Calculation - UK Peak Runoff Rates

PROJECT:	Dunmill BESS
PROJECT NO:	05104
REFERENCE NO:	05104-6919602

Issue	Date	Author	Nature and Location of Change
1	05.12.2023	Antonis Poulakis	First issue

Note: revision history should include design stage, revision of load and other relevant information.

Peak Runoff Rates

This calculation will determine the peak runoff rate for a given catchment, in a certain geographic location for a select return period.

To determine peak runoff flows for a particular catchment, the modified rational method can be used to model the impervious areas and the IH124 and FEH method can be used to calculate the pervious areas in accordance with CIRIA Guide C753.

1. INPUT PARAMETERS AND ASSUMPTIONS

1.1 First category of inputs - Hydrological Characteristics

	YES		Does this calculation include pervious area?
	NO		Does this calculation include impervious / semi-impervious area?
SAAR	696	mm	*Standard Average Annual Rainfall from FSR Map (see "Data" Tab)*
RP	2		*Return Period (1 in #)*
FARL	1		*A measurement of attenuation influence of water bodies in the catchement (typically assume FARL = 1 for a conservative value)*
BFIHOST	0.459		*A measure of the baseflow from the catchment (see "Data" tab)*

1.2 Second category of inputs - Catchment Area Characteristics

Ap	0.83	ha	*Pervious area*

2. CALCULATIONS

2.1 Calculation section - runoff from pervious areas (FEH Statistical Method)

Qmed	2.71	l/s	*Peak rate of flow from a catchment for the median annual flood*

$$Qmed = 8.3062 \times AREA^{0.851} \times 0.15361000 / SAAR \times FARL^{3.4451} \times 0.0460^{BFIHOST \times BFIHOST}$$

Calculation - UK Storage Volumes

PROJECT:	Dunmill BESS
PROJECT NO:	5104
REFERENCE NO:	05104-6837999

Issue	Date	Author	Nature and Location of Change
1	17/11/2023	Antonis Poulakis	First issue

Note: revision history should include design stage, revision of load and other relevant information.

Attenuation Storage

1. INPUT PARAMETERS AND ASSUMPTIONS

1.1 First category of inputs - Hydrological Characteristics

m5-60	14.00	mm	*Five Year - 60 Minute Rainfall Depth (see "Data" Tab)*
r	0.30		*Ratio M5-60/M5-2day (see "Data" Tab)*
Location	S/NI		*E/W (England and Wales) or S/NI (Scotland and Northern Ireland)*
Fc	1.39		*Climate Change Factor (refer to the hyperlink for what to choose)*

1.2 Second category of inputs - Catchment Area Characteristics

Ap	0.00	ha	*Permeable Area*
Cp	0		*Permeable area runoff coefficient (see "Data" Tab)*
Ai	0.83	ha	*Impermeable Area (C= 1 assumed) (ha)*
Qa	0.00300	m³/s	*Allowable Discharge*

2. CALCULATIONS

2.1 First calculation section - effective catchment area calculation

Ae	0.83	ha	*Effective area (see "Data" Tab)*

2.2 Second calculation section - calculation to dermine the m5 rainfall for various durations

D (min)	Z1	m5 - D (mm)
15.00	0.59	8.26
30.00	0.77	10.78
60.00	1.00	14.00
120.00	1.25	17.50
240.00	1.57	21.98
360.00	1.78	24.92
600.00	2.12	29.68
1440.00	2.84	39.76
2160.00	3.25	45.50

m5-D calculation

Note: z1 is calculation in the "Att Data" Tab

2.3 Third calculation section - attenuation volume calculations for various durations and return periods

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	0.68	8	64	3	62
30.00	0.68	10	85	5	79
60.00	0.69	13	111	11	100
120.00	0.70	17	140	22	119
240.00	0.70	22	179	43	135
360.00	0.71	25	204	65	139
600.00	0.72	30	246	108	138
1440.00	0.74	41	339	259	80
2160.00	0.75	47	391	389	3

1 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	1.03	12	98	3	95
30.00	1.03	15	128	5	123
60.00	1.02	20	165	11	154
120.00	1.02	25	206	22	184
240.00	1.02	31	259	43	215
360.00	1.02	35	293	65	228
600.00	1.02	42	349	108	241
1440.00	1.02	56	468	259	209
2160.00	1.02	65	535	389	147

5 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	1.18	14	113	3	110
30.00	1.19	18	148	5	143
60.00	1.20	23	193	11	183
120.00	1.20	29	241	22	220
240.00	1.19	36	301	43	258
360.00	1.18	41	339	65	274
600.00	1.18	49	404	108	296
1440.00	1.17	65	537	259	278
2160.00	1.16	74	611	389	222

10 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	1.47	17	140	3	138
30.00	1.49	22	185	5	180
60.00	1.49	29	241	11	230
120.00	1.48	36	299	22	278
240.00	1.47	45	372	43	329
360.00	1.46	51	420	65	355
600.00	1.44	60	495	108	387
1440.00	1.41	78	649	259	389
2160.00	1.39	88	730	389	342

30 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	1.93	22	184	3	181
30.00	1.97	30	245	5	240
60.00	1.98	38	319	11	309
120.00	1.96	48	395	22	373
240.00	1.91	58	485	43	442
360.00	1.89	65	544	65	479
600.00	1.85	76	634	108	526
1440.00	1.77	98	813	259	554
2160.00	1.74	110	915	389	526

100 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	2.20	25	209	3	207
30.00	2.25	34	280	5	275
60.00	2.26	44	365	11	354
120.00	2.23	54	450	22	429
240.00	2.18	66	552	43	509
360.00	2.14	74	616	65	551
600.00	2.09	86	717	108	609
1440.00	1.98	110	909	259	650
2160.00	1.95	123	1022	389	633

200 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

3. RESULTS

Att 1	139	m³	*Attenuation volume required in a 1 in 1 year event*
Att 5	241	m³	*Attenuation volume required in a 1 in 5 year event*
Att 10	296	m³	*Attenuation volume required in a 1 in 10 year event*
Att 30	389	m³	*Attenuation volume required in a 1 in 30 year event*
Att 100	554	m³	*Attenuation volume required in a 1 in 100 year event*
Att 200	650	m³	*Attenuation volume required in a 1 in 200 year event*