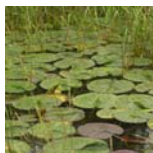


**COLDHARBOUR FARM DEVELOPMENT
53 RESIDENTIAL DWELLINGS
EMSWORTH
HAMPSHIRE**

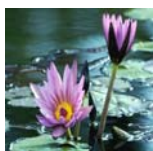
SITE REFERENCE: UE37

**SITE SPECIFIC FLOOD RISK ASSESSMENT
LEVEL 2**

REVISION 1

**CONTENTS**

- 1.0 Executive Summary
- 2.0 Introduction
- 3.0 Sources of Information
- 4.0 Site Details
- 5.0 Proposed Development with Supporting Drainage Design in Outline
- 6.0 Potential Flood Hazards
- 7.0 Discussions and Conclusions

**APPENDICES**

- A. Surface Water Drainage Design in Outline
- B. Environment Agency Flood Mapping
- C. Summary Analysis

REFERENCES

- 1. The role in urban surfaces (permeable pavements) in regulating drainage and evaporation. C Anderson, D Foster & C Pratt. Coventry University

Issue	Copies	Distribution	Format	Date	Status
1	1	Paul White – Genesis Town Planning	By email	17 February 2014	Draft
Rev 1	1	Paul White – Genesis Town Planning	By email	4 March 2014	Rev 1

1.0 EXECUTIVE SUMMARY

- 1.1 This document reports upon an outline surface water drainage design which supports the development proposals for 53 residential dwellings by reducing peak off-site surface water flows below existing greenfield rates. Additionally, the design will manage local out of bank flows from West Brook in order to reduce flood risk locally and downstream.

2.0 INTRODUCTION

2.1 Archibald Shaw were commissioned by Telstar Limited to undertake a Level 2 Flood Risk Assessment [FRA] in accordance with the National Planning Policy Framework on the parcel of land shown overleaf – herein known as ‘the site’.

2.1.2 The site area totals some 1.89ha approximately of which 0.24 ha is being set aside to manage off site flood waters from West Brook. The site lies contiguous and north of the A27, and to the western end of Coldharbour Farm Road, Emsworth. The local postcode is PO10 7XA.

2.1.3 This report has been written in support of a planning application for a residential development of 53 dwellings.

2.1.4 Nothing in this report confers or purports to confer on any third party, any benefit or any right to enforce any term of this report pursuant to the Contract [Rights of Third Parties] Act 1999.

2.2 Terms of Reference

2.2.1 This report comprises a Level 2 Flood Risk Assessment in accordance with the requirements and guidance of:

- The National Planning Policy Framework
- Technical Guidance to the National Planning Policy Framework
- Flooding – Engineering Resilience, ICE:
- Flood Risks to People – FD2321/TR2 defra

2.2.2 The National Planning Policy Framework states that: *“a site specific flood risk assessment is required for proposals of 1 hectare (ha) or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency), and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding”*.

2.2.3 The proposed development is greater than 1ha and therefore requires a FRA.

2.2.4 The author of this report attended a meeting with Havant Borough Council and the Environment Agency on 16 April 2013 in order to agree how this development may reduce local surface water flooding as part of the Environment Agency's flood management strategy for Emsworth. The proposal to manage West Brook out of bank flows within the site was accepted by the Environment Agency, and would reinforce the Agency's own proposals north of the site.

2.2.5 Further to the Pre-Application meeting with local Councillors and Havant Borough Council's Planning Officers the author of this report gained assurance from Mr I Miller of the Environment Agency that the proposal to provide an on-site dry basin to manage out of bank flows from West Brook, and to provide independent surface water attenuation measures to serve the housing development would, in principle, be accepted by the Environment Agency.

2.3 Proposed Development

2.3.1 Vehicular and pedestrian access to the development would be from Coldharbour Farm Road to the east. Pedestrian and cycle access to the south, beneath the A27, would be via an existing underpass.

2.3.2 According to the Environment Agency's flood mapping, the eastern part of the site lies within a medium risk of river flooding and may be categorised as lying within Flood Zone 2. This zone comprises land having a likely frequency of flooding between 1 in 100 and 1 in 30 in any one year.

