

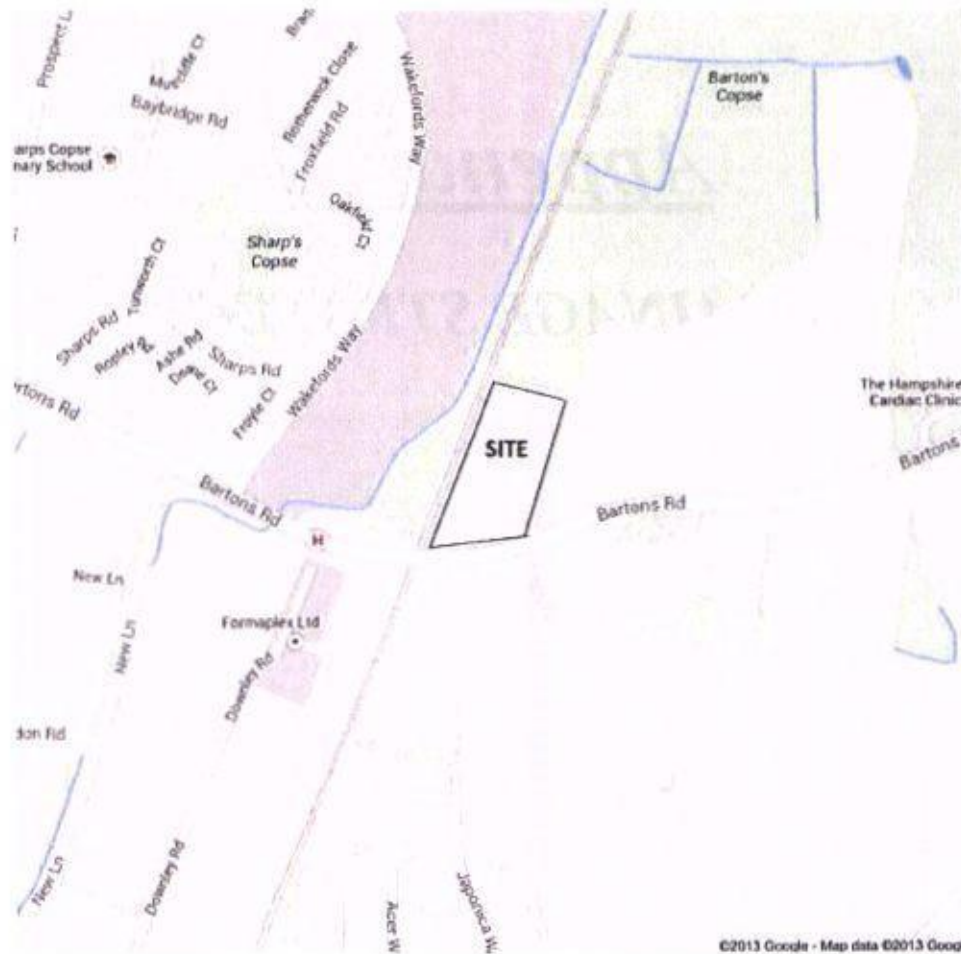


HAVANT BOROUGH
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FLOOD RISK ASSESSMENT

1. INTRODUCTION

Figure 1: Site Location Plan



Subject to the developer obtaining planning permission, the developer intends to develop the site for 55 residential units. The site is currently used by a number of premises, including a lawnmower service and retail centre, dog kennels and three residential dwellings, together with various associated buildings, parking areas and an open paddock at the rear of the site. The buildings

1.1.3 Correspondence and Discussions

During the preparation of this document the Environment Agency has been contacted in order to obtain information. The report has been based on the information provided by the Environment Agency, the client and observations from site visits.

1.1.4 Objectives

The principle aims of the FRA are:

1. To assess the risk associated with all potential flood sources;
2. To investigate the interaction between potential flood sources and the redevelopment proposals;
3. To discuss management of storm water runoff related to the potential development.

2. SITE DESCRIPTION

2.1 Location

The site is located 2km to the north east of Havant Town Centre on the outskirts of the town, with a frontage on Bartons Road and is immediately east of the London to Portsmouth Railway. An area of ancient woodland (Bartons Copse) is located to the north of the site with farmland to the east.

2.2 Site Appearance

The site covers an area of approximately 1.50 hectares, and is accessed from Bartons Road.

Appendix 1 shows the existing site survey. The site is currently used by a number of premises: a lawnmower service/retail centre and three residential dwellings at the southern end of the site, dog kennels along the eastern boundary, together with various associated buildings, parking areas and an open paddock at the northern end of the site. The existing impermeable area is 0.375 hectares.

Site levels generally fall from east to west towards the Railway Line and south to north towards Bartons Copse. The maximum site level is approximately 32.90m AOD at the south east corner of the site on Bartons Road. The site then falls steeply towards the north west corner of the site at an average gradient of 1in17, where the minimum site level is approximately 23.00m AOD.

