



David Edwards & Associates

E V E R Y D A Y E N G I N E E R I N G

LOWER FARM ROWDE

Drainage Calculations

26088

NOTE: DO NOT use the dimensions in the calculations to order materials.

Paul Dawson
February 2026

David Edwards & Associates EVERY DAY ENGINEERING 28 Old Church Road Clevedon BS21 6LY	Project Lower Farm, Rowde				Job no. 26088	
	Calcs for Proposed Drainage				Start page no./Revision 1	
	Calcs by PD	Calcs date 09/02/2026	Checked by PH	Checked date 9/2/26	Approved by PH	Approved date 9/2/26

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Calculations indicate that to maintain a flow rate of 0.6l/s - 50.2 m³ of attenuation storage is required. There is a 10,000 gallon redundant sludge tank on site providing 45.4 m³ of storage. It is proposed to split the roof drainage in two to provide two sets of attenuation. 27.4 m³ of attenuation storage will be provided for the other half of the roof by means of 144 Aquacells. Both storage areas will then discharge via a hydro brake manhole into the water course at a rate of 0.6l/s.

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	Calcs for Proposed Drainage				Start page no./Revision 2	
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DESIGN RAINFALL EXISTING

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area; Bristol
Storm duration; D = **5 min**
Return period; Period = **100 yr**
Ratio 60 min to 2 day rainfall of 5 yr return period; r = **0.450**
5-year return period rainfall of 60 minutes duration; M5_60min = **20.0 mm**
Increase of rainfall intensity due to global warming; p_{climate} = **40 %**
Factor Z1 (Wallingford procedure); Z1 = **0.39**
Rainfall for 5min storm with 5 year return period; $M5_{5min_i} = Z1 \cdot M5_{60min} \cdot (1 + p_{climate}) = \mathbf{10.9\ mm}$
Factor Z2 (Wallingford procedure); Z2 = **1.92**
Rainfall for 5min storm with 100 year return period; M100_5min = Z2 · M5_5min_i = **21.0 mm**
Design rainfall intensity; I_{max} = M100_5min / D = **252.2 mm/hr**

Maximum surface water runoff

Catchment area; A_{catch} = **1063 m²**
Percentage of area that is impermeable; p = **100 %**
Maximum surface water runoff; $Q_{max} = A_{catch} \cdot p \cdot I_{max} = \mathbf{74.5\ l/s}$

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DESIGN RAINFALL PROPOSED

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area; Bristol
Storm duration; D = **5 min**
Return period; Period = **100 yr**
Ratio 60 min to 2 day rainfall of 5 yr return period; r = **0.450**
5-year return period rainfall of 60 minutes duration; M5_60min = **20.0 mm**
Increase of rainfall intensity due to global warming; p_{climate} = **40 %**
Factor Z1 (Wallingford procedure); Z1 = **0.39**
Rainfall for 5min storm with 5 year return period; $M5_{5min_i} = Z1 \cdot M5_{60min} \cdot (1 + p_{climate}) = \mathbf{10.9\ mm}$
Factor Z2 (Wallingford procedure); Z2 = **1.92**
Rainfall for 5min storm with 100 year return period; M100_5min = Z2 · M5_5min_i = **21.0 mm**
Design rainfall intensity; I_{max} = M100_5min / D = **252.2 mm/hr**

Maximum surface water runoff

Catchment area; A_{catch} = **667 m²**
Percentage of area that is impermeable; p = **100 %**
Maximum surface water runoff; $Q_{max} = A_{catch} \cdot p \cdot I_{max} = \mathbf{46.7\ l/s}$

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ATTENUATION STORAGE EA DEFRA METHOD

ATTENUATION DESIGN

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

Tedds calculation version 1.0.04

EA_Defra method

Site characteristics

Location;	Bristol
Hydrological region;	8
Soil type (Wallingford Procedure W.R.A.P map);	4
Standard percentage runoff;	SPR = 0.47
Average annual rainfall;	SAAR = 850 mm
5 year return period rainfall of 60 minute duration;	M5_60min = 20.0 mm
Ratio 60-minute to 2 day rainfalls of 5 year return;	r = 0.35
Rainfall intensity increase due to global warming;	p _{climate} = 40 %
Impervious area req. attenuation storage;	α = 100.0 %

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%);	Impermeable. area (ha)
1;	Proposed Building ;	0.07;	100.0;	0.07;
Total		0.07;	100.0;	0.07;

Greenfield runoff rates

Catchment area;	AREA = 50.00 hectare
Greenfield runoff rate (50 hectare site);	$\bar{Q}_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} \cdot (\text{AREA}/1\text{km}^2)^{0.89} \cdot (\text{SAAR}/1\text{mm})^{1.17}$ SPR ^{2.17} = 303.0 l / s
Greenfield runoff rate;	$\bar{Q} = \bar{Q}_{\text{rural}} / \text{AREA} \cdot A = \mathbf{0.4}$ l / s
Greenfield runoff rate per unit area;	$\bar{Q}_A = \bar{Q} / A = \mathbf{6.1}$ l / s / hectare

