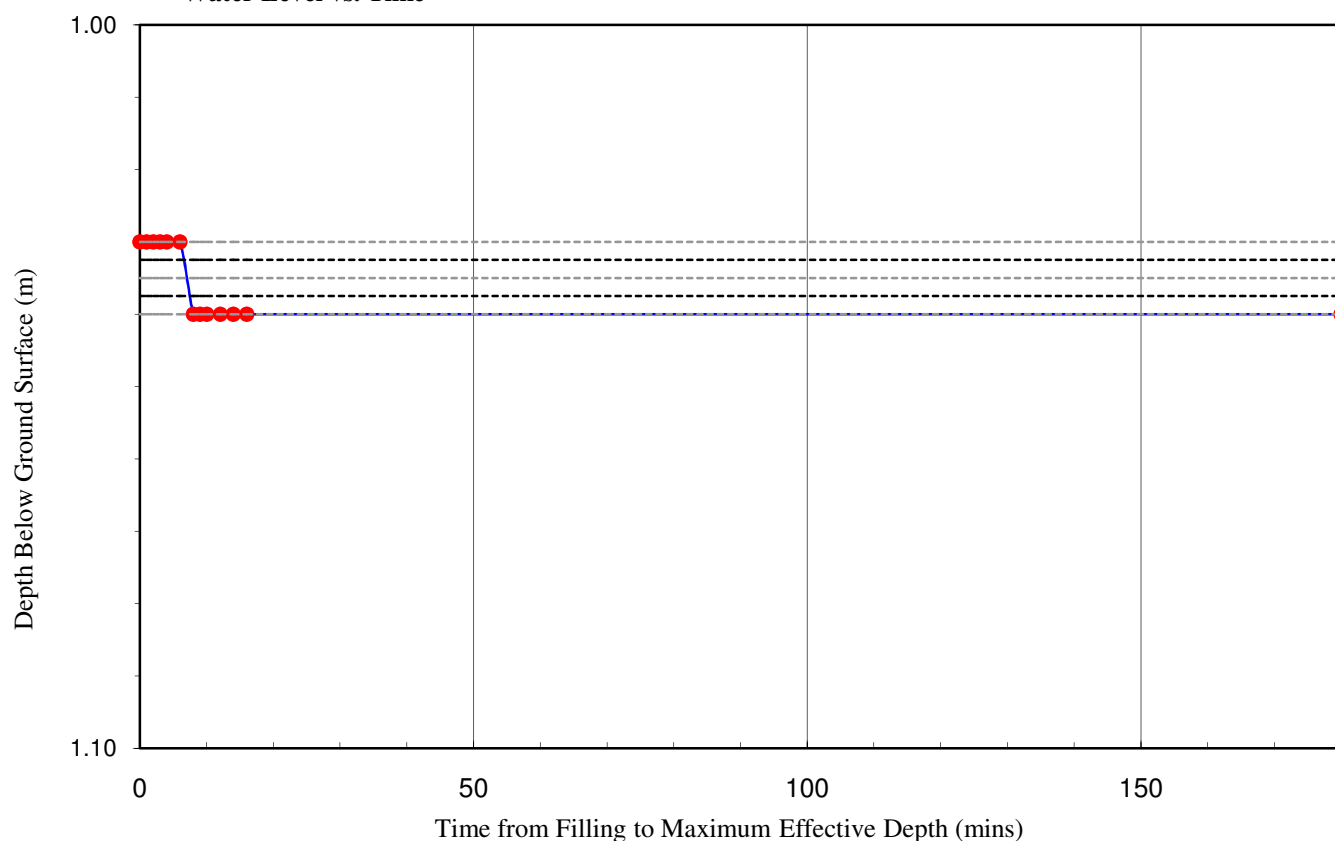
t_{p75-25} : **13 mins**

t_{p75-25} : **780 secs**

Soil infiltration rate, f : **0.0115/(2.333 x 780)**

f : **6.32E-06 ms⁻¹**

Water Level vs. Time



APPENDIX F

Proposed Storage Design

Pell Frischmann		Project/Calc No. M53295/C002																							
		Sheet No. 2																							
CALCULATIONS		Project South West Milton Keynes																							
Subject To calculate the storage attenuation requirements at the site		Date 05.03.13																							
		By HM																							
Chkd																									
Ref.	Output																								
The following parameters have been input into Micro Drainage to calculate the storage requirements for each proposed land use within each sub-catchment <table><tr><td>Inflow = Rainfall Data</td><td>selected within Micro Drainage</td></tr><tr><td>Additional Inflow = None</td><td>selected within Micro Drainage</td></tr><tr><td>Storage Structure = Tank/Pond</td><td>selected within Micro Drainage</td></tr><tr><td>Outflow Control = Hydrobrake</td><td>selected within Micro Drainage</td></tr><tr><td>Overflow Control = Orifice</td><td>selected within Micro Drainage</td></tr><tr><td>Climate Change (%) = 30</td><td>NPPF (2012) Technical Guidance</td></tr><tr><td>Rainfall Model = FEH</td><td>FEH CD Rom v3</td></tr><tr><td>Time / Area Diagram = Impermeable Area (ha)</td><td>taken from M53295/C002 Sheet 2 for each subcatchment and proposed land use</td></tr><tr><td>Cover Level (m) = 3</td><td>selected within Micro Drainage</td></tr><tr><td>Invert Level (m) = 1</td><td>selected within Micro Drainage</td></tr><tr><td>Design Flow = Existing Greenfield runoff rate</td><td>taken from M53295/C001 Sheet 1 for each subcatchment and proposed land use</td></tr></table>				Inflow = Rainfall Data	selected within Micro Drainage	Additional Inflow = None	selected within Micro Drainage	Storage Structure = Tank/Pond	selected within Micro Drainage	Outflow Control = Hydrobrake	selected within Micro Drainage	Overflow Control = Orifice	selected within Micro Drainage	Climate Change (%) = 30	NPPF (2012) Technical Guidance	Rainfall Model = FEH	FEH CD Rom v3	Time / Area Diagram = Impermeable Area (ha)	taken from M53295/C002 Sheet 2 for each subcatchment and proposed land use	Cover Level (m) = 3	selected within Micro Drainage	Invert Level (m) = 1	selected within Micro Drainage	Design Flow = Existing Greenfield runoff rate	taken from M53295/C001 Sheet 1 for each subcatchment and proposed land use
Inflow = Rainfall Data	selected within Micro Drainage																								
Additional Inflow = None	selected within Micro Drainage																								
Storage Structure = Tank/Pond	selected within Micro Drainage																								
Outflow Control = Hydrobrake	selected within Micro Drainage																								
Overflow Control = Orifice	selected within Micro Drainage																								
Climate Change (%) = 30	NPPF (2012) Technical Guidance																								
Rainfall Model = FEH	FEH CD Rom v3																								
Time / Area Diagram = Impermeable Area (ha)	taken from M53295/C002 Sheet 2 for each subcatchment and proposed land use																								
Cover Level (m) = 3	selected within Micro Drainage																								
Invert Level (m) = 1	selected within Micro Drainage																								
Design Flow = Existing Greenfield runoff rate	taken from M53295/C001 Sheet 1 for each subcatchment and proposed land use																								

Pell Frischmann				Project/Calc No. M53295/C002	
				Sheet No. 1	
CALCULATIONS			Project South West Milton Keynes		Date 23.01.14
Subject To calculate the amount of attenuation storage required at the site			Bv HM		Chkd SCS
Ref.	Output				
To calculate the amount of attenuation storage required at the site, restricting the discharge to existing Greenfield rates (identified in M53295/C002)					
Each subcatchment has been split into the proposed land use based on drawing SWMK03-073					
Sub-Catchment 1					
TOTAL AREA (ha) 26.1					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Residential	17.55	0.55	9.6525		
Infrastructure	1.64	1	1.64		
Greenfield (public open space)	6.91	0.2	1.382		
Total	26.1		12.6745		8390
Sub-Catchment 2					
TOTAL AREA (ha) 15.1					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Residential	9.54	0.55	5.247		
Infrastructure	0.66	1	0.66		
Greenfield (public open space)	4.9	0.2	0.98		
Total	15.1		6.887		4395
Sub-Catchment 3					
TOTAL AREA (ha) 14.9					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Residential	4.5	0.55	2.475		
Mixed Use	0.72	0.55	0.396		
Infrastructure	1.78	1	1.78		
Employment	2.35	0.6	1.41		
Greenfield (public open space)	5.55	0.2	1.11		
Total	14.9		7.171		4096
Sub-Catchment 4					
TOTAL AREA (ha) 20.7					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Secondary Education	8.37	0.55	4.6035		
Infrastructure	0.62	1	0.62		
Greenfield (public open space)	11.71	0.2	2.342		
Total	20.7		7.5655		3822
Sub-Catchment 5					
TOTAL AREA (ha) 43.5					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Primary School	3.1	0.45	1.395		
Residential	19.22	0.55	10.571		
Infrastructure	1	1	1		
Greenfield (public open space)	20.18	0.2	4.036		
Total	43.5		17.002		9427
Sub-Catchment 6					
TOTAL AREA (ha) 19.2					
	Area to be developed (ha)	Impermeability Factor	Contributing Area (ha)	Attenuation for 1 year event (m³)	Attenuation for 100 year event plus 30% climate change (m³)
Land Use					
Residential	8.87	0.55	4.8785		
Infrastructure	0.7	1	0.7		
Greenfield (public open space)	9.63	0.2	3.84		
Total	19.2		9.4185		5275
The calculations assume no permeable paving is used therefore representing the worst case scenario.					

