

21 August 2019

Laura Gibbons
Arun District Council
By Email: Laura.gibbons@arun.gov.uk
Cc: [REDACTED]

Reference: Soakage Test Workshop

Dear Laura,

Ferring Country Centre Proposed Workshop – Soakage Testing

The following investigation was carried out at Ferring Country Centre between the 6 and 8 August 2019. Weather conditions were cloudy with some light showers on the day of testing.

Preparation

On the 6 August 2019 a trial pit was excavated 2m by 2m and 1.5m deep at the proposed soakaway location.

The soils and geology consisted of made ground and topsoil to 0.5 metres below ground level (mbgl) overlying a silty sandy alluvial material with some flints and stone overlying a weathered Chalk surface at 1.5mbgl.

The trial pit was filled for 2 hours using a mains water connection and left to drain overnight.

Soakage Test

The soakage test was carried out 7 August 2019 and was noted to be dry at the start of the test.

Filling took place over 2 hours and 40 minutes, a total of 160 minutes, at a measured rate of 0.57 Litres/Second from the mains connection. This equated to a total inflow volume of 5.45m³.

The water level in the trial pit reached 0.73mbgl and at 11:50 the test commenced.

Water levels were monitored manually using a dip tape secured on the eastern side of the trial pit. Readings were collected every minute for the first 10 minutes, every 5 minutes for the next 20 minutes and then every 10 minutes for the remainder of the test = 300 minutes (5 Hours).

The starting depth to water at Time=0 was 0.73 metres below ground level (mbgl) and the final level at Time=300 minutes was 1.15mbgl. The trial pit was reported dry on the morning of 8 August 2019.

Soil Infiltration Rate

Analysis of this data has been carried out with reference to the BRE365 Digest.

The test data presented in Attachment A and summarised in Figure 1 shows that during the 5 hour testing period water levels did not recede to the 25% full level. As a result, water levels beyond 300 minutes, have been projected using a straight line (Figure 2) with the x intercept at 25% was calculated to be 408 minutes. Early data, i.e. pre-90 minutes and above 75% fill, has been removed to calculate the equation for the straight line.

Using these figures, based on the 75% to 25% projected values the Soil Infiltration Rate (f) is equivalent to 1.1×10^{-05} m/second.

Roof Drainage

The proposed roof area is 106.29m² (7.32 x 14.53m).

A copy of the Micro Drainage calculations from previous work carried out on site are presented in Attachment B showing storm durations ranging from 15 minutes to 48 hours.

A climate change allowance of 40% has been applied by back-calculating the 1 in 100 year event plus 30%.

The revised figures are shown in the table below, Column D:

Table 1 1 in 100 Year Rainfall + 40% per hour

Column A	Column B	Column C	Column D
Storm Duration (minutes)	Winter/Summer	1 in 100 + 30% Rainfall (mm/hr)	1 in 100 + 40% Rainfall (mm/hr)
15	Summer	122.43	131.85
30	Summer	82.24	88.57
60	Summer	52.66	56.71
120	Summer	32.5	35.00
180	Summer	24.12	25.98
240	Summer	19.39	20.88
360	Summer	14.27	15.37
480	Summer	11.46	12.34
600	Summer	9.66	10.40
720	Summer	8.4	9.05
960	Summer	6.72	7.24
1440	Summer	4.91	5.29
2160	Summer	3.57	3.84
2880	Summer	2.85	3.07
4320	Summer	2.07	2.23
5760	Summer	1.64	1.77
7200	Summer	1.38	1.49
8640	Summer	1.19	1.28
10080	Summer	1.06	1.14
15	Winter	122.43	131.85
30	Winter	82.24	88.57
60	Winter	52.66	56.71
120	Winter	32.5	35.00
180	Winter	24.12	25.98
240	Winter	19.39	20.88
360	Winter	14.27	15.37
480	Winter	11.46	12.34
600	Winter	9.66	10.40
720	Winter	8.4	9.05
960	Winter	6.72	7.24
1440	Winter	4.91	5.29
2160	Winter	3.57	3.84
2880	Winter	2.85	3.07
4320	Winter	2.07	2.23
5760	Winter	1.64	1.77
7200	Winter	1.38	1.49
8640	Winter	1.19	1.28
10080	Winter	1.06	1.14

