

Project Title
**127a-127b London Road,
Waterlooville**

Report Title
Drainage Assessment

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3066/006/R01

Prepared For
Maven Plan Ltd

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EXECUTIVE SUMMARY

- I. This Drainage Assessment considers the drainage impact of the redevelopment of a site at 127A – 127B London Road, Waterloooville. The application site contains two residential dwellings; those will be demolished and developed it into 26 retirement flats.
- II. The site is located within Flood Zone 1 and is at a low risk of fluvial flooding.
- III. An existing pipe drains the site to the foul sewer in London Road. Building Regulations and current drainage best practice prevents the use of the existing connection to the foul sewer for conveying surface water, so a new connection to the surface water sewer in Arnside Close is proposed.
- IV. The new drainage scheme will restrict surface water run-off from the site to a maximum outflow of 5 litres/second. Excess storm flows during extreme events will be stored within below-ground attenuation tanks and within the sub-base to permeable paving. The storage required is estimated to be 50 cubic metres in volume.
- V. Rainwater butts and below ground storage will be used to store the first 5mm of all storm events and allow it to infiltrate to ground.

1.0 INTRODUCTION

- 1.1 This Drainage Assessment accompanies the planning application for the redevelopment of a site at 127A – 127B London Road, Waterloooville. The application site contains two residential dwellings on the site with gardens to the rear and tarmac surfacing to the front.
- 1.2 The development seeks to increase the number of residential units on the site from 2 units to 26 units (see Appendix A for proposed layout).
- 1.3 The Flood and Water Management Act (FWMA) 2010 requires new developments and redevelopments in England and Wales to have drainage plans for surface water runoff approved by the SuDS Approval Body (SAB) where construction work would have drainage implications. In relation to this application, the SAB is deemed to be Havant Borough Council.
- 1.4 This document seeks to explain how the SuDS strategy for the application site has been developed and provide calculations to explain how it will meet the requirements of the FWMA. The “National Standards for Sustainable Drainage Systems” (NSSDS) published by DEFRA in draft for in December 2011 has been used as a basis for communicating the SuDS strategy for the site.
- 1.5 The area of the application site is 0.2 hectares and is located within Flood Zone 1 (i.e. at a low risk of flooding from fluvial sources – see Appendix G), therefore the Environment Agency will not be considered to be a statutory consultee as part of the planning process, and their standing advice to planning authorities is expected to be applied. The principles set out in the NSSDS are deemed to be complementary to the Environment Agency’s standing advice.

2.0 BASELINE INFORMATION

- 2.1 Two residential houses occupy the current site (see the Topographical plan in Appendix A). The buildings appear to have been constructed in the 1950s and have a single 100mm diameter foul water connection to the existing 225mm diameter public foul sewer located within London Road.
- 2.2 A buried services survey carried out on the application site identified that the existing rainwater pipes from the roof discharged rainfall run-off directly into the ground. No access to these pipes were apparent at ground level, so the method of disposal downstream of the downpipes could not be established. In some locations it is possible that it connects into the foul drain, however in other locations the rainwater pipes are at a distance from that drain.
- 2.3 Due to the age of the properties it is possible that rainwater discharges to the foul drain, however it is also possible that the rainwater pipes connect to buried soakaways in the front and rear gardens.
- 2.4 Borehole data close to the site taken from the British Geological survey website (see Appendix B) describes the underlying soils as “firm grey brown fissured silty CLAY” to 3.2m bgl (below ground level) and “Stiff grey fissured silty CLAY” to 7m bgl.
- 2.5 The local water authority responsible for sewers in the area is Southern Water. Their sewer asset records for the site are provided in Appendix C.

3.0 PROPOSED DRAINAGE STRATEGY

Development of the site's Drainage Strategy

- 3.1 The development of the site drainage strategy is explained below. The format has been based upon the NSSDS document.

Discharge into the ground

- 3.2 As stated in 2.4 above, local borehole data indicates that clay soils are pre-dominant. Therefore, surface water management at source using infiltration means is impractical since the infiltration rate into the soil will be less than the run-off rate from impermeable surfaces.
- 3.3 Therefore discharging surface water into the ground is not considered to be an acceptable method of surface water management.

Discharge to a surface water body

- 3.4 The nearest surface water body is located 400m away to the east of the site. Connection to this body of water is not practical.

Discharge to a surface water sewer

- 3.5 A public surface water sewer is located in Arnside Road located to the west of the application site (see Appendix C). Manhole 2550 is at the head of a 150mm diameter public surface water sewer; it has a cover level of 51.07m AOD and an invert level of 48.6m AOD. The ground levels on the application site are all above 54.0m AOD, a steep bank covered with trees separates the site from the Southern Water manhole.
- 3.6 Since the industrial estate is believed to have been constructed a number of years after the buildings located on the application site. It is believed that no connection to this surface water sewer currently exists (and no such drain was identified from the buried services survey).

Discharge to a combined sewer

- 3.7 No combined sewers owned and maintained by Southern Water exist on or near the site. As explained in 2.3 above the destination of rainwater run-off from the roofs has not been identified. It is possible that it discharges to the existing foul drain/sewer, however this cannot be proven.
- 3.8 Since the foul drain in London Road is designated as a foul sewer, it is unlikely that a surface water connection to that sewer would be an acceptable for of surface water management to the SAB or to Southern Water. Indeed current best practice discourages such a combined connection.

Proposed method of surface water disposal

- 3.9 Based upon the comments made above, the surface water drainage system serving the development is proposed to be discharged via a new connection to the public surface water manhole located on Arnside Close (to manhole 2550 – see Appendix D). This new piped connection will need to be laid through a well-vegetated embankment and is likely to require the removal of a number of young trees to create a suitable easement width for future maintenance. Replacement landscaping will be carried out elsewhere on the embankment to compensate for the loss of these young trees.
- 3.10 Prior to discharge into the new outfall pipe from the site, a manhole containing a flow restriction device (such as a hydrobrake or an orifice plate) will be located within the application site to control the run-off rate. Excess storm flows will be stored within below-ground attenuation devices to prevent surface flood events occurring on the site for a 1 in 30 year storm event. Flooding to buildings and to those off-site will be prevented during a 1 in 100 year storm event (plus a 30% allowance for climate change).
- 3.11 For the purposes of this outline assessment a long-term storage volume of 50m³ has been used within the hydraulic modelling. This value corresponds with the long-term storage volume calculated using HR Wallingford's UK Sustainable Drainage Greenfield Run-Off and Storage Estimation Tool.¹
- 3.12 It should be noted that the practical minimum restriction to flows from small sites of below 1 hectare is 5 litres/second². On a site such as this, the specification of 2 litres/second/hectare stated within the NSSDS becomes much less than the practical minimum (0.42 litres/second). A restriction of 5 litres/second will be proposed as part of the design solution, this approach is also in line with the guidance contained within sewers for Adoption 6th Edition.
- 3.13 The below ground attenuation devices are anticipated to be a combination of storage crates beneath the green spaces and/or storage within the sub-base layer beneath permeable paving. Below ground storage can be designed to allow the volume from the first 5mm of a rainfall event to infiltrate slowly to ground. Since the infiltration rate of the clay soils is unknown a conservative value may be applied to estimate what this volume may be.

