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Drainage Simulations for Surface Water

Revision 0

Job No. 24756

Proposed Industrial Development
Unit H - M
Land off Hornbeam Road
North Walsham
Norfolk
NR28 0FQ

Client: Birchwood Building

November 2021

pdc

civil / structural / environmental / surveying

REPORT CONTROL SHEET

Client: Birchwood Building **Job No.:** 24756

Project Name: Proposed Industrial Development
Unit H - M
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North Walsham
Norfolk
NR28 0FQ

Issue		
Revision 0	November 2021	**Report Prepared by:** Chloe Spencer B.Sc (Hons) AMIEnvSc Environmental Consultant
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DESIGN COMMENTS

This Drainage Simulations for Surface Water (DSSW) was prepared by Plandescil Ltd. on behalf of Birchwood Building. This has been prepared for a proposed industrial unit at Unit H - M, Land off Hornbeam Road, North Walsham, Norfolk, NR28 0FQ, referred to here within as the site.

Percolation tests were undertaken on the adjacent site, based on guidance set in BRE 365 and Part H of the Building Regulations, refer to **Appendix A** for the test results. Based upon the slowest infiltration rate of 0.07242m/hr an infiltration drainage system has been designed to drain the roof area of the site.

The drainage system has been designed to contain up to and including the 1 in 100 year rainfall event including the effects of climate change (40%), refer to **Appendix B** for the Micro Drainage design simulations.

Surface water runoff from the 1150m^2 roof of Units H - M will be collected in a soakaway which should be a minimum of 105.0m^2 x 0.8m deep.

In the event where the surface water system fails or during an exceedance event, consideration should be given to route surface water away from vulnerable areas towards drainage features. Where possible, the external landscape and paving levels will fall away from the buildings, and the access road levels near buildings will be set lower than the finished floor levels of the buildings.

The proposed surface water soakaway system shall be pre-formed geocellular drainage units with minimum 95% volumetric void ratio. Geocellular units to be fully encapsulated with high performance filter geotextile. The drainage should be installed strictly in accordance with the manufacturer's instructions and specified materials.

To reduce the risk of flooding due to the failure of the surface water drainage system over its lifespan, regular maintenance should be undertaken. The long term maintenance and repair of the proposed surface water drainage system shall be the responsibility of the site owner, and will be included within their general maintenance regime.

Refer to **Appendix C** for the Surface Water Maintenance Schedule detailing the management of the drainage including the schedule, actions, and frequencies.

The increase in hardstanding areas will create an increase in the surface water runoff generated within the site prior to mitigation. However, through the incorporation of a surface water drainage system the increased surface water runoff will be entirely contained within an on-site infiltration drainage system, therefore the proposal complies with NPPF.

APPENDIX A

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Soil Percolation Test

Soil Test: BRE 365 & Part H of the Building Regulations

Job No. 24756
Site: Hornbeam Road, North Walsham
Date: 28/11/2019

Trial Hole 1

Test Hole Dimensions

Test No.	1	2	3
Width (m)	0.80	0.80	0.80
Length (m)	1.60	1.60	1.60
Effective Depth (m)	0.50	0.80	0.80
75% of Effective Depth (m)	0.375	0.6	0.6
25% of Effective Depth (m)	0.125	0.2	0.2

Time to fall

Test No.	1	2	3
to 75% of effective depth (mins)	121	145	151
to 25% of effective depth (mins)	14	15	24
from 75% to 25% (mins)	107	130	127

f (soil percolation) =

$$\frac{V_{p\ 75\text{-}25}}{A_{P50} \times t_{p\ 75\text{-}25}}$$

Test No.	1	2	3
$V_{p\ 75\text{-}25}$ (m^3)	0.32	0.512	0.512
A_{P50} (m^2)	2	3.2	3.2
Soil Filtration Rate (f) (m/s)	2.01E-05	2.05E-05	2.10E-05
Soil Filtration Rate (f) (m/hr)	0.07242	0.07385	0.07559

