



CONSULTING ENGINEERS

CIVIL • STRUCTURAL
GEOTECHNICAL • ENVIRONMENTAL

SURFACE WATER DRAINAGE

**WOODLANDS FARM
DODDS LANE
GWERSYLLT
WREXHAM**

**WALES AND WEST
HOUSING ASSOCIATION**

JUNE 2016

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1.0 INTRODUCTION

Robert E Fry & Associates are consulting civil and structural engineers based in Wigan, with over 20 years experience in the appraisal and design of drainage schemes to serve new housing developments, ranging from small developments of 6 units up to 400 units plus.

We are instructed by Wales and West Housing Association to review the surface water drainage options for phase 1 of the above housing development site consisting of 27 properties.

2.0 PROPOSED SURFACE WATER DRAINAGE SOLUTION

There is an established hierarchical process to be adopted when arriving at a surface water drainage solution for a development site set out in part H3 of the Approved Document, summarised in order of preference as follows:

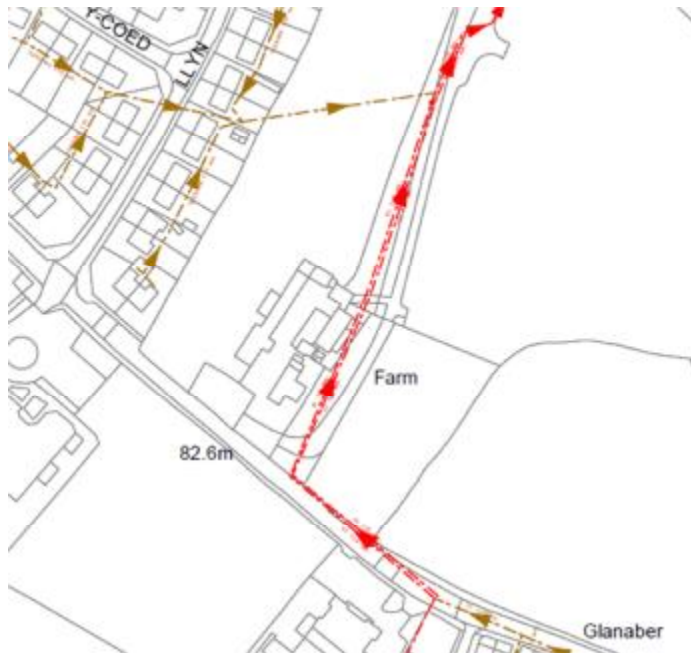
- a. Infiltration / soakaway
- b. Discharge to watercourse
- c. Discharge to sewer

Reference to Geo-Environmental report reference 14155/GEIR dated April 2015 indicates that infiltration may be an option for surface water disposal on this site.

A more detailed review of the trial pit records for this portion of the site indicates that the clay subgrade in some areas is of a stiff nature which in our opinion would preclude the use of traditional soakaways at nominal depths.

There are no watercourses contiguous with or in close proximity to this parcel of land, likewise the sewer records do not indicate any suitable surface water sewers into which the site could connect.

See plan below



It was thus decided in conjunction with our client to explore further the possibility of soakaways using deep bore techniques.

To this end Geo-Ventures were appointed to undertake 2 boreholes and perform falling head tests to ascertain the suitability of strata at a lower level in to which the surface water runoff from this site could discharge.

The boreholes were taken down to depths of 13m below existing ground level.

Standing water was observed in borehole 1 at a depth of 9.25m below ground level and at 9.75m in borehole 2.

250 gallons of water were added to each hole over a 5 minute period.

In both cases the water level was measured immediately and the level of water was noted to have remained unchanged.

The results and conclusions from Geo-Ventures are appended to this report and indicate that the ground appears to be highly permeable at the depths tested.

Due to the very rapid ingress of water it was not possible to calculate an infiltration rate in the usual manner.

Geo-Ventures have however undertaken lower boundary estimation on the assumption that had it been possible to fill the borehole to top of gravel stratum in say 1.5 minutes and H/H_0 @ 0.37 approximately 30 seconds then a k value of 2×10^{-3} m./sec. (7.2 m./hour) is foreseeable, which is within the range of a clean sand / gravel mixture.

To introduce a further factor of safety a sample calculation using an infiltration rate reduced by 41% to 4.25 m./hour is appended to this report for an area drained of 60 square metres

On this basis it is considered that deep borehole soakaways will provide an effective surface water drainage solution for this phase of the development.

Signed for and on behalf of
R E FRY & ASSOCIATES LTD



Geoff Hardman B.Sc
27.6.16

PERMEABILITY TEST RESULTS (Borehole)

Contract:

Woodlands Farm, Gwersylt

Borehole

BH 1

Test No.

