



Consulting Civil Engineers

SuDS Maintenance and Management Plan

Highground Barn, Barnham

For

Nicky Bates

Rev - A

Reference **C1317**

Date **3rd February 2020**

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1. Introduction

CGS Civils Ltd have been appointed to undertake a surface water drainage design using sustainable techniques for a proposed development in Barnham, West Sussex.

The site will consist of the development of an all-weather show jumping practice arena. The site falls to the south-east. A watercourse flows along the south-eastern border of the site which connects to the Lydney Rife.

2. Sustainable Drainage Systems (SuDS)

The surface water management strategy has been developed using best practice Sustainable Drainage Systems (SuDS) techniques. Guidance on suitable techniques and methods has been obtained from the EA, and the SuDS manual (CIRIA C753).

The National Planning Policy Framework (NPPF) recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development.

The overall philosophy of SuDS is to replicate, as closely as possible, the natural drainage process of a site prior to development to mitigate the adverse effect of storm water runoff on the environment. SuDS not only provide the ability to control surface water flows, but also improve water quality, amenity and bio-diversity within the development.

The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- 1- Discharge into the ground
- 2- Discharge to a surface water body
- 3- Discharge to a surface water sewer

3. SuDS at Highground Barn

Soakage tests to the BRE 365 method were undertaken on site on 24th January 2020. Testing undertaken on site proved the clay sub soils to be effectively impermeable.

1. BRE 365 Soakaway Test Results					
Test Pit No	Infiltration Rate (1-3 Tests)			Depth of Test	Soil Type
SAT1	N/A	N/A	N/A	0.9m	Clay
SAT2	N/A	N/A	N/A	0.4m	Clay
SAT3	N/A	N/A	N/A	0.9m	Clay
SAT4	N/A	N/A	N/A	0.4m	Clay

Based on the above results, the site will discharge all surface water into the watercourse to the south of the site via a flow control chamber restricted to 2l/s which is the generally accepted minimum rate.

The practice arena is constructed using a tanked permeable surface with a fin drain to allow the water to discharge into the surface water drainage system. This area will also provide a level of treatment for any possible pollutants.

The practice arena sub-base been will have a minimum 30% void ratio and is designed to cater for and contain the 1 in 100-year storm + 40%.

4. Managing SuDS

The SuDS have been designed for easy maintenance and comprise:

- Regular day-to-day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS feature
- Occasional tasks – checking the SUDS feature and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

The client will be responsible for the maintenance of the drainage system as per the requirements and specifications within this document.

Once design life has been met on the SuDS features then these will be repaired or replaced in part in accordance with the SuDS maintenance specification in Section 6 or fully replaced in accordance with the respective manufacturer's specifications.

5. SuDS Drainage Maintenance Specification

5.1. Drainage Ditch

Watercourses and drainage ditches require correct maintenance in order to allow surface water to flow freely, this will also reduce the risks of flooding. Correctly maintained watercourses can also create an excellent habitat for wildlife. There are specific maintenance procedures that should be followed in order to correctly maintain the ditch.

In order to maintain the functioning of a drainage ditch, the following requirements should be adhered to:

Watercourse and Drainage Ditches	
Regular Maintenance	Frequency
Keep Watercourse Free of Debris Remove any physical obstructions such as large rocks, rubble, fallen trees and branches and other waste materials (litter, grass cuttings etc) so that water can flow freely. All non-organic waste should be completely removed off site and disposed of in an appropriate manner. Any green waste resulting from the maintenance of ditches can be left a safe distance from the back for a few days to allow any organisms to move back into the watercourse, after which the green waste should be removed so it doesn't wash back into the watercourse. Ensure that any disturbed debris does not end up flowing downstream and causing problems for other landowners. Do not store anything alongside the watercourse which may interfere with maintenance, affect the stability of the bank or get washed into the channel.	Monthly
Keep growth of vegetation under control When trimming vegetation, it is important to consider any impact on biodiversity. Mowing of banks around ditches should be minimised during the animal spawning season of March to mid-July. Some trees may have tree protection orders (TPOs) on them, so if in doubt check with local planning authority. It is recommended to cut only up to just above the water level on one side of the watercourse, leaving the fringe of the bank uncut, thereby maintaining	As Required

some habitat as well as enabling a free flow of water in the ditch. Cuttings from any clearance work should be removed from the channel to avoid it causing blockages downstream. Putting removed material too close to the top of the bank can lead to it falling back in during times of flooding.	
Remove excess Silt Silt should be removed along the length of the ditch to ensure it flows properly in the right direction. If there are any pipes into or out of the ditch you should remove silt to the same level or below the bottom of the pipe(s). Where possible, try to maintain the original slope and cross section of the ditch when de-silting. If the slope of the ditch is altered it can change the flow pattern, cause erosion or increase flood risk either upstream or downstream. As long as the silt is non-hazardous you can put it on the bank of the watercourse. Depositing silt on top of the banks of the watercourse allows for any organisms to move back into the ditch. However; • It is essential that this material does not then block any other ditches or nearby roads, or stop water draining into the ditch if it would normally do so. • The silts must be as close as possible to where it was dredged from either: on the bank of the waters from where it was taken or on land directly next to the watercourse. If you think a material may be hazardous. Contact the Environment Agency for advice.	As required.

