

Doc. Ref.	29528-CALC-0101
Sheet	1 of 7
Engineer	Z. Jordan
Date	23 Apr 25
Revision	-

DESIGN CALCULATIONS FRONT SHEET

SCHEME	Horncastle House Nursing Home, Plawhatch Lane, Sharpthorne
CLIENT	QED Planning
ASPECTS OF SCHEME TO BE DESIGNED	Brownfield Calculations Greenfield Calculations Surface water attenuation design and simulation results for the 50%AEP, 3.3%AEP40CC and 1%AEP45CC event for the development site.
CODES OF PRACTICE, DESIGN SPECIFICATIONS & BRITISH STANDARDS	- Design and analysis of urban storm drainage. Wallingford Procedure Vol.1 - Sustainable Drainage Systems- Non-Statutory technical standards for Sustainable drainage systems- 2015 - The SuDS Manual – CIRIA C753
NOTES	Brownfield runoff conditions have been calculated using the Modified Rational Method to calculate the Brownfield Discharge Rates. For the existing impermeable area of 0.88ha, the peak discharge rate has been calculated as 110.09l/s based on a rainfall intensity of 50mm/hr. Greenfield runoff conditions have been calculated using the FEH module within Causeway Flow. For the proposed impermeable area of 0.95ha, the peak discharge rate has been calculated as 6.1l/s. This is a 95% betterment from the original site. In accordance with the National SuDS standards the drainage strategy involves conveying surface water flows to a geo-cellular tank via permeable paving. This geo-cellular tank will then discharge at the greenfield discharge rate of 6.1l/s into the existing assumed discharge manhole in the east of the site into the ditch network within Horncastle Wood.

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2	Modified Rational Method to calculated Brownfield Discharge Rate based on a rainfall intensity of 50mm/hr.	TS	23.04.2025
3 - 7	Surface Water Sewer design details for the 50%, 3.3%AEP40CC and 1%AEP45CC simulation results	TS	23.04.2025



Brownfield Run-off Calculation

Project: Horncastle House Nursing Home, Plawhatch Lane, Sharpthorne
File Ref: 29528
O.S. Grid Ref: 539175 , 132267

The Rational Method equation used to calculate peak stormwater runoff rate is:

$$Q = 2.78 CiA$$

Where;

Q = The peak stormwater runoff rate from the drainage area (L/S).

2.78 = Conversion factor to use standard units.

C = Runoff coefficient for drainage area (A).

i = The intensity of the design storm for peak runoff calculation (mm/hr).

A = The area of the watershed that drains to the point for which the peak runoff rate is calculated (ha).

The following figures will be used to calculate the peak runoff for the site;

C = 0.9, as not all run-off will discharge from the site.

i = 50 mm/hr

A = 0.88 ha

Peak run-off for the site;

$$Q = 2.78 \times 0.9 \times 50 \times 0.88$$

$$Q = 110.088 \text{ l/s}$$



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Attenuation Tank	0.950	4.00	167.500	1500	2.200
HydroBrake			167.500	1500	2.300
Outfall			164.530	1500	2.930

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	Attenuation Tank	HydroBrake	10.000	0.600	165.300	165.200	0.100	100.0	525	4.07	100.0
1.001	HydroBrake	Outfall	15.000	0.600	165.200	161.600	3.600	4.2	525	4.10	100.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.240	484.8	343.3	1.675	1.775	0.950	0.0	327	2.420
1.001	11.023	2386.2	343.3	1.775	2.405	0.950	0.0	133	7.939

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	10.000	100.0	525	Circular	167.500	165.300	1.675	167.500	165.200	1.775
1.001	15.000	4.2	525	Circular	167.500	165.200	1.775	164.530	161.600	2.405

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Attenuation Tank	1500	Manhole	Adoptable	HydroBrake	1500	Manhole	Adoptable
1.001	HydroBrake	1500	Manhole	Adoptable	Outfall	1500	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
Attenuation Tank	167.500	2.200	1500					
				0	1.000	165.300	525	
HydroBrake	167.500	2.300	1500		1	1.000	165.200	525
				0	1.001	165.200	525	
Outfall	164.530	2.930	1500		1	1.001	161.600	525

**Simulation Settings**

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	5.5
Summer CV	1.000	Drain Down Time (mins)	240	30 year (l/s)	12.2
Winter CV	1.000	Additional Storage (m ³ /ha)	0.0	100 year (l/s)	15.2
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	45	0	0
30	40	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1	QMed	5.5
Greenfield Method	FEH	QBar/QMed conversion factor	1.111	QBar	6.1
Positively Drained Area (ha)	0.950	Growth Factor 1 year	0.85	Q 1 year (l/s)	
SAAR (mm)	865	Growth Factor 30 year	1.95	Q 30 year (l/s)	
Host	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	
BFIHost	0.441	Betterment (%)	0		

Node HydroBrake Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	165.200	Product Number	CTL-SHE-0106-6100-1700-6100
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.1	Min Node Diameter (mm)	1200

Node Attenuation Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	165.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	635.0	0.0	1.600	635.0	0.0	1.601	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Attenuation Tank	360	165.588	0.288	38.8	173.9992	0.0000	OK
360 minute summer	HydroBrake	304	165.599	0.399	20.9	0.7050	0.0000	OK
15 minute summer	Outfall	1	161.600	0.000	5.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	Attenuation Tank	1.000	HydroBrake	19.7	0.261	0.041	1.4858	
360 minute summer	HydroBrake	Hydro-Brake®	Outfall	5.8				174.6

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Attenuation Tank	705	166.410	1.110	51.1	671.3210	0.0000	SURCHARGED
720 minute winter	HydroBrake	705	166.410	1.210	19.6	2.1373	0.0000	SURCHARGED
15 minute summer	Outfall	1	161.600	0.000	5.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	Attenuation Tank	1.000	HydroBrake	19.6	0.439	0.041	2.1603	
720 minute winter	HydroBrake	Hydro-Brake®	Outfall	5.8				278.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Attenuation Tank	1380	166.866	1.566	40.4	947.4270	0.0000	SURCHARGED
1440 minute winter	HydroBrake	1380	166.866	1.666	21.1	2.9437	0.0000	SURCHARGED
15 minute summer	Outfall	1	161.600	0.000	5.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	Attenuation Tank	1.000	HydroBrake	21.1	0.413	0.043	2.1603	
1440 minute winter	HydroBrake	Hydro-Brake®	Outfall	6.0				528.6