

DRAINAGE STATEMENT
FOR PROPOSED LODGE DEVELOPMENT
PLAS COCH
WREXHAM

PREPARED FOR:



JOB NO: 14998
DATE: 29.03.18



DOCUMENT HISTORY

Issue	Description	Date
1	First Issue	29.03.18

CONTENTS

1. INTRODUCTION	3
2. SURFACE WATER MANAGEMENT & DRAINAGE STRATEGY.....	3
3. FOUL WATER DRAINAGE STRATEGY.....	6
4. CONCLUSIONS	6

APPENDICES

APPENDIX A:	SITE LAYOUT PLAN
APPENDIX B:	TOPOGRAPHICAL SURVEY
APPENDIX C:	SOAKAWAY TEST RESULTS
APPENDIX D:	PRELIMINARY LEVELS AND DRAINAGE STRATEGY
APPENDIX E:	MICRODRAINAGE DESIGN RESULTS
APPENDIX F:	SUDS IMPLEMENTATION PLAN
APPENDIX G	SUDS MAINTENANCE PLAN
APPENDIX H:	WELSH WATER SEWER RECORDS

1. INTRODUCTION

- 1.1 This report has been prepared by Simpson Associates, on behalf of Marston's Inns & Taverns to accompany a planning application for a proposed 24 bedroom Lodge Development on land to the east of the Plas Coch pub/restaurant, Wrexham.
- 1.2 A copy of the proposed Site Layout Plan is included in *Appendix A* for reference, and the topographical survey showing the existing site layout has been included in *Appendix B*.
- 1.3 The report details a strategy for the disposal of foul and surface water runoff from the development including proposals for the management of surface water runoff using Sustainable Urban Drainage Systems (SUDS).
- 1.4 The report has been prepared in accordance with Welsh Assembly Government's "*Recommended non-statutory standards for sustainable drainage in Wales*", which provides guidance on designing, constructing and maintaining surface water drainage systems in Wales.

2. SURFACE WATER MANAGEMENT & DRAINAGE STRATEGY

Standard S1 - Surface Water Runoff Destination

- 2.1 The suggested procedures for managing surface water runoff from new developments in Wales are set out in the 2017 Welsh Government Document "*Recommended non-statutory standards for sustainable drainage (SUDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems*".
- 2.2 Standard S1 of the SUDS Standards Document sets out a hierarchy for the disposal of surface water runoff. The methods of disposal are summarised in *Table 1* with an assessment of each methods suitability also provided.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 3
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

Table 1: Surface Water Runoff Destination Assessment

Surface Water Runoff Destination	Assessment
Priority Level 1: Surface water runoff is collected for use	Given the proposed development's uses, it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Priority Level 2: Surface water runoff is infiltrated to ground	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration with BRE 365 soakaway tests establishing an infiltration rate of 5.5×10^{-04} m/s. The soakaway test results are included in <i>Appendix C</i> .
Priority Level 3: Surface water runoff is discharged to a surface water body	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water body.
Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore, it is not necessary to consider the discharge of surface water runoff to a surface water sewer, highway drain, or another drainage system.
Priority Level 5: Surface water runoff is discharged to a combined sewer.	It has been established that it would be appropriate to discharge surface water runoff to ground by infiltration, therefore it is not necessary to consider the discharge of surface water runoff to a combined sewer.

Standard S2 - Surface water runoff hydraulic control

- 2.3 Standard S2 of the SUDS Standards Document advises that consideration should be given to the use of Sustainable Urban Drainage Systems (SUDS) for the interception of surface water runoff to prevent any discharge from new development for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events. The SUDS considered to achieve this requirement are listed in *Table 2* below with an assessment of each methods suitability also provided.

Table 2: Assessment of SUDS Methods considered to prevent any discharge of surface water for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events.