APPENDIX B

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 509 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.304	0.304	1.2	30.3	O K
30 min Summer	0.395	0.395	1.2	39.4	O K
60 min Summer	0.479	0.479	1.3	47.8	O K
120 min Summer	0.566	0.566	1.3	56.5	O K
180 min Summer	0.618	0.618	1.3	61.7	O K
240 min Summer	0.651	0.651	1.3	64.9	O K
360 min Summer	0.678	0.678	1.3	67.6	O K
480 min Summer	0.678	0.678	1.3	67.6	O K
600 min Summer	0.669	0.669	1.3	66.8	O K
720 min Summer	0.656	0.656	1.3	65.4	O K
960 min Summer	0.624	0.624	1.3	62.3	O K
1440 min Summer	0.556	0.556	1.3	55.5	O K
2160 min Summer	0.459	0.459	1.2	45.8	O K
2880 min Summer	0.376	0.376	1.2	37.5	O K
4320 min Summer	0.248	0.248	1.2	24.7	O K
5760 min Summer	0.160	0.160	1.1	15.9	O K
7200 min Summer	0.104	0.104	1.1	10.3	O K
8640 min Summer	0.070	0.070	1.1	7.0	O K
10080 min Summer	0.052	0.052	1.1	5.2	O K
15 min Winter	0.341	0.341	1.2	34.0	O K
30 min Winter	0.445	0.445	1.2	44.4	O K
60 min Winter	0.541	0.541	1.3	54.0	O K
120 min Winter	0.643	0.643	1.3	64.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	145.040	0.0	19
30 min Summer	95.760	0.0	33
60 min Summer	59.780	0.0	62
120 min Summer	37.170	0.0	122
180 min Summer	28.329	0.0	182
240 min Summer	23.345	0.0	242
360 min Summer	17.640	0.0	360
480 min Summer	14.299	0.0	418
600 min Summer	12.074	0.0	478
720 min Summer	10.477	0.0	542
960 min Summer	8.318	0.0	674
1440 min Summer	5.933	0.0	950
2160 min Summer	4.175	0.0	1344
2880 min Summer	3.249	0.0	1732
4320 min Summer	2.290	0.0	2468
5760 min Summer	1.800	0.0	3176
7200 min Summer	1.511	0.0	3824
8640 min Summer	1.321	0.0	4496
10080 min Summer	1.188	0.0	5144
15 min Winter	145.040	0.0	18
30 min Winter	95.760	0.0	33
60 min Winter	59.780	0.0	62
120 min Winter	37.170	0.0	120

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	0.706	0.706	1.3	70.4	O K
240 min Winter	0.747	0.747	1.4	74.5	O K
360 min Winter	0.788	0.788	1.4	78.6	O K
480 min Winter	0.793	0.793	1.4	79.1	O K
600 min Winter	0.780	0.780	1.4	77.8	O K
720 min Winter	0.763	0.763	1.4	76.1	O K
960 min Winter	0.722	0.722	1.4	72.0	O K
1440 min Winter	0.628	0.628	1.3	62.6	O K
2160 min Winter	0.488	0.488	1.3	48.7	O K
2880 min Winter	0.370	0.370	1.2	36.9	O K
4320 min Winter	0.191	0.191	1.1	19.1	O K
5760 min Winter	0.081	0.081	1.1	8.1	O K
7200 min Winter	0.047	0.047	1.0	4.7	O K
8640 min Winter	0.042	0.042	0.9	4.1	O K
10080 min Winter	0.037	0.037	0.8	3.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	28.329	0.0	178
240 min Winter	23.345	0.0	236
360 min Winter	17.640	0.0	348
480 min Winter	14.299	0.0	456
600 min Winter	12.074	0.0	554
720 min Winter	10.477	0.0	576
960 min Winter	8.318	0.0	724
1440 min Winter	5.933	0.0	1026
2160 min Winter	4.175	0.0	1452
2880 min Winter	3.249	0.0	1848
4320 min Winter	2.290	0.0	2592
5760 min Winter	1.800	0.0	3176
7200 min Winter	1.511	0.0	3680
8640 min Winter	1.321	0.0	4408
10080 min Winter	1.188	0.0	5144

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 628150 329950 TG 28150 29950
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.115

Time (mins) From:	To:	Area (ha)
0	4	0.115

Model Details

Storage is Online Cover Level (m) 0.800

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.07242 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07242

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	105.0	105.0	0.800	105.0	137.8

APPENDIX C

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Surface Water Maintenance Schedule

Feature	Schedule	Required Action	Frequency	Responsibility
Geocellular/ Modular Systems	Regular Inspections	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually	Site Owner
		Remove debris from the catchment surface (where it may cause risks to performance)	Monthly	
		For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually	
		Remove sediment from pre-treatment structures	Annually, or as required	
	Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required	
	Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually	
		Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required	
Drainage Pipe Network	Regular Inspections	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually	Site Owner
		Remove debris from the catchment surface (where it may cause risks to performance)	Monthly	
		Maintain vegetation to designed limits within the vicinity of below ground drainage pipes to avoid damage to system.	Monthly or as required	
		Inspect rainwater down pipes, channel drains and road gullies, removing obstructions and silt as necessary. Check there is no physical damage.	Monthly	
	Occasional Maintenance	Remove silt and leaf build up from manholes, gutters etc.	Annually (or as required).	
		Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually (or as required).	
		Remove inspection covers and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.	Annually	
		Removal of sediment, oil, grease and floatables from pre-treatment structures	Half yearly. (or as required).	
	Remedial Actions	Replacement of malfunctioning parts.	As required.	
		Repair physical damage if necessary	As required	
	Monitoring	Inspect inlets and pre-treatment systems for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.	
		Undertake inspection after leaf fall in Autumn	Annually	
		Inspect all inlets, outlets and vents to ensure that they are in good condition and operating as designed.	Annually	
		Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required	
		Check manholes, gutters etc. for silt and leaf build up.	Annually	