Mr Jason Hughes

Phase 2
Southview
Darfield

Drainage Assessment

Prepared by EWE Associates Ltd
Draft Rev0 October 2020

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CLIENT DETAILS

Mr Jason Hughes

CONTRACT

This report describes work commissioned on behalf of Mr Jason Hughes by their representatives during September 2020. The representatives for the contract is Mr James Roberts. Lea Favill of EWE Associates Ltd carried out the work.

Date: 26th October 2020

Prepared by: …… ……. Lea Favill
Director

REVISION HISTORY

Draft Report Rev0 issued 26th October 2020
- 1No copy issued to James Roberts

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1. INTRODUCTION

Terms of Reference

This report was commissioned by Mr Jason Hughes to consider the surface water drainage system for the proposed residential development at Southview Darfield.

The proposal involves the construction 31 residential units and access roads. The drainage issues are being considered as part of the 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 building and external works.
- Catchment area draining to the existing public sewers.
- Existing infiltration characteristics of subsoils.
- 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.
- Discharge rates into Phase 1 and public sewer.
- 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 a residential development as such any SUDs features or attenuation structures will be maintained by the individual owner/maintenance company.
- SUDs features are to be recommended where practically possible.
- RB Geotechnical has undertaken percolation tests within the site. Trial holes within the site identified made ground and mudstone/sandstone. The infiltration rates estimated are extremely low and the site steeply slopes down from north to south. As such, soakaways not considered practical for this site.

- A site visit was completed during September 2020. During the visit no open or culverted watercourse were found. There is a 225mm diameter combined Yorkshire Water public sewer located within Snape Hill Road to the south of the site. The sewer is over 1.7m deep in line with the site entrance.
- Phase 1 of the development has been granted planning permission and highway/drainage conditions discharged. The Phase 2 development assumes that a connection will be made into the Phase 1 drainage system for both surface water and foul water drainage.
- The minimum design standard is 1 in 100 years plus climate change (40%). Based on latest climate change allowance figures dated February 2016.
- No on site above ground flooding will be acceptable up to and including 1 in 100 years plus climate change (40%) storm.
- A discharge rate of 5.7l/s has been estimated from the site based on ADAS345 greenfield runoff rates. The site is considered to eb 100% permeable with no roofed or paved areas.

2. DESIGN OF PROPOSED SURFACE WATER DRAIANGE SYSTEM

Existing Runoff

The existing site has a total area of 0.867 hectares which is steeply sloping (1 in 5). There are no roofed or paved areas within the site. Due to the steep sloping site the ADAS345 method has been used to estimate the Qbar runoff from the site at 5.7l/s. The calculations are provided at Appendix B of this report.

Catchment Area

The catchment area was calculated from proposed layout drawing provide by the clients representative. The total impermeable area has been estimated at 0.411 hectares.

Yorkshire Water Sewer

There is a 225mm diameter combined Yorkshire Water sewer located inline with the site entrance within Snape Hill Road to the south of the site. The sewer is at least 1.7m deep. The phase 1 development will include a connection into this sewer. At this stage it is envisaged that this the Phase 2 development will connect into the Phase 1 surface water sewer via a control manhole limiting flows to 5.7l/s from the Phase 2 site. The sewer plan is provided at Appendix A of this report.

The phase 1 development has not commenced.

Drainage Strategy

The proposed drainage strategy is as follows and is illustrated on the drainage layout drawing provided at Appendix C of this report. The drainage system will include oversized pipes within the adoptable highway and two tanks located in areas which could allow easements directly off the adoptable highway.

Adoption & Maintenance

It is considered that the piped drainage system within the adoptable highway will be adopted by Yorkshire Water and the two tanks will be the responsibility of a private management company.

Proposed Drainage Strategy

It is proposed to ultimately discharge any surface water flows generated by the development of the site which cannot drain via infiltration to the Phase 1 surface water sewer and then into the Yorkshire Water combined sewer.

The 0.411 ha of Phase 2 will be directed to a system of oversized pipes and tanks.

The drainage strategy utilises an appropriately sized hydro brake to restrict the flow rate to a maximum of 5.7l/s. A second hydro brake will eb provided due to the steep slopes within the proposed highway. As such, the flow will vary for each of the design storms shown above and it is expected that during the more extreme return periods there will be a considerable betterment as the hydro brake is likely to restrict flows to a lesser rate than estimated at present.