System	Assessment
Green Roofs	The lodge is proposed to have traditional pitched roof profiles which would be appropriate to the site and its context, therefore the use of green roofs is not considered appropriate for the management of surface water runoff.
Rainwater Harvesting	Given the proposed development's uses, it is considered that rainwater harvesting would not significantly contribute to a reduction in surface water runoff volumes or peak water demand. Therefore, the collection of surface water runoff for re-use is not considered to be an appropriate surface water runoff destination.
Soakaway / Infiltration Systems	The underlying soils are considered suitable for disposal of surface water runoff to ground by infiltration, therefore soakaways / and other infiltrations systems including infiltration trenches, swales, permeable pavements, infiltration basins are considered appropriate for the interception of surface water runoff.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 4
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

- 2.4 Based on the assessment in *Table 2*, a surface water drainage scheme has been developed for the site and is shown on the Preliminary Levels and Drainage Strategy drawing included in *Appendix D*. The drawing shows roof water runoff from the proposed building is shown to be discharged to a new concrete ring soakaway located to the south of the development. Roof water would be drained via roof gutters and rainwater downpipes, which would discharge to the soakaway via a traditional network of below ground pipework.
- 2.5 The SUDS described above and shown on the proposed drainage layout have been designed in accordance with the flood protection requirements of the SUDS Standards Document with sufficient capacity to store and attenuate excess surface water runoff associated with rainfall events exceeding the natural infiltration rate of the underlying soils for up to and including a 1 in 100 year event with 40% allowance for climate change. In accordance with BRE 365 all infiltration features are designed to achieve a half drain time below 24 hours following a 1 in 10 year plus climate change storm event.
- 2.6 The SUDS have been designed using the Source Control facility in the MicroDrainage software package by XP Solutions based on an infiltration rate of 5.5×10^{-4} m/s (1980mm/hr). Design results for both the 1 in 100 year and 1 in 10 year events, each with a 40% climate change allowance, are included in *Appendix E*.
- 2.7 In the event that the capacity of the surface water drainage network was exceeded, surface water would flow off-site to the south and east, following the falls identified on the Preliminary Levels and Drainage Strategy drawing in *Appendix D*, which closely match the sites existing falls. The finished floor level of the proposed building is raised above the surrounding levels so there would no risk of buildings being affected by such overland flows.

Standard S3 - Water Quality

- 2.8 Standard S3 of the SUDS Standards Document advises that where surface water is likely to be contaminated, effective management is required to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.
- 2.9 The proposed drainage layout drawing included in *Appendix D* shows roof water runoff from the development to be discharged to ground using a concrete ring soakaway with granular surround which will offer one stage of treatment, complying with the standards.

Standard S4 & S5 – Amenity & Biodiversity

- 2.10 Standard S4 of the SUDS Standards Document advises that the design of the surface water management system should maximise amenity benefits, while Standard S5 requires the design of the surface water management system to maximise biodiversity benefits.
- 2.11 The proposed drainage layout drawing included in *Appendix D* shows all of the proposed surface water storage to be located below ground and no unnecessary loss of amenity space is therefore required to enable the development. The proposals also maximise the opportunity for biodiversity benefits to be implemented within the retained open space at the site.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 5
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

Standard S6 – Design of drainage for Construction, Operation and Maintenance

- 2.12 Standard S6 sets out requirements for surface water drainage systems so that they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.
- 2.13 The SUDS Implementation Plan included in *Appendix F* sets out measures to be implemented during construction of the scheme to ensure the site and areas downstream are protected from surface water runoff during construction phases.
- 2.14 Following handover of the drainage system to the Operations Team, it is recommended that the surface water drainage system is maintained in accordance with the SUDS Maintenance Plan included in *Appendix G*. The measures would help to prevent a reduction in the performance of the surface water drainage system over the lifetime of the development.

3. FOUL WATER DRAINAGE STRATEGY

- 3.1 The proposed drainage layout drawing included in *Appendix D* shows foul water to be discharged via a system of underground pipework to an existing manhole on the line of an existing 150mm diameter foul drain which serves the Plas Coch Pub.
- 3.2 The proposed foul drainage network will remain under private ownership and therefore the property owners would be responsible for any maintenance up to the connection with the public sewerage network.

4. CONCLUSIONS

- 4.1 New development can increase the volume and rate at which surface water runoff is discharged from a site when compared to the existing situation, which can cause an increase in flood risk both on the site and elsewhere within the catchment. Therefore, a surface water drainage scheme has been prepared for the development that will allow for surface water runoff to infiltrate into the ground using Sustainable Urban Drainage Systems (SUDS) in the form of a concrete ring soakaway with gravel surround, the drainage strategy will ensure excess surface water runoff from the development is stored and attenuated up to a 1 in 100 year plus 40% climate change event.
- 4.2 Foul water runoff from the development would be discharged to the public sewerage network via the sites existing foul water drainage network.
- 4.3 It is concluded that the development can be occupied and operated safely and that there will be no increase in the level of flood risk to the site or neighbouring sites as a result of the development. Therefore, the development can be considered acceptable in terms of flood risk.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 6
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