¹ HR Wallingford, 2012. UK Sustainable Drainage [online], Available at <http://geoservergisweb2.hrwallingford.co.uk/uksd/tools.htm> [Accessed 20th June 2012]

² Kellagher, R., January 2012. Preliminary rainfall runoff management for developments R&D Technical Report W5-074/A/TR/1 Revision E [pdf] Joint Defra/EA Flood and Coastal Erosion Risk Management R&D Programme. Available at: < http://geoservergisweb2.hrwallingford.co.uk/uksd/information/SR744_Flood%20Risk%20User%20Guide.pdf > [Accessed 20th June 2012].

- 3.14 Water butts can also be installed to allow rainfall run-off from the roof to be used for watering of the green spaces around the development. The water butts will also be beneficial in preventing the first 5mm of any rainfall event from being discharged off the site.

Peak Flow Rates and Volumes

Existing Condition

3.15 Hydraulic modelling using the Microdrainage package has been used to estimate the existing and proposed run-off rates from the application site. The existing peak flow rates and volumes are presented below. Table 1 provides the input parameters used in calculating the flow rates and volumes. Table 2 presents the results. The calculations are presented within Appendix E.

Parameter	Value	Notes
Site area	2,100 sqm	Total area of the application site
Impermeable Area (Roof)	325 sqm	Total area of the existing roofs
Impermeable Area (Paving)	370 sqm	Total area of all hard-paved spaces
Total Impermeable Area	695 sqm	
Percentage Impermeable Area	33%	

Table 1: Input parameters to estimate existing flow rates and volumes

3.16 Using the parameters detailed in Table 1, an assessment of the surface water storage requirements for the site using the tools accessed via the UKSuDS website (www.uksuds.com) has been carried out (see Appendix F). This assessment confirms that the attenuation storage plus long-term storage of 50m³ on the site will be sufficient to store excess storm flows. It should be noted that due to the size of the site this tool defaults the Greenfield run-off rate to 5 litres/second as explained in section 3.12 above.

3.17 Since the Greenfield run-off rate has defaulted to 5 litres/second, no volumetric analysis of the existing run-off has been made since the post-development run-off rate will be expected to be 5 litres/second, thus replicating the existing (Greenfield) run-off condition as close as practically possible.

Proposed Condition

3.18 By applying the strategy explained in 3.9 to 3.14 above the proposed peak flow rates and volumes are presented below. Table 3 provides the input parameters used in calculating the flow rates and volumes. Table 2 presents the results. The calculations are presented within Appendix E.

Parameter	Value	Notes
Site area	2,100 sqm	Total area of the application site
Impermeable Area (Roof)	750 sqm	Total area of the existing roofs
Impermeable Area (Paving)	220 sqm	Total area of all hard-paved spaces
Total Impermeable Area	970 sqm	
Percentage Impermeable Area	46%	

Table 2: Input parameters to estimate existing flow rates and volumes

3.19 Based upon the parameters detailed in Table 2, the run-off rates for the proposed site have been calculated and are provided in Table 3 below.

Storm	Run-off rate	Maximum stored volume
1 in 1 year storm	2.7 l/s	5.6m ³
1 in 30 year storm	3.6 l/s	16.1m ³
1 in 100 year storm	3.6 l/s	23.1m ³
1 in 100 year + 30%	3.7 l/s	32.5m ³

Table 3: Proposed run-off rates

3.20 Based upon the parameters detailed in Table 2, the Greenfield run-off volumes for the existing site have been calculated and are provided in Table 4 below.

Storm	Run-off Volume (Winter)	Run-off Volume (Summer)
1 in 1 year storm	18.2m ³	16.3m ³
1 in 30 year storm	35.7m ³	40.0m ³
1 in 100 year storm	51.8m ³	46.3m ³
1 in 100 year storm + 30%	67.4m ³	60.1m ³

Table 4: Proposed run-off volumes

Comparison between Existing Condition and Proposed condition

Storm	Condition	Run-off Rate
1 in 1 year	Existing	2.0 l/s
1 in 1 year	Proposed	2.7 l/s
1 in 100 year	Existing	5.9 l/s
1 in 100 year	Proposed	3.6 l/s

Table 5: Comparison of run-off rates

- 3.21 The 1 in 1 year peak run-off rate under the proposed condition is slightly more than that calculated from the existing condition. Since the flow restriction applied is the practical minimum, this difference is deemed to be insignificant.
- 3.22 The 1 in 100 year peak run-off rate for the proposed development is 3.6 l/s which is less than the existing run-off rate of 5.9 l/s.

Selection of a design approach on previously developed land

- 3.23 As stated above, the design approaches detailed within the NSSDS cannot be achieved due to the size of the site. A restriction of less than 5 litres/second is not practically possible using conventional methods of flow control, therefore the strategy described within this assessment is deemed to be as close to Approach 1 as reasonably possible.

Water Quality

- 3.24 The site is located outside any Source Protection Zone or Secondary Aquifer (see Appendix G). It may be described as being "Unproductive Strata". In accordance with Table C2 of the NSSDS, Roof drainage requires one stage of treatment stage and all other areas require two treatment stages.
- 3.25 Although the majority of surface water run-off will be discharged to the surface water sewer network, it will be possible to allow the first 5mm of any rainfall event to discharge to ground. For the roof areas, the treatment stage will be achieved through clean stone material used to surround the below-ground attenuation tanks. For the remaining paved areas, the first treatment stage will be through the permeable blocks, with a second treatment stage as run-off passes through the stone sub-base material.
- 3.26 The requirements relating to Infiltration do not apply since the Groundwater is deemed to be classed as G5.
- 3.27 The surface water sewer, into which the site is proposed to discharge, is understood to convey run-off to the Potwell Trib waterbody. This is not considered to be a sensitive surface water body. Table

C3 requires two treatment stages for run-off from paved areas. These are described in paragraph 3.25 above.

- 3.28 The proposed drainage system has been designed to prevent flooding occurring to the 1 in 30 year rainfall event. Flooding to buildings and to those off-site will be prevented during the 1 in 100 year (plus 30% climate change) event.

Foul Water Connection

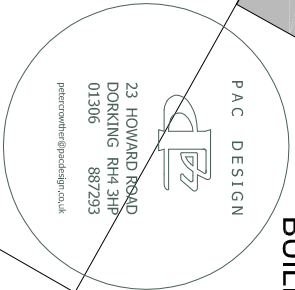
- 3.29 It is noted that the existing foul drain connection to London Road is likely to be used to drain the proposed development of foul water flows. This assessment excludes any analysis of that connection, which subject to ongoing liaison with Southern Water.