Burrator House
Peninsula Park
Exeter, EX2 7NT

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Cascade Summary of Results for 140124 HM subcatchment 1.srcx

Upstream Structures

Outflow To Overflow To

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140124 HM subcatchment 2.srcx
140124 HM Subcatchment 3.srcx
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(None)

(None)

	Storm	Max	Max	Max	Max	Max	Max	Status
	Event	Level	Depth	Control	Overflow	Σ	Outflow	Volume
		(m)	(m)	(l/s)	(l/s)		(l/s)	(m³)
15 min	Summer	1.517	0.517	63.0	0.0		63.0	4134.2
30 min	Summer	1.604	0.604	63.0	0.0		63.0	4830.8
60 min	Summer	1.725	0.725	63.0	0.0		63.0	5797.5
120 min	Summer	1.862	0.862	63.0	120.9		176.3	6893.8
180 min	Summer	1.934	0.934	63.0	256.0		311.5	7475.1
240 min	Summer	1.968	0.968	63.0	328.9		384.6	7742.7
360 min	Summer	1.986	0.986	63.0	371.7		427.6	7888.6
480 min	Summer	2.000	1.000	63.0	404.1		460.1	8000.0
600 min	Summer	2.011	1.011	63.0	432.3		488.4	8091.4
720 min	Summer	2.019	1.019	63.0	452.3		508.5	8153.2
960 min	Summer	2.014	1.014	63.0	439.8		495.9	8114.5
1440 min	Summer	1.997	0.997	63.0	398.0		454.0	7979.0
2160 min	Summer	1.969	0.969	63.0	332.4		388.0	7754.5
2880 min	Summer	1.945	0.945	63.0	279.3		334.8	7562.9
4320 min	Summer	1.910	0.910	63.0	207.7		263.0	7283.1
5760 min	Summer	1.887	0.887	63.0	163.7		219.0	7095.0
7200 min	Summer	1.869	0.869	63.0	133.3		188.6	6951.9
8640 min	Summer	1.855	0.855	63.0	109.8		165.1	6837.3
10080 min	Summer	1.843	0.843	63.0	91.4		146.9	6743.2
15 min	Winter	1.579	0.579	63.0	0.0		63.0	4632.2

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
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15 min Summer	174.944	0.0	4925.0	0.0	31
30 min Summer	102.405	0.0	5198.6	0.0	46
60 min Summer	59.944	0.0	9845.3	0.0	172
120 min Summer	35.089	0.0	11313.2	1303.7	150
180 min Summer	25.652	0.0	12480.6	2515.5	192
240 min Summer	20.540	0.0	13369.3	3457.9	244
360 min Summer	15.016	0.0	14671.7	4878.7	310
480 min Summer	12.023	0.0	15601.9	5936.2	364
600 min Summer	10.119	0.0	16303.5	6771.3	424
720 min Summer	8.790	0.0	16846.1	7452.2	486
960 min Summer	6.896	0.0	17143.0	8044.8	616
1440 min Summer	4.898	0.0	17176.9	8675.6	878
2160 min Summer	3.479	0.0	25117.2	8930.6	1264
2880 min Summer	2.729	0.0	25551.4	8814.5	1648
4320 min Summer	1.940	0.0	23867.6	8105.7	2388
5760 min Summer	1.522	0.0	30598.7	7103.1	3168
7200 min Summer	1.261	0.0	31572.6	6325.1	3936
8640 min Summer	1.082	0.0	32265.6	5654.5	4744
10080 min Summer	0.950	0.0	32543.7	4977.7	5544
15 min Winter	174.944	0.0	5159.3	0.0	31



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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
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Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
----------------	-----------------	--	--	---	---------------------

30 min Winter	102.405	0.0	5214.2	0.0	87
60 min Winter	59.944	0.0	10874.4	819.4	120
120 min Winter	35.089	0.0	12932.1	2897.2	132
180 min Winter	25.652	0.0	14317.5	4325.1	184
240 min Winter	20.540	0.0	15361.5	5417.0	234
360 min Winter	15.016	0.0	16887.2	7048.3	288
480 min Winter	12.023	0.0	17978.7	8254.6	358
600 min Winter	10.119	0.0	18810.1	9207.6	428
720 min Winter	8.790	0.0	19464.5	9988.9	496
960 min Winter	6.896	0.0	19882.5	10680.2	634
1440 min Winter	4.898	0.0	20095.0	11444.1	898
2160 min Winter	3.479	0.0	28266.9	11807.8	1292
2880 min Winter	2.729	0.0	28783.2	11709.2	1676
4320 min Winter	1.940	0.0	27154.8	10947.0	2388
5760 min Winter	1.522	0.0	34297.3	9809.3	3160
7200 min Winter	1.261	0.0	35388.8	8731.9	3928
8640 min Winter	1.082	0.0	36155.0	7793.1	4760
10080 min Winter	0.950	0.0	36373.9	6721.4	5560

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Burrator House Peninsula Park Exeter, EX2 7NT																																																										
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Micro Drainage		Source Control 2013.1.1																																																								
<u>Cascade Rainfall Details for 140124 HM subcatchment 1.srcx</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Site Location</td> <td>GB 484150 232000 SP 84150 32000</td> </tr> <tr> <td>C (1km)</td> <td>-0.026</td> </tr> <tr> <td>D1 (1km)</td> <td>0.347</td> </tr> <tr> <td>D2 (1km)</td> <td>0.276</td> </tr> <tr> <td>D3 (1km)</td> <td>0.277</td> </tr> <tr> <td>E (1km)</td> <td>0.310</td> </tr> <tr> <td>F (1km)</td> <td>2.405</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 12.680 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>3.170</td> <td>4 8</td> <td>3.170</td> <td>8 12</td> <td>3.170</td> <td>12 16</td> <td>3.170</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	Site Location	GB 484150 232000 SP 84150 32000	C (1km)	-0.026	D1 (1km)	0.347	D2 (1km)	0.276	D3 (1km)	0.277	E (1km)	0.310	F (1km)	2.405	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+30	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	3.170	4 8	3.170	8 12	3.170	12 16	3.170
Rainfall Model	FEH																																																									
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From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)																																																			
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Storage is Online Cover Level (m) 3.000

Invert Level (m) 1.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8000.0	0.700	8000.0	1.400	8000.0	2.100	8000.0
0.100	8000.0	0.800	8000.0	1.500	8000.0	2.200	8000.0
0.200	8000.0	0.900	8000.0	1.600	8000.0	2.300	8000.0
0.300	8000.0	1.000	8000.0	1.700	8000.0	2.400	8000.0
0.400	8000.0	1.100	8000.0	1.800	8000.0	2.500	8000.0
0.500	8000.0	1.200	8000.0	1.900	8000.0		
0.600	8000.0	1.300	8000.0	2.000	8000.0		

Design Head (m)	0.500	Diameter (mm)	284
Design Flow (l/s)	63.0	Invert Level (m)	1.000
Hydro-Brake® Type Md12 SW Only			

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.6	1.200	59.2	3.000	92.3	7.000	141.1
0.200	31.2	1.400	63.3	3.500	99.7	7.500	146.0
0.300	49.3	1.600	67.5	4.000	106.6	8.000	150.8
0.400	60.0	1.800	71.5	4.500	113.1	8.500	155.4
0.500	63.0	2.000	75.4	5.000	119.2	9.000	159.9
0.600	61.0	2.200	79.1	5.500	125.0	9.500	164.3
0.800	55.8	2.400	82.6	6.000	130.6		
1.000	56.0	2.600	86.0	6.500	135.9		