APPENDIX A
SITE LAYOUT PLAN



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KEY

Soft Landscaping
See Separate Drawing

Bitmac Surface to Parking
Areas with Thermoplastic
White Lining

Existing tarmac

Tarmac to Road suitable for
HGVs

Regular Style Concrete
Sett Block Paving to match
existing

Post & Rail Fence to
boundary

Stained 1100mm Timber
Picket Fence

Knee Rail fence

Tree removed

Tree remain

RPA

'No dig' construction

Soakaway clearance zone

D	14/3/18	Updated with topo survey & arbo advice	SF
C	19/02/18	Surveyed tree locations added	SF
B	14/2/18	ADDITIONAL LANDSCAPE ADDED	NW
A	23/1/18	EXISTING FOOTPRINT UPDATED	NW
Rev	Date	Description	By

AXIOM
ARCHITECTS

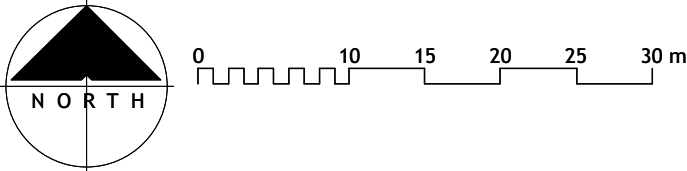
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www.axiomarchitects.co.uk

Client
MARSTONS PLC

Project
PROPOSED LODGE
PLAS COCH
WREXHAM

Drawing
SITE PLAN

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Scale
1:500 @ A3

Status
PLANNING

Date
17.10.17

Drawn
ACR

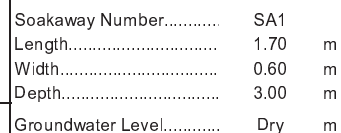
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Revision
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APPENDIX B
TOPOGRAPHICAL SURVEY

APPENDIX C
SOAKAWAY TEST RESULTS



See B.R.E. Digest 365, 1991, Soakaway Design.

Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
A. Jubb	08.02.18	A.Hodgkinson	08.02.18	S.Dawson	08.02.18

