AKSWard²

CONSTRUCTION CONSULTANTS

New Technical Site

Drainage Strategy and Water Quality Management Report

NTS-AKSW-XX-XX-RP-C-0003

Prepared for

Bicester Heritage

July 2018

Job №: X162034

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LONDON • HITCHIN • OXFORD • POOLE • SOUTHAMPTON

Contents

Appendices

Revision	Amendments	Prepared By	Checked	Date
P01	Preliminary Issue	NJ	GT	18.07.18
P02	Minor amendments	NJ	GT	19.07.18

1.0 Introduction

1.1 AKS Ward have been commissioned to undertake a Drainage Strategy and Water Quality Management to support the planning application for extension to existing Technical Site to provide new employment units comprising flexible B1(c) light industrial, B2 (general industrial), B8 (storage or distribution) uses with ancillary offices, storage, display and sales, together with associated access, parking and landscaping

1.2 The site is in Flood Zone 1 (low risk of fluvial flooding) and is 1.61 Hectares in area with approximately 1.08 Ha served by drainage. The site is located in Bicester and is currently a greenfield site with approximately 700m^2 of hard standing area (6.5%).

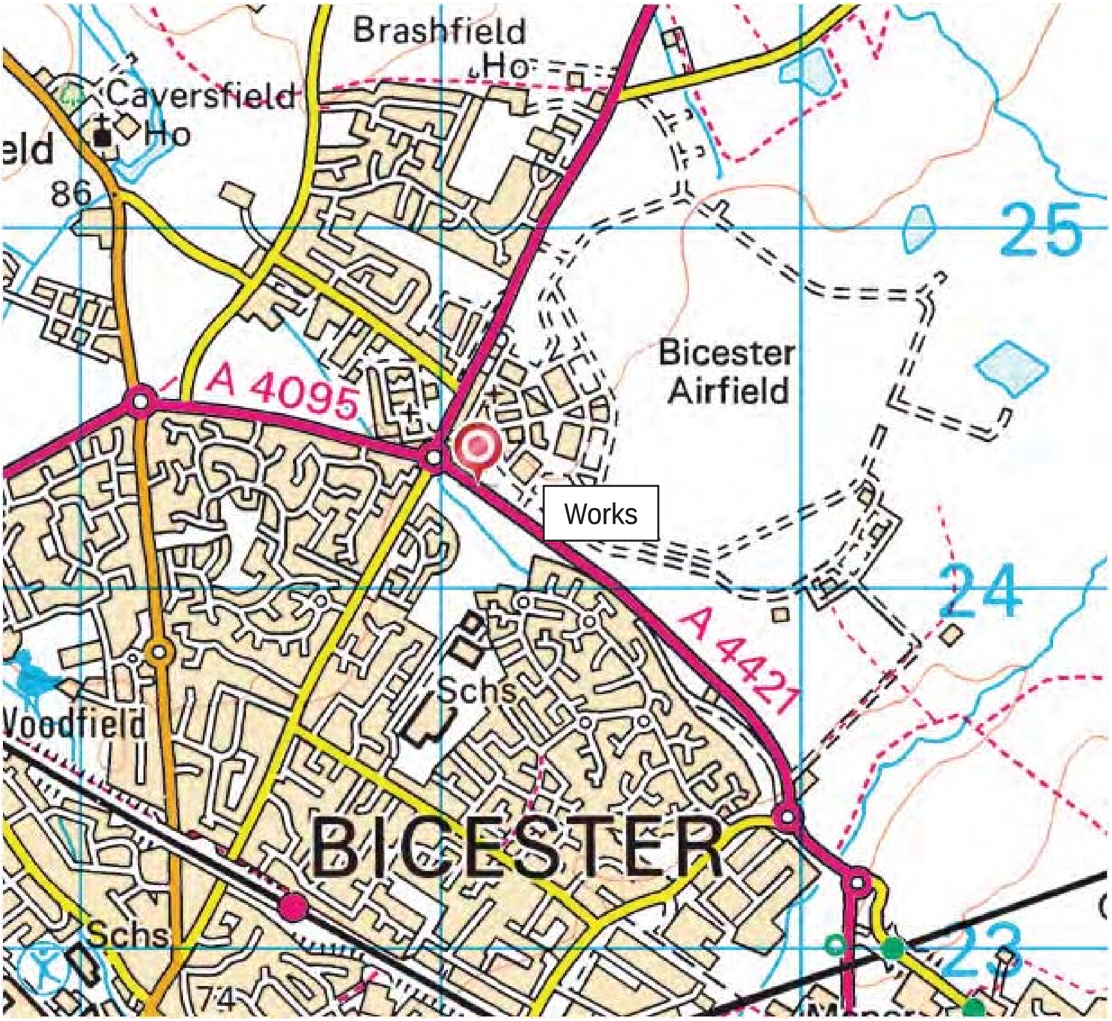
1.3 The site is bounded by hangar units to the north, by the A4421 road to the west and south and by the Bicester Airfield to the east.

1.4 This Drainage Strategy must be read in conjunction with the Flood Risk Assessment prepared for the site by RAB Consultants.

2.0 Development Site Details

2.1 Development Description & Location
The site is located at NGR SP 59101 24291.

The plans of the development are contained within Appendix C.



3.0 Site Drainage Strategy

3.1 Existing Surface Water

The site currently drains towards the southeast and infiltrates into the ground. During exceedance events when the ground is saturated, it is understood that the runoff volume would drain towards the watercourse located further southeast outside of Bicester Heritage

British Geological Survey indicates that the site is underlaid by Cornbrash Formation – Limestone. Infiltration tests were carried out within Bicester Heritage area and the results obtained were $1.43x10^{-6}$ m/s and $1.81x10^{-6}$ m/s.

Greenfield runoff rates and volumes have been calculated as follows:

Qbar:	0.5 l/s
Greenfield volume:	62.554 l/s

Existing drainage drawings are contained in Appendix A. Microdrainage calculations are contained in Appendix B

3.2 Proposed Surface Water

Surface system will be designed to agree with the National Standards for Sustainable Drainage.

Refer to drainage drawings and Microdrainage calculations in Appendix C and D. A Surface Water Pro-forma has been completed with a copy contained in Appendix E to ensure that the design is in accordance with the current SuDS requirements.

3.2.1 Runoff Destination

Due to ground conditions obtained, existing soil is considered permeable therefore infiltration as means of disposal is feasible.

Surface water drainage from the building and some hard paving areas will be attenuated and infiltrated using three new cellular soakaways with volumes of 310.08 m^3 , 54.72 m^3 and 158.40 m^3. Soakaway has been designed using the lowest infiltration rate obtained ($1.43x10^{-6}$ m/s)

New parking areas and access road will be drained using permeable paving. In addition to this, a new swale will be used to discharge and infiltrate runoff from the southern access road.

3.2.2 Peak flow control

SuDS will be utilised on site in the form of permeable paving, swale and cellular soakaway. There will be no discharge flow rate from the site therefore peak runoff will not exceed the current flow rates for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event with an allowance for climate change.

3.2.3 Volume control

There is no additional discharged volume as the proposed hard paving areas and building will be drained into the permeable paving, cellular soakaway and swale therefore it will not exceed the current volume form each storm.

3.2.4 Flood risk within the development

The system has been designed in accordance with CIRIA SuDS manual with no flooding in the 30 year event and no flood water leaving the site for the 100 year + 40% climate change critical storm event.

The Flood Risk Assessment identifies the site at medium to high risk of surface water flooding within the site caused by exceedance runoff from off site. The current flow path follows the existing ditch located along Bicester Heritage boundary with Skimmingdish Lane. Existing ditch is to be retained therefore the current flood path will remain unchanged. FFLs of proposed new buildings will be located higher than ditch level to reduce the risk of surface water flooding to the buildings. A plan showing the flood path has been included in Appendix C.

3.2.5 Exceedance Events

In storm events exceeding the designed storm events above the 100 year + climate change the flow of water would run towards the southeast of the site and ultimately discharge into the existing watercourse. This path is as per the existing situation

3.2.6 Structural integrity and construction

Surface system will be designed and constructed using approved materials in line with Building Regulation's and current British Standards appropriate for the location and proposed use.

3.2.7 Maintenance and operation

The drainage system will be CCTV surveyed on completion to ensure that the system is fully operational and maintenance schedules provided in the O&M manual for the owner to maintain the cellular tank, permeable paving and swale.

Maintenance schedules have been provided in Appendix F for the SuDS. The owner of the site will be responsible for maintaining the SuDS on site.

3.3 Existing and Proposed Foul Water.

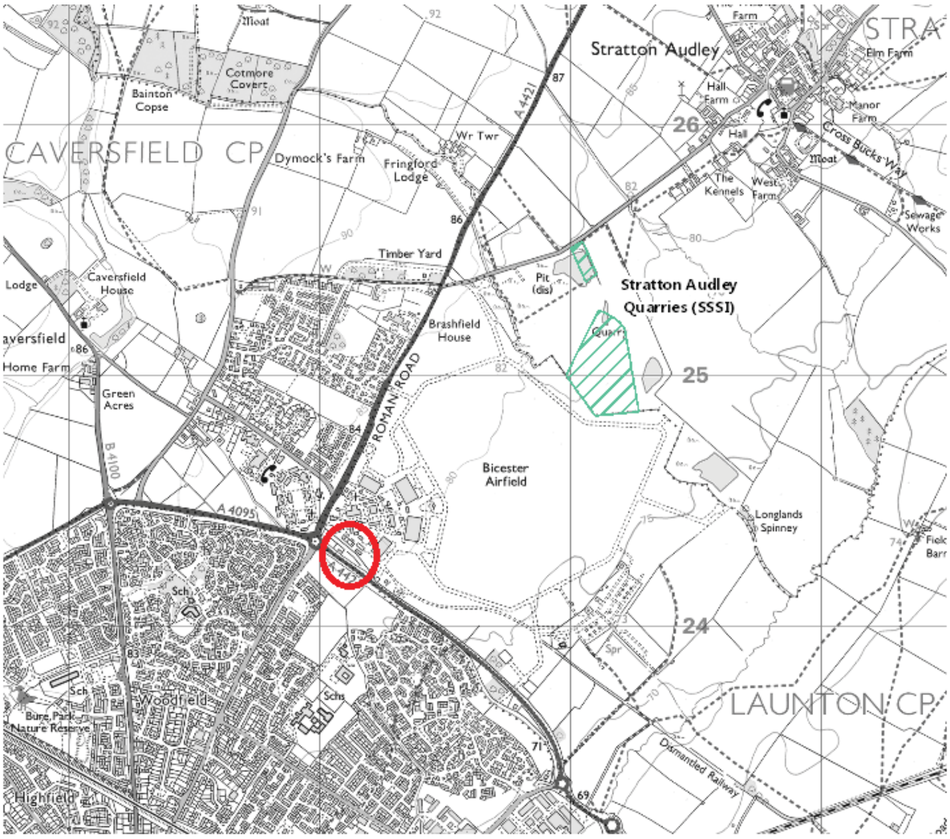
Foul water will discharge via private pumping chamber into the existing public sewer located within the site. Connection will be on site and via direct connection to the existing public drainage system.

