Kettleby Lane West Developments Ltd

Proposed Residential Development
Kettleby Lane
Wrawby
North Lincolnshire

Drainage Design
Prepared by EWE Associates Ltd
Final RevA January 2024

EWE Associates Ltd
7 Waveney Close
Burton Upon Stather
Scunthorpe
North Lincolnshire

CLIENT DETAILS

Kettleby Lane West Developments Ltd

CONTRACT

This report describes work commissioned by Kettleby Lane West Developments Ltd following written instruction by their representative during October 2023. Kettleby Lane West Developments Ltd representative for the contract was Kate Kelly. Lea Favill of EWE Associates Ltd carried out the work.

Date: 3rd January 2024

Prepared by: ……[redacted]…… Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 12th December 2023 - 1No copy issued to Kate Kelly
Final Report RevA issued 3rd January 2024 - 1No copy issued to Kate Kelly

CONTENTS

APPENDICES:

1. INTRODUCTION

Terms of Reference

This report was commissioned by Kettleby Lane West Developments Ltd to design the surface water for the construction of a residential development off Kettleby Lane in Wrawby.

The proposal involves the construction of 4 residential dwellings and driveways. The drainage issues are being considered as part of the current planning conditions relating to drainage.

Approach to the Assessment

For the purposes of this study, the following have been considered: -

- Site level information and proposed finished levels of the building and external works.
- Catchment area draining to the existing surface water system within the development site.
- Existing infiltration characteristics of subsoils.
- Environment Agency groundwater team comments.
- Onsite constriction.
- Options available to developer.
- NPPF guidelines with regards to the control of runoff.
- PPG3 pollution prevention guidelines.
- Future adoption and management of drainage system.
- Flood risk to adjacent land users.

Design Constraints

For the purposes of this study, the following constraints have been applied: -

- The design is based on the proposed layout provided by the client's representative. At this stage no modifications to the layout are proposed.
- SUDs features are to be recommended where practically possible.
- There is an existing foul water sewer within the rear of the site which conveys sewerage into Wrawby.
- The minimum design standard is 1 in 100 years plus climate change (40%).

- The proposal is for a residential development with 4 private dwellings and gardens. The private drives and roof drainage will remain within private ownership.
- The site consists of a topsoil above Sand formation. Percolation tests were undertaken within the 3 boreholes within the site and provide rates varying between 73mm/hr and 167mm/hr. No groundwater was observed in any boreholes which extended to 3m below ground level. Borehole details and infiltration calculations are provided at Appendix A of this report.
- The site is low density with enough space provided for soakaways.

2. DESIGN OF PROPOSED SURFACE WATER DRAIANGE SYSTEM

Catchment Area

The catchment area was calculated from proposed layout drawing provide by the Architect. The total impermeable area has been estimated at 1271m² (0.127 hectares).

Drainage Strategy

The proposed drainage strategy is as follows and is illustrated on the drainage layout drawing provided at Appendix B of this report.

The surface water drainage hierarchy has been followed on determining the most suitable means for surface water disposal.

The percolation tests are showing a reasonable level of infiltration within the site with a minimum rate of 73mm/hr. There is no recorded groundwater within the site.

The four plots include roofed and paved area with a maximum catchment area of 330m². Therefore, crate soakaways located within the private gardens are recommended which are at least 5m from any buildings or major structures.

Adoption & Maintenance

It is considered that the roof drainage system and driveways will be maintained by the private land owners.

Proposed Surface Water Drainage System

It is proposed that the maximum roofed and paved area draining to a single soakaway is 330m² and the minimum infiltration rate adopted is 73mm/hr.

Using WinDes Source Control software developed by Microdrainage the required soakaway has been calculated for the 1 in 100 year plus climate change (40%) event. The minimum size required is 25m² by 1.2m deep. Reference should be made to Appendix C where the calculation sheets are provided.

It is proposed that the front of the access drive draining to a single soakaway is 22m² and the minimum infiltration rate adopted is 73mm/hr.

Using WinDes Source Control software developed by Microdrainage the required soakaway has been calculated for the 1 in 100 year plus climate change (40%) event. The minimum size required is 3m² by 1.2m deep. Reference should be made to Appendix D where the calculation sheets are provided.