APPENDIX D
PRELIMINARY LEVELS AND DRAINAGE STRATEGY

APPENDIX E
MICRODRAINAGE DESIGN RESULTS

Simpson Associates				Page 1																																																																																																																																																																																																																			
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Date 27/03/2018 14:51 File 14998 - SOAKAWAY DESIGN...		Designed by jordanhutchins Checked by																																																																																																																																																																																																																					
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<u>Summary of Results for 10 year Return Period (+40%)</u> Half Drain Time : 15 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>85.487</td><td>1.147</td><td>4.5</td><td>6.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>85.637</td><td>1.297</td><td>4.8</td><td>7.0</td><td>O K</td></tr><tr><td>60 min Summer</td><td>85.652</td><td>1.312</td><td>4.8</td><td>7.1</td><td>O K</td></tr><tr><td>120 min Summer</td><td>85.525</td><td>1.185</td><td>4.6</td><td>6.4</td><td>O K</td></tr><tr><td>180 min Summer</td><td>85.380</td><td>1.040</td><td>4.2</td><td>5.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>85.249</td><td>0.909</td><td>3.9</td><td>4.9</td><td>O K</td></tr><tr><td>360 min Summer</td><td>85.040</td><td>0.700</td><td>3.4</td><td>3.8</td><td>O K</td></tr><tr><td>480 min Summer</td><td>84.884</td><td>0.544</td><td>3.1</td><td>2.9</td><td>O K</td></tr><tr><td>600 min Summer</td><td>84.763</td><td>0.423</td><td>2.8</td><td>2.3</td><td>O K</td></tr><tr><td>720 min Summer</td><td>84.667</td><td>0.327</td><td>2.6</td><td>1.8</td><td>O K</td></tr><tr><td>960 min Summer</td><td>84.527</td><td>0.187</td><td>2.3</td><td>1.0</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>84.389</td><td>0.049</td><td>1.9</td><td>0.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>84.377</td><td>0.037</td><td>1.4</td><td>0.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>84.370</td><td>0.030</td><td>1.2</td><td>0.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>84.363</td><td>0.023</td><td>0.9</td><td>0.1</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>84.359</td><td>0.019</td><td>0.7</td><td>0.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>84.356</td><td>0.016</td><td>0.6</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>84.354</td><td>0.014</td><td>0.6</td><td>0.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>84.353</td><td>0.013</td><td>0.5</td><td>0.1</td><td>O K</td></tr><tr><td>15 min Winter</td><td>85.654</td><td>1.314</td><td>4.9</td><td>7.1</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>69.371</td><td>0.0</td><td>15</td></tr><tr><td>30 min Summer</td><td>46.640</td><td>0.0</td><td>23</td></tr><tr><td>60 min Summer</td><td>30.208</td><td>0.0</td><td>40</td></tr><tr><td>120 min Summer</td><td>19.108</td><td>0.0</td><td>74</td></tr><tr><td>180 min Summer</td><td>14.500</td><td>0.0</td><td>106</td></tr><tr><td>240 min Summer</td><td>11.884</td><td>0.0</td><td>138</td></tr><tr><td>360 min Summer</td><td>8.956</td><td>0.0</td><td>200</td></tr><tr><td>480 min Summer</td><td>7.323</td><td>0.0</td><td>260</td></tr><tr><td>600 min Summer</td><td>6.261</td><td>0.0</td><td>320</td></tr><tr><td>720 min Summer</td><td>5.507</td><td>0.0</td><td>382</td></tr><tr><td>960 min Summer</td><td>4.496</td><td>0.0</td><td>500</td></tr><tr><td>1440 min Summer</td><td>3.375</td><td>0.0</td><td>730</td></tr><tr><td>2160 min Summer</td><td>2.531</td><td>0.0</td><td>1088</td></tr><tr><td>2880 min Summer</td><td>2.062</td><td>0.0</td><td>1452</td></tr><tr><td>4320 min Summer</td><td>1.544</td><td>0.0</td><td>2144</td></tr><tr><td>5760 min Summer</td><td>1.257</td><td>0.0</td><td>2904</td></tr><tr><td>7200 min Summer</td><td>1.073</td><td>0.0</td><td>3624</td></tr><tr><td>8640 min Summer</td><td>0.942</td><td>0.0</td><td>4264</td></tr><tr><td>10080 min Summer</td><td>0.844</td><td>0.0</td><td>5104</td></tr><tr><td>15 min Winter</td><td>69.371</td><td>0.0</td><td>15</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	85.487	1.147	4.5	6.2	O K	30 min Summer	85.637	1.297	4.8	7.0	O K	60 min Summer	85.652	1.312	4.8	7.1	O K	120 min 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2880 min Summer	2.062	0.0	1452																																																																																																																																																																																																																				
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7200 min Summer	1.073	0.0	3624																																																																																																																																																																																																																				
8640 min Summer	0.942	0.0	4264																																																																																																																																																																																																																				