The site is on the outskirts of the Havant conurbation and separated from existing residential areas by the London to Portsmouth railway line along its western boundary. The railway line is in a cutting approximately 10.0m below site levels at the southern western end of the site, and at approximately 1.0m below site levels at the northern western end of the site.

The site fronts Bartons Road on its southern boundary, the carriageway continues westwards towards Havant over the railway, via a road bridge. The areas to the north and east of the site have not been developed, with ancient woodland to the north (Bartons Copse) and pastoral farm land to the east.

2.2.1 Site Drainage

Southern Water have provided their sewer records for the area (see Figure 4). These confirm that there are no existing surface water sewers in the vicinity of the site, although a foul sewer crosses the site from east to west and then beneath the railway. This would suggest that soakaways were used for the disposal of surface water run-off, but following a drainage investigation of the site and carrying out soakaway tests it was found that this was not the case. The soakaway tests confirmed that the London Clay sub-strata had no soakage potential and the drainage investigation confirmed that although a some surface water run-off discharged to the existing foul sewer, it mostly discharge overland to the lowest part of the site in the north west corner.

The surface water run-off then either discharges directly to the open watercourse on the opposite side of the railway line, or via the woodland area which also falls towards the railway line, through the hogging beneath the railway line. Although 0.375ha of the existing site is impermeable, given

the pathway by which surface water run-off discharges to the existing watercourse, the existing discharge rates should be deemed to be the equivalent of a greenfield site.

It should be noted that Bartons Copse is classified as Ancient Woodland and so a buffer zone at the northern end of the site has been left clear of any development in root protection zone. This effectively reduces the developable area by approximately 0.20ha to 1.30ha.

Therefore from the net development area of 1.30ha, and taking into account the site soil characteristics, the Mean Annual Flood Rate (Qbar) for a 'Greenfield Site', can be calculated using the IH124 method of calculation, together with the peak rate of discharge to the existing watercourse for varying storm events (Figure 3).

Figure 3: Existing Discharge Rates.

Andrew Malcolm Associates Ltd		Page 1	
15 Wild Rose Crescent Southampton SO31 6TG		Greenfield Qbar Bartons Road Havant	
Date 16-09-13 File		Designed By ajn Checked By	
Micro Drainage		Source Control W.II.2	



IH 124 Mean Annual Flood			
Input			
Return Period (years)	100	GAFA (mm)	840.000
Area (ha)	1.300	Soil	0.450
		Region Number	1
Results			
l/s			
QBAR Rural 10.8			
QBAR Urban 10.6			
Q 100 years 33.1			
Q 1 year 9.0			
Q 2 years 9.3			
Q 5 years 13.5			
Q 10 years 17.1			
Q 20 years 21.2			
Q 25 years 22.7			
Q 30 years 23.9			
Q 50 years 27.1			
Q 100 years 33.1			
Q 200 years 39.0			
Q 250 years 41.5			
Q 1000 years 54.5			

2.2.2 Geology

GESL undertook an intrusive site investigation during May 2013. Table 1 shows the generalised ground profile encountered during this investigation.

Table 1. Generalised Ground Profile

Top (m bgl)	Base (m bgl)	Description
0	0.3	Dark brown silty clay with roots (TOPSOIL)
0	1.2	Dark brown silty sandy clay with brick concrete metal fabric and plastic (MADE GROUND)
0.3 - 1.2	1.6 - 3.0+	Soft to stiff orange-brown and light grey mottled sandy CLAY with gravel and cobble sized flint (HEAD DEPOSITS)
1.6 - 2.0	3.0+	Firm to very stiff grey/brown CLAY locally closely to very closely fissured with occasional silt partings (LONDON CLAY FORMATION)

A review of published records for boreholes within the vicinity of the site indicated that the London Clay Formation was likely to be at least 20m deep beneath the site and underlain by approximately 30-35m of interbedded sand and silty clay of the Lambeth Group, which in turn was underlain by Chalk.

2.3 Surrounding Area

The site is on the outskirts of the Havant conurbation and separated from existing residential areas by the London to Portsmouth railway line along its western boundary. The railway line is in a cutting approximately 10.0m below site levels at the southern western end of the site, and at approximately 1.0m below site levels at the northern western end of the site.

The site fronts Bartons Road on its southern boundary, the carriageway continues westwards towards Havant over the railway, via a road bridge. The areas to the north and east of the site have not been developed, with ancient woodland to the north (Bartons Copse) and pastoral farm land to the east.

The nearest watercourse is located to the west of the site on the opposite side of the railway line, which is classified as Main River by the Environment Agency.

The land to the east of the site falls westwards towards the railway line from a high point on Comley Hill, located approximately 500m east of the site. Similarly land to the west of the site falls eastwards towards the railway line. It therefore appears that prior to the construction of the railway, there was a natural valley with a watercourse running through it from north to south. With the construction of the railway the watercourse was diverted into a man-made channel running parallel with and on the western side of the railway.