Crate Soakaway Maintenance

Following construction regular inspection is recommended. The main concern is to reduce the level of siltation entering the crate tank and as such a catchpit manhole should be located directly upstream of the tank to intercept any silt being washed down the surface water system. It is recommended that this manhole is lifted and inspected on a monthly basis and any silt located in the bottom removed. Furthermore the location of the tank within the site should be clearly marked on a plan. This area should also be inspected for any deformation of the topsoil/pavement which could indicate settlement or failure. A log book should be completed which will show the inspection and maintenance history of the system. The log book, site plan and construction check list should form maintenance manual for the system.

The maintenance plan has been tabulated below and will be the responsibility of the appointed management company.

Maintenance Schedule	**Required action**	**Frequency**
Monitoring	Inspect catchpit manhole for silt and debris	Monthly
	Inspect crate tank locations for ground deformation	3 monthly
	Inspect crate tank for silt buildup	6 monthly
Regular Maintenance	Litter and debris removal from road gullies	Monthly
	Remove silt and debris from catchpit manholes	Monthly
Occasional Maintenance	Remove silt from crate tank	6 monthly
Remedial actions	Repair deformation of topsoil once settlement stopped	As required
	Repair deformation of paved areas once settlement stopped	As required

Appendix A: - SI Info

Appendix B: - Drainage Drawing

Appendix C: - 1 in 100 year+CC WinDes Calculation Sheets main soakaway

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 12/12/2023 15:20	Designed By Lea	
File Plot 1 Kettleby L...	Checked By	
Micro Drainage	Source Control W.12.4	

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

Half Drain Time : 1266 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	36.865	0.465	0.1	11.0	O K
30 min Summer	36.947	0.547	0.1	13.0	O K
60 min Summer	37.040	0.640	0.1	15.2	O K
120 min Summer	37.144	0.744	0.2	17.7	O K
180 min Summer	37.207	0.807	0.2	19.2	O K
240 min Summer	37.252	0.852	0.2	20.2	O K
360 min Summer	37.310	0.910	0.2	21.6	O K
480 min Summer	37.345	0.945	0.2	22.4	O K
600 min Summer	37.366	0.966	0.2	22.9	O K
720 min Summer	37.379	0.979	0.2	23.2	O K
960 min Summer	37.368	0.968	0.2	23.0	O K
1440 min Summer	37.351	0.951	0.2	22.6	O K
2160 min Summer	37.326	0.926	0.2	22.0	O K
2880 min Summer	37.299	0.899	0.2	21.3	O K
4320 min Summer	37.246	0.846	0.2	20.1	O K
5760 min Summer	37.197	0.797	0.2	18.9	O K
7200 min Summer	37.152	0.752	0.2	17.9	O K
8640 min Summer	37.112	0.712	0.1	16.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	184.877	19
30 min Summer	109.094	34
60 min Summer	64.375	64
120 min Summer	37.986	124
180 min Summer	27.901	182
240 min Summer	22.415	242
360 min Summer	16.464	362
480 min Summer	13.227	482
600 min Summer	11.161	600
720 min Summer	9.715	720
960 min Summer	7.597	818
1440 min Summer	5.371	1066
2160 min Summer	3.798	1468
2880 min Summer	2.970	1876
4320 min Summer	2.107	2684
5760 min Summer	1.652	3512
7200 min Summer	1.368	4320
8640 min Summer	1.172	5096

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 12/12/2023 15:20	Designed By Lea	
File Plot 1 Kettleby L...	Checked By	
Micro Drainage	Source Control W.12.4	

