



Carpark Drake Way, Reading Drainage Strategy

For Diageo Pension Trust Ltd

Date: 18 November 2020

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DOCUMENT CONTROL SHEET

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1	Preliminary	04.11.2020	Planning
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1. INTRODUCTION

This report has been produced in support of the planning application for the proposed car park site at Drake Way, Reading in Reading Borough Council.

The surface water drainage strategy has been produced in accordance with Reading Borough Council requirements.

A Flood Risk Assessment (FRA) has also been prepared for the wider site, prepared by Peter Brett Associates, Ref No. R001/RevB dated September 2012 and should be read in conjunction with this drainage strategy.

Proposed Drainage drawings for the site are contained within Appendix A.

2. SURFACE WATER STRATEGY

2.1 Existing Site

Located off Drake Way, the site is a vacant area with access provided from the accessway into the BMW dealership.

The approximate ordnance survey grid reference of the site is SU 71192 70526, postcode is RG2 0NX.

Foudry Brook is located approximately 100m to the west of the site, and the site generally falls in a south westerly direction towards this Brook.

As mentioned above, a Flood Risk Assessment (FRA) was prepared for the wider site area of the BMW development, including the parcel of land (the site) that was remediated but left undeveloped. The drainage strategy set out in this FRA included the provision of SUDs elements, including permeable paving to limit discharge from the site to brownfield runoff rates with 50% betterment to Foudry Brook. At the time of writing this report as built survey or below ground drainage survey was not available, however based on the proposed drainage strategy included in the FRA we have indicatively shown existing drainage from the BMW development out to Foudry Brook.

As set out in the FRA, ground remediation works were undertaken on the whole of the site however despite these works it is considered that infiltration is not appropriate for the site. This is to limit any impact on groundwater and the leaching of potential contaminants.

The proposed drainage strategy for the carpark follows the strategy set out in the FRA, with requirements updated to suit current regulations and Council standards.

2.2 Surface Water Design

Surface water from the site will be collected via road gullies or drain directly onto the permeable paving surface.

Permeable paving is proposed across all of the parking bays, with the subbase comprising open graded crushed rock (OGCR) providing attenuation for the site. Water will then be collected and piped into a new pipe run adjacent to the site access and drain to the existing Thames Water surface water system in Drake Way. Due to ground water conditions this system will be a lined (tanked) system.

2.3 Discharge rates

In accordance with Reading Borough Council Sustainable Design and Construction Supplementary Planning Document (SPD) the drainage strategy for the site has been prepared in accordance with CIRIA C753 SuDS Manual and DEFRA's Non-Statutory technical Standards.

Greenfield runoff rates for the site, based on an area of 0.228ha were calculated using the UK SuDS drainage tool, which utilises the Wallingford procedure. Full results are contained within Appendix B, table 2.1 below summarises the greenfield runoff rates for the site.

Table 2.1: Greenfield Runoff Rates

Storm Event	Discharge Rate (l/s)
1yr Event	0.32
QBAR (approx 2.3yr event)	0.37
30yr Event	0.86
100yr Event	1.19

In accordance with EA guidelines and industry best practice the minimum site discharge from a site is 5l/s on the basis of blockage risks, however flow rates may be set to lower rates where possible if the blockage risk can be addressed.

In accordance with the Design and Construction Guidance for foul and surface water sewers, by Water UK, dated March 2020, Section C7.12 states;

The design of flow control devices should, wherever practicable, include the following features:

- a) flow controls may be static (such as vortex flow controls or fixed orifice plates) or variable (such as pistons or slide valves);*
- b) where debris can enter the control (e.g., where the upstream system is open or where the inlets are gullies), static controls should have a minimum opening size of 100 mm, or equivalent;*
- c) where the design of the upstream system will prevent debris entering the system (e.g., underground systems where the inlets are pervious pavement systems), static controls should have a minimum opening size of 50 mm;*
- d) variable controls may have a smaller opening provided they have a self-cleansing mechanism;*
- e) a bypass should be included with a surface operated penstock or valve; and*
- f) access should be provided to the upstream and downstream sections of a flow control device to allow maintenance.*

The proposed attenuation system for the site is a lined permeable paving system, therefore the minimum ideal opening size for any flow controls is 50mm. However, to ensure the maximum discharge from the site is limited to 5l/s maximum, smaller orifices may be required. Further detail is provided in the following section.