It should also be noted that the Environment Agency maintain a database of maps on their website indicating groundwater protection zones, where special measures may need to be taken to prevent the discharge of pollutants into the ground water. This website has been interrogated and it should be noted that the site does not fall within one of these areas.

2.3.1 Local Drainage Network

As indicated on Southern Water's records (see Figure 4), there is a foul sewer running through the site, but no surface water sewers in the immediate vicinity of the site. The nearest surface water sewers are located in the existing residential development on the western side of the railway, these eventually discharge to the existing water course.

There is also an existing 225mm dia. Highway Drain along the frontage of the site in Bartons Road. This highway drain is at the high end of the site and no surface water run-off from the site itself discharges to it.

Surface water run-off from the surrounding area generally discharges to the water course running parallel with the railway. As already discussed, surface water run-off from land to the east of the railway, generally flows overland to the railway and discharges to the watercourse on the opposite side of the railway line, or via the woodland area which also falls towards the railway line, through the hogging beneath the railway line.

Figure 4: Southern Water Drainage Records



2.4 Description Of Redevelopment

The proposed residential development consists of 55 new residential units, as indicated on the Drainage Strategy drawing (see Appendix 2). It should be noted that Bartons Copse is a classified as Ancient Woodland and so the a buffer zone at the northern end of the site has been left clear of any development in the root protection zone. Taking into account the net developable area of 1.30ha, the impermeable area will increase from 0.375ha to 0.711ha, an increase from 28% to 54%. Proposed ground levels will remain broadly in line with existing levels.

3. EXTERNAL FLOOD SOURCES

Current guidance recommends that a FRA must investigate all potential sources of flood risk that may affect each particular site. A number of site-specific mechanisms exist; however, many of these are not relevant to this site. Table 2 summarises the range of potential flood sources, pathways and the possibility of relevance to the site itself and immediately surrounding area.

Table 2: Summary of potential flood sources

Flood Type	Source	Pathway	Consider Further
Fluvial	Existing Watercourse alongside Railway Line	Adjacent to site.	Yes
Tidal	None	None	No
Overland Flow	Higher ground to the east of the site and from Bartons Road	Surface Water Run-off in exceptional storm events.	Yes
Drainage	Existing Highway Drain in Bartons Road	Blockage/overwhelmed capacity	Yes
Groundwater	Clay Sub-Strata	Rising Water Table	Yes

3.1 Fluvial

The EA Flood Map indicates that fluvial flooding occurs alongside the watercourse on the opposite side of the railway line from the site. Since this watercourse is a minimum 5.0m below the level of the site, the proposed development will not be at risk of fluvial flooding.

3.2 Overland Flow

The overland flow route for surface water run-off from land to the east of the site and Barton Road is through the proposed development. To ensure that this flood route is maintained to bypass the proposed buildings, existing levels should be maintained.

3.3 Drainage

Southern Water maintains a database that records reported incidents of sewer flooding. There have been no recorded instances of flooding the site as a result of their sewers being overwhelmed. This is not surprising as they have no sewers in the vicinity of the site.

There is also a Highway Drain in Bartons Road, and anecdotal evidence suggests that this system sometimes becomes overwhelmed during exceptional storm events, with surface water run-off from the public highway flowing overland into the site. Measures should therefore be taken to ensure that this does not occur once the site is developed.

3.4 Groundwater

As part of the intrusive investigation undertaken by GESL, groundwater data was available. This confirmed that groundwater was not present at depths up to 3.0m below ground level. It was also suggested that because of the depth of London Clay below the site (approximately 15.0m), no groundwater would be encountered until even greater depths. The site is therefore not at risk of flooding from high groundwater levels.

4. FLOOD MITIGATION AND MANAGEMENT

The assessment undertaken in Section 3 identified fluvial flooding, overland flow, off-site drainage and groundwater as a potential source of flood risk to the proposed development. However, it was demonstrated that the only potential sources of flooding were from overland flow and the existing highway drainage system in Bartons Road. Provided the following recommendations are implemented they will not be a potential source of flooding in the future.

4.1 Overland Flow Pathways

It has been identified that a flood route through the site from the higher land to the east of the site needs to be maintained. This should be achieved by maintaining existing site levels, so that overland flows bypass the proposed buildings.

4.2 Existing Drainage Infrastructure

It has been identified that when the existing highway drain in Bartons Road is overwhelmed during exceptional storm events and surface water run-off from the public highway enters the site. To prevent this occurring once the site has been developed, levels on the boundary of the site should be engineered, so that surface water run-off from the highway is confined to the existing carriageway in Bartons Road.

5. SITE GENERATED FLOOD RISK

5.1 Storm Water Strategy

5.1.1 Background

Drainage proposals for the site have been prepared as indicated on the Drainage Layout dwg.no.LIND48-sk2 (see Appendix 2). As the site prior to development discharged indirectly, into the existing watercourse on the western side of the railway, a new connection to the watercourse beneath the railway is proposed with the rate of discharge being limited to less than existing discharge rates (see Figure 3). To this end storage in the form of a cellular tank and oversized pipes are located within the site to cater for exceptional storm events.

