Mr C Muscroft

Proposed Residential Development
Severn Lakes
Ealand
Crowle

Drainage Assessment

Prepared by EWE Associates Ltd
Final RevA October 2018

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CLIENT DETAILS

Mr C Muscroft
Mr Ian Johnston - Canley Food Packers

C/o Mr Howard Wroot
Chartered Surveyor

CONTRACT

This report describes work commissioned by Mr C Muscroft during July 2017. Mr C Muscroft representative for the contract was Mr Howard Wroot. Lea Favill of EWE Associates Ltd carried out the work.

Date: 8th October 2018

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

REVISION HISTORY

Draft Report Rev0 issued 29th May 2018 - 1No copy issued to Mr Howard Wroot
Final Report RevA issued 8th October 2018 - 1No copy issued to Mr Howard Wroot

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1. INTRODUCTION

Terms of Reference

This report was commissioned by Mr C Muscroft to consider the surface water and foul water drainage systems for the proposed residential development to the west of Ealand near Crowle.

The proposal involves the construction of residential dwellings which includes houses, private driveways 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.
- 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 North Soak Drain 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.
- The proposal is for residential dwellings which will be sold to individual owners 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.
- Site investigation works have been undertaken within the site which included percolation tests. It was concluded that the subsoils are of a low permeability and as such infiltration drainage is not a practical solution for this site within the constraints of BRE365.
- A site visit was completed during May 2018. During the site visit the existing foul pumping station was inspected by an M&E Contractor.

- The whole of the site currently drains south into the North Soak Drain via a 100l/s pumping station and a 225mm diameter gravity connection (52l/s). the pumping station also includes over 500m³ of storage tanks.
- Based on existing topography the site appears to drain south towards the North Soak Drain.
- There is evidence of positive drainage within the site.
- The Severn Trent Water sewer plan shows only a 150mm diameter foul sewer to the north east of the site within New Trent Street. The existing foul pumping station within the site currently discharges to this sewer via a rising main.
- The discharge rate of 100l/s into the North Soak Drain is estimated.
- It is assumed that the minimum design standard is 1 in 100 years plus climate change (40%).
- No above ground flooding will be acceptable up to and including 1 in 100 years plus climate change (40%) storm.

SUDs Features Considered

The Lead Drainage Authority requires that adequate pollution control is incorporated into the proposed drainage system in order to prevent deterioration of the quality of the water environment. However, this is only applicable for surface water originating from access roads and communal parking areas, which needs to be passed through a petrol/oil interceptor or equivalent system prior to discharge into the existing surface water sewer or infiltration system. It is noted however, that this will not apply to surface water originating from roof drainage.

To reduce the impact of surface water runoff from the development in accordance with the requirements of the Environment Agency and Local Authority, the employment of SUDS techniques to limit runoff volumes and rates from the site are recommended. SUDS techniques can also be used to provide an appropriate level of treatment to the runoff.

It is normal practice to ensure that the 1 in 30 year event is maintained within the drainage system and the 1 in 100 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 in specific areas proposed for this purpose.

The following section will provide some possible SUDS techniques which could be employed on the site to balance flows in excess of the 1 in 30 year event. SUDS techniques will also provide treatment to the runoff to remove a proportion of the pollution and protect the quality of the downstream watercourses. Following guidance from CIRIA Report C522 the following levels of treatment will be provided:

- Roofs – 1 level
- Driveways – 1 level
- Roads and communal parking areas – 2 levels.

The level of treatment indicates the number of SUDS techniques that will be used to treat pollution. For example if two levels are required the runoff may enter a filter drain that leads to a basin or pond before outfall. It is recommended that source control techniques are used. In practice there will be little outflow from these

techniques for a 1 in 2 year storm as most of the rainfall will be held within the system and will disperse via evapotranspiration.

The site is underlain by an impermeable layer which is unlikely to allow any infiltration at a reasonable rate. The impermeable area within the site will be increased to 1.575 hectares following development. There will therefore be an increase in surface water runoff from the site when it is developed. It is considered that the site currently drains to the North Soak Drain to the south of the site. The development site has space set aside, in which to incorporate SUDs techniques such as pond. As such, the following SUDS techniques shown below within Table 1-1 are suitable. The precise combination of methods used will be dependent upon the site constraints identified at the final design stage.

Table 1-1: SUDS Techniques and Suitability of Use

Method	Description	Potential for use at site
Filter drains and rain gardens	Drainage trench filled with gravel and provided with a pipe	Could be used within both private and adoptable highways
Swales	Shallow grass ditch	Swale to be incorporated adjacent to A161 highway embankment to collect runoff and direct around site and into North Soak Drain.
Permeable surfaces	Pavement surfaces that allow water to pass through into underlying storage in sub base e.g. permeable concrete block paving or porous asphalt.	Could be used on private driveways.
Ponds and basins	Open areas that are used to store and treat rainwater. Ponds are permanent bodies of water and basins are generally dry and occasionally store water.	Space provided adjacent to North Soak Drain. Will be constructed to provide at least 2 levels of treatment.
Green roofs	Roof system that is vegetated with plants (note sedum plants rather than grass so no mowing is required)	Traditional Build Unit is proposed which does not incorporate green roofs.
Infiltration devices	Methods that allow rainwater to soak into the ground, e.g. soakaways.	Ground conditions not suitable.
Storage tanks	Underground tanks that temporarily store water in the drainage system.	Not suitable for this development

2. DESIGN OF PROPOSED SURFACE WATER DRAIANGE SYSTEM

Catchment Area

The catchment area was calculated from proposed layout drawing provide by Howard Wroot. The total site area has been estimated at 38380m² (3.84 hectares). The total impermeable area has been estimated at 15748m² (1.575 hectares).

Existing Drainage

The development currently has planning permission for a commercial estate which has an overall area of 3.84 hectares. However, none of the buildings have been constructed within the site. There is a main access road which runs north to south through the site which has been constructed with a gravity sewer which outfalls into the north soak drain to the south of the site. The system is generally 150mm and 225mm diameter pipes with an interceptor. There are no hydro brakes or controls on the system. Therefore, the flow is regulated by the final pipe diameter and head above the pipe soffit.

The site was split into five commercial plots of which this development is the north west plot within the site. The commercial plots have a total area of 32012m². A separate surface water drainage system was designed and constructed with tails to each of the plots within the site. The surface water drainage system also included 3 storage tanks each 13.5m long constructed from tubosider pipes 4m in diameter. This provides over 500m³ of storage. Due to the significant depth of the pipes a pumping station was required to lift the surface water into the North Soak Drain to the south. The pumping station has a peak flow rate of 100l/s.