2.3.3 The divide between the western and eastern areas may be taken as the existing hedge line which bisects the site.

2.3.4 To the west of this flood zone lies higher land which has a very low risk of river flooding and may be categorised as lying in flood zone 1. This zone comprises land having less than 1 in 1000 chance of flooding.

2.3.5 The risk of surface water flooding from sheet flows is higher than from river flooding. The areas affected are shown within appendix B. In summary, the eastern part of the site has a frequency of flooding greater than 1 in 30 and may be categorised as having a high risk of flooding. Further to the west the risk falls to medium and low.

2.4 Summary of Brief

2.4.1 In accordance with the Client's specific objectives, the purpose of this report is primarily:

- (i) To provide a contemporary record of current flood risks affecting the site and future proposals.
- (ii) To advise on exceptional flooding events that may have an influence on developing the site.
- (iii) To advise on potential methods of mitigating flood risks on site.
- (iv) To form the basis of site based drainage strategy.



Aerial view of site

3.0 SOURCES OF INFORMATION**3.1 Desk Top and Site Based Research**

3.1.1 The flood risk assessment research comprised:

Site Information	YES	NO
Review of information supplied by the Client	✓	
Site walkover	✓	
Preliminary discussion with owner/occupier	✓	

Public Domain Information	YES	NO
Geological mapping	✓	
Statutory services information		✓
Local Authority enquiry	✓	
Strategic Flood Risk Assessment	✓	
Topographic site survey	✓	
Internet data	✓	
Anecdotal flooding information	✓	
Aerial photographs	✓	
LIDAR Survey		✓
Historic mapping		✓

Key: NA = Not applicable
 NR = No records available
 AR = Awaiting response

3.2 Response to Enquiries**3.2.1 Water Authority**

3.2.1.1 The design peak foul water flow from this development is estimated to equate to 2.3 l/s. Such flows are not anticipated to cause distress to the local foul water drainage system.

3.2.1.2 Archibald Shaw will issue a detailed assessment of foul water rates to Southern Water on finalisation of building forms and occupation rates.

3.2.2 Environment Agency

3.2.2.1 The Environment Agency's flood mapping indicates the site may be divided into two parts in respect of flood risk. To the east, the site suffers flooding from West Brook. Whilst higher land to the west is free from fluvial flooding. A copy of the Environment Agency's flood mapping is enclosed within appendix B. See also 2.3.2, 2.3.4 and 2.3.5.

4.0 SITE DETAILS

4.1 Site Location

4.1.1 The site lies immediately north of the A27, and to the western end of Coldharbour Farm Road, Emsworth, Hampshire. Immediately to the west of the site lies a filling station serving the A27. To the north lies open fields and gently rising land. The site's National Grid Reference is 474521: 106529.

4.2 Site Description

4.2.1 The site is predominantly laid to grass and is bisected by a hedge line beneath which lies a culvert, details of which will be subject to further investigation. The area east of the hedge is currently home to grazing ponies.

4.3 Local Topography and Geology

4.3.1 The site lies within a shallow valley contiguous with West Brook. The highest point on site, to the north west corner, lies at a level of 13.08m LD [Local Datum] and falls at an average gradient of 1 in 55 to a level of 9.2m LD in the south east corner. To the east of the site and West Brook the land form rises to the north and east. The land form also rises to the north and west of the site. The southern boundary of the site lies close to the embankment toe of the A27 trunk road.

4.3.2 With reference to the British Geological Survey Sheet 316, Fareham, site geology may be divided into two, with the boundary broadly in line with the on-site bisecting hedge.

West of Hedge Line

Superficial Geology: River Terrace Deposits of Sand, Silt and Clay. These deposits were formed up to 3 million years ago in the Quaternary Period when the local environment was dominated by rivers.

Bedrock Geology: London Clay Formation of Clay, Sand and Silt. This sedimentary bedrock was formed approximately 34 to 50 million years ago in the Palaeogene Period when the local environment was dominated by deep seas.