2.4 MicroDrainage Results

The surface water drainage attenuation has been modelled using Microdrainage for a range of events including the 1 in 1year, 1 in 30year and 1 in 100year + 40% climate change event.

In accordance with regulations, the piped network has been designed to ensure there is no flooding up to and including the 1 in 30yr event. The network has also been designed to ensure flooding in the 1 in 100yr event will be safely contained on site and will not increase flood risk elsewhere. With an OGCR layer (with 30% voids) of 350mm, the results show there is no flooding in the 100yr + 40% climate change event.

Please note pipes 1.000, 2.000 and 3.000 are dummy pipes for the permeable paving systems.

While the permeable paving systems are shallow, it was found that in order to ensure water builds up in each permeable paving area orifices less than 50mm are required.

As calculated using MicroDrainage, four (4) outlet controls are required to ensure the maximum discharge from the site is a maximum 5l/s. This is achieved by having orifices on each permeable paving system, between 35-50mm and having a flow control manhole before discharging to Drake Way. The resulting proposed discharge flow rate from the site for the 100yr + 40% CC event is 4.9l/s.

2.5 The Drainage Hierarchy

The drainage hierarchy and reasoning for using or not using each level is as follows:

Table 2.2: Drainage Hierarchy

Level	Hierarchy Description	Included?
1	Store rainwater for later use	No, not appropriate for the development as there is no use for stored water.
2	use infiltration techniques, such as porous surfaces in non-clay areas	The site is not suitable for soakaway or infiltration drainage.
3	attenuate rainwater in ponds or open water features for gradual release	Due to site and spatial constraints it is not possible to have any above ground attenuation systems.
4	attenuate rainwater by storing in tanks or sealed water features for gradual release	Yes, below ground attenuation via lined (sealed) permeable paving system.
5	discharge rainwater direct to a watercourse/water body	No, we have no way of connecting to Foundary Brook as this is private land.
6	discharge rainwater to a surface water sewer/drain	Yes, we are connecting to the existing Thames Water surface water system.
7	discharge rainwater to the combined sewer.	No, not required.

It is proposed to comply with level 4 and 6.

2.6 Suitability of Infiltration

As mentioned above infiltration methods have been ruled out due to ground and ground water conditions. Please refer to the FRA.

2.7 Suitability of SUDS features

The following SUDS features have been considered during the design process, the table states which features have been incorporated and which have been excluded and reasons for their exclusion.

Table 2.3: Suitability of SuDS Features

SuDS Feature	Incorporated within design	Reasoning
Green Roofs/BluRoofs	No	Due to development type.
Brown roofs	No	Due to development type.
Attenuation Pond (above ground)	No	Attenuation ponds have been excluded due to lack of available space and site constraints.
Rainwater Harvesting	No	Rainwater harvesting is not effective for this type of development where there is no use for harvested water
Infiltration methods	No	Infiltration was ruled out due to ground conditions and ground water.
Raingardens/Bio-retention areas	No	Excluded due to lack of available space and ground conditions.
Filter strips and swales	No	Excluded due to lack of available space and ground conditions.
Permeable paving	Yes	Please refer to drainage plan showing the extent and location.
Below ground attenuation system	No	Not required.

2.8 Water Quality

Developments should include at least one 'at source' SUDS measure, resulting in a net improvement in water quality discharging from the site.

With reference to the SUDS Manual 2016, the water treatment benefits offered by the components provided within the proposed network have been considered in parallel with the risk of pollution imposed by the nature of the site and its usage. As such, the runoff from this carpark has a low pollution hazard level. The surface water runoff from a majority of the carpark will drainage directly onto the permeable paving. A small area near the access will be collected by means of external gullies, which shall have sumps for the removal of silts.