4.0 CONCLUSIONS AND RECOMMENDATIONS

- 4.1 This Drainage Assessment considers the drainage impact of the redevelopment of a site at 127A – 127B London Road, Waterloooville. The application site contains two residential dwellings; those will be demolished and developed it into 26 retirement flats.
- 4.2 A buried services survey carried out on the application site identified that the rainwater pipes from the roof discharged rainfall run-off into the ground and/or possibly directly to the existing foul drain.
- 4.3 Buildings Regulations prevents the use of the existing connection to the foul sewer for conveying surface water, so a new connection to the surface water sewer in Arnside Close is proposed.
- 4.4 The proposed drainage scheme will restrict surface water run-off from the site to 5 litres/second. Excess storm flows during extreme events will be stored within below-ground attenuation tanks and within the sub-base to permeable paving. The storage required has been calculated to be 50 cubic metres in volume.
- 4.5 Rainwater butts and will be used to store the first 5mm of all storm events. It is intended that the stored water will be kept for garden use. The attenuation tanks can also be designed to allow the first 5mm of run-off to infiltrate into the ground. However, since the sub-soil is Clay, it should be accepted that any infiltration will be at a very low rate.
- 4.6 The first 5mm of run-off from the paved areas, will also be able to infiltrate to ground through the base of the permeable pavement.

Appendix A – Topographical & Proposed Layout

INDUSTRIAL
BUILDINGS



Single
storey

FRESHFIELD
GARDENS

Tree root protection zone
shown in dotted red line

Trees to be removed
shown dashed

2m High Laurel
hedging

Shared
Amenity

Store for 6 No. mobility
scooters

Covered area for 12 No.
cycles

Single
storey

OFF SITE EXISTING
TREE CLUSTER

footprint of refused scheme
shown dotted in black dashed line

9m High Cherry Laurel
shrubs

Line of footprint of existing
buildings to be demolished
shown in blue dashed line

Pedestrian
subway

Dwarf wall with railings to 1.5m

New tree
planting

LONDON ROAD

127A AND 127B, LONDON ROAD,
WATERLOOVILLE PO8 7SH

SITE LAYOUT

Scale 1:200 at A3

Drawing No. LRW / P12 / 03

Appendix B – Borehole Data

RECORD OF BOREHOLE No: 1									
Location : MULBERT ROAD, HAVANT					SHEET ...1... OF ...1....				
Contract No. : CF 669/1415					Borehole Dia : 0.20m				
Type of Boring : Shell and Auger					Casing : 0.20m				
Date (started) : 31st July 1975					Ground Level : 51.96m m AOD				
Date & Time	Depth of Casing	Water Level	SAMPLES			STRATA		DESCRIPTION OF STRATA	
			Depth	Type	No.	Legend	Depth	Thickness	
0.20							G.L.		MADE GROUND (Firm brown mottled orange silty clay with small pebbles)
0.40			0.75m (N=9)	D	1		1.00m		
0.60			1.00 - 1.45m	U	2		1.00m		
0.80									
1.00									
1.20									
1.40									
1.60			1.75m	D	3		2.25m		Firm grey brown fissured silty CLAY
1.80									
2.00									
2.20			2.50 - 2.95m	U	4	3.25m			
2.40									
2.60									
2.80			3.25m	D	5	3.75m		Stiff grey fissured silty CLAY	
3.00									
3.20									
3.40			4.00 - 4.45m	U	6	7.00m			
3.60									
3.80			4.75m	D	7	Borehole Terminated			
4.00									
4.20									
4.40			5.50 - 5.95m	U	8				
4.60									
4.80									
5.00			6.25m	D	9				
5.20									
5.40									
5.60			7.00m	D	10				
5.80									
6.00									
6.20									
6.40									
6.60									
6.80									
7.00									
7.20									
7.40									
7.60									
7.80									
8.00									
8.20									
8.40									
8.60									
8.80									
9.00									
9.20									
9.40									
9.60									
9.80									
10.00									

REMARKS: Piezometer installed at 6.70m below ground level in one meter sand chamber plugged with bentonite.

SCALE. 1 : 50

Foundation Engineering Ltd.

Appendix C – SW Asset Data

Appendix D – Proposed Drainage Connection

Appendix E- Microdrainage Modelling Data

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4-6 The Moors Worcester WR1 3EG		
Date 21 June 2012 11:23 File	Designed By petercampbell Checked By	
Micro Drainage	Source Control W.10.4	

IH 124 Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	750.000	Urban	0.330
Area (Ha)	0.210	Soil	0.400	Region Number	7

Results l/s

QBAR Rural	1.4
QBAR Urban	2.3
Q 100 years	5.9
Q 1 year	2.0
Q 2 years	2.2
Q 5 years	3.1
Q 10 years	3.7
Q 20 years	4.3
Q 25 years	4.5
Q 30 years	4.7
Q 50 years	5.1
Q 100 years	5.9
Q 200 years	6.7
Q 250 years	6.9
Q 1000 years	8.5

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 1RP HB	
Date 21-06-12 File Tank 1 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	2.1	0.0	2.1	53.0823	0.0823	0.0	4.1	0 K
30 Summer	2.5	0.0	2.5	53.0953	0.0953	0.0	4.8	0 K
60 Summer	2.6	0.0	2.6	53.1033	0.1033	0.0	5.2	0 K
120 Summer	2.6	0.0	2.6	53.1008	0.1008	0.0	5.0	0 K
180 Summer	2.4	0.0	2.4	53.0948	0.0948	0.0	4.7	0 K
240 Summer	2.3	0.0	2.3	53.0888	0.0888	0.0	4.4	0 K
360 Summer	2.0	0.0	2.0	53.0778	0.0778	0.0	3.9	0 K
480 Summer	1.8	0.0	1.8	53.0698	0.0698	0.0	3.5	0 K
600 Summer	1.6	0.0	1.6	53.0633	0.0633	0.0	3.2	0 K
720 Summer	1.5	0.0	1.5	53.0583	0.0583	0.0	2.9	0 K
960 Summer	1.3	0.0	1.3	53.0503	0.0503	0.0	2.5	0 K
1440 Summer	1.0	0.0	1.0	53.0403	0.0402	0.0	2.0	0 K
2160 Summer	0.8	0.0	0.8	53.0318	0.0317	0.0	1.6	0 K
2880 Summer	0.7	0.0	0.7	53.0268	0.0267	0.0	1.3	0 K
4320 Summer	0.5	0.0	0.5	53.0203	0.0203	0.0	1.0	0 K
5760 Summer	0.4	0.0	0.4	53.0168	0.0168	0.0	0.8	0 K
7200 Summer	0.4	0.0	0.4	53.0148	0.0148	0.0	0.7	0 K
8640 Summer	0.3	0.0	0.3	53.0128	0.0128	0.0	0.6	0 K
10080 Summer	0.3	0.0	0.3	53.0118	0.0118	0.0	0.6	0 K
15 Winter	2.4	0.0	2.4	53.0923	0.0923	0.0	4.6	0 K
30 Winter	2.6	0.0	2.6	53.1063	0.1063	0.0	5.3	0 K
60 Winter	2.7	0.0	2.7	53.1123	0.1123	0.0	5.6	0 K
120 Winter	2.6	0.0	2.6	53.1033	0.1033	0.0	5.2	0 K
180 Winter	2.4	0.0	2.4	53.0928	0.0928	0.0	4.6	0 K
240 Winter	2.2	0.0	2.2	53.0843	0.0843	0.0	4.2	0 K
360 Winter	1.8	0.0	1.8	53.0703	0.0703	0.0	3.5	0 K
480 Winter	1.6	0.0	1.6	53.0608	0.0608	0.0	3.0	0 K
600 Winter	1.4	0.0	1.4	53.0538	0.0538	0.0	2.7	0 K
720 Winter	1.2	0.0	1.2	53.0483	0.0483	0.0	2.4	0 K
960 Winter	1.0	0.0	1.0	53.0403	0.0402	0.0	2.0	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	28.42	15
30 Summer	18.86	24
60 Summer	12.23	40
120 Summer	7.78	74
180 Summer	5.95	106
240 Summer	4.92	138
360 Summer	3.73	200
480 Summer	3.06	260
600 Summer	2.62	320
720 Summer	2.31	382
960 Summer	1.89	502
1440 Summer	1.43	740
2160 Summer	1.08	1104
2880 Summer	0.89	1468
4320 Summer	0.67	2204
5760 Summer	0.55	2936
7200 Summer	0.47	3672
8640 Summer	0.42	4400
10080 Summer	0.37	5104
15 Winter	28.42	15
30 Winter	18.86	25
60 Winter	12.23	44
120 Winter	7.78	78
180 Winter	5.95	110
240 Winter	4.92	142
360 Winter	3.73	206
480 Winter	3.06	266
600 Winter	2.62	328
720 Winter	2.31	388
960 Winter	1.89	510