It should be noted that it is the intention of the developer to requisition the sewer connection from the watercourse and beneath the railway line from Southern Water, because of the complexities in dealing with Network Rail and the carrying out the undertrack crossing.

5.1.2 Run-off Calculations

The maximum rate of discharge for the development post development should not exceed the existing rates of discharge from the site for each storm event or to Qbar for all storm events. For the purposes of comparison, the maximum run-off rate form for design storms of 1in1 year, 1in30 year, 1in100 year and 1in100year+30% allowance for climate change, have been calculated prior to and after the site is developed, in accordance with the National Planning Policy Framework and the Code for Sustainable Homes (Table 3).

Table 3: Run-off calculations based on relevant design storm

Development Status	1in1year Design Storm	Qbar – Mean Annual Max. Flood Rate	1in30year Design Storm	1in100year Design Storm	1in100year+30% Design Storm
Existing	9.0 l/sec	10.6 l/sec	23.9 l/sec	33.7 l/sec	43.8 l/sec
Proposed	9.0 l/sec	n/a	11.4 l/sec	12.7 l/sec	14.6 l/sec

5.2 Options for Disposal

5.2.1 Unattenuated Discharge

The existing site drains indirectly to the existing watercourse. Given the increase in impermeable area of the development and the decrease in time of concentration associated with a new piped drainage system, an unattenuated discharge may overwhelm the watercourse with an increase in the risk of fluvial flooding. Therefore this method of discharge is not an option.

In accordance with PPS25, the volume of run-off from the impermeable areas prior to and after development have been calculated for a 1in100 yr storm +30%CC of 6 hours duration in Table 4. It should be noted that for this site these figures are irrelevant, because of the issues with overland flows from the existing site.

Table 4: Volume of run-off from Impermeable Areas (1in100 yr storm +30%CC of 6 hours duration).

Conditions	Impermeable Area	Volume
Existing	0.375 hectares	255m ³
Proposed	0.711 hectares	482m ³

2.2.2 Attenuated Discharge

Attenuation of storm water will be required if the permitted maximum rate of discharge is limited to existing rates of discharge for each storm event or to Qbar for all storm events. The storage requirements will have to accord with the requirements of the Code for Sustainable Homes and cater for a 1in100year storm with a 30% allowance in rainfall intensities for climate change.

A drainage scheme using underground storage with a discharge to the existing watercourse via an undertrack crossing is proposed. The maximum rate of discharge will be limited to less than existing discharge rates to meet the aforementioned requirements.

2.2.3 Infiltration

As already discussed, GESL have carried out an intrusive site investigation. As part of this investigation soakaway tests have been carried out which confirmed that the London Clay substrata has no soakage potential.

The disposal of surface water run-off using infiltration techniques is therefore not an option.

2.2.4 Foul Drainage

As already discussed, an existing foul sewer passes through the northern end of the site. Southern Water have advised there is insufficient capacity in this sewer to serve the proposed development. However, the surface water run-off from existing impermeable areas within the site discharge to this foul sewer. By removing these connections and diverting all surface water run-off into the proposed surface water system, sufficient capacity will be created for the proposed development.

6. CONCLUSIONS AND RECOMMENDATIONS.

The following conclusions and recommendations can be made:

- The site is not located within an area considered to be at risk from fluvial flooding.
- It has been identified that a flood route through the site from the higher land to the east of the site needs to be maintained. This should be achieved by maintaining existing site levels, so that overland flows bypass the proposed buildings.
- It has been identified that when the existing highway drain in Bartons Road is overwhelmed during exceptional storm events and surface water run-off from the public highway enters the site. To prevent this occurring once the site has been developed, levels on the boundary of the site should be engineered, so that surface water run-off from the highway is confined to the existing carriageway in Bartons Road.
- Southern Water have advised there is insufficient capacity in their existing foul sewer to serve the proposed development. However, the surface water run-off from existing impermeable areas within the site discharge to this foul sewer. By removing these connections and diverting all surface water run-off into the proposed surface water system, sufficient capacity will be created for the proposed development.
- The surface water run-off from the existing site discharges to the existing watercourse on the western side of the adjacent railway line. Post development the impermeable area will increase from 0.375ha to 0.711ha.
- It is proposed that surface water run-off from impermeable areas will continue to discharge to the existing water course on the western side of the adjacent railway line, the rate of discharge should not exceed the existing rates of discharge. On-site storage should be provided to cater for the volumes of storm water anticipated up to and including 1in100yr storms with a 30% allowance for climate change.
- A detailed survey of the watercourse on the western side of the railway line should be carried out to confirm levels and the point of connection.
- Detailed calculations for storage should be undertaken. Based on the drainage strategy, the maximum discharge rate for each storm event has been calculated. These have been indicated in Appendix 3.