A Pre-development Enquiry will be submitted to Thames Water to agree the discharge flow rates from the new development.

Any new foul drainage will be connected to the public system and S106 connection applications made to Thames Water.

3.4 Stratton Audley Quarries Site of Special Scientific Interest

The proposed development is located approximately 1300m from Stratton Audley Quarries, and area declared 'Site of Special Scientific Interest'.



The proposed site falls from northwest to southeast therefore it does not contribute to the hydrology of the SSSI.

4.0 Water Quality Management

The surface system will be designed in order to not affect the water quality of the receiving watercourse.

CIRIA SuDS Manual 2015 Chapter 26 assigns pollution hazard indices for different land use types and SuDS mitigation index for every SuDS component depending on where the discharge is, surface or ground water.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	0.8	0.8
Proprietary treatment systems[3,5]	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

CIRIA SuDS Manual states that *'To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index that equals or exceeds the pollution hazard index'*

Total SuDS mitigation index ≥ pollution hazard index
(for each contaminant type) (for each contaminant type)

Pollution hazard indices for land use are as follows:

Roof:	TTS 0.2	Metals 0.2	Hydrocarbons 0.05
Access road & car park:	TTS 0.5	Metals 0.4	Hydrocarbons 0.4

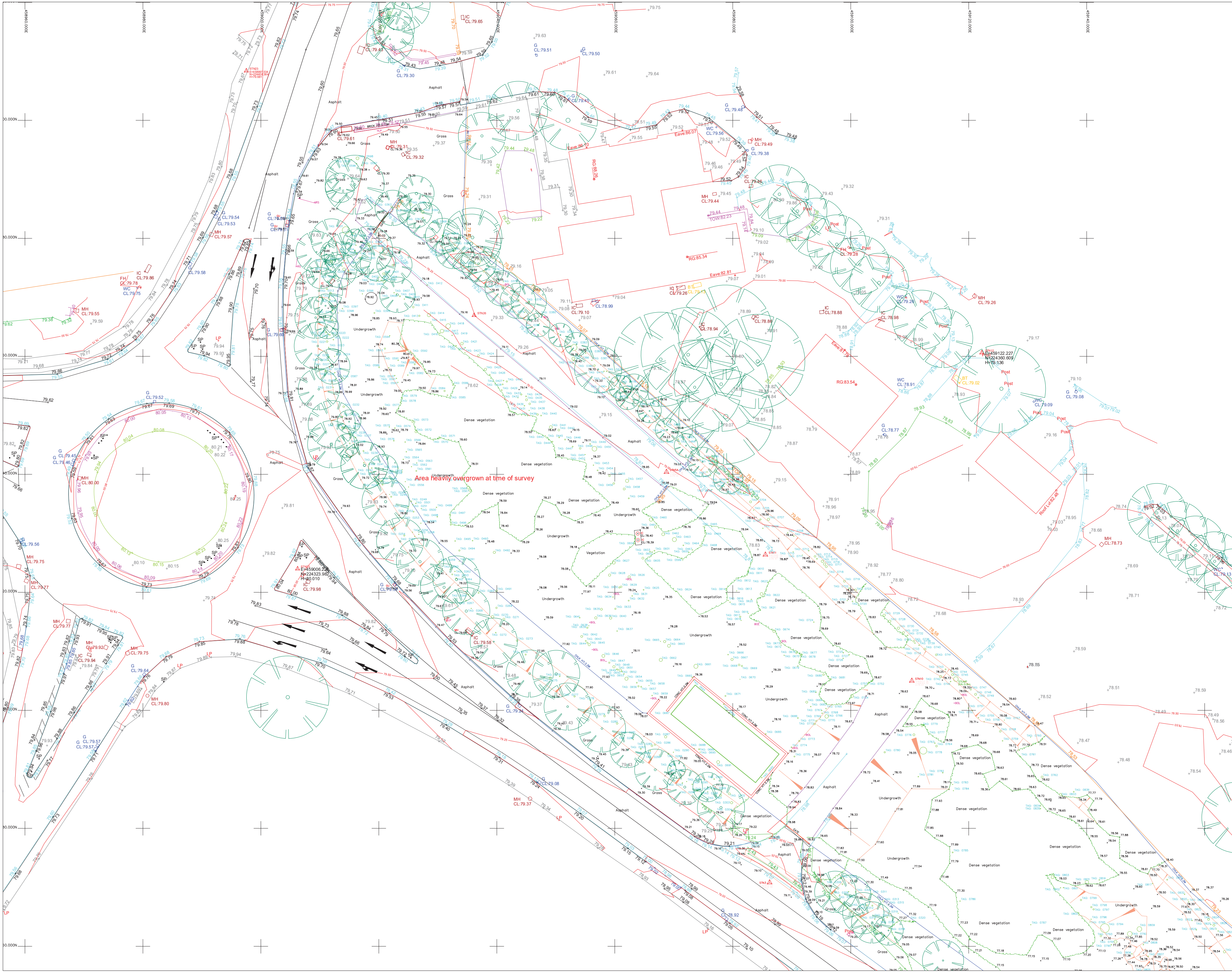
SuDS mitigation indices are determined by the type of SuDS utilised on site. The proposal for this site permeable paving, swale and cellular soakaway:

Permeable pavement:	TTS 0.7	Metals 0.6	Hydrocarbons 0.7
Swale:	TTS 0.5	Metals 0.6	Hydrocarbons 0.6

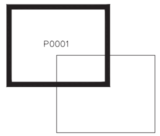
Catchpit manholes will be installed prior to connecting into the new cellular soakaway therefore providing additional treatment for the surface water drained from the roof which will improve the water quality further.

Appendix A

Surveys & Historic Information



OS NORTH



Topographical Abbreviations

A/R	Assumed Route	MKR	Marker
BH	Borehole	MT	Mercury Telecom Cover
BOL	Bollard	OHC	Overhead Cable
BT	British Telecom Cover	OHP	Overhead Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
BWK	Brickwork	PB	Post Box
CATV	Cable TV Cover	PGM	Permanent Ground Marker
CB	Close Boarded Fence	PR	Post & Rail Fence
CCTV	Closed Circuit TV	PW	Post & Wire Fence
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence
CHPL	Chestnut Paling Fence	RE	Rodding Eye
CL	Cover Level	RG	Road Gully
CM	Cable Marker	RN	Road Name
CP	Catch Pit	RS	Road Sign
CPL	Catch Pit Base Level	RW	Retaining Wall
DIA	Diameter	RWP	Rain Water Pipe
DK	Drop Kerb	SAP	Sapling
DP	Down Pipe	SC	Stop Cock
EJB	Electricity Junction Box	SPR	Spread
EC	Electricity Cover	STA	Traverse Station
EP	Electricity Pole	SV	Stop Valve
ER	Earthing Rod	SVP	Soil Vent Pipe
FCL	Finished Ceiling Level	SW	Storm Water
FH	Fire Hydrant	TB	Telephone Box
FIG	Feed Into Ground	TBM	Temporary Bench Mark
FW	Foul Water	TFR	Taken From Records
GU	Gully	TJB	Telephone Junction Box
GV	Gas Valve	TPT	Trial Pit
H	Height	TL	Traffic Light
IC	Inspection Cover	TP	Telephone Pole
IL	Invert Level	UTL	Unable To Lift
IR	Iron Railing Fence	UTT	Unable To Trace
KO	Kerb Outlet	VP	Vent Pipe
LB	Litter Bin	WKH	Water Key Hole
LC	Lamp Column	WM	Water Meter
LP	Lamp Post	WV	Water Valve
MH	Manhole		

Notes

The Grid is related to OS using RTK GPS
All Levels are related to OS Datum using RTK GPS
All dimensions are in metres unless otherwise specified

Rev	QA Check	Description	Date
5	-	-	-
4	-	-	-
3	-	-	-
2	-	-	-
1	-	-	-
0	BF	First Complete Issue	16/11/2016
Prelim	-	Preliminary - Not Complete	-

WARNER SURVEYS
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Head Office Beaumont Hse 59 High St Theale Reading RG7 5AL
T +44 (0)118 930 3314
London Office 28A Queensway Bayswater London W2 3RX
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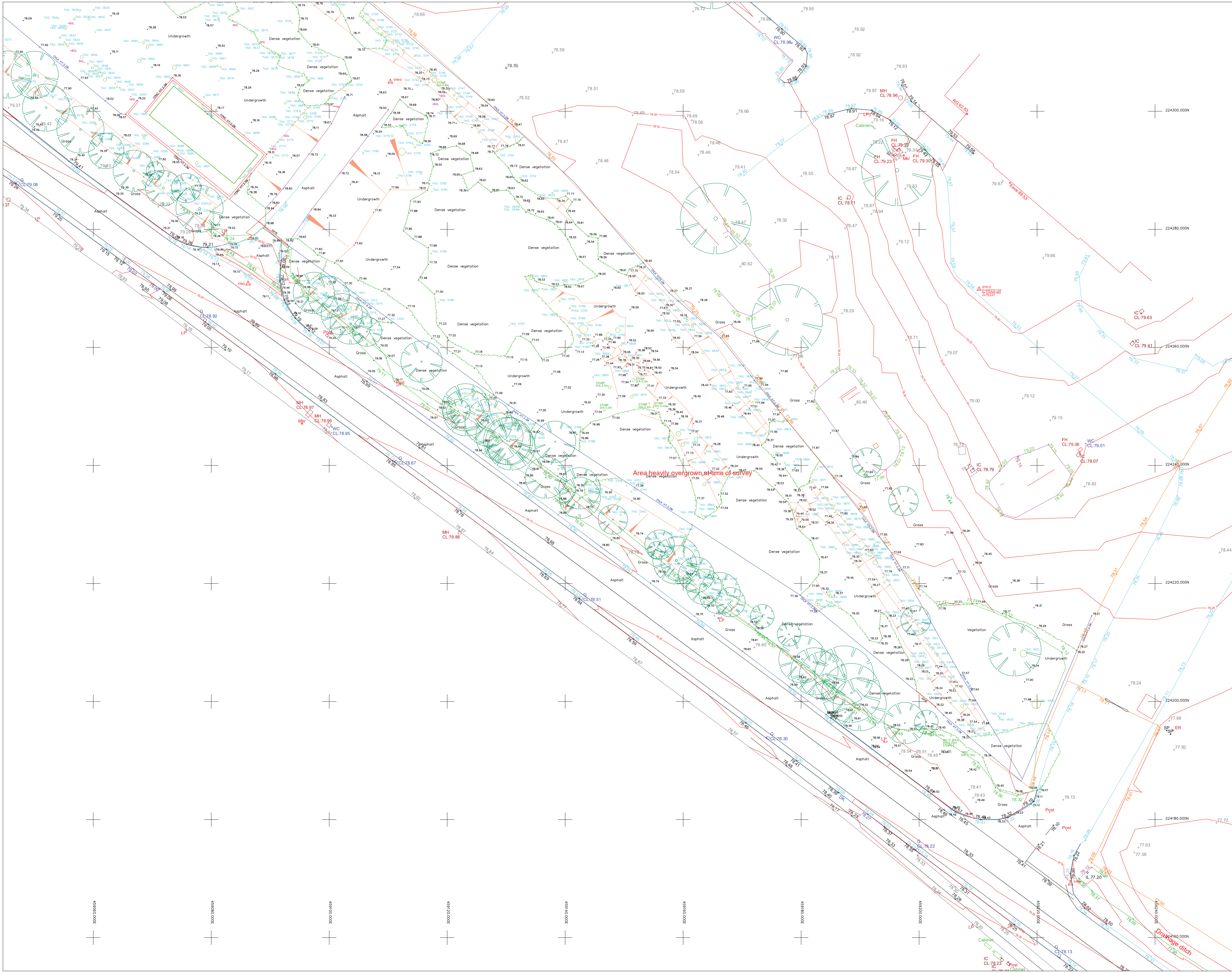
SURVEYED	KF	Bicester Heritage Limited
DRAWN	KF	
SCALE	1:200	