1

Test Zone

1.00 - 13.00m

Date

12.10.15

Type of Test : Falling Head

Units in metres unless otherwise stated

Elapsed Time (mins)	Depth of water below top of casing
0.0	
0.5	
1.0	
2.0	
3.0	
4.0	
5.0	
7.0	
10.0	
15.0	
20.0	
25.0	
30.0	
35.0	
40.0	
45.0	
50.0	
55.0	
60.0	

Height of casing above GL =

0.00

Borehole dia. (mm)

150

Ground Level

Depth of casing below GL =

N/A

Water added to borehole to ground level

Water level within borehole before test 9.25m

Remarks:

Before commencement of test, water level within well monitored at 9.25m below existing ground level. 250 gallons of water added to well over a 5 minute period water level immediately monitored and water level within well remained unchanged at 9.25m

Assumed highly permeable

Test undertaken by:

P. Platt / M. Foster

Geo-Ventures (UK) Limited

70 Riverside Close, Waterside, Howley, Warrington, Cheshire, WA1 2JD

Tel. 01925 240476 / 01942 870967

Tel. 01925 240476 / 01942 870967

Woodlands Farm, Gwersylt

Although it has not been possible to calculate a value of permeability from the insitu tests, due to the very rapid fall in head, a lowerbound figure can be estimated as follows:

prior to test water standing at an average of 9.50m depth.

assume if had been possible to fill borehole to top of the gravel stratum in say 1.50 mins and $H/H_o @ 0.37$

approximately 30 secs

$k \approx 2 \times 10^{-3} \text{ m/ sec}$

This is within range of a clean sand and gravel mix, which is the case at this site

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XP Solutions	Source Control 2016.1	

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

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	80.383	3.683	2.7	0.1	O K
30 min Summer	80.065	3.365	2.5	0.1	O K
60 min Summer	79.242	2.542	1.9	0.1	O K
120 min Summer	78.481	1.781	1.3	0.1	O K
180 min Summer	78.098	1.398	1.0	0.0	O K
240 min Summer	77.857	1.157	0.9	0.0	O K
360 min Summer	77.570	0.870	0.6	0.0	O K
480 min Summer	77.408	0.708	0.5	0.0	O K
600 min Summer	77.302	0.602	0.4	0.0	O K
720 min Summer	77.226	0.526	0.4	0.0	O K
960 min Summer	77.126	0.426	0.3	0.0	O K
1440 min Summer	77.015	0.315	0.2	0.0	O K
2160 min Summer	76.933	0.233	0.2	0.0	O K
2880 min Summer	76.889	0.189	0.1	0.0	O K
4320 min Summer	76.838	0.138	0.1	0.0	O K
5760 min Summer	76.811	0.111	0.1	0.0	O K
7200 min Summer	76.793	0.093	0.1	0.0	O K
8640 min Summer	76.781	0.081	0.1	0.0	O K
10080 min Summer	76.772	0.072	0.1	0.0	O K
15 min Winter	80.400	3.700	2.7	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	96.918	0.0	10
30 min Summer	67.029	0.0	18
60 min Summer	44.405	0.0	32
120 min Summer	28.487	0.0	62
180 min Summer	21.655	0.0	92
240 min Summer	17.694	0.0	122
360 min Summer	13.184	0.0	182
480 min Summer	10.704	0.0	242
600 min Summer	9.097	0.0	300
720 min Summer	7.960	0.0	364
960 min Summer	6.440	0.0	482
1440 min Summer	4.766	0.0	720
2160 min Summer	3.518	0.0	1068
2880 min Summer	2.831	0.0	1420
4320 min Summer	2.079	0.0	2152
5760 min Summer	1.668	0.0	2856
7200 min Summer	1.408	0.0	3544
8640 min Summer	1.226	0.0	4280
10080 min Summer	1.090	0.0	5096
15 min Winter	96.918	0.0	10