6. General Drainage Maintenance Specification

6.1. Inlet Structures and Inspection Chambers

- Inlet structures such as rain water downpipes, road gullies and channel drains should be free from obstruction at all times to allow free flow through the SuDS.
- Inspection Chambers and rodding eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	Frequency
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Strim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspections Chambers and below ground control chambers Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

6.2. Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

6.3. Culvert and Headwalls

- Culverts allow the drainage ditch to flow freely under the access road. They should always be free from obstruction to allow free flow.
- Headwalls are used as an outlet to the drainage ditch from the surface water network; they are also used as an inlet and outlet for the culvert.

Culvert and Headwalls	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

6.4. Arena Surface

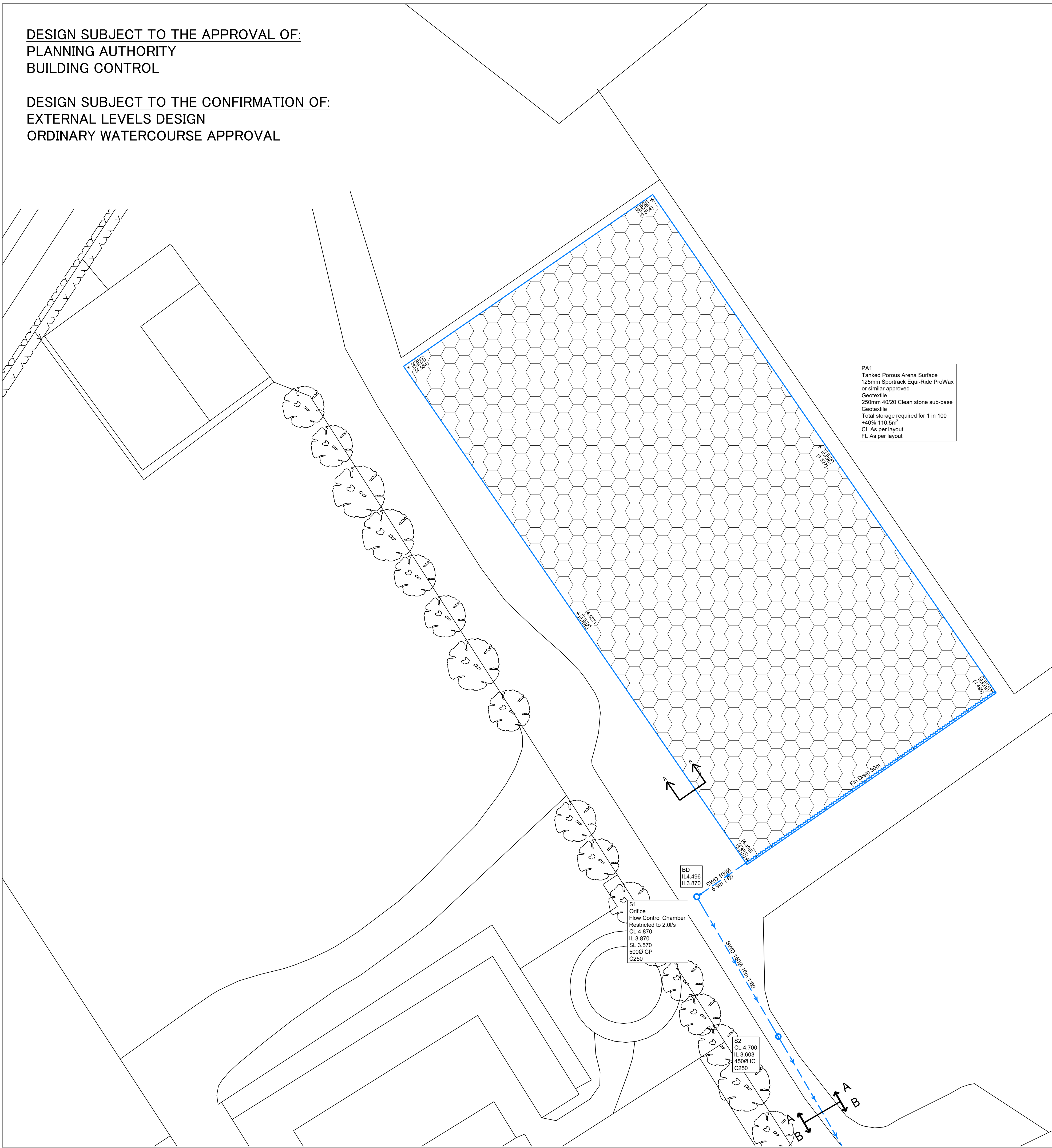
- Surface to be levelled 1 – 4 times per month as required
- Additional fibre material to be added as required
- Full replacement of surface every 15-20 years

