Mr & Mrs Light

Proposed Residential Development
Moorhouse Farm
Moorhouse Lane
Birkenshaw

Drainage Assessment

Prepared by EWE Associates Ltd
Final RevA November 2021

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CLIENT DETAILS

Mr & Mrs Light
Moorhouse Farm
Moorhouse Lane
Birkenshaw
Bradford
BD11 2AY

CONTRACT

This report describes work commissioned by Mr & Mrs Light on 19th October 2021. Mr & Mrs Light representative for the contract was Mr Michael Townsend of Townsend Planning. Lea Favill of EWE Associates Ltd carried out the work.

Date: 29th November 2021

Prepared by: …… …… Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 26th November 2021 - 1No copy issued to Mr Michael Townsend
Final Report RevA issued 29th November 2021 - 1No copy issued to Mr Michael Townsend

CONTENTS

APPENDICES:

1. INTRODUCTION

Terms of Reference

This report was commissioned by Mr & Mrs Light to consider the surface water and foul water drainage system for the proposed residential dwelling at Moorhouse Farm off Moorhouse Lane in Birkenshaw.

The proposal involves the construction of six dwellings. The development will also include an access road and private drives off an existing private access road. The drainage issues are being considered as part of the current planning application.

Approach to the Assessment

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

- Site level information and proposed finished levels of the buildings and external works.
- 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.
- Infiltration characteristics of subsoils.
- Discharge rates into existing watercourse.
- 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.
- The proposal is for six private dwellings which will be sold to individual owners as such any drainage features or attenuation structures will be maintained by the individual owner/maintenance company.
- SUDs features are to be recommended where practically possible.
- There is a public combined sewer to the west of the site which is connectable via an existing private foul sewer within the clients land ownership.
- Based on the FEH data the soils have potential for infiltration. No site investigation has been undertaken to date to determine actual infiltration

rates. It is recommended that testing is undertaken once panning approval granted.

- There is an existing open watercourse 270m south of the site within the clients land ownership. The watercourse is at least 15m lower than the site as such gravity connection can be made from the site to the watercourse. Any overland flows from the site currently drain into the watercourse via a landscaped valley. At this stage it is assumed that infiltration drainage is not practical and a discharge to the watercourse is required.
- It is assumed that the minimum design standard is 1 in 100 years plus climate change (40%) as the site is less vulnerable.
- No on site above ground flooding will be acceptable up to and including 1 in 100 years plus climate change (40%) storm.

2. DESIGN OF PROPOSED SURFACE WATER DRAIANGE SYSTEM

Existing Drainage

The existing development site has a total area of 0.36 hectares. There are two roofed buildings within the site which currently drain to soakaways within the site. The roofed area totals 0.199 hectares. The remaining 0.16 hectares of the site is grass and rough ground. The existing runoff areas are shown on the plan at Appendix A.

Table 2-1: Modified Rational runoff from existing site 0.199 hectares

Return Period	Flow in litres per second (l/s)
1 in 1 year	30.92
1 in 30 year	71.10
1 in 100 year	110.36

The Modified Rational Calculation has been used to calculate the existing runoff from the paved site. The calculation sheet is provided at Appendix B of this report. The 1 year rate of 30.92l/s has been calculated. It is assumed that the LLFA will request a 30% reduction. Therefore, a discharge rate of 21.6l/s into the existing watercourse is estimated for the development.

Any discharge from the site into the watercourse may require the consent of the water authority.

Proposed Drainage Strategy

A peak discharge rate from the site of 21.6 l/s has been estimated. An assessment of the required balance volume has been made using the estimated post development impermeable area of 0.18 hectares. Using WinDes Source Control software developed by Microdrainage the required attenuation has been calculated for the 1 in 100 year plus climate change (40%) event.

Reference should be made to Appendix D where the calculation sheets are provided. The attenuation size has been tabulated overleaf in Table 1. It is estimated that during the 1 in 100 year plus climate change (40%) event that 61.1m³ of storage will be required. This will be provided within a crate tank within the access road within the site.

