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Etonbrook Investments Ltd

FAO Mr Stephen Wantling

11th December 2021.

Dear Stephen,

COED DERWEN, GROVES LANE, ERBISTOCK, WREXHAM. LL13 0DN

Introduction

Hughes Consulting have been appointed by Etonbrook Investments to carry out a soakaway investigation on land at The Old Farmhouse, Coed Derwen, Groves Lane, Erbistock, Wrexham.

The purpose of the investigation was to provide information on the subsurface conditions at the site for installing soakaways.

This letter report details the study to determine the infiltration characteristics of the superficial deposits.

Infiltration drainage systems rely on the infiltration properties of the surrounding soils to facilitate natural drainage of water within the unsaturated zone that lies above the groundwater table. The system disposes of storm water by providing detention storage during a storm and allowing the water to infiltrate into the underlying soil or rock. The system must be designed so that infiltration occurs quickly enough to be able to deal with the next storm event without overloading the design capacity.

The hydraulic parameters for soakaway systems are based on field permeability tests, and on information provided in the trial pits excavated as part of the investigation.

Soil Infiltration Tests

The purpose of the tests was to determine the soil infiltration rate of the strata identified in the trial pits. This information is required in order to design the infiltration drainage system.

We have some details of the proposed development as shown by the appended layout submitted for planning approval. The object is to construct soakaways where possible and practical to dispose of storm water run-off generated from the roof areas, and possibly the parking areas, although porous hardstanding systems are still an option under consideration.

The fieldwork was carried out based on the advice contained in BRE Digest 365. For the purpose of this report, the design is based on the lowest value of the soil infiltration rate calculated from the **successful** field tests.

Fieldwork

Two trial pits (designated TH1 and TH2) were excavated by a mechanical excavator on 11th December 2021.

The trial pit locations are shown on the site plan which also shows the proposed building arrangement. Both pits revealed gravel soils, which the BGS data records state as the prevailing soils in the area, beneath a topping of loamy topsoil and stony sandy silty clayey soil to shallow depth. Record photographs are appended.

Test Procedure

Following the guidance in BRE Digest 365, the trial pits were filled with water. The water in the pit was allowed to drain to near empty or empty, and the water level recorded at intervals from the time of filling. The pits were then refilled, and the process repeated for readings when the soil had been saturated. The lowest value of infiltration rate is to be used in design,

Infiltration Test Results

Calculations to determine the soil infiltration rate (permeability) of the soil were carried out and the calculated soil infiltration rates are listed below:

Trial Pit No.	Initial Water Depth (m)	Soil Infiltration Rate f (m/sec)
TH 1	0.4	0.0000615 (6.15×10^{-5})
TH 2	0.3	0.0000651 (6.51×10^{-5})

The calculation sheets are appended. These include preliminary soakaway sizing.

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APPENDIX

SOIL INFILTRATION RATE DATA AND CALCULATIONS

RECORD PHOTOGRAPHS

SOAKAWAY SIZING (PRELIMINARY)

SITE PLAN WITH TRIAL HOLE LOCATIONS

SOIL PERCOLATION TEST DATA

SITE – OLD FARM BUILDINGS, COED DERWEN, GROVES LANE, ERBISTOCK WREXHAM

DATE - FRIDAY 10TH DECEMBER 2021

TRIAL HOLE 1

WIDTH 1.3m

LENGTH 1.4m

DEPTH 1.0m

PERCOLATION TEST DATA (TIMES OF EMPTYING)

TEST NUMBER	75% OF VOL	25% OF VOL	25% - 75%
1	10 minutes	42 minutes	32 minutes
2	11.5 minutes	45 minutes	34 minutes

SOIL INFILTRATION RATE:-

$$f = V_{p75-25} / a_{p50} \times t_{p75-25}$$

V_{p75-25} = effective storage volume of water in trial pit between 75% and 25% effective depth

a_{p50} = internal surface area of trial pit up to 50% volume effective depth, including base area

t_{p75-25} = the time for the water to fall from 75% to 25% effective depth

Infiltration rate, worst case – test 2 = $0.364 / 2.9 \times 34 \times 60 = 6.15 \times 10^{-5}$ m/s

