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SURFACE WATER DRAINAGE STRATEGY

PROPOSED RESIDENTIAL DEVELOPMENT OFF WIGNALS GATE, HOLBEACH, LINCS.

For D Brown Builders

Issue 3 – February 2019

Introduction

1) New Planning Requirements make it necessary to consider Sustainable Drainage Systems (SuDS) with respect to planning applications of the size and number of dwellings in this instance.

2) It is recognised that the type and scale of this development is what the local planning department is supporting. This being relatively dense use of available land.

3) The site is located to the south of Wignals Gate, and has typical low-lying flat Fenland topography. The proposed development site area is 5.1 hectares.

Discussion

With respect to SuDS, the introduction of a swale/filter drain along the road/pavement was considered. Due to the limited amount of available land and the relatively short length of road, these were considered to be impractical and unreasonable and therefore discounted. Furthermore, the high ground water table and flat topography experienced in the Fenland areas make these features unfeasible. These challenges are highlighted in 'Lincolnshire Development Roads and Sustainable Drainage Design Approach, November 2017 Edition'.

Further thought/discussion was given to providing a permeable road surface throughout and an open stone road base with an impermeable membrane to direct water to the drainage system.

This was considered unworkable since there would be many penetrations in the membrane for the foul sewer and all services.

Furthermore, Lincolnshire County Council would not adopt a permeable road surface in this area due to the high ground water table.

Although an Internal Drainage Board open drain is present to the Eastern side of the site, there is a requirement to minimise rainfall discharge into their system. Consequently the available space for soakaways to accept roof water also needs to be considered.

Ground investigation to determine soil infiltration rates took place on site, the location and results are attached ref 36916/SK02. It can be seen that the soil infiltration rate is poor and although this is acceptable for a 1:10 year event for roof water, soakaways would not be suitable for Lincolnshire County Council 1:30 year event requirement.

With respect to the local plan, it is necessary to provide affordable housing. Consequently, on small sites, it is necessary to have a relatively dense development, giving limited available space for swales, lagoons etc.

Having considered the "Development Road and Sustainable Drainage Specification and Construction". May 2018 Edition, issued by Lincolnshire County Council Highway and Flood Authority, it is clear that the introduction of swales or filter drains, would not comply with the design requirements of the document.

Reference being made to Figure 5/8 Element 12 and Figure 5/12 element 9, where in the Fenland Area the maximum ground water level cannot be achieved, please refer to ground investigation information attached.

Design Proposal

It is intended to discharge surface water from the road only into the existing South Holland Internal Drainage Board system to the east of the site via two separate outfalls.

Both outfalls will have a restricted discharge to 5.0 litres per second via the use of a HydroBrake located in an upstream chamber to the edge of the IDB easement strip. The excess flows over this discharge rate will be stored in the new upstream pipe network, underground storage pipes and open attenuation areas within the public open space.

Surface water from the roofs will be placed in suitable designed soakaways.

Please refer to attached drawing No.d 36916/15C for drainage design and layout of both surface and foul water. This drawing has been prepared in conjunction with MicroDrainage design calculations, also attached.

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Green Area = 0.198ha
Proposed 1:30yr Design Flow 40.1 l/s
Flow Restricted & Attenuated To 5.0 l/s

Purple Area = 0.266ha
Proposed 1:30yr Design Flow 54.1 l/s
Flow Restricted & Attenuated To 5.0 l/s

Key:
- Existing Foul Sewer
- Existing Surface Sewer
- Proposed Foul Sewer
- F01 Proposed Foul Manhole
- Proposed Highway Drain
- HG1 Proposed Highway Manhole
- Proposed Highway Gully
- 3.67 Existing Site Level
- 3.400 Proposed Site Level
- HP Proposed High Point
- LP Proposed Low Point

ALL DRAINAGE FOR PRIVATE ACCESS ROADS, ROOF WATER & DRIVEWAYS TO DISCHARGE TO PRIVATE SOAKAWAYS LOCATED IN REAR GARDENS

Phase 1 (31 dwellings)
Phase 2 (34 dwellings)
Phase 3 (12 dwellings)

Rev	Date	Remarks
C	07.02.19	Drawing Developed In-Line With S38 & S104.
B	13.11.18	Drainage Layout Developed & Minor Changes To Suit Latest Architects Drawing.
A	24.07.18	Refuse Collection Points Added.

Status: FOR PLANNING

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Project: Proposed Residential Development off Wignals Gate, Holbeach, Lincs. For D Brown Builders

Title: Proposed Drainage Strategy

Date	Jul. '18	Scale	1:500 @A1
Drawn	MP	Checked	SRC
Design	SRC	File Name	36916-15

DRG No. 36916/15 Rev C

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Project: **Proposed Residential Development off Wignals Gate, Holbeach**

Title:	**S38 Highway Drain Design Calculations**
Project:	**Proposed Residential Development**
Location:	**Wignals Gate, Holbeach, Lincs.**
Client:	**D Brown Builders**
Project Ref:	**36916**
Prepared By:	**M.Pett**
Date:	**February 2019 – Revision A**

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	27.000	0.180	150.0	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	23.221	0.155	150.0	0.029	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	39.641	0.227	175.0	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	11.792	0.047	250.9	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	10.849	0.043	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	25.283	0.169	150.0	0.031	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	16.649	0.111	150.0	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	30.202	0.173	175.0	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	25.018	0.100	250.0	0.053	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.004	22.571	0.090	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	75.00	5.55	2.475	0.019	0.0	0.0	0.0	0.82	14.5	3.9
1.001	75.00	6.02	2.295	0.048	0.0	0.0	0.0	0.82	14.5	9.8
1.002	75.00	6.69	2.065	0.102	0.0	0.0	0.0	0.99	39.2	20.7
1.003	75.00	6.89	1.763	0.113	0.0	0.0	0.0	0.99	69.8	22.9
1.004	75.00	7.08	1.716	0.113	0.0	0.0	0.0	0.99	70.0	22.9
2.000	75.00	5.52	2.552	0.031	0.0	0.0	0.0	0.82	14.5	6.3
2.001	75.00	5.85	2.383	0.054	0.0	0.0	0.0	0.82	14.5	11.0
2.002	75.00	6.37	2.197	0.080	0.0	0.0	0.0	0.99	39.2	16.2
2.003	75.00	6.79	1.949	0.133	0.0	0.0	0.0	0.99	70.0	27.1
2.004	75.00	7.17	1.849	0.133	0.0	0.0	0.0	0.99	70.0	27.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.005	21.519	0.086	250.0	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	39.000	0.156	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	6.334	0.021	300.0	0.000	5.00	0.0	0.600	o	375	Pipe/Conduit	
3.001	6.297	0.262	24.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	11.750	0.078	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	13.287	0.089	149.3	0.059	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	15.063	0.100	150.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	15.857	0.106	149.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.003	10.913	0.062	175.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.004	17.600	0.101	174.3	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	23.001	0.131	175.0	0.049	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.005	12.998	0.052	250.0	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.006	17.739	0.071	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.007	11.186	0.045	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	48.206	0.321	150.0	0.049	5.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.005	75.00	7.53	1.759	0.153	0.0	0.0	0.0	0.99	70.0	31.0
1.005	75.00	8.19	1.673	0.265	0.0	0.0	0.0	0.99	70.0	53.9
3.000	75.00	5.10	1.800	0.000	0.0	0.0	0.0	1.04	115.0	0.0
3.001	75.00	5.13	1.779	0.000	0.0	0.0	0.0	3.71	409.7	0.0
1.006	75.00	8.42	1.517	0.265	0.0	0.0	0.0	0.82	14.5«	53.9
4.000	75.00	5.27	2.118	0.059	0.0	0.0	0.0	0.82	14.5	11.9
4.001	75.00	5.58	2.029	0.059	0.0	0.0	0.0	0.82	14.4	11.9
4.002	75.00	5.90	1.929	0.059	0.0	0.0	0.0	0.82	14.5	11.9
4.003	75.00	6.08	1.748	0.059	0.0	0.0	0.0	0.99	39.2	11.9
4.004	75.00	6.38	1.686	0.087	0.0	0.0	0.0	0.99	39.3	17.7
5.000	75.00	5.39	1.716	0.049	0.0	0.0	0.0	0.99	39.2	9.9
4.005	75.00	6.60	1.510	0.147	0.0	0.0	0.0	0.99	70.0	29.9
4.006	75.00	6.90	1.458	0.147	0.0	0.0	0.0	0.99	70.0	29.9
4.007	75.00	7.09	1.387	0.147	0.0	0.0	0.0	0.99	70.0	29.9
6.000	75.00	5.98	1.813	0.049	0.0	0.0	0.0	0.82	14.5	10.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.008	18.500	0.074	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	6.074	0.030	202.5	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	5.944	0.902	6.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.009	11.842	0.079	149.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.008	75.00	7.40	1.342	0.197	0.0	0.0	0.0	0.99	70.0	39.9
7.000	75.00	5.09	2.000	0.000	0.0	0.0	0.0	1.10	77.8	0.0
7.001	75.00	5.11	1.970	0.000	0.0	0.0	0.0	6.16	435.6	0.0
4.009	75.00	7.64	1.268	0.197	0.0	0.0	0.0	0.82	14.5«	39.9

