

**STONE CONSULTING
ENGINEERS LTD.**

**CONSULTING CIVIL, STRUCTURAL AND
FOUNDATION ENGINEERS**

Hundred Acres House
Wickham
Hampshire
PO17 4ED

117 Barrack Lane
Aldwick
West Sussex
PO21 4ED

Job No. 1876

Date: Mar 2019

QA INFORMATION

CLIENT:	Wickland
JOB ID:	White Cottage, Walberton
SCOPE OF WORK:	Soakaway Design
DESIGN CODES AND REFERENCES:	BRE 365
SOFTWARE:	MS EXCEL
SUB-SOIL/ FOUNDATION DATA:	N/A

MATERIAL DATA

CONCRETE:	
REINFORCEMENT:	
STEELWORK:	
TIMBER:	
OTHER:	
	Field observation by others

OTHER INFORMATION / NOTES

Rev A	First issue
Rev B	Revised area calculation

STONE CONSULTING ENGINEERS LTD

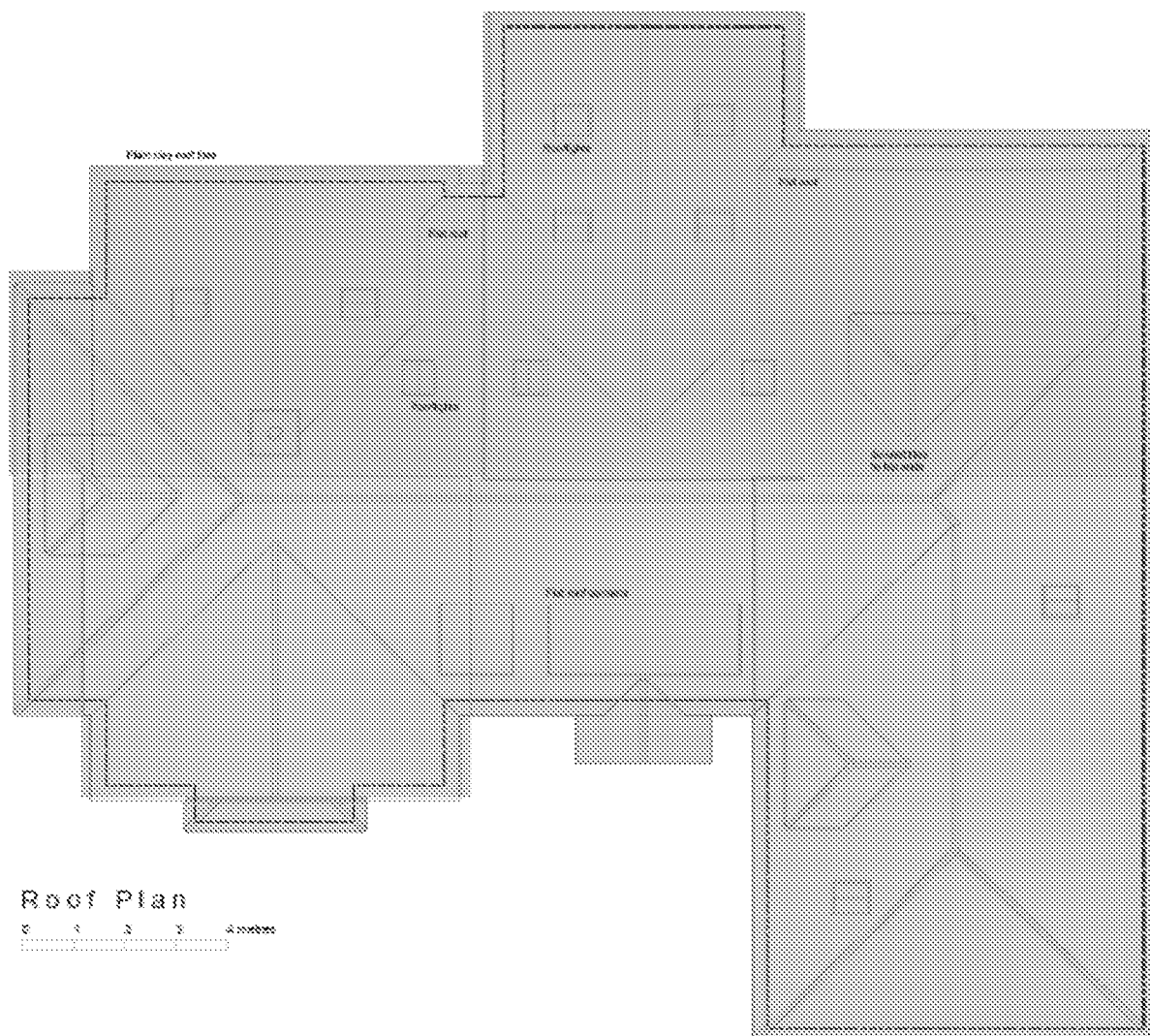
Project:	White Cottage, Walberton	Date:	Mar 2019	Made by:	KS	Sheet No.	1
CALCULATION SHEET		Job No.	1876	Chkd:	-	Rev.	A

