

**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. 1870

Date: May 2019

QA INFORMATION

CLIENT:	Aaron Millar
JOB ID:	37 Hill Lane. Barnham
SCOPE OF WORK:	Surface water run-off
DESIGN CODES AND REFERENCES:	BRE 365 The Building Regulations
SOFTWARE:	MS EXCEL
SUB-SOIL/ FOUNDATION DATA:	N/A

MATERIAL DATA

CONCRETE:	
REINFORCEMENT:	
STEELWORK:	
TIMBER:	
OTHER:	

OTHER INFORMATION / NOTES

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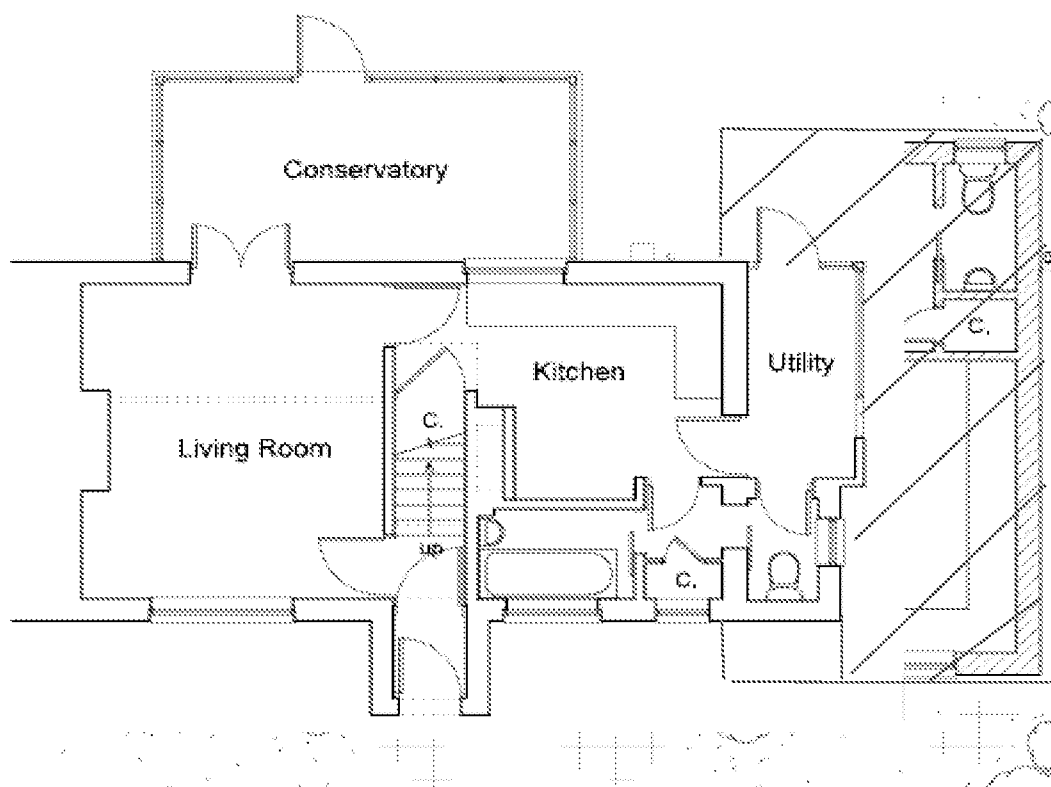
Project:	37 Hill Lane. Barnham	Date:	May 2019	Made by:	KS	Sheet No.	1
CALCULATION SHEET		Job No.	1870	Chkd:	-	Rev.	0

Summary:

The site is underlain by 'Brickearth'. Groundwater monitoring on the an adjacent site recorded a maximum winter (march) water table at a depth of 3.6m bgl.

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

A discharge rate of 2 l/sec has been agreed and at this discharge rate no attenuation is required. Discharge can be direct to watercourse.