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	3.155	0.680	Open Manhole	1200	1.000	2.475	150				
2	2.950	0.655	Open Manhole	1200	1.001	2.295	150	1.000	2.295	150	
3	2.815	0.750	Open Manhole	1200	1.002	2.065	225	1.001	2.140	150	
4	2.735	0.972	Open Manhole	1200	1.003	1.763	300	1.002	1.838	225	
5	2.810	1.094	Open Manhole	1200	1.004	1.716	300	1.003	1.716	300	
7	3.315	0.763	Open Manhole	1200	2.000	2.552	150				
8	3.165	0.782	Open Manhole	1200	2.001	2.383	150	2.000	2.383	150	
9	3.050	0.853	Open Manhole	1200	2.002	2.197	225	2.001	2.272	150	
10	2.855	0.906	Open Manhole	1200	2.003	1.949	300	2.002	2.024	225	
11	3.025	1.176	Open Manhole	1200	2.004	1.849	300	2.003	1.849	300	
12	3.030	1.271	Open Manhole	1200	2.005	1.759	300	2.004	1.759	300	
6	2.875	1.202	Open Manhole	1200	1.005	1.673	300	1.004	1.673	300	
								2.005	1.673	300	
S Tank	3.000	1.200	Open Manhole	1350	3.000	1.800	375				
S Basin	3.000	1.221	Open Manhole	1350	3.001	1.779	375	3.000	1.779	375	
13	3.000	1.483	Open Manhole	1350	1.006	1.517	150	1.005	1.517	300	
								3.001	1.517	375	
	3.000	1.561	Open Manhole	0		OUTFALL		1.006	1.439	150	
20	3.035	0.917	Open Manhole	1200	4.000	2.118	150				
21	3.115	1.086	Open Manhole	1200	4.001	2.029	150	4.000	2.029	150	
22	3.215	1.286	Open Manhole	1200	4.002	1.929	150	4.001	1.929	150	
23	3.230	1.482	Open Manhole	1200	4.003	1.748	225	4.002	1.823	150	
24	3.165	1.479	Open Manhole	1200	4.004	1.686	225	4.003	1.686	225	
26	2.880	1.164	Open Manhole	1200	5.000	1.716	225				
25	3.035	1.525	Open Manhole	1200	4.005	1.510	300	4.004	1.585	225	
								5.000	1.585	225	
27	3.125	1.667	Open Manhole	1200	4.006	1.458	300	4.005	1.458	300	
28	3.240	1.853	Open Manhole	1200	4.007	1.387	300	4.006	1.387	300	
30	3.035	1.222	Open Manhole	1200	6.000	1.813	150				
29	3.305	1.963	Open Manhole	1200	4.008	1.342	300	4.007	1.342	300	
								6.000	1.492	150	
N Tank	2.800	0.800	Open Manhole	1200	7.000	2.000	300				
N Basin	2.800	0.830	Open Manhole	1200	7.001	1.970	300	7.000	1.970	300	
31	3.200	2.132	Open Manhole	1200	4.009	1.268	150	4.008	1.268	300	
								7.001	1.068	300	
	3.000	1.811	Open Manhole	0		OUTFALL		4.009	1.189	150	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	1	3.155	2.475	0.530	Open Manhole	1200
1.001	o	150	2	2.950	2.295	0.505	Open Manhole	1200
1.002	o	225	3	2.815	2.065	0.525	Open Manhole	1200
1.003	o	300	4	2.735	1.763	0.672	Open Manhole	1200
1.004	o	300	5	2.810	1.716	0.794	Open Manhole	1200
2.000	o	150	7	3.315	2.552	0.613	Open Manhole	1200
2.001	o	150	8	3.165	2.383	0.632	Open Manhole	1200
2.002	o	225	9	3.050	2.197	0.628	Open Manhole	1200
2.003	o	300	10	2.855	1.949	0.606	Open Manhole	1200
2.004	o	300	11	3.025	1.849	0.876	Open Manhole	1200
2.005	o	300	12	3.030	1.759	0.971	Open Manhole	1200
1.005	o	300	6	2.875	1.673	0.902	Open Manhole	1200
3.000	o	375	S Tank	3.000	1.800	0.825	Open Manhole	1350
3.001	o	375	S Basin	3.000	1.779	0.846	Open Manhole	1350
1.006	o	150	13	3.000	1.517	1.333	Open Manhole	1350
4.000	o	150	20	3.035	2.118	0.767	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	27.000	150.0	2	2.950	2.295	0.505	Open Manhole	1200
1.001	23.221	150.0	3	2.815	2.140	0.525	Open Manhole	1200
1.002	39.641	175.0	4	2.735	1.838	0.672	Open Manhole	1200
1.003	11.792	250.9	5	2.810	1.716	0.794	Open Manhole	1200
1.004	10.849	250.0	6	2.875	1.673	0.902	Open Manhole	1200
2.000	25.283	150.0	8	3.165	2.383	0.632	Open Manhole	1200
2.001	16.649	150.0	9	3.050	2.272	0.628	Open Manhole	1200
2.002	30.202	175.0	10	2.855	2.024	0.606	Open Manhole	1200
2.003	25.018	250.0	11	3.025	1.849	0.876	Open Manhole	1200
2.004	22.571	250.0	12	3.030	1.759	0.971	Open Manhole	1200
2.005	21.519	250.0	6	2.875	1.673	0.902	Open Manhole	1200
1.005	39.000	250.0	13	3.000	1.517	1.183	Open Manhole	1350
3.000	6.334	300.0	S Basin	3.000	1.779	0.846	Open Manhole	1350
3.001	6.297	24.0	13	3.000	1.517	1.108	Open Manhole	1350
1.006	11.750	150.0		3.000	1.439	1.411	Open Manhole	0
4.000	13.287	149.3	21	3.115	2.029	0.936	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.001	o	150	21	3.115	2.029	0.936	Open Manhole	1200
4.002	o	150	22	3.215	1.929	1.136	Open Manhole	1200
4.003	o	225	23	3.230	1.748	1.257	Open Manhole	1200
4.004	o	225	24	3.165	1.686	1.254	Open Manhole	1200
5.000	o	225	26	2.880	1.716	0.939	Open Manhole	1200
4.005	o	300	25	3.035	1.510	1.225	Open Manhole	1200
4.006	o	300	27	3.125	1.458	1.367	Open Manhole	1200
4.007	o	300	28	3.240	1.387	1.553	Open Manhole	1200
6.000	o	150	30	3.035	1.813	1.072	Open Manhole	1200
4.008	o	300	29	3.305	1.342	1.663	Open Manhole	1200
7.000	o	300	N Tank	2.800	2.000	0.500	Open Manhole	1200
7.001	o	300	N Basin	2.800	1.970	0.530	Open Manhole	1200
4.009	o	150	31	3.200	1.268	1.782	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.001	15.063	150.6	22	3.215	1.929	1.136	Open Manhole	1200
4.002	15.857	149.6	23	3.230	1.823	1.257	Open Manhole	1200
4.003	10.913	175.0	24	3.165	1.686	1.254	Open Manhole	1200
4.004	17.600	174.3	25	3.035	1.585	1.225	Open Manhole	1200
5.000	23.001	175.0	25	3.035	1.585	1.225	Open Manhole	1200
4.005	12.998	250.0	27	3.125	1.458	1.367	Open Manhole	1200
4.006	17.739	250.0	28	3.240	1.387	1.553	Open Manhole	1200
4.007	11.186	250.0	29	3.305	1.342	1.663	Open Manhole	1200
6.000	48.206	150.0	29	3.305	1.492	1.663	Open Manhole	1200
4.008	18.500	250.0	31	3.200	1.268	1.632	Open Manhole	1200
7.000	6.074	202.5	N Basin	2.800	1.970	0.530	Open Manhole	1200
7.001	5.944	6.6	31	3.200	1.068	1.832	Open Manhole	1200
4.009	11.842	149.9		3.000	1.189	1.661	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.019	0.019	0.019
1.001	User	-	100	0.029	0.029	0.029
1.002	User	-	100	0.054	0.054	0.054
1.003	User	-	100	0.011	0.011	0.011
1.004	-	-	100	0.000	0.000	0.000
2.000	User	-	100	0.031	0.031	0.031
2.001	User	-	100	0.023	0.023	0.023
2.002	User	-	100	0.026	0.026	0.026
2.003	User	-	100	0.053	0.053	0.053
2.004	-	-	100	0.000	0.000	0.000
2.005	User	-	100	0.019	0.019	0.019
1.005	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
4.000	User	-	100	0.059	0.059	0.059
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.000	0.000	0.000
4.003	-	-	100	0.000	0.000	0.000
4.004	User	-	100	0.029	0.029	0.029
5.000	User	-	100	0.049	0.049	0.049
4.005	User	-	100	0.011	0.011	0.011
4.006	-	-	100	0.000	0.000	0.000
4.007	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.049	0.049	0.049
4.008	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
7.001	-	-	100	0.000	0.000	0.000
4.009	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.462	0.462	0.462