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Date 21-06-12 File Tank 1 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
1440 Winter	0.8	0.0	0.8	53.0313	0.0312	0.0	1.6	0 K
2160 Winter	0.6	0.0	0.6	53.0238	0.0237	0.0	1.2	0 K
2880 Winter	0.5	0.0	0.5	53.0198	0.0197	0.0	1.0	0 K
4320 Winter	0.4	0.0	0.4	53.0148	0.0148	0.0	0.7	0 K
5760 Winter	0.3	0.0	0.3	53.0123	0.0123	0.0	0.6	0 K
7200 Winter	0.3	0.0	0.3	53.0108	0.0108	0.0	0.5	0 K
8640 Winter	0.2	0.0	0.2	53.0093	0.0093	0.0	0.5	0 K
10080 Winter	0.2	0.0	0.2	53.0083	0.0083	0.0	0.4	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	1.43	748
2160 Winter	1.08	1104
2880 Winter	0.89	1456
4320 Winter	0.67	2208
5760 Winter	0.55	2928
7200 Winter	0.47	3576
8640 Winter	0.42	4368
10080 Winter	0.37	5144

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 30RP HB	
Date 21-06-12 File Tank 30 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 30 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	3.6	0.0	3.6	53.2113	0.2112	0.0	10.6	0 K
30 Summer	3.6	0.0	3.6	53.2563	0.2562	0.0	12.8	0 K
60 Summer	3.6	0.0	3.6	53.2828	0.2827	0.0	14.1	0 K
120 Summer	3.6	0.0	3.6	53.2823	0.2822	0.0	14.1	0 K
180 Summer	3.6	0.0	3.6	53.2633	0.2632	0.0	13.2	0 K
240 Summer	3.6	0.0	3.6	53.2398	0.2397	0.0	12.0	0 K
360 Summer	3.6	0.0	3.6	53.1993	0.1992	0.0	10.0	0 K
480 Summer	3.3	0.0	3.3	53.1713	0.1712	0.0	8.6	0 K
600 Summer	3.1	0.0	3.1	53.1493	0.1492	0.0	7.5	0 K
720 Summer	2.9	0.0	2.9	53.1313	0.1313	0.0	6.6	0 K
960 Summer	2.6	0.0	2.6	53.1053	0.1053	0.0	5.3	0 K
1440 Summer	2.1	0.0	2.1	53.0813	0.0813	0.0	4.1	0 K
2160 Summer	1.6	0.0	1.6	53.0623	0.0623	0.0	3.1	0 K
2880 Summer	1.3	0.0	1.3	53.0513	0.0512	0.0	2.6	0 K
4320 Summer	1.0	0.0	1.0	53.0383	0.0382	0.0	1.9	0 K
5760 Summer	0.8	0.0	0.8	53.0308	0.0307	0.0	1.5	0 K
7200 Summer	0.7	0.0	0.7	53.0263	0.0262	0.0	1.3	0 K
8640 Summer	0.6	0.0	0.6	53.0228	0.0227	0.0	1.1	0 K
10080 Summer	0.5	0.0	0.5	53.0203	0.0202	0.0	1.0	0 K
15 Winter	3.6	0.0	3.6	53.2398	0.2397	0.0	12.0	0 K
30 Winter	3.6	0.0	3.6	53.2948	0.2947	0.0	14.7	0 K
60 Winter	3.6	0.0	3.6	53.3223	0.3222	0.0	16.1	0 K
120 Winter	3.6	0.0	3.6	53.3133	0.3132	0.0	15.7	0 K
180 Winter	3.6	0.0	3.6	53.2793	0.2792	0.0	14.0	0 K
240 Winter	3.6	0.0	3.6	53.2413	0.2412	0.0	12.1	0 K
360 Winter	3.4	0.0	3.4	53.1848	0.1847	0.0	9.2	0 K
480 Winter	3.1	0.0	3.1	53.1483	0.1483	0.0	7.4	0 K
600 Winter	2.8	0.0	2.8	53.1213	0.1213	0.0	6.1	0 K
720 Winter	2.6	0.0	2.6	53.1018	0.1018	0.0	5.1	0 K
960 Winter	2.2	0.0	2.2	53.0838	0.0838	0.0	4.2	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	69.60	16
30 Summer	46.34	29
60 Summer	29.55	46
120 Summer	18.30	80
180 Summer	13.67	114
240 Summer	11.05	146
360 Summer	8.18	208
480 Summer	6.61	270
600 Summer	5.59	330
720 Summer	4.88	390
960 Summer	3.93	504
1440 Summer	2.89	740
2160 Summer	2.13	1104
2880 Summer	1.71	1468
4320 Summer	1.25	2200
5760 Summer	1.00	2936
7200 Summer	0.85	3656
8640 Summer	0.74	4368
10080 Summer	0.65	5048
15 Winter	69.60	17
30 Winter	46.34	30
60 Winter	29.55	50
120 Winter	18.30	88
180 Winter	13.67	124
240 Winter	11.05	156
360 Winter	8.18	218
480 Winter	6.61	280
600 Winter	5.59	338
720 Winter	4.88	390
960 Winter	3.93	510