The drainage strategy drawing provided at Appendix C shows the drainage strategy for the site which includes a crate tank connecting to the existing watercourse via a new 225mm diameter sewer. The location of the tank can be modified to suit on site constraints.

Table 1: WinDes 1 in 100 year+CC Storage Volume

Return Period	Required Attenuation	Approx Volume (m^3)
1 in 100 year + CC	Crate tank 9m by 8.5m by 0.8m deep	61.1

It is normal practice to ensure that the 1 in 30 year event is maintained below the ground in the form of storage and the difference between the 1 in 100 year and the 1 in 30 year is permitted to flood the surface as long as there is no flooding to buildings and the flood volume is contained within the site boundary. Alternatively, if the development is sensitive, the client can choose to store the full 1 in 100 year plus climate change balance volume below ground.

Adoption & Maintenance

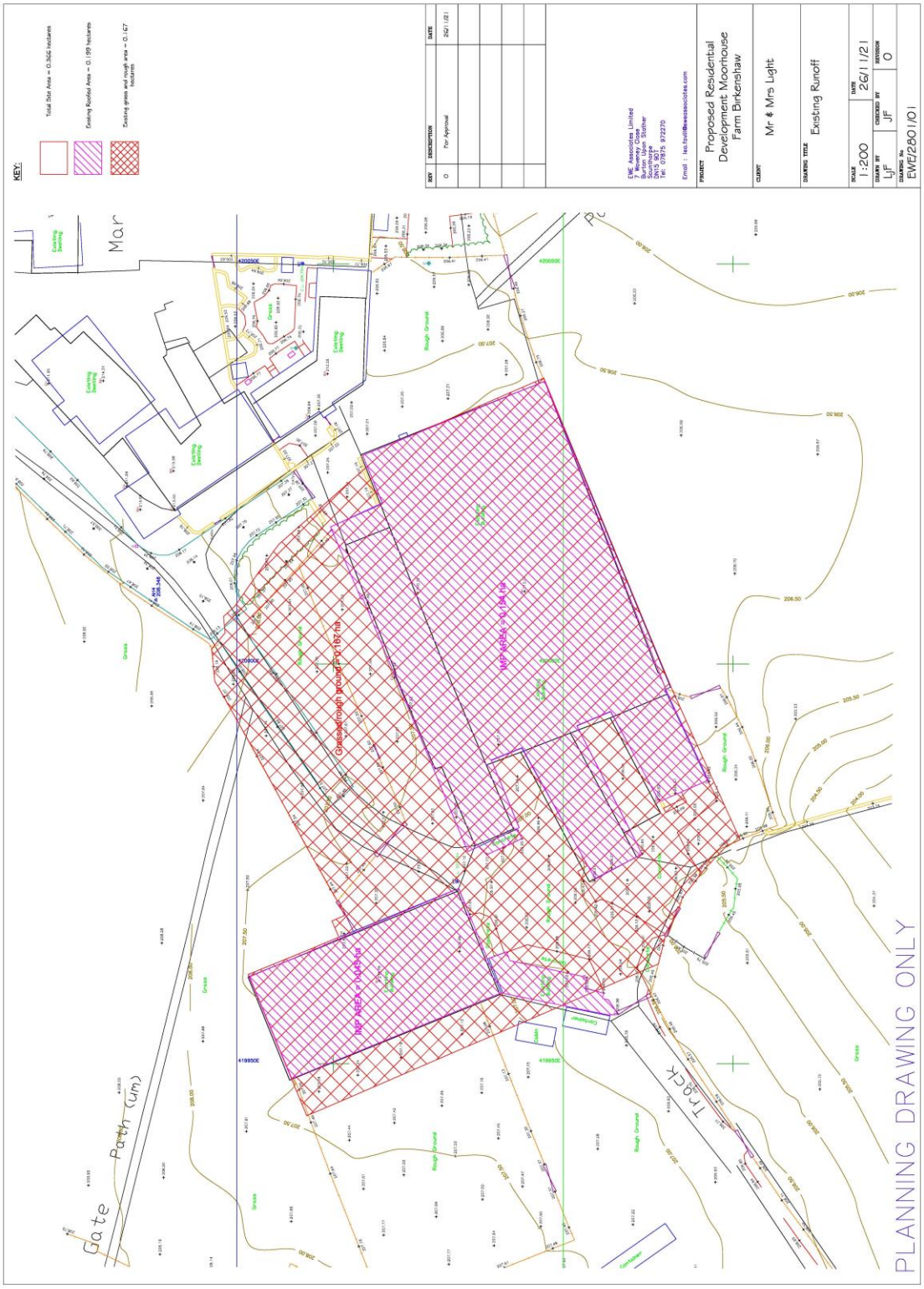
It is considered that the piped drainage systems and attenuation structure will be maintained by private land owners and management company.