Therefore, almost the entire site will be treated by the permeable paving. The permeable paving not only serves to attenuate waters, but also provides water quality measures through filtering the water. Further silt retention shall be provided within the site by the use of catch pits.

2.9 Exceedance and Surface Water Flood Risk within the Development

As required by Paragraph S7 of the Defra Non – Statutory Standards and as stated above, no flooding occurs during a 1 in 30 year event. As stated above there is also no flooding during a 1 in 100 year +40% CC event therefore the site complies.

During an exceedance event additional flooding could occur on the surface of the carpark and within the layers of the permeable paving build up. In compliance with Paragraph S9 there is additional storage capacity within these areas (both above ground with ponding and below ground within the substrate layers) which shall retain further volumes.

3. WHOLE LIFE MAINTENANCE OF THE NETWORK

To enable the water treatment process to occur as intended the drainage network shall require maintenance. The maintenance strategy and responsibilities are as set out in the table below.

Table 3.1: Maintenance Strategy

Component to be maintained	Actions	Frequency	Responsibility of:
Site wide external areas	Site to be generally kept free from litter and debris which may enter the drainage system.	On-going	Site management team/tenants
General network inc. pipes/ manholes/ gullies/channels	Manhole, gully and channel covers/grates to be lifted and inspect for sediment build up, clean as required. Any pipe blockages to be cleared, catch pits and sumps to be cleared of any debris and sediment	Annually and after each heavy rainfall event	Site management team
Flow control manhole	Manhole cover to be lifted and inspect, remove litter/ debris and sediment. Manhole base, sump, any debris screen, orifice opening, to be cleaned as required. Check operation of any pivoting by-pass door/remote access cable and fix if required.	6 monthly	Site management team
	Check operation and mechanics of flow control device(s) in accordance with manufacturer specifications	Annually	
Permeable paving	Clean surface with brush to remove any build up of sediment and litter and remove any weeds. Inspect outs and control structures for any blockages Note: If loss of permeability suspected (indicated by ponding waters on the surface) use jetting or agitation brushing (manually or mechanically with a suction brush) to dislodge the affected jointing material and refill with clean material to manufacturers specification.	Annually	Site management team

