





CHARLTON STREET

Scale

A3

# Proposed Ground Floor





1103-A





Project Number Drawing Ref

Revision

Scale

Page size



Appendix G – EA Flood mapping





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Appendix H – SFRA Maps





teriCurrent Projects\47070547 Camden SFRA Update (ghost)\0700 WIP\0705 GIS\_Data(01-WIP\01\_03-Project\_File)





Appendix I – Greenfield Runoff Rates



DOCUMENT VERIFICATION RECORD					
Project:	Chalton Street and Churchway, London				
Client:	Rangepay Ltd				
Report Title:	Proposed hotel and residential development – Flood Risk Assessment & Drainage Strategy				
Date:	17 <sup>th</sup> January 2019				

DOCUMENT REVIEW & APPROVAL				
Author:	Sally Pettit BSc			
Checker:	Aled Williams BSc (Hons) MCIWEM			
Approver:	Victoria Griffin BSc (Hons) MSc CEnv MIEnvSc			

Return Period (Years)	As-rural Peak Flow (I/s)
1	7.48E-02
2	8.83E-02
5	1.34E-01
10	1.68E-01
30	2.31E-01
50	2.68E-01
75	3.04E-01
100	3.33E-01
200	4.13E-01
1000	6.17E-01

\*Runoff Rates printed from the ReFH Flood Modelling software package



Appendix J – MicroDrainage Storage Volumes



Waterco Ltd			Page 1
Eden Court	w10253		(r.
Lon Parcwr Business Park	70 Churchway		No.
Denbighshire I.I.15 1NJ	1 in 100 vear	+40%CC	11
$D_{a+a} = 23/01/2019$	Designed by S	.TD	MICIO
Date 23/01/2013	Charled by 5	01	Urainage
File /o churchway i in 100 y	Checked by Aw		
XP Solutions	Source Contro	1 2018.1	
		turn Deviad (140%)	
<u>Summary of Results ic</u>	or 100 year Re	<u>turn Period (+40%)</u>	
Storm Max	May May	May Status	
Event Level	L Depth Control	Volume	
(m)	(m) (1/s)	(m³)	
15 min Ourman 0.044	0.042 0.7		
30 min Summer 9.943	3 0.043 0.7 3 0.048 0.8	1.7 Flood Risk	
60 min Summer 9.940	0.051 0.8	2.0 Flood Risk	
120 min Summer 9.95	2 0.052 0.8	2.1 Flood Risk	
180 min Summer 9.950	0.050 0.8	2.0 Flood Risk	
240 min Summer 9.94	7 0.047 0.8	1.9 Flood Risk	
360 min Summer 9.942	2 0.042 0.7	1.7 Flood Risk	
480 min Summer 9.93	7 0.037 0.6	1.5 Flood Risk	
600 min Summer 9.934	4 0.034 0.5	1.4 Flood Risk	
720 min Summer 9.931	L 0.031 0.4	1.3 Flood Risk	
960 min Summer 9.92	7 0.027 0.4	1.1 Flood Risk	
1440 min Summer 9.922	2 0.022 0.3	0.9 Flood Risk	
2160 min Summer 9.918	3 0.018 0.2	0.7 Flood Risk	
2880 min Summer 9.915	0.012 0.1	U.6 Flood Risk	
4320 min Summer 9.912	0.012 $0.1$	0.5 Flood Risk	
	0.010 0.1	0.1 11000 KIDK	
Storm Ra	in Flooded Dis	scharge Time-Peak	
Event (mm/	hr) Volume V	olume (mins)	
	(m³)	(m <sup>3</sup> )	
15 min Summer 179	.200 0.0	2.0 15	
30 min Summer 115.	.272 0.0	2.6 23	
60 min Summer 70.	.337 0.0	3.1 40	
120 min Summer 45.	.133 0.0	4.0 74	
180 min Summer 34.	.200 0.0	4.6 106	
240 min Summer 27.	.801 0.0	5.0 138	
360 min Summer 20.	.401 0.0	5.5 200	
480 min Summer 16.	.173 0.0	5.8 260	
600 min Summer 13. 720 min Summer 11	.420 U.U	6.0 320	
960 min Summer 8	.943 0.0	6.4 502	
1440 min Summer 6.	.240 0.0	6.7 748	
2160 min Summer 4.	.326 0.0	7.0 1104	
2880 min Summer 3.	.336 0.0	7.2 1472	
4320 min Summer 2.	.322 0.0	7.5 2204	
5760 min Summer 1.	.805 0.0	7.8 2912	
<u></u>	2_2018 Tana	70	
0198	2 2010 THUOVÀ2	20	

Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ W10253 70 Churchway 1 in 100 year+40%CC	
Lon Parcwr Business Park 70 Churchway Denbighshire LL15 1NJ 1 in 100 year+40%CC Micro	
Denbighshire LL15 1NJ 1 in 100 year+40%CC	
Date 22/01/2010 Designed by STP	
Date 23/01/2019 Designed by SSP	6
File /U Churchway I in IOU y Checked by AW	
XP Solutions Source Control 2018.1	
<u>Summary of Results for 100 year Return Period (+40%)</u>	
Storm Max Max Max Max Status	
$(m)$ $(m)$ $(1/s)$ $(m^3)$	
7200 min Summer 9.908 0.008 0.1 0.3 Flood Risk	
8640 min Summer 9.907 0.007 0.1 0.3 Flood Risk	
10080 min Summer 9.907 0.007 0.1 0.3 Flood Risk	
15 min Winter 9.948 U.U48 U.8 1.9 Flood Risk	
50 Min Winter 9.954 0.054 0.9 2.2 Flood Risk	
120 min Winter 9.954 0.054 0.9 2.2 Flood Risk	
180 min Winter 9.950 0.050 0.8 2.0 Flood Risk	
240 min Winter 9.946 0.046 0.7 1.8 Flood Risk	
360 min Winter 9.939 0.039 0.6 1.6 Flood Risk	
480 min Winter 9.934 0.034 0.5 1.4 Flood Risk	
600 min Winter 9.930 0.030 0.4 1.2 Flood Risk	
720 min Winter 9.928 0.028 0.4 1.1 Flood Risk	
960 min Winter 9.924 0.024 0.3 0.9 Flood Risk	
1440 min Winter 9.919 0.019 0.2 0.7 Flood Risk	
2160 min Winter 9.915 0.015 0.2 0.6 Flood Risk	
Storm Rain Flooded Discharge Time-Peak	
Event (mm/hr) Volume Volume (mins)	
(m <sup>3</sup> ) (m <sup>3</sup> )	
7200 min Summer 1.494 0.0 8.0 3672	
8640 min Summer 1.285 0.0 8.3 4408	
10080 min Summer 1.137 0.0 8.6 5088	
30 min Winter 115,272 0.0 2.9 24	
60 min Winter 70.337 0.0 3.5 44	
120 min Winter 45.133 0.0 4.5 78	
180 min Winter 34.200 0.0 5.2 112	
240 min Winter 27.801 0.0 5.6 144	
360 min Winter 20.401 0.0 6.1 206	
480 min Winter 16.173 0.0 6.5 266	
600 min Winter 13.426 0.0 6.7 330	
/20 min Winter 11.494 0.0 6.9 390	
960 min Winter 8.943 0.0 7.2 510	
2160 min Winter 4.326 0.0 7.8 1116	
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								Page 3
Eden Court w10253								ſc.
Lon Parcwr Business I	7	0 Chui	rchway				No.	
Denbighshire LL15 11	IJ	1	in 10	)0 year-	+40%CC			Micro
Date 23/01/2019		D	esigne	ed by St	JP			Drainago
File 70 Churchway 1	n 100 y	· C	Checked	d by AW				Drainiage
XP Solutions		S	Source	Contro	L 2018.	1		
Sto	rm	Мах	Max	Max	Max	Stat	tus	
Eve	nt	Level	Depth	Control	Volume			
Eve	nt	Level (m)	Depth (m)	Control (1/s)	Volume (m³)			
<b>Ev</b> e 2880 mi	n <b>t</b> n Winter	Level (m) 9.912	Depth (m) 0.012	Control (1/s) 0.1	Volume (m <sup>3</sup> ) 0.5	Flood	Risk	
<b>Ev</b> e 2880 mi 4320 mi	nt N Winter N Winter	Level (m) 9.912 9.909	Depth (m) 0.012 0.009	Control (1/s) 0.1 0.1	Volume (m <sup>3</sup> ) 0.5 0.4	Flood Flood	Risk Risk	
2880 mi 4320 mi 5760 mi	nt n Winter n Winter n Winter	Level (m) 9.912 9.909 9.907	Depth (m) 0.012 0.009 0.007	Control (1/s) 0.1 0.1 0.1	Volume (m <sup>3</sup> ) 0.5 0.4 0.3	Flood Flood Flood	Risk Risk Risk	
Eve 2880 mi 4320 mi 5760 mi 7200 mi	nt n Winter n Winter n Winter n Winter	Level (m) 9.912 9.909 9.907 9.906	Depth (m) 0.012 0.009 0.007 0.006	Control (1/s) 0.1 0.1 0.1 0.1	Volume (m <sup>3</sup> ) 0.5 0.4 0.3 0.2	Flood Flood Flood Flood	Risk Risk Risk Risk	
Eve 2880 mi 4320 mi 5760 mi 7200 mi 8640 mi	nt N Winter N Winter N Winter N Winter	Level (m) 9.912 9.909 9.907 9.906 9.906	Depth (m) 0.012 0.009 0.007 0.006 0.006	Control (1/s) 0.1 0.1 0.1 0.1 0.0	Volume (m <sup>3</sup> ) 0.5 0.4 0.3 0.2 0.2	Flood Flood Flood Flood Flood	Risk Risk Risk Risk Risk	
Eve 2880 mi 4320 mi 5760 mi 7200 mi 8640 mi 10080 mi	nt N Winter N Winter N Winter N Winter N Winter	Level (m) 9.912 9.909 9.907 9.906 9.906 9.905	Depth (m) 0.012 0.009 0.007 0.006 0.006 0.005	Control (1/s) 0.1 0.1 0.1 0.0 0.0	Volume (m <sup>3</sup> ) 0.5 0.4 0.3 0.2 0.2 0.2	Flood Flood Flood Flood Flood Flood	Risk Risk Risk Risk Risk Risk	

Storm		Rain	Flooded	Discharge	Time-Peak	
Event		(mm/hr)	Volume	Volume	(mins)	
				(m³)	(m³)	
2880	min	Winter	3.336	0.0	8.1	1468
4320	min	Winter	2.322	0.0	8.4	2180
5760	min	Winter	1.805	0.0	8.7	3000
7200	min	Winter	1.494	0.0	9.0	3672
8640	min	Winter	1.285	0.0	9.3	4472
10080	min	Winter	1.137	0.0	9.6	5144

Waterco Ltd		Page 4
Eden Court	w10253	in a start s
Lon Parcwr Business Park	70 Churchway	No.
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Micro
Date 23/01/2019	Designed by SJP	Drainago
File 70 Churchway 1 in 100 y	Checked by AW	Diamage
XP Solutions	Source Control 2018.1	

## <u>Rainfall Details</u>

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 529783 182863	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

<u>Time Area Diagram</u>

Total Area (ha) 0.006

Time	(mins)	Area
From:	То:	(ha)

0 1 0.006

Waterco Ltd							H	Page 5	5
Eden Court	w10253	3					0	0	
Lon Parcwr Business Park	70 Chu	ırchwa	У					4	
Denbighshire LL15 1NJ	1 in 1	LOO ye	ar+	40%CC	2		8	Mirro	( John
Date 23/01/2019	Desigr	ned by	SJ	P				Deain	J
File 70 Churchway 1 in 100 y	Checke	ed by	AW					UIdii	lage
XP Solutions	Source	e Cont	rol	2018	.1				
Ma	odel D	etails	<u>5</u>						
Storage is Onl	ine Cov	ver Lev	rel	(m) 10	0.000				
Tank c	or Pond	d Stru	ictu	<u>ire</u>					
Inver	t Level	L (m) 9	9.90	0					
Depth (m) Area	(m²)	Depth	(m)	Area	(m²)				
0.000	40.0	0.	100		40.0				
<u>Hydro-Brake®</u>	<u>Optimu</u>	um Out	flc	ow Cor	<u>ntrol</u>				
Unit	Referer	nce MD-	SHE	-0059-	-1000-0	0100-10	00		
Design	Head	(m)				0.1	00		
Design F	low (l/	/s)			~	1	.0		
E.	lusn-Fl Objecti	LOM ivo Mi	nim	i so ur	Ca	alculat	ea ao		
An	plicati	ion	. 11 ⊥ 111	rse uł	JSLIEAI	Surfa	ye ce		
Sump	Availak	ole				Y	es		
Diam	eter (m	nm)					59		
Invert	Level	(m)				9.8	95		
Minimum Outlet Pipe Diam	eter (n	nm)					75		
Suggested Manhole Diam	eter (n	nm)				12	00		
Control Poi	nts	Hea	d (n	n) Flo	w (l/s	)			
Design Point (Cal	culate	d)	0.10	0 0	1.	0			
FI	ush-Fl	OTM	0.07	74	1.	0			
F	lick-Fl	o®	0.09	94	1.	0			
Mean Flow over He	ad Ran	ge		-	0.	6			
The hydrological calculations have	been b	based o	n tì	he Hea	d/Disc	harge 1	rela	tions	hip
for the Hydro-Brake® Optimum as sp	ecified	l. Sho	uld	anoth	er typ	e of co	ontr	col de	vice
other than a Hydro-Brake Optimum® 1	be util	ised t	hen	these	stora	ige rout	ting	J	
calculations will be invalidated									
Depth (m) Flow (l/s) Depth (m) Flow	(l/s)	Depth	(m)	Flow	(l/s)	Depth	(m)	Flow	(1/s)
0.100 1.0 0.600	2.2	1.	600		3.5	2.	600		4.5
0.200 1.4 0.800	2.6	1.	800		3.8	3.	000		4.9
0.300 1.6 1.000	2.8	2.	000		4.0	3.	500		5.3
0.400 1.9 1.200	3.1	2.	200		4.2	4.	000		5.6
0.500 2.1 1.400	3.3	2.	400		4.4	4.	500		6.0
©1982-2018 Innovyze									