East of Hedge Line through to West Brook

Superficial Geology: Head – Gravel, Clay. These deposits were formed in the Quaternary Period when the local environment was dominated by sub-aerial slopes.

Bedrock Geology: London Clay Formation of Clay, Sand and Silt. This sedimentary bedrock was formed approximately 34 to 50 million years ago in the Palaeogene Period when the local environment was dominated by deep seas.

- 4.3.5 The closest watercourse is West Brook which bounds the eastern side of the site. This man-made watercourse is known to occasionally break out of bank with flows discharging into the south east corner of the site.

5.0 PROPOSED DEVELOPMENT WITH SUPPORTING DRAINAGE DESIGN

5.1 Existing Greenfield Drainage Flows

5.1.1 For comparative analysis greenfield run-off rates are assessed on areas proposed to accommodate impermeable structures such as macadam roads, houses and flats.

5.2 With reference to drawing 25525/200 [appendix A] impermeable pavements and roofs equate to an area of 0.64 ha. The greenfield run-off rates from Q bar [mean annual flood] through to the worst case M100 + 30% storm event are given below based on local soil types and the Standard Average Annual Rainfall [SAAR].

Return Period	Flow (l/s)
Q bar	4.27
M30	9.83
M100	13.63
M100 + 30%	17.72

Table 5.1
Greenfield Run-off

Notes: SOIL type : 5
SAAR : 739mm
Area : 0.64 ha

5.3 Proposed Drainage Design

5.3.1 The proposed development arrangement is shown indicatively on drawing 25525/200 [appendix A]. Key elements and benefits of the outline surface water drainage design summarizing attenuation and volumetric measures are summarised in table 5.2

Ref	Element	Benefit
1	Porous paved car parking areas	(ii) Waters attenuated below greenfield rates (ii) Waters encouraged to dissipate into sub-soils. Note sub-soils have low infiltration rates. (iii) Volumetric benefits through exfiltration and evaporation during Spring, Summer and Autumn months, average evaporation depth per day estimated at $0.15\text{mm}^1 = 50\text{mm/year}$
2	Slimline water barrels (100 l)	(i) Rainwater barrel provision will have a small but beneficial effect on reducing flow volume off-site.
3	Box culverts	(i) Peak development flows reduced below greenfield run-off rates
4	Dry basin	(i) Will manage out of bank flows from West Brook and reduce peak discharges downstream. (ii) Feature acts independently from site development infrastructure. (iii) Dry basin will compliment proposed Environment Agency flood reduction works to the north of this site.

Table 5.2**5.4 Comparison between Greenfield Flows and Proposed Development Flows**

5.4.1 This assessment assumes proposed on site porous pavings act as improved greenfield areas in respect of surface sheet flows. Porous paving offers significant gains in terms of reduced run-off flows and attenuation. However, this benefit will be ignored in this assessment because site testing indicates subsoil infiltration rates are very low, i.e. in the order of $10\text{E}-8$ m/s.

5.4.2 The comparison between greenfield and development flows will be made on roofed and impermeable road areas.

Catchment Area (ha)	Greenfield M100 + 30% Discharge (l/s)	Attenuated Development Discharge (l/s)	Peak Flow Reduction
0.64	17.72	10.2	42%

Table 5.3
Comparative Peak Flow Summary

- 5.4.3 This preliminary design offers a 42% reduction in peak surface water discharge compared with existing conditions.
- 5.4.4 As part of a future detailed design appraisal the operation of porous paved high level overflow connections to box culverts will require analysis

6.0 POTENTIAL FLOOD HAZARDS

6.1 Flooding from Rivers

6.1.1 Rivers flood out of bank when the amount of water in them exceeds the flow capacity of the river channel. Flooding can also result when culverts, trash screens and bridges are partially or fully blocked by debris and washload.

6.1.2 West Brook is known to flood out of bank and partially flood the eastern part of the site.

6.1.3 The proposal to provide a local bund within and to the north of the site, as well as providing a dry basin within the flood area will manage these flows in order to reduce flood risk to the proposed development and to catchments downstream.