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales
Return Period (years)	30	M5-60 (mm)	19.000

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Synthetic Rainfall Details

Ratio R	0.400	Cv (Winter)	0.840
Profile Type	Summer	Storm Duration (mins)	30
Cv (Summer)	0.750		

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Online Controls for Storm

Non Return Valve Manhole: S Basin, DS/PN: 3.001, Volume (m³): 2.3

Hydro-Brake® Optimum Manhole: 13, DS/PN: 1.006, Volume (m³): 5.3

Unit Reference	MD-SHE-0103-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	1.517
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0
Flush-Flo™	0.354	5.0
Kick-Flo®	0.745	4.0
Mean Flow over Head Range	-	4.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	5.0	3.000	7.7	7.000	11.5
0.200	4.7	1.400	5.4	3.500	8.3	7.500	11.8
0.300	5.0	1.600	5.7	4.000	8.8	8.000	12.2
0.400	5.0	1.800	6.0	4.500	9.3	8.500	12.6
0.500	4.9	2.000	6.3	5.000	9.8	9.000	12.9
0.600	4.7	2.200	6.6	5.500	10.2	9.500	13.3
0.800	4.1	2.400	6.9	6.000	10.7		
1.000	4.6	2.600	7.2	6.500	11.1		

Non Return Valve Manhole: N Basin, DS/PN: 7.001, Volume (m³): 1.3

Hydro-Brake® Optimum Manhole: 31, DS/PN: 4.009, Volume (m³): 3.7

Unit Reference	MD-SHE-0103-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage

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Hydro-Brake® Optimum Manhole: 31, DS/PN: 4.009, Volume (m³): 3.7

Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	1.268
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0
Flush-Flo™	0.354	5.0
Kick-Flo®	0.745	4.0
Mean Flow over Head Range	-	4.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	5.0	3.000	7.7	7.000	11.5
0.200	4.7	1.400	5.4	3.500	8.3	7.500	11.8
0.300	5.0	1.600	5.7	4.000	8.8	8.000	12.2
0.400	5.0	1.800	6.0	4.500	9.3	8.500	12.6
0.500	4.9	2.000	6.3	5.000	9.8	9.000	12.9
0.600	4.7	2.200	6.6	5.500	10.2	9.500	13.3
0.800	4.1	2.400	6.9	6.000	10.7		
1.000	4.6	2.600	7.2	6.500	11.1		

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Offline Controls for Storm

Pipe Manhole: 13, DS/PN: 1.006, Loop to PN: 3.001

Diameter (m)	0.375	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	4.306	Upstream Invert Level (m)	1.800

Pipe Manhole: 31, DS/PN: 4.009, Loop to PN: 7.001

Diameter (m)	0.300	Roughness k (mm)	0.600
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500
Slope (1:X)	100.0	Coefficient of Contraction	0.600
Length (m)	5.944	Upstream Invert Level (m)	2.000

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Storage Structures for Storm

Tank or Pond Manhole: S Tank, DS/PN: 3.000

Invert Level (m) 1.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	59.0	0.800	186.0

Tank or Pond Manhole: N Tank, DS/PN: 7.000

Invert Level (m) 2.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.0	0.800	116.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	1	+0%	100/15 Summer			
1.001	2	15 Winter	1	+0%	30/15 Summer			
1.002	3	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.003	4	30 Winter	1	+0%	2/30 Winter			
1.004	5	30 Winter	1	+0%	2/15 Summer			
2.000	7	15 Winter	1	+0%	100/15 Summer			
2.001	8	15 Winter	1	+0%	30/15 Summer			
2.002	9	15 Winter	1	+0%	30/15 Summer			
2.003	10	15 Winter	1	+0%	30/15 Summer			
2.004	11	30 Winter	1	+0%	30/15 Summer			
2.005	12	30 Winter	1	+0%	2/30 Winter			
1.005	6	30 Winter	1	+0%	1/15 Winter			
3.000	S Tank	60 Winter	1	+0%	30/60 Winter			
3.001	S Basin	30 Winter	1	+0%	30/15 Summer			
1.006	13	30 Winter	1	+0%	1/15 Summer		1/15 Summer	62
4.000	20	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
4.001	21	15 Winter	1	+0%	2/60 Winter			
4.002	22	60 Winter	1	+0%	2/30 Summer			
4.003	23	60 Winter	1	+0%	1/60 Winter			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	2.519	-0.106	0.000	0.18		2.5	OK	
1.001	2	2.363	-0.082	0.000	0.42		5.7	OK	
1.002	3	2.151	-0.139	0.000	0.31		11.5	OK	4
1.003	4	2.004	-0.059	0.000	0.16		9.1	OK	
1.004	5	2.000	-0.016	0.000	0.13		7.4	OK	
2.000	7	2.608	-0.094	0.000	0.29		4.0	OK	
2.001	8	2.458	-0.075	0.000	0.49		6.6	OK	
2.002	9	2.274	-0.148	0.000	0.25		9.3	OK	
2.003	10	2.049	-0.200	0.000	0.24		14.9	OK	
2.004	11	2.010	-0.139	0.000	0.19		12.0	OK	
2.005	12	2.002	-0.057	0.000	0.17		10.5	OK	
1.005	6	1.991	0.018	0.000	0.24		15.5	SURCHARGED	
3.000	S Tank	1.905	-0.270	0.000	0.04		3.0	OK	
3.001	S Basin	1.967	-0.187	0.000	0.02		3.7	OK	
1.006	13	1.972	0.305	0.000	0.38	10.3	5.0	SURCHARGED	
4.000	20	2.201	-0.067	0.000	0.58		7.6	OK	3
4.001	21	2.111	-0.068	0.000	0.58		7.7	OK	
4.002	22	2.031	-0.048	0.000	0.30		4.1	OK	
4.003	23	2.024	0.051	0.000	0.11		3.8	SURCHARGED	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.004	24	60 Winter	1	+0%	1/30 Winter			
5.000	26	60 Winter	1	+0%	1/30 Winter			
4.005	25	60 Winter	1	+0%	1/15 Summer			
4.006	27	60 Winter	1	+0%	1/15 Summer			
4.007	28	60 Winter	1	+0%	1/15 Summer			
6.000	30	60 Winter	1	+0%	1/60 Winter	100/15 Summer		
4.008	29	60 Winter	1	+0%	1/15 Summer			
7.000	N Tank	60 Winter	1	+0%	30/30 Winter			
7.001	N Basin	60 Winter	1	+0%	30/15 Summer			
4.009	31	60 Winter	1	+0%	1/15 Summer		1/60 Winter	39

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.004	24	2.022	0.111	0.000	0.14		5.0	SURCHARGED	
5.000	26	2.020	0.079	0.000	0.09		3.2	SURCHARGED	
4.005	25	2.017	0.207	0.000	0.10		5.9	SURCHARGED	
4.006	27	2.014	0.256	0.000	0.08		4.9	SURCHARGED	
4.007	28	2.010	0.323	0.000	0.08		4.4	SURCHARGED	
6.000	30	2.018	0.055	0.000	0.24		3.4	SURCHARGED	4
4.008	29	2.007	0.365	0.000	0.09		5.6	SURCHARGED	
7.000	N Tank	2.000	-0.300	0.000	0.00		0.0	OK	
7.001	N Basin	1.982	-0.288	0.000	0.00		0.1	OK	
4.009	31	2.002	0.584	0.000	0.38	0.1	5.0	SURCHARGED	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	2	+0%	100/15 Summer			
1.001	2	15 Winter	2	+0%	30/15 Summer			
1.002	3	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
1.003	4	30 Winter	2	+0%	2/30 Winter			
1.004	5	30 Winter	2	+0%	2/15 Summer			
2.000	7	15 Winter	2	+0%	100/15 Summer			
2.001	8	15 Winter	2	+0%	30/15 Summer			
2.002	9	15 Winter	2	+0%	30/15 Summer			
2.003	10	30 Winter	2	+0%	30/15 Summer			
2.004	11	30 Winter	2	+0%	30/15 Summer			
2.005	12	30 Winter	2	+0%	2/30 Winter			
1.005	6	30 Winter	2	+0%	1/15 Winter			
3.000	S Tank	60 Winter	2	+0%	30/60 Winter			
3.001	S Basin	30 Winter	2	+0%	30/15 Summer			
1.006	13	30 Winter	2	+0%	1/15 Summer		1/15 Summer	62
4.000	20	15 Winter	2	+0%	30/15 Summer	100/15 Winter		
4.001	21	60 Winter	2	+0%	2/60 Winter			
4.002	22	60 Winter	2	+0%	2/30 Summer			
4.003	23	60 Winter	2	+0%	1/60 Winter			

