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Soil Infiltration Test for Design of Soakaway

At

Rathcoole Co. Dublin

Prepared by

Dr. Eugene Bolton
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Report on Soil Infiltration Test

Introduction

To manage the surface water from the development it is proposed to construct Soakaways in accordance with BRE Digest365 As part of this, the infiltration capacity of the soil was assessed. Dr. Eugene Bolton of Trinity Green Environmental Consultants was commissioned to carry out soil Infiltration Tests in accordance with BRE Digest365 to establish the suitability of the site for disposal of water.

1.0 Visual assessment of Site

The site is located off the Main Street in Rathcoole. The landscape is relatively flat. On the day of the tests there was no surface water present. There is no vegetation on the site that would indicate poor soakage

2.0 Sub-soil profile

A test pit was excavated to 1.8mbgl. There is a layer of made ground down to 500mm bgl. This consists of Topsoil with a Crumb Structure. Below this and down to 1.5m bgl the soil is a clay – initially with few cobbles but content of angular cobbles and shale fragments increase with depth. From 1.5m down the soil is Shale with a high clay content.
There was no evidence of a watertable.

4.0 Infiltration Tests

The Infiltration rate, generally expressed as metres per second, is the volume of water that enters the soil over a unit area and unit time. In order to obtain this measurement a pit is excavated and filled with water. The fall in the level of the water is recorded over time. The test pit had dimensions

Length 1.3m
Width 0.3m
Depth 1.4m

The base of the pit was filled with water to a depth of 1000mm and the drop in the water level was followed over time

4.1 Results

The time required for the level to fall from 75% full to 25% full (ie 50% drop) – from a water depth of 0.750m to a water depth of 0.250m is estimated to be 99min.

Table 1 – Time taken for water level to fall

Elapsed Time (Mins)	Depth of Water (mm)
0	1000
7	900
13	800
26	700
41	600
58	500
79	400
103	300
132	200

Infiltration rate (f) = Volume of water used/unit exposed area /unit time

Volume = pit length (m) x Width (m) x Drop in water level (m)
= 1.3 x 0.3 x 0.5
= 0.195m3

Exposed area = (Length x Half the effective height x 2) + (Width x Half the effective height x 2) + Base area
= (1.3 x 0.5 x 2) + (0.5 x 0.5 x 2) + (1.3 x 0.3)
= 2.19m2

Time = 99min

Infiltration rate (f) = 0.195/2.19/99

= 8.99E-04 m/min

f = 1.49E-05 m/sec

5.0 *Conclusions*

From the above observation it is concluded that the soakage is slow but may be sufficient to allow infiltration of the stormwater if the soakaway can be of sufficient size

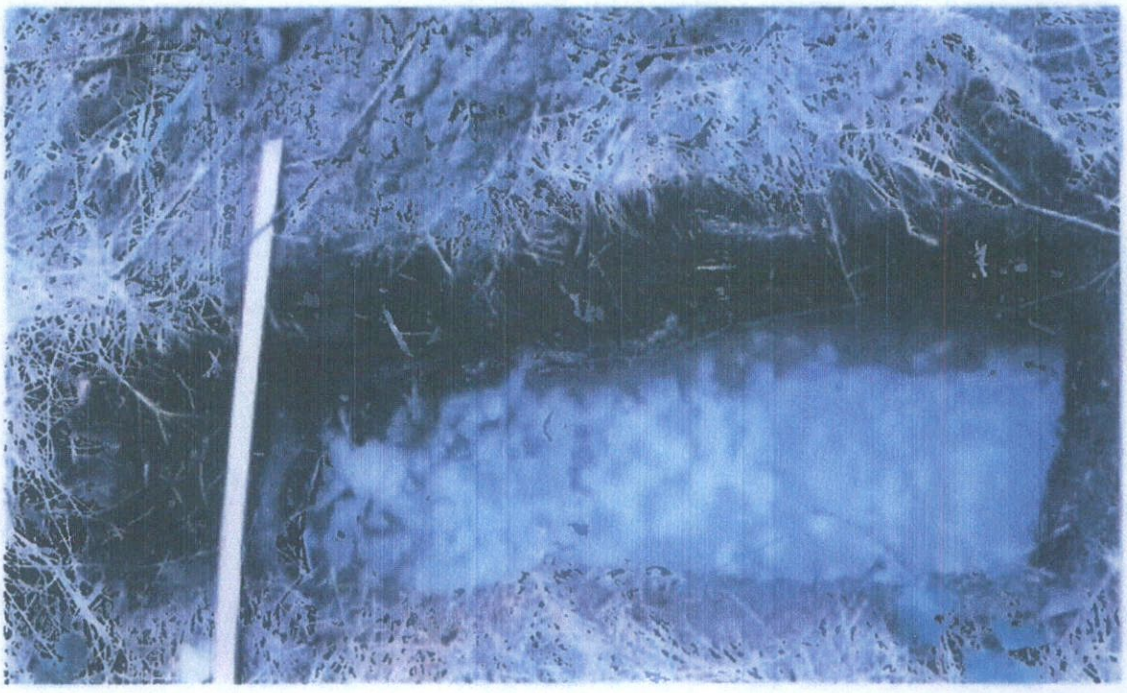
Signed .....
Dr. Eugene Bolton
Senior Consultant
Trinity Green
27/11/2022