6.1.4 It is considered that the risk of flooding from local watercourses will be low.

6.2 Flooding from the Sea

6.2.1 The site is located some 5 miles from the sea.

6.2.2 It is considered that the risk of flooding from the sea is low.

6.3 Flooding from Land

6.3.1 Intense rainfall of short duration, which is unable to soak into the ground or enter drainage systems can run off land in sheet flows resulting in local flooding.

6.3.2 Given the local topography and superficial and bedrock geology, over land flows are anticipated. See also appendix B.

6.3.3 The surface water drainage design will reduce on site surface water sheet flows. Nevertheless house and garage floor levels will require careful consideration to prevent remaining sheet flows entering properties.

6.4 Flooding from Groundwater

6.4.1 There is no evidence of local groundwater flooding

6.4.2 The risk of groundwater flooding is low.

6.5 Flooding from Sewers

- 6.5.1 Flooding can result when a sewer is overwhelmed by heavy rainfall, groundwater becomes blocked or is of inadequate capacity.
- 6.5.2 The site has no record of surface water sewer or foul water sewer flooding. A detailed assessment of foul water flow rates will be submitted to Southern Water on finalisation of the building forms and occupation rates. It is not anticipated at this stage that foul water flows will cause a nuisance to local drainage infrastructure.

6.6 Flooding from Reservoirs, Canals other Manmade Sources

- 6.6.1 Reservoir or canal flooding may occur as a result of the structure being overwhelmed, or as a result of dam and bank failure.
- 6.6.2 There are no such manmade features local to the site that could result in flooding of the site.

7.0 DISCUSSIONS AND CONCLUSIONS

- 7.1 Subject to detailed design this development will not adversely affect the site or surrounding areas in terms of flood risk.
- 7.2 This report demonstrates that the current proposed development can offer a reduction in off-site surface water peak and volumetric flows, which will reduce flood risk to downstream catchments.

Prepared by: Eur Ing Vincent Carpenter BSc (Hons) CEng MICE CWEM FCIWEM MIHT MIOd

Date: 4 March 2014

APPENDIX A

Surface Water Drainage Design in Outline



PRELIMINARY OUTLINE SURFACE WATER DESIGN

NOTES

- This drawing to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
- Dimensions are in millimetres unless noted otherwise.
- Original topographic survey undertaken by J.C. Radford Site Engineering. For full topographic survey information see J.C. Radford drawings. All levels are based on a local datum. Location and value to be confirmed.
- Site boundary is shown thus:

Total Area of Site : 18900m²

Area :

- Roof Area : 2475m²**
- Impermeable Pavement : 1790m²**
- Porous Pavement : 2135m²**
- Area of Pond : 2395m²**
- Footways**

Flow Control / Pipe Details :

Attenuation Tank (Box Culvert) Cross Section :

Water Buttes are shown thus (indicative positions only) : ●
100 litre shallow water butts by Sinterlay, or equivalent.

West Brook Overflow Schematic :

PS	EXTENT OF BOX CULVERTS REVISED	-	PS-12-03-14
PS	AREA OF POND SHOWN	-	PS-04-03-14
REV	DESCRIPTION	CHECKED	DATE

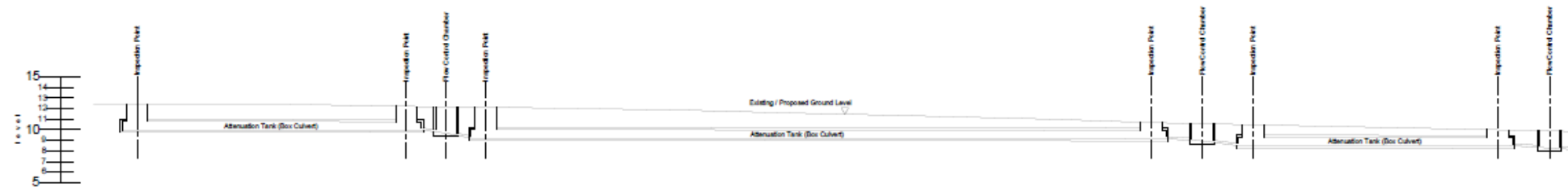
Archibald Shaw

Consulting Civil & Structural Engineers
One Unity London, Oldbury, West Sussex PO19 1PP
Telephone: 01243 786471 Facsimile: 01243 779346
info@archibaldshaw.co.uk www.archibaldshaw.co.uk