Appendix 1

SITE SURVEY

NOTES:

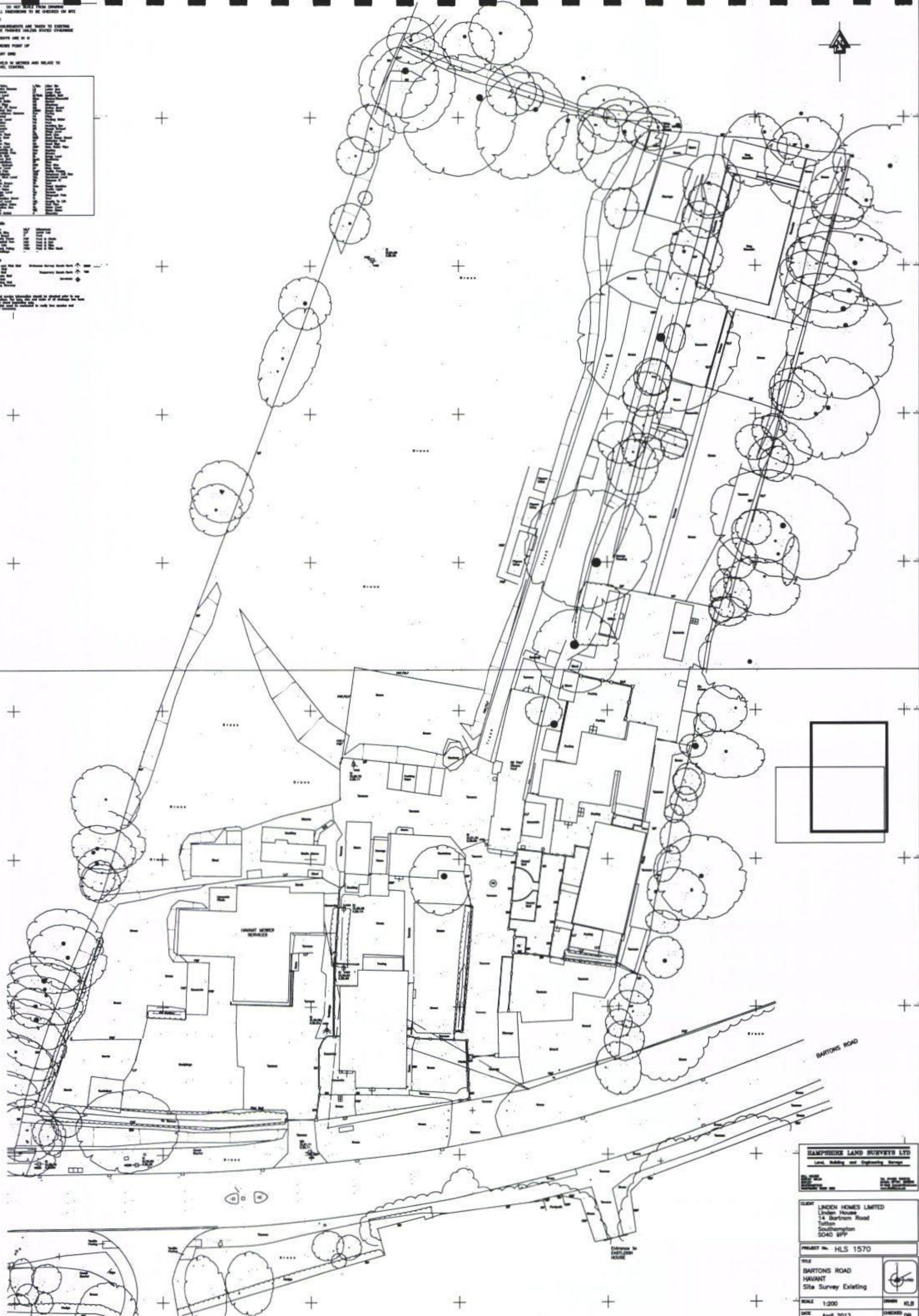
ALL MEASUREMENTS ARE TAKEN TO EXISTING
SURFACE, UNLESS INDICATED OTHERWISE

ALL HEIGHTS ARE IN M

ALL ANGLES POINT UP

ARBITRARY GRID

ALL LEVELS IN METERS AND RELATE TO
SPS LEVEL, CONTROL

[illegible][illegible]

HAMPSHIRE LAND SURVEYS LTD
Land, Building and Engineering Services

CLIENT LINDEN HOMES LIMITED
Linden House
14 Bartram Road
Totton
Southampton
SO40 9PP