10080 min Summer	0.844	0.0	5104																																																																																																																																																																																																																				
15 min Winter	69.371	0.0	15																																																																																																																																																																																																																				
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Simpson Associates				Page 2	
1 Market Place Mews Henley-on-Thames RG9 2AH					
Date 27/03/2018 14:51 File 14998 - SOAKAWAY DESIGN...		Designed by jordanhutchins Checked by			
Micro Drainage		Source Control 2015.1			
<u>Summary of Results for 10 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	85.813	1.473	5.2	8.0	O K
60 min Winter	85.782	1.442	5.1	7.8	O K
120 min Winter	85.551	1.211	4.6	6.5	O K
180 min Winter	85.333	0.993	4.1	5.4	O K
240 min Winter	85.154	0.814	3.7	4.4	O K
360 min Winter	84.890	0.550	3.1	3.0	O K
480 min Winter	84.707	0.367	2.7	2.0	O K
600 min Winter	84.575	0.235	2.4	1.3	O K
720 min Winter	84.476	0.136	2.1	0.7	O K
960 min Winter	84.387	0.047	1.8	0.3	O K
1440 min Winter	84.376	0.036	1.4	0.2	O K
2160 min Winter	84.367	0.027	1.0	0.1	O K
2880 min Winter	84.362	0.022	0.8	0.1	O K
4320 min Winter	84.356	0.016	0.6	0.1	O K
5760 min Winter	84.354	0.014	0.5	0.1	O K
7200 min Winter	84.352	0.012	0.5	0.1	O K
8640 min Winter	84.350	0.010	0.4	0.1	O K
10080 min Winter	84.349	0.009	0.4	0.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	46.640	0.0	24		
60 min Winter	30.208	0.0	44		
120 min Winter	19.108	0.0	78		
180 min Winter	14.500	0.0	112		
240 min Winter	11.884	0.0	144		
360 min Winter	8.956	0.0	206		
480 min Winter	7.323	0.0	266		
600 min Winter	6.261	0.0	326		
720 min Winter	5.507	0.0	384		
960 min Winter	4.496	0.0	490		
1440 min Winter	3.375	0.0	734		
2160 min Winter	2.531	0.0	1080		
2880 min Winter	2.062	0.0	1424		
4320 min Winter	1.544	0.0	2200		
5760 min Winter	1.257	0.0	2944		
7200 min Winter	1.073	0.0	3664		
8640 min Winter	0.942	0.0	4280		
10080 min Winter	0.844	0.0	5192		
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1 Market Place Mews Henley-on-Thames RG9 2AH																																			
Date 27/03/2018 14:51 File 14998 - SOAKAWAY DESIGN...	Designed by jordanhutchins Checked by																																		
Micro Drainage		Source Control 2015.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>10</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.311</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.069 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.069</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	10	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Shortest Storm (mins)	15	Ratio R	0.311	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.069
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Simpson Associates		Page 4																				
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Micro Drainage Source Control 2015.1																						
<u>Model Details</u> Storage is Online Cover Level (m) 87.340 <u>Lined Soakaway Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>1.98000</td> <td>Ring Diameter (m)</td> <td>2.10</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>1.98000</td> <td>Pit Multiplier</td> <td>1.5</td> </tr> <tr> <td>Safety Factor</td> <td>3.0</td> <td>Number Required</td> <td>1</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Invert Level (m)</td> <td>84.340</td> <td>Cap Infiltration Depth (m)</td> <td>0.000</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	1.98000	Ring Diameter (m)	2.10	Infiltration Coefficient Side (m/hr)	1.98000	Pit Multiplier	1.5	Safety Factor	3.0	Number Required	1	Porosity	0.30	Cap Volume Depth (m)	0.000	Invert Level (m)	84.340	Cap Infiltration Depth (m)	0.000
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4TH FLOOR 43 EAGLE STREET LONDON WC1R 4AT																																																																																																																																																																																																																							
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Summer</td><td>85.632</td><td>1.292</td><td>4.8</td><td>7.0</td><td>O K</td></tr><tr><td>600 min Summer</td><td>85.430</td><td>1.090</td><td>4.3</td><td>5.9</td><td>O K</td></tr><tr><td>720 min Summer</td><td>85.268</td><td>0.928</td><td>4.0</td><td>5.0</td><td>O K</td></tr><tr><td>960 min Summer</td><td>85.021</td><td>0.681</td><td>3.4</td><td>3.7</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>84.711</td><td>0.371</td><td>2.7</td><td>2.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>84.460</td><td>0.120</td><td>2.1</td><td>0.7</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>84.385</td><td>0.045</td><td>1.8</td><td>0.2</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>84.373</td><td>0.033</td><td>1.3</td><td>0.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>84.367</td><td>0.027</td><td>1.0</td><td>0.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>84.363</td><td>0.023</td><td>0.9</td><td>0.