

Project Title
Barnsley FRA - Belle Vue

Job Number CS/071060

Version Version 1

File Path [S:\ZWET\Sheffield Based Jobs\CSXXXXX_Barnsley_FRA\Surface Water Calcs\Belle Vue\Belle Vue SW Calculations \(70%existing v proposed\).xls](#)

Produced by JL **Date** 03/07/2014

Checked by **Date**

Rainfall Data NGR SE 34000 07000

Duration (mins)	Duration (hrs)	Return Period					
		1	2	10	30	100	100 + CC (+30%)
15	0.25	3.80	7.13	13.34	19.46	29.16	37.91
30	0.5	5.05	9.18	16.63	23.78	34.89	45.36
60	1	6.72	11.83	20.73	29.06	41.76	54.29
120	2	8.94	15.23	25.84	35.52	49.97	64.96
240	4	11.90	19.61	32.20	43.41	59.79	77.73
360	6	14.07	22.74	36.63	48.82	66.41	86.33
480	8	15.84	25.25	40.14	53.05	71.55	93.02
600	10	17.37	27.39	43.09	56.59	75.81	98.55
840	14	20.10	31.21	48.31	62.85	83.34	108.34
1440	24	25.77	39.00	58.87	75.43	98.39	127.91
2880	48	35.48	51.96	75.91	95.37	121.80	158.34

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File Path	S:\ZWET\Sheffield Based Jobs\CSXXXXX_Barnsley_FRA\Surface Water Calcs\Belle Vue\Belle Vue SW Calculations (70%existing v proposed).xls		
Produced by	JL	Date	03/07/2014
Checked by		Date	00/01/1900

Calculation of Greenfield Runoff Rates - Institute of Hydrology Report 124 FSR 3-parameter equation

Site name	AREA (km)	SPRHOST (%)	SAAR (mm)	SOIL	QBAR (m ³ /s)
Carrington Avenue	0.5	35.88	679	0.3	0.08793218

S1 0
S2 100
S3 0
S4 0
S5 0

Greenfield runoff in m3/s	Return Period						
	QBAR	1	2	10	30	100	100 + CC
Region		0.09	0.08	0.08	0.13	0.18	0.23
4		0.00	0.88	0.89	1.49	2.06	2.57

Greenfield runoff in l/s for 50 ha Area	Return Period						
	QBAR	1	2	10	30	100	100 + CC
	87.93	77.38	78.26	131.02	181.14	225.99	293.78

Greenfield runoff in l/s/ha	Return Period						
	QBAR	1	2	10	30	100	100 + CC
	1.75864	1.55	1.57	2.62	3.62	4.52	5.88

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Produced by	JL	Date	03/07/2014
Checked by	0	Date	00/01/1900

Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period	1 in 1	Year
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Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	3.8	15.20	0.0164	11.3
30	5.05	10.10	0.0109	15.1
60	6.72	6.72	0.0072	20.1
120	8.94	4.47	0.0048	26.7
240	11.9	2.98	0.0032	35.5
360	14.07	2.35	0.0025	42.0
480	15.84	1.98	0.0021	47.3
600	17.37	1.74	0.0019	51.8
840	20.1	1.44	0.0015	60.0
1440	25.77	1.07	0.0012	76.9
2880	35.48	0.74	0.0008	105.9

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36 ha	
	QBAR	Return Period
		1
Greenfield Runoff Rate (l/s/ha)	1.76	1.55
Greenfield Runoff from Open Space (l/s)	0.63	0.56

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other			0
Total	0.43		0.815116279

Return Period	1 in 1	Year
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Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	3.8	15.20	0.0193	13.3
30	5.05	10.10	0.0128	17.7
60	6.72	6.72	0.0085	23.6
120	8.94	4.47	0.0057	31.3
240	11.9	2.98	0.0038	41.7
360	14.07	2.35	0.0030	49.3
480	15.84	1.98	0.0025	55.5
600	17.37	1.74	0.0022	60.9
840	20.1	1.44	0.0018	70.5
1440	25.77	1.07	0.0014	90.3
2880	35.48	0.74	0.0009	124.4

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.3000 ha	
	QBAR	Return Period
		1
Greenfield Runoff Rate (l/s/ha)	1.76	1.55
Greenfield Runoff from Open Space (l/s)	0.53	0.46

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 1 **Year**

Storm Duration	Permitted Discharge Runoff Rate	Post-Development Runoff Rate	Permitted Outflow Volume (Greenfield)	Post-Development Runoff Volume	Storage, Inflow - Outflow
(minutes)	m³/s	m³/s	m³	m³	m³
15	0.0219	0.0197	19.74	13.74	-6.00
30	0.0219	0.0133	39.48	18.54	-20.94
60	0.0219	0.0090	78.95	25.23	-53.73
120	0.0219	0.0061	157.90	34.68	-123.23
240	0.0219	0.0042	315.81	48.40	-267.41
360	0.0219	0.0034	473.71	59.34	-414.37
480	0.0219	0.0030	631.62	68.89	-562.73
600	0.0219	0.0027	789.52	77.60	-711.93
840	0.0219	0.0023	1105.33	93.85	-1011.48
1440	0.0219	0.0018	1894.85	130.44	-1764.42
2880	0.0219	0.0014	3789.71	204.59	-3585.12