3. DESIGN OF PROPOSED FOUL WATER DRAINAGE SYSTEM

There is a public combined sewer located to the west of the site. The sewer can be seen on the Yorkshire Water sewer plan of the area provided at Appendix E. There is a 100mm diameter private sewer within the client's landownership which connects into the public sewer. The existing sewers are illustrated on the drainage plan at Appendix C.

It is also proposed that the new development connects into the existing private manhole which is approximately 800mm deep. The foul sewers within the site will remain private. Some minor raising of floor levels is required to allow a ravity connection.

Appendix A: - Existing Site & Drainage



Appendix B: - Modified Rational Runoff Calculation

Modified Rational Method

Length (m)	64	m
Area (ha)	0.199	Ha
Max Height	213.8	mAOD
Min Height	205.9	mAOD
DeltaH	7.9	
Slope (%)	12.36	
Te (mins)	6.50	mins
ARF	0.998	
SAAR	798.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.40	
Percentage Runoff PR	78.83	
DEEPSTOR	0.21	

Cv	0.7883	
Cr	1.3	
allowable outflow		
1 year	30.92	l/s

Return Period flood Rainfall: 1 years, 2 years

Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.11	0.005	6	6.0	54.5	30.9	155.4
0.25	0.010	6.24	6.4	25.0	14.2	71.1
0.5	0.021	8.28	8.5	16.6	9.4	47.2
0.75	0.031	9.75	10.0	13.0	7.4	37.0
1	0.042	10.95	11.2	11.0	6.2	31.2
1.25	0.052	11.98	12.3	9.6	5.4	27.3
1.5	0.063	12.88	13.2	8.6	4.9	24.5
1.75	0.073	13.7	14.0	7.8	4.4	22.3
2	0.083	14.45	14.8	7.2	4.1	20.6
2.25	0.094	15.15	15.5	6.7	3.8	19.2
2.5	0.104	15.8	16.2	6.3	3.6	18.0
2.75	0.115	16.41	16.8	6.0	3.4	17.0
3	0.125	16.99	17.4	5.7	3.2	16.1
3.25	0.135	17.54	18.0	5.4	3.1	15.4
3.5	0.146	18.06	18.5	5.2	2.9	14.7
3.75	0.156	18.56	19.0	4.9	2.8	14.1
4	0.167	19.05	19.5	4.8	2.7	13.6
4.25	0.177	19.51	20.0	4.6	2.6	13.1

Modified Rational Method

Length (m)	64	m
Area (ha)	0.199	Ha
Max Height	213.8	mAOD
Min Height	205.9	mAOD
DeltaH	7.9	
Slope (%)	12.36	
Te (mins)	6.50	mins
ARF	0.998	
SAAR	798.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.40	
Percentage Runoff PR	78.83	
DEEPSTOR	0.21	