The design standard of the two surface water drainage systems are unknown. However, based on the catchment areas, discharge restrictions and storage provide the design standard is estimate at between 50 and 100 years based on current design standards and practices.

Existing Runoff from Site to North Soak Drain

The pumping station into the North Soak Drain controls the discharge from the whole site of 32012m² at a peak flow rate of 100l/s. The site would also use the 500m³ of storage provided upstream of the pumping station.

There is also a 225mm diameter gravity discharge which has a final gradient of 1 in 77 which currently directs runoff from the access road within the site to the North Soak Drain. The peak capacity of the seer has been estimated at 52l/s. The calculation sheet is provided at Appendix A of this report.

Therefore, the peak discharge from the site has been estimated at 152l/s (100l/s+52l/s).

In line with current policy a minimum brownfield restriction of 30% should be applied. Therefore, for the purpose of this assessment a discharge rate of 100l/s has been estimated for the proposed development into the North Soak Drain.

The Environment Agency have confirmed that the 100l/s is acceptable. The email confirming this is provided at Appendix G of this report.

Adoption & Maintenance

It is considered that the piped drainage systems within the highway and communal open spaces will be adopted by Severn Trent Water.

It is considered that the piped drainage systems within private land will be the responsibility of individual land owners.

The foul pumping station will remain private and will be maintained by a private management company.

The rising main will be adopted by Severn Trent Water.

The attenuation pond will be maintained by a private management company.

The existing surface water pumping station will be demolished.

Construction

The Proposed drainage system is simple in design however, its construction is essential to ensure that the system functions as it has been designed. As such it is recommended that construction inspection check list is adopted during the construction phase of the works to ensure that the drainage system is correctly installed. The inspection checklist is provided at Appendix B of this report and has been taken from the CIRIA Sustainable Drainage Systems Manual.

Post Construction

Following construction regular inspection is recommended. The main concern is to reduce the level of siltation entering the pond and as such a catchpit structure should be located at the upstream end of the pond to intercept any silt being washed down the surface water system. It is recommended that this structure is inspected on a monthly basis and any silt located in the bottom removed. The pond should also be inspected for any deformation of the topsoil 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.

Existing surface water Pumping Station

The existing surface water pumping station will not be required for the new development. As such, the existing station will be demolished and grubbed up prior to completion of the development.

Maintenance Schedule	Required action	Frequency
Monitoring	Inspect catchpit structure for silt and debris	Monthly
	Inspect pond for ground deformation	3 monthly
	Inspect pond 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 debris from pond	6 monthly
Remedial actions	Repair deformation of topsoil once settlement stopped	As required
	Repair inlet and outlet to pond	As required

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 North Soak Drain to the south of the site.

The proposed impermeable area for the development site has been calculated to be approximately 15748m² (1.575 hectares) of roofed and paved area with the remainder of the site proposed as gardens and landscaping.

The drainage strategy utilises an appropriately sized hydro brake to restrict the flow to 100l/s. This allows the discharge through the hydro brake to vary as the head increases due to the increase in upstream flows. Storage will be provided by a single pond located adjacent to the North Soak Drain.

Based upon the assumption that the drainage authority will agree to the maximum discharge rate of 100l/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;

- 25 pipes to represent the proposed system
- 1 hydro-brake
- 1 attenuation pond
- 1 outfall into the watercourse with surcharging (3mOD) to replicate flood level with NSD.

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 Ealand 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 Ealand has been used. A MADD factor of 0 has been applied.

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, 90, 180, 240, 360, 480, 600, 720, 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 60 minute duration produced the largest flow through the hydro-brake (96.7 l/s) which is less than the proposed discharge restriction of 100l/s and the 360 minute duration produced the largest level within the pond at 3.349mOD. The modelled result for the 360 minute Winter model run is provided at Appendix D. There was no flooding during any of the durations simulated.

Return Period	Profile	Duration (min)	Peak depth in pond	Peak flow into North Soak Drain
100 year+CC	Winter FSR	15min	2.930	89.6
100 year+CC	Winter FSR	45min	2.951	84.4
100 year+CC	Winter FEH	60min	3.038	96.7
100 year+CC	Winter FEH	90min	3.250	61.2
100 year+CC	Winter FEH	180min	3.333	51.2
100 year+CC	Winter FEH	240min	3.345	53.3
100 year+CC	Winter FEH	360min	3.349	54.0
100 year+CC	Winter FEH	480min	3.338	52.3
100 year+CC	Winter FEH	600min	3.326	50.1
100 year+CC	Winter FEH	720min	3.313	47.8
100 year+CC	Winter FEH	900min	3.294	44.2
100 year+CC	Winter FEH	1140min	3.273	39.7
100 year+CC	Winter FEH	1440min	3.250	35.2
100 year+CC	Winter FEH	10080min	3.113	83.6

3. DESIGN OF PROPSOED FOUL DRAINAGE SYSTEM

Existing Foul Drainage

There is a public foul sewer to the north east of the site located within New Trent Street. The existing foul pumping station within the site currently discharges to this sewer via a rising main. The existing foul sewer plans are provided at Appendix E which clearly show the pumping station and rising main.

Proposed Foul Drainage

The existing pumping station has been inspected by Direct Pumps & Tanks Ltd. The pumps are currently not running due to issues with the control panel. The M&E Contractor has discussed the pumping station with STW and provided a break down of the works required as shown at Appendix F of this report.

The pumping station will remain as private and utilise the existing rising main which connects to the public sewer. All drainage from the site will discharge into the existing foul pumping station via gravity.

STW Developer Enquiry

A developer enquiry response has been received from STW which acknowledges the presence of the existing foul pumping station and its discharge into the STW network. The response also comments that there are existing flooding issues local to the site. STW have recommended that once planning is granted that the network is modelled. A copy of the response is provided at Appendix H of this report.