New roof area (shown hatched) = **23.20** m2

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Project: 37 Hill Lane. Barnham	Date: May 2019	Made by: KS	Sheet No. 2
CALCULATION SHEET	JobNo. 1870	Chkd: -	Rev. 0

SOAKAWAY DESIGN TO BRE(1991)

SOAKAWAY DETAILS

Ring		Pit/crates	
Soakaway size, Ds =	0.00 m	Length =	0.00 m
Depth of below invert, Hs =	0.00 m	Width =	0.00 m
		Depth below invert =	0.00 m
Free volume, S =	0.00 m ³		0.00 m ³
Rubble filled volume, S' =	0.00 m ³		0.00 m ³

INITIAL SOAKAWAY SIZING

Drained area =	23.20 m ²
Climate change allowance =	40 %

INFLOW

$$\text{Inflow, I} = (\text{run off area}) \times (\text{design rainfall})$$

$$= A \times (M10-D)$$

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 duration (hrs)	Storm duration (mins)	Z1	M5-D (mm)	Z2 M10 (cor. Fac)	M10-D* rainfall	Z2 M100 Design	100 yr + 40%	
							rainfall	
0	5	0.36	7.2	1.19	12.00	1.84	18.55	
0	10	0.54	10.8	1.22	18.45	1.92	29.03	
0	15	0.65	13	1.23	22.39	1.96	35.67	
1	30	0.82	16.4	1.24	28.47	2.00	45.92	
1	60	1	20	1.24	34.72	2.03	56.84	
2	120	1.19	23.8	1.24	41.32	2.01	66.97	
4	240	1.39	27.8	1.23	47.87	1.97	76.67	
6	360	1.53	30.6	1.22	52.26	1.94	83.11	
10	600	1.7	34	1.21	57.60	1.90	90.44	
24	1440	2.07	41.4	1.19	68.97	1.81	104.91	
36	2160	2.38	47.6	1.17	77.97	1.75	116.62	

* including 40% for climate change

OUTFLOW

Outflow via regulator = 2.00E+00 l/sec

Outflow /sec = 2.00E-03 m3/sec (ring)

Outflow /sec = 2.00E-03 m3/sec (pit)

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STORAGE CAPACITY

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

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

Ring soakaway					Pit/crates soakaway			
Storm duration (hrs)	Storm duration (mins)	Inflow S(1) m ³	Outflow Max m ³	Required capacity m ³	Inflow rate l/sec	Outflow Max m ³	Outflow rate l/sec	Required capacity m ³
0	5	0.43	0.00	n/a	1.43	0.60	2.00	n/a
0	10	0.67	1.20	n/a	0.81	1.20	2.00	n/a
0	15	0.83	1.80	n/a	0.51	1.80	2.00	n/a
1	30	1.07	3.00	n/a	0.26	3.60	2.00	n/a
1	60	1.32	7.20	n/a	0.14	7.20	2.00	n/a
2	120	1.55	14.40	n/a	0.07	14.40	2.00	n/a
4	240	1.78	28.80	n/a	0.03	28.80	2.00	n/a
6	360	1.93	43.20	n/a	0.02	43.20	2.00	n/a
10	600	2.10	72.00	n/a	0.01	72.00	2.00	n/a
24	1440	2.43	172.80	n/a	0.01	172.80	2.00	n/a
Max required capacity = 0.00					= 0.00			
Max ring capacity = 0.00					Free volume = 0.00			
Rubble filled volume = 0.00					Rubble filled volume = 0.00			

Summary

The estimated of run-off predicts a maximum volume of run-off rate of 1.43 l/sec which reduces with time as the design storm dies out.

Installation is to be in accordance with manufacturers details.

Typical installation/construction details for a crate storage system are presented in the following pages.

Installation Guidance

AquaCell Units

AquaCell Prime, Core and Plus: Construction Loads

Construction plant such as excavators can impose significant loads on any AquaCell unit. The following guidelines should be observed:

- ① Tracked excavators (not exceeding 21 tonnes weight) should be used to place fill over the AquaCell units when the geotextile or geomembrane wrapping has been completed
- ① At least 300mm of fill should be placed before the excavators or trucks delivering the backfill are allowed to traffic over the installed units
- ① Compaction plant used over the AquaCell units should not exceed 2300kg/metre width. This will allow the compaction of Type 1 sub-base in 150mm layers over the units in accordance with the Specification for Highways Works
- ① All other construction plant should be prevented from trafficking over the system once it is installed and surfacing completed, unless a site specific assessment demonstrates that it is acceptable
- ① In particular cranes should not be used over, or place their outriggers over the system

AquaCell Eco: Construction Loads

As AquaCell Eco is designed for landscaped and non-loaded applications, certain precautions are recommended on site to prevent damage to the units through excess loading.