Waterco Ltd		
Eden Court	w10253	6
Lon Parcwr Business Park	70 Churchway	No.
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Micro
Date 23/01/2019	Designed by SJP	Drainage
File 70 Churchway 1 in 100 y	Checked by AW	Dianage
XP Solutions	Source Control 2018.1	

### <u>Hydro-Brake® Optimum Outflow Control</u>

Depth (m)	Flow (l/s)						
5.000	6.3	6.500	7.2	8.000	8.0	9.500	8.7
5.500	6.6	7.000	7.5	8.500	8.2		
6.000	6.9	7.500	7.7	9.000	8.5		







Waterco Ltd						Page 1
Eden Court	W	10253				6
Lon Parcwr Business Park	60	) Chur	chway			
Denbighshire LL15 1NJ	1	in 10	0 yea:	r plus	40% CC	Micco
Date 22/01/2019	De	esiane	ed by s	- SJP		
File 60 Churchway-1 in 100 y		necker	hv A	002 M		Drainage
VP Solutions			Contro	2018	1	
		Juice	CONCIN	51 2010	• ±	
Summary of Result	s for	100 5	vear R	eturn P	eriod (+40%)	
<u>Ballandi y</u> Or Robart	20 101	<u> </u>	<u>your n</u>	<u>ocurn r</u>	<u>erroa (+100)</u>	
Storm	Max	Max	Max	Max	Status	
Event	Level	Depth	Control	l Volume		
	(m)	(m)	(l/s)	(m³)		
15 min Summer	9,954	0.054	0.0	9 3.0	Flood Bisk	
30 min Summer	9.962	0.062	1.0	) 3.4	Flood Risk	
60 min Summer	9.966	0.066	1.0	3.7	Flood Risk	
120 min Summer	9.972	0.072	1.0	3.9	Flood Risk	
180 min Summer	9.970	0.070	1.0	3.9	Flood Risk	
240 min Summer	9.967	0.067	1.0	J 3.7	Flood Risk	
480 min Summer	9.959 9 953	0.059	0.9	y 3.3 2 2 0	Flood Risk	
600 min Summer	9.948	0.048	0.8	3 2.9	Flood Risk	
720 min Summer	9.944	0.044	0.	7 2.4	Flood Risk	
960 min Summer	9.938	0.038	0.0	6 2.1	Flood Risk	
1440 min Summer	9.931	0.031	0.4	4 1.7	Flood Risk	
2160 min Summer	9.925	0.025	0.3	3 1.4	Flood Risk	
2880 min Summer	9.921	0.021	0.2		Flood Risk	
4320 min Summer 5760 min Summer	9.91/ 9.91/	0.017	0.2	2 0.9	Flood Risk	
7200 min Summer	9.912	0.012	0.1	1 0.7	Flood Risk	
8640 min Summer	9.911	0.011	0.1	1 0.6	Flood Risk	
10080 min Summer	9.910	0.010	0.2	1 0.6	Flood Risk	
15 min Winter	9.960	0.060	1.0	3.3	Flood Risk	
30 min Winter	9.971	0.071	1.0	3.9	Flood Risk	
Storm	Rai		oded D	ischarge	Time-Peak	
Event	(mm/l	nr) Vo	lume	Volume	(mins)	
	(, -	(1	m <sup>3</sup> )	(m <sup>3</sup> )	(	
			_			
15 min Summe	r 179.2	200	0.0	3.3	15	
30 min Summe	r 115.2	21Z	0.0	4.3	26	
120 min Summe	r 45.1	L33	0.0	5.2 6.7	78	
180 min Summe	r 34.2	200	0.0	7.7	112	
240 min Summe	r 27.8	301	0.0	8.3	144	
360 min Summe	r 20.4	101	0.0	9.2	206	
480 min Summe	r 16.1	L73	0.0	9.7	266	
600 min Summe	r 13.4	426	0.0	10.0	326	
/20 min Summe 960 min Summe	r 11.4	194 243	0.0	10.3	390 510	
1440 min Summe	r 6.3	240	0.0	11.2	750	
2160 min Summe	r 4.3	326	0.0	11.7	1120	
2880 min Summe	r 3.3	336	0.0	12.0	1476	
4320 min Summe	r 2.3	322	0.0	12.5	2204	
5760 min Summe	r 1.8	305	0.0	13.0	2936	
7200 min Summe	r 1.4	194	0.0	13.4	3672	
0640 min Summe 10080 min Summe	r 1.2 r 1.1	200 137	0.0	13.8 14 २	4384 5112	
15 min Winte	r 179.2	200	0.0	11.3 3.7	15	
30 min Winte	r 115.2	272	0.0	4.8	29	
	©1982-	2018	Innovy	/ze		

Waterco Ltd					Page 2
Eden Court	w10253	3			6
Lon Parcwr Business Park	60 Chu	urchway			
Denbighshire LL15 1NJ	1 in 1	.00 year	plus	40% CC	Micco
Date 22/01/2019	Design	ned by S	JP		Desinade
File 60 Churchway-1 in 100 y	Checke	ed by AW	I		Digitigu
XP Solutions	Source	e Contro	1 2018	.1	
<u>Summary of Results f</u>	or 100	<u>year Re</u>	<u>eturn P</u>	eriod (+40%)	-
Storm Ma Event Lev	x Max	Max Control	Max	Status	
(n	ຍາມຍຸມເກ ເ) (m)	(1/s)	(m <sup>3</sup> )		
60 min Winter 9.9		4 1.0 2 1.0	4.1	Flood Risk	
180 min Winter 9.9	73 0.073	3 1.0	4.0	Flood Risk	
240 min Winter 9.9	67 0.067	1.0	3.7	Flood Risk	
360 min Winter 9.9	57 0.057	0.9	3.1	Flood Risk	
480 min Winter 9.9	49 0.049	0.8	2.7	Flood Risk	
600 min Winter 9.9	43 0.043	3 0.7	2.4	Flood Risk	
960 min Winter 9.9	33 0.035	, U.6 3 N.5	2.2 1 8	riood Risk Flood Risk	
1440 min Winter 9.9	26 0.026	5 0.4	1.5	Flood Risk	
2160 min Winter 9.9	21 0.021	0.2	1.1	Flood Risk	
2880 min Winter 9.9	17 0.017	0.2	1.0	Flood Risk	
4320 min Winter 9.9	14 0.014	l 0.1	0.7	Flood Risk	
5760 min Winter 9.9 7200 min Winter 9.9	10 0.011	L U.L	0.6	Flood Risk	
8640 min Winter 9.9	09 0.009	0.1	0.5	Flood Risk	
10080 min Winter 9.9	08 0.008	3 0.1	0.4	Flood Risk	
Storm I Event (m	Rain Fl m/hr) V	Looded Di olume V (m³)	.scharge Volume (m³)	Time-Peak (mins)	
		( <i>)</i>	<b>, ,</b>		
60 min Winter 7	0.337	0.0	5.9	46	
120 Min Winter 4 180 min Winter 3	4.200	0.0	7.0 8.6	120	
240 min Winter 2	7.801	0.0	9.3	152	
360 min Winter 2	0.401	0.0	10.3	214	
480 min Winter 1	6.173	0.0	10.8	276	
600 min Winter 1 720 min Winter 1	.3.426 1 /9/	0.0	11.3 11.6	336	
960 min Winter	8.943	0.0	12.0	520	
1440 min Winter	6.240	0.0	12.6	764	
2160 min Winter	4.326	0.0	13.1	1124	
2880 min Winter	3.336	0.0	13.4	1500	
4320 min Winter 5760 min Winter	2.322 1 805	0.0	14.0 12 5	2212	
7200 min Winter	1.494	0.0	15.0	3568	
8640 min Winter	1.285	0.0	15.5	4392	
10080 min Winter	1.137	0.0	16.0	4896	
©19	82-2018	Tnnovy	7.0		