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	79.657	2.957	2.2	0.1	O K
60 min Winter	78.755	2.055	1.5	0.1	O K
120 min Winter	78.047	1.347	1.0	0.0	O K
180 min Winter	77.730	1.030	0.8	0.0	O K
240 min Winter	77.543	0.843	0.6	0.0	O K
360 min Winter	77.329	0.629	0.5	0.0	O K
480 min Winter	77.211	0.511	0.4	0.0	O K
600 min Winter	77.134	0.434	0.3	0.0	O K
720 min Winter	77.080	0.380	0.3	0.0	O K
960 min Winter	77.008	0.308	0.2	0.0	O K
1440 min Winter	76.928	0.228	0.2	0.0	O K
2160 min Winter	76.868	0.168	0.1	0.0	O K
2880 min Winter	76.836	0.136	0.1	0.0	O K
4320 min Winter	76.800	0.100	0.1	0.0	O K
5760 min Winter	76.780	0.080	0.1	0.0	O K
7200 min Winter	76.768	0.068	0.1	0.0	O K
8640 min Winter	76.759	0.059	0.0	0.0	O K
10080 min Winter	76.752	0.052	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	67.029	0.0	18
60 min Winter	44.405	0.0	32
120 min Winter	28.487	0.0	62
180 min Winter	21.655	0.0	92
240 min Winter	17.694	0.0	122
360 min Winter	13.184	0.0	182
480 min Winter	10.704	0.0	242
600 min Winter	9.097	0.0	300
720 min Winter	7.960	0.0	364
960 min Winter	6.440	0.0	482
1440 min Winter	4.766	0.0	722
2160 min Winter	3.518	0.0	1068
2880 min Winter	2.831	0.0	1456
4320 min Winter	2.079	0.0	2152
5760 min Winter	1.668	0.0	2840
7200 min Winter	1.408	0.0	3632
8640 min Winter	1.226	0.0	4352
10080 min Winter	1.090	0.0	5096

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.006

Time (mins)	Area
From:	To: (ha)
0	4 0.006

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Model Details

Storage is Online Cover Level (m) 84.700

Deep Bore Soakaway Structure

Chamber Invert Level (m) 82.700
 Infiltration Coefficient Base (m/hr) 0.00000

Chamber Diameter/Width (m) 1.200
 Safety Factor 2.0

Borehole Diameter (m) 0.200

Borehole Depth (m) 6.000

Side		Side	
Depth	Infil.	Depth	Infil.
(m)	Coef.	(m)	Coef.
	(m/hr)		(m/hr)
0.000	4.25000	6.000	4.25000

GENERAL

1. All adoptable sewers and associated works are to comply with the Sewers for Adoption (Technical) Regulations 2012.
2. All highway works to be to adoptable standards and to comply with the Local Authority Policy.
3. All private drainage works are to comply fully with part 4 of the Building Regulations.
4. All casting inlet levels to be checked by the Contractor at the start of works and any All levels are based on topographical survey information provided by others.
5. All materials to meet the relevant BS/Kitemark and comply fully with the specifications.
6. All concrete & concrete products must use BS5885 Portland Cement and BS5958 Portland Cement. Investigation report proves that sulphate attack from salts and groundwater will not occur).
6. All opening notices etc. are to be obtained prior to works and to be displayed on site.
7. All works are to be inspected by L.A. NHC, or relevant Water Authority as applicable.

C.D.M. REGULATIONS 2015

In line with the above regulations, we are obliged to inform the client of their responsibilities under section OIM 15/1, and residual risks that may be encountered in the construction of these works. Health and Safety aspects govern full consideration. Wherever possible risks have been eliminated from the design, however due to the very nature of this type of work it is not possible to remove all the risks from the design.

We would also respectfully remind the Client of this obligation to inform the relevant state authorities, and that only competent Contractors who have a valid safety policy are employed.

They should also provide satisfactory responses at tender stage as to the manner in which they will deal with the elements at risk involved in this type of work, in particular those highlighted by BEFA below:

1. Support / treatment for All excavation work.
2. Guarding to edges of excavations to prevent people, materials and vehicles falling into excavations.
3. Guarding of excavations outside working hours to prevent unauthorised access.
4. Underpinning to adjacent roads or structures.
5. Confined space operations.

6. Dealing with existing services.
7. Traffic management on existing highways.
8. Procedure to be followed in event of accident or emergency.

10. Confirmation will be required that all operatives are adequately trained, copies of relevant training certificates to be supplied.

The above list is by no means exhaustive but it does highlight operations that present a risk to contractors and the general public.
For clarification on any item please contact REFA.

[illegible]

rev		Revision details		Date	
Drawing Stage		Drawing Status			
☐ Draft ☒ Issued	☐ Comments ☐ Information ☐ Approval	☐ Tender ☐ Construction ☐ As Built			
Client					

WALES & WEST HOUSING ASSOCIATION

Job title
DODDS LANE
GWERSYLLT, WREXHAM

Drawing title
**ROAD AND DRAINAGE
LAYOUT**

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Date 5.2.16	Scale 1/250	Drawn GWH
DRAWING NO	14155/04/1	Rev B



NOTE
AS IT IS PROPOSED TO DISCHARGE
SURFACE WATER TO SOAKAWAYS
ONLY THE FOUL WATER SYSTEM
IS TO BE ADOPTED BY DCWW