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>84.360</td><td>0.020</td><td>0.8</td><td>0.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>84.358</td><td>0.018</td><td>0.7</td><td>0.1</td><td>O K</td></tr><tr><td>15 min Winter</td><td>86.600</td><td>2.260</td><td>7.0</td><td>12.2</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>112.688</td><td>0.0</td><td>15</td></tr><tr><td>30 min Summer</td><td>77.339</td><td>0.0</td><td>23</td></tr><tr><td>60 min Summer</td><td>50.812</td><td>0.0</td><td>40</td></tr><tr><td>120 min Summer</td><td>32.267</td><td>0.0</td><td>74</td></tr><tr><td>180 min Summer</td><td>24.360</td><td>0.0</td><td>108</td></tr><tr><td>240 min Summer</td><td>19.797</td><td>0.0</td><td>138</td></tr><tr><td>360 min Summer</td><td>14.705</td><td>0.0</td><td>200</td></tr><tr><td>480 min Summer</td><td>11.905</td><td>0.0</td><td>262</td></tr><tr><td>600 min Summer</td><td>10.097</td><td>0.0</td><td>324</td></tr><tr><td>720 min Summer</td><td>8.819</td><td>0.0</td><td>384</td></tr><tr><td>960 min Summer</td><td>7.116</td><td>0.0</td><td>504</td></tr><tr><td>1440 min Summer</td><td>5.248</td><td>0.0</td><td>748</td></tr><tr><td>2160 min Summer</td><td>3.859</td><td>0.0</td><td>1104</td></tr><tr><td>2880 min Summer</td><td>3.098</td><td>0.0</td><td>1432</td></tr><tr><td>4320 min Summer</td><td>2.269</td><td>0.0</td><td>2168</td></tr><tr><td>5760 min Summer</td><td>1.816</td><td>0.0</td><td>2920</td></tr><tr><td>7200 min Summer</td><td>1.531</td><td>0.0</td><td>3616</td></tr><tr><td>8640 min Summer</td><td>1.331</td><td>0.0</td><td>4352</td></tr><tr><td>10080 min Summer</td><td>1.183</td><td>0.0</td><td>5120</td></tr><tr><td>15 min Winter</td><td>112.688</td><td>0.0</td><td>15</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	86.328	1.988	6.4	10.7	O K	30 min Summer	86.684	2.344	7.2	12.7	O K	60 min Summer	86.833	2.493	7.6	13.5	O K	120 min Summer	86.683	2.343	7.2	12.7	O K	180 min Summer	86.455	2.115	6.7	11.4	O K	240 min Summer	86.239	1.899	6.2	10.3	O K	360 min Summer	85.891	1.551	5.4	8.4	O K	480 min Summer	85.632	1.292	4.8	7.0	O K	600 min Summer	85.430	1.090	4.3	5.9	O K	720 min Summer	85.268	0.928	4.0	5.0	O K	960 min Summer	85.021	0.681	3.4	3.7	O K	1440 min Summer	84.711	0.371	2.7	2.0	O K	2160 min Summer	84.460	0.120	2.1	0.7	O K	2880 min Summer	84.385	0.045	1.8	0.2	O K	4320 min Summer	84.373	0.033	1.3	0.2	O K	5760 min Summer	84.367	0.027	1.0	0.1	O K	7200 min Summer	84.363	0.023	0.9	0.1	O K	8640 min Summer	84.360	0.020	0.8	0.1	O K	10080 min Summer	84.358	0.018	0.7	0.1	O K	15 min Winter	86.600	2.260	7.0	12.2	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	112.688	0.0	15	30 min Summer	77.339	0.0	23	60 min Summer	50.812	0.0	40	120 min Summer	32.267	0.0	74	180 min Summer	24.360	0.0	108	240 min Summer	19.797	0.0	138	360 min Summer	14.705	0.0	200	480 min Summer	11.905	0.0	262	600 min Summer	10.097	0.0	324	720 min Summer	8.819	0.0	384	960 min Summer	7.116	0.0	504	1440 min Summer	5.248	0.0	748	2160 min Summer	3.859	0.0	1104	2880 min Summer	3.098	0.0	1432	4320 min Summer	2.269	0.0	2168	5760 min Summer	1.816	0.0	2920	7200 min Summer	1.531	0.0	3616	8640 min Summer	1.331	0.0	4352	10080 min Summer	1.183	0.0	5120	15 min Winter	112.688	0.0	15
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Date 22/03/2018 11:14 File SOAKAWAY DESIGN FOR 1 I...		Designed by jordanhutchins Checked by				
XP Solutions			Source Control 2015.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
30 min Winter	86.990	2.650	7.9	14.3	O K	
60 min Winter	87.090	2.750	8.2	14.9	O K	
120 min Winter	86.783	2.443	7.5	13.2	O K	
180 min Winter	86.435	2.095	6.7	11.3	O K	
240 min Winter	86.138	1.798	6.0	9.7	O K	
360 min Winter	85.694	1.354	4.9	7.3	O K	
480 min Winter	85.388	1.048	4.2	5.7	O K	
600 min Winter	85.164	0.824	3.7	4.4	O K	
720 min Winter	84.992	0.652	3.3	3.5	O K	
960 min Winter	84.746	0.406	2.8	2.2	O K	
1440 min Winter	84.458	0.118	2.1	0.6	O K	
2160 min Winter	84.381	0.041	1.6	0.2	O K	
2880 min Winter	84.373	0.033	1.3	0.2	O K	
4320 min Winter	84.364	0.024	0.9	0.1	O K	
5760 min Winter	84.359	0.019	0.7	0.1	O K	
7200 min Winter	84.356	0.016	0.6	0.1	O K	
8640 min Winter	84.354	0.014	0.6	0.1	O K	
10080 min Winter	84.353	0.013	0.5	0.1	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
30 min Winter	77.339	0.0	25			
60 min Winter	50.812	0.0	44			
120 min Winter	32.267	0.0	78			
180 min Winter	24.360	0.0	112			
240 min Winter	19.797	0.0	144			
360 min Winter	14.705	0.0	208			
480 min Winter	11.905	0.0	270			
600 min Winter	10.097	0.0	332			
720 min Winter	8.819	0.0	392			
960 min Winter	7.116	0.0	512			
1440 min Winter	5.248	0.0	750			
2160 min Winter	3.859	0.0	1100			
2880 min Winter	3.098	0.0	1420			
4320 min Winter	2.269	0.0	2204			
5760 min Winter	1.816	0.0	2864			
7200 min Winter	1.531	0.0	3672			
8640 min Winter	1.331	0.0	4464			
10080 min Winter	1.183	0.0	5168			
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4TH FLOOR 43 EAGLE STREET LONDON WC1R 4AT		
Date 22/03/2018 11:14 File SOAKAWAY DESIGN FOR 1 I...	Designed by jordanhutchins Checked by	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.311	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.069