Waterco Ltd		Page 3
Eden Court	w10253	6
Lon Parcwr Business Park	60 Churchway	No.
Denbighshire LL15 1NJ	1 in 100 year plus 40% CC	Micco
Date 22/01/2019	Designed by SJP	Desinado
File 60 Churchway-1 in 100 y	Checked by AW	Diamaye
XP Solutions	Source Control 2018.1	
Rainfall Model	<u>infall Details</u> FEH Winter Storms Y	es
FEH Rainfall Version Site Location GB 5 Data Type Summer Storms	2013 Cv (Summer) 0.7 2013 Cv (Winter) 0.8 29783 182863 Shortest Storm (mins) Point Longest Storm (mins) 100 Yes Climate Change % +	40 15 80 40
Tin	<u>ne Area Diagram</u>	
Tota	al Area (ha) 0.010	
Ti Fr	ime (mins) Area com: To: (ha)	
	0 1 0.010	

Waterco Ltd		Page 4							
Eden Court	w10253	(c							
Lon Parcwr Business Park	60 Churchway								
Denbighshire LL15 1NJ	1 in 100 year plus 40% CC	Micco							
Date 22/01/2019	Designed by SJP								
File 60 Churchway-1 in 100 y	Checked by AW	Diamaye							
XP Solutions	Source Control 2018.1								
<u>1</u>	<u>Iodel Details</u>								
Storage is On	line Cover Level (m) 10.000								
Tank	Tank or Pond Structure								
Inve	rt Level (m) 9.900								
Depth (m) Are	ea (m²) Depth (m) Area (m²)								
0.000	55.0 0.100 55.0								
Hydro-Brake®	Optimum Outflow Control								
Unit	Reference MD-SHE-0059-1000-0100-1000								
Desig	n Head (m) 0.100								
Design	Flow (1/s) 1.0								
	Flush-Flo™ Calculated								
A	pplication Surface								
Sump	Available Yes								
Dia	meter (mm) 59								
Minimum Outlet Pipe Dia	meter (mm) 75								
Suggested Manhole Dia	meter (mm) 1200								
Control Po	ints Head (m) Flow (l/s)								
Design Point (Ca	alculated) 0.100 1.0								
E	'lush-Flo™ 0.074 1.0								
Mean Flow over F	Kick-Flo® 0.094 I.0 Head Range - 0.6								
The hydrological calculations have b Hydro-Brake® Optimum as specified. Hydro-Brake Optimum® be utilised the invalidated	een based on the Head/Discharge relation Should another type of control device of n these storage routing calculations wi	onship for the other than a .ll be							
Depth (m) Flow (1/s) Depth (m) Flow	7 (l/s) Depth (m) Flow (l/s) Depth (m)	Flow (l/s)							
0.100 1.0 1.200	3.1 3.000 4.9 7.000	7.5							
0.200 1.4 1.400	3.3     3.500     5.3     7.500       3.5     4.000     5.6     9.000	7.7							
0.400 1.9 1.800	3.8 4.500 6.0 8.500	8.2							
0.500 2.1 2.000	4.0 5.000 6.3 9.000	8.5							
0.600 2.2 2.200	4.2 5.500 6.6 9.500	8.7							
	4.4 6.000 6.9   4.5 6.500 7.2								
1.000 2.0 2.000									