Based upon the assumption that the drainage authority will agree to the maximum discharge rates of 5.7l/s, a preliminary surface water network has been developed and attenuation has been sized using MicroDrainage software.

The model data for the proposed surface water drainage network has been obtained from the proposed development layout drawing and the drainage strategy drawing is provided at Appendix C of this report. A model has been developed to represent the main drainage runs within the proposed drainage network and contributing drainage areas within the development.

Overall, the hydraulic models include the following;

- 4 pipes to represent the proposed system
- 2 hydro-brake downstream of pond (5.7l/s)
- 2 Tanks
- 1 outfall into the Phase 1 sewer

Impermeable area contributions have been based on those supplied on the proposed layout drawing, considered to be 100% impermeable, comprising of roofed and paved areas.

The models have been set up as a fixed runoff model assuming 100% runoff coefficient for roofed and paved areas. The rainfall characteristics for Darfield have been utilised with a value for M5-60 given as 20mm (the depth of rain in a once in five years one hour duration event); and r given as 0.40 (the ratio of the M5-60 rainfall to the M5-2day rainfall). For durations over 60 minutes the FEH runoff data for Darfield has been used.

Hydraulic Modelling Results

The proposed MicroDrainage models have been simulated with the 1 in 100 year plus climate change (40%) return period design storm events with durations of 15, 45, 60, 180, 240, 300, 360, 420, 480, 600, 720, 840, 900, 1140 and 1440 minutes. At the request of the Environment Agency seven day 10080 minute duration was also undertaken. The durations were run in both Winter and Summer profiles. It was found that the Winter profile was critical.

The table overleaf shows a summary of the 1 in 100 year plus climate change model runs and the impact on the drainage system in terms of peak depth within the pond and flow through the hydro-brake.

The 720 minute duration produced the largest flow through the hydro-brake (5.3 l/s) which is less than the restricted runoff rate (5.7l/s). The modelled result for the 720 minute Winter model run is provided at Appendix D. There was no flooding during this event.

Return Period	Duration (min)	Peak water level in Tank1	Peak flow Upper site	Peak water level in Tank2	Peak flow into Phase 1	Status
100 yr+CC	15min	49.188	4.1	45.811	3.2	SUR
100 yr+CC	45min	49.401	4.7	45.977	3.2	SUR
100 yr+CC	60min	49.505	4.9	46.109	3.4	Flood risk
100 yr+CC	180min	49.706	5.3	46.527	4.6	Flood risk
100 yr+CC	240min	49.752	5.4	46.580	4.7	Flood risk
100 yr+CC	300min	49.770	5.5	46.617	4.8	Flood risk
100 yr+CC	360min	49.767	5.5	46.644	4.8	Flood risk
100 yr+CC	420min	49.752	5.4	46.664	4.9	Flood risk
100 yr+CC	480min	49.735	5.4	46.667	4.9	Flood risk
100 yr+CC	600min	49.705	5.3	46.687	4.9	Flood risk
100 yr+CC	720min	49.670	5.3	46.684	4.9	Flood risk
100 yr+CC	840min	49.649	5.2	46.684	4.9	Flood risk
100 yr+CC	900min	49.637	5.2	46.680	4.9	Flood risk
100 yr+CC	1140min	49.602	5.1	46.660	4.9	Flood risk
100 yr+CC	1440min	49.554	5.0	46.633	4.8	Flood risk
100 yr+CC	10080min	48.546	2.8	45.713	2.8	OK