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	2.525	-0.100	0.000	0.24		3.3	OK	
1.001	2	2.374	-0.071	0.000	0.54		7.4	OK	
1.002	3	2.164	-0.126	0.000	0.40		14.7	OK	4
1.003	4	2.071	0.008	0.000	0.19		10.9	SURCHARGED	
1.004	5	2.065	0.049	0.000	0.18		10.1	SURCHARGED	
2.000	7	2.616	-0.086	0.000	0.37		5.2	OK	
2.001	8	2.470	-0.063	0.000	0.64		8.6	OK	
2.002	9	2.286	-0.136	0.000	0.33		12.0	OK	
2.003	10	2.094	-0.155	0.000	0.26		16.3	OK	
2.004	11	2.083	-0.066	0.000	0.22		13.5	OK	
2.005	12	2.071	0.012	0.000	0.20		12.5	SURCHARGED	
1.005	6	2.059	0.086	0.000	0.31		20.3	SURCHARGED	
3.000	S Tank	1.963	-0.212	0.000	0.05		3.5	OK	
3.001	S Basin	2.011	-0.143	0.000	0.02		3.1	OK	
1.006	13	2.017	0.350	0.000	0.38	15.1	5.0	SURCHARGED	
4.000	20	2.217	-0.051	0.000	0.75		9.9	OK	3
4.001	21	2.180	0.001	0.000	0.39		5.1	SURCHARGED	
4.002	22	2.170	0.091	0.000	0.38		5.1	SURCHARGED	
4.003	23	2.159	0.186	0.000	0.13		4.2	SURCHARGED	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.004	24	60 Winter	2	+0%	1/30 Winter			
5.000	26	60 Winter	2	+0%	1/30 Winter			
4.005	25	60 Winter	2	+0%	1/15 Summer			
4.006	27	60 Winter	2	+0%	1/15 Summer			
4.007	28	60 Winter	2	+0%	1/15 Summer			
6.000	30	60 Winter	2	+0%	1/60 Winter	100/15 Summer		
4.008	29	60 Winter	2	+0%	1/15 Summer			
7.000	N Tank	60 Winter	2	+0%	30/30 Winter			
7.001	N Basin	60 Winter	2	+0%	30/15 Summer			
4.009	31	60 Winter	2	+0%	1/15 Summer		1/60 Winter	39

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.004	24	2.155	0.244	0.000	0.15		5.4	SURCHARGED	
5.000	26	2.152	0.211	0.000	0.10		3.6	SURCHARGED	
4.005	25	2.148	0.338	0.000	0.12		7.1	SURCHARGED	
4.006	27	2.142	0.384	0.000	0.11		6.7	SURCHARGED	
4.007	28	2.136	0.449	0.000	0.12		6.6	SURCHARGED	
6.000	30	2.150	0.187	0.000	0.30		4.2	SURCHARGED	4
4.008	29	2.131	0.489	0.000	0.15		8.9	SURCHARGED	
7.000	N Tank	2.064	-0.236	0.000	0.04		2.2	OK	
7.001	N Basin	2.120	-0.150	0.000	0.01		2.4	OK	
4.009	31	2.123	0.705	0.000	0.38	3.9	5.0	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	30	+0%	100/15 Summer			
1.001	2	15 Winter	30	+0%	30/15 Summer			
1.002	3	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.003	4	15 Winter	30	+0%	2/30 Winter			
1.004	5	15 Winter	30	+0%	2/15 Summer			
2.000	7	15 Winter	30	+0%	100/15 Summer			
2.001	8	15 Winter	30	+0%	30/15 Summer			
2.002	9	15 Winter	30	+0%	30/15 Summer			
2.003	10	15 Winter	30	+0%	30/15 Summer			
2.004	11	15 Winter	30	+0%	30/15 Summer			
2.005	12	15 Winter	30	+0%	2/30 Winter			
1.005	6	15 Winter	30	+0%	1/15 Winter			
3.000	S Tank	60 Winter	30	+0%	30/60 Winter			
3.001	S Basin	60 Winter	30	+0%	30/15 Summer			
1.006	13	15 Winter	30	+0%	1/15 Summer		1/15 Summer	62
4.000	20	30 Winter	30	+0%	30/15 Summer	100/15 Winter		
4.001	21	30 Winter	30	+0%	2/60 Winter			
4.002	22	30 Winter	30	+0%	2/30 Summer			
4.003	23	30 Winter	30	+0%	1/60 Winter			

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	2.546	-0.079	0.000	0.45		6.2	OK	
1.001	2	2.514	0.069	0.000	1.03		14.2	SURCHARGED	
1.002	3	2.439	0.149	0.000	0.81		30.0	SURCHARGED	4
1.003	4	2.370	0.307	0.000	0.43		24.1	SURCHARGED	
1.004	5	2.311	0.295	0.000	0.41		22.8	SURCHARGED	
2.000	7	2.662	-0.040	0.000	0.69		9.5	OK	
2.001	8	2.619	0.086	0.000	1.21		16.3	SURCHARGED	
2.002	9	2.550	0.128	0.000	0.62		22.5	SURCHARGED	
2.003	10	2.511	0.262	0.000	0.56		35.3	SURCHARGED	
2.004	11	2.441	0.292	0.000	0.43		26.6	SURCHARGED	
2.005	12	2.372	0.313	0.000	0.43		26.3	SURCHARGED	
1.005	6	2.291	0.318	0.000	0.75		48.4	SURCHARGED	
3.000	S Tank	2.191	0.016	0.000	0.05		4.1	SURCHARGED	
3.001	S Basin	2.190	0.036	0.000	0.02		3.6	SURCHARGED	
1.006	13	2.202	0.535	0.000	0.38	43.5	5.0	SURCHARGED	
4.000	20	2.691	0.423	0.000	0.98		13.0	SURCHARGED	3
4.001	21	2.641	0.462	0.000	0.92		12.2	SURCHARGED	
4.002	22	2.596	0.517	0.000	0.75		10.1	SURCHARGED	
4.003	23	2.545	0.572	0.000	0.29		9.7	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.004	24	30 Winter	30	+0%	1/30 Winter			
5.000	26	30 Winter	30	+0%	1/30 Winter			
4.005	25	30 Winter	30	+0%	1/15 Summer			
4.006	27	30 Winter	30	+0%	1/15 Summer			
4.007	28	30 Winter	30	+0%	1/15 Summer			
6.000	30	30 Winter	30	+0%	1/60 Winter	100/15 Summer		
4.008	29	30 Winter	30	+0%	1/15 Summer			
7.000	N Tank	60 Winter	30	+0%	30/30 Winter			
7.001	N Basin	60 Winter	30	+0%	30/15 Summer			
4.009	31	60 Winter	30	+0%	1/15 Summer		1/60 Winter	39

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.004	24	2.532	0.621	0.000	0.36		12.8	SURCHARGED	
5.000	26	2.522	0.581	0.000	0.27		9.6	SURCHARGED	
4.005	25	2.506	0.696	0.000	0.38		21.9	SURCHARGED	
4.006	27	2.488	0.730	0.000	0.36		21.5	SURCHARGED	
4.007	28	2.428	0.741	0.000	0.38		21.5	SURCHARGED	
6.000	30	2.564	0.601	0.000	0.68		9.6	SURCHARGED	4
4.008	29	2.412	0.770	0.000	0.51		30.6	SURCHARGED	
7.000	N Tank	2.369	0.069	0.000	0.07		3.8	SURCHARGED	
7.001	N Basin	2.369	0.099	0.000	0.01		3.2	SURCHARGED	
4.009	31	2.369	0.951	0.000	0.38	21.4	5.0	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	4	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+30%	100/15 Summer			
1.001	2	15 Winter	100	+30%	30/15 Summer			
1.002	3	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
1.003	4	15 Winter	100	+30%	2/30 Winter			
1.004	5	60 Winter	100	+30%	2/15 Summer			
2.000	7	15 Winter	100	+30%	100/15 Summer			
2.001	8	15 Winter	100	+30%	30/15 Summer			
2.002	9	15 Winter	100	+30%	30/15 Summer			
2.003	10	15 Winter	100	+30%	30/15 Summer			
2.004	11	15 Winter	100	+30%	30/15 Summer			
2.005	12	60 Winter	100	+30%	2/30 Winter			
1.005	6	60 Winter	100	+30%	1/15 Winter			
3.000	S Tank	120 Winter	100	+30%	30/60 Winter			
3.001	S Basin	60 Winter	100	+30%	30/15 Summer			
1.006	13	120 Winter	100	+30%	1/15 Summer		1/15 Summer	62
4.000	20	30 Winter	100	+30%	30/15 Summer	100/15 Winter		
4.001	21	60 Winter	100	+30%	2/60 Winter			
4.002	22	60 Winter	100	+30%	2/30 Summer			
4.003	23	60 Winter	100	+30%	1/60 Winter			