Skimmingdish Lane, Bicester

TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
S616/0328	S616/0328/P/0001

A0 Sheet - 1,189mm X 841mm



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P0002

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Oil, Gas and Industrial Surveying

SURVEYED	KF	Bicester Heritage Limited
DRAWN	KF	
SCALE	1:200	

Skimmingdish Lane, Bicester

TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
S616/0328	S616/0328/P/0002

A0 Sheet - 1,189mm X 841mm

Asset location search

Thames Water Property Searches

AKS Ward
Seacourt Tower
West WaySeacourt Tower
OXFORD
OX2 0JJ

Search address supplied Royal Air Force
Buckingham Road
Bicester
OX26 5HA

Your reference X162034 - Bicester Heritage

Our reference ALS/ALS Standard/2018_3816510

Search date 19 June 2018

Keeping you up-to-date

Knowledge of features below the surface is essential in every development. The benefits of this not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility for any commercial or residential project.

An asset location search provides information on the location of known Thames Water clean and/or wastewater assets, including details of pipe sizes, direction of flow and depth. Please note that information on cover and invert levels will only be provided where the data is available.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

Asset location search

Thames Water Property Searches

Search address supplied: Royal Air Force, Buckingham Road, Bicester, OX26 5HA

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SP5824SE
SP5824NE
SP5924SW
SP5924NW

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

The following quartiles have been printed as they fall within Thames' water area:

SP5824SE
SP5824NE

SP5924SW
SP5924NW

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510	SP5824SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
531K	n/a	n/a
521C	n/a	n/a
621A	n/a	n/a
711A	n/a	n/a
721C	n/a	n/a
721D	n/a	n/a
6101	n/a	80.4
601B	n/a	n/a
7003	n/a	79.8
7001	n/a	79.38
701B	n/a	n/a
701C	n/a	n/a
7102	n/a	78.6
7002	n/a	77.75
7005	n/a	n/a
7006	n/a	n/a
7004	n/a	79.1
701A	n/a	n/a
7110	n/a	77.94
7104	n/a	78.83
7111	n/a	77.48
8103	n/a	78.66
8051	81.08	80.26
8001	81.12	77.24
8050	81.22	80.29
8052	80.23	78.35
8055	n/a	n/a
8053	80.1	78.55
8054	n/a	n/a
5205	83.41	80.91
5305	83.43	81.48
521B	n/a	n/a
531A	n/a	n/a
5207	83.36	81.12
5206	83.4	80.6
531I	n/a	n/a
521A	n/a	n/a
531E	n/a	n/a
5201	83.06	81.38
531J	n/a	n/a
531B	n/a	n/a
531H	n/a	n/a
531C	n/a	n/a
5101	83.15	80.18
5310	82.8	80.51
5110	83.01	80.34
5309	82.8	81.18
5209	83.05	79.75
5208	83.01	80.41
5102	83.05	80.39
5109	83.04	80.94
5311	82.77	81.07
6201	82.47	80.18
6202	82.49	79.54
6206	82.57	80.88
6207	82.59	80.63
5202	83.66	81
5203	83.65	81.7
5302	83.8	81.15
5301	83.81	81.71
5304	83.57	81.57
5303	83.8	81.15
5204	83.41	81.55
5010	82.5	80.05
5004	82.52	79.75
5005	82.75	79.69
5009	82.76	80.15
5003	82.95	79.75
5008	83	80.4
501A	n/a	n/a
501B	n/a	n/a
501C	n/a	n/a
5001	82.97	81.31
5002	82.97	81.81
601A	n/a	n/a
5105	83.14	81
5106	83.11	81.53
611B	n/a	n/a
611A	n/a	n/a
611C	n/a	n/a
5107	83.31	81.36
5104	83.37	80.76
5108	83.11	81.12
5103	83.13	80.5
5306	83.42	80.74
5307	83.17	81.26
5308	83.21	81.65
6302	82.8	80.77
6301	82.83	80.09
631A	n/a	n/a
9401	79.54	78.59

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7204	n/a	79.25
7208	81.4	80.02
7207	n/a	n/a
6210	81.97	79.7
6203	81.93	80.21
6209	81.88	79.94
6204	81.9	80.42
7209	n/a	n/a
721B	n/a	n/a
721A	n/a	n/a
6208	82.24	80.17
6205	82.22	80.55
7310	n/a	n/a
6305	82.01	80.57
7309	81.47	79.41
7308	81.45	79.79
7311	81.44	79.15
7306	80.99	79.37
7301	81.03	78.32
6304	82.16	80.36
7305	81.33	79.65
7302	81.38	78.78
6303	82.15	79.68
7304	81.77	79.97
7303	81.77	79.19
6306	82.41	80.53
6307	82.46	79.8
8101	80.65	77.43
8104	n/a	78.05
8110	80.56	77.53
8108	n/a	77.03
8105	n/a	78.26
8107	n/a	77.85
8106	n/a	78.41
7201	n/a	78.13
8212	n/a	n/a
8210	n/a	78.67
8213	n/a	n/a
8211	80.56	78.76
8214	80.27	77.56
8204	n/a	79.18
8202	n/a	78.88
8206	n/a	77.63
8203	n/a	78.98
8205	n/a	77.7
8216	80.57	78.89
8215	80.55	77.85
8303	80.4	79.05
8301	80.36	78.04
7307	80.66	79.17
8302	80.67	78.14
8306	80.47	79.04
8304	80.43	79.2
8305	80.48	78.81
831A	n/a	n/a
831B	n/a	n/a
831C	n/a	n/a
8102	80.5	78.02
8207	n/a	76.54
8201	n/a	78.72
8109	n/a	n/a
9204	n/a	78.47
9203	n/a	78.92
9303	n/a	78.75
9302	n/a	79.19
9104	n/a	n/a
9205	n/a	n/a
9201	79.59	77.75
9101	n/a	n/a
9207	n/a	n/a
9102	n/a	n/a
9208	n/a	n/a
9202	79.54	77.72
9103	n/a	n/a
9301	79.62	77.9
9106	n/a	n/a
6103	n/a	79.98
611D	n/a	n/a
7109	n/a	78.07
7105	n/a	78.96
7101	n/a	78.38
7108	n/a	78.16
7106	n/a	79.05
7103	n/a	79.28
6104	n/a	78.72
6102	n/a	79.56
6107	n/a	79.73
6110	n/a	78.89
7121	n/a	79.23
7118	n/a	79.65
6108	n/a	80.01
6111	n/a	79.56
7120	n/a	79.43

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7117	n/a	79.85
6109	n/a	79.93
6112	82.48	79.32
7112	n/a	78
7107	n/a	78.54
7119	n/a	80.15
7206	n/a	79.73
7202	n/a	78.68
7205	n/a	79.09
7203	n/a	78.83
9006	n/a	n/a
9001	79.47	77.16
9002	n/a	n/a
9007	n/a	n/a
9008	n/a	n/a
9004	n/a	n/a
9009	n/a	n/a
9005	n/a	n/a
9105	n/a	n/a