Appendix A: - 225mm diameter pipe Calculation

COLEBROOK WHITE

Roughness	1.5	mm	**U/S level**	1.36	m
Diam(mm)	225	mm	**D/S level**	0.96	m
Length	30.5	m	**Gradient**	0.01311475	

76.25

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
FULL	0.70685835	0.039760782	0.0562500	1.31	52.21	225	
0.01	0.04507534	6.72971E-05	0.0014930	0.09	0.01	2	45
0.02	0.06385367	0.000189769	0.0029719	0.16	0.03	5	63
0.03	0.07833735	0.000347567	0.0044368	0.22	0.07	7	77
0.04	0.09061106	0.000533473	0.0058875	0.27	0.14	9	88
0.05	0.10148103	0.00074325	0.0073240	0.32	0.23	11	98
0.1	0.14478775	0.002069311	0.0142920	0.51	1.06	23	135
0.15	0.17896474	0.003739907	0.0208975	0.67	2.51	34	161
0.2	0.20864142	0.00566108	0.0271331	0.80	4.55	45	180
0.25	0.23561945	0.007773277	0.0329908	0.92	7.14	56	195
0.3	0.26083788	0.010032273	0.0384617	1.02	10.22	68	206
0.35	0.28487333	0.012402137	0.0435356	1.11	13.73	79	215
0.4	0.30812364	0.014851846	0.0482009	1.19	17.60	90	220
0.45	0.3308915	0.017353366	0.0524443	1.25	21.76	101	224
0.5	0.35342917	0.019880391	0.0562500	1.31	26.10	113	225
0.55	0.37596684	0.022407416	0.0595994	1.36	30.56	124	224
0.6	0.39873471	0.024908936	0.0624699	1.41	35.05	135	220
0.65	0.42198502	0.027358645	0.0648332	1.44	39.45	146	215
0.7	0.44602046	0.029728509	0.0666528	1.47	43.67	158	206
0.75	0.4712389	0.031987505	0.0678796	1.49	47.57	169	195
0.8	0.49821692	0.034099702	0.0684435	1.50	50.98	180	180
0.85	0.52789361	0.036020875	0.0682351	1.49	53.74	191	161
0.9	0.5620706	0.037691471	0.0670583	1.48	55.59	203	135
0.95	0.60537731	0.039017532	0.0644516	1.44	56.07	214	98
1	0.70685835	0.039760782	0.0562500	1.31	52.21	225	0

Appendix B: - Construction Checklist

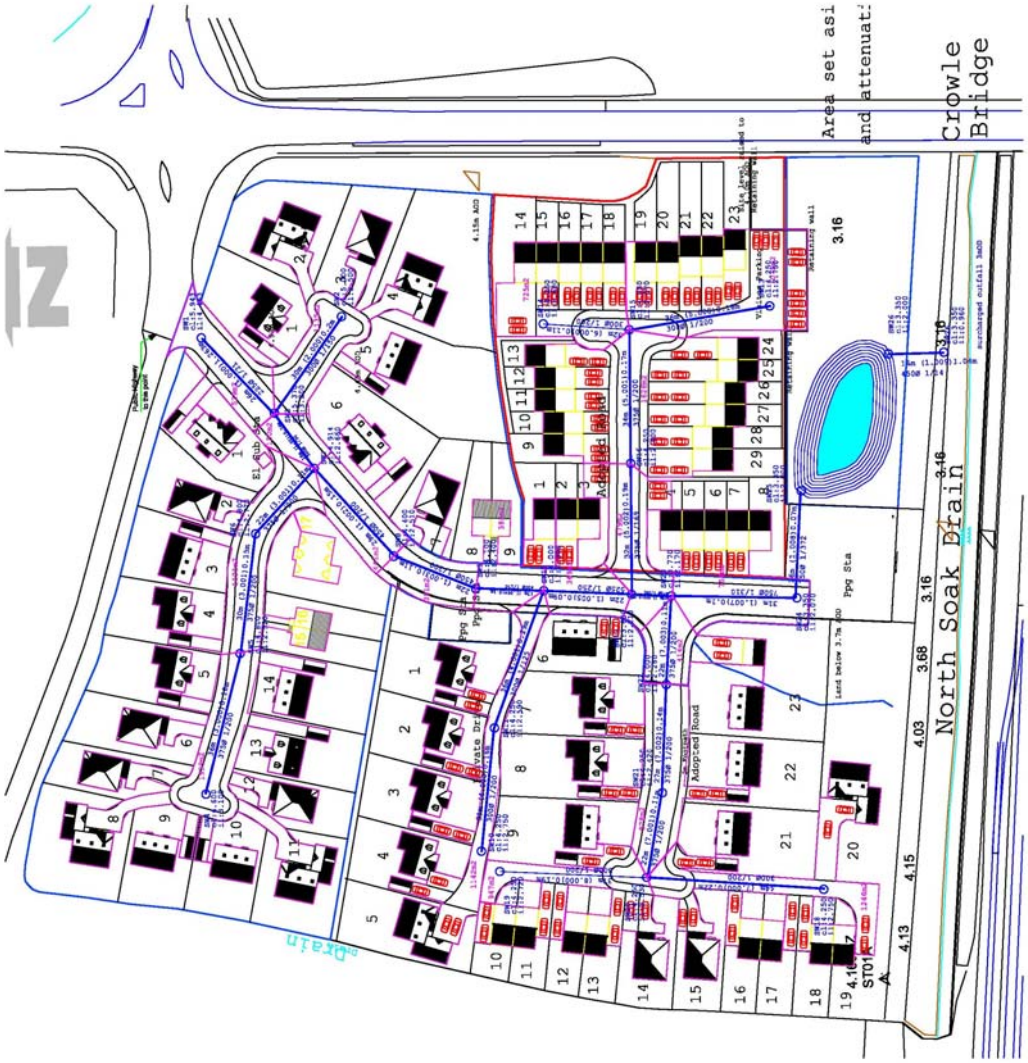
A7 Construction inspection checklist

Phase and inspection item	Inspection date	Condition*	Date phase completed	Remarks/remedial works
Pre-excavation				
Runoff from areas of bare soil diverted to site control				
Runoff from contaminated areas diverted to site control				
Excavation				
Soil is not smeared or compacted so that permeability is reduced				
Excavation is to required size and gradient and is located in correct position				
Side slopes are correct				
All debris (eg loose roots) removed from base feature				
There is no groundwater seepage in the base of the feature				
Depth of excavation is correct				
Construction				
Earthworks materials to specification with test results				
Filter materials in accordance with specification with test results				
Compaction acceptable				
Inlets and outlets constructed in accordance with drawings and specification and drawings				
Construction to required line and levels				
Planting				
Planting in accordance with specification				
Planting established				
Handover inspection				
No silting from construction				
No erosion or bare areas of planting				
All litter removed and inlets and outlets operating correctly				