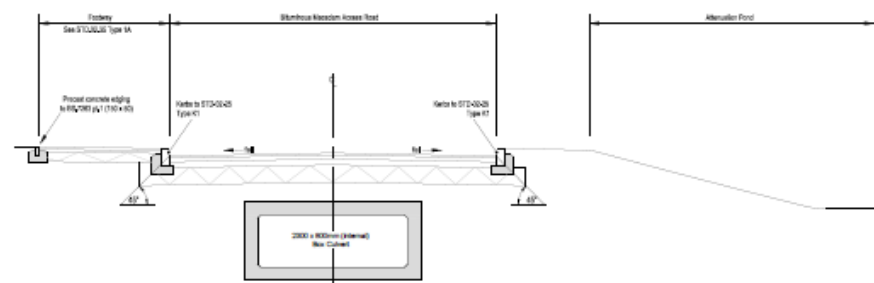
CLIENT
Telstar Limited

PROJECT
Coldharbour Farm
Emsworth
Site Area Plan and Attenuation Proposals

DRAWN BY PF	CHECKED BY VC	DESIGNED BY VC
SCALE @ A1 Plan 1:500	DATE Nov, 2013	STATUS Preliminary
JOB NO. 25525	DRAWING NO. 200	REVISION P3



SECTION A - A
Scale 1:250



SECTION B - B
Scale 1:50

- NOTES**
1. This drawing to be read in conjunction with all relevant Architects and Engineers drawings and specifications.
 2. Dimensions are in millimetres unless noted otherwise.
 3. Original topographic survey undertaken by J.C. Radford Site Engineering. For full topographic survey information see J.C. Radford drawings. All levels are based on a local datum. Location and value to be confirmed.
 4. For full notes see drawing 25525-200.

REV	DESCRIPTION	CHECKED	DATE
Archibald Shaw Consulting Civil & Structural Engineers One Little London, Chichester, West Sussex PO19 1PP Telephone: 01243 786471 Fax: 01243 775346 info@archibaldshaw.co.uk www.archibaldshaw.co.uk			
CLIENT Tetra Laval			
PROJECT Coldharbour Farm Emsworth Sections AA and BB			
DRAWN BY PF	CHECKED BY VC	DESIGNED BY VC	
SCALE @ A1 As Shown	DATE Feb, 2014	STATUS Preliminary	
JOB NO. 25525	DRAWING NO. 201	REVISION P1	

APPENDIX B

Environment Agency Flood Mapping

The shading on the map shows the risk of flooding from rivers and the sea in this particular area.
Click on the map for a more detailed explanation.

Map of X: 473,906; Y: 106,769 at scale 1:10,000

[Data search](#) 