4. SUMMARY AND CONCLUSIONS

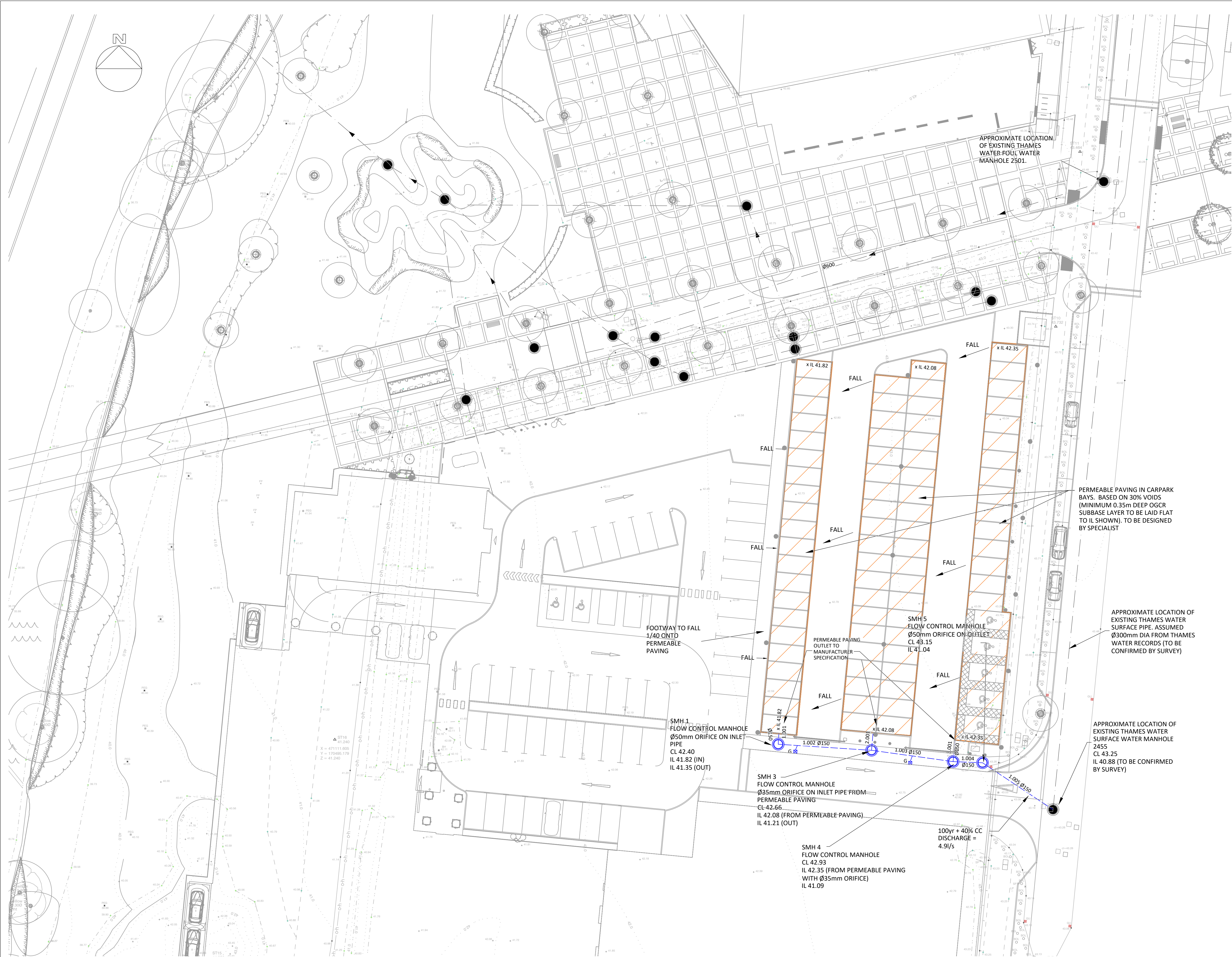
In summary, the drainage strategy complies with Reading Borough Council requirements, CIRIA C753, Non-statutory technical standards for sustainable drainage systems (DEFRA, March 2015), The Environment Agency Science Report SC030219 'Rainfall Runoff Management for Developments', Design and Construction Guidance for foul and surface water sewers dated March 2020, and has been designed in accordance with industry best practice.

Surface water drainage is proposed to follow the existing drainage regime for the wider site, connecting to Foudry Brook.

Permeable paving attenuation has been provided to ensure the discharge from the site is limited to 4.9l/s.

Little to no pollutants are expected, and water quality requirements are met by the inclusion of trapped gullies, catch pits and permeable paving.

Appendix A : Civil Engineering Drawings



- NOTES