* Acceptable or unacceptable

CIRIA C609 303

Appendix C: - Surface water drainage strategy drawing



Appendix D: - 1 in 100 year+CC40% 360 minute

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/05/2018 09:19	Designed By Windows7	
File 100yr+CC40%Winter...	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	26.000	1.263	20.6	0.053	4.00	0.600	o	225
2.000	30.000	0.300	100.0	0.114	4.00	0.600	o	300
1.001	16.000	0.540	29.6	0.015	0.00	0.600	o	300
3.000	36.000	0.180	200.0	0.194	4.00	0.600	o	300
3.001	30.000	0.150	200.0	0.112	0.00	0.600	o	375
3.002	22.000	0.110	200.0	0.000	0.00	0.600	o	375
1.002	29.000	0.150	193.3	0.044	0.00	0.600	o	450
1.003	22.000	0.110	200.0	0.039	0.00	0.600	o	450
1.004	17.000	0.100	170.0	0.039	0.00	0.600	o	450
4.000	31.000	0.160	193.8	0.114	4.00	0.600	o	300
4.001	36.000	0.290	124.1	0.000	0.00	0.600	o	300
1.005	22.000	0.090	244.4	0.037	0.00	0.600	o	525
5.000	36.000	0.180	200.0	0.108	4.00	0.600	o	300

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	5.943	4.463	1.255	5.370	3.200	1.945		1050
2.000	2	5.000	3.500	1.200	5.370	3.200	1.870		1050
1.001	3	5.370	3.200	1.870	4.914	2.660	1.954		1200
3.000	4	4.300	3.100	0.900	4.800	2.920	1.580		1050
3.001	5	4.800	2.920	1.505	4.800	2.770	1.655		1350
3.002	6	4.800	2.770	1.655	4.914	2.660	1.879		1350
1.002	7	4.914	2.660	1.804	4.400	2.510	1.440		1350
1.003	8	4.400	2.510	1.440	4.100	2.400	1.250		1350
1.004	9	4.100	2.400	1.250	4.000	2.300	1.250		1350
4.000	10	4.250	2.750	1.200	4.250	2.590	1.360		1050
4.001	11	4.250	2.590	1.360	4.000	2.300	1.400		1050
1.005	12	4.000	2.300	1.175	3.800	2.210	1.065		1500
5.000	13	4.250	2.750	1.200	4.250	2.570	1.380		1050

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/05/2018 09:19	Designed By Windows7	
File 100yr+CC40%Winter...	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)
6.000	32.000	0.110	290.9	0.073	4.00	0.600	o	300
5.001	34.000	0.170	200.0	0.163	0.00	0.600	o	375
5.002	32.000	0.190	168.4	0.048	0.00	0.600	o	375
1.006	10.000	0.040	250.0	0.000	0.00	0.600	o	675
7.000	44.000	0.220	200.0	0.125	4.00	0.600	o	300
8.000	37.000	0.190	194.7	0.095	4.00	0.600	o	300
7.001	22.000	0.110	200.0	0.088	0.00	0.600	o	375
7.002	27.000	0.140	192.9	0.000	0.00	0.600	o	375
7.003	22.000	0.110	200.0	0.042	0.00	0.600	o	375
1.007	31.000	0.100	310.0	0.075	0.00	0.600	o	750
1.008	26.000	0.070	371.4	0.000	0.00	0.600	o	750
1.009	14.000	1.040	13.5	0.000	0.00	0.600	o	750

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)
6.000	14	4.250	2.680	1.270	4.250	2.570	1.380		1050
5.001	15	4.250	2.570	1.305	4.250	2.400	1.475		1350
5.002	16	4.250	2.400	1.475	3.800	2.210	1.215		1350
1.006	17	3.800	2.210	0.915	3.770	2.170	0.925		1500
7.000	18	4.250	2.750	1.200	4.250	2.530	1.420		1050
8.000	19	4.250	2.720	1.230	4.250	2.530	1.420		1050
7.001	20	4.250	2.530	1.345	4.250	2.420	1.455		1350
7.002	21	4.250	2.420	1.455	4.000	2.280	1.345		1350
7.003	22	4.000	2.280	1.345	3.770	2.170	1.225		1350
1.007	23	3.770	2.170	0.850	3.350	2.070	0.530		1800
1.008	24	3.350	2.070	0.530	3.350	2.000	0.600		1800
1.009	25	3.350	2.000	0.600	3.350	0.960	1.640	Hydro-Brake®	1800

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/05/2018 09:19	Designed By Windows7	
File 100yr+CC40%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	SW26	3.350	0.960	0.960	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	3.000	1740	3.000	3420	3.000	5100	3.000	6780	3.000	8460	3.000
120	3.000	1800	3.000	3480	3.000	5160	3.000	6840	3.000	8520	3.000
180	3.000	1860	3.000	3540	3.000	5220	3.000	6900	3.000	8580	3.000
240	3.000	1920	3.000	3600	3.000	5280	3.000	6960	3.000	8640	3.000
300	3.000	1980	3.000	3660	3.000	5340	3.000	7020	3.000	8700	3.000
360	3.000	2040	3.000	3720	3.000	5400	3.000	7080	3.000	8760	3.000
420	3.000	2100	3.000	3780	3.000	5460	3.000	7140	3.000	8820	3.000
480	3.000	2160	3.000	3840	3.000	5520	3.000	7200	3.000	8880	3.000
540	3.000	2220	3.000	3900	3.000	5580	3.000	7260	3.000	8940	3.000
600	3.000	2280	3.000	3960	3.000	5640	3.000	7320	3.000	9000	3.000
660	3.000	2340	3.000	4020	3.000	5700	3.000	7380	3.000	9060	3.000
720	3.000	2400	3.000	4080	3.000	5760	3.000	7440	3.000	9120	3.000
780	3.000	2460	3.000	4140	3.000	5820	3.000	7500	3.000	9180	3.000
840	3.000	2520	3.000	4200	3.000	5880	3.000	7560	3.000	9240	3.000
900	3.000	2580	3.000	4260	3.000	5940	3.000	7620	3.000	9300	3.000
960	3.000	2640	3.000	4320	3.000	6000	3.000	7680	3.000	9360	3.000
1020	3.000	2700	3.000	4380	3.000	6060	3.000	7740	3.000	9420	3.000
1080	3.000	2760	3.000	4440	3.000	6120	3.000	7800	3.000	9480	3.000
1140	3.000	2820	3.000	4500	3.000	6180	3.000	7860	3.000	9540	3.000
1200	3.000	2880	3.000	4560	3.000	6240	3.000	7920	3.000	9600	3.000
1260	3.000	2940	3.000	4620	3.000	6300	3.000	7980	3.000	9660	3.000
1320	3.000	3000	3.000	4680	3.000	6360	3.000	8040	3.000	9720	3.000
1380	3.000	3060	3.000	4740	3.000	6420	3.000	8100	3.000	9780	3.000
1440	3.000	3120	3.000	4800	3.000	6480	3.000	8160	3.000	9840	3.000
1500	3.000	3180	3.000	4860	3.000	6540	3.000	8220	3.000	9900	3.000
1560	3.000	3240	3.000	4920	3.000	6600	3.000	8280	3.000	9960	3.000
1620	3.000	3300	3.000	4980	3.000	6660	3.000	8340	3.000	10020	3.000
1680	3.000	3360	3.000	5040	3.000	6720	3.000	8400	3.000	10080	3.000