Map legend

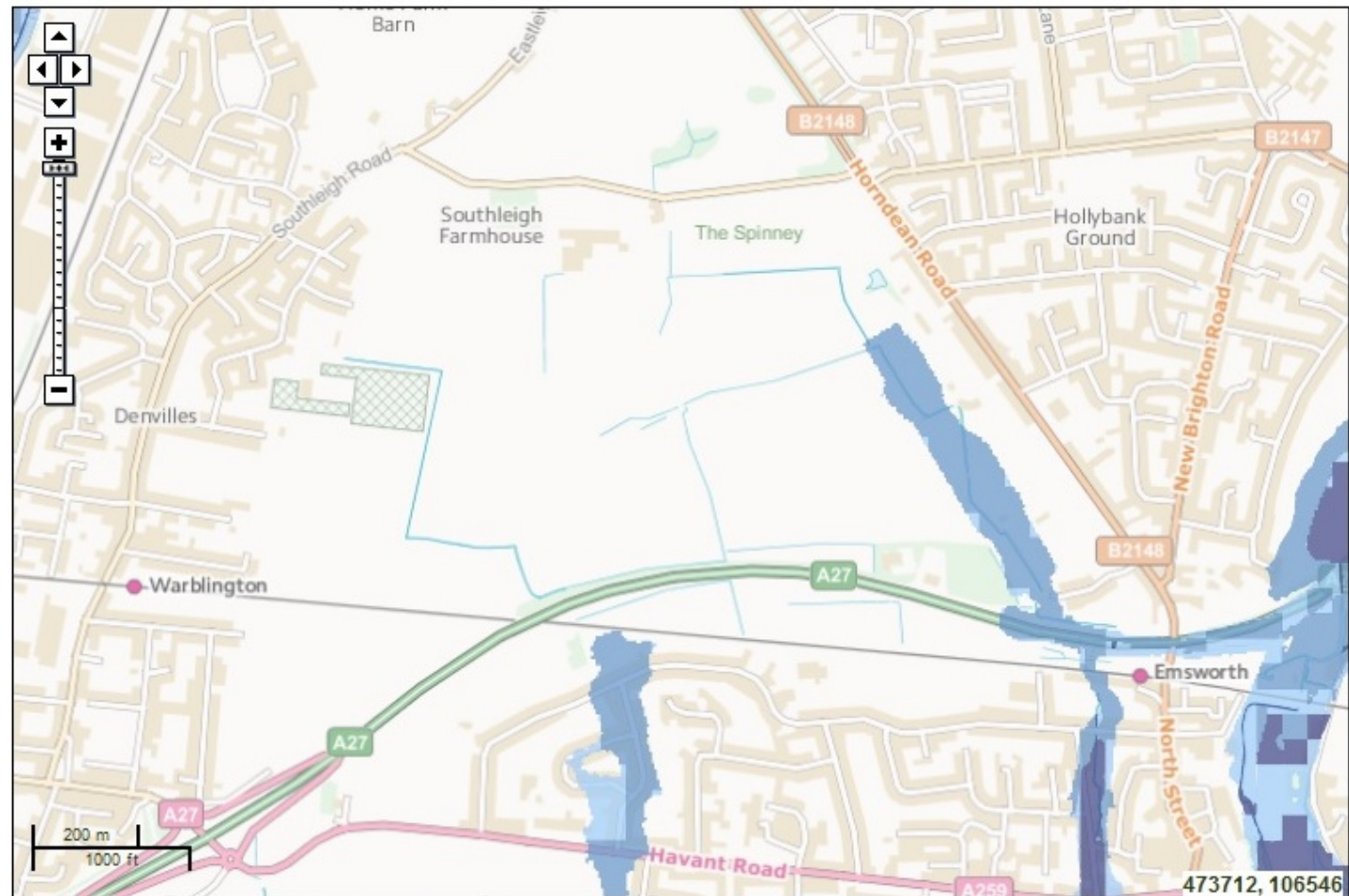
☒ Risk of Flooding from Rivers and Sea

High

Medium

Low

Very Low



Customers in Wales - From 1 April 2013 Natural Resources Wales (NRW) will take over the responsibilities of the Environment Agency in Wales.
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Contains Royal Mail data © Royal Mail copyright and database right 2014.

APPENDIX C

Summary Analysis

Sketch/Calc ☒ Site Visit ☐ Memo ☐
 Phone Call ☒ Meeting ☐ File Note ☐

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 www.archibaldshaw.co.uk

Project No./Ref: 25725/1

Project: COLDHARBOUR

Section: CMCS

Prepared: VC

Checked:

Date: 02.02.14

Time:

Site comprises: 18500m^2

of which: 16500m^2 - developable

2400m^2 - Dry Basin

Developable land - Discharge Criteria

Developable land will not discharge water from site at a greater rate than greenfield run-off rates.

Outline preliminary design based on $M100+30\%$

Estimated Greenfield runoff rate

1H Report 126

Soil factor: 5

SAAR: 733mm.

$$M100+30\% = 1.3 \times 13.63\text{ L/s}$$

$$= \boxed{17.72\text{ L/s}}$$

Exceed site $M100+30\%$ development peak $\times 17.72\text{ L/s}$.