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
10080 min Summer	37.076	0.676	0.1	16.1	O K
15 min Winter	36.921	0.521	0.1	12.4	O K
30 min Winter	37.012	0.612	0.1	14.5	O K
60 min Winter	37.117	0.717	0.1	17.0	O K
120 min Winter	37.234	0.834	0.2	19.8	O K
180 min Winter	37.305	0.905	0.2	21.5	O K
240 min Winter	37.355	0.955	0.2	22.7	O K
360 min Winter	37.420	1.020	0.2	24.2	O K
480 min Winter	37.461	1.061	0.2	25.2	O K
600 min Winter	37.486	1.086	0.2	25.8	O K
720 min Winter	37.502	1.102	0.2	26.2	O K
960 min Winter	37.488	1.088	0.2	25.8	O K
1440 min Winter	37.462	1.062	0.2	25.2	O K
2160 min Winter	37.421	1.021	0.2	24.3	O K
2880 min Winter	37.378	0.978	0.2	23.2	O K
4320 min Winter	37.298	0.898	0.2	21.3	O K
5760 min Winter	37.227	0.827	0.2	19.6	O K
7200 min Winter	37.166	0.766	0.2	18.2	O K
8640 min Winter	37.114	0.714	0.1	16.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	1.029	5848
15 min Winter	184.877	19
30 min Winter	109.094	34
60 min Winter	64.375	64
120 min Winter	37.986	122
180 min Winter	27.901	180
240 min Winter	22.415	238
360 min Winter	16.464	354
480 min Winter	13.227	468
600 min Winter	11.161	580
720 min Winter	9.715	688
960 min Winter	7.597	892
1440 min Winter	5.371	1108
2160 min Winter	3.798	1560
2880 min Winter	2.970	2016
4320 min Winter	2.107	2892
5760 min Winter	1.652	3696
7200 min Winter	1.368	4536
8640 min Winter	1.172	5360

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 12/12/2023 15:20 File Plot 1 Kettleby L...	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

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
10080 min Winter	37.068	0.668	0.1	15.9	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	1.029	6152

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 12/12/2023 15:20 File Plot 1 Kettleby L...	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	501750 409450 TA 01750 09450
C (1km)	-0.025
D1 (1km)	0.354
D2 (1km)	0.260
D3 (1km)	0.269
E (1km)	0.307
F (1km)	2.416
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) 0.032

Time (mins)	Area (ha)
0-4	0.032

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 12/12/2023 15:20 File Plot 1 Kettleby L...	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

Model Details

Storage is Online Cover Level (m) 38.000

Cellular Storage Structure

Invert Level (m) 36.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07300

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	25.0	25.0	2.600	0.0	51.0
0.200	25.0	29.0	2.800	0.0	51.0
0.400	25.0	33.0	3.000	0.0	51.0
0.600	25.0	37.0	3.200	0.0	51.0
0.800	25.0	41.0	3.400	0.0	51.0
1.000	25.0	45.0	3.600	0.0	51.0
1.200	25.0	49.0	3.800	0.0	51.0
1.400	0.0	51.0	4.000	0.0	51.0
1.600	0.0	51.0	4.200	0.0	51.0
1.800	0.0	51.0	4.400	0.0	51.0
2.000	0.0	51.0	4.600	0.0	51.0
2.200	0.0	51.0	4.800	0.0	51.0
2.400	0.0	51.0	5.000	0.0	51.0

Appendix D: - 1 in 100 year+CC WinDes Calculation Sheets drive soakaway

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 12/12/2023 15:22 File Driveway Kettleby...	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

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

Half Drain Time : 407 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	38.360	0.360	0.0	1.0	O K
30 min Summer	38.420	0.420	0.0	1.2	O K
60 min Summer	38.484	0.484	0.0	1.4	O K
120 min Summer	38.544	0.544	0.0	1.6	O K
180 min Summer	38.571	0.571	0.0	1.6	O K
240 min Summer	38.583	0.583	0.0	1.7	O K
360 min Summer	38.597	0.597	0.0	1.7	O K
480 min Summer	38.605	0.605	0.0	1.7	O K
600 min Summer	38.609	0.609	0.0	1.7	O K
720 min Summer	38.610	0.610	0.0	1.7	O K
960 min Summer	38.592	0.592	0.0	1.7	O K
1440 min Summer	38.554	0.554	0.0	1.6	O K
2160 min Summer	38.504	0.504	0.0	1.4	O K
2880 min Summer	38.463	0.463	0.0	1.3	O K
4320 min Summer	38.400	0.400	0.0	1.1	O K
5760 min Summer	38.355	0.355	0.0	1.0	O K
7200 min Summer	38.320	0.320	0.0	0.9	O K
8640 min Summer	38.292	0.292	0.0	0.8	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	184.877	19
30 min Summer	109.094	33
60 min Summer	64.375	62
120 min Summer	37.986	122
180 min Summer	27.901	180
240 min Summer	22.415	236
360 min Summer	16.464	288
480 min Summer	13.227	348
600 min Summer	11.161	416
720 min Summer	9.715	484
960 min Summer	7.597	618
1440 min Summer	5.371	894
2160 min Summer	3.798	1296
2880 min Summer	2.970	1676
4320 min Summer	2.107	2460
5760 min Summer	1.652	3176
7200 min Summer	1.368	3960
8640 min Summer	1.172	4672

