

HARTS FARM WAY UNIT 1 & ACCESS ROAD

DRAINAGE STRATEGY

for

Durngate Property Group

December 2013

Report Ref: 034.0036/AAM/MD/db/97356 (RevB)



Upton M^cGougan Limited

Partnership House
Moorside Road
Winchester
Hampshire SO23 7RX
T: 01962 834400
F: 01962 834411

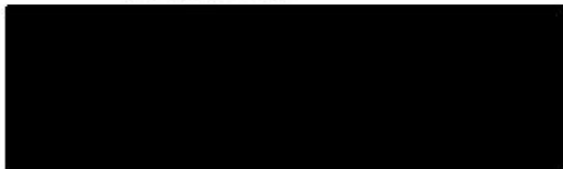
E: win@uptonmcgougan.com
W: www.uptonmcgougan.com

Document Control

Rev	Date	Purpose/ Status	Comments	Revised By
	01/08/2013			
	21/08/2013		Revised to suit EA Comments	MD
B	6/12/2013		Tidal Flood Levels Revised	MD

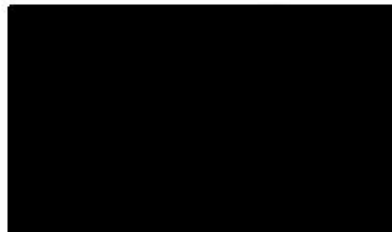
\\UMFSERV1\um-project-data\031-040\034\0036\Reports\Civils\97356 RevB Drainage Strategy.docx

Prepared by:



Mike Dewson
Associate

Approved by:



Disclaimer

This document has been prepared in accordance with the scope of Upton McGougan Ltd's appointment with its client and is subject to the terms of that appointment. It is addressed to and for the sole use and reliance of Upton McGougan Ltd's client. Upton McGougan Ltd accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of a Director of Upton McGougan Ltd. Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the document as a whole. The contents of this document are not to be construed as providing legal, business or tax advice or opinion.

© Upton McGougan Limited 2011

CONTENTS

1.0	INTRODUCTION.....	1
2.0	EXISTING SITE.....	2
3.0	UNIT 1 SURFACE WATER DRAINAGE STRATEGY.....	3
4.0	ACCESS ROAD SURFACE WATER DRAINAGE STRATEGY.....	6
5.0	FOUL WATER DRAINAGE STRATEGY	7

Appendices

Appendix A : Topographical Survey
Appendix B : Sewer Records
Appendix C : Green Field Run-off Rate
Appendix D : Unit 1 Proposed Drainage Layout & Details
Appendix E : Drainage Calculations
Appendix F : Access Road Proposed Drainage Layout

Tables

Table 1 - Existing Brownfield Runoff Rates	3
Table 2 - Existing Greenfield Runoff Rates	3
Table 3 - Comparison of Unit 1 Flow Rates.....	4
Table 4 - Comparison Of Access Road Flow Rates	6

1.0 INTRODUCTION

- 1.1.1 This report has been prepared in pursuance of discharge of Conditions 3(ii) (g), 9 and 10 of the outline Planning Permission ref: APP/10/00737 for the redevelopment of the former Harts Farm Way Depot, Havant.
- 1.1.2 In summary, the conditions to relate to the submission of foul water and surface water drainage proposals for approval prior to works commencing.
- 1.1.3 The site is to be developed on a phased basis therefore this report relates only to the first phase of the development, known as Unit 1, and access road which will serve it.

2.0 EXISTING SITE

- 2.1.1 The existing site was formally an old council depot which has since been cleared of all superstructures with only the hard standings and old foundations remaining, the site is almost entirely hard paved however there is a stream running east-west through the centre with some soft landscape each side.
- 2.1.2 Surface water runoff from the existing site is drained via gullies and channels into the existing stream, there are no known petrol interceptors or attenuation facilities present.
- 2.1.3 A topographical survey has been completed post site clearance and this can be found in Appendix A.
- 2.1.4 Southern Water are the sewerage undertaker for the area and their records can be found in Appendix B, it should be noted that there are trunk sewers running north-south through the centre of the site and also in the south west corner.