Begin porous paving as 'self serving'. Infiltration rates are negligible, but porous paving will discharge less water than green field areas.

Sketch/Calc ☒ Site Visit ☐ Memo ☐
 Phone Call ☐ Meeting ☐ File Note ☐

Archibald Shaw



Consulting Civil and Structural Engineers
www.archibaldshaw.co.uk

Project No./Ref: 2525/2

Project: CALDARE BUR.

Section: CMCS

Prepared: VC

Checked:

Date: 03.02.14.

Time:

Design sub-surface attenuation to accommodate peak flows from impermeable surfaces. Allow residual capacity to accommodate high level overflows from porous paving.

Greenfield runoff estimation for sites

Site name: coldharbour

Site location: Emsworth

Site coordinates

Latitude: 50.85332° N

Longitude: 0.94279° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", WS-0746A/TR 1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: gcp36996p3uv / 1.65

Date: 6 Feb 2014

Site characteristics

Total site area	1.65	ha
Significant public open space	1.01	ha
Area positively drained	0.64	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	5
HOST class	N/A
SPR	0.53

Hydrological characteristics

	Default	Edited	
SAAR	739	739	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.81	0.81	
Hydrological region	7	7	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	1.24	4.27	l/s
1 in 1 year	5.00	5.00	l/s
1 in 30 years	5.00	9.83	l/s
1 in 100 years	5.00	13.63	l/s

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

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One Little London Chichester Sussex PO19 1PP	Coldharbour Farm Emsworth M100+30%	
Date 07.02.2014	Designed By vlc	
File	Checked By	
Micro Drainage	Source Control W.11.2	

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

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	9.5	9.5	100.2687	0.2687	67.2	O K
30 Summer	9.5	9.5	100.3262	0.3262	86.9	O K
60 Summer	9.6	9.6	100.3717	0.3717	102.8	O K
120 Summer	9.7	9.7	100.3917	0.3917	109.7	O K
180 Summer	9.7	9.7	100.3912	0.3912	109.4	O K
240 Summer	9.7	9.7	100.3842	0.3842	107.0	O K
360 Summer	9.5	9.5	100.3657	0.3657	100.7	O K
480 Summer	9.5	9.5	100.3457	0.3457	93.7	O K
600 Summer	9.5	9.5	100.3252	0.3252	86.7	O K
720 Summer	9.5	9.5	100.3057	0.3057	79.8	O K
960 Summer	9.5	9.5	100.2673	0.2672	66.6	O K
1440 Summer	9.5	9.5	100.2097	0.2097	46.6	O K
2160 Summer	8.1	8.1	100.1707	0.1707	33.2	O K
2880 Summer	7.0	7.0	100.1468	0.1468	24.9	O K
4320 Summer	5.6	5.6	100.1158	0.1158	15.5	O K
5760 Summer	4.6	4.6	100.0957	0.0958	10.7	O K
7200 Summer	4.0	4.0	100.0823	0.0823	7.9	O K
8640 Summer	3.5	3.5	100.0723	0.0723	6.1	O K
10080 Summer	3.1	3.1	100.0642	0.0643	4.8	O K
15 Winter	9.5	9.5	100.2947	0.2947	76.2	O K
30 Winter	9.5	9.5	100.3602	0.3602	98.7	O K
60 Winter	9.9	9.9	100.4142	0.4142	117.5	O K
120 Winter	10.2	10.2	100.4392	0.4392	126.2	O K
180 Winter	10.2	10.2	100.4367	0.4367	125.2	O K
240 Winter	10.1	10.1	100.4262	0.4262	121.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	94.49	28
30 Summer	62.87	41
60 Summer	40.05	68
120 Summer	24.75	108
180 Summer	18.45	140
240 Summer	14.91	176
360 Summer	11.04	244
480 Summer	8.91	312
600 Summer	7.54	380
720 Summer	6.58	446
960 Summer	5.30	570
1440 Summer	3.90	798
2160 Summer	2.86	1156
2880 Summer	2.30	1508
4320 Summer	1.69	2216
5760 Summer	1.35	2944
7200 Summer	1.14	3672
8640 Summer	0.99	4408
10080 Summer	0.88	5136
15 Winter	94.49	28
30 Winter	62.87	41
60 Winter	40.05	68
120 Winter	24.75	120
180 Winter	18.45	150
240 Winter	14.91	188