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 30RP HB	
Date 21-06-12 File Tank 30 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 30 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
1440 Winter	1.6	0.0	1.6	53.0628	0.0628	0.0	3.1	0 K
2160 Winter	1.2	0.0	1.2	53.0468	0.0468	0.0	2.3	0 K
2880 Winter	1.0	0.0	1.0	53.0378	0.0377	0.0	1.9	0 K
4320 Winter	0.7	0.0	0.7	53.0278	0.0277	0.0	1.4	0 K
5760 Winter	0.6	0.0	0.6	53.0223	0.0222	0.0	1.1	0 K
7200 Winter	0.5	0.0	0.5	53.0188	0.0188	0.0	0.9	0 K
8640 Winter	0.4	0.0	0.4	53.0163	0.0163	0.0	0.8	0 K
10080 Winter	0.4	0.0	0.4	53.0148	0.0148	0.0	0.7	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	2.89	750
2160 Winter	2.13	1104
2880 Winter	1.71	1468
4320 Winter	1.25	2200
5760 Winter	1.00	2936
7200 Winter	0.85	3680
8640 Winter	0.74	4408
10080 Winter	0.65	5176

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 30RP HB	
Date 21-06-12 File Tank 30 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	30	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	19.200	Shortest Storm (mins)	15	Climate Change %	+0
Ratio-R	0.350	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.097

Time	(mins)	Area
from:	to:	(ha)
0	4	0.097

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 30RP HB	
Date 21-06-12 File Tank 30 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Tank/Pond Details

Invert Level (m) 53.000 Ground Level (m) 54.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	50.0	0.40	50.0	0.80	50.0	1.20	50.0	1.60	50.0	2.00	50.0	2.40	50.0
0.10	50.0	0.50	50.0	0.90	50.0	1.30	50.0	1.70	50.0	2.10	50.0	2.50	50.0
0.20	50.0	0.60	50.0	1.00	50.0	1.40	50.0	1.80	50.0	2.20	50.0		
0.30	50.0	0.70	50.0	1.10	50.0	1.50	50.0	1.90	50.0	2.30	50.0		

Hydro-Brake Outflow Control

Design Head (m) 1.250 Hydro-Brake Type MD6 Invert Level (m) 53.000
Design Flow (l/s) 5.0 Diameter (mm) 89

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	2.6	0.60	3.6	1.60	5.7	2.60	7.3	5.00	10.1	7.50	12.4
0.20	3.6	0.80	4.1	1.80	6.1	3.00	7.8	5.50	10.6	8.00	12.8
0.30	3.4	1.00	4.5	2.00	6.4	3.50	8.5	6.00	11.1	8.50	13.2
0.40	3.3	1.20	5.0	2.20	6.7	4.00	9.0	6.50	11.5	9.00	13.6
0.50	3.4	1.40	5.4	2.40	7.0	4.50	9.6	7.00	12.0	9.50	13.9

Weir / Flume Overflow Control

Discharge Coef 0.544 Width (m) 5.000 Crest Level (m) 54.250

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100RP HB	
Date 21-06-12 File Tank 100 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	3.6	0.0	3.6	53.2823	0.2822	0.0	14.1	0 K
30 Summer	3.6	0.0	3.6	53.3543	0.3542	0.0	17.7	0 K
60 Summer	3.6	0.0	3.6	53.3988	0.3987	0.0	19.9	0 K
120 Summer	3.6	0.0	3.6	53.4083	0.4082	0.0	20.4	0 K
180 Summer	3.6	0.0	3.6	53.3893	0.3892	0.0	19.5	0 K
240 Summer	3.6	0.0	3.6	53.3613	0.3612	0.0	18.1	0 K
360 Summer	3.6	0.0	3.6	53.3053	0.3052	0.0	15.3	0 K
480 Summer	3.6	0.0	3.6	53.2548	0.2547	0.0	12.7	0 K
600 Summer	3.6	0.0	3.6	53.2143	0.2142	0.0	10.7	0 K
720 Summer	3.4	0.0	3.4	53.1873	0.1872	0.0	9.4	0 K
960 Summer	3.1	0.0	3.1	53.1493	0.1493	0.0	7.5	0 K
1440 Summer	2.6	0.0	2.6	53.1033	0.1033	0.0	5.2	0 K
2160 Summer	2.0	0.0	2.0	53.0778	0.0778	0.0	3.9	0 K
2880 Summer	1.6	0.0	1.6	53.0633	0.0633	0.0	3.2	0 K
4320 Summer	1.2	0.0	1.2	53.0468	0.0467	0.0	2.3	0 K
5760 Summer	1.0	0.0	1.0	53.0378	0.0377	0.0	1.9	0 K
7200 Summer	0.8	0.0	0.8	53.0318	0.0317	0.0	1.6	0 K
8640 Summer	0.7	0.0	0.7	53.0273	0.0272	0.0	1.4	0 K
10080 Summer	0.6	0.0	0.6	53.0243	0.0242	0.0	1.2	0 K
15 Winter	3.6	0.0	3.6	53.3203	0.3202	0.0	16.0	0 K
30 Winter	3.6	0.0	3.6	53.4058	0.4057	0.0	20.3	0 K
60 Winter	3.6	0.0	3.6	53.4592	0.4592	0.0	23.0	0 K
120 Winter	3.6	0.0	3.6	53.4623	0.4622	0.0	23.1	0 K
180 Winter	3.6	0.0	3.6	53.4312	0.4312	0.0	21.6	0 K
240 Winter	3.6	0.0	3.6	53.3877	0.3877	0.0	19.4	0 K
360 Winter	3.6	0.0	3.6	53.2988	0.2987	0.0	14.9	0 K
480 Winter	3.6	0.0	3.6	53.2248	0.2247	0.0	11.2	0 K
600 Winter	3.4	0.0	3.4	53.1813	0.1812	0.0	9.1	0 K
720 Winter	3.1	0.0	3.1	53.1518	0.1518	0.0	7.6	0 K
960 Winter	2.7	0.0	2.7	53.1098	0.1098	0.0	5.5	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	90.05	17
30 Summer	60.53	31
60 Summer	38.83	52
120 Summer	24.05	86
180 Summer	17.90	120
240 Summer	14.41	154
360 Summer	10.60	218
480 Summer	8.52	280
600 Summer	7.18	338
720 Summer	6.24	396
960 Summer	5.00	512
1440 Summer	3.65	748
2160 Summer	2.66	1104
2880 Summer	2.12	1468
4320 Summer	1.54	2204
5760 Summer	1.23	2936
7200 Summer	1.03	3656
8640 Summer	0.89	4408
10080 Summer	0.79	5112
15 Winter	90.05	17
30 Winter	60.53	31
60 Winter	38.83	58
120 Winter	24.05	92
180 Winter	17.90	130
240 Winter	14.41	168
360 Winter	10.60	234
480 Winter	8.52	290
600 Winter	7.18	346
720 Winter	6.24	406
960 Winter	5.00	520