Waterco Ltd				Page 1
Eden Court	w10253			
Lon Parcwr Business Park	53-55 Ch	t	No.	
Denbighshire LL15 1NJ	1 in 100	vear+40%CC		Micco
Date 23/01/2019	Designed	by SJP		MILIU
File $53-55$ Chalton Street- 1	Checked	by AW		Urainage
VP Solutions	Source C	$\frac{\text{optrol}}{2018}$	1	
	Source C	0111101 2010	• 1	
Summary of Results fo	r 100 va	ar Poturn D	ariod (+108)	
Summary of Results it	<u>)T TOO ĀG</u>	ai ketuin r	errou (+40%)	
Storm Max	Max	Max Max	Status	
Event Level	L Depth Co	ontrol Volume		
(m)	(m)	(l/s) (m³)		
15 min Summer 0.04	5 0 045	07 20	Elood Dick	
30 min Summer 9.94	1 0 051	0.7 2.0	Flood Risk	
60 min Summer 9.95	4 0.054	0.9 2.4	Flood Risk	
120 min Summer 9.95	7 0.057	0.9 2.5	Flood Risk	
180 min Summer 9.95	5 0.055	0.9 2.5	Flood Risk	
240 min Summer 9.95	2 0.052	0.8 2.3	Flood Risk	
360 min Summer 9.94	6 0.046	0.7 2.1	Flood Risk	
480 min Summer 9.94	1 0.041	0.7 1.9	Flood Risk	
600 min Summer 9.93	/ 0.037	0.6 1.7	Flood Risk	
960 min Summer 9 93	+ 0.034 ) 0.030	0.5 1.6	Flood Risk	
1440 min Summer 9.92	4 0.024	0.3 1.1	Flood Risk	
2160 min Summer 9.91	9 0.019	0.2 0.9	Flood Risk	
2880 min Summer 9.91	5 0.016	0.2 0.7	Flood Risk	
4320 min Summer 9.91	3 0.013	0.1 0.6	Flood Risk	
5760 min Summer 9.91	1 0.011	0.1 0.5	Flood Risk	
Storm Ra	in Flood	led Discharge	Time-Peak	
Event (mm.	(m <sup>3</sup> ) (m <sup>3</sup>	ne volume	(mins)	
	(111 )	, (		
15 min Summer 179	.200 0	.0 2.3	15	
30 min Summer 115	.272 0	.0 3.0	24	
60 min Summer 70	.337 0	.0 3.7	40	
120 min Summer 45	0 čči.	4.7	100	
240 min Summer 27	.200 0 801 0	0 5.4	140	
360 min Summer 20	.401 0	.0 6.4	202	
480 min Summer 16	.173 0	.0 6.8	262	
600 min Summer 13	.426 0	.0 7.0	324	
720 min Summer 11	.494 0	.0 7.2	384	
960 min Summer 8	.943 0	.0 7.5	508	
1440 min Summer 6	.240 0	.0 7.8	750	
2160 min Summer 4	.326 0	.0 8.2	1124	
2880 min Summer 3 4320 min Summer 2	.330 U 322 N	0 8.4	14/2 2208	
5760 min Summer 1	.805 0	.0 9.1	2936	
	Ũ			
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Waterco Ltd				Page 2
Eden Court	w10253			
Lon Parcwr Business Park	53-55 (	No.		
Denbighshire LL15 1NJ	1 in 10	11		
$D_{2}$ = 23/01/2019	Design	od by SIP		MICIO
Date 23/01/2019	Charles	ed by SUP		Drainage
File 53-55 Chalton Street- I	Checked	a by Aw		
XP Solutions	Source	Control 201	3.1	
<u>Summary of Results f</u>	or 100	<u>year Return</u>	<u>Period (+40%)</u>	
Storm Ma	x Max	Max Max	Status	
Event Lev (m	) (m)	(1/s) (m <sup>3</sup> )	e	
	., (,	(_, _, _, _,		
7200 min Summer 9.9	09 0.009	0.1 0.	4 Flood Risk	
8640 min Summer 9.9	08 0.008	0.1 0.	4 Flood Risk	
10080 min Summer 9.9	08 0.008	0.1 0.	3 Flood Risk	
15 min Winter 9.9	50 0.050	0.8 2.	3 Flood Risk	
60 min Winter 9.9	59 0 059	0.9 2.	7 Flood Risk	
120 min Winter 9.9	59 0.059	0.9 2.	7 Flood Risk	
180 min Winter 9.9	55 0.055	0.9 2.	5 Flood Risk	
240 min Winter 9.9	51 0.051	0.8 2.	3 Flood Risk	
360 min Winter 9.9	43 0.043	0.7 1.	9 Flood Risk	
480 min Winter 9.9	38 0.038	0.6 1.	7 Flood Risk	
600 min Winter 9.9	34 0.034	0.5 1.	5 Flood Risk	
720 min Winter 9.9	31 0.031	0.4 1.	4 Flood Risk	
960 min Winter 9.9	26 0.026	0.4 1.	2 Flood Risk	
1440 min Winter 9.9	21 0.021	0.2 0.	9 Flood Risk	
2160 min Winter 9.9	10 0.010	0.2 0.	/ Flood Kisk	
Storm H	Rain Flo	ooded Discharg	e Time-Peak	
Event (m	m/hr) Vo	lume Volume	(mins)	
	(	m <sup>3</sup> ) (m <sup>3</sup> )		
7000	1 404			
7200 min Summer	1.494	0.0 9.	4 3672	
10080 min Summer	1 137	0.0 9.	/ 4400 0 5128	
15 min Winter 17	9.200	0.0 2.	6 15	
30 min Winter 11	5.272	0.0 3.	4 25	
60 min Winter 7	0.337	0.0 4.	1 44	
120 min Winter 4	5.133	0.0 5.	3 80	
180 min Winter 3	4.200	0.0 6.	0 114	
240 min Winter 2	7.801	0.0 6.	5 146	
360 min Winter 2	0.401	0.0 7.	2 208	
480 min Winter 1	6.173	0.0 7.	6 270	
600 min Winter 1	3.426	0.0 7.	y 330	
ACO min Winter 1	1.494 8 9/3	0.0 8.	⊥ 390 4 510	
1440 min Winter	6.240	0.0 8	8 7.52	
2160 min Winter	4.326	0.0 9.	1 1124	
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Waterco Ltd			
Eden Court	w10253	ſ.	
Lon Parcwr Business Park	53-55 Chalton Street		
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Mirro	
Date 23/01/2019	Designed by SJP	Drainage	
File 53-55 Chalton Street- 1	Checked by AW	Dramage	
XP Solutions	Source Control 2018.1		

Summary of Results for 100 year Return Period (+40%)

Storm Event		Max Level	Max Depth	Max Control	Max Volume	Stat	us	
			(m)	(m)	(1/s)	(m³)		
2880	min	Winter	9.914	0.014	0.1	0.6	Flood	Risk
4320	min	Winter	9.910	0.010	0.1	0.5	Flood	Risk
5760	min	Winter	9.909	0.009	0.1	0.4	Flood	Risk
7200	min	Winter	9.907	0.007	0.1	0.3	Flood	Risk
8640	min	Winter	9.906	0.006	0.1	0.3	Flood	Risk
10080	min	Winter	9.906	0.006	0.0	0.2	Flood	Risk

	Stor: Even	m t	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
2880	min	Winter	3.336	0.0	9.4	1524
4320	min	Winter	2.322	0.0	9.8	2244
5760	min	Winter	1.805	0.0	10.2	3008
7200	min	Winter	1.494	0.0	10.5	3600
8640	min	Winter	1.285	0.0	10.9	4408
10080	min	Winter	1.137	0.0	11.2	5040

Waterco Ltd		Page 4
Eden Court	w10253	6
Lon Parcwr Business Park	53-55 Chalton Street	No.
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Micro
Date 23/01/2019	Designed by SJP	Drainago
File 53-55 Chalton Street- 1	Checked by AW	Diamage
XP Solutions	Source Control 2018.1	

## <u>Rainfall Details</u>

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 529783 182863	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

<u>Time Area Diagram</u>

Total Area (ha) 0.007

Time	(mins)	Area
From:	То:	(ha)