Discharge Coef 0.544 Width (m) 1.900 Invert Level (m) 1.750

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Burrator House Peninsula Park Exeter, EX2 7NT							
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Micro Drainage			Source Control 2013.1.1				
<u>Cascade Summary of Results for 140124 HM subcatchment 2.srcx</u>							
Upstream Structures		Outflow To			Overflow To		
140124 HM Subcatchment 3.srcx		140124 HM subcatchment 1.srcx			140124 HM subcatchment 1.srcx		
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.550	0.550	36.2	0.0	36.2	2752.4	O K
30 min Summer	1.644	0.644	36.2	0.0	36.2	3220.8	O K
60 min Summer	1.745	0.745	36.2	66.8	102.5	3725.4	O K
120 min Summer	1.821	0.821	36.2	189.5	225.3	4103.3	O K
180 min Summer	1.840	0.840	36.2	226.4	262.3	4199.7	O K
240 min Summer	1.850	0.850	36.2	247.7	283.7	4252.0	O K
360 min Summer	1.868	0.868	36.2	284.7	320.7	4337.9	O K
480 min Summer	1.876	0.876	36.2	303.2	339.4	4381.8	O K
600 min Summer	1.880	0.880	36.2	311.0	347.1	4397.6	O K
720 min Summer	1.879	0.879	36.2	309.9	346.0	4397.4	O K
960 min Summer	1.867	0.867	36.2	283.6	319.7	4336.9	O K
1440 min Summer	1.844	0.844	36.2	235.5	271.4	4221.1	O K
2160 min Summer	1.817	0.817	36.2	182.0	217.8	4083.5	O K
2880 min Summer	1.797	0.797	36.2	147.0	182.7	3985.0	O K
4320 min Summer	1.774	0.774	36.2	108.2	143.9	3869.0	O K
5760 min Summer	1.760	0.760	36.2	87.0	122.7	3797.7	O K
7200 min Summer	1.749	0.749	36.2	71.5	107.2	3744.1	O K
8640 min Summer	1.740	0.740	36.2	60.3	95.9	3701.6	O K
10080 min Summer	1.733	0.733	36.2	51.5	87.1	3665.4	O K
15 min Winter	1.617	0.617	36.2	0.0	36.2	3082.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)		
15 min Summer	174.944	0.0	3061.2	0.0	31		
30 min Summer	102.405	0.0	3068.6	0.0	46		
60 min Summer	59.944	0.0	6064.6	391.5	74		
120 min Summer	35.089	0.0	7082.0	1279.2	126		
180 min Summer	25.652	0.0	7763.7	1926.0	172		
240 min Summer	20.540	0.0	8277.6	2428.3	192		
360 min Summer	15.016	0.0	9027.7	3183.6	250		
480 min Summer	12.023	0.0	9560.1	3742.3	314		
600 min Summer	10.119	0.0	9958.2	4179.5	380		
720 min Summer	8.790	0.0	10263.0	4532.0	446		
960 min Summer	6.896	0.0	10428.4	4817.1	576		
1440 min Summer	4.898	0.0	10435.5	5090.0	834		
2160 min Summer	3.479	0.0	14219.3	5154.6	1200		
2880 min Summer	2.729	0.0	14696.3	5077.9	1560		
4320 min Summer	1.940	0.0	14621.4	4743.7	2264		
5760 min Summer	1.522	0.0	16948.7	4179.0	3008		
7200 min Summer	1.261	0.0	17521.8	3769.0	3752		
8640 min Summer	1.082	0.0	17967.0	3449.1	4504		
10080 min Summer	0.950	0.0	18250.0	3124.1	5256		
15 min Winter	174.944	0.0	3087.5	0.0	31		
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
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Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
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30 min Winter	102.405	0.0	3264.2	207.5	45
60 min Winter	59.944	0.0	6804.1	1021.0	70
120 min Winter	35.089	0.0	7998.2	2139.4	120
180 min Winter	25.652	0.0	8789.2	2909.5	150
240 min Winter	20.540	0.0	9384.2	3498.1	186
360 min Winter	15.016	0.0	10252.8	4373.5	258
480 min Winter	12.023	0.0	10871.2	5015.3	330
600 min Winter	10.119	0.0	11338.6	5517.9	398
720 min Winter	8.790	0.0	11703.7	5926.2	468
960 min Winter	6.896	0.0	11931.6	6263.4	606
1440 min Winter	4.898	0.0	12026.6	6600.3	872
2160 min Winter	3.479	0.0	15960.9	6694.0	1284
2880 min Winter	2.729	0.0	16486.2	6571.7	1684
4320 min Winter	1.940	0.0	16310.7	6132.7	2260
5760 min Winter	1.522	0.0	18990.1	5523.6	3000
7200 min Winter	1.261	0.0	19635.4	4954.8	3744
8640 min Winter	1.082	0.0	20140.3	4490.5	4496
10080 min Winter	0.950	0.0	20472.3	3931.4	5256

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Burrator House Peninsula Park Exeter, EX2 7NT																																																																		
Date 13/02/2014 15:02 File	Designed by hmontgomery Checked by																																																																	
Micro Drainage		Source Control 2013.1.1																																																																
<u>Cascade Rainfall Details for 140124 HM subcatchment 2.srcx</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Site Location</td> <td>GB 484150 232000 SP 84150 32000</td> </tr> <tr> <td>C (1km)</td> <td>-0.026</td> </tr> <tr> <td>D1 (1km)</td> <td>0.347</td> </tr> <tr> <td>D2 (1km)</td> <td>0.276</td> </tr> <tr> <td>D3 (1km)</td> <td>0.277</td> </tr> <tr> <td>E (1km)</td> <td>0.310</td> </tr> <tr> <td>F (1km)</td> <td>2.405</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 8.400 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>4</td> <td>8</td> <td>8</td> <td>12</td> <td>12</td> <td>16</td> </tr> <tr> <td>2.100</td> <td>2.100</td> <td>2.100</td> <td>2.100</td> <td>2.100</td> <td>2.100</td> <td>2.100</td> <td>2.100</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	Site Location	GB 484150 232000 SP 84150 32000	C (1km)	-0.026	D1 (1km)	0.347	D2 (1km)	0.276	D3 (1km)	0.277	E (1km)	0.310	F (1km)	2.405	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+30	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From:	To:	From:	To:	From:	To:	From:	To:	0	4	4	8	8	12	12	16	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100
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0	4	4	8	8	12	12	16																																																											
2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100																																																											
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Storage is Online Cover Level (m) 3.000

Invert Level (m) 1.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	5000.0	0.700	5000.0	1.400	5000.0	2.100	5000.0
0.100	5000.0	0.800	5000.0	1.500	5000.0	2.200	5000.0
0.200	5000.0	0.900	5000.0	1.600	5000.0	2.300	5000.0
0.300	5000.0	1.000	5000.0	1.700	5000.0	2.400	5000.0
0.400	5000.0	1.100	5000.0	1.800	5000.0	2.500	5000.0
0.500	5000.0	1.200	5000.0	1.900	5000.0		
0.600	5000.0	1.300	5000.0	2.000	5000.0		

Design Head (m)	0.500	Hydro-Brake® Type	Md5 SW Only	Invert Level (m)	1.000
Design Flow (l/s)	36.5	Diameter (mm)	242		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.7	1.200	39.4	3.000	61.0	7.000	93.3
0.200	21.6	1.400	42.0	3.500	65.9	7.500	96.5
0.300	31.1	1.600	44.7	4.000	70.5	8.000	99.7
0.400	35.0	1.800	47.3	4.500	74.8	8.500	102.8
0.500	36.2	2.000	49.9	5.000	78.8	9.000	105.7
0.600	36.0	2.200	52.3	5.500	82.7	9.500	108.6
0.800	35.8	2.400	54.6	6.000	86.3		
1.000	37.1	2.600	56.8	6.500	89.9		

Discharge Coef 0.544 Width (m) 1.900 Invert Level (m) 1.670

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Burrator House Peninsula Park Exeter, EX2 7NT							
Date 13/02/2014 15:01 File			Designed by hmontgomery Checked by				
Micro Drainage			Source Control 2013.1.1				
<u>Cascade Summary of Results for 140124 HM Subcatchment 3.srcx</u>							
Upstream Structures	Outflow To			Overflow To			
(None) 140124 HM subcatchment 2.srcx 140124 HM subcatchment 2.srcx							
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.578	0.578	32.6	0.0	32.6	2311.9	O K
30 min Summer	1.674	0.674	32.6	0.1	32.6	2695.5	O K
60 min Summer	1.779	0.779	32.6	14.2	46.5	3115.3	O K
120 min Summer	1.876	0.876	32.7	49.2	81.9	3503.9	O K
180 min Summer	1.915	0.915	33.0	68.1	101.1	3658.5	O K
240 min Summer	1.928	0.928	33.1	74.4	107.5	3711.4	O K
360 min Summer	1.943	0.943	33.3	81.6	114.9	3771.2	O K
480 min Summer	1.953	0.953	33.4	88.8	122.2	3812.7	O K
600 min Summer	1.958	0.958	33.4	93.0	126.4	3833.7	O K
720 min Summer	1.960	0.960	33.4	94.6	128.1	3841.7	O K
960 min Summer	1.947	0.947	33.3	83.8	117.1	3788.3	O K
1440 min Summer	1.917	0.917	33.0	69.3	102.3	3668.5	O K
2160 min Summer	1.878	0.878	32.7	50.4	83.1	3513.5	O K
2880 min Summer	1.845	0.845	32.6	35.3	67.8	3380.0	O K
4320 min Summer	1.786	0.786	32.6	16.1	48.3	3145.6	O K
5760 min Summer	1.726	0.726	32.6	4.5	36.6	2902.0	O K
7200 min Summer	1.642	0.642	32.6	0.0	32.6	2567.6	O K
8640 min Summer	1.559	0.559	32.6	0.0	32.6	2235.6	O K
10080 min Summer	1.490	0.490	32.6	0.0	32.6	1958.2	O K
15 min Winter	1.648	0.648	32.6	0.0	32.6	2593.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)		
15 min Summer	174.944	0.0	1977.4	0.0	30		
30 min Summer	102.405	0.0	2262.3	0.0	45		
60 min Summer	59.944	0.0	3074.8	67.2	74		
120 min Summer	35.089	0.0	3605.2	333.6	128		
180 min Summer	25.652	0.0	3957.6	563.4	184		
240 min Summer	20.540	0.0	4227.1	745.2	234		
360 min Summer	15.016	0.0	4634.4	1013.8	282		
480 min Summer	12.023	0.0	4941.5	1202.3	342		
600 min Summer	10.119	0.0	5188.1	1339.1	408		
720 min Summer	8.790	0.0	5392.4	1438.2	474		
960 min Summer	6.896	0.0	5589.7	1454.7	616		
1440 min Summer	4.898	0.0	5765.8	1362.9	890		
2160 min Summer	3.479	0.0	6647.6	1110.1	1304		
2880 min Summer	2.729	0.0	6931.6	860.8	1732		
4320 min Summer	1.940	0.0	7290.1	425.0	2596		
5760 min Summer	1.522	0.0	7821.2	94.3	3464		
7200 min Summer	1.261	0.0	8093.2	0.0	4264		
8640 min Summer	1.082	0.0	8312.2	0.0	5016		
10080 min Summer	0.950	0.0	8474.0	0.0	5664		
15 min Winter	174.944	0.0	2185.1	0.0	30		