Cv	0.7883	
Cr	1.3	
allowable outflow		
30 year	77.10	l/s

Return Period flood Rainfall: 30 years, 50 years

Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.15	0.006	20.4	21.0	136.0	77.1	387.5
0.25	0.010	21.23	21.8	84.9	48.1	241.9
0.5	0.021	26.37	27.0	52.7	29.9	150.3
0.75	0.031	29.88	30.6	39.8	22.6	113.5
1	0.042	32.65	33.5	32.7	18.5	93.0
1.25	0.052	34.95	35.8	28.0	15.9	79.7
1.5	0.063	36.95	37.9	24.6	14.0	70.2
1.75	0.073	38.73	39.7	22.1	12.5	63.1
2	0.083	40.33	41.3	20.2	11.4	57.4
2.25	0.094	41.8	42.8	18.6	10.5	52.9
2.5	0.104	43.16	44.2	17.3	9.8	49.2
2.75	0.115	44.42	45.5	16.2	9.2	46.0
3	0.125	45.61	46.7	15.2	8.6	43.3
3.25	0.135	46.73	47.9	14.4	8.2	41.0
3.5	0.146	47.79	49.0	13.7	7.7	38.9
3.75	0.156	48.79	50.0	13.0	7.4	37.1
4	0.167	49.75	51.0	12.4	7.1	35.4
4.25	0.177	50.67	51.9	11.9	6.8	34.0

Modified Rational Method

Length (m)	64	m
Area (ha)	0.199	Ha
Max Height	213.8	mAOD
Min Height	205.9	mAOD
DeltaH	7.9	
Slope (%)	12.36	
Te (mins)	6.50	mins
ARF	0.998	
SAAR	798.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.40	
Percentage Runoff PR	78.83	
DEEPSTOR	0.21	

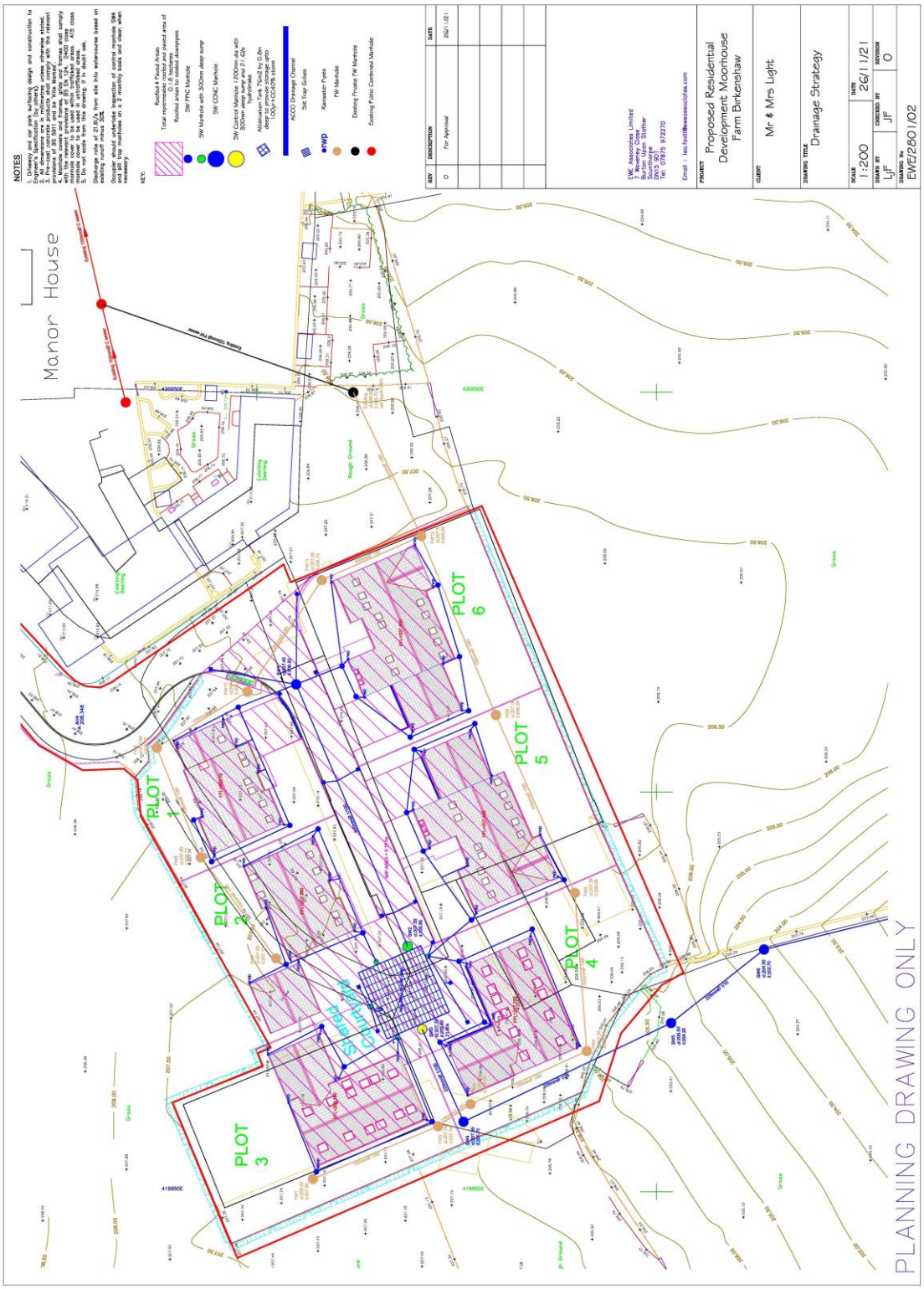
Cv	0.7883	
Cr	1.3	
allowable outflow		
100 year	110.36	l/s