0 1 0.007

Waterco Ltd							H	Page	5
Eden Court	w10253	3					ſ	0	
Lon Parcwr Business Park	53-55	Chalto	on :	Stree	t			Sec.	
Denbighshire LL15 1NJ	1 in 3	100 yea	ar+	40%CC			8	Micc	
Date 23/01/2019	Design	ned by	SJ	P				Deair	U
File 53-55 Chalton Street- 1	Checke	ed by A	AM					UIdii	lage
XP Solutions	Source	e Conti	rol	2018	.1				
<u>M</u>	<u>Model Details</u>								
Storage is Onl	ine Co	ver Leve	el	(m) 10	0.000				
Tank	or Pon	d Stru	<u>ctu</u>	re					
Inver	t Leve	l (m) 9	.900	C					
Depth (m) Are	a (m²)	Depth (	(m)	Area	(m²)				
0.000	45.0	0.1	00		45.0				
<u>Hydro-Brake®</u>	Optim	<u>um Out</u> :	flo	w Cor	<u>ntrol</u>				
Unit	Refere	nce MD-S	SHE-	-0059-	-1000-0	0100-10	00		
Desigr	n Head	(m)				0.1	00		
Design H	low (l	/s)				1	.0		
F	Clush-F.	lo <sup>m</sup>			Cá	alculat	ed		
٦r	object.	ion	[] _ [[] _	rse ut	stream	Surfa	ye ce		
Sump	Availa	ble				Y	es		
Dian	neter (1	mm)					59		
Invert	Level	(m)				9.8	95		
Minimum Outlet Pipe Diam	neter (1	mm)					75		
Suggested Manhole Diam	neter (1	mm)				12	00		
Control Poi	nts	Head	l (m	) Flo	w (l/s	)			
Design Point (Ca	lculate	ed) 0	.10	0	1.	0			
F	lush-Fl	. О <sup>тм</sup> 0	.07	4	1.	0			
	Kick-Fl	.o® 0	.09	4	1.	0			
Mean Flow over H	ead Ran	ge		-	0.	6			
The hydrological calculations have	been k	based or	n th	ne Hea	d/Disc	harge 1	cela	tions	hip
for the Hydro-Brake® Optimum as sp	ecified	d. Shou	ıld	anoth	er typ	e of co	ontr	col de	vice
other than a Hydro-Brake Optimum®	be util	Lised th	nen	these	stora	ge rout	cinc	J	
calculations will be invalidated									
Depth (m) Flow (l/s) Depth (m) Flow	(1/s)	Depth (	(m)	Flow	(1/s)	Depth	(m)	Flow	(1/s)
0.100 1.0 0.600	2.2	1.6	500		3.5	2.	600		4.5
0.200 1.4 0.800	2.6	1.8	800		3.8	3.	000		4.9
0.300 1.6 1.000	2.8	2.0	000		4.0	3.	500		5.3
0.400 1.9 1.200	3.1	2.2	200		4.2	4.	000		5.6
0.500 2.1 1.400	3.3	2.4	100		4.4	4.	o 0 0 c		6.0
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			-						

Waterco Ltd		Page 6
Eden Court	w10253	
Lon Parcwr Business Park	53-55 Chalton Street	
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Mirro
Date 23/01/2019	Designed by SJP	Drainage
File 53-55 Chalton Street- 1	Checked by AW	Dianage
XP Solutions	Source Control 2018.1	

### <u>Hydro-Brake® Optimum Outflow Control</u>

Depth (m)	Flow (l/s)						
5.000	6.3	6.500	7.2	8.000	8.0	9.500	8.7
5.500	6.6	7.000	7.5	8.500	8.2		
6.000	6.9	7.500	7.7	9.000	8.5		