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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
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Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
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30 min Winter	102.405	0.0	2476.1	34.0	44
60 min Winter	59.944	0.0	3450.1	259.6	72
120 min Winter	35.089	0.0	4050.3	670.7	124
180 min Winter	25.652	0.0	4448.0	970.1	176
240 min Winter	20.540	0.0	4751.9	1197.8	202
360 min Winter	15.016	0.0	5211.0	1525.3	272
480 min Winter	12.023	0.0	5557.2	1750.3	346
600 min Winter	10.119	0.0	5835.5	1914.0	416
720 min Winter	8.790	0.0	6066.9	2035.5	488
960 min Winter	6.896	0.0	6292.8	2065.1	632
1440 min Winter	4.898	0.0	6501.8	1975.3	920
2160 min Winter	3.479	0.0	7452.7	1679.3	1348
2880 min Winter	2.729	0.0	7769.8	1329.9	1784
4320 min Winter	1.940	0.0	8154.0	686.1	2688
5760 min Winter	1.522	0.0	8761.7	144.7	3688
7200 min Winter	1.261	0.0	9068.0	0.0	4544
8640 min Winter	1.082	0.0	9316.5	0.0	5200
10080 min Winter	0.950	0.0	9505.7	0.0	5856

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Peninsula Park
Exeter, EX2 7NT

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Cascade Rainfall Details for 140124 HM Subcatchment 3.srcx

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 484150 232000 SP 84150 32000
C (1km)	-0.026
D1 (1km)	0.347
D2 (1km)	0.276
D3 (1km)	0.277
E (1km)	0.310
F (1km)	2.405
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 7.160

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	1.790	4 8	1.790	8 12	1.790	12 16	1.790