SOIL PERCOLATION TEST DATA

SITE – OLD FARM BUILDINGS, COED DERWEN, GROVES LANE, ERBISTOCK WREXHAM

DATE - FRIDAY 10TH DECEMBER 2021

TRIAL HOLE 2

WIDTH 1.2m LENGTH 1.2m DEPTH 1.0m

PERCOLATION TEST DATA (TIMES OF EMPTYING)

TEST NUMBER	75% OF VOL	25% OF VOL	25% - 75%
1	5 minutes	27 minutes	21 minutes
2	6 minutes	30 minutes	24 minutes

SOIL INFILTRATION RATE;- $f = V_{p75-25} / a_{p50} \times t_{p75-25}$

V_{p75-25} = effective storage volume of water in trial pit between 75% and 25% effective depth

a_{p50} = internal surface area of trial pit up to 50% volume effective depth, including base area

t_{p75-25} = the time for the water to fall from 75% to 25% effective depth

Infiltration rate, worst case – test 2 $= 0.216 / 2.3 \times 24 \times 60 = 6.51 \times 10^{-5} \text{ m/s}$



TRIAL HOLE 1



TRIAL HOLE 2



TRIAL HOLE 1 – TEST IN PROGRESS

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area; Liverpool
 Impermeable area drained to the system; $A = 80.0 \text{ m}^2$
 Return period; Period = 10 yr
 Ratio 60 min to 2 day rainfall of 5 yr return period; $r = 0.400$
 5-year return period rainfall of 60 minutes duration; $M5_{60\text{min}} = 19.0 \text{ mm}$
 Increase of rainfall intensity due to global warming; $p_{\text{climate}} = 0 \%$

Soakaway / infiltration trench details

Soakaway type; Rectangular
 Minimum depth of pit (below incoming invert); $d = 1337 \text{ mm}$
 Width of pit; $w = 1000 \text{ mm}$
 Length of pit; $l = 2000 \text{ mm}$
 Percentage free volume; $V_{\text{free}} = 40 \%$
 Soil infiltration rate; $f = 61.5 \times 10^{-6} \text{ m/s}$
 Wetted area of pit 50% full; $a_{50} = l \times d + w \times d = 4012338 \text{ mm}^2$

Table equations

Inflow (cl.3.3.1); $I = M10 \times A$
 Outflow (cl.3.3.2); $O = a_{50} \times f \times D$
 Storage (cl.3.3.3); $S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	10 year rainfall, M10 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5;	0.37;	7.1;	1.20;	8.5;	0.68;	0.07;	0.61
10;	0.52;	9.9;	1.22;	12.1;	0.97;	0.15;	0.82
15;	0.63;	12.0;	1.23;	14.8;	1.18;	0.22;	0.96
30;	0.80;	15.3;	1.24;	18.9;	1.51;	0.44;	1.07
60;	1.00;	19.0;	1.24;	23.6;	1.88;	0.89;	1.00
120;	1.21;	22.9;	1.24;	28.4;	2.27;	1.78;	0.50
240;	1.45;	27.5;	1.23;	33.8;	2.70;	3.55;	0.00
360;	1.60;	30.5;	1.22;	37.1;	2.97;	5.33;	0.00
600;	1.79;	34.1;	1.21;	41.2;	3.29;	8.88;	0.00
1440;	2.24;	42.6;	1.18;	50.4;	4.03;	21.32;	0.00

Required storage volume; $S_{\text{req}} = 1.07 \text{ m}^3$
 Soakaway storage volume; $S_{\text{act}} = l \times d \times w \times V_{\text{free}} = 1.07 \text{ m}^3$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume; $t_{50} = S_{\text{req}} \times 0.5 / (a_{50} \times f) = 36 \text{ min } 9 \text{ s}$

PASS - Soakaway discharge time less than or equal to 24 hours