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 12/12/2023 15:22	Designed By Lea	
File Driveway Kettleby...	Checked By	
Micro Drainage	Source Control W.12.4	

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
10080 min Summer	38.269	0.269	0.0	0.8	O K
15 min Winter	38.403	0.403	0.0	1.1	O K
30 min Winter	38.470	0.470	0.0	1.3	O K
60 min Winter	38.542	0.542	0.0	1.5	O K
120 min Winter	38.610	0.610	0.0	1.7	O K
180 min Winter	38.642	0.642	0.1	1.8	O K
240 min Winter	38.657	0.657	0.1	1.9	O K
360 min Winter	38.667	0.667	0.1	1.9	O K
480 min Winter	38.674	0.674	0.1	1.9	O K
600 min Winter	38.674	0.674	0.1	1.9	O K
720 min Winter	38.670	0.670	0.1	1.9	O K
960 min Winter	38.641	0.641	0.1	1.8	O K
1440 min Winter	38.585	0.585	0.0	1.7	O K
2160 min Winter	38.516	0.516	0.0	1.5	O K
2880 min Winter	38.462	0.462	0.0	1.3	O K
4320 min Winter	38.384	0.384	0.0	1.1	O K
5760 min Winter	38.330	0.330	0.0	0.9	O K
7200 min Winter	38.290	0.290	0.0	0.8	O K
8640 min Winter	38.260	0.260	0.0	0.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Summer	1.029	5440
15 min Winter	184.877	19
30 min Winter	109.094	33
60 min Winter	64.375	62
120 min Winter	37.986	120
180 min Winter	27.901	176
240 min Winter	22.415	230
360 min Winter	16.464	290
480 min Winter	13.227	366
600 min Winter	11.161	442
720 min Winter	9.715	518
960 min Winter	7.597	664
1440 min Winter	5.371	952
2160 min Winter	3.798	1364
2880 min Winter	2.970	1760
4320 min Winter	2.107	2552
5760 min Winter	1.652	3296
7200 min Winter	1.368	4040
8640 min Winter	1.172	4832

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Date 12/12/2023 15:22 File Driveway Kettleby...	Designed By Lea Checked By	
Micro Drainage	Source Control W.12.4	

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
10080 min Winter	38.235	0.235	0.0	0.7	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
10080 min Winter	1.029	5544

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D1 (1km)	0.354
D2 (1km)	0.260
D3 (1km)	0.269
E (1km)	0.307
F (1km)	2.416
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) 0.003

Time (mins)	Area (ha)
0-4	0.003

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
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Model Details

Storage is Online Cover Level (m) 39.000

Cellular Storage Structure

Invert Level (m) 38.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.07300

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	3.0	3.0	2.600	0.0	9.2
0.200	3.0	4.4	2.800	0.0	9.2
0.400	3.0	5.8	3.000	0.0	9.2
0.600	3.0	7.2	3.200	0.0	9.2
0.800	3.0	8.5	3.400	0.0	9.2
1.000	0.0	9.2	3.600	0.0	9.2
1.200	0.0	9.2	3.800	0.0	9.2
1.400	0.0	9.2	4.000	0.0	9.2
1.600	0.0	9.2	4.200	0.0	9.2
1.800	0.0	9.2	4.400	0.0	9.2
2.000	0.0	9.2	4.600	0.0	9.2
2.200	0.0	9.2	4.800	0.0	9.2
2.400	0.0	9.2	5.000	0.0	9.2