Inflow to Soakaway

Inflow to the soakaway (I) is calculated by:

$$I = A \times R$$

Where:

$$A = 106.29\text{m}^2$$

$$R = 15.37\text{mm}$$

Based on the proposed roof area and 1 in 100 year event plus 40% the anticipated maximum flow rate = water volume collected from the roof = $1.63\text{m}^3/\text{hour}$.

Outflow from the soakaway

The outflow from the soakaway (O) is calculated by:

$$O = as50 \times f \times D$$

where:

$$as50 = 7.08\text{m}^2$$

$$f = 1.1 \times 10^{-5}\text{m/sec}$$

$$D = 6 \text{ hours}$$

The calculated outflow from the soakaway = $1.63\text{m}^3/\text{second}$

Soakaway Storage Volume

The soakaway storage volume (S) is calculated by:

$$\text{Length} \times \text{Width} \times \text{Depth} \times 30\%, \text{ therefore } S = 1.8\text{m}^3$$

Half Drain-Down Time

The half drain-down time ($ts50$) is calculated by:

$$ts50 = S \times 0.5 / as50 \times f$$

$$\text{And} = 3.32 \text{ hours}$$

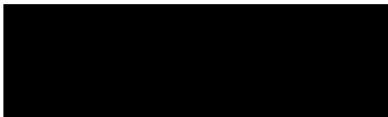
Summary

Based on the flow rate into the trial pit (0.57 Litres/Second) and the amount of time taken to fill, an estimated volume of 5.45m^3 of water was used for the test. With no outflow from the trial pit this would have equated to a water level of 0.14mbgl. Using the measured water level at 2 hours 40 minutes of 0.73mbgl this equates to a volume of 3.08m^3 in the trial pit and a loss of 2.37m^3 into the surrounding formation.

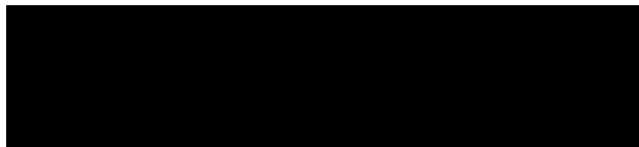
With a loss of over 2m^3 during the first 2 hours 40 minutes and a calculated Soil Infiltration Rate of $1.1 \times 10^{-5}\text{m/sec}$ the soakaway potential appears viable for the proposed development.

Checks carried out in this report, looking at soakaway storage volumes and half drain-down times, also provide some assurance that the proposed size of soakaway (2m x 2m x 1.5m) will be able to manage the roof water during a 1 in 100 year storm event +40% over a 6 hour period.

Yours sincerely



Director & Hydrogeologist



Statement of Limitations

This report was prepared in accordance with the scope of work outlined within this report and is subject to the applicable cost, time and other constraints.

H2Ogeo performed the services on behalf of the Client in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. No warranties, expressed or implied, are made.

Except as otherwise stated, H2Ogeo's assessment is limited strictly to the scope of work outlined in above and does not evaluate structural or geotechnical conditions of any part of the Site (including any buildings, equipment or infrastructure) or outside the Site boundary.

All conclusions and recommendations made in the report are the professional opinions of H2Ogeo personnel involved with the project and, while normal checking of the accuracy of data has been conducted, H2Ogeo assumes no responsibility or liability for errors in data obtained from external sources, regulatory agencies or any other external sources, nor from occurrences outside the scope of this project.

H2Ogeo is not engaged in environmental consulting and reporting for the purpose of advertising, sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity or investment purposes.