3.0 UNIT 1 SURFACE WATER DRAINAGE STRATEGY

- 3.1.1 It is proposed to discharge surface water runoff from the site into the aforementioned stream via new outfalls as existing ground conditions will not facilitate the use of infiltration devices.
- 3.1.2 In order to comply with the requirements of the National Planning Policy Framework it is proposed to attenuate surface water runoff in order to reduce flood risk elsewhere and adopt a sustainable approach.
- 3.1.3 The existing hard paved area of Unit 1 occupies some 12,000m², an estimate of the rate of surface water runoff generated by this area has been made using the modified rationale method and rainfall depths for a variety of return periods using the FEH DDF Model for the given site location and a storm duration of 1 hour, the results are tabulated below:

	Return Period			
	1/1 Yr	1/2 Yr	1/30 Yr	1/100 Yr
Rainfall Depth	4.5mm	9.5mm	24.1mm	35mm
Runoff Rate	15 l/s	31.7 l/s	80.4 l/s	116.8 l/s

Table 1 - Existing Brownfield Runoff Rates

- 3.1.4 In order to adopt a sustainable approach it is to attenuate runoff rates to as close as possible to green field runoff rates, whilst ensuring that the risk of blockage of any surface water control is minimised as far as possible.
- 3.1.5 Green field runoff rates have been estimated using the Windes software ICP SUDS method, the results can be found in Appendix C and have been tabulated below:

	Return Period			
	1/1 Yr	1/2 Yr	1/30 Yr	1/100 Yr
GFRR	4.3 l/s	4.5 l/s	11.6 l/s	16.3 l/s

Table 2 - Existing Greenfield Runoff Rates

- 3.1.6 It is proposed to use a Vortex type control to restrict flows and to optimise attenuation volumes, in order to ensure that the control will not be subject to continual blockage the flows will be restricted to a minimum of 5l/s through each device, as per current codes of practice.
- 3.1.7 The proposed site layout is relatively elongated with service yards at each end, it will therefore not be possible to discharge all of the surface water runoff through a single outfall due to the relatively shallow depth of the stream, two outfalls will therefore be required at each end of the development.

- 3.1.8 In order to ensure that flows are restricted for a range of storm return periods it is proposed to use a complex control in the form of a twin vortex control, each device having a minimum flow rate of 5 l/s.
- 3.1.9 As two outfalls will be used, each having a minimum discharge rate of 5 l/s it can be seen that the minimum total discharge rate for the lower order return periods will be 10 l/s, although this is higher than the green field run off rate it remains significantly lower than the existing runoff rate, thus reducing flood risk overall and meeting the requirements of policy.
- 3.1.10 The total runoff rates for both outfalls for a variety of returns periods have been tabulated below with the corresponding greenfield runoff rate.

Return Period:	1/1 Year	1/2 Year	1/30 Year	1/100 Year + CC
Green Field Runoff Rate	4.3 l/s	4.5 l/s	11.6 l/s	16.3 l/s
Total Proposed Runoff Rate	9.9 l/s	10.0 l/s	12.7 l/s	16.4 l/s
Existing Runoff Rate	15.0 l/s	31.7 l/s	80.4 l/s	116.8 l/s
Reduction in Flows	5.1 l/s	21.7 l/s	67.7 l/s	100.40 l/s

Table 3 - Comparison of Unit 1 Flow Rates

- 3.1.11 It is proposed to use shallow cellular storage beneath the car park area of the new development, a plan of the proposed surface water drainage can be found in Appendix D which clearly shows the network, controls and cellular storage, details of the controls are also included in the appendix.
- 3.1.12 It should be noted that the service yards will be drained through bypass separators prior to discharge to the network, however the car park area will be drained through a permeable paving system in order to facilitate the use of shallow cellular storage, it is not possible to lower the hydraulic gradient of the system any further due to the shallow depth of the stream.
- 3.1.13 Detailed calculations of the surface water drainage systems can be found in Appendix E, the calculations have been split into two networks, representing the two outfalls, it should be noted that rainfall intensities have been increased by 30% to allow for the effects of climate change.
- 3.1.14 The cellular storage provision has been set out within the calculations, this is shown as 370 m³ for network 1 (page 3 of the calculations) and 234m³ for network 2 (again, page 3 of the calculations).
- 3.1.15 The volume of storage is suitable for the site runoff however network 1 shows some slight flooding at the upstream end during a 1 in 100 year event, the chambers that will flood are located in a landscaped area at the rear of the building. The total volume of flooding is 16.225m³, the length of the landscaped area is approximately 90m and it is approximately 5.0m wide, therefore the depth of flooding will be

approximately 36mm, any ponding of surface water should not present any risk to property or health and is manageable.