3. DESIGN OF PROPSOED FOUL DRAINAGE SYSTEM

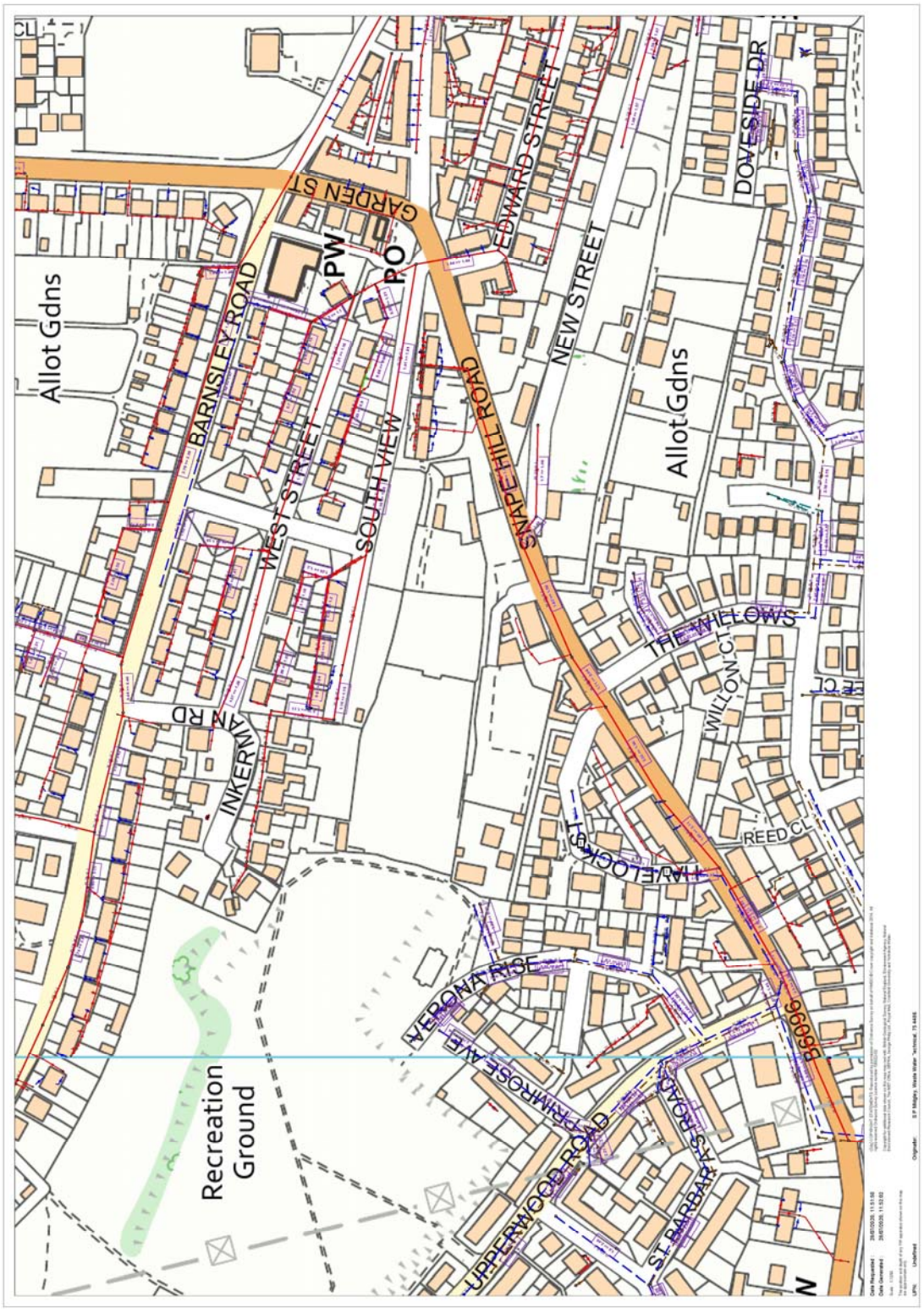
Existing Foul Drainage

There is a public combined sewer within Snape Hill Road.

Proposed Foul Drainage

A gravity connection will be made via Phase 1 into the Yorkshire Water public sewer within Snape Hill Road.

Appendix A: - YW Sewer Plan



Appendix B: - ADAS345 Runoff Calculations

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 30/07/2020 12:27 File	Designed By Windows7 Checked By	
Micro Drainage	Source Control W.12.4	