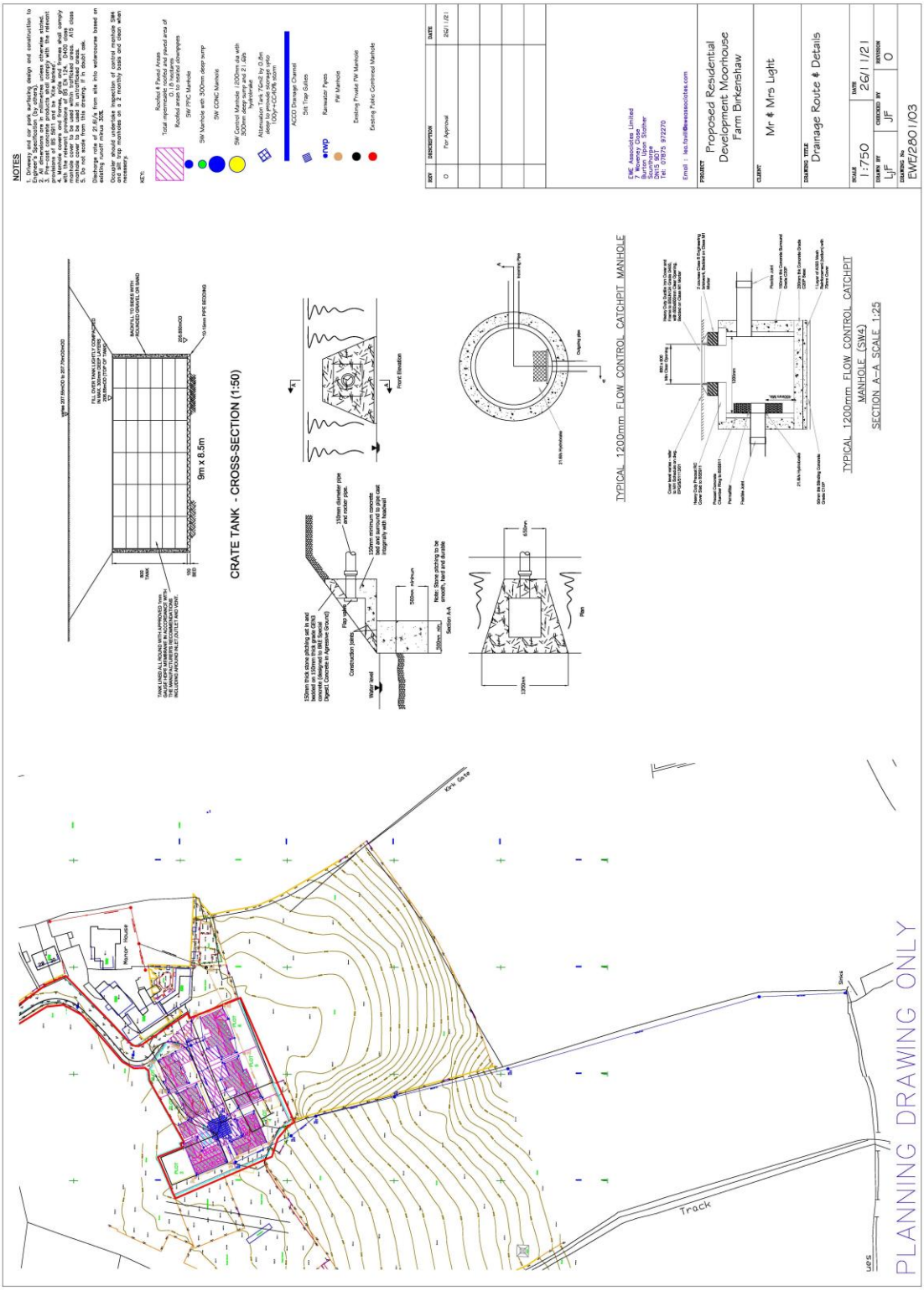
Return Period flood Rainfall: 100 years, 140 years

Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.15	0.006	29.2	29.3	194.7	110.4	554.6
0.25	0.010	35.2	36.1	140.8	79.8	401.1
0.5	0.021	37.03	37.9	74.1	42.0	211.0
0.75	0.031	41.49	42.5	55.3	31.4	157.6
1	0.042	44.97	46.1	45.0	25.5	128.1
1.25	0.052	47.84	49.0	38.3	21.7	109.0
1.5	0.063	50.32	51.6	33.5	19.0	95.6
1.75	0.073	52.52	53.8	30.0	17.0	85.5
2	0.083	54.49	55.8	27.2	15.4	77.6
2.25	0.094	56.29	57.7	25.0	14.2	71.3
2.5	0.104	57.94	59.4	23.2	13.1	66.0
2.75	0.115	59.48	61.0	21.6	12.3	61.6
3	0.125	60.92	62.4	20.3	11.5	57.9
3.25	0.135	62.27	63.8	19.2	10.9	54.6
3.5	0.146	63.55	65.1	18.2	10.3	51.7
3.75	0.156	64.76	66.4	17.3	9.8	49.2
4	0.167	65.92	67.6	16.5	9.3	47.0
4.25	0.177	67.02	68.7	15.8	8.9	44.9

Appendix C: - Drainage Drawings




NOTES
CRATE TANK - CROSS-SECTION (1:50)
9m x 8.5m
TYPICAL 1200mm FLOW CONTROL CATCHPIT MANHOLE
TYPICAL 1200mm FLOW CONTROL CATCHPIT MANHOLE (SW4)
SECTION A-A SCALE 1:25
Proposed Residential Development Moorhouse Farm Birkenshaw
Mr & Mrs Light
Drainage Route & Details
1:750
26/11/21
EWE/2801/03
Kirk Gate
Manor House
Track
Stable
PLANNING DRAWING ONLY

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

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 18/11/2021 18:43	Designed By Lea	
File 100yr+CC40% tank ...	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 Control (l/s)	Max Volume (m³)	Status
15 min Summer	204.669	0.669	14.6	50.2	O K
30 min Summer	204.717	0.717	14.6	53.7	O K
60 min Summer	204.717	0.717	14.6	53.7	O K
120 min Summer	204.665	0.665	14.6	49.9	O K
180 min Summer	204.595	0.595	14.6	44.6	O K
240 min Summer	204.522	0.522	14.6	39.2	O K
360 min Summer	204.373	0.373	14.6	28.0	O K
480 min Summer	204.284	0.284	14.6	21.3	O K
600 min Summer	204.241	0.241	13.8	18.1	O K
720 min Summer	204.216	0.216	12.6	16.2	O K
960 min Summer	204.186	0.186	10.7	14.0	O K
1440 min Summer	204.154	0.154	8.1	11.6	O K
2160 min Summer	204.130	0.130	6.1	9.7	O K
2880 min Summer	204.116	0.116	4.9	8.7	O K
4320 min Summer	204.098	0.098	3.6	7.3	O K
5760 min Summer	204.087	0.087	2.8	6.5	O K
7200 min Summer	204.080	0.080	2.4	6.0	O K
8640 min Summer	204.074	0.074	2.0	5.6	O K
10080 min Summer	204.070	0.070	1.8	5.3	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	174.143	17
30 min Summer	103.503	30
60 min Summer	61.517	46
120 min Summer	36.563	80
180 min Summer	26.969	114
240 min Summer	21.731	148
360 min Summer	16.029	206
480 min Summer	12.916	258
600 min Summer	10.924	314
720 min Summer	9.527	374
960 min Summer	7.679	492
1440 min Summer	5.666	736
2160 min Summer	4.181	1100
2880 min Summer	3.370	1468
4320 min Summer	2.422	2184
5760 min Summer	1.916	2936
7200 min Summer	1.598	3624
8640 min Summer	1.377	4400
10080 min Summer	1.215	5096