PROJECT NO. HLS 1570

WILE
BARTONS ROAD
HAVANT
Site Survey Existing

SCALE	1:200
DATE	April

ORD No. 1570_13_04_02

CHARGE	REL
CHARGE	CH

	1994
--	------

Appendix 2

DRAINAGE STRATEGY

ExMH 0101
CL 18.63
IL 16.78

ExMH 0102
CL 24.60
IL 20.65

MH S1
CL 24.00
BD 21.122
IL To be confirmed

ExMH 1101
CL 31.26
IL 29.86

SURFACE WATER CALCULATIONS
GROSS AREA(Excluding Ancient Woodland) = 1.300ha
EXISTING IMPERMEABLE AREA = 0.375ha (29%)
PROPOSED IMPERMEABLE AREA = 0.711ha (54%)
Using IH 124 Method of calculating the Mean Annual Peak Flow Rate,
Existing rates of surface water run-off for Greenfield Site are as follows:
Qbar = 10.6litres/sec
1in1yr storm = 9.0 litres/sec
1in30yr storm = 23.9 litres/sec
1in100yr storm = 33.7 litres/sec

So that existing run-off rates are not exceeded and to cater for 1in100 year storm + 30% allowance for climate change, storage to be provided in Cellular Tank and 1200mm dia. Pipework, with discharge limited by hydrobrake manholes as follows:
MH S10 - 14 litres/sec (2.0m head)
MH S7 - 16 litres/sec (2.0m head)
MH S2 - 9 litres/sec (0.8m head)
Actual peak rates of discharge from site will be:
1in1yr storm = 9.0 litres/sec
1in30yr storm = 11.4 litres/sec
1in100yr storm +30% = 14.6 litres/sec

FOUL WATER CALCULATIONS

No. of units = 55
At peak discharge rate of 4000 litres/unit/day,
Total discharge = 2.54 litres/sec

No. of existing units to be demolished = 5
Total discharge = 0.23 litres/sec

Total additional discharge = 2.31 litres/sec



LEGEND

- RETAINING WALLS
(HEIGHT IN mm SHOWN ON HIGH SIDE)
- UNDERBUILD/TANKING
(HEIGHT IN mm SHOWN ON HIGH SIDE)

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Appendix 3

DRAINAGE CALCULATIONS

Andrew Malcolm Associates Ltd		Page 1
15 Wild Rose Crescent	Network Details	
Southampton	Bartons Road	
SO31 6TG	Havant	
Date 29-07-14	Designed By AJM	
File lin100+30% 240mins.SIM	Checked By	
Micro Drainage	Simulation W.11.2	

Global Variables

Region	FSR - England & Wales
Return Period (yrs)	100
M5-60 (mm)	20.000
Ratio R	0.400
Volumetric Runoff Coef	0.840
Profile Type	Winter
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	360
Hot Start (mins)	0
Hot Start Level (mm)	0
Manhole Headloss Coefficient	0.500
MADD Factor * 10m ³ /ha Storage	2.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	30
Number of Input Hydrographs	0
Number of Time/Area Diagrams	8
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of On-Line Controls	4

Starting Storm file name

\\AMA-HP\Users\Public\Documents\PROJECTS\LINDEN\BARTONS ROAD\Windes\24-07-14\STORM.SWS

Time/Area Diagram at Pipe Number 1.000

Time (mins)	Area (ha)
From: To:	
0 4	0.230
Total Area (ha) 0.230	

Time/Area Diagram at Pipe Number 1.002

Time (mins)	Area (ha)
From: To:	
0 4	0.034
Total Area (ha) 0.034	

Time/Area Diagram at Pipe Number 1.003

Time (mins)	Area (ha)
From: To:	
0 4	0.153
Total Area (ha) 0.153	

Time/Area Diagram at Pipe Number 1.006

Time (mins)	Area (ha)
From: To:	
0 4	0.007
Total Area (ha) 0.007	

15 Wild Rose Crescent

Southampton

SO31 6TG

Date 29-07-14

File lin100+30% 240mins.SIM

Micro Drainage

Network Details

Bartons Road

Havant

Designed By AJM

Checked By

Simulation W.11.2

**Micro
Drainage.**Time/Area Diagram at Pipe Number 1.007

Time	(mins)	Area
From:	To:	(ha)

0	4	0.030
---	---	-------

Total Area (ha) 0.030

Time/Area Diagram at Pipe Number 2.000

Time	(mins)	Area
From:	To:	(ha)

0	4	0.110
---	---	-------

Total Area (ha) 0.110

Time/Area Diagram at Pipe Number 2.002

Time	(mins)	Area
From:	To:	(ha)

0	4	0.107
---	---	-------

Total Area (ha) 0.107

Time/Area Diagram at Pipe Number 1.008

Time	(mins)	Area
From:	To:	(ha)

0	4	0.037
---	---	-------

Total Area (ha) 0.037

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.009	S1	23.950	21.122	1200	0