Required Storage -6.00 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period	1 in 2	Year
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Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	7.13	28.52	0.0308	21.3
30	9.18	18.36	0.0198	27.4
60	11.83	11.83	0.0128	35.3
120	15.23	7.62	0.0082	45.5
240	19.61	4.90	0.0053	58.5
360	22.74	3.79	0.0041	67.9
480	25.25	3.16	0.0034	75.4
600	27.39	2.74	0.0030	81.8
840	31.21	2.23	0.0024	93.2
1440	39	1.63	0.0018	116.4
2880	51.96	1.08	0.0012	155.1

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36 ha	
	QBAR	Return Period
		2
Greenfield Runoff Rate (l/s/ha)	1.76	1.57
Greenfield Runoff from Open Space (l/s)	0.63	0.56

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other	0	0	0
Total	0.43		0.815116279

Return Period 1 in 2 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	7.13	28.52	0.0361	25.0
30	9.18	18.36	0.0233	32.2
60	11.83	11.83	0.0150	41.5
120	15.23	7.62	0.0096	53.4
240	19.61	4.90	0.0062	68.7
360	22.74	3.79	0.0048	79.7
480	25.25	3.16	0.0040	88.5
600	27.39	2.74	0.0035	96.0
840	31.21	2.23	0.0028	109.4
1440	39	1.63	0.0021	136.7
2880	51.96	1.08	0.0014	182.1

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.30 ha	
	QBAR	Return Period
		2
Greenfield Runoff Rate (l/s/ha)	1.76	1.57
Greenfield Runoff from Open Space (l/s)	0.53	0.47

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 2 **Year**

Storm Duration (minutes)	Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0219	0.0366	19.74	25.41	5.68
30	0.0219	0.0237	39.48	33.02	-6.46
60	0.0219	0.0155	78.95	43.15	-35.80
120	0.0219	0.0101	157.90	56.76	-101.14
240	0.0219	0.0067	315.81	75.49	-240.31
360	0.0219	0.0053	473.71	89.85	-383.87
480	0.0219	0.0045	631.62	102.02	-529.59
600	0.0219	0.0039	789.52	112.91	-676.62
840	0.0219	0.0033	1105.33	133.06	-972.27
1440	0.0219	0.0025	1894.85	177.26	-1717.59
2880	0.0219	0.0018	3789.71	263.26	-3526.45

Required Storage 5.68 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period 1 in 10 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	13.34	53.36	0.0576	39.8
30	16.63	33.26	0.0359	49.6
60	20.73	20.73	0.0224	61.9
120	25.84	12.92	0.0139	77.1
240	32.2	8.05	0.0087	96.1
360	36.63	6.11	0.0066	109.3
480	40.14	5.02	0.0054	119.8
600	43.09	4.31	0.0046	128.6
840	48.31	3.45	0.0037	144.2
1440	58.87	2.45	0.0026	175.7
2880	75.91	1.58	0.0017	226.6

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36 ha		
	QBAR	Return Period	
		10	
Greenfield Runoff Rate (l/s/ha)	1.76	2.62	
Greenfield Runoff from Open Space (l/s)	0.63	0.94	Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other	0	0	0
Total	0.43		0.815116279

Return Period 1 in 10 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	13.34	53.36	0.0676	46.8
30	16.63	33.26	0.0421	58.3
60	20.73	20.73	0.0263	72.7
120	25.84	12.92	0.0164	90.6
240	32.2	8.05	0.0102	112.9
360	36.63	6.11	0.0077	128.4
480	40.14	5.02	0.0064	140.7
600	43.09	4.31	0.0055	151.0
840	48.31	3.45	0.0044	169.3
1440	58.87	2.45	0.0031	206.3
2880	75.91	1.58	0.0020	266.1

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.30 ha	
	QBAR	Return Period 10
Greenfield Runoff Rate (l/s/ha)	1.76	2.62
Greenfield Runoff from Open Space (l/s)	0.53	0.79

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 10 **Year**

Storm Duration (minutes)	Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0219	0.0684	19.74	47.46	27.73
30	0.0219	0.0429	39.48	59.70	20.23
60	0.0219	0.0270	78.95	75.49	-3.46
120	0.0219	0.0172	157.90	96.23	-61.68
240	0.0219	0.0110	315.81	124.18	-191.63
360	0.0219	0.0085	473.71	145.37	-328.35
480	0.0219	0.0071	631.62	163.33	-468.29
600	0.0219	0.0062	789.52	179.33	-610.19
840	0.0219	0.0052	1105.33	208.95	-896.38
1440	0.0219	0.0039	1894.85	274.26	-1620.59
2880	0.0219	0.0028	3789.71	401.90	-3387.80