EWE Associates Ltd		Page 2
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 18/11/2021 18:43	Designed By Lea	
File 100yr+CC40% tank ...	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 Control (l/s)	Max Volume (m³)	Status
15 min Winter	204.757	0.757	14.6	56.8	O K
30 min Winter	204.816	0.816	14.6	61.1	O K
60 min Winter	204.808	0.808	14.6	60.6	O K
120 min Winter	204.726	0.726	14.6	54.4	O K
180 min Winter	204.617	0.617	14.6	46.2	O K
240 min Winter	204.494	0.494	14.6	37.0	O K
360 min Winter	204.284	0.284	14.6	21.3	O K
480 min Winter	204.223	0.223	13.0	16.7	O K
600 min Winter	204.194	0.194	11.3	14.6	O K
720 min Winter	204.176	0.176	9.9	13.2	O K
960 min Winter	204.153	0.153	8.1	11.5	O K
1440 min Winter	204.129	0.129	6.0	9.6	O K
2160 min Winter	204.109	0.109	4.4	8.2	O K
2880 min Winter	204.098	0.098	3.6	7.3	O K
4320 min Winter	204.083	0.083	2.6	6.2	O K
5760 min Winter	204.075	0.075	2.1	5.6	O K
7200 min Winter	204.069	0.069	1.7	5.1	O K
8640 min Winter	204.064	0.064	1.5	4.8	O K
10080 min Winter	204.060	0.060	1.3	4.5	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Winter	174.143	17
30 min Winter	103.503	30
60 min Winter	61.517	48
120 min Winter	36.563	88
180 min Winter	26.969	124
240 min Winter	21.731	158
360 min Winter	16.029	204
480 min Winter	12.916	258
600 min Winter	10.924	316
720 min Winter	9.527	376
960 min Winter	7.679	494
1440 min Winter	5.666	734
2160 min Winter	4.181	1100
2880 min Winter	3.370	1468
4320 min Winter	2.422	2192
5760 min Winter	1.916	2888
7200 min Winter	1.598	3640
8640 min Winter	1.377	4408
10080 min Winter	1.215	4952

EWE Associates Ltd		Page 3
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 18/11/2021 18:43	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	421150 428100 SE 21150 28100
C (1km)	-0.026
D1 (1km)	0.369
D2 (1km)	0.370
D3 (1km)	0.305
E (1km)	0.303
F (1km)	2.389
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) 0.180

Time (mins)	Area (ha)
0-4	0.180

EWE Associates Ltd		Page 4
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		
Date 18/11/2021 18:43	Designed By Lea	
File 100yr+CC40% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Model Details