Time (mins)		Area
From:	To:	(ha)
0	4	0.069

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4TH FLOOR 43 EAGLE STREET LONDON WC1R 4AT																						
Date 22/03/2018 11:14 File SOAKAWAY DESIGN FOR 1 I...	Designed by jordanhutchins Checked by																					
XP Solutions Source Control 2015.1																						
<u>Model Details</u> Storage is Online Cover Level (m) 87.340 <u>Lined Soakaway Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>1.98000</td> <td>Ring Diameter (m)</td> <td>2.10</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>1.98000</td> <td>Pit Multiplier</td> <td>1.5</td> </tr> <tr> <td>Safety Factor</td> <td>3.0</td> <td>Number Required</td> <td>1</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Invert Level (m)</td> <td>84.340</td> <td>Cap Infiltration Depth (m)</td> <td>0.000</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	1.98000	Ring Diameter (m)	2.10	Infiltration Coefficient Side (m/hr)	1.98000	Pit Multiplier	1.5	Safety Factor	3.0	Number Required	1	Porosity	0.30	Cap Volume Depth (m)	0.000	Invert Level (m)	84.340	Cap Infiltration Depth (m)	0.000
Infiltration Coefficient Base (m/hr)	1.98000	Ring Diameter (m)	2.10																			
Infiltration Coefficient Side (m/hr)	1.98000	Pit Multiplier	1.5																			
Safety Factor	3.0	Number Required	1																			
Porosity	0.30	Cap Volume Depth (m)	0.000																			
Invert Level (m)	84.340	Cap Infiltration Depth (m)	0.000																			
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APPENDIX F
SUDS IMPLEMENTATION PLAN

SUDS IMPLEMENTATION PLAN
FOR PROPOSED LODGE DEVELOPMENT
PLAS COCH, WREXHAM

- 4.1 This SUDS Implementation Plan sets out measures to be implemented during construction of the surface water drainage system for the scheme to ensure the site and areas downstream are protected from runoff during construction of the development. It is recommended that the plan is incorporated into the Contractors Construction Health and Safety Plan with the development carried out in accordance with the measures proposed.
- 4.2 It may not always be possible to ensure that new impermeable areas are immediately connected to the drainage system. Therefore, the following additional measures should be implemented to ensure construction runoff is appropriately managed:
- Protective coverings should be used to help prevent runoff stripping material stockpiles.
 - Plant and wheel washing should take place in a designated location. The area should be tanked and not allowed to discharge into the drainage system or infiltrate into the ground. Effluent should be treated as contaminated waste and disposed of offsite by a licensed waste management operator.
 - Surfaces used as access roads and storage areas during construction should be swept regularly to prevent the accumulation of dust and mud.
 - Should groundwater be encountered in excavations such water should not be discharged to the drainage system until the amount of suspended solids has been reduced though the controlled use of skips or tanks, which will act as stilling basins.
 - To prevent contamination associated with the use of oils and hydrocarbons during construction, the Contractor should ensure that the following precautionary measures are employed during construction:
 - Regular maintenance of machinery and plant.
 - Use of drip trays.
 - Regular checking of machinery and plant for oil leaks.
 - Use of correct storage facilities.
 - Regular checks for signs of wear and tear on tanks.
 - Specific procedures are followed when refuelling.
 - Use of a designated area for refuelling.
 - Emergency spill kit to be located near refuelling area.
 - Regular emptying of bunds.
 - Tanks should be located in secure areas to stop vandalism.
- 4.3 The above measures would help to ensure that untreated construction runoff would not be discharged to the surface water drainage system.
- 4.4 During construction all components of the drainage system should be constructed in accordance with relevant drawings, specifications and manufacturer's guidelines. Further to this Building Control should visit site on a regular basis to inspect completed works and ensure that the drainage system is installed correctly.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 1 of 1
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