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100RP HB	
Date 21-06-12 File Tank 100 HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
1440 Winter	2.0	0.0	2.0	53.0793	0.0793	0.0	4.0	0 K
2160 Winter	1.5	0.0	1.5	53.0583	0.0583	0.0	2.9	0 K
2880 Winter	1.2	0.0	1.2	53.0468	0.0468	0.0	2.3	0 K
4320 Winter	0.9	0.0	0.9	53.0343	0.0342	0.0	1.7	0 K
5760 Winter	0.7	0.0	0.7	53.0273	0.0272	0.0	1.4	0 K
7200 Winter	0.6	0.0	0.6	53.0228	0.0227	0.0	1.1	0 K
8640 Winter	0.5	0.0	0.5	53.0198	0.0198	0.0	1.0	0 K
10080 Winter	0.5	0.0	0.5	53.0178	0.0178	0.0	0.9	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	3.65	750
2160 Winter	2.66	1108
2880 Winter	2.12	1472
4320 Winter	1.54	2192
5760 Winter	1.23	2880
7200 Winter	1.03	3704
8640 Winter	0.89	4392
10080 Winter	0.79	5024

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100+CC HB	
Date 21-06-12 File Tank 100+30% HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period (+30%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	3.6	0.0	3.6	53.3778	0.3777	0.0	18.9	0 K
30 Summer	3.6	0.0	3.6	53.4802	0.4802	0.0	24.0	0 K
60 Summer	3.6	0.0	3.6	53.5498	0.5497	0.0	27.5	0 K
120 Summer	3.6	0.0	3.6	53.5698	0.5697	0.0	28.5	0 K
180 Summer	3.6	0.0	3.6	53.5558	0.5557	0.0	27.8	0 K
240 Summer	3.6	0.0	3.6	53.5293	0.5292	0.0	26.5	0 K
360 Summer	3.6	0.0	3.6	53.4722	0.4722	0.0	23.6	0 K
480 Summer	3.6	0.0	3.6	53.4157	0.4157	0.0	20.8	0 K
600 Summer	3.6	0.0	3.6	53.3602	0.3602	0.0	18.0	0 K
720 Summer	3.6	0.0	3.6	53.3098	0.3097	0.0	15.5	0 K
960 Summer	3.6	0.0	3.6	53.2288	0.2287	0.0	11.4	0 K
1440 Summer	3.1	0.0	3.1	53.1543	0.1543	0.0	7.7	0 K
2160 Summer	2.6	0.0	2.6	53.1013	0.1013	0.0	5.1	0 K
2880 Summer	2.1	0.0	2.1	53.0828	0.0828	0.0	4.1	0 K
4320 Summer	1.6	0.0	1.6	53.0608	0.0608	0.0	3.0	0 K
5760 Summer	1.3	0.0	1.3	53.0488	0.0487	0.0	2.4	0 K
7200 Summer	1.1	0.0	1.1	53.0408	0.0407	0.0	2.0	0 K
8640 Summer	0.9	0.0	0.9	53.0358	0.0357	0.0	1.8	0 K
10080 Summer	0.8	0.0	0.8	53.0313	0.0312	0.0	1.6	0 K
15 Winter	3.6	0.0	3.6	53.4278	0.4277	0.0	21.4	0 K
30 Winter	3.6	0.0	3.6	53.5468	0.5467	0.0	27.3	0 K
60 Winter	3.7	0.0	3.7	53.6313	0.6313	0.0	31.6	0 K
120 Winter	3.7	0.0	3.7	53.6508	0.6508	0.0	32.5	0 K
180 Winter	3.6	0.0	3.6	53.6278	0.6278	0.0	31.4	0 K
240 Winter	3.6	0.0	3.6	53.5878	0.5878	0.0	29.4	0 K
360 Winter	3.6	0.0	3.6	53.5002	0.5002	0.0	25.0	0 K
480 Winter	3.6	0.0	3.6	53.4118	0.4117	0.0	20.6	0 K
600 Winter	3.6	0.0	3.6	53.3248	0.3247	0.0	16.2	0 K
720 Winter	3.6	0.0	3.6	53.2503	0.2502	0.0	12.5	0 K
960 Winter	3.3	0.0	3.3	53.1738	0.1737	0.0	8.7	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	90.05	17
30 Summer	60.53	32
60 Summer	38.83	60
120 Summer	24.05	90
180 Summer	17.90	124
240 Summer	14.41	160
360 Summer	10.60	228
480 Summer	8.52	294
600 Summer	7.18	356
720 Summer	6.24	418
960 Summer	5.00	530
1440 Summer	3.65	764
2160 Summer	2.66	1104
2880 Summer	2.12	1468
4320 Summer	1.54	2204
5760 Summer	1.23	2936
7200 Summer	1.03	3672
8640 Summer	0.89	4384
10080 Summer	0.79	5136
15 Winter	90.05	17
30 Winter	60.53	31
60 Winter	38.83	58
120 Winter	24.05	96
180 Winter	17.90	134
240 Winter	14.41	172
360 Winter	10.60	246
480 Winter	8.52	316
600 Winter	7.18	376
720 Winter	6.24	428
960 Winter	5.00	532

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100+CC HB	
Date 21-06-12 File Tank 100+30% HB.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period (+30%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
1440 Winter	2.6	0.0	2.6	53.1043	0.1043	0.0	5.2	0 K
2160 Winter	2.0	0.0	2.0	53.0758	0.0758	0.0	3.8	0 K
2880 Winter	1.6	0.0	1.6	53.0608	0.0608	0.0	3.0	0 K
4320 Winter	1.1	0.0	1.1	53.0443	0.0442	0.0	2.2	0 K
5760 Winter	0.9	0.0	0.9	53.0353	0.0352	0.0	1.8	0 K
7200 Winter	0.8	0.0	0.8	53.0298	0.0297	0.0	1.5	0 K
8640 Winter	0.7	0.0	0.7	53.0258	0.0257	0.0	1.3	0 K
10080 Winter	0.6	0.0	0.6	53.0228	0.0227	0.0	1.1	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
1440 Winter	3.65	762
2160 Winter	2.66	1108
2880 Winter	2.12	1472
4320 Winter	1.54	2204
5760 Winter	1.23	2936
7200 Winter	1.03	3600
8640 Winter	0.89	4296
10080 Winter	0.79	5128

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 1RP 6hr Vol	
Date 21-06-12 File Tank 1 HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 1 year Return Period

Critical storm not identified, please run longer storm durations.