ADAS 345 Mean Annual Flood

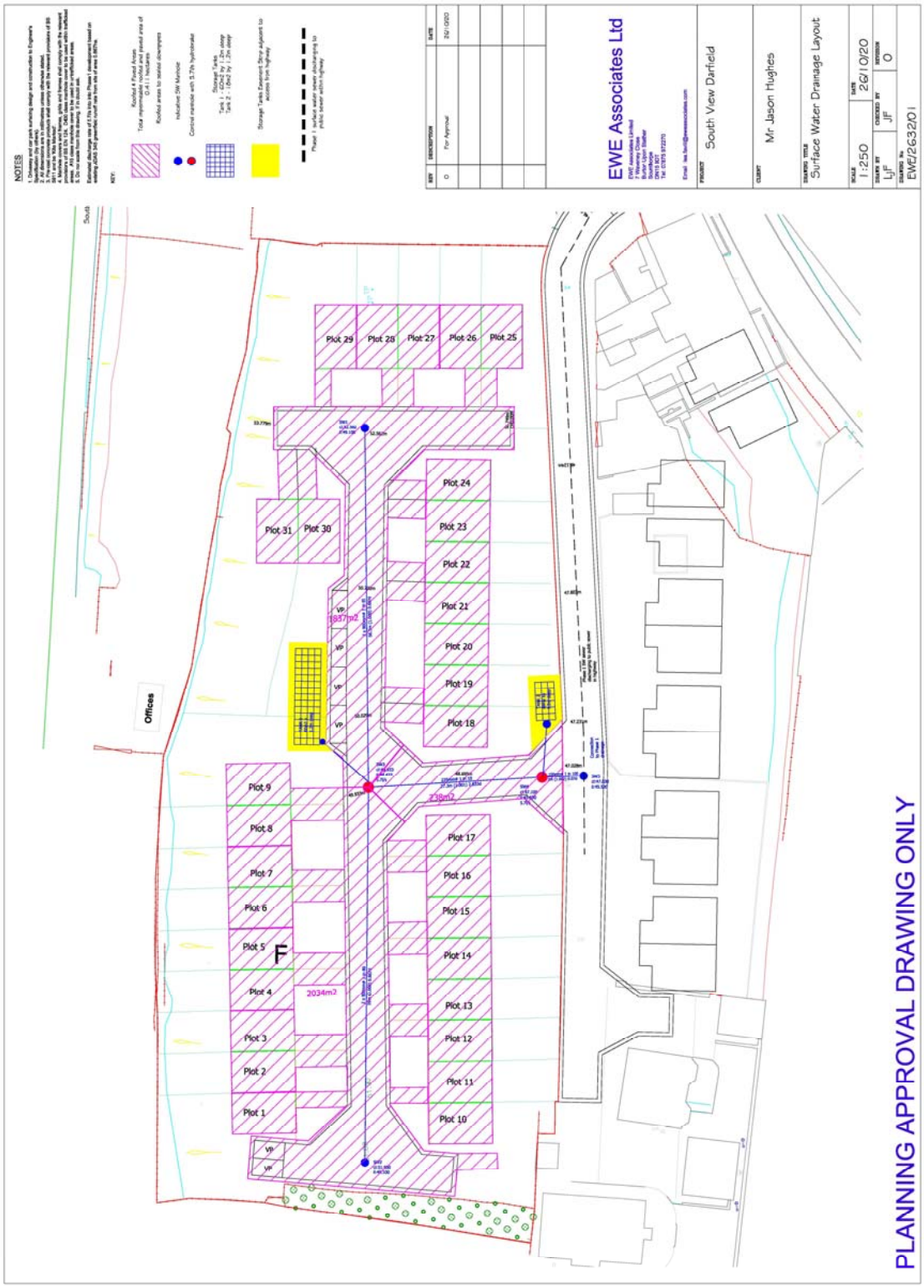
Input

Area (ha)	0.867	Soil Type Factor (St)	0.450
Length (m)	65.000	Paved Area (%)	0.000
Average Slope (1:X)	5.0	Dominant Crop Type	Grass
AAR (mm)	608	Region Number	Region 3

Results	l/s
Q0 - Peak Flood Flow	4.9
Total Q0	4.9
QBAR	5.7
Q1 year	4.9
Q1 year	4.9
Q2 years	5.4
Q5 years	7.1
Q10 years	8.3
Q20 years	9.4
Q25 years	9.7
Q30 years	10.0
Q50 years	10.8
Q100 years	11.9
Q200 years	13.5
Q250 years	14.0
Q1000 years	17.3

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Appendix C: - Drainage Drawing