This report has been prepared for the sole use of Client. The report may not be relied upon by any other party without the express written agreement of H2Ogeo. The provision of a copy of this report to any third party is provided for informational purposes only and any reliance on this report by a third party is done so at their own risk and H2Ogeo disclaim all liability to such third party to the extent permitted by law.

Any use of this report by a third party is deemed to constitute acceptance of this limitation.

This report does not constitute legal advice.

Figure 1 – 5 Hour Test Data

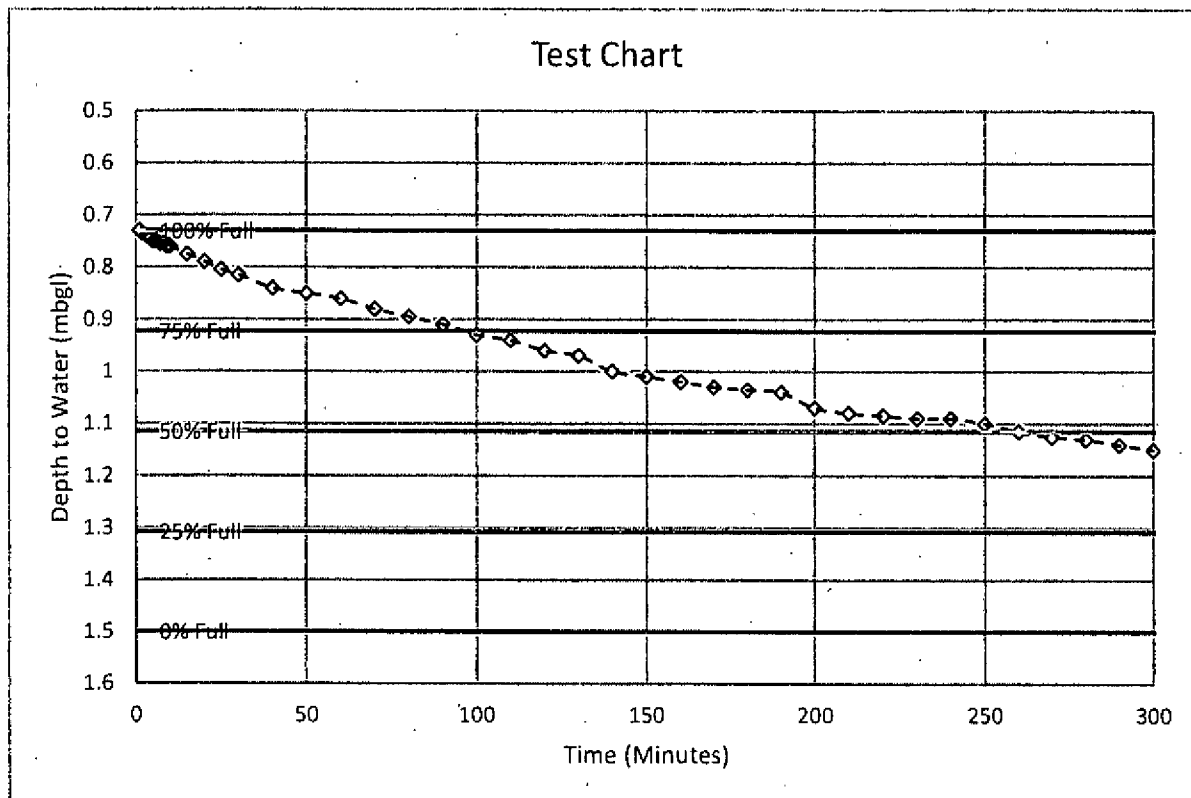
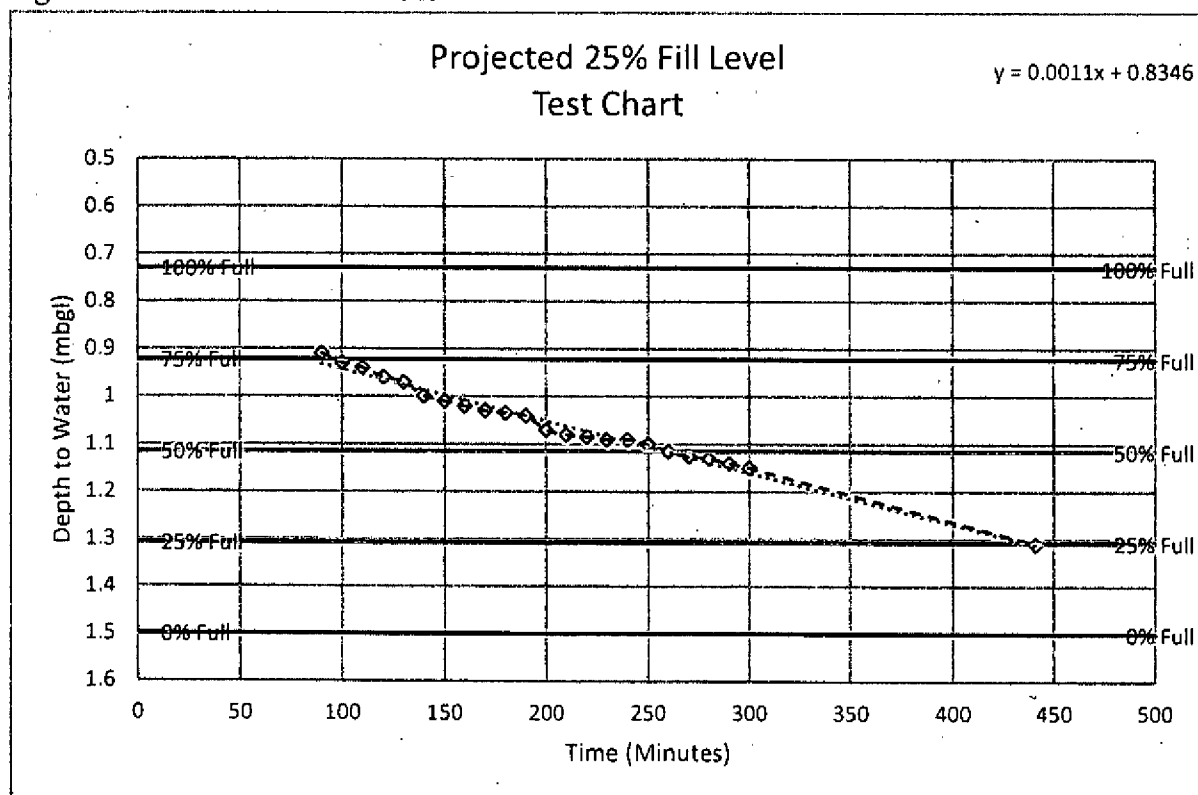