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	3.042	0.417	0.000	0.68		9.3	FLOOD RISK	
1.001	2	2.948	0.503	0.000	1.24		17.1	FLOOD RISK	
1.002	3	2.816	0.526	1.051	1.02		37.9	FLOOD	4
1.003	4	2.717	0.654	0.000	0.71		39.7	FLOOD RISK	
1.004	5	2.665	0.649	0.000	0.51		28.2	FLOOD RISK	
2.000	7	3.312	0.610	0.000	0.92		12.6	FLOOD RISK	
2.001	8	3.163	0.630	0.000	1.53		20.5	FLOOD RISK	
2.002	9	2.945	0.523	0.000	0.81		29.6	FLOOD RISK	
2.003	10	2.830	0.581	0.000	0.84		52.8	FLOOD RISK	
2.004	11	2.747	0.598	0.000	0.83		51.0	FLOOD RISK	
2.005	12	2.711	0.652	0.000	0.64		39.3	SURCHARGED	
1.005	6	2.659	0.686	0.000	1.03		66.6	FLOOD RISK	
3.000	S Tank	2.524	0.349	0.000	0.07		4.9	SURCHARGED	
3.001	S Basin	2.596	0.442	0.000	0.10		19.3	SURCHARGED	
1.006	13	2.612	0.945	0.000	0.38	49.9	5.0	SURCHARGED	
4.000	20	3.038	0.770	3.007	1.33		17.6	FLOOD	3
4.001	21	2.988	0.809	0.000	0.97		12.9	FLOOD RISK	
4.002	22	2.939	0.860	0.000	0.94		12.6	FLOOD RISK	
4.003	23	2.887	0.914	0.000	0.38		12.6	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
4.004	24	60 Winter	100	+30%	1/30 Winter			
5.000	26	60 Winter	100	+30%	1/30 Winter			
4.005	25	60 Winter	100	+30%	1/15 Summer			
4.006	27	60 Winter	100	+30%	1/15 Summer			
4.007	28	120 Winter	100	+30%	1/15 Summer			
6.000	30	15 Winter	100	+30%	1/60 Winter	100/15 Summer		
4.008	29	120 Winter	100	+30%	1/15 Summer			
7.000	N Tank	120 Winter	100	+30%	30/30 Winter			
7.001	N Basin	120 Winter	100	+30%	30/15 Summer			
4.009	31	120 Winter	100	+30%	1/15 Summer		1/60 Winter	39

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
4.004	24	2.874	0.963	0.000	0.58		20.5	FLOOD RISK	
5.000	26	2.865	0.924	0.000	0.39		13.8	FLOOD RISK	
4.005	25	2.847	1.037	0.000	0.65		37.2	FLOOD RISK	
4.006	27	2.785	1.027	0.000	0.61		36.8	SURCHARGED	
4.007	28	2.734	1.047	0.000	0.38		21.5	SURCHARGED	
6.000	30	3.036	1.073	0.567	1.33		18.7	FLOOD	4
4.008	29	2.732	1.090	0.000	0.49		29.3	SURCHARGED	
7.000	N Tank	2.725	0.425	0.000	0.08		4.2	FLOOD RISK	
7.001	N Basin	2.726	0.456	0.000	0.01		3.5	FLOOD RISK	
4.009	31	2.726	1.308	0.000	0.38	26.9	5.0	SURCHARGED	

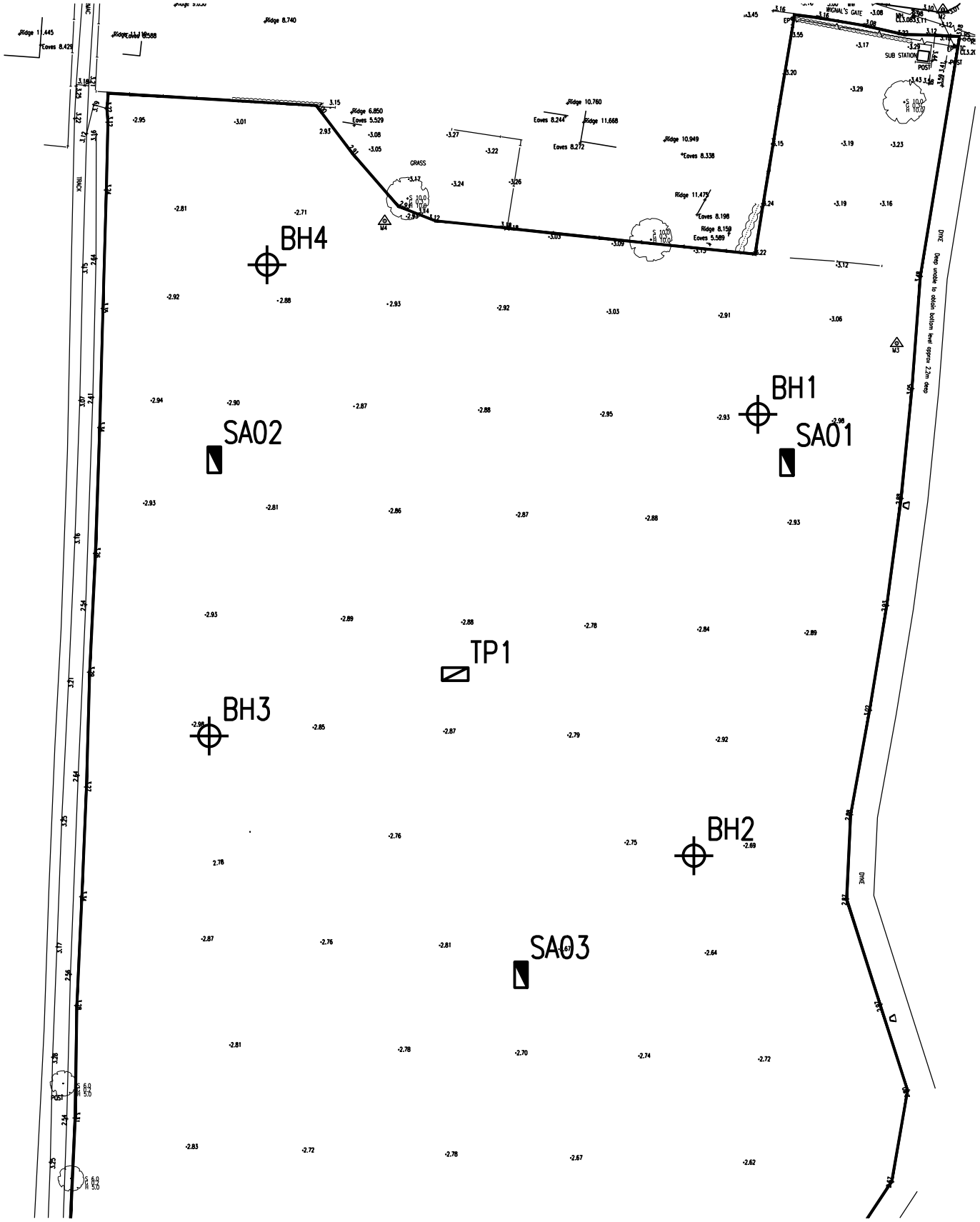
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Sheet No. 36916/SK02				Rev -	
Status FOR INFORMATION					
Date	Mar. '18	Drawn	MP	Checked	SRC
Scale	1:1250	Design	SRC	File Name	36916-SK02

Project: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Title: Plan Showing Ground Investigation Trial Locations



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Sheet No. 36916/BH01					Rev -
Status	FOR INFORMATION				
Date	Mar. '18	Drawn	MP	Checked	SRC
Scale		Design	-	File Name	36916-BH01

Location: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Carried Out For: D Brown Builders

Date Undertaken: 22/03/18

Logged By: MP

Equipment & Methods
100mmø HandAuger
Mackintosh Probe

Site Coordinates:

Ground Level:

Borehole No. 1

Description	Reduced Level	Legend	Depth (Thick)	Samples Depth	Samples Sample Reference	Samples Sample Type	Samples Sample No.	Test Required	M.P.T. Blow Count (Depth)
Topsoil.			450mm						
Mid Brown Moist Fine Sandy Silt.			1200mm (750mm)						0.6m Below G.L. 92 Blows For 300mm Movement
Orangey Brown Moist Silty Sand, Becoming Coarser With Depth.			1700mm (500mm)						1.55m Below G.L. 100 Blows For 230mm Movement
Brown Wet Silty Sand.			1900mm (200mm)						

Remarks
Standing Water @ 1.6m.
Borehole Terminated @ 1.9m Due To Collapse/Strata Washing Out.