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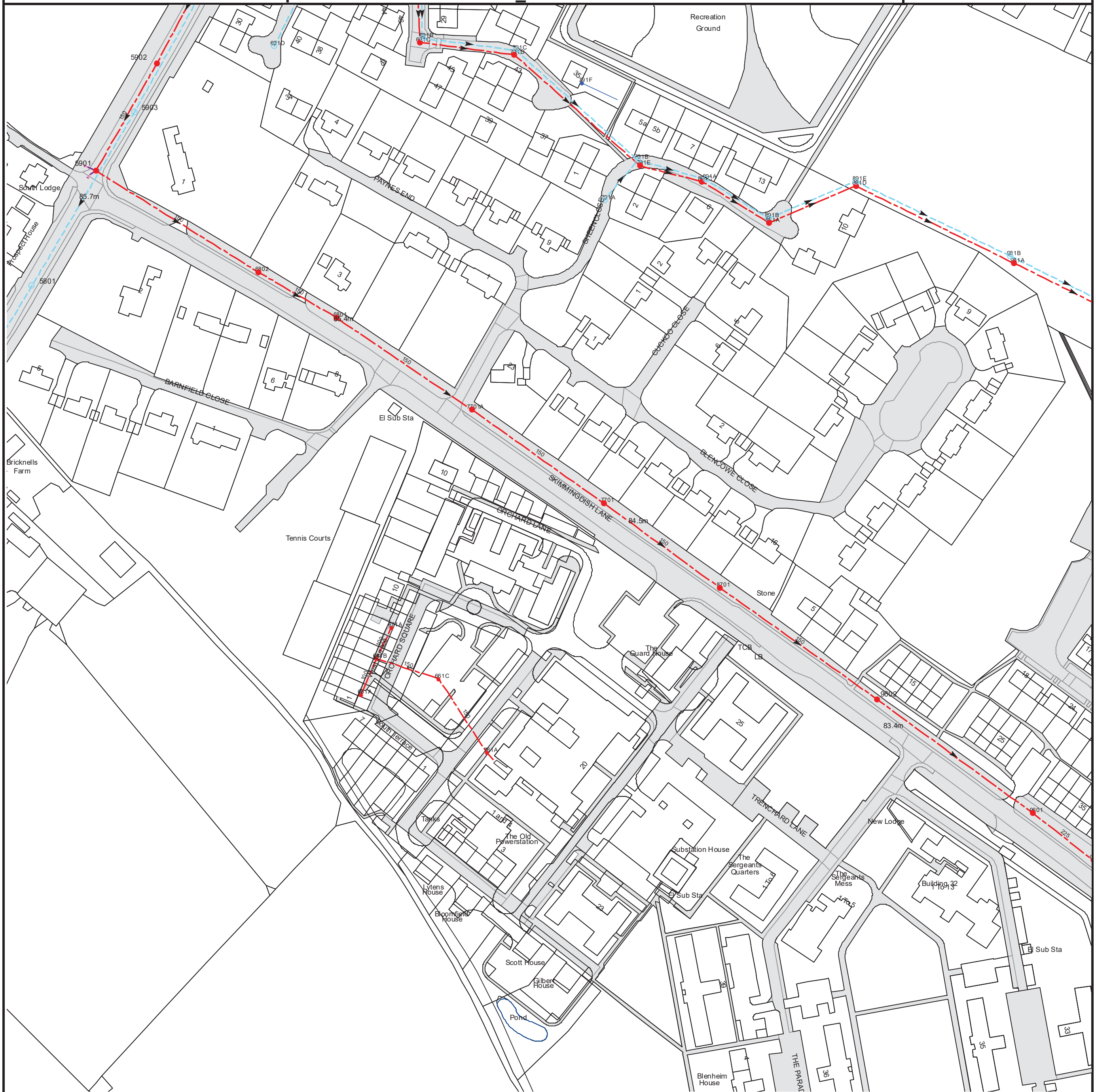
Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510	SP5824NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
661A	n/a	n/a
661B	n/a	n/a
671A	n/a	n/a
661C	n/a	n/a
761A	n/a	n/a
791F	n/a	n/a
5801	n/a	n/a
6802	85.62	83.47
5901	85.75	83.93
5903	n/a	n/a
5902	86.19	84.32
691D	n/a	n/a
691C	n/a	n/a
691B	n/a	n/a
791C	n/a	n/a
6801	85.368	83.078
7701A	85.025	82.595
791D	n/a	n/a
7701	84.35	82.18
791A	n/a	n/a
791B	n/a	n/a
791E	n/a	n/a
891C	n/a	n/a
891A	n/a	n/a
8701	84.05	81.75
891B	n/a	n/a
881A	n/a	n/a
891D	n/a	n/a
891E	n/a	n/a
9602	n/a	n/a
981B	n/a	n/a
981A	n/a	n/a
9601	82.4	80.59
0601	82.161	80.421

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Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510	SP5924SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0301	79.67	78.03
0302	79.52	78.48
0402	80.37	78.27
0401	80.61	79.04
0107	n/a	n/a
0305	n/a	n/a
0304	79.42	78.28
0113	n/a	n/a
0201	n/a	n/a
0202	n/a	n/a
0101	n/a	n/a
0303	n/a	n/a
0002	n/a	n/a
0001	77.72	76.44
1001	n/a	n/a
0106	n/a	n/a
0102	77.87	76.65
0108	n/a	n/a
0114	n/a	n/a
0104	n/a	n/a
0105	n/a	n/a
0109	n/a	n/a
301A	n/a	n/a

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Asset Location Search Sewer Map - ALS/ALS Standard/2018_3816510	SP5924NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224750

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
191S	n/a	n/a
091C	n/a	n/a
091B	n/a	n/a
091A	n/a	n/a
091G	n/a	n/a
091D	n/a	n/a
191J	n/a	n/a
191B	n/a	n/a
191A	n/a	n/a
191G	n/a	n/a
291D	n/a	n/a
291B	n/a	n/a
291C	n/a	n/a
0502	81.079	79.379
0501	81.22	79.22
1601	82.73	79.52
1701	83.87	79.67
1702	84.44	79.84
1703	84.17	80.85
1704	84.41	80.21
171A	n/a	n/a
2801	n/a	n/a
081A	n/a	n/a
191N	n/a	n/a
181C	n/a	n/a
181A	n/a	n/a
191Q	n/a	n/a
191R	n/a	n/a
181B	n/a	n/a
191L	n/a	n/a
191M	n/a	n/a
191K	n/a	n/a
191F	n/a	n/a
191P	n/a	n/a
091H	n/a	n/a
191I	n/a	n/a
091E	n/a	n/a
191C	n/a	n/a
091F	n/a	n/a
191O	n/a	n/a
191H	n/a	n/a
0504	82.09	80.06
0503	81.4	79.78
291A	n/a	n/a
2802	n/a	n/a
2901	n/a	n/a

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ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

- ▲/▲ Public/Private Pumping Station
- ✳ Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2018_3816510	SP5824SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224250

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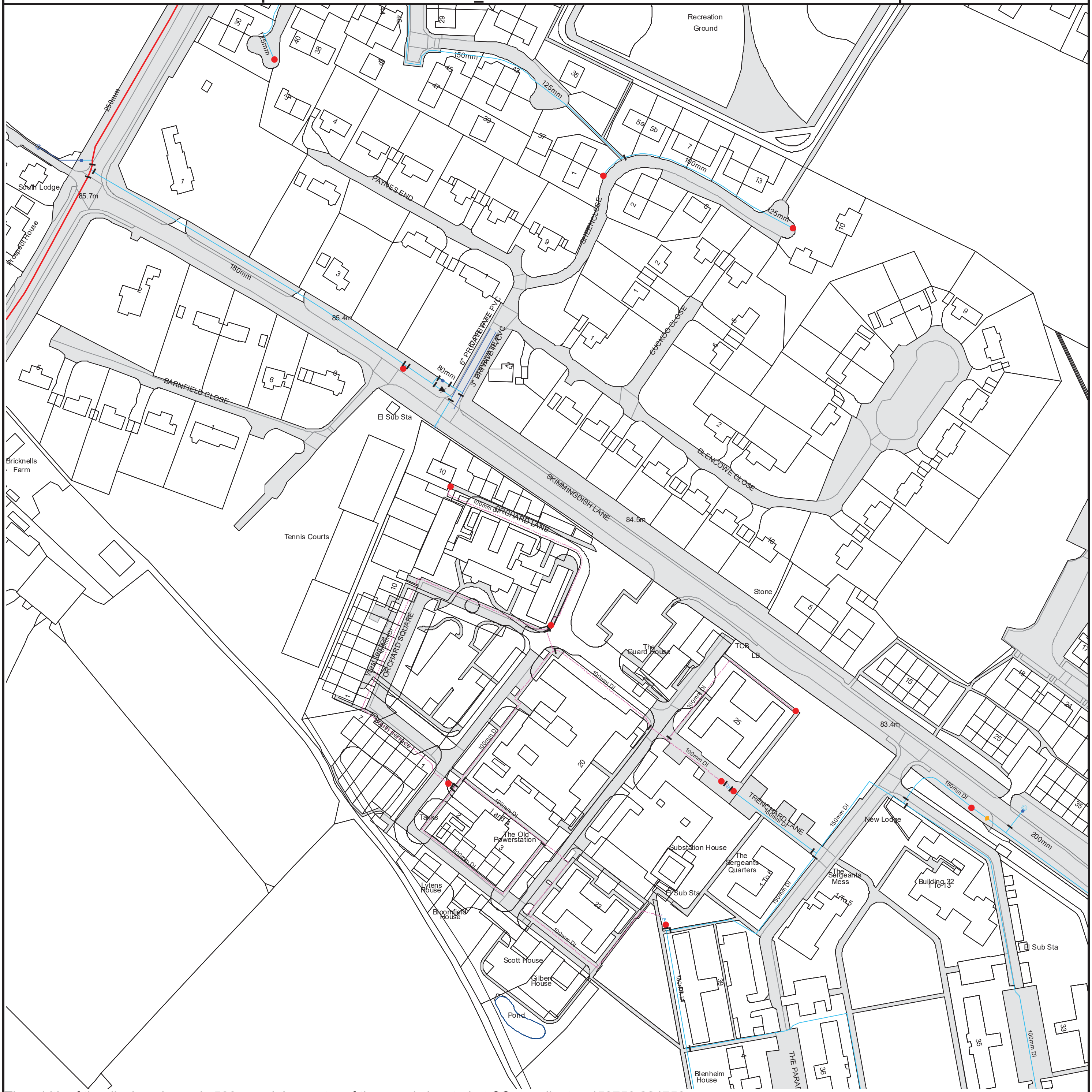
Asset Location Search Water Map - ALS/ALS Standard/2018_3816510 | SP5824NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 458750,224750