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE TO BE CHECKED ON SITE BEFORE THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT AND ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS' DRAWINGS AND SPECIFICATIONS.
 - THE MINIMUM PERMEABLE PAVING SUBBASE DEPTH (FOR STRUCTURAL CAPACITY) IS BASED ON AN ASSUMED DESIGN CBR VALUE OF 2.5-3.0%. CONTRACTOR TO CONFIRM WITH INSTUT TESTING. WHERE GROUND CONDITIONS DIFFER FROM THIS THE ENGINEER SHOULD BE NOTIFIED.
 - MANHOLE LEVELS SHOWN ARE BASED ON INTERLOCK SURVEY DRAWING '10672' DATED 23.11.2010.
 - DETAILED DRAINAGE AND BELOW GROUND SURVEY REQUIRED TO CONFIRM NEW DRAINAGE RUN LOCATION TO FOUNDRY BROOK.
 - FRA PREPARED BY PETER BRETT ASSOCIATES, DATED SEPTEMBER 2012 FOR THE WIDER SITE RECOMMENDS NO INFILTRATION DUE TO REMEDIATION WORKS UNDERTAKEN ON THE SITE AND POTENTIAL FOR CONTAMINATION. THEREFORE NO INFILTRATION IS PROPOSED, THE PERMEABLE PAVING SYSTEM WILL BE LINED.
 - LOCATION OF GULLIES INDICATIVE ONLY, PENDING CONFIRMATION OF LEVELS.
 - MANHOLE LEVELS INDICATIVE ONLY, SUBJECT TO DETAILED DESIGN BY LANDSCAPE ARCHITECT.