- 3.1.16 The Location of the permavoid storage is beneath the car parking area, as shown on the drawings in appendix D.
- 3.1.17 The stream diversion ultimately discharges to Langstone Harbour which has a maximum tide level of approximately 2.30m AOD, this is some 400m lower than the surface water drainage outfalls, therefore there is no risk of tide locking during normal conditions, the predicted 1 in 200 year tidal flood level is circa 3.30m AOD and should this coincide with a high order rainfall event there could be some surface flooding of the external areas, approximately 100m deep, however the building will not be at risk by virtue of the floor level being some 800mm higher than the access road thus facilitating flood routing during an extreme event.
- 3.1.18 The predicted 2070 tidal flooding, ie allowing for climate change, as advised by the EA, is 3.80m AOD, the finished floor level of the new building will be 300mm above this level therefore providing an adequate degree of freeboard protection, the external levels of the new building are also higher than this level however, as for the present day scenario, should the tidal flood coincide with a high order rainfall event there could be some flooding of external areas to a depth of 100mm.

4.0 ACCESS ROAD SURFACE WATER DRAINAGE STRATEGY

- 4.1.1 The access road forms part of the site wide infrastructure works for the Harts Farm Way development, these infrastructure works also include the stream diversion and its associated green corridor.
- 4.1.2 The access road is to be built to the adoptable standards of Hampshire County Council who have specific requirements in terms of highway drainage, due to the shallow nature of the stream it will not be possible to provide any attenuation storage whilst maintaining the minimum requirements for cover, therefore highway drainage will be discharged direct to the stream.
- 4.1.3 It is not proposed to pass runoff from the access road through petrol interceptors as the road will not be used for parking, deep trapped gullies are proposed however in order to control silt and debris. A plan of the highway drainage and green corridor can be found in Appendix F.
- 4.1.4 The total proposed hard paved area of the access road is 2343m² and the total existing soft landscaped within the area of the access road is 200m² therefore this will result in an increase of some 200m² of impermeable area, however the green corridor will result in 1330m² of existing hard paving being removed and landscaped, it is therefore concluded that the infrastructure works will result in a reduction of 1130m² of hard paving area.
- 4.1.5 This reduction in hard paved area will result in a reduction of surface water runoff to the stream and this is quantified below, the rainfall depths have been obtained from the FEH CD ROM for a 1 hour duration storm

Return Period:	1/2 Year	1/10 Year	1/30 Year	1/50 Year	1/100 Year
Rainfall Depth	10.3mm	18.6mm	26.5mm	31.0mm	38.6mm
Existing Peak Flow	9.94 l/s	17.95 l/s	25.57 l/s	29.91 l/s	37.25 l/s
Post Development Peak Flow	6.71 l/s	12.12 l/s	17.26 l/s	20.20 l/s	25.14 l/s
Runoff Reduction	3.23 l/s	5.83 l/s	8.31 l/s	9.71 l/s	12.11 l/s

Table 4 - Comparison Of Access Road Flow Rates

- 4.1.6 It can therefore be seen that the access road and green corridor proposals will result in lower flows thus reducing flood risk.

5.0 FOUL WATER DRAINAGE STRATEGY

- 5.1.1 It has been previously stated that there are foul trunk sewers running through the site, it is therefore proposed to discharge foul water effluent from the new development into the existing trunk sewer via a new gravity connection.
- 5.1.2 Should a foul water connection be required to serve any refuse / recycling area in the north-west corner of Unit 1 a mini package pumping station will be required due to its remoteness from the foul sewer.
- 5.1.3 The layout of the foul drains is also shown on the drawing found in Appendix D.

Appendix A : Topographical Survey

Appendix B : Sewer Records

SEWER RECORDS PAGE 1 OF 2

106142



105565

O.S. REF. SU7005NE Title: 111140_Site 4 Harts Farm Way,	Drawn by: roysaya	The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. WARNING: SAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (LHR) materials may include Bonded Asbestos Cement Based upon Ordnance Survey Digital Data with the permission of the controller of I.L.M.S.O. Crown Copyright Reserved Licence No. WU 298530.		
	Scale: 1:2500 Date: 09/12/2010			