Appendix A

Drainage Strategy

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN
ORDINARY WATERCOURSE APPROVAL



PA1
Tanked Porous Arena Surface
125mm Sportrack Equi-Ride ProWax
or similar approved
Geotextile
250mm 40/20 Clean stone sub-base
Geotextile
Total storage required for 1 in 100
+40% 110.5m³
CL As per layout
FL As per layout

DRAINAGE LEGEND (1:200)
PROPOSED FEATURES



Tanked Porous Arena Surface

Storm water sewer/drain

Fin Drain



Storm water inspection chamber (4500)



SEL Orifice Flow Control Chamber (5000)



Surface Water Headwall

1000 4.5m 1:100
2 BED

PIPE INFO - DIAMETER, LENGTH,
GRADIENT, BEDDING TYPE

ABBREVIATIONS

CP - CATCHPIT
MH - MANHOLE
IC - INSPECTION CHAMBER
AC - ACCESS CHAMBER
RE - RODDING EYE
IL - INVERT LEVEL
SL - SUMP LEVEL
CL - COVER LEVEL



Backdrop



High level IL



Low level IL



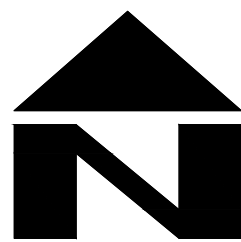
Surface level



Formation level

STANDARD DRAINAGE NOTES

- DO NOT SCALE FROM THIS DRAWING. REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
- ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
- ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
- COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
- ALL UN-REFERENCED PIPES ARE ASSUMED TO BE 100mm DIA
- ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
- THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
- IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.



PRELIMINARY
NOT FOR CONSTRUCTION

P1	14.04.20	UPDATED TO SUIT LPA COMMENTS	LH	CS	CS
P-	03.02.20	PRELIMINARY ISSUE	LH	CS	CS
REV	DATE	DESCRIPTION	BY	CHK	APP

 Consulting Civil Engineers					
CLIENT MRS NICKY BATES					
ARCHITECT RPS DESIGN GROUP					
JOB TITLE HIGHGROUND BARN BARNHAM					
DRAWING TITLE SURFACE WATER DRAINAGE LAYOUT SHEET 1 OF 2					
DRAWN LH	ENGINEER CS	CHECKED CS	APPROVED CS		
DATE JAN 2020	SCALE @ A1 1:200				
JOB No. C1317	STATUS P	DRAWING No. 100	REV P1		

PRELIMINARY

Appendix B

Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.600
Ratio-R	0.310	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.180	5.00	4.870	100	1178.693	66.603	0.375
S2	0.000		4.870	450	1173.829	63.251	1.000

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	5.907	0.600	4.495	3.870	0.625	9.5	150	5.03	50.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.907	9.5	150	Circular	4.870	4.495	0.225	4.870	3.870	0.850

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	100	Manhole	Adoptable	S2	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	1178.693	66.603	4.870	0.375	100				
						0	1.000	4.495	150
S2	1173.829	63.251	4.870	1.000	450		1	1.000	3.870
									150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.310	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	0	0	0
100	40	0	0

Node S2 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	2.0		
Invert Level (m)	3.870	Diameter (m)	0.031		

Node S1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.495	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.250
Safety Factor	2.0	Width (m)	30.000	Inf Depth (m)	
Porosity	0.30	Length (m)	60.000		

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	S1	232	4.615	0.120	12.6	49.9016	0.0000	OK
240 minute winter	S2	232	4.615	0.745	3.7	0.1184	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	S1	1.000	S2	3.7	0.562	0.063	0.0967	
240 minute winter	S2	Orifice		1.7				45.6

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	S1	464	4.725	0.230	13.8	110.4239	0.0000	FLOOD RISK
480 minute winter	S2	464	4.724	0.854	3.5	0.1359	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	S1	1.000	S2	3.5	0.282	0.059	0.1040	
480 minute winter	S2	Orifice		1.8				72.6