Pell Frischmann Consultants Ltd						Page 1																																																																																																																																																																																																																																																																																																																																																																																																	
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<u>Summary of Results for 100 year Return Period (+30%)</u> <table border="1"> <thead> <tr> <th>Storm Event</th> <th>Max Level (m)</th> <th>Max Depth (m)</th> <th>Max Control (l/s)</th> <th>Max Overflow (l/s)</th> <th>Max Σ Outflow (l/s)</th> <th>Max Volume (m³)</th> <th>Status</th> </tr> </thead> <tbody> <tr><td>15 min Summer</td><td>1.483</td><td>0.483</td><td>48.9</td><td>31.3</td><td>80.2</td><td>2416.8</td><td>O K</td></tr> <tr><td>30 min Summer</td><td>1.556</td><td>0.556</td><td>49.7</td><td>63.7</td><td>113.4</td><td>2778.6</td><td>O K</td></tr> <tr><td>60 min Summer</td><td>1.625</td><td>0.625</td><td>49.8</td><td>107.1</td><td>156.8</td><td>3127.2</td><td>O K</td></tr> <tr><td>120 min Summer</td><td>1.670</td><td>0.670</td><td>49.8</td><td>144.5</td><td>194.0</td><td>3352.0</td><td>O K</td></tr> <tr><td>180 min Summer</td><td>1.685</td><td>0.685</td><td>49.8</td><td>153.9</td><td>203.4</td><td>3424.3</td><td>O K</td></tr> <tr><td>240 min Summer</td><td>1.695</td><td>0.695</td><td>49.8</td><td>160.5</td><td>210.0</td><td>3476.2</td><td>O K</td></tr> <tr><td>360 min Summer</td><td>1.705</td><td>0.705</td><td>49.8</td><td>166.5</td><td>215.9</td><td>3523.8</td><td>O K</td></tr> <tr><td>480 min Summer</td><td>1.705</td><td>0.705</td><td>49.8</td><td>166.8</td><td>216.2</td><td>3526.0</td><td>O K</td></tr> <tr><td>600 min Summer</td><td>1.701</td><td>0.701</td><td>49.8</td><td>164.3</td><td>213.7</td><td>3505.0</td><td>O K</td></tr> <tr><td>720 min Summer</td><td>1.694</td><td>0.694</td><td>49.8</td><td>159.9</td><td>209.3</td><td>3472.3</td><td>O K</td></tr> <tr><td>960 min Summer</td><td>1.670</td><td>0.670</td><td>49.8</td><td>144.0</td><td>193.6</td><td>3348.9</td><td>O K</td></tr> <tr><td>1440 min Summer</td><td>1.631</td><td>0.631</td><td>49.8</td><td>111.7</td><td>161.4</td><td>3152.8</td><td>O K</td></tr> <tr><td>2160 min Summer</td><td>1.583</td><td>0.583</td><td>49.8</td><td>77.0</td><td>126.8</td><td>2916.6</td><td>O K</td></tr> <tr><td>2880 min Summer</td><td>1.545</td><td>0.545</td><td>49.7</td><td>58.4</td><td>108.0</td><td>2722.7</td><td>O K</td></tr> <tr><td>4320 min Summer</td><td>1.488</td><td>0.488</td><td>49.0</td><td>33.0</td><td>82.0</td><td>2441.4</td><td>O K</td></tr> <tr><td>5760 min Summer</td><td>1.445</td><td>0.445</td><td>47.9</td><td>18.3</td><td>66.3</td><td>2226.3</td><td>O K</td></tr> <tr><td>7200 min Summer</td><td>1.409</td><td>0.409</td><td>46.6</td><td>9.4</td><td>56.0</td><td>2044.6</td><td>O K</td></tr> <tr><td>8640 min Summer</td><td>1.376</td><td>0.376</td><td>45.0</td><td>4.6</td><td>49.5</td><td>1881.3</td><td>O K</td></tr> <tr><td>10080 min Summer</td><td>1.347</td><td>0.347</td><td>43.2</td><td>1.0</td><td>44.1</td><td>1735.0</td><td>O K</td></tr> <tr><td>15 min Winter</td><td>1.540</td><td>0.540</td><td>49.6</td><td>56.2</td><td>105.8</td><td>2700.4</td><td>O K</td></tr> <tr><td>30 min Winter</td><td>1.620</td><td>0.620</td><td>49.8</td><td>102.5</td><td>152.3</td><td>3097.8</td><td>O K</td></tr> <tr><td>60 min Winter</td><td>1.693</td><td>0.693</td><td>49.8</td><td>159.3</td><td>208.7</td><td>3466.7</td><td>O K</td></tr> <tr><td>120 min Winter</td><td>1.743</td><td>0.743</td><td>49.8</td><td>190.6</td><td>239.9</td><td>3716.6</td><td>O K</td></tr> <tr> <th>Storm Event</th> <th>Rain (mm/hr)</th> <th>Flooded Volume (m³)</th> <th>Discharge Volume (m³)</th> <th>Overflow Volume (m³)</th> <th>Time-Peak (mins)</th> <th></th> <th></th> </tr> <tr><td>15 min Summer</td><td>174.944</td><td>0.0</td><td>2138.6</td><td>150.2</td><td>30</td><td></td><td></td></tr> <tr><td>30 min Summer</td><td>102.405</td><td>0.0</td><td>2534.3</td><td>360.5</td><td>43</td><td></td><td></td></tr> <tr><td>60 min Summer</td><td>59.944</td><td>0.0</td><td>3267.1</td><td>675.0</td><td>68</td><td></td><td></td></tr> <tr><td>120 min Summer</td><td>35.089</td><td>0.0</td><td>3841.4</td><td>1090.5</td><td>120</td><td></td><td></td></tr> <tr><td>180 min Summer</td><td>25.652</td><td>0.0</td><td>4221.0</td><td>1365.2</td><td>146</td><td></td><td></td></tr> <tr><td>240 min Summer</td><td>20.540</td><td>0.0</td><td>4511.5</td><td>1567.0</td><td>178</td><td></td><td></td></tr> <tr><td>360 min Summer</td><td>15.016</td><td>0.0</td><td>4952.6</td><td>1847.1</td><td>244</td><td></td><td></td></tr> <tr><td>480 min Summer</td><td>12.023</td><td>0.0</td><td>5288.5</td><td>2029.8</td><td>312</td><td></td><td></td></tr> <tr><td>600 min Summer</td><td>10.119</td><td>0.0</td><td>5562.1</td><td>2154.4</td><td>378</td><td></td><td></td></tr> <tr><td>720 min Summer</td><td>8.790</td><td>0.0</td><td>5793.6</td><td>2237.7</td><td>444</td><td></td><td></td></tr> <tr><td>960 min Summer</td><td>6.896</td><td>0.0</td><td>6042.9</td><td>2214.2</td><td>576</td><td></td><td></td></tr> <tr><td>1440 min Summer</td><td>4.898</td><td>0.0</td><td>6379.1</td><td>2048.0</td><td>836</td><td></td><td></td></tr> <tr><td>2160 min Summer</td><td>3.479</td><td>0.0</td><td>7027.7</td><td>1734.5</td><td>1224</td><td></td><td></td></tr> <tr><td>2880 min Summer</td><td>2.729</td><td>0.0</td><td>7336.0</td><td>1449.7</td><td>1600</td><td></td><td></td></tr> <tr><td>4320 min Summer</td><td>1.940</td><td>0.0</td><td>7747.0</td><td>964.4</td><td>2380</td><td></td><td></td></tr> <tr><td>5760 min Summer</td><td>1.522</td><td>0.0</td><td>8252.8</td><td>585.1</td><td>3128</td><td></td><td></td></tr> <tr><td>7200 min Summer</td><td>1.261</td><td>0.0</td><td>8536.9</td><td>309.4</td><td>3896</td><td></td><td></td></tr> <tr><td>8640 min Summer</td><td>1.082</td><td>0.0</td><td>8763.8</td><td>124.7</td><td>4672</td><td></td><td></td></tr> <tr><td>10080 min Summer</td><td>0.950</td><td>0.0</td><td>8927.3</td><td>22.1</td><td>5448</td><td></td><td></td></tr> <tr><td>15 min Winter</td><td>174.944</td><td>0.0</td><td>2418.3</td><td>293.3</td><td>29</td><td></td><td></td></tr> <tr><td>30 min Winter</td><td>102.405</td><td>0.0</td><td>2867.0</td><td>585.3</td><td>42</td><td></td><td></td></tr> <tr><td>60 min Winter</td><td>59.944</td><td>0.0</td><td>3672.7</td><td>990.3</td><td>66</td><td></td><td></td></tr> <tr><td>120 min Winter</td><td>35.089</td><td>0.0</td><td>4316.8</td><td>1482.1</td><td>118</td><td></td><td></td></tr> </tbody> </table>								Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	1.483	0.483	48.9	31.3	80.2	2416.8	O K	30 min Summer	1.556	0.556	49.7	63.7	113.4	2778.6	O K	60 min Summer	1.625	0.625	49.8	107.1	156.8	3127.2	O K	120 min Summer	1.670	0.670	49.8	144.5	194.0	3352.0	O K	180 min Summer	1.685	0.685	49.8	153.9	203.4	3424.3	O K	240 min Summer	1.695	0.695	49.8	160.5	210.0	3476.2	O K	360 min Summer	1.705	0.705	49.8	166.5	215.9	3523.8	O K	480 min Summer	1.705	0.705	49.8	166.8	216.2	3526.0	O K	600 min Summer	1.701	0.701	49.8	164.3	213.7	3505.0	O K	720 min Summer	1.694	0.694	49.8	159.9	209.3	3472.3	O K	960 min Summer	1.670	0.670	49.8	144.0	193.6	3348.9	O K	1440 min Summer	1.631	0.631	49.8	111.7	161.4	3152.8	O K	2160 min Summer	1.583	0.583	49.8	77.0	126.8	2916.6	O K	2880 min Summer	1.545	0.545	49.7	58.4	108.0	2722.7	O K	4320 min Summer	1.488	0.488	49.0	33.0	82.0	2441.4	O K	5760 min Summer	1.445	0.445	47.9	18.3	66.3	2226.3	O K	7200 min Summer	1.409	0.409	46.6	9.4	56.0	2044.6	O K	8640 min Summer	1.376	0.376	45.0	4.6	49.5	1881.3	O K	10080 min Summer	1.347	0.347	43.2	1.0	44.1	1735.0	O K	15 min Winter	1.540	0.540	49.6	56.2	105.8	2700.4	O K	30 min Winter	1.620	0.620	49.8	102.5	152.3	3097.8	O K	60 min Winter	1.693	0.693	49.8	159.3	208.7	3466.7	O K	120 min Winter	1.743	0.743	49.8	190.6	239.9	3716.6	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)			15 min Summer	174.944	0.0	2138.6	150.2	30			30 min Summer	102.405	0.0	2534.3	360.5	43			60 min Summer	59.944	0.0	3267.1	675.0	68			120 min Summer	35.089	0.0	3841.4	1090.5	120			180 min Summer	25.652	0.0	4221.0	1365.2	146			240 min Summer	20.540	0.0	4511.5	1567.0	178			360 min Summer	15.016	0.0	4952.6	1847.1	244			480 min Summer	12.023	0.0	5288.5	2029.8	312			600 min Summer	10.119	0.0	5562.1	2154.4	378			720 min Summer	8.790	0.0	5793.6	2237.7	444			960 min Summer	6.896	0.0	6042.9	2214.2	576			1440 min Summer	4.898	0.0	6379.1	2048.0	836			2160 min Summer	3.479	0.0	7027.7	1734.5	1224			2880 min Summer	2.729	0.0	7336.0	1449.7	1600			4320 min Summer	1.940	0.0	7747.0	964.4	2380			5760 min Summer	1.522	0.0	8252.8	585.1	3128			7200 min Summer	1.261	0.0	8536.9	309.4	3896			8640 min Summer	1.082	0.0	8763.8	124.7	4672			10080 min Summer	0.950	0.0	8927.3	22.1	5448			15 min Winter	174.944	0.0	2418.3	293.3	29			30 min Winter	102.405	0.0	2867.0	585.3	42			60 min Winter	59.944	0.0	3672.7	990.3	66			120 min Winter	35.089	0.0	4316.8	1482.1	118		
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																																																																																																																																																
15 min Summer	1.483	0.483	48.9	31.3	80.2	2416.8	O K																																																																																																																																																																																																																																																																																																																																																																																																
30 min Summer	1.556	0.556	49.7	63.7	113.4	2778.6	O K																																																																																																																																																																																																																																																																																																																																																																																																
60 min Summer	1.625	0.625	49.8	107.1	156.8	3127.2	O K																																																																																																																																																																																																																																																																																																																																																																																																
120 min Summer	1.670	0.670	49.8	144.5	194.0	3352.0	O K																																																																																																																																																																																																																																																																																																																																																																																																
180 min Summer	1.685	0.685	49.8	153.9	203.4	3424.3	O K																																																																																																																																																																																																																																																																																																																																																																																																
240 min Summer	1.695	0.695	49.8	160.5	210.0	3476.2	O K																																																																																																																																																																																																																																																																																																																																																																																																
360 min Summer	1.705	0.705	49.8	166.5	215.9	3523.8	O K																																																																																																																																																																																																																																																																																																																																																																																																
480 min Summer	1.705	0.705	49.8	166.8	216.2	3526.0	O K																																																																																																																																																																																																																																																																																																																																																																																																
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720 min Summer	1.694	0.694	49.8	159.9	209.3	3472.3	O K																																																																																																																																																																																																																																																																																																																																																																																																
960 min Summer	1.670	0.670	49.8	144.0	193.6	3348.9	O K																																																																																																																																																																																																																																																																																																																																																																																																
1440 min Summer	1.631	0.631	49.8	111.7	161.4	3152.8	O K																																																																																																																																																																																																																																																																																																																																																																																																
2160 min Summer	1.583	0.583	49.8	77.0	126.8	2916.6	O K																																																																																																																																																																																																																																																																																																																																																																																																
2880 min Summer	1.545	0.545	49.7	58.4	108.0	2722.7	O K																																																																																																																																																																																																																																																																																																																																																																																																
4320 min Summer	1.488	0.488	49.0	33.0	82.0	2441.4	O K																																																																																																																																																																																																																																																																																																																																																																																																
5760 min Summer	1.445	0.445	47.9	18.3	66.3	2226.3	O K																																																																																																																																																																																																																																																																																																																																																																																																
7200 min Summer	1.409	0.409	46.6	9.4	56.0	2044.6	O K																																																																																																																																																																																																																																																																																																																																																																																																
8640 min Summer	1.376	0.376	45.0	4.6	49.5	1881.3	O K																																																																																																																																																																																																																																																																																																																																																																																																
10080 min Summer	1.347	0.347	43.2	1.0	44.1	1735.0	O K																																																																																																																																																																																																																																																																																																																																																																																																
15 min Winter	1.540	0.540	49.6	56.2	105.8	2700.4	O K																																																																																																																																																																																																																																																																																																																																																																																																
30 min Winter	1.620	0.620	49.8	102.5	152.3	3097.8	O K																																																																																																																																																																																																																																																																																																																																																																																																
60 min Winter	1.693	0.693	49.8	159.3	208.7	3466.7	O K																																																																																																																																																																																																																																																																																																																																																																																																
120 min Winter	1.743	0.743	49.8	190.6	239.9	3716.6	O K																																																																																																																																																																																																																																																																																																																																																																																																
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)																																																																																																																																																																																																																																																																																																																																																																																																		
15 min Summer	174.944	0.0	2138.6	150.2	30																																																																																																																																																																																																																																																																																																																																																																																																		
30 min Summer	102.405	0.0	2534.3	360.5	43																																																																																																																																																																																																																																																																																																																																																																																																		
60 min Summer	59.944	0.0	3267.1	675.0	68																																																																																																																																																																																																																																																																																																																																																																																																		
120 min Summer	35.089	0.0	3841.4	1090.5	120																																																																																																																																																																																																																																																																																																																																																																																																		
180 min Summer	25.652	0.0	4221.0	1365.2	146																																																																																																																																																																																																																																																																																																																																																																																																		
240 min Summer	20.540	0.0	4511.5	1567.0	178																																																																																																																																																																																																																																																																																																																																																																																																		
360 min Summer	15.016	0.0	4952.6	1847.1	244																																																																																																																																																																																																																																																																																																																																																																																																		
480 min Summer	12.023	0.0	5288.5	2029.8	312																																																																																																																																																																																																																																																																																																																																																																																																		
600 min Summer	10.119	0.0	5562.1	2154.4	378																																																																																																																																																																																																																																																																																																																																																																																																		
720 min Summer	8.790	0.0	5793.6	2237.7	444																																																																																																																																																																																																																																																																																																																																																																																																		
960 min Summer	6.896	0.0	6042.9	2214.2	576																																																																																																																																																																																																																																																																																																																																																																																																		
1440 min Summer	4.898	0.0	6379.1	2048.0	836																																																																																																																																																																																																																																																																																																																																																																																																		
2160 min Summer	3.479	0.0	7027.7	1734.5	1224																																																																																																																																																																																																																																																																																																																																																																																																		
2880 min Summer	2.729	0.0	7336.0	1449.7	1600																																																																																																																																																																																																																																																																																																																																																																																																		
4320 min Summer	1.940	0.0	7747.0	964.4	2380																																																																																																																																																																																																																																																																																																																																																																																																		
5760 min Summer	1.522	0.0	8252.8	585.1	3128																																																																																																																																																																																																																																																																																																																																																																																																		
7200 min Summer	1.261	0.0	8536.9	309.4	3896																																																																																																																																																																																																																																																																																																																																																																																																		
8640 min Summer	1.082	0.0	8763.8	124.7	4672																																																																																																																																																																																																																																																																																																																																																																																																		
10080 min Summer	0.950	0.0	8927.3	22.1	5448																																																																																																																																																																																																																																																																																																																																																																																																		
15 min Winter	174.944	0.0	2418.3	293.3	29																																																																																																																																																																																																																																																																																																																																																																																																		
30 min Winter	102.405	0.0	2867.0	585.3	42																																																																																																																																																																																																																																																																																																																																																																																																		
60 min Winter	59.944	0.0	3672.7	990.3	66																																																																																																																																																																																																																																																																																																																																																																																																		
120 min Winter	35.089	0.0	4316.8	1482.1	118																																																																																																																																																																																																																																																																																																																																																																																																		
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**Micro
Drainage®**