Photo

Trial Pit – Depth 1.8 No watertable

Test Pit before water added – Depth 1.0 m

Pit during test



Appendix 2

Soakaway Design

Design of Soakaway for Surface Water Drainage

Designed in accordance with BRE Digest 365.

Details

Area: Roof area (m)		60
Additional Impermeable area (m)		0
Total Impermeable area (m^2):		60
Trench width (m):		1.25
Effective depth (m):		1.2
Void ratio:		0.3
Infiltration Rate: (m/s)		1.5E-05
Rainfall Return Period (1 in _ years)		10
Percentage Increase for Climate Change (%)		20.0
Rainfall rates (mm):	**Unfactored**	**Factored**
M100-10	13.4	**16.1**
M10-15	15.7	**18.8**
M10-30	20.1	**24.1**
M10-60	25.7	**30.8**
M10-120	32.8	**39.4**
M10-240	41.9	**50.3**
M10-360	48.3	**58.0**
M10-720	61.7	**74.0**
M10-1440	78.9	**94.7**

Volume Equation: **I - O = S**

I = Inflow from the impermeable area drained to the soakway.
O = The outflow infiltrating into the soil during rainfall.
S = The required storage in the soakway to balance temporarily inflow and outflow.

Inflow to the Soakaway:

I = A * R

I = Inflow from the impermeable area drained to the soakway.
A = The impermeable area drained to the soakway.
R = The total rainfall in a design storm.

Duration D (mins)	(m^2)		Rainfall Rate (mm)	Volume Collected m^3
10	60	*	16.1	0.96
15	60	*	18.8	1.13
30	60	*	24.1	1.45
60	60	*	30.8	1.85
120	60	*	39.4	2.36
240	60	*	50.3	3.02
360	60	*	58.0	3.48
720	60	*	74.0	4.44
1440	60	*	94.7	5.68

Outflow from the Soakaway:

$O = a_{50} * f * D$

O = The outflow infiltrating into the soil during rainfall.
a_{50} = The internal surface area of the soakaway to 50% depth; this excludes the base area which may become clogged.
f = the soil infiltration rate.
D = The storm duration.

a_{50} = 2 * (1.3 + L)*(1.2 / 2)
= 1.5 + 1.2 L

O = (1.5 + 1.2 L) * (1.49E-05) * (D * 60)

Duration D (mins)				
10	O = (	1.34E-02	+ 1.07E-02	L)
15	O = (	2.01E-02	+ 1.61E-02	L)
30	O = (	4.02E-02	+ 3.22E-02	L)
60	O = (	8.05E-02	+ 6.44E-02	L)
120	O = (	1.61E-01	+ 1.29E-01	L)
240	O = (	3.22E-01	+ 2.57E-01	L)
360	O = (	4.83E-01	+ 3.86E-01	L)
720	O = (	9.66E-01	+ 7.72E-01	L)
1440	O = (	1.93E+00	+ 1.54E+00	L)

Soakaway Storage:

S = L * 1.25 * 1.2 * 0.3 = 0.45 L

	I	-	O				S
10 minute storm	0.9648	-	1.34E-02	-	0.010728 L	=	0.45 L
					0.95	=	0.46 L
					L	=	2.06497 m
15 minute storm	1.1304	-	0.020115	-	0.016092 L	=	0.45 L
					1.11	=	0.46609 L
					L	=	2.38212 m
30 minute storm	1.4472	-	0.04023	-	0.032184 L	=	0.45 L
					1.40697	=	0.48218 L
					L	=	2.91791 M
60 minute storm	1.8504	-	0.08046	-	0.064368 L	=	0.45 L
					1.76994	=	0.51437 L
					L	=	3.441 m
120 minute storm	2.3616	-	1.61E-01	-	0.128736 L	=	0.45 L
					2.20068	=	0.57874 L
					L	=	3.80256 m
240 minute storm	3.0168	-	3.22E-01	-	2.57E-01 L	=	0.45 L
					2.69496	=	0.70747 L
					L	=	3.80928 m
360 minute storm	3.4776	-	4.83E-01	-	3.86E-01 L	=	0.45 L
					2.99484	=	0.83621 L
					L	=	3.58145 m
720 minute storm	4.4424	-	9.66E-01	-	7.72E-01 L	=	0.45 L
					3.47688	=	1.22242 L
					L	=	2.84427 m
1440 minute storm	5.6808	-	1.93E+00	-	1.54E+00 L	=	0.45 L
					3.74976	=	1.9948 L
					L	=	1.87974 m

Storm Duration	Required Soakaway Length (m)
10	2.06
15	2.38
30	2.92
60	3.44
120	3.80
240	3.81
360	3.58
720	2.84
1440	1.88

Try a soakaway of length **3.81** m with a storm duration of **240** mins.

Internal surface area at 50% effective depth.

a_{50} = 2 + 1.2 L

= 6.07 m^2

Soakaway storage volume

S = 1.3 * 3.809281 * 1.2 * 0.3

S = 1.7 m^3

Check on time for emptying half storage volume, t_{s50}.

$$ts_{50} = \frac{S * 0.5}{a_{50} * f}$$

$$= \frac{1.7 * 0.5}{6.07 * 1.5E\text{-}05}$$

= 157.91 mins

= 2.63 h (>24h)

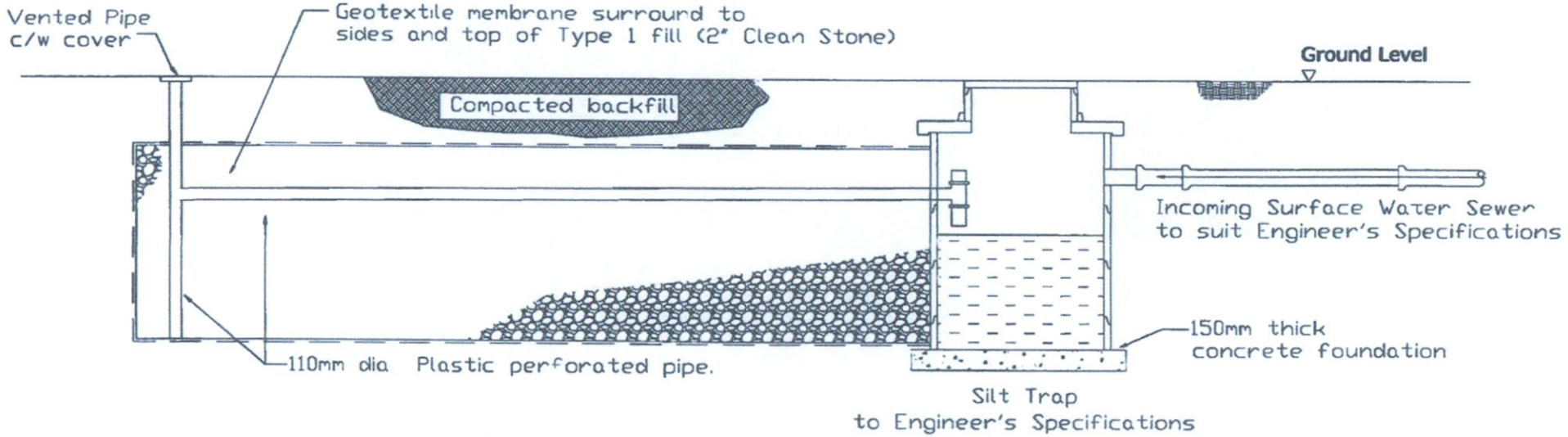
Therefore a soakaway of the following dimensions is acceptable:

Length = 3.81 m
Width = 1.25 m
Depth = 1.20 m

Appendix 3

Silt Trap

RevNo	Revision note	Date	Signature	Checked



Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No /Reference	
Designed by EB		Checked by AB	Approved by - date EB - 12/05/06	File name SDL/EB	Date 09/05/06	Scale NTS

TYPICAL SOAKAWAY DETAIL

SLD/001	Edition 0	Sheet 1/1