Required Storage 27.73 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period 1 in 30 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	19.46	77.84	0.0840	58.1
30	23.78	47.56	0.0513	71.0
60	29.06	29.06	0.0313	86.7
120	35.52	17.76	0.0192	106.0
240	43.41	10.85	0.0117	129.6
360	48.82	8.14	0.0088	145.7
480	53.05	6.63	0.0072	158.4
600	56.59	5.66	0.0061	168.9
840	62.85	4.49	0.0048	187.6
1440	75.43	3.14	0.0034	225.2
2880	95.37	1.99	0.0021	284.7

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36 ha	
	QBAR	Return Period
		30
Greenfield Runoff Rate (l/s/ha)	1.76	3.62
Greenfield Runoff from Open Space (l/s)	0.63	1.30

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other	0	0	0
Total	0.43		0.815116279

Return Period 1 in 30 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	19.46	77.84	0.0986	68.2
30	23.78	47.56	0.0602	83.3
60	29.06	29.06	0.0368	101.9
120	35.52	17.76	0.0225	124.5
240	43.41	10.85	0.0137	152.2
360	48.82	8.14	0.0103	171.1
480	53.05	6.63	0.0084	185.9
600	56.59	5.66	0.0072	198.3
840	62.85	4.49	0.0057	220.3
1440	75.43	3.14	0.0040	264.4
2880	95.37	1.99	0.0025	334.3

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.3 ha	
	QBAR	Return Period
		30
Greenfield Runoff Rate (l/s/ha)	1.76	3.62
Greenfield Runoff from Open Space (l/s)	0.53	1.09

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 30 **Year**

Storm Duration	Permitted Discharge Runoff Rate	Post-Development Runoff Rate	Permitted Outflow Volume (Greenfield)	Post-Development Runoff Volume	Storage, Inflow - Outflow
(minutes)	m³/s	m³/s	m³	m³	m³
15	0.0219	0.0997	19.74	69.19	49.45
30	0.0219	0.0613	39.48	85.31	45.83
60	0.0219	0.0379	78.95	105.77	26.82
120	0.0219	0.0236	157.90	132.32	-25.58
240	0.0219	0.0148	315.81	167.80	-148.01
360	0.0219	0.0114	473.71	194.59	-279.12
480	0.0219	0.0095	631.62	217.24	-414.38
600	0.0219	0.0083	789.52	237.47	-552.05
840	0.0219	0.0068	1105.33	275.07	-830.27
1440	0.0219	0.0051	1894.85	358.29	-1536.57
2880	0.0219	0.0036	3789.71	522.08	-3267.63

Required Storage 49.45 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period 1 in 100 Year

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	29.16	116.64	0.1258	87.0
30	34.89	69.78	0.0753	104.1
60	41.76	41.76	0.0450	124.7
120	49.97	24.99	0.0270	149.2
240	59.79	14.95	0.0161	178.5
360	66.41	11.07	0.0119	198.2
480	71.55	8.94	0.0096	213.6
600	75.81	7.58	0.0082	226.3
840	83.34	5.95	0.0064	248.8
1440	98.39	4.10	0.0044	293.7
2880	121.8	2.54	0.0027	363.6

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36 ha	
	QBAR	Return Period 100
Greenfield Runoff Rate (l/s/ha)	1.76	4.52
Greenfield Runoff from Open Space (l/s)	0.63	1.63

Refer greenfield runoff calcs

125.8287826 69.9048792

Project Title
Barnsley FRA - Belle Vue

Job Number CS/071060
Version Draft v1.0
File Path S:\ZWET\Sheffield Based Jobs\CSXXXXX Barnsley FRA\Surface
Produced by JL Date 03/07/2014
Checked by 0 Date 00/01/1900

Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other	0	0	0
Total	0.43		0.815116279

Return Period 1 in 100 Year

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	29.16	116.64	0.1477	102.2
30	34.89	69.78	0.0884	122.3
60	41.76	41.76	0.0529	146.4
120	49.97	24.99	0.0316	175.1
240	59.79	14.95	0.0189	209.6
360	66.41	11.07	0.0140	232.8
480	71.55	8.94	0.0113	250.8
600	75.81	7.58	0.0096	265.7
840	83.34	5.95	0.0075	292.1
1440	98.39	4.10	0.0052	344.9
2880	121.8	2.54	0.0032	426.9

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.3	ha
	QBAR	Return Period 100
Greenfield Runoff Rate (l/s/ha)	1.76	4.52
Greenfield Runoff from Open Space (l/s)	0.53	1.36