471075

Appendix C : Green Field Run-off Rate

Upton McGougan UK Limited		Page 1
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 Harts Farm Way Greenfield Runoff Rates	
Date 19 July 2013 File	Designed by MLH Checked by	
Micro Drainage		Source Control 2013.1.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 Soil 0.400 Area (ha) 1.500 Urban 0.000 SAAR (mm) 700 Region Number Region 7 Results 1/s QBAR Rural 5.1 QBAR Urban 5.1 Q2 years 4.5 Q1 year 4.3 Q30 years 11.6 Q100 years 16.3		
©1982-2013 Micro Drainage Ltd		

Appendix D : Unit 1 Proposed Drainage Layout & Details

CDM Regulations 2007 : Reg. 11

In preparing the design shown on this and related drawings Upton McGoogan has considered and, where reasonably practicable, avoided foreseeable risks. Significant risks, which remain, are listed below and identified thus Δ and should be given particular attention by all those carrying out works of construction or of future maintenance.

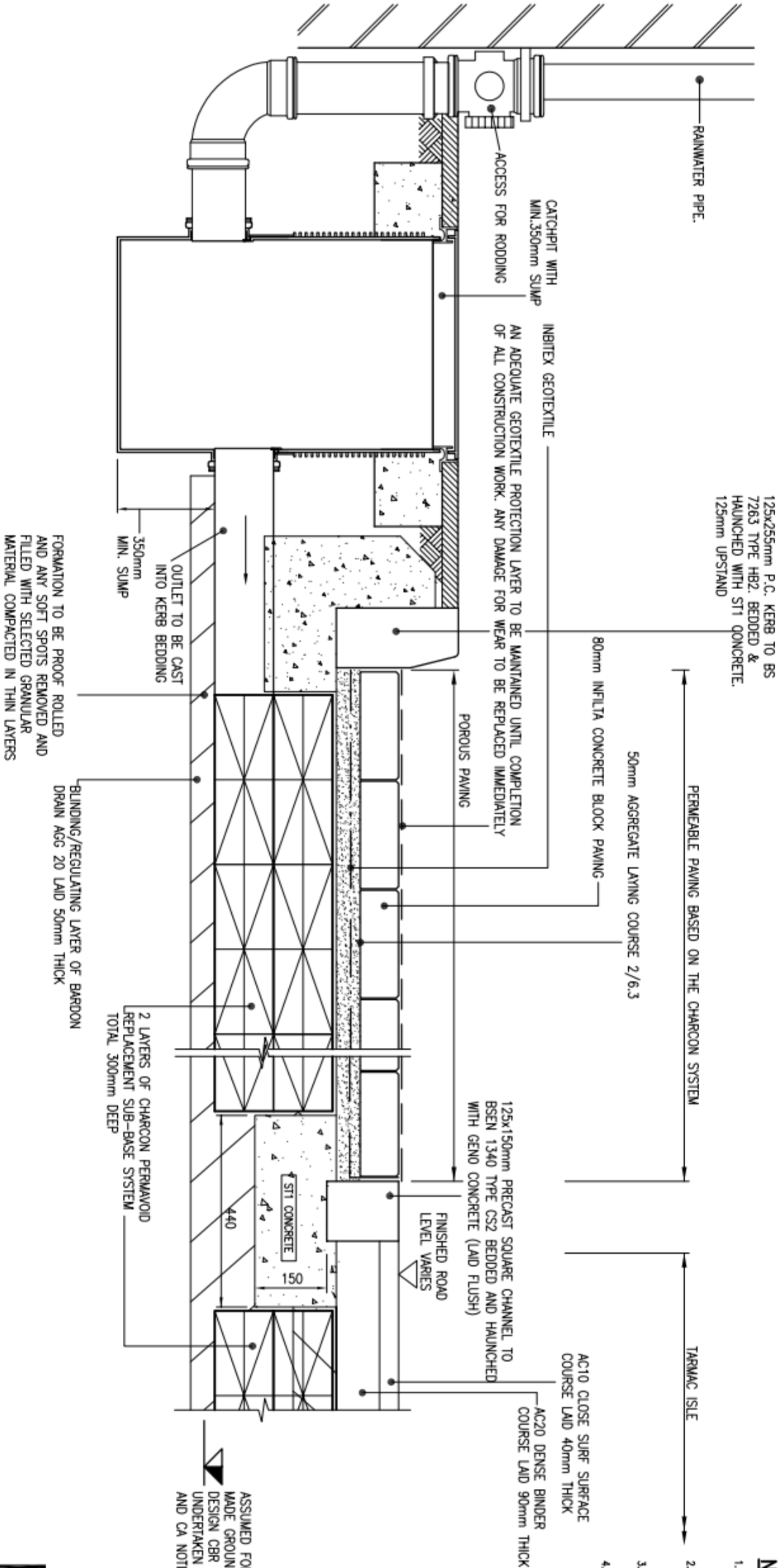
1. no significant risks
2.
3.