						Page 1
Eden Court	w1	0253				
Lon Parcwr Business Park	on Parcwr Business Park Central Area					
Denbighshire I.I.15 1NJ	1	in 10	0 vear	-+40%CC		
						- MICCO
Date 25/01/2019	Drainage					
File Central Area -1 in 100	- Shan large					
XP Solutions						
Summary of Results	for	100 y	vear Re	<u>eturn P</u>	eriod (+40%)	
Storm M	Max	Max	Max	Max	Status	
Event Le	evel 1	Depth	Control	Volume		
(	(m)	(m)	(1/s)	(m³)		
15 min Summer 9	954 (	0 054	0 9	3 0	Flood Risk	
30 min Summer 9.	.962 1	0.062	1.0	3.4	Flood Risk	
60 min Summer 9.	.966	0.066	1.0	3.7	Flood Risk	
120 min Summer 9.	.972 (	0.072	1.0	3.9	Flood Risk	
180 min Summer 9.	.970	0.070	1.0	3.9	Flood Risk	
240 min Summer 9.	.967	0.067	1.0	3.7	Flood Risk	
360 min Summer 9.	.959	0.059	0.9	3.3	Flood Risk	
480 min Summer 9.	.953	0.053	0.8	2.9	Flood Risk	
600 min Summer 9.	.948	0.048	0.8	2.6	Flood Risk	
720 min Summer 9.	.944	0.044	0.7	2.4	Flood Risk	
960 min Summer 9.	.938 (	0.038	0.6	2.1	Flood Risk	
1440 min Summer 9.	.931	0.031	0.4	1.7	Flood Risk	
2160 min Summer 9.	.925	0.025	0.3	1.4	Flood Risk	
4320 min Summer 9.	.921 ( 017 )	0.021	0.2	1.2	Flood Risk	
5760 min Summer 9	914 I	0.014	0.2	0.9	Flood Risk	
7200 min Summer 9.	.912 (	0.012	0.1	0.7	Flood Risk	
8640 min Summer 9.	.911	0.011	0.1	0.6	Flood Risk	
10080 min Summer 9.	.910	0.010	0.1	0.6	Flood Risk	
15 min Winter 9.	.960	0.060	1.0	3.3	Flood Risk	
30 min Winter 9.	.971	0.071	1.0	3.9	Flood Risk	
Storm	Rain	Flo	oded Di	scharge	Time-Peak	
Storm Event	Rain (mm/h:	r) Vol	oded Di Lume V	scharge Volume	Time-Peak (mins)	
Storm Event	Rain (mm/h:	r) Vol	oded Di Lume V n <sup>3</sup> )	.scharge Volume (m³)	Time-Peak (mins)	
Storm Event (	<b>Rain</b> (mm/h:	<b>Flo</b> r) Vol (r	oded Di Lume 7 n <sup>3</sup> )	scharge Volume (m³)	Time-Peak (mins)	
Storm Event 15 min Summer 1 30 min Summer 1	Rain (mm/h: 179.20 115.2	<b>Flo</b> <b>r) Voj</b> (r	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0	scharge Volume (m <sup>3</sup> ) 3.3 4.3	Time-Peak (mins) 15 26	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer	<b>Rain</b> (mm/h: 179.20 115.2 <sup>°</sup> 70.33	<b>Flo</b> <b>r) Vol</b> (r 00 72 37	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2	<b>Time-Peak</b> (mins) 15 26 42	
Storm Event ( 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer	Rain (mm/h: 179.20 115.2 <sup>7</sup> 70.3 45.1	<b>Flo</b> <b>r) Vol</b> (r 00 72 37 33	oded Di Lume 7 0.0 0.0 0.0 0.0 0.0	<b>scharge</b> Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7	<b>Time-Peak</b> (mins) 15 26 42 78	
Storm Event ( 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer	Rain (mm/h) 179.20 115.2 70.3 45.1 34.20	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0	<b>Scharge</b> Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7	<b>Time-Peak</b> (mins) 15 26 42 78 112	
Storm Event ( 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer	Rain (mm/h; 179.20 115.2 <sup>°</sup> 70.3 45.1 34.20 27.80	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	<b>scharge</b> Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3	<b>Time-Peak</b> (mins) 15 26 42 78 112 144	
Storm Event ( 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer	Rain (mm/h; 179.20 115.27 70.33 45.13 34.20 27.80 20.40	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b>scharge</b> Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2	<b>Time-Peak</b> (mins) 15 26 42 78 112 144 206	
Storm Event ( 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer	Rain (mm/h; 179.20 115.27 70.33 45.13 34.20 27.80 20.40 16.17	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01 73 00	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b>scharge</b> <b>Volume</b> (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7	<b>Time-Peak</b> (mins) 15 26 42 78 112 144 206 266 266	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 360 min Summer 480 min Summer 600 min Summer	Rain (mm/h: 179.20 115.22 70.33 45.13 34.20 27.80 20.40 16.12 13.42	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01 73 26 04	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b></b>	<b>Time-Peak</b> (mins) 15 26 42 78 112 144 206 266 326 326	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer	Rain (mm/h: 179.20 115.22 70.33 45.13 34.20 27.80 20.40 16.17 13.42	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01 73 26 94 43	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b></b>	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510	
Storm Event (1) 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer 960 min Summer	Rain (mm/h: 179.20 115.2 <sup>°</sup> 70.33 45.13 34.20 27.80 20.40 16.1 <sup>°</sup> 13.42 11.49 8.99 6.2°	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01 73 26 94 43 40	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer 960 min Summer 1440 min Summer	Rain (mm/h: 179.20 115.2 <sup>°</sup> 70.33 45.13 34.20 27.80 20.40 16.1 <sup>°</sup> 13.42 11.49 8.99 6.24 4.33	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 37 33 00 01 01 73 26 94 43 40 26	oded Di Lume V n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.2	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120	
Storm Event 15 min Summer 1 30 min Summer 1 30 min Summer 120 min Summer 120 min Summer 180 min Summer 360 min Summer 360 min Summer 480 min Summer 720 min Summer 720 min Summer 960 min Summer 1440 min Summer 2880 min Summer	Rain (mm/h: 179.20 115.2 <sup>-7</sup> 70.33 45.13 34.20 27.80 20.40 16.1 <sup>-7</sup> 13.42 11.49 6.24 4.32 3.33	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 337 33 00 01 01 73 26 94 43 40 26 36	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer 720 min Summer 960 min Summer 1440 min Summer 2160 min Summer 2880 min Summer	Rain (mm/h) 179.20 115.2 <sup>7</sup> 70.3 45.1 34.20 27.80 20.40 16.1 <sup>2</sup> 13.42 11.49 6.24 4.32 3.33 2.32	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 337 333 00 01 01 01 73 26 94 43 40 26 36 22	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer 720 min Summer 960 min Summer 1440 min Summer 2160 min Summer 2880 min Summer 4320 min Summer	Rain (mm/h) 179.20 115.2 <sup>°</sup> 70.3 45.1 34.20 27.80 20.40 16.1 <sup>°</sup> 13.42 11.49 6.24 4.32 3.3 2.32 1.80	<b>Flo</b> <b>r) Vol</b> ( <b>r</b> 00 72 337 333 00 01 01 73 26 94 43 40 26 36 22 05	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5 13.0	<b>Time-Peak</b> (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204 2936	
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Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 1 60 min Summer 120 min Summer 120 min Summer 180 min Summer 240 min Summer 360 min Summer 360 min Summer 480 min Summer 720 min Summer 960 min Summer 1440 min Summer 2480 min Summer 2400 min Summer 260 min Summer 260 min Summer 2700 min Summer 3700 min Summer 3700 min Summer 3700 min Summer 3700 min Summer	Rain (mm/h) 179.20 115.2 70.3 45.1 34.20 27.80 20.40 16.1 13.42 11.49 6.2 4.32 3.33 2.32 1.80 1.49 1.28	Flo r) Vol (r 00 72 377 33 00 01 01 73 26 94 43 40 26 36 22 05 94 85	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5 13.0 13.4 13.8	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204 2936 3672 4384	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 1 60 min Summer 120 min Summer 120 min Summer 240 min Summer 240 min Summer 360 min Summer 360 min Summer 480 min Summer 720 min Summer 960 min Summer 1440 min Summer 2160 min Summer 2880 min Summer 2880 min Summer 5760 min Summer 5760 min Summer 7200 min Summer 8640 min Summer	Rain (mm/h) 179.20 115.2 70.3 45.1 34.20 27.80 20.40 16.1 13.42 11.49 6.2 4.32 3.3 2.32 1.80 1.49 1.28 1.28	Flo r) Vo (r 00 72 377 333 00 01 01 01 01 01 01 01 01 01 01 01 01	oded Di Lume 7 a <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	<b>Scharge</b> <b>Volume</b> (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5 13.0 13.4 13.8 14.3	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204 2936 3672 4384 5112	
Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 1 60 min Summer 120 min Summer 120 min Summer 240 min Summer 360 min Summer 360 min Summer 480 min Summer 720 min Summer 720 min Summer 1440 min Summer 2160 min Summer 2880 min Summer 4320 min Summer 5760 min Summer 5760 min Summer 7200 min Summer 10080 min Summer 15 min Winter 1	Rain (mm/h) 179.20 115.2 70.3 45.1 34.20 27.80 20.40 16.1 13.42 11.49 6.24 4.32 3.33 2.32 1.80 1.49 1.28 1.12	Flo r) Vo (r 00 72 37 33 00 01 01 01 01 01 01 01 01 01 01 01 01	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5 13.0 13.4 13.8 14.3 3.7	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204 2936 3672 4384 5112 15	
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Storm Event 15 min Summer 1 30 min Summer 1 60 min Summer 120 min Summer 120 min Summer 240 min Summer 360 min Summer 480 min Summer 720 min Summer 960 min Summer 1440 min Summer 2160 min Summer 2880 min Summer 5760 min Summer 7200 min Summer 10080 min Summer 15 min Winter 1 30 min Winter 1	Rain (mm/h) 179.20 115.27 70.33 45.13 34.20 27.80 20.40 16.17 13.42 1.3.42 1.3.42 6.24 4.32 3.33 2.32 1.80 1.45 1.25 1.25 1.15 1.27 1.25 1.25 1.25 1.25 1.25 1.25 1.25 1.25	Flo r) Vol 72 37 33 00 01 01 73 26 94 43 40 26 36 22 20 5 94 43 40 26 36 22 20 5 94 43 40 26 36 22 20 5 94 43 70 20 72 20 1 8 5 37 72 20 1 8 5 20 72 20 20 20 20 20 20 20 20 20 20 20 20 20	oded Di Lume 7 n <sup>3</sup> ) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	scharge Volume (m <sup>3</sup> ) 3.3 4.3 5.2 6.7 7.7 8.3 9.2 9.7 10.0 10.3 10.7 11.2 11.7 12.0 12.5 13.0 13.4 13.8 14.3 3.7 4.8	Time-Peak (mins) 15 26 42 78 112 144 206 266 326 390 510 750 1120 1476 2204 2936 3672 4384 5112 15 29	