LEGEND

EXISTING DRAINAGE (APPROXIMATE LOCATION ONLY)

SURFACE WATER SEWER

SURFACE WATER MANHOLE

SURFACE WATER INSPECTION CHAMBER

SURFACE WATER CHANNEL (ACO CHANNEL OR SIMILAR TO MANUFACTURER SPECIFICATION)

ROAD GULLY

PERMEABLE PAVING (LINED WITH IMPERMEABLE MEMBRANE)

P2	18.11.2020	REVISED LANDSCAPE	MC	AB
P1	04.11.2020	PLANNING	AB	JH
Rev	Date	Description	By	Ckd

Architect : **DAVIESLANDSCAPE ARCHITECTS**

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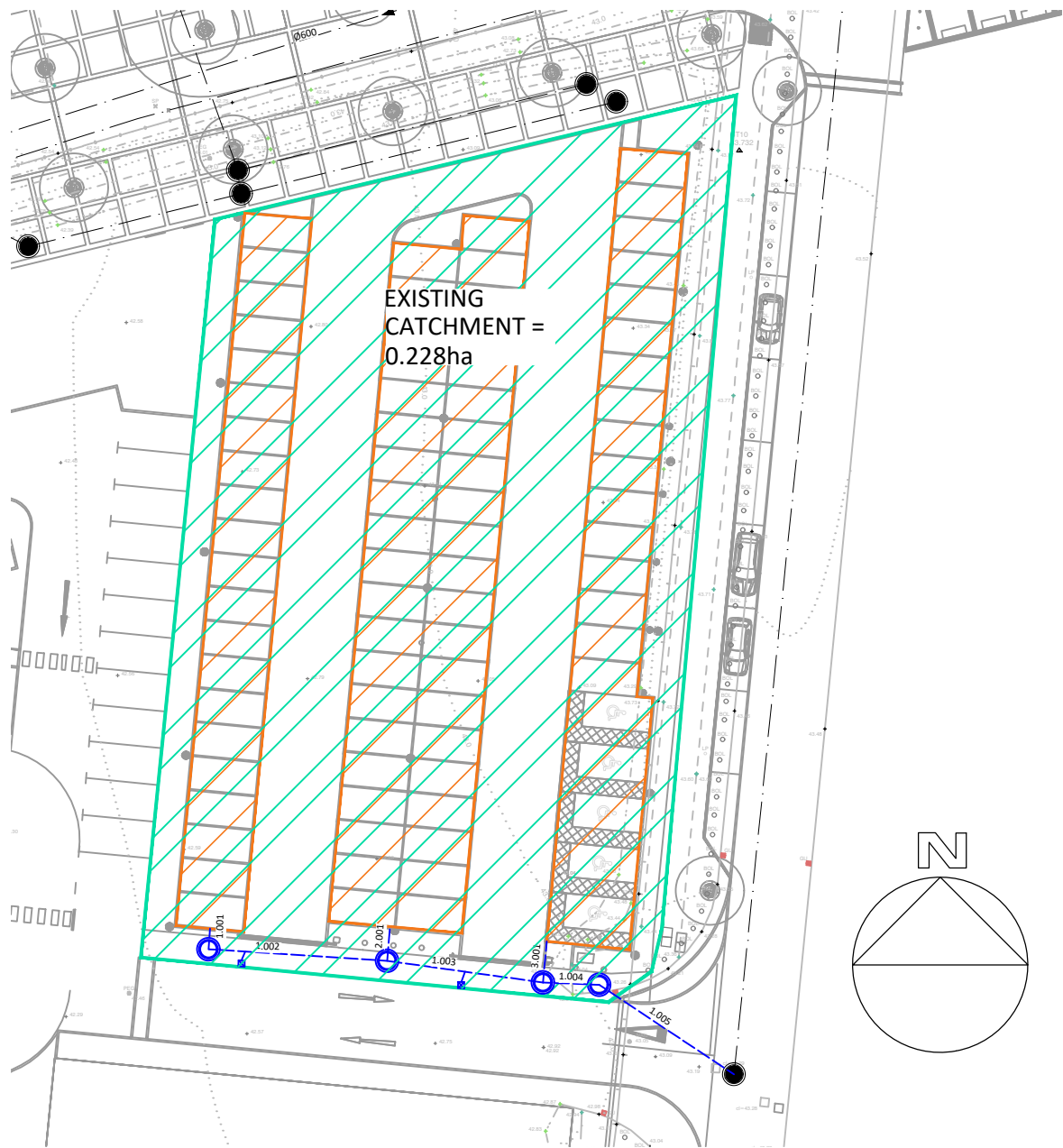
Project Title:
**CAR PARK
DRAKE WAY, READING**