One Little London
Chichester
Sussex PO19 1PF

Coldharbour Farm
Emsworth
M100+30%

Date 07.02.2014

Designed By vlc

File

Checked By

Micro Drainage

Source Control W.11.2



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

Storm Duration (mins)	Maximum Control (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
360 Winter	9.8	9.8	100.3982	0.3982	111.9	O K
480 Winter	9.5	9.5	100.3662	0.3662	100.9	O K
600 Winter	9.5	9.5	100.3347	0.3347	89.9	O K
720 Winter	9.5	9.5	100.3037	0.3037	79.2	O K
960 Winter	9.5	9.5	100.2452	0.2452	58.9	O K
1440 Winter	8.7	8.7	100.1833	0.1833	37.5	O K
2160 Winter	6.8	6.8	100.1432	0.1432	23.7	O K
2880 Winter	5.7	5.7	100.1182	0.1182	16.1	O K
4320 Winter	4.3	4.3	100.0882	0.0882	9.0	O K
5760 Winter	3.4	3.4	100.0713	0.0713	5.9	O K
7200 Winter	2.9	2.9	100.0602	0.0602	4.2	O K
8640 Winter	2.5	2.5	100.0527	0.0527	3.2	O K
10080 Winter	2.3	2.3	100.0468	0.0467	2.5	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
360 Winter	11.04	264
480 Winter	8.91	338
600 Winter	7.54	408
720 Winter	6.58	476
960 Winter	5.30	594
1440 Winter	3.90	814
2160 Winter	2.86	1172
2880 Winter	2.30	1528
4320 Winter	1.69	2216
5760 Winter	1.35	2944
7200 Winter	1.14	3672
8640 Winter	0.99	4392
10080 Winter	0.88	5056

Archibald Shaw Limited		Page 3
One Little London	Coldharbour Farm	
Chichester	Emsworth	
Sussex PO19 1PP	M100+30%	
Date 07.02.2014	Designed By vlc	
File	Checked By	
Micro Drainage	Source Control W.11.2	

Rainfall Details

Region	ENG+WAL	Shortest Storm (mins)	15
Return Period (years)	30	Longest Storm (mins)	10080
MS-60 (mm)	20.000	Summer Storms	Yes
Ratio-R	0.350	Winter Storms	Yes
Cv (Summer)	0.750	Climate Change %	+30
Cv (Winter)	0.840		

Time / Area Diagram

Total Area (ha) = 0.432

Time (mins)	Area	Time (mins)	Area
from: to:	(ha)	from: to:	(ha)
0 4	0.000	8 12	0.144
4 8	0.144	12 16	0.144

Archibald Shaw Limited		Page 4
One Little London	Coldharbour Farm	
Chichester	Emsworth	
Sussex PO19 1PP	M100+30%	
Date 07.02.2014	Designed By vlc	
File	Checked By	
Micro Drainage	Source Control W.11.2	

Box Culvert Details

Height (m) 0.800 Width (m) 2.300 Invert Level (m) 100.000
Length (m) 150.000 Slope (1:x) 1000.0 Cover Level (m) 101.500

Hydro-Brake Outflow Control

Design Head (m) 0.700 Diameter (mm) 118
Design Flow (l/s) 13.0 Invert Level (m) 100.000
Hydro-Brake Type MD1

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	4.8	0.80	13.8	2.00	21.8	4.00	30.9	7.00	40.8
0.20	9.5	1.00	15.4	2.20	22.9	4.50	32.7	7.50	42.3
0.30	9.0	1.20	16.9	2.40	23.9	5.00	34.5	8.00	43.6
0.40	9.8	1.40	18.3	2.60	24.9	5.50	36.2	8.50	45.0
0.50	10.9	1.60	19.5	3.00	26.7	6.00	37.8	9.00	46.3
0.60	12.0	1.80	20.7	3.50	28.9	6.50	39.3	9.50	47.6