Manual assembly

Whilst assembling the tank, it may be necessary to walk on top of previously laid AquaCell units. Therefore care should be taken not to damage the edges of the units.

Backfilling

When backfilling AquaCell Eco installations:

- ① Machines placing the material must be located OFF the units
- ① Only light compaction should be applied to the material
- ① Backfill with suitable, stone-free, as-dug material
- ① First layer should be 300mm thick before using any compaction plant
- ① NO vibratory mechanism should be used for compacting this first layer
- ① Compaction plant must not exceed 2300kg per metre width

Construction traffic on site

If construction plant (e.g. excavators or loaders) are likely to run over the installation:

- ① MINIMUM protective cover should be 500mm well-compacted granular material
- ① Only tracked excavators can be used and MUST NOT weigh more than 14 tonnes.
- ① HGVs MUST NOT run over installed AquaCell Eco units

Manual assembly

All ancillaries and adaptors (see page 8) can be used with either the AquaCell Eco, Prime, Core or Plus units, except the 225mm Flange Adaptor (6LB106) which must only be used with AquaCell Prime, Core or Plus.

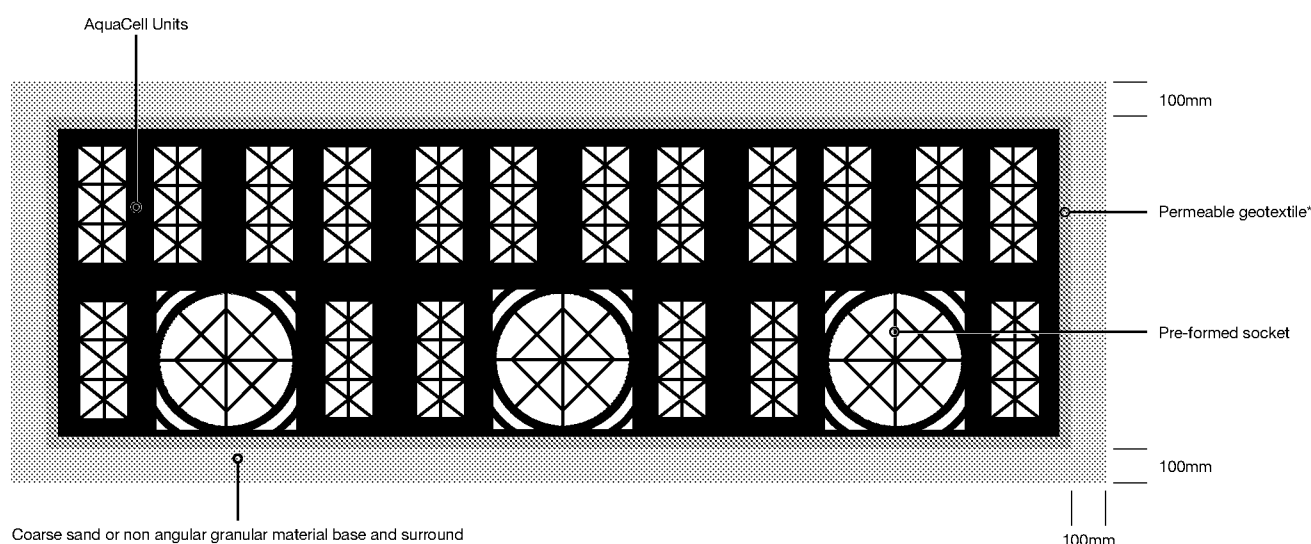
The 150mm Flange Adaptor (6LB104) should only be used when constructing an air vent on the top surface of an AquaCell Eco unit. The adaptor should not be used to connect inlet pipes to the side of an Eco unit.

Installation AquaCell Units

Typical Soakaway Installation Method

Typical installation procedure

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) – see page 12. 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 – see page 17 for installation guidelines.
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.



Example shows the use of AquaCell Eco. However, a soakaway can also be installed as shown using either of the other versions of AquaCell units (Prime, Core or Plus) as appropriate.

**The geotextile should be selected according to specific site conditions. Typically, however, a 300g non-woven material will be suitable. Specialist advice should be sought if surrounding soil characteristics exhibit a high degree of fines/low infiltration capacity and/or there is a high risk of damage from ground contaminants.*