15 Wild Rose Crescent

Southampton

SO31 6TG

Date 29-07-14

File lin100+30% 240mins.SIM

Micro Drainage

Network Details

Bartons Road

Havant

Designed By AJM

Checked By

Simulation W.11.2

**Micro
Drainage.**On-Line Controls (Hydro-Brake®)

US/PN	Volume (m³)	Ctrl MH Name	Invert (m)	Type	Dia (m)	D.Head (m)	D.Flow (l/s)	Headloss (m)	Flow (l/s)
1.000	55.689	S10	27.924	Md6 SW Only	0.132	2.000	14.0	0.2	8.8
								0.4	9.2
								0.6	8.7
								0.8	9.2
								1.0	10.0
								1.4	11.7
								1.8	13.3
								2.2	14.7
1.003	48.236	S7	26.146	Md6 SW Only	0.141	2.000	16.0	2.6	16.0
								0.2	10.0
								0.4	11.0
								0.6	10.3
								0.8	10.7
								1.0	11.5
								1.4	13.4
								1.8	15.2
1.008	0.335	S2	21.150	Md6 SW Only	0.131	0.790	9.0	2.2	16.8
								2.6	18.2
								0.2	8.7
								0.4	9.0
								0.6	8.5
								0.8	9.0
								1.0	9.8
								1.4	11.5
3.000	154.000	S2	21.150	Md6 SW Only	0.131	0.790	9.0	1.8	13.1
								2.2	14.4
								2.6	15.7
								3.0	16.9
								0.2	8.7
								0.4	9.0
								0.6	8.5
								0.8	9.0

15 Wild Rose Crescent

Southampton

SO31 6TG

Date 29-07-14

File lin100+30% 240mins.SIM

Micro Drainage

Network Details

Bartons Road

Havant

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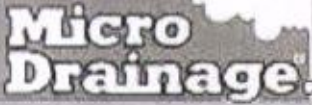
Checked By

Simulation W.11.2

**Micro
Drainage.**Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	51.04	0.255	200.2	0.000	5.00	1	0.600	o	1200
1.001	19.80	0.132	150.0	0.000	0.00	1	0.600	o	150
1.002	13.93	0.142	98.1	0.000	0.00	1	0.600	o	1200
1.003	44.45	0.454	97.9	0.000	0.00	1	0.600	o	1200
1.004	14.77	0.099	149.2	0.000	0.00	1	0.600	o	150
1.005	14.45	1.249	11.6	0.000	0.00	1	0.600	o	150
1.006	17.19	1.485	11.6	0.000	0.00	1	0.600	o	150
1.007	11.16	1.438	7.8	0.000	0.00	1	0.600	o	150
2.000	18.29	1.760	10.4	0.000	5.00	1	0.600	o	225
2.001	57.97	1.540	37.6	0.000	0.00	1	0.600	o	225
2.002	43.77	0.900	48.6	0.000	0.00	1	0.600	o	300
2.003	11.18	0.250	44.7	0.000	0.00	1	0.600	o	300
1.008	6.84	0.575	11.9	0.000	0.00	1	0.600	o	300
3.000	14.00	0.070	200.0	0.000	5.00	1	0.600	[]	-2
1.009	4.19	0.028	149.6	0.000	0.00	1	0.600	o	225

PN	USMH No.	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl No.	US/MH (mm)
1.000	S11	31.880	28.179	2.501	30.300	27.924	1.176		1800
1.001	S10	30.300	27.924	2.226	29.560	27.792	1.618	9	1800
1.002	S9	29.560	26.742	1.618	29.350	26.600	1.550		1800
1.003	S8	29.350	26.600	1.550	28.550	26.146	1.204		1800
1.004	S7	28.550	26.146	2.254	28.130	26.047	1.933	9	1800
1.005	S6	28.130	26.047	1.933	26.600	24.798	1.652		1200
1.006	S5	26.600	24.798	1.652	24.900	23.313	1.437		1200
1.007	S4	24.900	23.313	1.437	24.140	21.875	2.115		1050
2.000	S3.4	27.490	26.400	0.865	25.700	24.640	0.835		1050
2.001	S3.3	25.700	24.640	0.835	24.200	23.100	0.875		1050
2.002	S3.2	24.200	23.025	0.875	23.500	22.125	1.075		1050
2.003	S3.1	23.500	22.125	1.075	24.140	21.875	1.965		1050
1.008	S3	24.140	21.725	2.115	23.950	21.150	2.500		1200
3.000	S2.1	25.000	21.220	1.780	23.950	21.150	0.800		3000
1.009	S2	23.950	21.150	2.575	23.950	21.122	2.603	9	3000

Andrew Malcolm Associates Ltd		Page 5
15 Wild Rose Crescent	Network Details	
Southampton	Bartons Road	
SQ31 6TG	Havant	
Date 29-07-14	Designed By AJM	
File lin100+30 240mins.SIM	Checked By	
Micro Drainage	Simulation W.11.2	

The following hydraulic sections have been used in this network

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \ / open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file AQUACELL.SEC

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m ²)
-2	[]	7000	2000			3.111	14.000

Andrew Malcolm Associates Ltd		Page 1
15 Wild Rose Crescent	lin100yr +30% 360mins	
Southampton	Bartons Road	
SO31 6TG	Havant	
Date 29-07-14	Designed By AJM	
File lin100+30% 360mins.SIM	Checked By	
Micro Drainage	Simulation W.11.2	