Drawing Title:
DRAINAGE LAYOUT

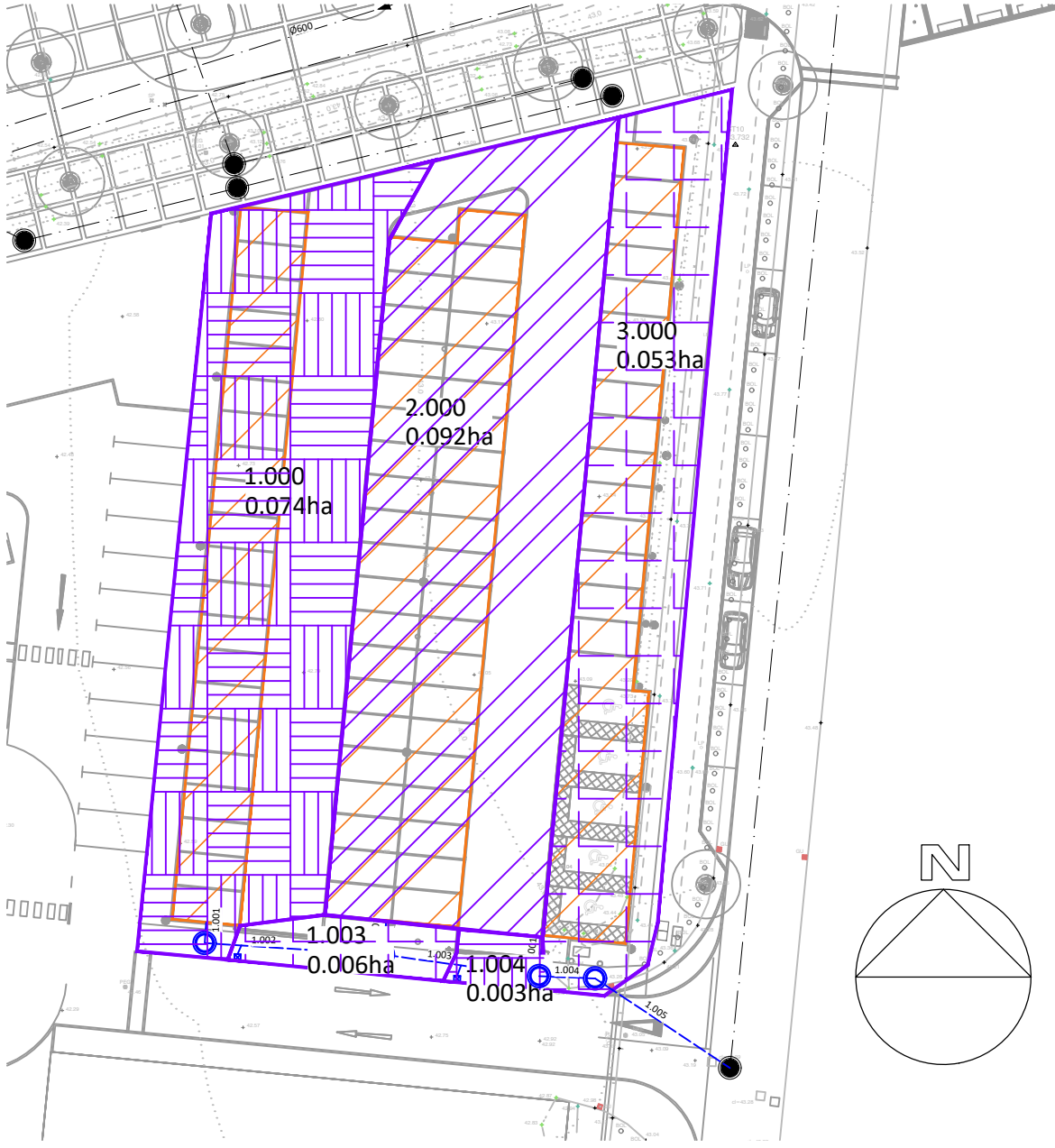
Drawing Status:
PRELIMINARY

Hydrock Job No: **C14698**

Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:250	04.11.2020	18.11.2020
Drawing Number: C14698-HYD-XX-XX-DR-C-0001				Revision: P2



PRE-DEVELOPED CATCHMENT AREA = 0.228ha
1:500



POST-DEVELOPED CATCHMENT AREA = 0.228ha
1:500

- NOTES
- DO NOT SCALE FROM THIS DRAWING.
 - ALL DIMENSIONS ARE TO BE CHECKED ON SITE BEFORE THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT AND ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS' DRAWINGS AND SPECIFICATIONS.

P1	04.11.2020	PLANNING	AB	JH
Rev	Date	Description	By	Ckd
Architect :				
DAVIESLANDSCAPE ARCHITECTS				
Client :				
 Hydrock Consultants Ltd 2nd Floor 172 Edmund Street Birmingham B3 2NB T +44 (0)121 752 5197 E info@hydrock.com www.hydrock.com				
				
Project Title:				
CAR PARK DRAKE WAY, READING				
Drawing Title:				
CATCHMENT PLAN				
Drawing Status:				
PRELIMINARY				
Hydrock Job No:				
C14698				
Drawn	Checked	Scale @ A1	Date	Issue Date
AB	JH	1:500	04.11.2020	04.11.2020
Drawing Number:				Revision:
C14698-HYD-XX-XX-DR-C-0002				P1

Appendix B : Greenfield Runoff Calculations

Calculated by:	Alexis Badek
Site name:	Carpark
Site location:	Drake Way, Reading

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.42927° N
Longitude:	0.97739° W
Reference:	601775030
Date:	Oct 07 2020 09:58

Runoff estimation approach**Site characteristics**

Total site area (ha):	0.228
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Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	639	639
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes**(1) Is $Q_{\text{BAR}} < 2.0$ l/s/ha?**

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	0.37	0.37
1 in 1 year (l/s):	0.32	0.32
1 in 30 years (l/s):	0.86	0.86
1 in 100 year (l/s):	1.19	1.19
1 in 200 years (l/s):	1.4	1.4

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix C : MicroDrainage Data and Result