Designed by hmontgomery
Checked by

Source Control 2013.1.1

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
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180 min Winter	1.757	0.757	49.8	199.4	248.6	3787.0	O K
240 min Winter	1.765	0.765	49.8	204.1	253.3	3822.7	O K
360 min Winter	1.762	0.762	49.8	202.5	251.7	3812.5	O K
480 min Winter	1.751	0.751	49.8	195.3	244.5	3754.8	O K
600 min Winter	1.736	0.736	49.8	186.2	235.5	3681.3	O K
720 min Winter	1.721	0.721	49.8	176.5	225.8	3604.4	O K
960 min Winter	1.683	0.683	49.8	153.0	202.5	3415.8	O K
1440 min Winter	1.631	0.631	49.8	112.1	161.8	3156.8	O K
2160 min Winter	1.574	0.574	49.8	72.4	122.2	2868.4	O K
2880 min Winter	1.530	0.530	49.6	51.1	100.7	2647.5	O K
4320 min Winter	1.466	0.466	48.5	25.2	73.8	2328.4	O K
5760 min Winter	1.417	0.417	46.9	11.2	58.2	2083.4	O K
7200 min Winter	1.373	0.373	44.8	4.0	48.8	1863.0	O K
8640 min Winter	1.331	0.331	42.0	0.3	42.2	1656.1	O K
10080 min Winter	1.294	0.294	38.4	0.0	38.4	1472.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
180 min Winter	25.652	0.0	4742.6	1801.2	148
240 min Winter	20.540	0.0	5068.5	2036.0	184
360 min Winter	15.016	0.0	5563.6	2366.3	258
480 min Winter	12.023	0.0	5940.8	2582.7	330
600 min Winter	10.119	0.0	6248.2	2727.7	400
720 min Winter	8.790	0.0	6508.6	2827.0	468
960 min Winter	6.896	0.0	6789.9	2802.4	600
1440 min Winter	4.898	0.0	7170.7	2596.6	866
2160 min Winter	3.479	0.0	7878.4	2168.0	1268
2880 min Winter	2.729	0.0	8224.8	1749.8	1652
4320 min Winter	1.940	0.0	8691.1	1033.0	2460
5760 min Winter	1.522	0.0	9246.8	492.0	3240
7200 min Winter	1.261	0.0	9566.6	146.3	4040
8640 min Winter	1.082	0.0	9824.2	6.4	4840
10080 min Winter	0.950	0.0	10016.6	0.0	5552

Burrator House
Peninsula Park
Exeter, EX2 7NT

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Date 31/01/2014 14:59
File 140124 HM Subcat...
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Checked by



Micro Drainage

Source Control 2013.1.1

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 484150 232000 SP 84150 32000
C (1km)	-0.026
D1 (1km)	0.347
D2 (1km)	0.276
D3 (1km)	0.277
E (1km)	0.310
F (1km)	2.405
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 7.560

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0	4 1.890	4	8 1.890	8	12 1.890	12	16 1.890

Date	31/01/2014	14:59
File	140124	HM Subcat...

Designed by hmontgomery
Checked by



Source Control 2013.1.1

Storage is Online Cover Level (m) 3.000

Invert Level (m) 1.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5000.0	0.700	5000.0	1.400	5000.0	2.100	5000.0
0.100	5000.0	0.800	5000.0	1.500	5000.0	2.200	5000.0
0.200	5000.0	0.900	5000.0	1.600	5000.0	2.300	5000.0
0.300	5000.0	1.000	5000.0	1.700	5000.0	2.400	5000.0
0.400	5000.0	1.100	5000.0	1.800	5000.0	2.500	5000.0
0.500	5000.0	1.200	5000.0	1.900	5000.0		
0.600	5000.0	1.300	5000.0	2.000	5000.0		

Design Head (m)	1.000	Hydro-Brake® Type	Md5 SW Only	Invert Level (m)	1.000
Design Flow (l/s)	50.0	Diameter (mm)	275		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.9	1.200	51.9	3.000	78.8	7.000	120.4
0.200	25.6	1.400	54.8	3.500	85.2	7.500	124.6
0.300	39.0	1.600	58.0	4.000	91.0	8.000	128.7
0.400	46.2	1.800	61.3	4.500	96.6	8.500	132.7
0.500	49.2	2.000	64.5	5.000	101.8	9.000	136.5
0.600	49.8	2.200	67.6	5.500	106.7	9.500	140.3
0.800	49.1	2.400	70.5	6.000	111.5		
1.000	49.7	2.600	73.4	6.500	116.0		