None of the above is deemed to relieve any contractor of his obligations under all applicable health and safety legislation.

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIMIST DRAWINGS AND SPECIFICATION.
2. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN THESE DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER IN WRITING FOR CLARIFICATION.
3. ALL DIMENSIONS ARE IN MILLIMETRES. ALL LEVELS ARE IN METRES. DO NOT SCALE THIS DRAWING. PRINT, PLOT OR DISK.
4. THIS DRAWING IS THE COPYRIGHT OF THE CONSULTANTS AND MUST NOT BE REPRODUCED OR USED WITHOUT THEIR PERMISSION.



ASSUMED FORMATION LEVEL POST SITE STRIP.
MADE GROUND TO BE PROOF ROLLED TO ACHIEVE DESIGN CBR OF 15%, CBR TESTS TO BE UNDERTAKEN @ 20.0m CENTRES ON CENTRE LINE AND CA NOTIFIED IMMEDIATELY OF RESULTS.

PRELIMINARY

20 JULY 2013

This supersedes earlier issues of this drawing

PRELIMINARY ISSUE

Revision P1 LG 20.07.13

Drawn Date Checked Date

LG 20.07.13

Scale

NOT TO SCALE

(AT A3 SIZE)

Drawing Number

034.0036-2149

Rev

P1

Project

HARTS FARM WAY
HAVANT

Drawing Title

CAR PARK
CONSTRUCTION DETAILS



Upton McGoogan Ltd
Partnership House
Moorside Road, Winchester
Hampshire, SO23 7RX
Tel: 01962 834400
Fax: 01962 834411



website: www.uptonmcgoogan.com
email: win@uptonmcgoogan.com



UPTON
McGOOGAN
CONSULTING ENGINEERS

1. no significant risks
- 2.
- 3.

NOTES

-
- 300 PERMAVOID CONNECTOR PIPE
- 300 STAGGER
- 300mm DIA. INLET
- 150mm DIA. OUTLET
- NEOPRENE RUBBER GASKET
- ROCKER PIPE. LENGTH = 0.5-0.75m
- JOINT TO BE AS CLOSE AS PRACTICABLE TO FACE OF MANHOLE TO PERMIT SATISFACTORY JOINT AND SUBSEQUENT MOVEMENT.
- SHORT LENGTH PIPE TO BE SIMILAR LENGTH TO ROCKER PIPE.
- TBC
- 300



—HYDRO-BRAKE

HYDRO-BRAKE
FLOW CONTROL
FITTED WITH PIVOTING
BY-PASS DOOR
150mm DIA.
(IL 3.00)

TO STREAM —→

PRELIMINARY

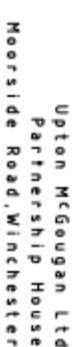
21 AUGUST 2013

Project

HARTS FARM WAY
HAVANT

Drawing Title

NETWORK 2 HYDROBRAKE CONSTRUCTION DETAIL



Hampshire, S023 7RX
Tel: 01962 834400
Fax: 01962 834411



website: www.upfomcgonan.com
email: info@upfomcgonan.com



P2

034.0036-2164

Appendix E : Drainage Calculations

Upton McGougan UK Limited		Page 1
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 1/WESTERN SIDE	
Date 19 July 2013 File Network 1.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	32.000	0.120	266.7	0.100	4.00	0.0	0.600	o	300
1.001	53.000	0.210	252.4	0.150	0.00	0.0	0.600	o	300
1.002	31.000	0.110	281.8	0.050	0.00	0.0	0.600	o	300
1.003	40.500	0.140	289.3	0.160	0.00	0.0	0.600	o	300
1.004	18.000	0.120	150.0	0.220	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.56	3.350	0.100	0.0	0.0	0.0	0.96	67.7	0.0
1.001	0.00	5.45	3.230	0.250	0.0	0.0	0.0	0.99	69.6	0.0
1.002	0.00	6.01	3.020	0.300	0.0	0.0	0.0	0.93	65.8	0.0
1.003	0.00	6.74	2.910	0.460	0.0	0.0	0.0	0.92	65.0	0.0
1.004	0.00	7.11	2.770	0.680	0.0	0.0	0.0	0.82	14.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	Headwall	4.150	2.650	2.650	0	0