Summary of Results

Return Period (years)	100	Analysis Time Step	Fine
Storm Duration (mins)	360	DTS Status	ON
Profile Type	Winter	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	ON

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	28.789	-0.590	0.000	0.01	0.0	17.9	O K
1.001	28.787	0.713	0.000	0.69	0.0	9.4	SURCH'ED
1.002	27.724	-0.218	0.000	0.01	0.0	11.2	O K
1.003	27.722	-0.078	0.000	0.01	0.0	20.5	O K
1.004	27.705	1.409	0.000	1.04	0.0	13.9	SURCH'ED
1.005	26.102	-0.095	0.000	0.29	0.0	13.9	O K
1.006	24.853	-0.095	0.000	0.29	0.0	14.1	O K
1.007	23.501	0.038	0.000	0.26	0.0	15.0	SURCH'ED
2.000	26.435	-0.190	0.000	0.06	0.0	8.7	O K
2.001	24.689	-0.176	0.000	0.11	0.0	8.7	O K
2.002	23.431	0.106	0.000	0.12	0.0	17.2	SURCH'ED
2.003	23.429	1.004	0.000	0.13	0.0	16.4	FLD RISK
1.008	23.428	1.403	0.000	0.17	0.0	33.1	SURCH'ED
3.000	23.420	0.200	0.000	0.00	0.0	1.0	SURCH'ED
1.009	23.420	2.045	0.000	0.49	0.0	14.6	SURCH'ED

15 Wild Rose Crescent

lin30yr 360mins

Southampton

Bartons Road

SQ31 6TG

Havant

Date 29-07-14

Designed By AJM

File lin30 360mins.SIM

Checked By

Micro Drainage

Simulation W.11.2

**Micro
Drainage.**Summary of Results

Return Period (years)	30	Analysis Time Step	Fine
Storm Duration (mins)	360	DTS Status	ON
Profile Type	Winter	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	ON

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	28.252	-1.127	0.000	0.01	0.0	10.8	O K
1.001	28.230	0.156	0.000	0.66	0.0	9.0	SURCH'ED
1.002	27.038	-0.904	0.000	0.01	0.0	10.4	O K
1.003	27.038	-0.762	0.000	0.01	0.0	17.0	O K
1.004	27.037	0.741	0.000	0.82	0.0	11.0	SURCH'ED
1.005	26.095	-0.102	0.000	0.23	0.0	11.0	O K
1.006	24.846	-0.102	0.000	0.23	0.0	11.2	O K
1.007	23.360	-0.103	0.000	0.21	0.0	12.4	O K
2.000	26.427	-0.198	0.000	0.04	0.0	5.2	O K
2.001	24.677	-0.188	0.000	0.06	0.0	5.2	O K
2.002	23.076	-0.249	0.000	0.07	0.0	10.2	O K
2.003	22.515	0.090	0.000	0.08	0.0	10.2	SURCH'ED
1.008	22.514	0.489	0.000	0.13	0.0	23.9	SURCH'ED
3.000	22.508	-0.712	0.000	0.00	0.0	1.1	O K
1.009	22.508	1.133	0.000	0.38	0.0	11.4	SURCH'ED

15 Wild Rose Crescent

Southampton

SQ31 6TG

Date 29-07-14

File linl_360mins.SIM

Micro Drainage

linl_360mins

Bartons Road

Havant

Designed By AJM

Checked By

Simulation W.11.2


**Micro
Drainage.**

Summary of Results

Return Period (year)	1	Analysis Time Step	Fine
Storm Duration (mins)	360	DTS Status	ON
Profile Type	Winter	DVD Status	ON
Margin for Flood Risk warning (mm)	300	Inertia Status	ON

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	28.193	-1.186	0.000	0.00	0.0	4.9	O K
1.001	28.035	-0.039	0.000	0.36	0.0	4.9	O K
1.002	26.758	-1.184	0.000	0.00	0.0	5.6	O K
1.003	26.619	-1.181	0.000	0.00	0.0	8.9	O K
1.004	26.323	0.027	0.000	0.66	0.0	8.8	SURCH'ED
1.005	26.090	-0.107	0.000	0.18	0.0	8.8	O K
1.006	24.841	-0.107	0.000	0.18	0.0	9.0	O K
1.007	23.354	-0.109	0.000	0.17	0.0	9.6	O K
2.000	26.417	-0.208	0.000	0.02	0.0	2.4	O K
2.001	24.665	-0.200	0.000	0.03	0.0	2.4	O K
2.002	23.059	-0.266	0.000	0.03	0.0	4.6	O K
2.003	22.162	-0.263	0.000	0.04	0.0	4.6	O K
1.008	21.781	-0.244	0.000	0.08	0.0	15.0	O K
3.000	21.623	-1.597	0.000	0.00	0.0	0.8	O K
1.009	21.623	0.248	0.000	0.30	0.0	9.0	SURCH'ED