Diameter (m) 0.600 Discharge Coefficient 0.600 Invert Level (m) 1.320

Pell Frischmann Consultants Ltd						Page 1	
Burrator House Peninsula Park Exeter, EX2 7NT							
Date 31/01/2014 15:06 File 140124 HM Total ...			Designed by hmontgomery Checked by				
Micro Drainage			Source Control 2013.1.1				
<u>Summary of Results for 100 year Return Period (+30%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.547	0.547	112.1	0.0	112.1	5472.8	O K
30 min Summer	1.636	0.636	120.0	0.0	120.0	6358.6	O K
60 min Summer	1.735	0.735	121.1	0.0	121.1	7350.9	O K
120 min Summer	1.831	0.831	121.1	90.4	205.4	8313.4	O K
180 min Summer	1.862	0.862	121.1	167.1	280.0	8622.2	O K
240 min Summer	1.870	0.870	121.1	189.3	301.7	8704.3	O K
360 min Summer	1.884	0.884	121.1	230.3	341.7	8843.4	O K
480 min Summer	1.893	0.893	121.1	258.0	368.9	8932.5	O K
600 min Summer	1.897	0.897	121.1	270.7	381.3	8974.2	O K
720 min Summer	1.899	0.899	121.1	275.5	386.0	8985.1	O K
960 min Summer	1.888	0.888	121.1	241.0	352.2	8879.0	O K
1440 min Summer	1.867	0.867	121.1	180.9	293.5	8671.0	O K
2160 min Summer	1.840	0.840	121.1	109.9	224.3	8399.4	O K
2880 min Summer	1.815	0.815	121.1	57.4	173.5	8152.7	O K
4320 min Summer	1.733	0.733	121.1	0.0	121.1	7325.9	O K
5760 min Summer	1.637	0.637	120.0	0.0	120.0	6367.0	O K
7200 min Summer	1.569	0.569	114.9	0.0	114.9	5691.7	O K
8640 min Summer	1.520	0.520	107.7	0.0	107.7	5203.8	O K
10080 min Summer	1.483	0.483	100.4	0.0	100.4	4830.3	O K
15 min Winter	1.613	0.613	118.7	0.0	118.7	6130.8	O K
30 min Winter	1.713	0.713	121.1	0.0	121.1	7133.7	O K
60 min Winter	1.822	0.822	121.1	70.2	185.8	8219.5	O K
120 min Winter	1.902	0.902	121.1	286.8	397.1	9020.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)		
15 min Summer	174.944	0.0	3999.2	0.0	34		
30 min Summer	102.405	0.0	4824.6	0.0	48		
60 min Summer	59.944	0.0	6635.1	0.0	76		
120 min Summer	35.089	0.0	7883.3	255.2	130		
180 min Summer	25.652	0.0	8720.0	760.8	182		
240 min Summer	20.540	0.0	9360.8	1182.0	212		
360 min Summer	15.016	0.0	10329.7	1781.9	264		
480 min Summer	12.023	0.0	11061.1	2158.6	328		
600 min Summer	10.119	0.0	11650.2	2390.6	394		
720 min Summer	8.790	0.0	12142.4	2523.2	460		
960 min Summer	6.896	0.0	12639.7	2350.8	596		
1440 min Summer	4.898	0.0	13263.3	1951.3	868		
2160 min Summer	3.479	0.0	15202.5	1321.8	1280		
2880 min Summer	2.729	0.0	15845.1	685.0	1708		
4320 min Summer	1.940	0.0	16638.1	0.0	2564		
5760 min Summer	1.522	0.0	18150.1	0.0	3288		
7200 min Summer	1.261	0.0	18736.4	0.0	3976		
8640 min Summer	1.082	0.0	19173.0	0.0	4680		
10080 min Summer	0.950	0.0	19435.8	0.0	5440		
15 min Winter	174.944	0.0	4585.8	0.0	34		
30 min Winter	102.405	0.0	5496.9	0.0	48		
60 min Winter	59.944	0.0	7518.1	144.5	74		
120 min Winter	35.089	0.0	8944.2	1069.9	124		
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m ³)	Status
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180 min	Winter	1.920	0.920	121.1	347.3	456.4	9204.6	O	K
240 min	Winter	1.933	0.933	121.1	391.5	499.9	9326.3	O	K
360 min	Winter	1.943	0.943	121.1	428.2	535.9	9427.7	O	K
480 min	Winter	1.942	0.942	121.1	426.3	534.1	9422.7	O	K
600 min	Winter	1.938	0.938	121.1	409.7	517.8	9377.1	O	K
720 min	Winter	1.932	0.932	121.1	387.9	496.3	9316.8	O	K
960 min	Winter	1.912	0.912	121.1	319.9	429.6	9123.5	O	K
1440 min	Winter	1.882	0.882	121.1	224.3	335.9	8820.7	O	K
2160 min	Winter	1.849	0.849	121.1	131.8	245.6	8488.9	O	K
2880 min	Winter	1.822	0.822	121.1	70.2	185.8	8217.0	O	K
4320 min	Winter	1.715	0.715	121.1	0.0	121.1	7149.8	O	K
5760 min	Winter	1.591	0.591	117.1	0.0	117.1	5911.2	O	K
7200 min	Winter	1.516	0.516	106.9	0.0	106.9	5155.9	O	K
8640 min	Winter	1.465	0.465	96.3	0.0	96.3	4650.2	O	K
10080 min	Winter	1.428	0.428	86.9	0.0	86.9	4282.7	O	K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Overflow Volume (m ³)	Time-Peak (mins)
180 min Winter	25.652	0.0	9889.8	1779.2	164
240 min Winter	20.540	0.0	10612.2	2306.8	192
360 min Winter	15.016	0.0	11703.9	3031.5	264
480 min Winter	12.023	0.0	12529.0	3485.9	334
600 min Winter	10.119	0.0	13194.8	3771.9	404
720 min Winter	8.790	0.0	13752.4	3941.9	472
960 min Winter	6.896	0.0	14320.2	3755.9	612
1440 min Winter	4.898	0.0	15018.4	3130.2	888
2160 min Winter	3.479	0.0	17106.1	2161.3	1316
2880 min Winter	2.729	0.0	17828.7	1159.7	1768
4320 min Winter	1.940	0.0	18744.1	0.0	2724
5760 min Winter	1.522	0.0	20383.6	0.0	3408
7200 min Winter	1.261	0.0	21050.2	0.0	4112
8640 min Winter	1.082	0.0	21555.2	0.0	4776
10080 min Winter	0.950	0.0	21880.1	0.0	5544

Pell Frischmann Consultants Ltd		Page 3																																																								
Burrator House Peninsula Park Exeter, EX2 7NT																																																										
Date 31/01/2014 15:06 File 140124 HM Total ...	Designed by hmontgomery Checked by																																																									
Micro Drainage		Source Control 2013.1.1																																																								
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Site Location</td> <td>GB 484150 232000 SP 84150 32000</td> </tr> <tr> <td>C (1km)</td> <td>-0.026</td> </tr> <tr> <td>D1 (1km)</td> <td>0.347</td> </tr> <tr> <td>D2 (1km)</td> <td>0.276</td> </tr> <tr> <td>D3 (1km)</td> <td>0.277</td> </tr> <tr> <td>E (1km)</td> <td>0.310</td> </tr> <tr> <td>F (1km)</td> <td>2.405</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 17.000 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> <th>From:</th> <th>To:</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4 3.400</td> <td>8</td> <td>12 3.400</td> <td>16</td> <td>20 3.400</td> </tr> <tr> <td>4</td> <td>8 3.400</td> <td>12</td> <td>16 3.400</td> <td></td> <td></td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	Site Location	GB 484150 232000 SP 84150 32000	C (1km)	-0.026	D1 (1km)	0.347	D2 (1km)	0.276	D3 (1km)	0.277	E (1km)	0.310	F (1km)	2.405	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+30	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From:	To:	From:	To:	From:	To:	0	4 3.400	8	12 3.400	16	20 3.400	4	8 3.400	12	16 3.400		
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Storage is Online Cover Level (m) 3.000

Invert Level (m) 1.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	10000.0	0.700	10000.0	1.400	10000.0	2.100	10000.0
0.100	10000.0	0.800	10000.0	1.500	10000.0	2.200	10000.0
0.200	10000.0	0.900	10000.0	1.600	10000.0	2.300	10000.0
0.300	10000.0	1.000	10000.0	1.700	10000.0	2.400	10000.0
0.400	10000.0	1.100	10000.0	1.800	10000.0	2.500	10000.0
0.500	10000.0	1.200	10000.0	1.900	10000.0		
0.600	10000.0	1.300	10000.0	2.000	10000.0		

Design Head (m)	1.000	Hydro-Brake® Type	Md4	Invert Level (m)	1.000
Design Flow (l/s)	105.0	Diameter (mm)	326		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	1.200	99.9	3.000	143.4	7.000	219.1
0.200	22.7	1.400	101.5	3.500	154.9	7.500	226.8
0.300	49.7	1.600	106.1	4.000	165.6	8.000	234.2
0.400	79.2	1.800	111.6	4.500	175.7	8.500	241.5
0.500	103.9	2.000	117.3	5.000	185.2	9.000	248.5
0.600	117.8	2.200	122.9	5.500	194.2	9.500	255.3
0.800	117.0	2.400	128.3	6.000	202.9		
1.000	104.7	2.600	133.5	6.500	211.1		