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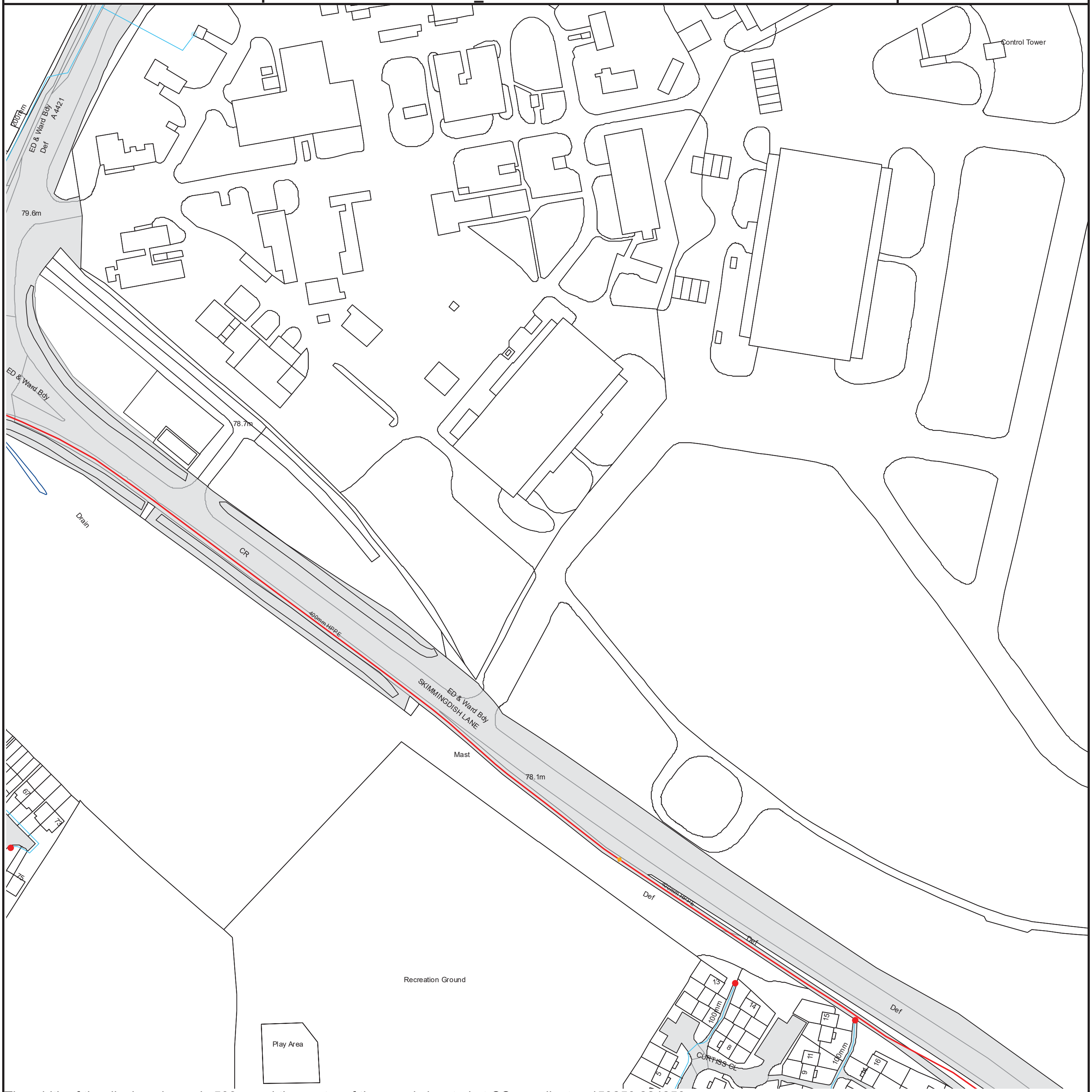
Asset Location Search Water Map - ALS/ALS Standard/2018_3816510	SP5924SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224250

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Asset Location Search Water Map - ALS/ALS Standard/2018_3816510	SP5924NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224750

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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"
Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"
Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY
Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE
Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED
Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles
Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints
If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

SOAKAWAY TEST - BRE DIGEST 365

PROJECT: Bicester Heritage
JOB REF: N16218
DATE: 01/02/2018
TEST REF: ST1 - SW Corner

Length of trial pit	=	L_{TP}	=	0.90	m
Width of trial pit	=	W_{TP}	=	0.90	m
Depth of trial pit	=	D	=	1.00	m
Pit Voids	=	PV	=	100	%

(Note - for open pits, PV = 100%. For stone filled pits, PV = 30%)

Water Depth at Start of Test, D_{TP}	=	0.850	m
75% Effective Depth, D_{75}	=	0.888	m
50% Effective Depth, D_{50}	=	0.926	m
25% Effective Depth, D_{25}	=	0.963	m

Time from 75% to 25% effective depth, T_L = 655 mins

Volume of water escaping during this test between D_{75} and D_{25}

= $V_{tp75-25}$

= (L_{TP} x W_{TP} x (D_{25} - D_{75}) x PV) = 0.061 m^3

Mean surface area through which the above volume escapes, is the wetted area.
Only 50% of the effective depth is allowed in the calculation:

Hence:
A_{P50} = Wet Base Area + Wet Sides Area (from D_{50} to base of pit)
A_{P50} = (L_{TP} x W_{TP}) + ($2L_{TP}+2W_{TP}$) x ($D-D_{50}$)
A_{P50} = 0.81 + 0.268
A_{P50} = 1.08 m^2

Soil Infiltration Rate = f = $\dfrac{V_{TP75-25}}{A_{P50} \times 60 \times T_L}$ m/s

f = $\dfrac{0.06}{1.08 \times 60 \times 655}$ m/s

Soil Infiltration Rate f = 1.43E-06 m/s

SOAKAWAY TEST - BRE DIGEST 365

PROJECT: Bicester Heritage
JOB REF: N16218
DATE: 01/02/2018
TEST REF: ST2 - Mid way along S elevation

Length of trial pit	=	L_{TP}	=	1.10	m
Width of trial pit	=	W_{TP}	=	0.90	m
Depth of trial pit	=	D	=	1.00	m
Pit Voids	=	PV	=	100	%

(Note - for open pits, PV = 100%. For stone filled pits, PV = 30%)

Water Depth at Start of Test, D_{TP}	=	0.800	m
75% Effective Depth, D_{75}	=	0.850	m
50% Effective Depth, D_{50}	=	0.900	m
25% Effective Depth, D_{25}	=	0.950	m

Time from 75% to 25% effective depth, T_L = 655 mins

Volume of water escaping during this test between D_{75} and D_{25}

= $V_{tp75-25}$

= (L_{TP} x W_{TP} x (D_{25} - D_{75}) x PV) = 0.099 m^3

Mean surface area through which the above volume escapes, is the wetted area.
Only 50% of the effective depth is allowed in the calculation:

Hence:
A_{P50} = Wet Base Area + Wet Sides Area (from D_{50} to base of pit)
A_{P50} = (L_{TP} x W_{TP}) + ($2L_{TP}+2W_{TP}$) x ($D-D_{50}$)
A_{P50} = 0.99 + 0.400
A_{P50} = 1.39 m^2

Soil Infiltration Rate = $f = \dfrac{V_{TP75-25}}{A_{P50} \times 60 \times T_L}$ m/s

$f = \dfrac{0.10}{1.39 \times 60 \times 655}$ m/s

Soil Infiltration Rate f = 1.81E-06 m/s

Appendix B

Existing Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	30	Soil	0.150
Area (ha)	1.080	Urban	0.065
SAAR (mm)	682	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.4
QBAR Urban	0.5
Q30 years	1.2
Q1 year	0.5
Q30 years	1.2
Q100 years	1.6

Greenfield Runoff Volume

FSR Data

Return Period (years)	1
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.060
SAAR (mm)	685
CWI	102.300
Urban	0.065
SPR	10.000

Results

Percentage Runoff (%)	5.61
Greenfield Runoff Volume (m³)	12.935

Greenfield Runoff Volume

FSR Data

Return Period (years)	30
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.060
SAAR (mm)	685
CWI	102.300
Urban	0.065
SPR	10.000

Results

Percentage Runoff (%)	7.50
Greenfield Runoff Volume (m^3)	38.156

Greenfield Runoff Volume

FSR Data

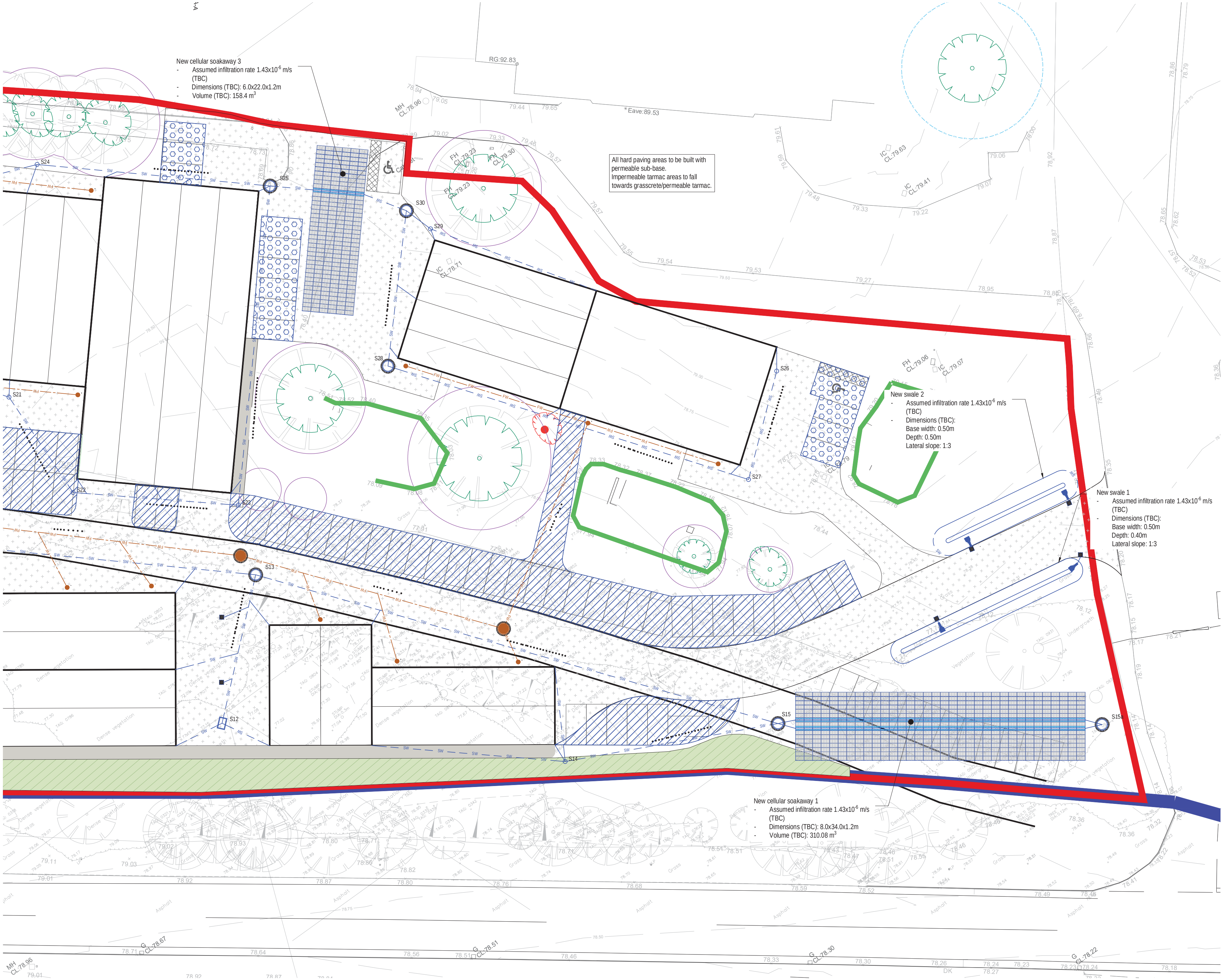
Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.404
Areal Reduction Factor	1.00
Area (ha)	1.060
SAAR (mm)	685
CWI	102.300
Urban	0.065
SPR	10.000