Hydrock Consultants Ltd		Page 3
.	Reading Carpark	
.	Drake Way	
.		
Date 18/11/2020 15:45	Designed by AB	
File READING CARPARK_NETWORK...	Checked by JH	
Innovyze	Network 2018.1.1	
<u>Online Controls for Storm</u> <u>Orifice Manhole: 1, DS/PN: 1.001, Volume (m³): 2.7</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 41.820 <u>Orifice Manhole: 4, DS/PN: 2.001, Volume (m³): 2.6</u> Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 42.080 <u>Orifice Manhole: 6, DS/PN: 3.001, Volume (m³): 3.0</u> Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 42.350 <u>Orifice Manhole: 11, DS/PN: 1.005, Volume (m³): 2.4</u> Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 41.040		
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.	Reading Carpark	
.	Drake Way	
.		
Date 18/11/2020 15:45	Designed by AB	
File READING CARPARK_NETWORK...	Checked by JH	
Innovyze	Network 2018.1.1	
<u>Storage Structures for Storm</u>		
<u>Porous Car Park Manhole: 1, DS/PN: 1.001</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 5.0
Membrane Percolation (mm/hr)	1000	Length (m) 52.5
Max Percolation (l/s)	72.9	Slope (1:X) 1000.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	41.820	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: 4, DS/PN: 2.001</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 10.0
Membrane Percolation (mm/hr)	1000	Length (m) 50.0
Max Percolation (l/s)	138.9	Slope (1:X) 1000.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	42.080	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: 6, DS/PN: 3.001</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 5.3
Membrane Percolation (mm/hr)	1000	Length (m) 56.0
Max Percolation (l/s)	82.4	Slope (1:X) 1000.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	42.350	Cap Volume Depth (m) 0.350
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Reading Carpark
Drake Way



Date 18/11/2020 15:45

Designed by AB

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Innovyze

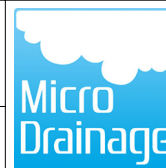
Network 2018.1.1

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

PN	US/MH	Surcharged	Flooded	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level Exceeded
	Name	Depth (m)	Volume (m³)			Flow (1/s)		
1.001	1	-0.070	0.000	0.11		1.2	OK	
1.002	3	-0.121	0.000	0.09		1.4	OK	
2.000	5	-0.071	0.000	0.76		11.8	OK	
2.001	4	-0.072	0.000	0.06		0.6	OK	
1.003	4	-0.060	0.000	0.12		1.9	OK	
3.000	8	-0.117	0.000	0.43		6.8	OK	
3.001	6	-0.082	0.000	0.04		0.6	OK	
1.004	5	0.053	0.000	0.18		2.5	SURCHARGED	
1.005	11	0.099	0.000	0.15		2.5	SURCHARGED	

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Reading Carpark
Drake Way



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File READING CARPARK NETWORK...
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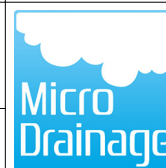
Innovyze

Network 2018.1.1

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

PN	US/MH	Surcharged	Flooded	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level Exceeded
	Name	Depth (m)	Volume (m³)			Flow (1/s)		
1.001	1	0.022	0.000	0.18		2.0	SURCHARGED	
1.002	3	0.152	0.000	0.13		2.1	SURCHARGED	
2.000	5	0.182	0.000	1.82		28.1	SURCHARGED	
2.001	4	0.014	0.000	0.09		1.0	SURCHARGED	
1.003	4	0.284	0.000	0.19		3.0	SURCHARGED	
3.000	8	0.063	0.000	0.98		15.3	SURCHARGED	
3.001	6	-0.013	0.000	0.06		0.9	OK	
1.004	5	0.393	0.000	0.28		3.9	SURCHARGED	
1.005	11	0.436	0.000	0.24		3.9	SURCHARGED	

Reading Carpark
Drake Way



Date 18/11/2020 15:45

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File READING CARPARK NETWORK...
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Checked by JH

Innovyze

Network 2018.1.1

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

PN	US/MH	Surcharged	Flooded	Flow / Cap.	Overflow (1/s)	Pipe	Status	Level Exceeded
	Name	Depth (m)	Volume (m³)			Flow (1/s)		
1.001	1	0.192	0.000	0.23		2.5	FLOOD	RISK
1.002	3	0.490	0.000	0.17		2.8	SURCHARGED	
2.000	5	0.578	0.000	3.18		49.2	FLOOD	RISK
2.001	4	0.155	0.000	0.13		1.4	FLOOD	RISK
1.003	4	0.621	0.000	0.24		4.0	SURCHARGED	
3.000	8	0.237	0.000	1.87		29.1	SURCHARGED	
3.001	6	0.099	0.000	0.09		1.2	SURCHARGED	
1.004	5	0.727	0.000	0.35		4.9	SURCHARGED	
1.005	11	0.769	0.000	0.31		4.9	SURCHARGED	