SUMMARY:

The calculation is based on a 100 year return period with a 40% allowance for Climate Change.

Soakaways (2.5 x 1.0 x 0.8m below invert level), located to the front and rear of the property are required to attenuate and discharge surface water.

The infiltration rate has been derived from infiltration testing at site in general accordance with BRE 365. The



Roof areas draining into soakaways to

Rear (blue) = 174.00 m²

Front (red) = 170.00 m²

Design soakaways to accommodate 178m² of roof area

STONE CONSULTING ENGINEERS LTD

Project: White Cottage, Walberton	Date: Mar 2019	Made by: KS	Sheet No. 2
CALCULATION SHEET	JobNo. 1876	Chkd: -	Rev. A

SOAKAWAY DESIGN TO BRE(1991)

SOAKAWAY DETAILS

Ring		Pit/crates	
Soakaway size, Ds =	1.50 m	Length =	2 m
Depth of below invert, Hs =	1.50 m	Width =	1.5 m
		Depth below invert =	0.8 m
Free volume, S =	2.65 m ³	=	2.40 m ³
Rubble filled volume, S' =	0.80 m ³	=	0.79 m ³

INITIAL SOAKAWAY SIZING

Drained area to soakaway = 174.00 m²
 Climate change allowance = 40 %

INFLOW

Inflow, I = (run off area) x (design rainfall)
 = A x (M10-D)

DESIGN RAINFALL

Return period = 100 yrs
 Ratio of 60 min to 2-Day rainfalls of 5 year return period, r = 0.35 BRE(1991) Fig 1.

M5 rainfalls are calculated from table 1 (BRE 365) using Z1 factor

Storm						100 yr + 40%	
duration	Z1	M5-D	Z2 M10	M10-D*	Z2 M100	rainfall	
(mins)		(mm)	(cor. Fac)	rainfall	Design		
5	0.38	7.5	1.19	12.50	1.84	19.32	
10	0.53	10.5	1.22	17.93	1.92	28.22	
15	0.64	12.7	1.23	21.87	1.96	34.85	
30	0.81	16.1	1.22	27.50	2.00	45.08	
60	1.00	20	1.24	34.72	2.03	56.84	
120	1.21	24.1	1.24	41.84	2.01	67.82	
240	1.45	28.9	1.22	49.36	1.97	79.71	
360	1.61	32.1	1.21	54.38	1.94	87.18	
600	1.80	35.9	1.2	60.31	1.90	95.49	
1440	2.24	44.8	1.18	74.01	1.81	113.52	

* including 40% for climate change

OUTFLOW

Soil infiltration rate, f = 2.05E-03 m/sec
 effective storage depth, a(50) = H x .5 = 0.75 m (ring)
 Outflow /sec = 3.142 x Dia x a(50) = 7.25E-03 m3/sec (ring)

effective storage depth, a(50) = H x .5 = 0.4 m (pit)
 Outflow /sec = 2 (L + W) x a(50) x f = 5.74E-03 m3/sec (pit)

STONE CONSULTING ENGINEERS LTD

Project: White Cottage, Walberton	Date: Mar 2019	Made by: KS	Sheet No. 3
CALCULATION SHEET	JobNo. 1876	Chkd: -	Rev. A