Storage is Online Cover Level (m) 206.000

Tank or Pond Structure

Invert Level (m) 204.000

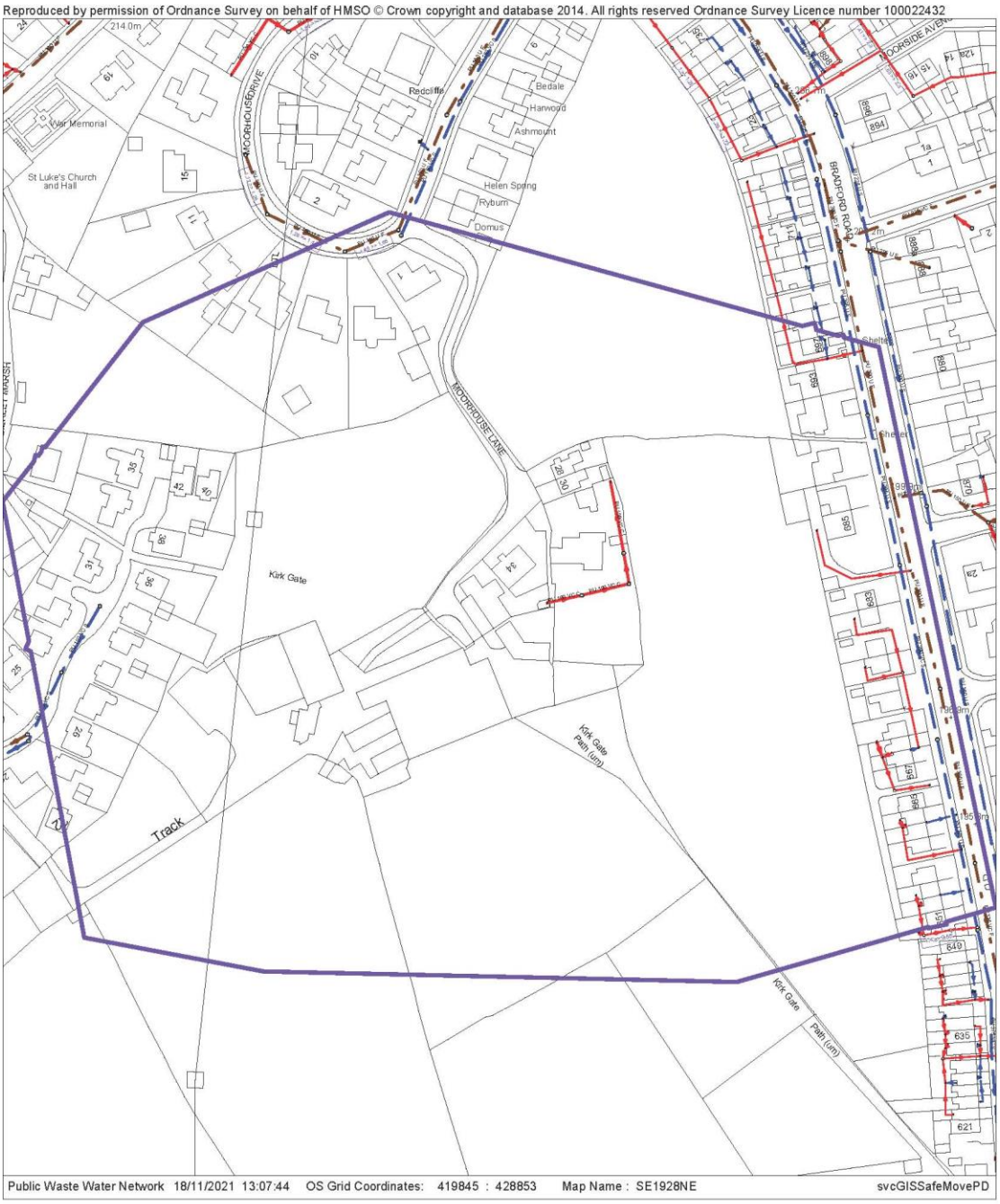
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	75.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	75.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	75.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	75.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	75.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	0.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 2.000 Hydro-Brake® Type Md4 Invert Level (m) 204.000
Design Flow (l/s) 21.6 Diameter (mm) 140

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	16.7	3.000	26.4	7.000	40.4
0.200	11.6	1.400	18.1	3.500	28.6	7.500	41.8
0.300	14.6	1.600	19.3	4.000	30.5	8.000	43.2
0.400	13.1	1.800	20.5	4.500	32.4	8.500	44.5
0.500	12.1	2.000	21.6	5.000	34.1	9.000	45.8
0.600	12.3	2.200	22.6	5.500	35.8	9.500	47.0
0.800	13.7	2.400	23.6	6.000	37.4		
1.000	15.3	2.600	24.6	6.500	38.9		

Appendix E: - Sewer Plan



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