Refer greenfield runoff calcs

Project Title
Barnsley FRA - Belle Vue

Job Number CS/071060
Version Draft v1.0
File Path S:\ZWET\Sheffield Based Jobs\CSXXXXX Barnsley FRA\Surface Water
Produced by JL **Date** 03/07/2014
Checked by 0 **Date** 00/01/1900

Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 100 **Year**

Storm Duration (minutes)	Permitted Discharge Runoff Rate m ³ /s	Post-Development Runoff Rate m ³ /s	Permitted Outflow Volume (Greenfield) m ³	Post-Development Runoff Volume m ³	Storage, Inflow - Outflow m ³
15	0.0219	0.1491	19.74	103.43	83.69
30	0.0219	0.0897	39.48	124.73	85.25
60	0.0219	0.0543	78.95	151.25	72.30
120	0.0219	0.0330	157.90	184.91	27.00
240	0.0219	0.0203	315.81	229.09	-86.72
360	0.0219	0.0154	473.71	262.05	-211.66
480	0.0219	0.0127	631.62	289.83	-341.78
600	0.0219	0.0110	789.52	314.53	-475.00
840	0.0219	0.0089	1105.33	360.44	-744.89
1440	0.0219	0.0065	1894.85	462.01	-1432.85
2880	0.0219	0.0046	3789.71	661.21	-3128.50

Required Storage 85.25 m³

Project Title
Barnsley FRA - Belle Vue

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.05	0.85	0.114864865
Hardstanding	0.32	0.8	0.691891892
Other	0	0	0
Total	0.37		0.806756757

Return Period 1 in 100 + CC **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	37.908	151.63	0.1636	113.2
30	45.357	90.71	0.0979	135.4
60	54.288	54.29	0.0586	162.0
120	64.961	32.48	0.0350	193.9
240	77.727	19.43	0.0210	232.0
360	86.333	14.39	0.0155	257.7
480	93.015	11.63	0.0125	277.6
600	98.553	9.86	0.0106	294.2
840	108.342	7.74	0.0083	323.4
1440	127.907	5.33	0.0057	381.8
2880	158.34	3.30	0.0036	472.6

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	0.36	ha
	QBAR	Return Period
		100 + CC
Greenfield Runoff Rate (l/s/ha)	1.76	5.88
Greenfield Runoff from Open Space (l/s)	0.63	2.12

Refer greenfield runoff calcs

Project Title
Barnsley FRA - Belle Vue

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.13	0.85	0.256976744
Hardstanding	0.3	0.8	0.558139535
Other	0	0	0
Total	0.43		0.815116279

Return Period 1 in 100 + CC **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	37.908	151.63	0.1921	132.9
30	45.357	90.71	0.1149	159.0
60	54.288	54.29	0.0688	190.3
120	64.961	32.48	0.0411	227.7
240	77.727	19.43	0.0246	272.4
360	86.333	14.39	0.0182	302.6
480	93.015	11.63	0.0147	326.0
600	98.553	9.86	0.0125	345.4
840	108.342	7.74	0.0098	379.7
1440	127.907	5.33	0.0068	448.3
2880	158.34	3.30	0.0042	555.0

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.3	ha
	QBAR	Return Period 100 + CC
Greenfield Runoff Rate (l/s/ha)	1.76	5.88
Greenfield Runoff from Open Space (l/s)	0.53	1.76

Refer greenfield runoff calcs

Project Title
Barnsley FRA - Belle Vue

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 100 + CC **Year**

Storm Duration (minutes)	Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0219	0.1938	19.74	134.45	114.72
30	0.0219	0.1167	39.48	162.15	122.67
60	0.0219	0.0705	78.95	196.63	117.67
120	0.0219	0.0429	157.90	240.38	82.48
240	0.0219	0.0264	315.81	297.82	-17.99
360	0.0219	0.0200	473.71	340.67	-133.04
480	0.0219	0.0165	631.62	376.78	-254.83
600	0.0219	0.0142	789.52	408.89	-380.64
840	0.0219	0.0116	1105.33	468.58	-636.75
1440	0.0219	0.0085	1894.85	600.61	-1294.24
2880	0.0219	0.0059	3789.71	859.57	-2930.13

Required Storage 122.67 m³

Project Title
Barnsley FRA - Belle Vue

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Produced by	JL	Date	03/07/2014
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Area (ha)	Site		
	Permeable area	Impermeable area	Total
Existing	0.36	0.37	0.73
Proposed Development	0.30	0.43	0.73

Greenfield Runoff Rate	l/s/ha
1	1.5
2	1.6
10	2.6
30	3.6
100	4.5
100+CC	5.9

Post Development Storage	m3
1	-6.0
2	5.7
10	27.7
30	49.4
100	85.3
100+CC	122.7