Estimated site discharges

FSR growth rate (1 year);	FSR _{1yr} = 0.78
Discharge (1 year);	Q _{1yr} = $\bar{Q} \cdot \text{FSR}_{1\text{yr}} = \mathbf{0.3}$ l/s
FSR growth rate (30 year);	FSR _{30yr} = 1.95
Discharge (30 year);	Q _{30yr} = $\bar{Q} \cdot \text{FSR}_{30\text{yr}} = \mathbf{0.8}$ l/s
FSR growth rate (100 year);	FSR _{100yr} = 2.43
Discharge (100 year);	Q _{100yr} = $\bar{Q} \cdot \text{FSR}_{100\text{yr}} = \mathbf{1.0}$ l/s

Estimated attenuation volume - 1 year

Attenuation storage vol (fig A7.1 - A7.8);	Uvol _{1yr} = 152.5 m ³ / hectare
Basic storage volume ;	BSV _{1yr} = Uvol _{1yr} · α · A = 10.68 m ³
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);	FF _{1yr} = 1.05
Storage volume ratio (fig A8.1 - A8.8);	SVR _{1yr} = 1.52
Adjusted storage volume;	ASV _{1yr} = SVR _{1yr} · BSV _{1yr} = 16.19 m ³
Hydrological regional volume ratio (fig A9.1);	HR _{1yr} = 1.03
Final estimated attenuation storage;	Vol _{1yr} = HR _{1yr} · ASV _{1yr} = 16.60 m ³

Library item: Estimated attenuation output

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Estimated attenuation volume - 30 year

Attenuation storage vol (fig A7.1 - A7.8);

$$Uvol_{30yr} = \mathbf{335.0 \text{ m}^3 / \text{hectare}}$$

Basic storage volume ;

$$BSV_{30yr} = Uvol_{30yr} \cdot \alpha \cdot A = \mathbf{23.45 \text{ m}^3}$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);

$$FF_{30yr} = \mathbf{1.00}$$

Storage volume ratio (fig A8.1 - A8.8);

$$SVR_{30yr} = \mathbf{1.64}$$

Adjusted storage volume;

$$ASV_{30yr} = SVR_{30yr} \cdot BSV_{30yr} = \mathbf{38.36 \text{ m}^3}$$

Hydrological regional volume ratio (fig A9.1);

$$HR_{30yr} = \mathbf{1.05}$$

Final estimated attenuation storage;

$$Vol_{30yr} = HR_{30yr} \cdot ASV_{30yr} = \mathbf{40.18 \text{ m}^3}$$

Library item: Estimated attenuation output

Estimated attenuation volume - 100 year

Attenuation storage vol (fig A7.1 - A7.8);

$$Uvol_{100yr} = \mathbf{415.0 \text{ m}^3 / \text{hectare}}$$

Basic storage volume ;

$$BSV_{100yr} = Uvol_{100yr} \cdot \alpha \cdot A = \mathbf{29.05 \text{ m}^3}$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4);

$$FF_{100yr} = \mathbf{1.00}$$

Storage volume ratio (fig A8.1 - A8.8);

$$SVR_{100yr} = \mathbf{1.64}$$

Adjusted storage volume;

$$ASV_{100yr} = SVR_{100yr} \cdot BSV_{100yr} = \mathbf{47.52 \text{ m}^3}$$

Hydrological regional volume ratio (fig A9.1);

$$HR_{100yr} = \mathbf{1.09}$$

Final estimated attenuation storage;

$$Vol_{100yr} = HR_{100yr} \cdot ASV_{100yr} = \mathbf{51.59 \text{ m}^3}$$

Library item: Estimated attenuation output

Attenuation storage required

Vol. increase due to head-discharge relationship;

$$p_{hydro} = \mathbf{1.25}$$

Maximum attenuation storage required;

$$V_{req_max} = Vol_{30yr} \cdot p_{hydro} = \mathbf{50.2 \text{ m}^3}$$

Interception storage

Interception rainfall depth;

$$d_{int} = \mathbf{5 \text{ mm}}$$

Volume of interception storage required;

$$V_{int_req} = 0.8 \cdot A_{imp} \cdot d_{int} = \mathbf{2.80 \text{ m}^3}$$

Long term storage

Proportion of paved area draining in to network;

$$\alpha = \mathbf{1.0}$$

Proportion of pervious area draining in to network;

$$\beta = \mathbf{0.5}$$

Rainfall depth for 100years, 6 hour event;

$$RD = M100_360 = \mathbf{86.7 \text{ mm}}$$

Extra runoff vol of dev.runoff over greenfield runoff;

$$Vol_{xs} = \max(RD \cdot A \cdot (PIMP \cdot \alpha \cdot 0.8 + ((1 - PIMP) \cdot \beta \cdot SPR) - SPR), 0 \text{ m}^3) = \mathbf{20.02 \text{ m}^3}$$

Treatment volume

Treatment volume (assume 80% runoff);

$$T_{vol} = 0.8 \cdot A \cdot 15 \text{ mm} \cdot PIMP = \mathbf{8.40 \text{ m}^3}$$

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