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	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	0.000
Hot Start (mins)	0	Run Time (mins)	720
Hot Start Level (mm)	0	Output Interval (mins)	6
Manhole Headloss Coeff (Global)	0.500		

Number of Input Hydrographs 0 Number of Online Controls 1

EWE Associates Ltd		Page 4
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/05/2018 09:19 File 100yr+CC40%Winter...	Designed By Windows7 Checked By	
Micro Drainage	Network W.12.4	

Simulation Criteria for Storm

Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Storage Structures 1

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	477700 411100 SE 77700 11100
C (1km)	-0.023
D1 (1km)	0.305
D2 (1km)	0.293
D3 (1km)	0.294
E (1km)	0.294
F (1km)	2.459
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.750
Storm Duration (mins)	360

EWE Associates Ltd		Page 5
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
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Micro Drainage	Network W.12.4	

Online Controls for Storm

Hydro-Brake® Manhole: 25, DS/PN: 1.009, Volume (m³): 14.1

Design Head (m) 1.300 Hydro-Brake® Type Md7 Invert Level (m) 2.000
Design Flow (l/s) 100.0 Diameter (mm) 361

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	1.200	96.3	3.000	152.3	7.000	232.7
0.200	25.5	1.400	104.1	3.500	164.5	7.500	240.9
0.300	46.6	1.600	111.3	4.000	175.9	8.000	248.8
0.400	64.4	1.800	118.0	4.500	186.6	8.500	256.4
0.500	73.7	2.000	124.4	5.000	196.7	9.000	263.9
0.600	70.4	2.200	130.5	5.500	206.3	9.500	271.1
0.800	78.7	2.400	136.3	6.000	215.4		
1.000	88.0	2.600	141.8	6.500	224.2		

EWE Associates Ltd		Page 6
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
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File 100yr+CC40%Winter...	Checked By	
Micro Drainage	Network W.12.4	

Storage Structures for Storm

Tank or Pond Manhole: 25, DS/PN: 1.009

Invert Level (m) 2.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	264.0	1.400	750.0	2.800	750.0	4.200	750.0
0.200	321.0	1.600	750.0	3.000	750.0	4.400	750.0
0.400	382.0	1.800	750.0	3.200	750.0	4.600	750.0
0.600	448.0	2.000	750.0	3.400	750.0	4.800	750.0
0.800	518.0	2.200	750.0	3.600	750.0	5.000	750.0
1.000	591.0	2.400	750.0	3.800	750.0		
1.200	669.0	2.600	750.0	4.000	750.0		

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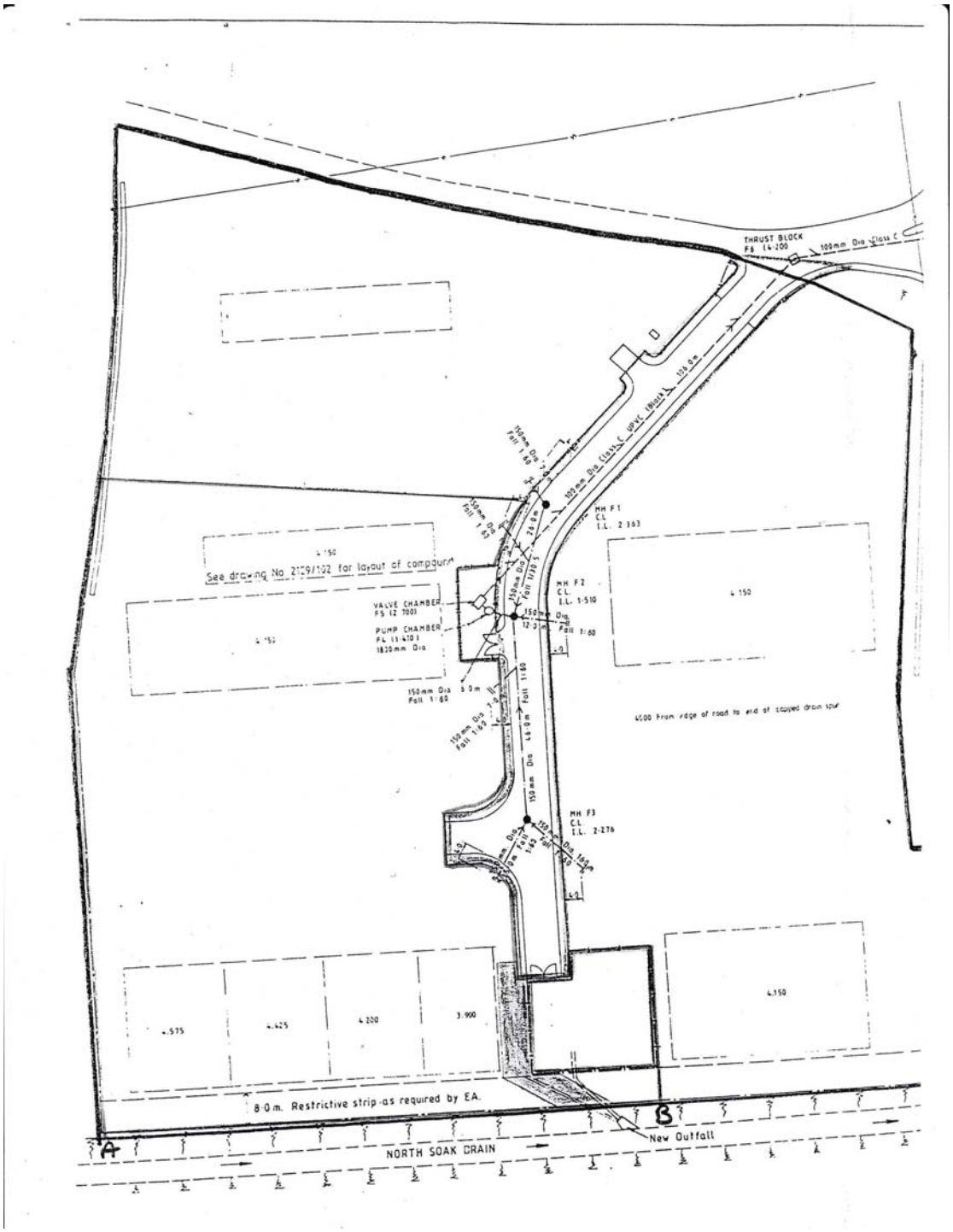
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 29/05/2018 09:19	Designed By Windows7	
File 100yr+CC40%Winter...	Checked By	
Micro Drainage	Network W.12.4	