Figure 2 – 75% to 25% Fill Data



Attachment A

Soakage Test Data

Time to fill 2 hours 40 minutes

Fill Start 09:00 6 August 2019

Test Start 11:40 6 August 2019

Test Pit	Value	Unit
Length	2	m
Width	2	m
Depth	1.5	m
Proposed Inlet Invert	0.73	m – only achieved 0.73mbgl fill over 2 hours 40 minutes therefore inlet invert level taken as this.

Time (Minutes)	Depth to Water	Change
1	0.73	0
2	0.735	0.005
3	0.74	0.01
4	0.74	0.01
5	0.75	0.02
6	0.75	0.02
7	0.755	0.025
8	0.755	0.025
9	0.76	0.03
10	0.76	0.03
15	0.775	0.045
20	0.79	0.06
25	0.805	0.075
30	0.815	0.085
40	0.84	0.11
50	0.85	0.12
60	0.86	0.13
70	0.88	0.15
80	0.895	0.165
90	0.91	0.18
100	0.93	0.2
110	0.94	0.21
120	0.96	0.23
130	0.97	0.24
140	1	0.27

150	1.01	0.28
160	1.02	0.29
Time (Minutes)	Depth to Water	Change
170	1.03	0.3
180	1.035	0.305
190	1.04	0.31
200	1.07	0.34
210	1.08	0.35
220	1.085	0.355
230	1.09	0.36
240	1.09	0.36
250	1.1	0.37
260	1.115	0.385
270	1.125	0.395
280	1.13	0.4
290	1.14	0.41
300	1.15	0.42
441	1.31	0.58

Attachment B

Rainfall Duration Calculations – MicroDrainage

Archibald Shaw Limited		Page 1
One Little London Chichester Sussex PO19 1PP	Ferring Country Centre Infiltration Blanket M100+30%	
Date 21.04.2017	Designed By vlc	
File	Checked By	
Micro Drainage		Source Control W.11.2

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 947 minutes

Storm Duration (mins)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	0.3	0.3	99.4643	0.0643	10.2	O K
30 Summer	0.3	0.3	99.4858	0.0858	13.6	O K
60 Summer	0.3	0.3	99.5083	0.1083	17.1	O K
120 Summer	0.3	0.3	99.5308	0.1308	20.6	O K
180 Summer	0.3	0.3	99.5418	0.1418	22.4	O K
240 Summer	0.3	0.3	99.5488	0.1488	23.5	O K
360 Summer	0.3	0.3	99.5573	0.1572	24.8	O K
480 Summer	0.3	0.3	99.5613	0.1612	25.5	O K
600 Summer	0.3	0.3	99.5633	0.1632	25.8	O K
720 Summer	0.3	0.3	99.5633	0.1632	25.8	O K
960 Summer	0.3	0.3	99.5623	0.1622	25.6	O K
1440 Summer	0.3	0.3	99.5583	0.1583	25.0	O K
2160 Summer	0.3	0.3	99.5498	0.1498	23.7	O K
2880 Summer	0.3	0.3	99.5403	0.1403	22.2	O K
4320 Summer	0.3	0.3	99.5208	0.1208	19.1	O K
5760 Summer	0.3	0.3	99.5033	0.1033	16.3	O K
7200 Summer	0.3	0.3	99.4883	0.0883	13.9	O K
8640 Summer	0.3	0.3	99.4758	0.0758	12.0	O K
10080 Summer	0.3	0.3	99.4653	0.0653	10.3	O K
15 Winter	0.3	0.3	99.4723	0.0723	11.4	O K
30 Winter	0.3	0.3	99.4963	0.0963	15.2	O K
60 Winter	0.3	0.3	99.5218	0.1218	19.2	O K
120 Winter	0.3	0.3	99.5468	0.1468	23.2	O K
180 Winter	0.3	0.3	99.5603	0.1602	25.3	O K
240 Winter	0.3	0.3	99.5683	0.1682	26.6	O K
360 Winter	0.3	0.3	99.5788	0.1787	28.2	O K
480 Winter	0.3	0.3	99.5843	0.1842	29.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	122.43	23
30 Summer	82.24	38
60 Summer	52.66	68
120 Summer	32.50	126
180 Summer	24.12	186
240 Summer	19.39	246
360 Summer	14.27	366
480 Summer	11.46	484
600 Summer	9.66	604
720 Summer	8.40	704
960 Summer	6.72	812
1440 Summer	4.91	1056
2160 Summer	3.57	1456
2880 Summer	2.85	1876
4320 Summer	2.07	2680
5760 Summer	1.64	3408
7200 Summer	1.38	4176
8640 Summer	1.19	4848
10080 Summer	1.06	5544
15 Winter	122.43	23
30 Winter	82.24	37
60 Winter	52.66	66
120 Winter	32.50	126
180 Winter	24.12	184
240 Winter	19.39	242
360 Winter	14.27	358
480 Winter	11.46	474