STORAGE CAPACITY

$$\text{Storage capacity, } S = \text{Inflow} - \text{Outflow}$$

$$= I - O = [A \times (M10-D)] - O$$

Ring soakaway

Storm duration (mins)	Inflow S(1) m ³	Outflow Max m ³	Required capacity m ³
5	3.36	2.17	1.19
10	4.91	4.35	0.56
15	6.06	6.52	n/a
30	7.84	13.05	n/a
60	9.89	26.10	n/a
120	11.80	52.19	n/a
240	13.87	104.39	n/a
360	15.17	156.58	n/a
600	16.62	260.96	n/a
1440	19.75	626.31	0

Max required capacity = **1.19**
 Max ring capacity = **2.65** *OK*
 Rubble filled volume = **0.80** *FAIL*

Pit/crates soakaway

Outflow Max m ³	Required capacity m ³
1.72	1.64
3.45	1.47
5.17	0.90
10.34	n/a
20.67	n/a
41.35	n/a
82.70	n/a
124.05	n/a
206.75	0
496.19	0

= **1.64**
 Free volume = **2.40** *OK*
 Rubble filled volume = **0.79** *FAIL*

Storage volume

Ring soakaway

Diameter	1.50 m	Unfilled	Status <i>OK</i>
Depth below invert =	1.50 m	Filled	FAIL

Pit or terno

Length =	2.00 m	Unfilled	Status <i>OK</i>
Width =	1.50 m	Filled	FAIL
Depth below invert =	0.8 m		

Select pit/crate soakaway

SUMMARY:

The design indicates that 1.5m x 1.0 x 1.2m deep soakaways located in the front and rear garden would be sufficient to cater for run-off from the roof areas.

A soakaways would be formed using 9 AquaCell or similar crates of 1 x 0.5 x 0.4(high) installed in accordance with manufacturers recommendations.