Results

Percentage Runoff (%)	9.48
Greenfield Runoff Volume (m^3)	62.554

Appendix C

Proposed Site Plans



GENERAL NOTES

1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2. All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.
3. Connections to Public sewers to be agreed and inspected by Water Authority.
4. Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
5. Invert to base of soil stack bends to be 450mm below lowest branch connection for up to 3 storeys buildings. For buildings up to 5 storeys the invert to base of soil stack bends should be not less than 750mm.
6. All RWP and Foul Water drain point setting out is to be confirmed by Architect.
7. All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
8. Foul drains to project 100mm above finished floor level.
9. All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
10. All external covers in footpaths and roads in non tarmac areas to have recessed trays to suit the paving material.
11. Refer to drainage specification for pipe materials.
12.
13. All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
14. This drawing has been produced in colour and should be reproduced in colour for clarity.
15. A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Key

- Road Gully
- Storm Polypropylene Inspection Chamber
- Storm Concrete Inspection Chamber
- Storm Concrete Manhole
- Permeable Tarmac
- Grasscrete Paving
- Foul Polypropylene Inspection Chamber
- Foul Concrete Inspection Chamber
- Foul Concrete Manhole
- FW — New Foul Sewer
- SW — New Surface Water Sewer
- New Linear Drainage System

Existing Drainage

- Existing Manholes
- ExFW — Existing Foul Sewer
- ExSW — Existing Surface Water Sewer
- Existing Sewers to be abandoned and grouted up either end

Rev.	Amendment	Drn	Chkd	Date
P01	Preliminary Issue	NJ	GT	18.07.18

Drg. Status: Preliminary
Suitability:

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■ Oxford
☐ Southampton
☐ Birmingham

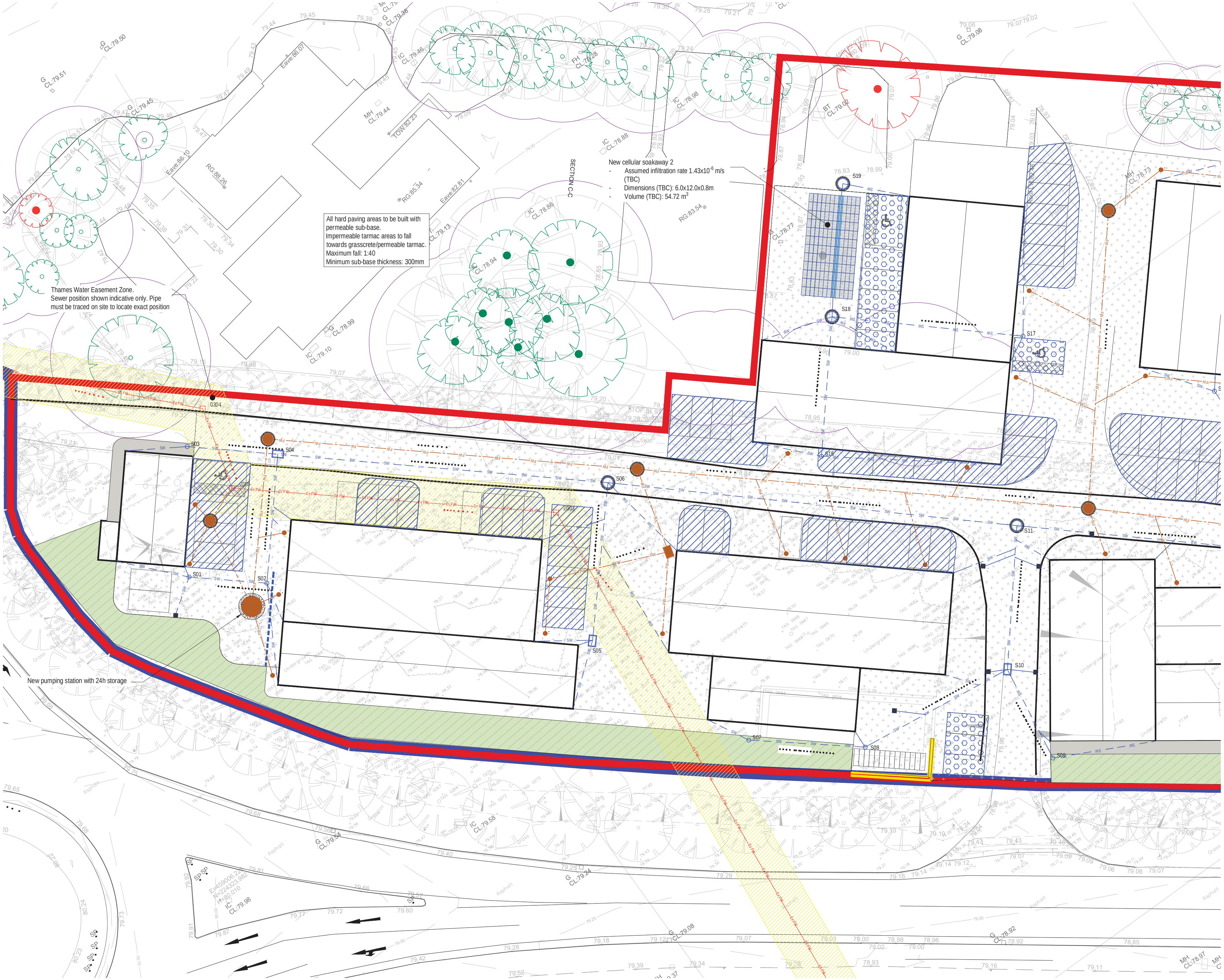
Client: Bicester Heritage Ltd.

Project: New Technical Site

Title: Drainage Layout
Sheet 1 of 2

Reviewed Scheme	GT	Date	18.07.18
Reviewed Final		Date	
Scales at A1	1:200	Project No.	X162034

Project Ref.	Originator	Zone	Level	Type	Role	Drg No.	Rev.
BHH	AKSW	XX	GF	DR	C	9201	P01



GENERAL NOTES

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7. All RWP & SVP sizes & setting out by Architect / M&E Engineer. All below ground connections to match above ground outlet size, Min 100/110mm diameter.
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9. All internal Manholes and Inspection Chambers to have double sealed recessed covers to suit floor finishes by Architect.
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11. Refer to drainage specification for pipe materials.
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14. This drawing has been produced in colour and should be reproduced in colour for clarity.
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IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Key

- Road Gully
- Storm Polypropylene Inspection Chamber
- Storm Concrete Inspection Chamber
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- Foul Concrete Inspection Chamber
- Foul Concrete Manhole
- New Foul Sewer
- New Surface Water Sewer
- New Linear Drainage System

Existing Drainage

- Existing Manholes
- Existing Foul Sewer
- Existing Surface Water Sewer
- Existing Sewers to be abandoned and grouted up either end

Rev.	Amendment	Drn	Chkd	Date
P01	Preliminary Issue	NJ	GT	18.07.18

Drg. Status: Preliminary | Suitability:

AKSWard

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☐ London
☐ Hitchin
■ Oxford
☐ Southampton
☐ Birmingham

Client: Bicester Heritage Ltd.

Project: New Technical Site

Title: Drainage Layout Sheet 1 of 2

Reviewed Scheme: GT | Date: 18.07.18
Reviewed Final | Date
Scales at A1: 1:200 | Project No.: X162034

Project Ref. / Originator / Zone / Level / Type / Role / Drg No. / Rev.: BHH - AKSW - XX - GF - DR - C - 9201 - P01

GENERAL NOTES

1. All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.

IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS:

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

Rev.	Amendment	Drn	Chkd	Date
P01	Preliminary Issue	NJ	GT	19.07.18

Drg. Status: Preliminary
Suitability

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☐ Hitchin
■ Oxford
☐ Southampton
☐ Birmingham

Client: Bicester Heritage Ltd.

Project: New Technical Site

Title: Exceedance Flood Paths

Reviewed Scheme: GT — Date: 19.07.18
Reviewed Final — Date:
Scales at A1: 1:200 — Project No. X162034

Project Ref. · Originator · Zone · Level · Type · Role · Drg No. · Rev.
BHH · AKSW · XX · GF · DR · C · 9209 - P01

Appendix D

Proposed Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.404	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.404		

Online Controls for Storm

Pump Manhole: S15, DS/PN: S1.006, Volume (m³): 7.1

Invert Level (m) 76.206

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Pump Manhole: Soakaway 2, DS/PN: S8.002, Volume (m³): 1.4

Invert Level (m) 77.821

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Pump Manhole: Soakaway 3, DS/PN: S11.004, Volume (m³): 2.2

Invert Level (m) 76.970

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Storage Structures for Storm

Cellular Storage Manhole: S15, DS/PN: S1.006

Invert Level (m) 75.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00515 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00515

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	272.0	272.0	1.201	0.0	372.8
1.200	272.0	372.8			

Cellular Storage Manhole: Soakaway 2, DS/PN: S8.002

Invert Level (m) 77.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00515 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00515

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	72.0	72.0	0.801	0.0	100.8
0.800	72.0	100.8			

Cellular Storage Manhole: Soakaway 3, DS/PN: S11.004

Invert Level (m) 76.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00515 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00515

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	135.0	135.0	1.201	0.0	203.4
1.200	135.0	203.4			