Waterco Ltd						Page 2
Eden Court	w10	253				6
Lon Parcwr Business Park	Cen	tral .	Area			
Denbighshire LL15 1NJ 1 in 100 year+40%CC						Micco
Date 25/01/2019	Desinar					
File Central Area -1 in 100 .	Che	cked 1	by AW			Diamay
XP Solutions	Sou	rce C	ontro	1 2018	.1	
<u>Summary of Results</u>	s for 1	<u>00 ye</u>	ar Re	turn P	eriod (+40%)	-
Storm	May N	dav.	Mav	May	Status	
Event	Level De	epth Co	ontrol	Volume		
	(m)	(m)	(1/s)	(m³)		
60 min Winter	9.974 0.	074	1.0	4.1	Flood Bisk	
120 min Winter	9.978 0.	.078	1.0	4.3	Flood Risk	
180 min Winter	9.973 0.	.073	1.0	4.0	Flood Risk	
240 min Winter	9.967 0.	.067	1.0	3.7	Flood Risk	
360 min Winter	9.957 0.	.057	0.9	3.1	Flood Risk	
400 Min Winter 600 min Winter	9,943 0.	.049	0.8	2./ 2./	Flood Risk	
720 min Winter	9.939 0.	.039	0.6	2.4	Flood Risk	
960 min Winter	9.933 0.	.033	0.5	1.8	Flood Risk	
1440 min Winter	9.926 0.	.026	0.4	1.5	Flood Risk	
2160 min Winter	9.921 0.	.021	0.2	1.1	Flood Risk	
2880 min Winter 4320 min Winter	9.91/ U. 9.91/ O.	.01/	0.2	1.0	Flood Risk	
5760 min Winter	9.911 0.	.011	0.1	0.6	Flood Risk	
7200 min Winter	9.910 0.	.010	0.1	0.5	Flood Risk	
8640 min Winter	9.909 0.	.009	0.1	0.5	Flood Risk	
10080 min Winter	9.908 0.	.008	0.1	0.4	Flood Risk	
Storm Event	Rain (mm/hr)	Flood Volu (m <sup>3</sup>	led Di: me V )	scharge Volume (m³)	Time-Peak (mins)	
		(	,	( )		
60 min Winter	70.337	7 (	0.0	5.9	46	
120 Min Winter 180 min Winter	45.133	5 ( ) (	).0	7.6	84 120	
240 min Winter	27.801	L (	0.0	9.3	152	
360 min Winter	20.401	1 (	0.0	10.3	214	
480 min Winter	16.173	3 (	0.0	10.8	276	
600 min Winter	13.426	o ( 1 (	0.0	11.3	336	
960 min Winter	±±•494 8_943	т ( 3 (	).0	12.0	520	
1440 min Winter	6.240	) (	0.0	12.6	764	
2160 min Winter	4.326	5 (	0.0	13.1	1124	
2880 min Winter	3.336	5 (	0.0	13.4	1500	
4320 min Winter	2.322	2 (	0.0	14.0	2212	
7200 min Winter	1.494	1 (	).0	15.0	2900 3568	
8640 min Winter	1.285	5 (	0.0	15.5	4392	
10080 min Winter	1.137	7 (	0.0	16.0	4896	
(C)	1982-20	018 Ir	novv	ze		

Waterco Ltd		Page 3
Eden Court	w10253	6
Lon Parcwr Business Park	Central Area	
Denbighshire LL15 1NJ	1 in 100 year+40%CC	Micco
Date 25/01/2019	Designed by SJP	Desinado
File Central Area -1 in 100	Checked by AW	Diamaye
XP Solutions	Source Control 2018.1	
<u>R</u> a	ainfall Details	
Rainfall Model Return Period (years) FEH Rainfall Version Site Location GB Data Type Summer Storms	FEH Winter Storms 100 Cv (Summer) 0 2013 Cv (Winter) 0 529783 182863 Shortest Storm (mins) Point Longest Storm (mins) 10 Yes Climate Change %	Yes .750 .840 15 0080 +40
Ti	me Area Diagram	
Tot	tal Area (ha) 0.010	
T F:	Time (mins) Area rom: To: (ha)	
	0 1 0.010	

Waterco Ltd	Page 4							
Eden Court	w10253							
Lon Parcwr Business Park	Central Area							
Denbighshire LL15 1NJ	1 in 100 year+40%CC							
Date 25/01/2019	Designed by SJP							
File Central Area -1 in 100	Checked by AW							
XP Solutions	Source Control 2018.1							
1	<u>Model Details</u>							
Storage is Online Cover Level (m) 10.000								
<u>Tank_</u>	or Pond Structure							
Inve	ert Level (m) 9.900							
Depth (m) Are	rea (m <sup>2</sup> ) Depth (m) Area (m <sup>2</sup> )							
0.000	55.0 0.100 55.0							
<u>Hydro-Brake®</u>	Optimum Outflow Control							
Unit	t Reference MD-SHE-0059-1000-0100-1000							
Desig	gn Head (m) 0.100							
Design	Flow (1/s) I.U Flush-Flo™ Calculated							
	Objective Minimise upstream storage							
A	Application Surface							
Sump	p Available Yes							
Invert	t Level (m) 9.895							
Minimum Outlet Pipe Dia	ameter (mm) 75							
Suggested Mannole Dia	ameter (mm) 1200							
Control Po	pints Head (m) Flow (l/s)							
Design Point (Ca	alculated) 0.100 1.0							
	Kick-Flo® 0.094 1.0							
Mean Flow over H	Head Range - 0.6							
The hydrological calculations have b	been based on the Head/Discharge relationship for the							
Hydro-Brake® Optimum as specified.	Should another type of control device other than a							
Hydro-Brake Optimum® be utilised the invalidated	en these storage routing calculations will be							
Depth (m) Flow (1/s) Depth (m) Flow	w (l/s) Depth (m) Flow (l/s) Depth (m) Flow (l/s)							
0.100 1.0 1.200	3.1 3.000 4.9 7.000 7.5							
	3.3 3.500 5.3 7.500 7.7 3.5 4.000 5.6 8.000 9.0							
0.400 1.9 1.800	3.8     4.500     6.0     8.500     8.2							
0.500 2.1 2.000	4.0 5.000 6.3 9.000 8.5							
0.600 2.2 2.200	4.2 5.500 6.6 9.500 8.7   4.4 6.000 6.0							
1.000 2.8 2.600	4.5 6.500 7.2							
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Appendix K – Blue / Green Roof Plan





1103-A





Project Number Drawing Ref

Revision

Scale

Page size

A3

**Appendix L – Maintenance Schedule** 





# **Operation and Maintenance Requirements for Green Roofs**

Maintenance Schedule	Required Action	Typical Frequency
	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
Regular inspections	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
Pogular maintonanco	Post establishment, replace dead plants as requirement (where > 5% of coverage)	Annually (in autumn)
Regular maintenance	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planning (if appropriate) as required – clippins should be removed andnot allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, theses should eb stabilised with extra soil substrate similar ot the original material and sources of erosion damage should be identified and controlled	As required
	If drainage inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Ref. Table 12.5, CIRIA C753 'The SuDS Manual



The maintenance requirements detailed above are to be undertaken by the site owner

Name: .....

Position:

Date:

Signed on behalf Of the site owner