Appendix D: - WinDes drainage Calculations Sheets

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 26/10/2020 13:29 File 100yr+CC40%Winter...	Designed By Windows7 Checked By	
Micro Drainage	Network W.12.4	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.000	56.300	0.667	84.4	0.184	4.00	0.600	oo	900
2.000	59.000	0.667	88.5	0.203	4.00	0.600	oo	900
1.001	27.300	2.833	9.6	0.024	0.00	0.600	o	225
1.002	7.000	0.070	100.0	0.000	0.00	0.600	o	150

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	52.562	49.100	2.562	49.933	48.433	0.600		3000
2.000	2	51.900	49.100	1.900	49.933	48.433	0.600		3000
1.001	3	49.933	48.433	1.275	47.100	45.600	1.275	Hydro-Brake®	3000
1.002	4	47.100	45.600	1.350	47.030	45.530	1.350	Hydro-Brake®	2400

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		47.030	45.530	45.530	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Run Time (mins)	1440
Hot Start Level (mm)	0	Output Interval (mins)	12
Manhole Headloss Coeff (Global)	0.500		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	441350 403850 SE 41350 03850
C (1km)	-0.025
D1 (1km)	0.356
D2 (1km)	0.406

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Synthetic Rainfall Details

D3 (1km)	0.248
E (1km)	0.301
F (1km)	2.361
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	720

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Micro Drainage	Network W.12.4	

Online Controls for Storm

Hydro-Brake® Manhole: 3, DS/PN: 1.001, Volume (m³): 149.7

Design Head (m) 1.500 Hydro-Brake® Type Md4 Invert Level (m) 48.433
Design Flow (l/s) 5.7 Diameter (mm) 78

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	5.2	3.000	8.2	7.000	12.5
0.200	3.2	1.400	5.6	3.500	8.9	7.500	13.0
0.300	2.8	1.600	6.0	4.000	9.5	8.000	13.4
0.400	3.0	1.800	6.4	4.500	10.1	8.500	13.8
0.500	3.4	2.000	6.7	5.000	10.6	9.000	14.2
0.600	3.7	2.200	7.0	5.500	11.1	9.500	14.6
0.800	4.2	2.400	7.3	6.000	11.6		
1.000	4.7	2.600	7.6	6.500	12.1		

Hydro-Brake® Manhole: 4, DS/PN: 1.002, Volume (m³): 7.8

Design Head (m) 1.500 Hydro-Brake® Type Md4 Invert Level (m) 45.600
Design Flow (l/s) 5.7 Diameter (mm) 78

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	5.2	3.000	8.2	7.000	12.5
0.200	3.2	1.400	5.6	3.500	8.9	7.500	13.0
0.300	2.8	1.600	6.0	4.000	9.5	8.000	13.4
0.400	3.0	1.800	6.4	4.500	10.1	8.500	13.8
0.500	3.4	2.000	6.7	5.000	10.6	9.000	14.2
0.600	3.7	2.200	7.0	5.500	11.1	9.500	14.6
0.800	4.2	2.400	7.3	6.000	11.6		
1.000	4.7	2.600	7.6	6.500	12.1		

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Date 26/10/2020 13:29 File 100yr+CC40%Winter...	Designed By Windows7 Checked By	
Micro Drainage	Network W.12.4	

Storage Structures for Storm

Tank or Pond Manhole: 3, DS/PN: 1.001

Invert Level (m) 48.433

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	60.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	60.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	60.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	60.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	60.0	2.400	0.0	3.800	0.0		
1.200	60.0	2.600	0.0	4.000	0.0		

Tank or Pond Manhole: 4, DS/PN: 1.002

Invert Level (m) 45.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	18.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	18.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	18.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	18.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	18.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	18.0	2.400	0.0	3.800	0.0		
1.200	18.0	2.600	0.0	4.000	0.0		

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 26/10/2020 13:29 File 100yr+CC40%Winter...	Designed By Windows7 Checked By	
Micro Drainage	Network W.12.4	

Summary of Results for 720 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	49.670	-0.330	0.000	0.00	0.0	9.2	OK
2.000	2	49.670	-0.330	0.000	0.00	0.0	10.1	OK
1.001	3	49.670	1.012	0.000	0.03	0.0	5.3	FLOOD RISK
1.002	4	46.684	0.934	0.000	0.33	0.0	4.9	FLOOD RISK

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