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 Coeffiecient	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	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.404
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	1	+0%	100/15 Summer			
S1.001	S02	15 Winter	1	+0%	30/15 Summer			
S2.000	S03	15 Winter	1	+0%	100/15 Summer			
S1.002	S04	15 Winter	1	+0%	100/15 Summer			
S3.000	S05	15 Winter	1	+0%	100/15 Summer			
S1.003	S06	15 Winter	1	+0%	100/15 Summer			
S4.000	S07	15 Winter	1	+0%	100/15 Summer			
S4.001	S08	15 Winter	1	+0%	100/15 Summer			
S5.000	S09	15 Winter	1	+0%	100/15 Summer			
S4.002	S10	15 Winter	1	+0%	100/15 Summer			
S1.004	S11	15 Winter	1	+0%	100/15 Summer			
S6.000	S12	15 Winter	1	+0%	100/15 Summer			
S1.005	S13	15 Winter	1	+0%	30/15 Summer			
S7.000	S14	15 Winter	1	+0%	100/4320 Winter			
S1.006	S15	2880 Winter	1	+0%	100/480 Winter			
S8.000	S16	15 Winter	1	+0%	100/15 Summer			
S9.000	S17	15 Winter	1	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	78.225	-0.075	0.000	0.14		0.9	OK	
S1.001	S02	78.151	-0.083	0.000	0.41		5.5	OK	
S2.000	S03	78.221	-0.079	0.000	0.10		0.7	OK	
S1.002	S04	77.962	-0.170	0.000	0.13		7.3	OK	
S3.000	S05	77.743	-0.107	0.000	0.18		2.9	OK	
S1.003	S06	77.524	-0.140	0.000	0.30		13.4	OK	
S4.000	S07	77.717	-0.083	0.000	0.07		0.4	OK	
S4.001	S08	77.515	-0.114	0.000	0.13		2.1	OK	
S5.000	S09	77.740	-0.110	0.000	0.16		2.5	OK	
S4.002	S10	77.290	-0.148	0.000	0.25		11.5	OK	
S1.004	S11	77.087	-0.182	0.000	0.32		27.7	OK	
S6.000	S12	77.755	-0.095	0.000	0.28		4.7	OK	
S1.005	S13	76.755	-0.166	0.000	0.41		35.6	OK	
S7.000	S14	77.746	-0.104	0.000	0.20		3.3	OK	
S1.006	S15	75.896	-0.610	0.000	0.00		0.0	OK	
S8.000	S16	78.239	-0.061	0.000	0.32		2.4	OK	
S9.000	S17	78.235	-0.065	0.000	0.27		1.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S8.001	S18	15 Winter	1	+0%	30/15 Summer		
S10.000	S19	15 Winter	1	+0%			
S8.002	Soakaway 2	2160 Winter	1	+0%	100/2160 Winter		
S11.000	S21	15 Winter	1	+0%	100/15 Summer		
S11.001	S22	15 Winter	1	+0%	100/15 Summer		
S11.002	S23	15 Winter	1	+0%	100/15 Summer		
S12.000	S24	15 Winter	1	+0%	100/4320 Winter		
S11.003	S25	15 Winter	1	+0%	100/15 Summer		
S13.000	S26	15 Winter	1	+0%	100/15 Summer		
S13.001	S27	15 Winter	1	+0%	100/15 Summer		
S13.002	S28	15 Winter	1	+0%	30/15 Summer		
S13.003	S29	15 Winter	1	+0%	30/15 Summer		
S13.004	S30	15 Winter	1	+0%	30/15 Summer		
S11.004	Soakaway 3	2880 Winter	1	+0%	100/2160 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.001	S18		77.953	-0.069	0.000	0.56		7.0	OK
S10.000	S19		78.225	-0.075	0.000	0.14		0.8	OK
S8.002	Soakaway 2		77.382	-0.589	0.000	0.00		0.0	OK
S11.000	S21		77.735	-0.115	0.000	0.13		2.0	OK
S11.001	S22		77.625	-0.090	0.000	0.33		4.5	OK
S11.002	S23		77.420	-0.165	0.000	0.16		6.3	OK
S12.000	S24		77.746	-0.104	0.000	0.20		3.8	OK
S11.003	S25		77.206	-0.128	0.000	0.39		13.0	OK
S13.000	S26		78.029	-0.071	0.000	0.18		1.2	OK
S13.001	S27		77.820	-0.115	0.000	0.12		2.1	OK
S13.002	S28		77.395	-0.096	0.000	0.28		4.7	OK
S13.003	S29		77.250	-0.072	0.000	0.53		7.3	OK
S13.004	S30		77.197	-0.077	0.000	0.47		7.2	OK
S11.004	Soakaway 3		76.298	-0.897	0.000	0.00		0.0	OK

PN	US/MH Name	Level Exceeded
S8.001	S18	
S10.000	S19	
S8.002	Soakaway 2	
S11.000	S21	
S11.001	S22	
S11.002	S23	
S12.000	S24	
S11.003	S25	

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

PN	US/MH Name	Level Exceeded
S13.000	S26	
S13.001	S27	
S13.002	S28	
S13.003	S29	
S13.004	S30	
S11.004	Soakaway 3	

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 Coeffiecient 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 3
Number of Online Controls 3 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.404
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	30	+0%	100/15 Summer			
S1.001	S02	15 Winter	30	+0%	30/15 Summer			
S2.000	S03	15 Winter	30	+0%	100/15 Summer			
S1.002	S04	15 Winter	30	+0%	100/15 Summer			
S3.000	S05	15 Winter	30	+0%	100/15 Summer			
S1.003	S06	15 Winter	30	+0%	100/15 Summer			
S4.000	S07	15 Winter	30	+0%	100/15 Summer			
S4.001	S08	15 Winter	30	+0%	100/15 Summer			
S5.000	S09	15 Winter	30	+0%	100/15 Summer			
S4.002	S10	15 Winter	30	+0%	100/15 Summer			
S1.004	S11	15 Winter	30	+0%	100/15 Summer			
S6.000	S12	15 Winter	30	+0%	100/15 Summer			
S1.005	S13	15 Winter	30	+0%	30/15 Summer			
S7.000	S14	15 Winter	30	+0%	100/4320 Winter			
S1.006	S15	4320 Winter	30	+0%	100/480 Winter			
S8.000	S16	15 Winter	30	+0%	100/15 Summer			
S9.000	S17	15 Winter	30	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	78.290	-0.010	0.000	0.35		2.2	OK	
S1.001	S02	78.273	0.039	0.000	1.17		15.7	SURCHARGED	
S2.000	S03	78.233	-0.067	0.000	0.24		1.7	OK	
S1.002	S04	78.005	-0.128	0.000	0.38		20.5	OK	
S3.000	S05	77.770	-0.080	0.000	0.43		7.2	OK	
S1.003	S06	77.601	-0.063	0.000	0.83		37.3	OK	
S4.000	S07	77.728	-0.072	0.000	0.17		1.1	OK	
S4.001	S08	77.543	-0.086	0.000	0.38		6.4	OK	
S5.000	S09	77.765	-0.085	0.000	0.39		6.3	OK	
S4.002	S10	77.358	-0.081	0.000	0.73		33.8	OK	
S1.004	S11	77.215	-0.053	0.000	0.89		76.0	OK	
S6.000	S12	77.794	-0.056	0.000	0.69		11.5	OK	
S1.005	S13	76.959	0.039	0.000	1.06		91.8	SURCHARGED	
S7.000	S14	77.775	-0.075	0.000	0.48		8.1	OK	
S1.006	S15	76.277	-0.230	0.000	0.00		0.0	OK	
S8.000	S16	78.268	-0.032	0.000	0.79		5.9	OK	
S9.000	S17	78.260	-0.040	0.000	0.65		4.2	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S8.001	S18	15 Winter	30	+0%	30/15 Summer		
S10.000	S19	15 Winter	30	+0%			
S8.002	Soakaway 2	2880 Winter	30	+0%	100/2160 Winter		
S11.000	S21	15 Winter	30	+0%	100/15 Summer		
S11.001	S22	15 Winter	30	+0%	100/15 Summer		
S11.002	S23	15 Winter	30	+0%	100/15 Summer		
S12.000	S24	15 Winter	30	+0%	100/4320 Winter		
S11.003	S25	15 Winter	30	+0%	100/15 Summer		
S13.000	S26	15 Winter	30	+0%	100/15 Summer		
S13.001	S27	15 Winter	30	+0%	100/15 Summer		
S13.002	S28	15 Winter	30	+0%	30/15 Summer		
S13.003	S29	15 Winter	30	+0%	30/15 Summer		
S13.004	S30	15 Winter	30	+0%	30/15 Summer		
S11.004	Soakaway 3	4320 Winter	30	+0%	100/2160 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.001	S18		78.083	0.061	0.000	1.49		18.6	SURCHARGED
S10.000	S19		78.240	-0.060	0.000	0.34		2.1	OK
S8.002	Soakaway 2		77.626	-0.345	0.000	0.00		0.0	OK
S11.000	S21		77.757	-0.093	0.000	0.31		5.0	OK
S11.001	S22		77.680	-0.035	0.000	0.92		12.5	OK
S11.002	S23		77.467	-0.118	0.000	0.45		17.9	OK
S12.000	S24		77.776	-0.074	0.000	0.50		9.4	OK
S11.003	S25		77.330	-0.004	0.000	1.00		33.3	OK
S13.000	S26		78.047	-0.053	0.000	0.44		2.8	OK
S13.001	S27		77.846	-0.089	0.000	0.33		5.6	OK
S13.002	S28		77.505	0.014	0.000	0.75		12.4	SURCHARGED
S13.003	S29		77.409	0.087	0.000	1.42		19.3	SURCHARGED
S13.004	S30		77.312	0.038	0.000	1.24		19.2	SURCHARGED
S11.004	Soakaway 3		76.678	-0.517	0.000	0.00		0.0	OK

PN	US/MH Name	Level Exceeded
S8.001	S18	
S10.000	S19	
S8.002	Soakaway 2	
S11.000	S21	
S11.001	S22	
S11.002	S23	
S12.000	S24	
S11.003	S25	

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

PN	US/MH Name	Level Exceeded
S13.000	S26	
S13.001	S27	
S13.002	S28	
S13.003	S29	
S13.004	S30	
S11.004	Soakaway 3	