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Date	Mar. '18	Drawn	MP	Checked	SRC
Scale		Design	-	File Name	36916-BH02

Location: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Carried Out For: D Brown Builders

Date Undertaken: 22/03/18

Logged By: MP

Equipment & Methods
100mmø HandAuger
Mackintosh Probe

Site Coordinates:

Ground Level:

Borehole No. 2

Description	Reduced Level	Legend	Depth (Thick)	Samples: Depth	Samples: Sample Reference	Samples: Sample Type	Samples: Sample No.	Test Required	M.P.T. Blow Count (Depth)
Topsoil.			450mm						
Orangey Brown Moist Sandy Silt.			1100mm (650mm)						0.6m Below G.L. 103 Blows For 300mm Movement 0.9m Below G.L. 97 Blows For 300mm Movement
Mid Brown Moist Silty Fine Sand, Becoming Sandier With Depth. Very Moist.			2100mm (1000mm)						1.2m Below G.L. 96 Blows For 300mm Movement 1.5m Below G.L. 96 Blows For 300mm Movement
Brown/Grey Wet Silt/Coarse Sand.			2300mm (200mm)						

Remarks
Standing Water @ 1.6m After 1 Hour.
Borehole Terminated @ 2.3m Due To Collapse/Strata Washing Out.

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Date	Mar. '18	Drawn	MP	Checked	SRC
Scale		Design	-	File Name	36916-BH03

Location: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Carried Out For: D Brown Builders

Date Undertaken: 22/03/18

Logged By: MP

Equipment & Methods
100mmø HandAuger
Mackintosh Probe

Site Coordinates:

Ground Level:

Borehole No. 3

Description	Reduced Level	Legend	Depth (Thick)	Samples Depth	Samples Sample Reference	Samples Sample Type	Samples Sample No.	Test Required	M.P.T. Blow Count (Depth)
Topsoil.			500mm						
Orangey Brown Moist Sandy Silt.			1200mm (700mm)						0.6m Below G.L. 123 Blows For 300mm Movement 0.9m Below G.L. 62 Blows For 300mm Movement 1.2m Below G.L.
Orangey Brown Very Moist Silty Sand, Becoming Wetter & Coarser With Depth. @ 1700mm Black Inclusions With Tiny Shells.			2100mm (900mm)						45 Blows For 300mm Movement
Dark Brown Very Wet Silty Sand.			2300mm (200mm)						

Remarks
Standing Water @ 1.4m After 1 Hour.
Borehole Terminated @ 2.3m Due To Collapse/Strata Washing Out.

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Date	Mar. '18	Drawn	MP	Checked	SRC
Scale		Design	-	File Name	36916-BH04

Location: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Carried Out For: D Brown Builders

Date Undertaken: 22/03/18

Logged By: MP

Equipment & Methods
100mmø HandAuger
Mackintosh Probe

Site Coordinates:

Ground Level:

Borehole No. 4

Description	Reduced Level	Legend	Depth (Thick)	Samples Depth	Samples Sample Reference	Samples Sample Type	Samples Sample No.	Test Required	M.P.T. Blow Count (Depth)
Topsoil.			500mm						
Orangey Moist Sand / Silt.			900mm (400mm)						0.6m Below G.L. 104 Blows For 300mm Movement 0.9m Below G.L.
Orangey Moist Silty Sand.			1200mm (300mm)						70 Blows For 300mm Movement 1.2m Below G.L.
Brown Very Moist Fine Sandy Silt.			1600mm (400mm)						34 Blows For 300mm Movement
Brown Wet Sandy Silt.			1800mm (200mm)						

Remarks

Standing Water @ 1.3m After 1 Hour.
Borehole Terminated @ 1.8m Due To Collapse/Strata Washing Out.

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Sheet No. 36916/TP01					Rev -
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Date	Mar. '18	Drawn	MP	Checked	SRC
Scale	-	Design	-	File Name	36916-TP01

Location: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Carried Out For: D Brown Builders

Date Undertaken: 22/03/18

Logged By: MP

Equipment & Methods

Site Coordinates:

Ground Level:

Trial Pit No. 1

Description	Reduced Level	Legend	Depth (Thick)
Topsoil.			500mm
Mid Brown Moist Fine Sandy Silt.			1200mm (700mm)
Orangey Brown Moist Silty Sand.			2200mm (1000mm)
Very Moist Firm Grey Clayey Silt. Becoming Clayier With Depth.			2900mm (700mm)

Remarks

Trial Pit Terminated @ 2.9m.

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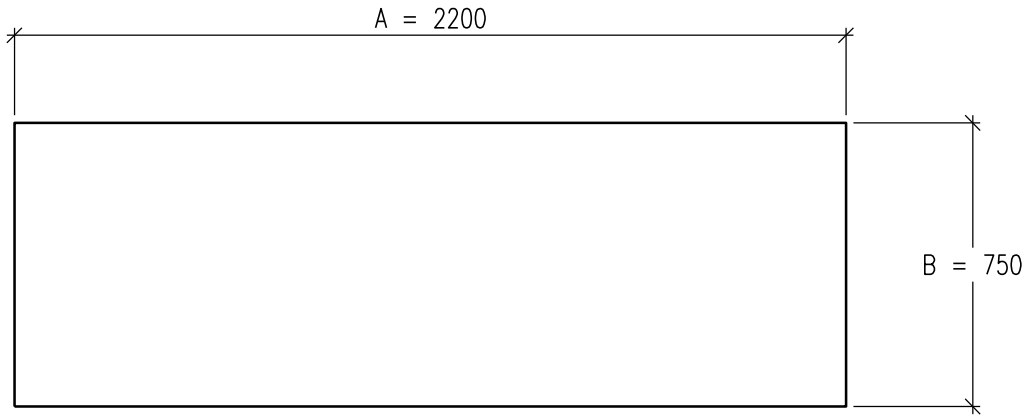
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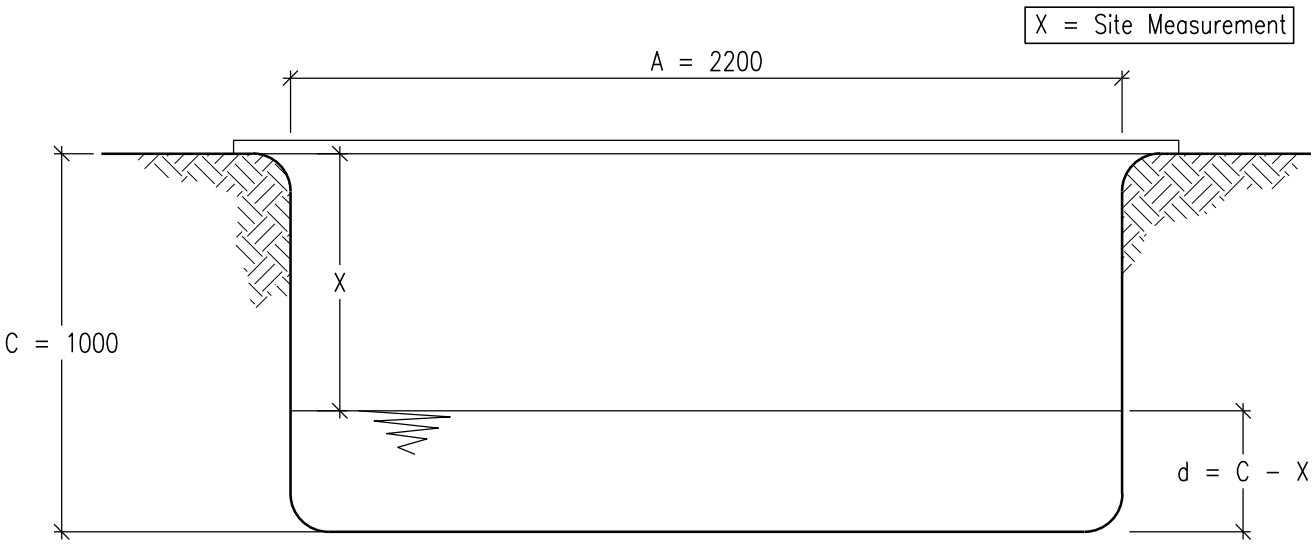
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Scale	1:20	Design	-	File Name	36916-SA01

Project: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Title: Infiltration Soak Away Sketch



Plan On SA01



Section Through SA01

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Soak-Away Test SA01

Job Reference Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	320
10	310
40	305
70	290
110	290
145	280
180	270
215	260
275	255
320	240