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
360 Summer	0.0	0.0	0.0	53.3252	0.3252	0.0	16.3	0 K
360 Winter	0.0	0.0	0.0	53.3643	0.3642	0.0	18.2	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Summer	3.73	364
360 Winter	3.73	364

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 1RP 6hr Vol	
Date 21-06-12 File Tank 1 HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	1	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	19.200	Shortest Storm (mins)	360	Climate Change %	+0
Ratio-R	0.350	Longest Storm (mins)	360		

Time / Area Diagram

Total Area (ha) = 0.097

Time	(mins)	Area
from:	to:	(ha)
	0	4
		0.097

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 1RP 6hr Vol	
Date 21-06-12 File Tank 1 HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Tank/Pond Details

Invert Level (m) 53.000 Ground Level (m) 54.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	50.0	0.40	50.0	0.80	50.0	1.20	50.0	1.60	50.0	2.00	50.0	2.40	50.0
0.10	50.0	0.50	50.0	0.90	50.0	1.30	50.0	1.70	50.0	2.10	50.0	2.50	50.0
0.20	50.0	0.60	50.0	1.00	50.0	1.40	50.0	1.80	50.0	2.20	50.0		
0.30	50.0	0.70	50.0	1.10	50.0	1.50	50.0	1.90	50.0	2.30	50.0		

Depth / Flow Outflow Control

Invert Level of Control 53.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	0.0	0.60	0.0	1.60	0.1	2.60	0.1	5.00	0.1	7.50	0.1
0.20	0.0	0.80	0.0	1.80	0.1	3.00	0.1	5.50	0.1	8.00	0.1
0.30	0.0	1.00	0.0	2.00	0.1	3.50	0.1	6.00	0.1	8.50	0.1
0.40	0.0	1.20	0.0	2.20	0.1	4.00	0.1	6.50	0.1	9.00	0.1
0.50	0.0	1.40	0.0	2.40	0.1	4.50	0.1	7.00	0.1	9.50	0.1

Weir / Flume Overflow Control

Discharge Coef 0.544 Width (m) 5.000 Crest Level (m) 54.250

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 30RP HB	
Date 21-06-12 File Tank 30 HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 30 year Return Period

Critical storm not identified, please run longer storm durations.

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
360 Summer	0.0	0.0	0.0	53.7143	0.7143	0.0	35.7	0 K
360 Winter	0.0	0.0	0.0	53.8003	0.8003	0.0	40.0	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Summer	8.18	364
360 Winter	8.18	364

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100RP HB	
Date 21-06-12 File Tank 100 HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period

Critical storm not identified, please run longer storm durations.

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
360 Summer	0.0	0.0	0.0	53.9254	0.9253	0.0	46.3	0 K
360 Winter	0.0	0.0	0.0	54.0363	1.0363	0.0	51.8	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Summer	10.60	364
360 Winter	10.60	364

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100+CC RP	
Date 21-06-12 File Tank 100+30% HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Summary of Results for 100 year Return Period (+30%)

Critical storm not identified, please run longer storm durations.

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
360 Summer	0.0	0.0	0.0	53.8018	0.8018	0.0	60.1	0 K
360 Winter	0.0	0.0	0.0	53.8983	0.8983	0.0	67.4	0 K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Summer	10.60	364
360 Winter	10.60	364

Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	100	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	19.200	Shortest Storm (mins)	360	Climate Change %	+30
Ratio-R	0.350	Longest Storm (mins)	360		

Time / Area Diagram

Total Area (ha) = 0.097

Time	(mins)	Area
from:	to:	(ha)
	0	4
		0.097

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4-6 The Moors Worcester WR1 3EG	3066/006 Waterlooville Tank 100+CC RP	
Date 21-06-12 File Tank 100+30% HB 6hr.SRC	Designed By PCC Checked By	
Micro Drainage	Source Control W.10.4	

Tank/Pond Details

Invert Level (m) 53.000 Ground Level (m) 54.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	75.0	0.40	75.0	0.80	75.0	1.20	75.0	1.60	75.0	2.00	75.0	2.40	75.0
0.10	75.0	0.50	75.0	0.90	75.0	1.30	75.0	1.70	75.0	2.10	75.0	2.50	75.0
0.20	75.0	0.60	75.0	1.00	75.0	1.40	75.0	1.80	75.0	2.20	75.0		
0.30	75.0	0.70	75.0	1.10	75.0	1.50	75.0	1.90	75.0	2.30	75.0		

Depth / Flow Outflow Control

Invert Level of Control 53.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	0.0	0.60	0.0	1.60	0.1	2.60	0.1	5.00	0.1	7.50	0.1
0.20	0.0	0.80	0.0	1.80	0.1	3.00	0.1	5.50	0.1	8.00	0.1
0.30	0.0	1.00	0.0	2.00	0.1	3.50	0.1	6.00	0.1	8.50	0.1
0.40	0.0	1.20	0.0	2.20	0.1	4.00	0.1	6.50	0.1	9.00	0.1
0.50	0.0	1.40	0.0	2.40	0.1	4.50	0.1	7.00	0.1	9.50	0.1

Weir / Flume Overflow Control

Discharge Coef 0.544 Width (m) 5.000 Crest Level (m) 54.250

Appendix F – Storage Requirements Calculations

Surface Water Storage Requirements for Sites

Site name: Waterloooville
Site location:
Site coordinates
Latitude: 50.94667 deg N
Longitude: 1.13535 deg W

Reference: 1340285591315

Date: 21/6/2012

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments" (2005), W5-074/A/TR1/1 rev. D and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that detailed design of any drainage scheme uses hydraulic modelling software to finalise storage requirements before construction takes place.

• Site Characteristics:

Total site area	0.21	ha
Significant public open space		ha
Area positively drained	0.21	ha
Impermeable area	0.0695	ha
Percentage of drained area that is impermeable	< 50%	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	70	%
Net site area for storage volume design	0.21	ha

• Methodology:

Greenfield runoff method	IH 124
Volume control approach	Long Term Storage

Hydrological Characteristics:	Automatic values	Editable values	
HOST	1	3	
SPRHOST	0.02	0.145	%
SAAR	864	750	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.4	
FEH/FSR conversion factor	0.83	0.83	
Hydrological region	7	7	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

• Design Criteria:

Climate change allowance factor	1.3	1.3	
Urban creep allowance factor	1.1	1.1	
Interception rainfall depth	5	5	mm

• Greenfield Runoff Rates:

Qbar	0	0.09	l/s
1 in 1 year	5	5	l/s
1 in 30 years	5	5	l/s
1 in 100 years	5	5	l/s

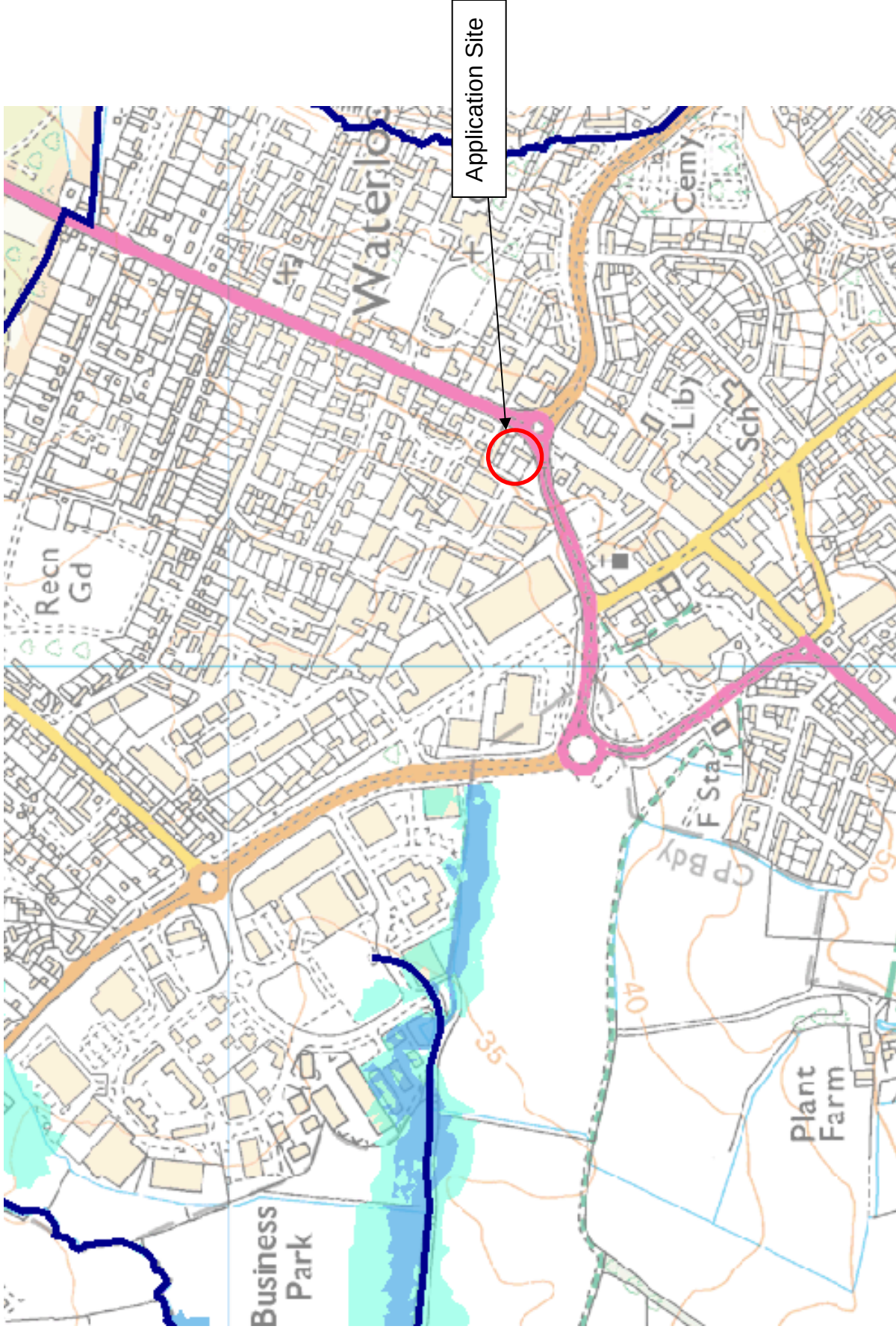
• **Estimated Storage Volumes:**

Interception storage	2.78	2.78	m ³
Attenuation storage	40.7	35.53	m ³
Long term storage	35.98	15.84	m ³
Treatment storage	8.34	8.34	m ³
Total storage	74.29	59.32	m ³

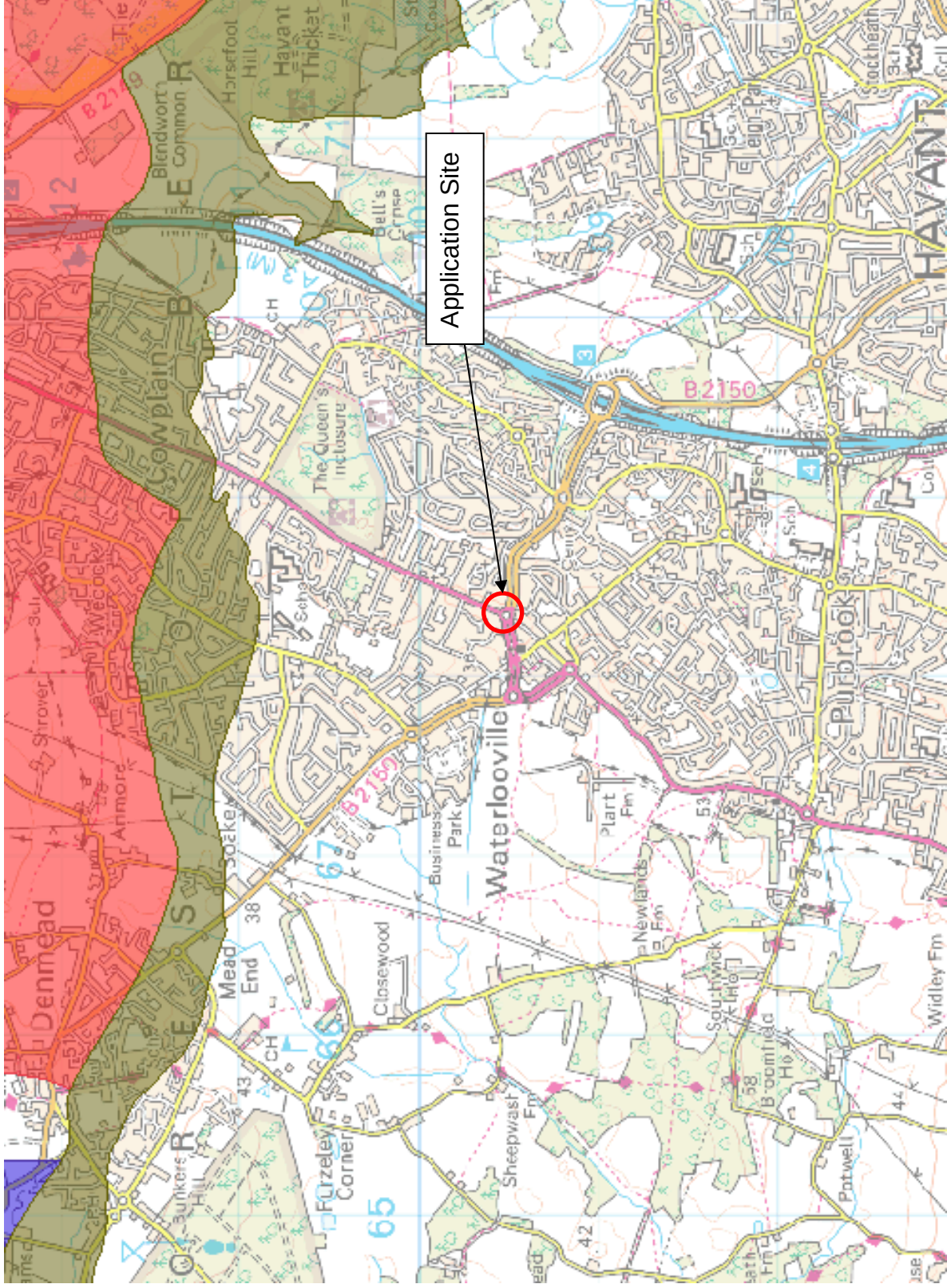
Please note that a minimum flow of 5 l/s applies to any site

[HR Wallingford Ltd](#), the Environment Agency and any local authority are not liable for the performance of a drainage scheme which is based upon the output of this report.

Appendix G – EA Maps



Risk of Flooding from Rivers and Sea (1:10,000)



Groundwater (1:40,000)