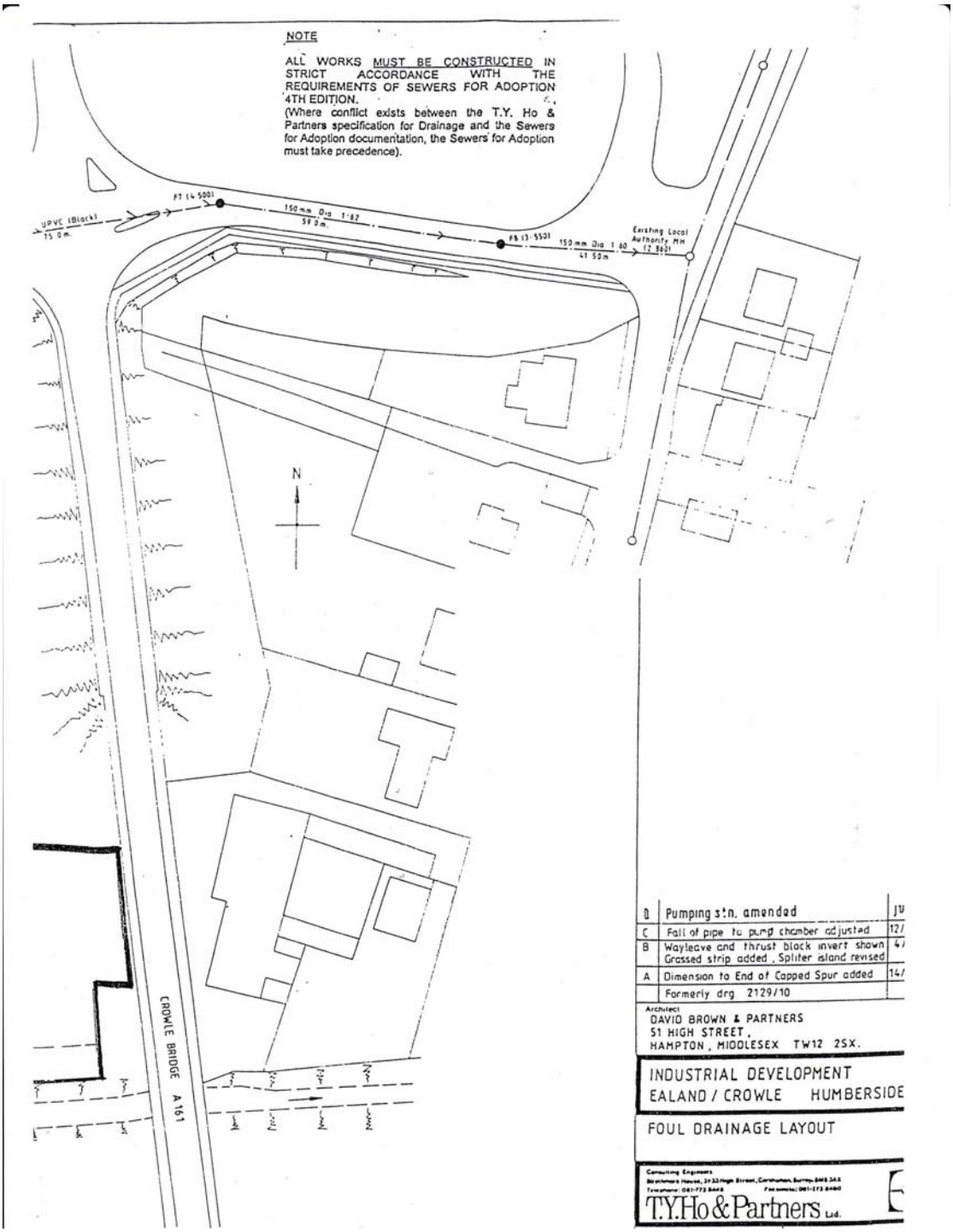
Summary of Results for 360 minute 100 year Winter (Storm)

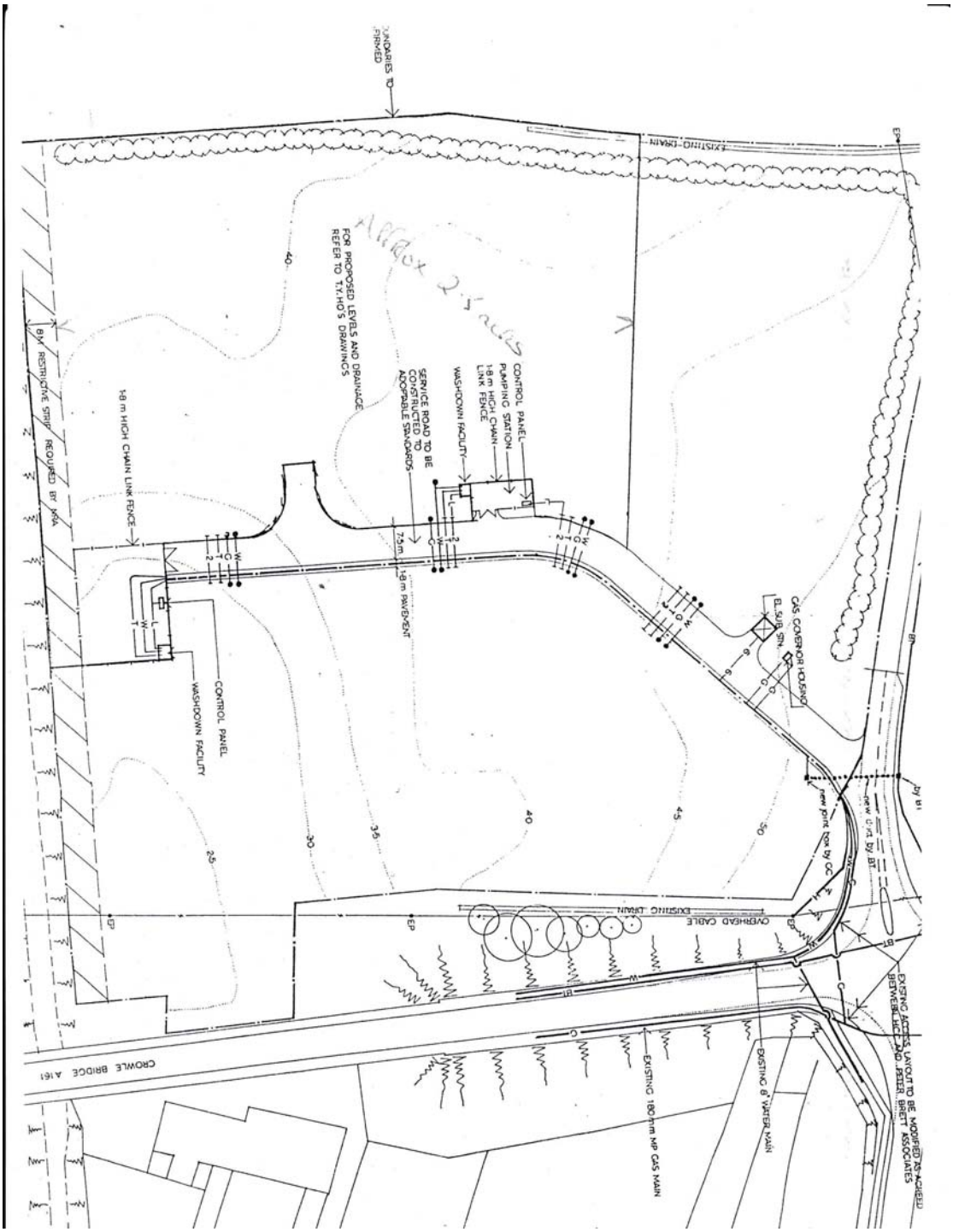
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