APPENDIX G
SUDS MAINTENANCE PLAN

DRAINAGE MAINTENANCE & MANAGEMENT PLAN

FOR PROPOSED LODGE DEVELOPMENT

PLAS COCH

WREXHAM

- 4.1 This Drainage Management and Maintenance Plan provides details of the plan proposed for maintenance and management of the drainage scheme associated with the proposed lodge development at Plas Coch, Wrexham.
- 4.2 On occupation of the development, the maintenance and management plan should be incorporated into the sites Operation and Maintenance Manual with the as-built drainage system operated and maintained in accordance with the regime set out in the tables below.

Table 1: Below Ground Drainage System - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove all litter and debris from external hard landscaped areas and adjacent landscaping, which may pose a risk to the performance of the system.	Monthly.
	Remove build-up of sediment / silt in catch-pits and dispose of oils / petrol residues using safe standard practices.	As required.
	Stabilise and mow adjacent landscaped areas and remove weeds.	
Remedial actions	Repair or rehabilitate inlet and outlets to ensure they are in good condition and operating as designed.	As required.
	Remediate any landscaping, which has raised to within 50mm of the level of adjacent hard landscaping.	
Monitoring	Check of all inlets / outlets for blockages or evidence of physical damage with any necessary remedial action or clearance carried out if required.	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.
	Inspect all surfaces for ponding, or silt accumulation. Record areas where water is ponding for more than 48 hours and carry out any remedial work deemed necessary.	After severe storms.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 1 of 2
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

Table 2: Concrete Ring Manhole Soakaway - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for first 3 months of operation, then every 6 months.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly.
	Remove sediment from pre-treatment structures.	Annually, or as required.
	Repair/rehabilitation of inlet and perforated outlets.	As required.
Remedial actions	Inspect/check all inlets and perforated outlets to ensure that they are in good condition and operating as designed.	Annually and after large storms.
Monitoring		

4.3 The Site Manager should ensure that the Maintenance Contractor tasked with carrying out any maintenance works provides a risk assessment and method statement that adopts best practice health and safety policies for maintenance personnel throughout the duration of any maintenance works. Measures may include:

- Ensure the use of safe systems of work and procedures are followed.
- Certificated operatives only to be used for all confined space entry.
- Ensure appropriate PPE is worn at all times including the use of safety goggles, ear defenders and other relevant equipment when using high pressure jetting.
- Do not work in weather conditions where flooding or surging is likely.
- Erect barriers where appropriate and provide adequate lighting.
- No operations to be carried out by operatives working alone.
- Time maintenance to not conflict with other on-site activities.
- Method statement to be prepared and approved prior to entry into confined space.

JOB NO:	14998	ISSUE NO:	1	ISSUE DATE:	29.03.18	Page 2 of 2
AUTHOR:	J. Hutchins	OFFICE:	Henley-On-Thames	CHECKED BY:	G. Crowther	

APPENDIX H
WELSH WATER SEWER RECORDS

land at Plas Coch Public House, Plas Coch Road, Wrexham



LEGEND(Representative of most common features)

- Waste network:

 - Foul chamber
 - Surface water chamber
 - Combined chamber
 - Combined sewer overflow
 - Special purpose chamber
 - Treatment works
 - Pumping station
 - Combined
 - Surface Water
 - Foul
 - Former S24 sewers (for indicative purposes only)
- Outfall
 - Lamphole
 - Storm Overflow
 - Rising main
 - Gravity sewer
 - Private sewer
 - Private sewer subject to Sect. 104 adoption agreement
 - Private Sewer Transfer
 - Lateral Drain
 - Inspection Chamber

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation.

Dŵr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.

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