Upton McGougan UK Limited		Page 2
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 1/WESTERN SIDE	
Date 19 July 2013 File Network 1.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

Online Controls for Storm

Complex Manhole: 6, DS/PN: 1.004, Volume (m³): 3.9

Hydro-Brake®

Design Head (m) 0.550 Hydro-Brake® Type Md5 SW Only Invert Level (m) 2.770
Design Flow (l/s) 5.0 Diameter (mm) 105

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	7.3	3.000	11.5	7.000	17.6
0.200	4.5	1.400	7.9	3.500	12.4	7.500	18.2
0.300	4.4	1.600	8.4	4.000	13.3	8.000	18.8
0.400	4.5	1.800	8.9	4.500	14.1	8.500	19.3
0.500	4.8	2.000	9.4	5.000	14.8	9.000	19.9
0.600	5.2	2.200	9.8	5.500	15.6	9.500	20.5
0.800	5.9	2.400	10.3	6.000	16.3		
1.000	6.6	2.600	10.7	6.500	16.9		

Hydro-Brake®

Design Head (m) 0.620 Hydro-Brake® Type Md7 Invert Level (m) 3.320
Design Flow (l/s) 2.6 Diameter (mm) 69

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.5	3.000	5.6	7.000	8.5
0.200	1.4	1.400	3.8	3.500	6.0	7.500	8.8
0.300	1.8	1.600	4.1	4.000	6.4	8.000	9.1
0.400	2.0	1.800	4.3	4.500	6.8	8.500	9.4
0.500	2.3	2.000	4.5	5.000	7.2	9.000	9.6
0.600	2.5	2.200	4.8	5.500	7.5	9.500	9.9
0.800	2.9	2.400	5.0	6.000	7.9		
1.000	3.2	2.600	5.2	6.500	8.2		

Upton McGougan UK Limited		Page 3
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 1/WESTERN SIDE	
Date 19 July 2013 File Network 1.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

Storage Structures for Storm

Cellular Storage Manhole: 6, DS/PN: 1.004

Invert Level (m) 3.240 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	1232.4	1232.4	0.301	0.0	1289.2
0.300	1232.4	1289.2			

Upton McGougan UK Limited		Page 6
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 1/WESTERN SIDE	
Date 19 July 2013 File Network 1.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 Site Location GB 470600 106250 SU 70600 06250
 C (1km) -0.029
 D1 (1km) 0.459
 D2 (1km) 0.293
 D3 (1km) 0.377
 E (1km) 0.310
 F (1km) 2.223
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

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

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	60 Summer	30	+30%	30/60 Summer	100/60 Summer			4
1.001	60 Summer	30	+30%	30/60 Summer	100/60 Summer			3
1.002	60 Summer	30	+30%	1/60 Summer				
1.003	60 Summer	30	+30%	1/60 Summer	100/480 Winter			1
1.004	480 Winter	30	+30%	1/60 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	1	3.882	0.232	0.000	0.32	0.0	19.9	FLOOD RISK
1.001	2	3.858	0.328	0.000	0.75	0.0	49.2	FLOOD RISK
1.002	3	3.737	0.417	0.000	0.98	0.0	58.7	SURCHARGED
1.003	4	3.629	0.419	0.000	1.46	0.0	88.5	SURCHARGED
1.004	6	3.451	0.531	0.000	0.49	0.0	6.7	SURCHARGED

Upton McGougan UK Limited		Page 1
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	37.000	0.215	172.1	0.050	4.00	0.0	0.600	o	225
1.001	24.000	0.110	218.2	0.150	0.00	0.0	0.600	o	300
1.002	13.000	0.050	260.0	0.220	0.00	0.0	0.600	o	300
1.003	13.000	0.087	150.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	4.62	3.450	0.050	0.0	0.0	0.0	0.99	39.5	0.0
1.001	0.00	5.00	3.160	0.200	0.0	0.0	0.0	1.06	75.0	0.0
1.002	0.00	5.22	3.050	0.420	0.0	0.0	0.0	0.97	68.6	0.0
1.003	0.00	5.49	3.000	0.420	0.0	0.0	0.0	0.82	14.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	Headwall	3.900	2.913	2.760	0	0

Upton McGougan UK Limited		Page 2
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