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	4.492	-0.196	0.000	0.04	0.0	4.2	OK
2.000	2	3.560	-0.240	0.000	0.09	0.0	9.0	OK
1.001	3	3.403	-0.097	0.000	0.08	0.0	14.4	OK
3.000	4	3.424	0.024	0.000	0.21	0.0	15.3	SURCHARGED
3.001	5	3.413	0.118	0.000	0.18	0.0	22.7	SURCHARGED
3.002	6	3.404	0.259	0.000	0.17	0.0	20.9	SURCHARGED
1.002	7	3.395	0.285	0.000	0.19	0.0	37.6	SURCHARGED
1.003	8	3.385	0.425	0.000	0.22	0.0	40.3	SURCHARGED
1.004	9	3.377	0.527	0.000	0.24	0.0	43.0	SURCHARGED
4.000	10	3.379	0.329	0.000	0.12	0.0	8.8	SURCHARGED
4.001	11	3.374	0.484	0.000	0.09	0.0	8.6	SURCHARGED
1.005	12	3.368	0.543	0.000	0.22	0.0	54.0	SURCHARGED
5.000	13	3.386	0.336	0.000	0.11	0.0	8.3	SURCHARGED
6.000	14	3.384	0.404	0.000	0.09	0.0	5.6	SURCHARGED
5.001	15	3.381	0.436	0.000	0.21	0.0	26.4	SURCHARGED
5.002	16	3.371	0.596	0.000	0.22	0.0	29.8	SURCHARGED
1.006	17	3.360	0.475	0.000	0.23	0.0	83.1	SURCHARGED
7.000	18	3.386	0.336	0.000	0.13	0.0	9.6	SURCHARGED
8.000	19	3.384	0.364	0.000	0.10	0.0	7.3	SURCHARGED
7.001	20	3.379	0.474	0.000	0.20	0.0	23.5	SURCHARGED
7.002	21	3.372	0.577	0.000	0.19	0.0	23.3	SURCHARGED
7.003	22	3.364	0.709	0.000	0.22	0.0	26.3	SURCHARGED
1.007	23	3.356	0.436	0.000	0.21	0.0	114.7	SURCHARGED
1.008	24	3.349	0.529	0.000	0.24	0.0	114.2	FLOOD RISK
1.009	25	3.342	0.592	0.000	0.03	0.0	54.0	FLOOD RISK

Appendix E: - Existing Foul Drainage




NOTE
ALL WORKS MUST BE CONSTRUCTED IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF SEWERS FOR ADOPTION 4TH EDITION.
(Where conflict exists between the T.Y. Ho & Partners specification for Drainage and the Sewers for Adoption documentation, the Sewers for Adoption must take precedence).
FS 14-5001
150 mm Dia 1:67
59.9m
FS 13-5501
150 mm Dia 1:60
41.50m
Existing Local Authority MH
12 8601
UPVC (Black)
75.0m
N
CROWLE BRIDGE A161
D Pumping stn. amended JV
C Fall of pipe to pump chamber adjusted 12/
B Wayleave and thrust block invert shown Grassed strip added . Splitter island revised 4/
A Dimension to End of Capped Spur added 14/
Formerly drg 2129/10
Architect
DAVID BROWN & PARTNERS
51 HIGH STREET,
HAMPTON, MIDDLESEX TW12 2SX.
INDUSTRIAL DEVELOPMENT
EALAND / CROWLE HUMBERSIDE
FOUL DRAINAGE LAYOUT
T.Y.Ho & Partners Ltd.


FOR PROPOSED LEVELS AND DRAINAGE REFER TO T.Y.HO'S DRAWINGS
SERVICE ROAD TO BE CONSTRUCTED TO ADOPTABLE STANDARDS
CONTROL PANEL PUMPING STATION
1.8 m HIGH CHAIN LINK FENCE
WASHDOWN FACILITY
7.5m
1.8 m PAVEMENT
8M RESTRICTIVE STRIP REQUIRED BY AINA
CONTROL PANEL
WASHDOWN FACILITY
GAS GOVERNOR HOUSING
EL SUB STN.
EXISTING DRAIN
OVERHEAD CABLE
CROWLE BRIDGE A161
EXISTING 180mm MP GAS MAIN
EXISTING 8" WATER MAIN
EXISTING ACCESS LAYOUT TO BE MODIFIED AS AGREED BETWEEN HCC AND PETER BRETT ASSOCIATES