Job No. 36916

Date 22/03/2018

Trial Dimensions

A =	2.2	m
B =	0.75	m
C =	1	m

C.S.Area of SA01 = 1.65 m^2

Total Volume =	0.132	m^3
75% Volume =	0.099	m^3
25%Volume =	0.033	m^3

Time Taken From 75% Volume to 25% Volume

172 Mins

Effective Depth From 75% Volume to 25% Volume

0.04 m

50% Effective Internal Surface Area Including Base area

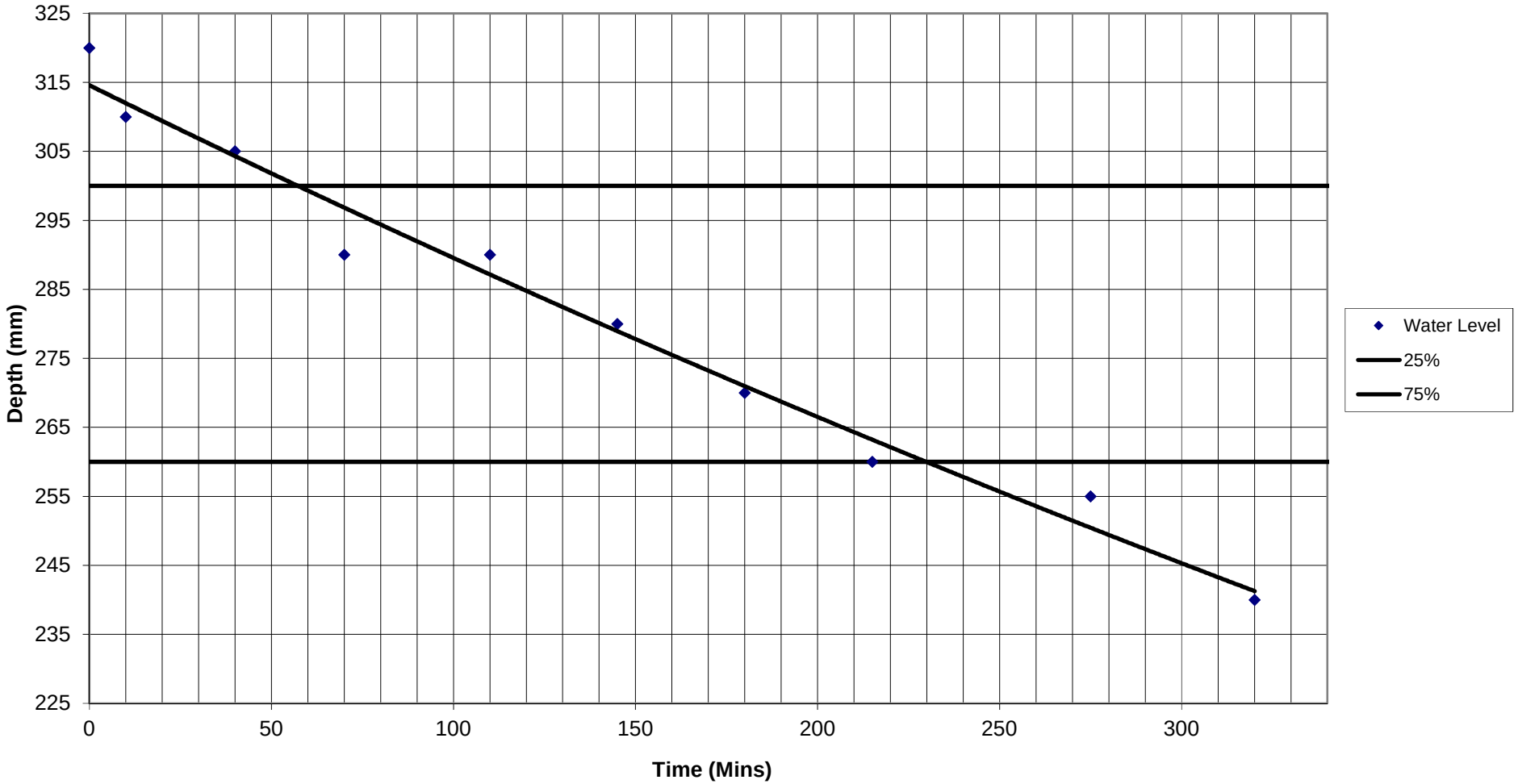
1.886 m^2

Soil Infiltration rate, f

3.39096E-06 m/s

3.39 x 10^ - 3 mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.
Job No. 36916 22/03/18
Plot showing water level aginst time for SA01

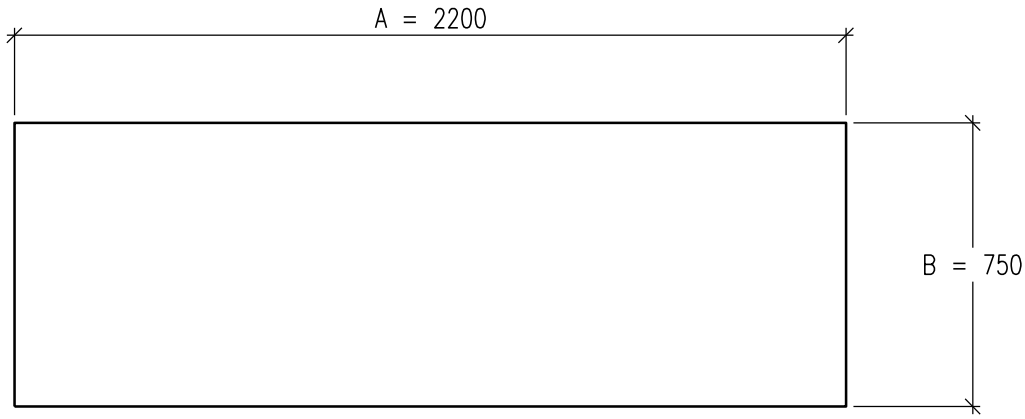


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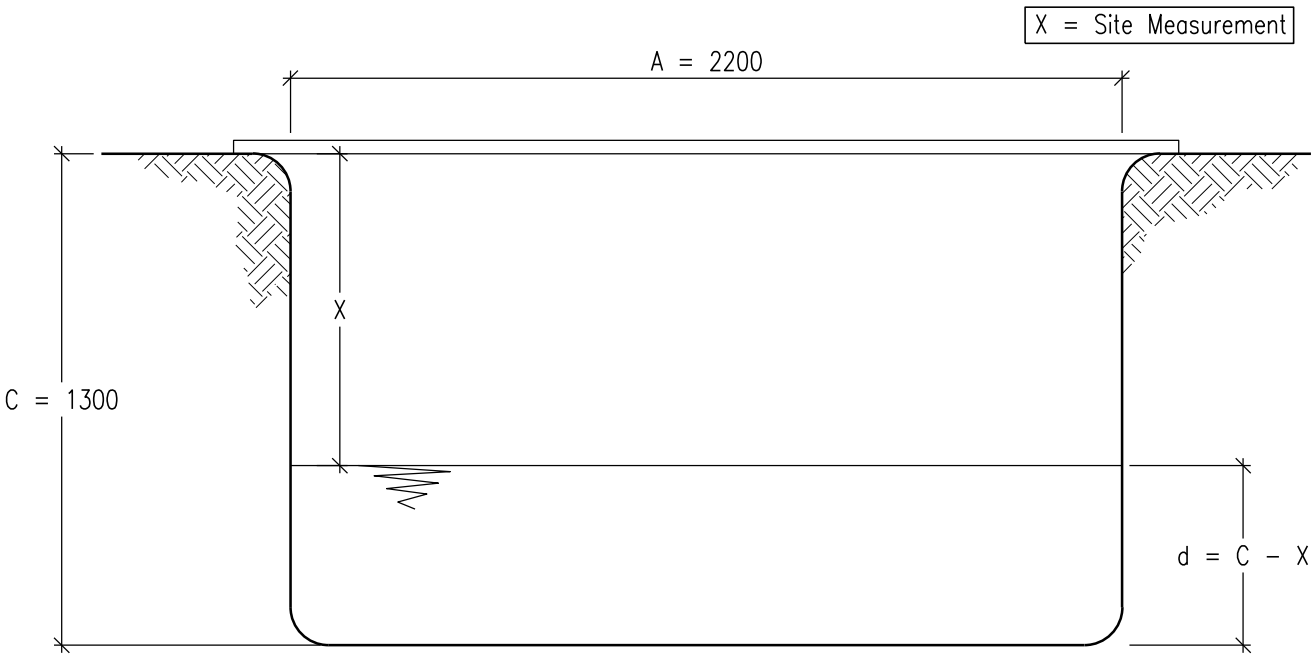
Sheet No. 36916/SA02					Rev -
Status	FOR INFORMATION				
Date	Mar. '18	Drawn	MP	Checked	SRC
Scale	1:20	Design	-	File Name	36916-SA02

Project: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Title: Infiltration Soak Away Sketch



Plan On SA02



Section Through SA02

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Soak-Away Test SA02

Job Reference Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	475
15	430
35	410
80	400
110	385
145	375
180	350
205	340
235	330
275	325