STONE CONSULTING ENGINEERS LTD

Project: White Cottage, Walberton

Date: Mar 2019

Made by: KS

Sheet No. 4

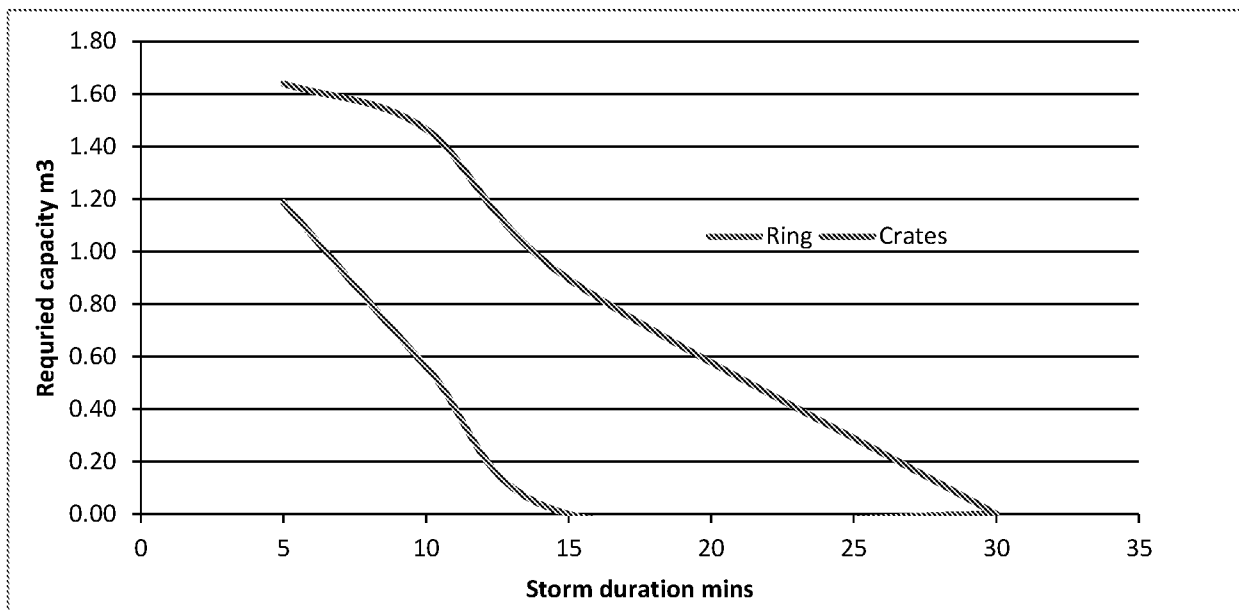
CALCULATION SHEET

JobNo. 1876

Chkd: -

Rev. A

Soakaway performance



Estimation of infiltration rate

Site conditions : Permeable silty GRAVEL

Soakage test data

Test hole A

Depth of water at start of test = 0.56 m

Length of pit = 1 m

Width of pit = 0.38 m

Water level drop of 0.56 m in 1.5 mins

Total volume out = 0.2128 m³

Mean area sides = 0.7728 m² (50% of water depth)

Area base = 0.38 m²

Total outflow area = 1.1528 m²

Infiltration rate = 2.05E-03 m/sec

The ground is confirmed as highly permeable.

Depth to water table

It should be noted that the water table was not encountered in a trial excavation to a depth of 2.5m.

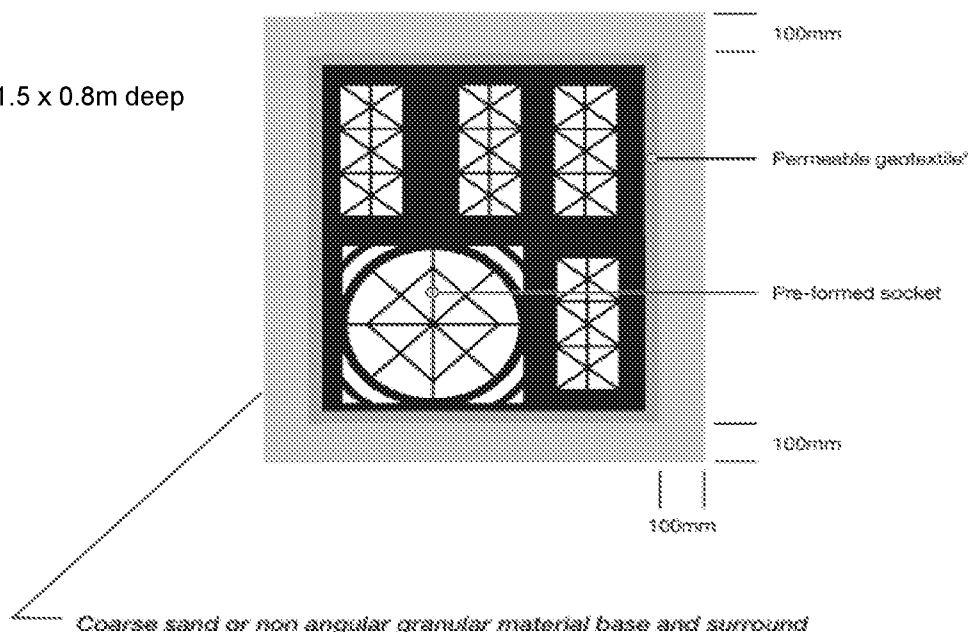
STONE CONSULTING ENGINEERS LTD

Project: White Cottage, Walberton	Date: Mar 2019	Made by: KS	Sheet No. 5
CALCULATION SHEET	JobNo. 1876	Chkd: -	Rev. A

Typical installation procedure for AquaCell Eco (or similar) crated

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand or non angular granular material, level and compact.
3. Lay the geotextile over the base and up the sides of the trench.
4. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below). For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
5. Fix the Adaptors to the AquaCell units as required and connect pipework.
6. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework.
7. Wrap and overlap the geotextile covering the entire AquaCell structure.
8. Lay 100mm of coarse sand or non angular granular material between the trench walls and the AquaCell structure and compact.
9. Lay 100mm of coarse sand or non angular granular material over the geotextile and compact.
10. Backfill with suitable material.
11. Rainwater from roof areas may discharge directly into the soakaway but rainwater from carparks must discharge through a catchpit manhole and/or a petrol interceptor.

Pit to be 2 x 1.5 x 0.8m deep



Notes:

1. Crates installed in 2 layers to give 0.8m depth below invert level
2. Modular crate size 1m x 0.5 x 0.4m
3. AquaCell Prime or similar product to be used in areas subject to traffic such as below driveways.