Online Controls for Storm

Hydro-Brake® Manhole: 4, DS/PN: 1.003, Volume (m³): 1.9

Design Head (m) 0.500 Hydro-Brake® Type Md7 Invert Level (m) 3.000
Design Flow (l/s) 6.5 Diameter (mm) 116

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	9.9	3.000	15.7	7.000	24.0
0.200	4.1	1.400	10.7	3.500	17.0	7.500	24.9
0.300	5.0	1.600	11.5	4.000	18.2	8.000	25.7
0.400	5.7	1.800	12.2	4.500	19.3	8.500	26.5
0.500	6.4	2.000	12.8	5.000	20.3	9.000	27.2
0.600	7.0	2.200	13.5	5.500	21.3	9.500	28.0
0.800	8.1	2.400	14.1	6.000	22.2		
1.000	9.1	2.600	14.6	6.500	23.2		

Upton McGougan UK Limited		Page 3
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

Storage Structures for Storm

Cellular Storage Manhole: 4, DS/PN: 1.003

Invert Level (m) 3.270 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	780.0	780.0	0.301	0.0	819.4
0.300	780.0	819.4			

Upton McGougan UK Limited		Page 4
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
 Site Location GB 470600 106250 SU 70600 06250
 C (1km) -0.029
 D1 (1km) 0.459
 D2 (1km) 0.293
 D3 (1km) 0.377
 E (1km) 0.310
 F (1km) 2.223
 Cv (Summer) 0.750
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

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

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	60 Summer	1	+30%	100/60 Summer				
1.001	60 Summer	1	+30%	30/60 Summer				
1.002	120 Winter	1	+30%	30/60 Summer				
1.003	240 Winter	1	+30%	1/60 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	1	3.501	-0.174	0.000	0.11	0.0	4.1	OK
1.001	2	3.326	-0.134	0.000	0.23	0.0	15.5	OK
1.002	6	3.311	-0.039	0.000	0.35	0.0	19.5	OK
1.003	4	3.305	0.155	0.000	0.38	0.0	5.0	SURCHARGED

Upton McGougan UK Limited		Page 5
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage Network 2013.1.1		

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Site Location GB 470600 106250 SU 70600 06250	
C (1km)	-0.029
D1 (1km)	0.459
D2 (1km)	0.293
D3 (1km)	0.377
E (1km)	0.310
F (1km)	2.223
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

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

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	60 Summer	2	+30%	100/60 Summer				
1.001	60 Summer	2	+30%	30/60 Summer				
1.002	240 Winter	2	+30%	30/60 Summer				
1.003	240 Winter	2	+30%	1/60 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	1	3.507	-0.168	0.000	0.14	0.0	5.1	OK
1.001	2	3.342	-0.118	0.000	0.29	0.0	19.2	OK
1.002	6	3.326	-0.024	0.000	0.29	0.0	16.5	OK
1.003	4	3.321	0.171	0.000	0.39	0.0	5.1	SURCHARGED

Upton McGougan UK Limited		Page 6
6 Forres Street Edinburgh Scotland EH3 6BJ	034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE	
Date 19 July 2013 File Network 2.mdx	Designed by MLH Checked by	
Micro Drainage	Network 2013.1.1	