Job No. 36916

Date 22/03/2018

Trial Dimensions

A =	2.2	m
B =	0.75	m
C =	1.3	m

C.S.Area of SA01 = 1.65 m^2

Total Volume =	0.248	m^3
75% Volume =	0.186	m^3
25%Volume =	0.062	m^3

Time Taken From 75% Volume to 25% Volume

150 Mins

Effective Depth From 75% Volume to 25% Volume

0.075 m

50% Effective Internal Surface Area Including Base area

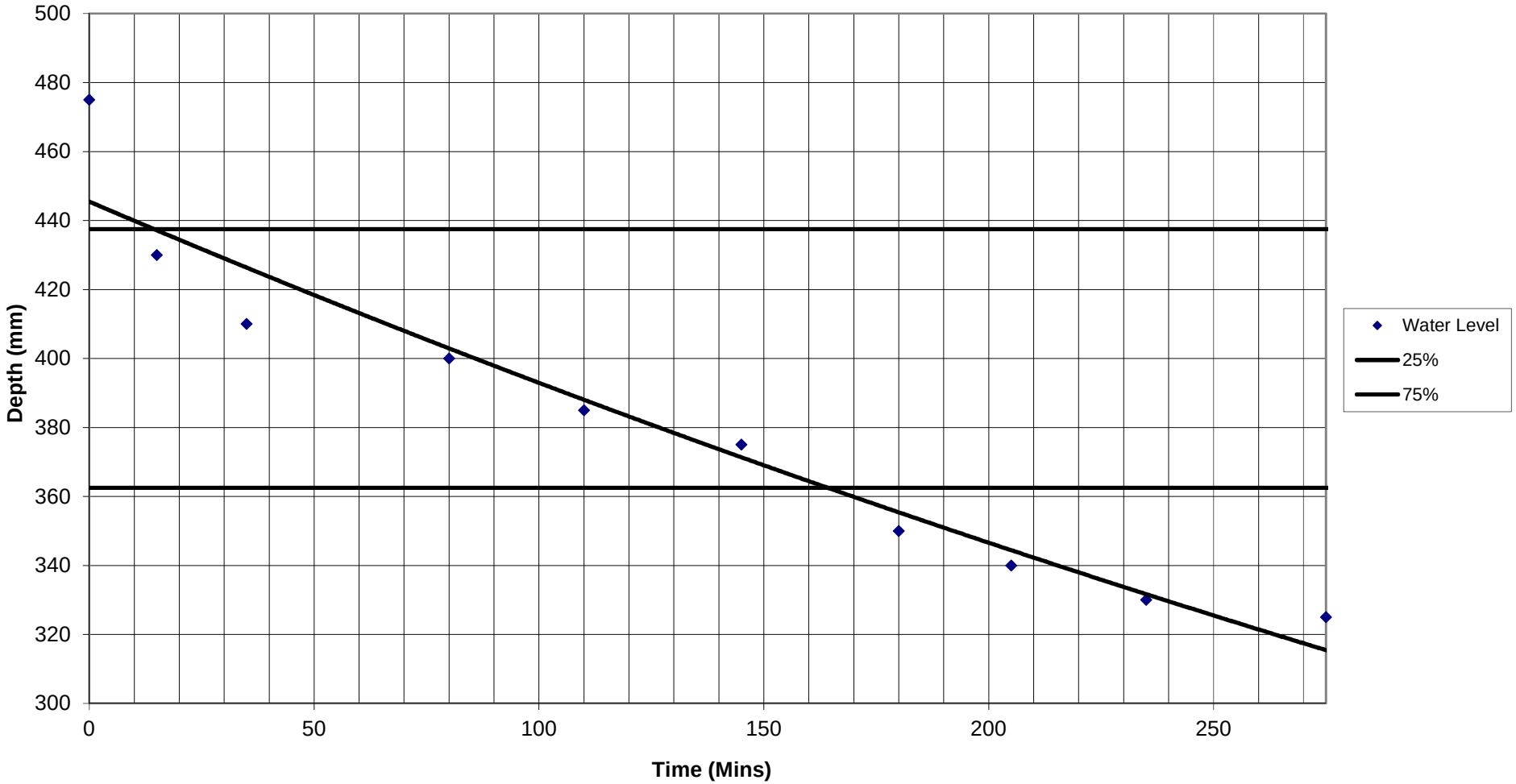
2.0925 m^2

Soil Infiltration rate, f

6.57109E-06 m/s

6.57 x 10^ - 3 mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.
Job No. 36916 22/03/18
Plot showing water level aginst time for SA02

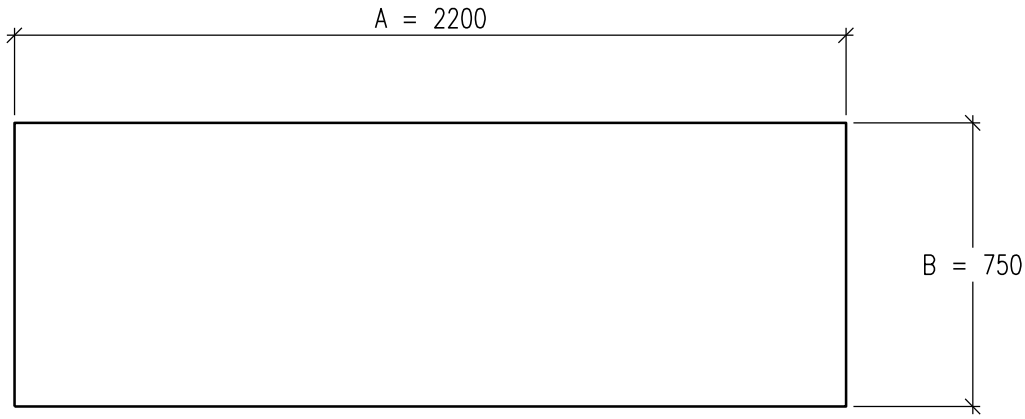


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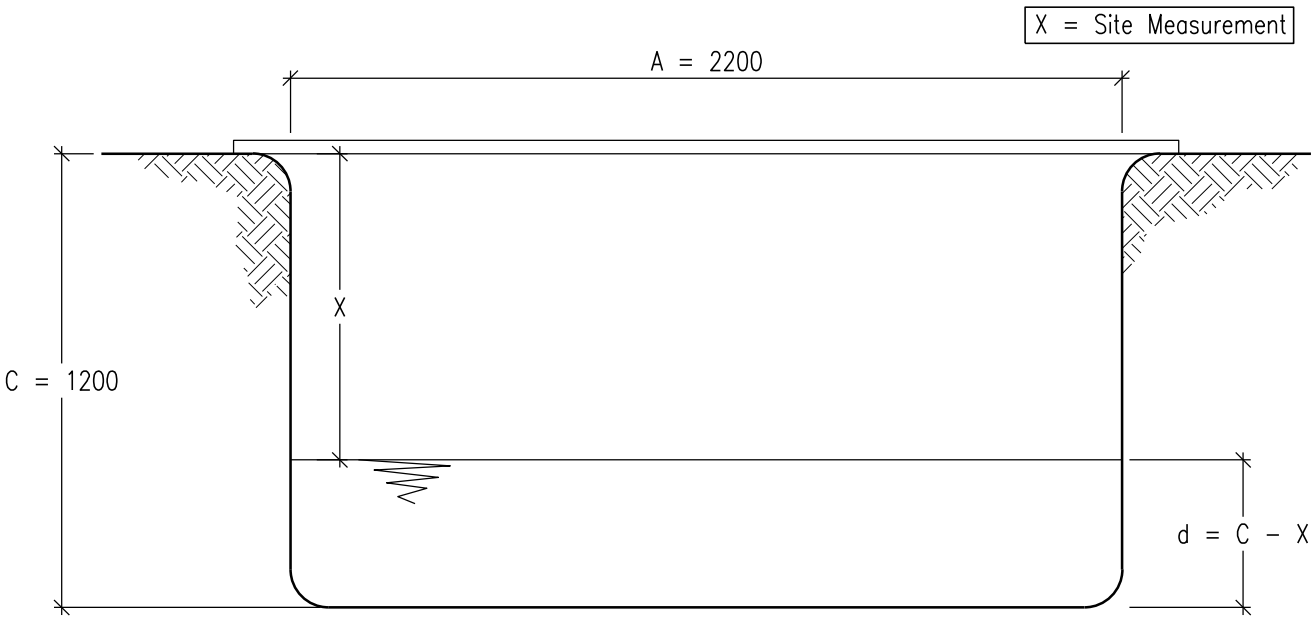
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Status	FOR INFORMATION				
Date	Mar. '18	Drawn	MP	Checked	SRC
Scale	1:20	Design	-	File Name	36916-SA03

Project: Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

Title: Infiltration Soak Away Sketch



Plan On SA03



Section Through SA03

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Soak-Away Test SA03

Job Reference Proposed Residential Development off Wignals Gate, Holbeach, Lincs.

SA01	
TIME (Mins)	DEPTH mm (d)
0	390
25	385
60	380
90	375
130	370
185	365
230	360

Job No. 36916

Date 22/03/2018

Trial Dimensions

A =	2.2	m
B =	0.75	m
C =	1.2	m

C.S.Area of SA01 = 1.65 m^2

Total Volume =	0.050	m^3
75% Volume =	0.037	m^3
25%Volume =	0.012	m^3

Time Taken From 75% Volume to 25% Volume

117 Mins

Effective Depth From 75% Volume to 25% Volume

0.015 m

50% Effective Internal Surface Area Including Base area

1.7385 m^2

Soil Infiltration rate, f

2.02798E-06 m/s

2.03 x 10^ - 3 mm/s

Proposed Residential Development off Wignals Gate, Holbeach, Lincs.
Job No. 36916 22/03/18
Plot showing water level aginst time for SA03