Discharge Coef 0.544 Width (m) 3.500 Invert Level (m) 1.770

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Burrator House Peninsula Park Exeter, EX2 7NT								
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Micro Drainage			Source Control 2013.1.1					
<u>Summary of Results for 100 year Return Period (+30%)</u>								
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer		2.014	1.014	43.8	0.0	43.8	3042.5	O K
30 min Summer		2.182	1.182	45.7	0.0	45.7	3545.1	O K
60 min Summer		2.363	1.363	48.2	19.4	67.7	4090.0	O K
120 min Summer		2.519	1.519	50.5	75.0	125.5	4557.8	O K
180 min Summer		2.575	1.575	51.4	98.6	149.9	4724.1	O K
240 min Summer		2.591	1.591	51.6	106.0	157.6	4771.7	O K
360 min Summer		2.614	1.614	51.9	116.8	168.8	4841.1	O K
480 min Summer		2.628	1.628	52.2	123.6	175.8	4882.9	O K
600 min Summer		2.633	1.633	52.2	126.1	178.3	4898.4	O K
720 min Summer		2.633	1.633	52.2	126.1	178.3	4897.6	O K
960 min Summer		2.603	1.603	51.8	111.6	163.4	4807.8	O K
1440 min Summer		2.546	1.546	50.9	85.0	136.0	4637.0	O K
2160 min Summer		2.472	1.472	49.8	58.8	108.6	4414.5	O K
2880 min Summer		2.417	1.417	49.0	36.0	85.0	4252.3	O K
4320 min Summer		2.307	1.307	47.4	7.3	54.7	3922.0	O K
5760 min Summer		2.147	1.147	45.3	0.0	45.3	3440.9	O K
7200 min Summer		1.986	0.986	43.6	0.0	43.6	2958.7	O K
8640 min Summer		1.841	0.841	43.3	0.0	43.3	2521.8	O K
10080 min Summer		1.710	0.710	43.3	0.0	43.3	2131.1	O K
15 min Winter		2.138	1.138	45.1	0.0	45.1	3412.8	O K
30 min Winter		2.324	1.324	47.7	10.5	58.1	3973.3	O K
60 min Winter		2.513	1.513	50.4	73.0	123.4	4539.6	O K
120 min Winter		2.668	1.668	52.7	143.0	195.8	5003.1	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)		
15 min Summer		174.944	0.0	2832.9	0.0	30		
30 min Summer		102.405	0.0	3236.3	0.0	45		
60 min Summer		59.944	0.0	4169.3	63.9	74		
120 min Summer		35.089	0.0	4883.8	417.8	128		
180 min Summer		25.652	0.0	5357.2	708.3	182		
240 min Summer		20.540	0.0	5719.8	934.1	216		
360 min Summer		15.016	0.0	6270.1	1257.0	272		
480 min Summer		12.023	0.0	6688.3	1472.0	336		
600 min Summer		10.119	0.0	7027.6	1619.6	402		
720 min Summer		8.790	0.0	7312.4	1716.4	470		
960 min Summer		6.896	0.0	7605.1	1669.3	610		
1440 min Summer		4.898	0.0	7897.4	1433.3	890		
2160 min Summer		3.479	0.0	8831.0	1032.8	1308		
2880 min Summer		2.729	0.0	9225.9	674.3	1740		
4320 min Summer		1.940	0.0	9775.8	125.5	2644		
5760 min Summer		1.522	0.0	10334.0	0.0	3512		
7200 min Summer		1.261	0.0	10699.5	0.0	4256		
8640 min Summer		1.082	0.0	11001.8	0.0	5016		
10080 min Summer		0.950	0.0	11245.6	0.0	5664		
15 min Winter		174.944	0.0	3126.4	0.0	30		
30 min Winter		102.405	0.0	3524.5	25.8	44		
60 min Winter		59.944	0.0	4673.2	329.5	70		
120 min Winter		35.089	0.0	5476.5	864.0	122		
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Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
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180 min	Winter	2.714	1.714	53.4	165.7	219.2	5143.3	Flood	Risk
240 min	Winter	2.732	1.732	53.7	174.6	228.3	5197.4	Flood	Risk
360 min	Winter	2.757	1.757	54.1	186.6	240.7	5270.9	Flood	Risk
480 min	Winter	2.758	1.758	54.1	187.3	241.4	5275.0	Flood	Risk
600 min	Winter	2.749	1.749	54.0	182.9	236.9	5247.6	Flood	Risk
720 min	Winter	2.735	1.735	53.8	176.0	229.8	5206.2	Flood	Risk
960 min	Winter	2.686	1.686	53.0	151.8	204.8	5056.9		O K
1440 min	Winter	2.606	1.606	51.8	113.3	165.1	4818.1		O K
2160 min	Winter	2.517	1.517	50.5	74.3	124.8	4551.4		O K
2880 min	Winter	2.450	1.450	49.5	51.0	100.4	4350.5		O K
4320 min	Winter	2.343	1.343	47.9	14.2	62.1	4029.2		O K
5760 min	Winter	2.150	1.150	45.3	0.0	45.3	3451.2		O K
7200 min	Winter	1.916	0.916	43.3	0.0	43.3	2748.9		O K
8640 min	Winter	1.702	0.702	43.3	0.0	43.3	2107.2		O K
10080 min	Winter	1.537	0.537	43.3	0.0	43.3	1610.7		O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
180 min	Winter	25.652	0.0	6008.0	1237.1	174
240 min	Winter	20.540	0.0	6415.0	1516.3	198
360 min	Winter	15.016	0.0	7032.7	1912.4	270
480 min	Winter	12.023	0.0	7502.5	2178.2	344
600 min	Winter	10.119	0.0	7883.9	2362.6	416
720 min	Winter	8.790	0.0	8204.6	2491.6	488
960 min	Winter	6.896	0.0	8537.3	2473.6	630
1440 min	Winter	4.898	0.0	8874.5	2234.1	916
2160 min	Winter	3.479	0.0	9893.9	1720.1	1348
2880 min	Winter	2.729	0.0	10335.6	1222.8	1788
4320 min	Winter	1.940	0.0	10936.0	347.9	2768
5760 min	Winter	1.522	0.0	11575.0	0.0	3752
7200 min	Winter	1.261	0.0	11985.4	0.0	4544
8640 min	Winter	1.082	0.0	12325.9	0.0	5200
10080 min	Winter	0.950	0.0	12605.2	0.0	5840

Burrator House
Peninsula Park
Exeter, EX2 7NT

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	GB 484150 232000 SP 84150 32000
C (1km)	-0.026
D1 (1km)	0.347
D2 (1km)	0.276
D3 (1km)	0.277
E (1km)	0.310
F (1km)	2.405
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 9.440

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	2.360	4 8	2.360	8 12	2.360	12 16	2.360

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<u>Model Details</u> Storage is Online Cover Level (m) 3.000 <u>Tank or Pond Structure</u> Invert Level (m) 1.000 <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> </tr> </thead> <tbody> <tr><td>0.000</td><td>3000.0</td><td>0.700</td><td>3000.0</td><td>1.400</td><td>3000.0</td><td>2.100</td><td>3000.0</td></tr> <tr><td>0.100</td><td>3000.0</td><td>0.800</td><td>3000.0</td><td>1.500</td><td>3000.0</td><td>2.200</td><td>3000.0</td></tr> <tr><td>0.200</td><td>3000.0</td><td>0.900</td><td>3000.0</td><td>1.600</td><td>3000.0</td><td>2.300</td><td>3000.0</td></tr> <tr><td>0.300</td><td>3000.0</td><td>1.000</td><td>3000.0</td><td>1.700</td><td>3000.0</td><td>2.400</td><td>3000.0</td></tr> <tr><td>0.400</td><td>3000.0</td><td>1.100</td><td>3000.0</td><td>1.800</td><td>3000.0</td><td>2.500</td><td>3000.0</td></tr> <tr><td>0.500</td><td>3000.0</td><td>1.200</td><td>3000.0</td><td>1.900</td><td>3000.0</td><td></td><td></td></tr> <tr><td>0.600</td><td>3000.0</td><td>1.300</td><td>3000.0</td><td>2.000</td><td>3000.0</td><td></td><td></td></tr> </tbody> </table> <u>Hydro-Brake® Outflow Control</u> Design Head (m) 1.000 Hydro-Brake® Type Md5 SW Only Invert Level (m) 1.000 Design Flow (l/s) 44.0 Diameter (mm) 260 <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Flow (l/s)</th> <th>Depth (m)</th> <th>Flow (l/s)</th> <th>Depth (m)</th> <th>Flow (l/s)</th> <th>Depth (m)</th> <th>Flow (l/s)</th> </tr> </thead> <tbody> <tr><td>0.100</td><td>9.4</td><td>1.200</td><td>45.9</td><td>3.000</td><td>70.5</td><td>7.000</td><td>107.6</td></tr> <tr><td>0.200</td><td>23.8</td><td>1.400</td><td>48.8</td><td>3.500</td><td>76.1</td><td>7.500</td><td>111.4</td></tr> <tr><td>0.300</td><td>35.4</td><td>1.600</td><td>51.7</td><td>4.000</td><td>81.4</td><td>8.000</td><td>115.1</td></tr> <tr><td>0.400</td><td>41.0</td><td>1.800</td><td>54.7</td><td>4.500</td><td>86.3</td><td>8.500</td><td>118.6</td></tr> <tr><td>0.500</td><td>43.1</td><td>2.000</td><td>57.6</td><td>5.000</td><td>91.0</td><td>9.000</td><td>122.1</td></tr> <tr><td>0.600</td><td>43.2</td><td>2.200</td><td>60.4</td><td>5.500</td><td>95.4</td><td>9.500</td><td>125.4</td></tr> <tr><td>0.800</td><td>42.7</td><td>2.400</td><td>63.0</td><td>6.000</td><td>99.7</td><td></td><td></td></tr> <tr><td>1.000</td><td>43.7</td><td>2.600</td><td>65.6</td><td>6.500</td><td>103.7</td><td></td><td></td></tr> </tbody> </table> <u>Orifice Overflow Control</u> Diameter (m) 0.400 Discharge Coefficient 0.600 Invert Level (m) 2.220			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	3000.0	0.700	3000.0	1.400	3000.0	2.100	3000.0	0.100	3000.0	0.800	3000.0	1.500	3000.0	2.200	3000.0	0.200	3000.0	0.900	3000.0	1.600	3000.0	2.300	3000.0	0.300	3000.0	1.000	3000.0	1.700	3000.0	2.400	3000.0	0.400	3000.0	1.100	3000.0	1.800	3000.0	2.500	3000.0	0.500	3000.0	1.200	3000.0	1.900	3000.0			0.600	3000.0	1.300	3000.0	2.000	3000.0			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	9.4	1.200	45.9	3.000	70.5	7.000	107.6	0.200	23.8	1.400	48.8	3.500	76.1	7.500	111.4	0.300	35.4	1.600	51.7	4.000	81.4	8.000	115.1	0.400	41.0	1.800	54.7	4.500	86.3	8.500	118.6	0.500	43.1	2.000	57.6	5.000	91.0	9.000	122.1	0.600	43.2	2.200	60.4	5.500	95.4	9.500	125.4	0.800	42.7	2.400	63.0	6.000	99.7			1.000	43.7	2.600	65.6	6.500	103.7		
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