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

Simulation Criteria

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep      Fine Inertia Status OFF
      DTS Status      ON
```

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

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	60 Summer	30	+30%	100/60 Summer				
1.001	60 Summer	30	+30%	30/60 Summer				
1.002	60 Summer	30	+30%	30/60 Summer				
1.003	360 Winter	30	+30%	1/60 Summer				

PN	US/MH Name	Water	Surch'd Depth (m)	Flooded	Flow / Cap.	O'flow	Pipe	Status
		Level (m)		Volume (m³)		(l/s)	Flow (l/s)	
1.000	1	3.565	-0.110	0.000	0.31	0.0	11.6	OK
1.001	2	3.533	0.073	0.000	0.69	0.0	45.7	SURCHARGED
1.002	6	3.480	0.130	0.000	1.69	0.0	95.1	SURCHARGED
1.003	4	3.434	0.284	0.000	0.45	0.0	6.0	SURCHARGED

Upton McGougan UK Limited			Page 7																																																						
6 Forres Street Edinburgh Scotland EH3 6BJ		034.0036 HARTS FARM WAY NETWORK 2/EASTERN SIDE																																																							
Date 19 July 2013 File Network 2.mdx		Designed by MLH Checked by																																																							
Micro Drainage		Network 2013.1.1																																																							
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																																																									
<u>Simulation Criteria</u>																																																									
Areal Reduction Factor 1.000		Additional Flow - % of Total Flow 0.000																																																							
Hot Start (mins) 0		MADD Factor * 10m³/ha Storage 2.000																																																							
Hot Start Level (mm) 0		Inlet Coefficient 0.800																																																							
Manhole Headloss Coeff (Global) 0.500		Flow per Person per Day (l/per/day) 0.000																																																							
Foul Sewage per hectare (l/s) 0.000																																																									
Number of Input Hydrographs 0		Number of Storage Structures 1																																																							
Number of Online Controls 1		Number of Time/Area Diagrams 0																																																							
Number of Offline Controls 0		Number of Real Time Controls 0																																																							
<u>Synthetic Rainfall Details</u>																																																									
Rainfall Model		FEH																																																							
Site Location GB 470600 106250 SU 70600 06250																																																									
C (1km)		-0.029																																																							
D1 (1km)		0.459																																																							
D2 (1km)		0.293																																																							
D3 (1km)		0.377																																																							
E (1km)		0.310																																																							
F (1km)		2.223																																																							
Cv (Summer)		0.750																																																							
Cv (Winter)		0.840																																																							
Margin for Flood Risk Warning (mm) 300.0		DVD Status OFF																																																							
Analysis Timestep		Fine Inertia Status OFF																																																							
DTS Status		ON																																																							
Profile(s)		Summer and Winter																																																							
Duration(s) (mins) 60, 120, 240, 360, 480, 960, 1440																																																									
Return Period(s) (years) 1, 2, 30, 100																																																									
Climate Change (%) 30, 30, 30, 30																																																									
PN	Storm	Return Climate Period Change	First X Surge	First Y Flood	First Z Overflow	O/F Act. Lvl Exc.																																																			
1.000	60 Summer	100 +30%	100/60 Summer																																																						
1.001	60 Summer	100 +30%	30/60 Summer																																																						
1.002	60 Summer	100 +30%	30/60 Summer																																																						
1.003	360 Winter	100 +30%	1/60 Summer																																																						
<table><tr><th rowspan="2">PN</th><th rowspan="2">US/MH Name</th><th colspan="2">Water</th><th colspan="2">Flooded</th><th colspan="2">Pipe</th><th rowspan="2">Status</th></tr><tr><th>Level (m)</th><th>Surch'd Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>O'flow (l/s)</th><th>Flow (l/s)</th></tr><tr><td>1.000</td><td>1</td><td>3.827</td><td>0.152</td><td>0.000</td><td>0.44</td><td>0.0</td><td>16.3</td><td>FLOOD RISK</td></tr><tr><td>1.001</td><td>2</td><td>3.782</td><td>0.322</td><td>0.000</td><td>0.98</td><td>0.0</td><td>65.6</td><td>FLOOD RISK</td></tr><tr><td>1.002</td><td>6</td><td>3.673</td><td>0.323</td><td>0.000</td><td>2.44</td><td>0.0</td><td>137.5</td><td>FLOOD RISK</td></tr><tr><td>1.003</td><td>4</td><td>3.528</td><td>0.378</td><td>0.000</td><td>0.50</td><td>0.0</td><td>6.6</td><td>SURCHARGED</td></tr></table>							PN	US/MH Name	Water		Flooded		Pipe		Status	Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	1.000	1	3.827	0.152	0.000	0.44	0.0	16.3	FLOOD RISK	1.001	2	3.782	0.322	0.000	0.98	0.0	65.6	FLOOD RISK	1.002	6	3.673	0.323	0.000	2.44	0.0	137.5	FLOOD RISK	1.003	4	3.528	0.378	0.000	0.50	0.0	6.6	SURCHARGED
PN	US/MH Name	Water		Flooded		Pipe			Status																																																
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)																																																		
1.000	1	3.827	0.152	0.000	0.44	0.0	16.3	FLOOD RISK																																																	
1.001	2	3.782	0.322	0.000	0.98	0.0	65.6	FLOOD RISK																																																	
1.002	6	3.673	0.323	0.000	2.44	0.0	137.5	FLOOD RISK																																																	
1.003	4	3.528	0.378	0.000	0.50	0.0	6.6	SURCHARGED																																																	
©1982-2013 Micro Drainage Ltd																																																									

Appendix F : Access Road Proposed Drainage Layout