Appendix F: - M&E Contactor Inspection

Direct Pumps & Tanks Ltd

CUSTOMER/SITE ADDRESS

7 Lakes
Wharf Road
DN17 4JW

UNIT TYPE	Twin storm	DATE	30.04.18
OTHER EQUIPMENT		TIME ON SITE	

C = CHECK A = ADJUST R = REPLACE

	C	A	R		C	A	R
Control Panel Function	-						
Electrical Connections	X						
Pump 1				Pump 2			
Type: KSB Amerex requires cleaning off to ID.				Type: KSB Amerex requires cleaning off to ID.			
Serial No:				Serial No:			
Insulation mohm				Insulation mohm			
Phase phz				Phase phz			
Balance ohm				Balance ohm			
Current amp				Current amp			
Overload				Overload amp			
Impellor				Impellor			
NRV: may require attention	*			NRV: may require attention	*		
Stop Float							
Start Float				Back up and high level float.			
Duty Assist Float							
High Level Float				Hydro ranger.			
High Level Alarm Type:							
Pump Trip Alarm Type:	X			Panel light			
Junction Box							
Pipework: 100mm	X						
Lifting Chain	*						
Steel Work Condition	X						
Inlet Clear	X						
Outlet Clear	*						
Tank Depth: 3.9m							
Guide Rails: guide wires.	X						

PARTS USED:

COMMENTS/RECOMMENDATIONS

Panel does not run pumps. Possible control relay fault but could not bypass. May require new panel or see if Cartman's can solve. Varmeter BA9041 possible fault on 11.21, no voltage passing through. Valve pit 2m deep, could not test NRVs. Possible discharge point offer road across bridge but could not verify.

Engineers Name	Del	Engineers Signature	

Direct Pumps & Tanks Ltd, Unit 12, Cossall Industrial Estate, Ilkeston, Derbyshire, DE7 5UA
T: 01159 444474 F: 01159 442040 E: info@dpandt.co.uk
www.directpumpsandtanks.co.uk

Direct Pumps & Tanks Ltd

Thursday, 03 May 2018

Quotation

REF: DPT/50634

Dear Mr Muscroft,

The station and associated equipment has been examined.
The control panel will not function, the likelihood is that years of damp have affected the contacts and relays.
The valves and pipe work all seem ok.
The pumps have been removed and tested, I would suggest a routine service, seals and bearings etc.

I have spoken to STWA and as the station is in the ground using the same pumps as installed now will be ok.

Works required -

To replace the control panel, an adoptable panel is not required.
To service both pump units.
To service all valves.
To supply and install level regulators.
To commission on site.

Total cost - **£7725.00 +vat**

If this quote is of interest to you, please don't hesitate to contact me.

Yours faithfully,

Daniel Booth

Direct Pumps & Tanks Ltd, Unit 12, Cossall Industrial Estate, Ilkeston, Derbyshire, DE7 5UA
T: 01159 444474 F: 01159 442040 E: info@dpandt.co.uk
www.directpumpsandtanks.co.uk

Appendix G: - EA Correspondence

Lea Favill

From: Goldsmith, Paul <paul.goldsmith@environment-agency.gov.uk>
Sent: 01 August 2018 13:23
To: Lea Favill
Cc: 'Howard J Wroot'
Subject: RE: Severn Lakes Residential Development Ealand Crowle

Hi Lea,

Thank you for the clarification and forgive me for the misunderstanding.

The proposed run off rates still offer a considerable betterment on the run off rates already experienced on site and therefore I have no further comments to make in addition to those from NLC.

I hope this is sufficient.

Many thanks

Paul

Paul Goldsmith
Flood Risk Management Officer
Partnership and Strategic Overview Team, Nottinghamshire & Tidal Trent
East Midlands Area
paul.goldsmith@environment-agency.gov.uk
Environment Agency, Owston Ferry Office, South Street, Owston Ferry, North Lincolnshire DN9 1RR
External 020 3025 3833
Internal 30253833

From: Lea Favill [mailto:lea.favill@eweassociates.com]
Sent: 01 August 2018 13:20
To: Goldsmith, Paul <paul.goldsmith@environment-agency.gov.uk>
Cc: 'Howard J Wroot' <howard@howardjwroot.com>
Subject: RE: Severn Lakes Residential Development Ealand Crowle

Paul,

Just to confirm the runoff rates from the site will not be reduced to greenfield runoff rates.

The discharge rate will be restricted from 152l/s down to 100l/s.

Regards

Lea

1

From: Goldsmith, Paul <paul.goldsmith@environment-agency.gov.uk>
Sent: 25 July 2018 11:00
To: Lea Favill <lea.favill@eweassociates.com>
Subject: RE: Severn Lakes Residential Development Ealand Crowle

Hi Lea,

While it is the responsibility of the LLFA as the statutory consultee to approve surface water management we are pleased that the run off rates will be reduced to greenfield run off rates.

We have no further comment to make.

I did want to ask about the extension to the care home in Owston Ferry as I wasn't entirely sure what the proposed FFL would be from your report. Could you please just confirm what, if any changes were recommended from the report?

Kind regards

Paul

Paul Goldsmith
Flood Risk Management Officer
Partnership and Strategic Overview Team, Nottinghamshire & Tidal Trent
East Midlands Area
paul.goldsmith@environment-agency.gov.uk
Environment Agency, Owston Ferry Office, South Street, Owston Ferry, North Lincolnshire DN9 1RR
External 020 3025 3833
Internal 30253833

From: Lea Favill [mailto:lea.favill@eweassociates.com]
Sent: 15 July 2018 20:13
To: Goldsmith, Paul <paul.goldsmith@environment-agency.gov.uk>
Cc: Enquiries, Unit <enquiries@environment-agency.gov.uk>; 'Howard J Wroot' <howard@howardjwroot.com>
Subject: FW: Severn Lakes Residential Development Ealand Crowle

Paul,

I hope you are keeping well.

I have forwarded the attached drainage information to Billy Green at NLC who has asked that I get confirmation from the EA that the proposed discharge rates are OK.

The site currently has a surface water pumping station discharging into the North Soak Drain at a peak rate of 100l/s.

There is also a 225mm diameter gravity sewer which can discharge at a maximum rate of 52l/s.

Hence, the exiting peak brownfield rate is 152l/s.

2

We are proposing to remove the pumping station and restrict to 100l/s gravity discharge therefore providing considerable betterment.

Could you please conform that this acceptable?

With thanks

Lea Favill
EWE Associates Ltd
07875 972270

From: Lea Favill <lea.favill@eweassociates.com>
Sent: 29 May 2018 10:07
To: 'Billy Green' <Billy.Green@northlincs.gov.uk>
Cc: 'Howard J Wroot' <howard@howardjwroot.com>
Subject: Severn Lakes Residential Development Ealand Crowle

Billy,

Please find attached drainage report for the above residential development at Ealand for your comments/approval.

With thanks

Lea Favill
EWE Associates Ltd
07875 972270

3

4

Appendix H: - STW Developer Enquiry