100 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 Coeffiecient 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 3
Number of Online Controls 3 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.404
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	100	+0%	100/15 Summer			
S1.001	S02	15 Winter	100	+0%	100/15 Summer			
S2.000	S03	15 Winter	100	+0%				
S1.002	S04	15 Winter	100	+0%				
S3.000	S05	15 Winter	100	+0%				
S1.003	S06	15 Winter	100	+0%	100/15 Summer			
S4.000	S07	15 Winter	100	+0%				
S4.001	S08	15 Winter	100	+0%				
S5.000	S09	15 Winter	100	+0%				
S4.002	S10	15 Winter	100	+0%	100/15 Summer			
S1.004	S11	15 Winter	100	+0%	100/15 Summer			
S6.000	S12	15 Winter	100	+0%				
S1.005	S13	15 Winter	100	+0%	100/15 Summer			
S7.000	S14	15 Winter	100	+0%				
S1.006	S15	4320 Winter	100	+0%				
S8.000	S16	15 Winter	100	+0%	100/15 Summer			
S9.000	S17	15 Winter	100	+0%	100/15 Summer			
S8.001	S18	15 Winter	100	+0%	100/15 Summer			
S10.000	S19	15 Winter	100	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	78.395	0.095	0.000	0.46		2.9	SURCHARGED	
S1.001	S02	78.372	0.138	0.000	1.52		20.3	FLOOD RISK	
S2.000	S03	78.239	-0.061	0.000	0.32		2.2	OK	
S1.002	S04	78.020	-0.112	0.000	0.49		26.5	OK	
S3.000	S05	77.804	-0.046	0.000	0.56		9.3	OK	
S1.003	S06	77.764	0.099	0.000	0.93		41.6	SURCHARGED	
S4.000	S07	77.732	-0.068	0.000	0.22		1.4	OK	
S4.001	S08	77.554	-0.075	0.000	0.50		8.2	OK	
S5.000	S09	77.776	-0.074	0.000	0.51		8.1	OK	
S4.002	S10	77.519	0.081	0.000	0.88		40.8	SURCHARGED	
S1.004	S11	77.426	0.158	0.000	0.96		82.5	SURCHARGED	
S6.000	S12	77.813	-0.037	0.000	0.90		14.9	OK	
S1.005	S13	77.106	0.185	0.000	1.22		105.1	SURCHARGED	
S7.000	S14	77.788	-0.062	0.000	0.63		10.6	OK	
S1.006	S15	76.473	-0.033	0.000	0.00		0.0	OK	
S8.000	S16	78.414	0.114	0.000	0.98		7.4	SURCHARGED	
S9.000	S17	78.339	0.039	0.000	0.83		5.4	SURCHARGED	
S8.001	S18	78.145	0.123	0.000	1.86		23.2	SURCHARGED	
S10.000	S19	78.247	-0.053	0.000	0.44		2.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S8.002	Soakaway 2	2880 Winter	100	+0%				
S11.000	S21	15 Winter	100	+0%				
S11.001	S22	15 Winter	100	+0%	100/15 Summer			
S11.002	S23	15 Winter	100	+0%				
S12.000	S24	15 Winter	100	+0%				
S11.003	S25	15 Winter	100	+0%	100/15 Summer			
S13.000	S26	15 Winter	100	+0%				
S13.001	S27	15 Winter	100	+0%				
S13.002	S28	15 Winter	100	+0%	100/15 Summer			
S13.003	S29	15 Winter	100	+0%	100/15 Summer			
S13.004	S30	15 Winter	100	+0%	100/15 Summer			
S11.004	Soakaway 3	4320 Winter	100	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S8.002	Soakaway 2	77.757	-0.214	0.000	0.00		0.0	OK	
S11.000	S21	77.786	-0.064	0.000	0.40		6.5	OK	
S11.001	S22	77.760	0.045	0.000	1.16		15.7	SURCHARGED	
S11.002	S23	77.483	-0.102	0.000	0.56		22.5	OK	
S12.000	S24	77.789	-0.061	0.000	0.64		12.2	OK	
S11.003	S25	77.375	0.041	0.000	1.37		45.5	SURCHARGED	
S13.000	S26	78.055	-0.045	0.000	0.58		3.7	OK	
S13.001	S27	77.855	-0.080	0.000	0.42		7.3	OK	
S13.002	S28	77.664	0.173	0.000	0.93		15.4	SURCHARGED	
S13.003	S29	77.520	0.199	0.000	1.72		23.4	SURCHARGED	
S13.004	S30	77.374	0.099	0.000	1.52		23.4	SURCHARGED	
S11.004	Soakaway 3	76.879	-0.317	0.000	0.00		0.0	OK	

100 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 Coeffiecient 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 3
Number of Online Controls 3 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.404
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 20.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S01	15 Winter	100	+40%	100/15 Summer			
S1.001	S02	15 Winter	100	+40%	30/15 Summer			
S2.000	S03	15 Winter	100	+40%	100/15 Summer			
S1.002	S04	15 Winter	100	+40%	100/15 Summer			
S3.000	S05	15 Winter	100	+40%	100/15 Summer			
S1.003	S06	15 Winter	100	+40%	100/15 Summer			
S4.000	S07	5760 Winter	100	+40%	100/15 Summer			
S4.001	S08	5760 Winter	100	+40%	100/15 Summer			
S5.000	S09	5760 Winter	100	+40%	100/15 Summer			
S4.002	S10	5760 Winter	100	+40%	100/15 Summer			
S1.004	S11	5760 Winter	100	+40%	100/15 Summer			
S6.000	S12	5760 Winter	100	+40%	100/15 Summer			
S1.005	S13	5760 Winter	100	+40%	30/15 Summer			
S7.000	S14	5760 Winter	100	+40%	100/4320 Winter			
S1.006	S15	5760 Winter	100	+40%	100/480 Winter			
S8.000	S16	15 Winter	100	+40%	100/15 Summer			
S9.000	S17	15 Winter	100	+40%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S01	78.637	0.337	0.000	0.59		3.7	SURCHARGED	
S1.001	S02	78.595	0.361	0.000	2.01		26.8	FLOOD RISK	
S2.000	S03	78.477	0.177	0.000	0.44		3.1	SURCHARGED	
S1.002	S04	78.460	0.328	0.000	0.57		30.9	SURCHARGED	
S3.000	S05	78.444	0.594	0.000	0.65		10.9	FLOOD RISK	
S1.003	S06	78.376	0.712	0.000	1.08		48.3	SURCHARGED	
S4.000	S07	78.209	0.409	0.000	0.00		0.0	FLOOD RISK	
S4.001	S08	78.210	0.581	0.000	0.01		0.2	FLOOD RISK	
S5.000	S09	78.210	0.360	0.000	0.01		0.2	FLOOD RISK	
S4.002	S10	78.210	0.771	0.000	0.02		0.9	FLOOD RISK	
S1.004	S11	78.210	0.941	0.000	0.03		2.2	SURCHARGED	
S6.000	S12	78.210	0.360	0.000	0.02		0.3	FLOOD RISK	
S1.005	S13	78.210	1.289	0.000	0.03		2.8	SURCHARGED	
S7.000	S14	78.209	0.359	0.000	0.01		0.2	FLOOD RISK	
S1.006	S15	78.210	1.703	0.000	0.00		0.0	FLOOD RISK	
S8.000	S16	78.784	0.484	0.000	1.33		10.0	FLOOD RISK	
S9.000	S17	78.641	0.341	0.000	1.12		7.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S8.001	S18	15 Winter	100	+40%	30/15 Summer		
S10.000	S19	4320 Winter	100	+40%			
S8.002	Soakaway 2	4320 Winter	100	+40%	100/2160 Winter		
S11.000	S21	5760 Winter	100	+40%	100/15 Summer		
S11.001	S22	5760 Winter	100	+40%	100/15 Summer		
S11.002	S23	5760 Winter	100	+40%	100/15 Summer		
S12.000	S24	5760 Winter	100	+40%	100/4320 Winter		
S11.003	S25	5760 Winter	100	+40%	100/15 Summer		
S13.000	S26	5760 Winter	100	+40%	100/15 Summer		
S13.001	S27	5760 Winter	100	+40%	100/15 Summer		
S13.002	S28	5760 Winter	100	+40%	30/15 Summer		
S13.003	S29	5760 Winter	100	+40%	30/15 Summer		
S13.004	S30	5760 Winter	100	+40%	30/15 Summer		
S11.004	Soakaway 3	5760 Winter	100	+40%	100/2160 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S8.001	S18		78.286	0.264	0.000	2.48		31.0	SURCHARGED
S10.000	S19		78.271	-0.029	0.000	0.01		0.1	OK
S8.002	Soakaway 2		78.271	0.300	0.000	0.00		0.0	SURCHARGED
S11.000	S21		78.209	0.359	0.000	0.01		0.1	FLOOD RISK
S11.001	S22		78.209	0.494	0.000	0.02		0.3	FLOOD RISK
S11.002	S23		78.209	0.624	0.000	0.01		0.5	FLOOD RISK
S12.000	S24		78.209	0.359	0.000	0.01		0.3	FLOOD RISK
S11.003	S25		78.210	0.876	0.000	0.03		1.0	FLOOD RISK
S13.000	S26		78.210	0.110	0.000	0.01		0.1	SURCHARGED
S13.001	S27		78.210	0.275	0.000	0.01		0.2	SURCHARGED
S13.002	S28		78.210	0.719	0.000	0.03		0.4	SURCHARGED
S13.003	S29		78.210	0.888	0.000	0.06		0.8	SURCHARGED
S13.004	S30		78.210	0.935	0.000	0.04		0.7	SURCHARGED
S11.004	Soakaway 3		78.210	1.015	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
S8.001	S18	
S10.000	S19	
S8.002	Soakaway 2	
S11.000	S21	
S11.001	S22	
S11.002	S23	
S12.000	S24	
S11.003	S25	

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

PN	US/MH Name	Level Exceeded
S13.000	S26	
S13.001	S27	
S13.002	S28	
S13.003	S29	
S13.004	S30	
S11.004	Soakaway 3	

Summary of Results for 1 year Return Period

Half Drain Time : 304 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.041	0.041	0.4	4.0	O K
30 min Summer	0.073	0.073	0.8	12.4	O K
60 min Summer	0.095	0.095	1.1	21.2	Flood Risk
120 min Summer	0.113	0.113	1.3	29.8	Flood Risk
180 min Summer	0.121	0.121	1.4	34.2	Flood Risk
240 min Summer	0.125	0.125	1.4	36.8	Flood Risk
360 min Summer	0.130	0.130	1.5	39.4	Flood Risk
480 min Summer	0.132	0.132	1.5	41.0	Flood Risk
600 min Summer	0.134	0.134	1.5	42.0	Flood Risk
720 min Summer	0.135	0.135	1.5	42.7	Flood Risk
960 min Summer	0.136	0.136	1.5	43.2	Flood Risk
1440 min Summer	0.135	0.135	1.5	42.5	Flood Risk
2160 min Summer	0.130	0.130	1.5	39.6	Flood Risk
2880 min Summer	0.124	0.124	1.4	36.2	Flood Risk
4320 min Summer	0.113	0.113	1.3	29.7	Flood Risk
5760 min Summer	0.102	0.102	1.1	24.6	Flood Risk
7200 min Summer	0.094	0.094	1.0	20.7	O K
8640 min Summer	0.087	0.087	1.0	17.6	O K
10080 min Summer	0.080	0.080	0.9	15.1	O K
15 min Winter	0.056	0.056	0.6	7.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	31.093	0.0	19
30 min Summer	20.252	0.0	33
60 min Summer	12.800	0.0	62
120 min Summer	7.926	0.0	122
180 min Summer	5.960	0.0	182
240 min Summer	4.862	0.0	240
360 min Summer	3.628	0.0	302
480 min Summer	2.939	0.0	362
600 min Summer	2.495	0.0	428
720 min Summer	2.183	0.0	494
960 min Summer	1.768	0.0	634
1440 min Summer	1.314	0.0	908
2160 min Summer	0.977	0.0	1300
2880 min Summer	0.791	0.0	1696
4320 min Summer	0.588	0.0	2424
5760 min Summer	0.476	0.0	3176
7200 min Summer	0.405	0.0	3896
8640 min Summer	0.354	0.0	4592
10080 min Summer	0.317	0.0	5344
15 min Winter	31.093	0.0	19

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.085	0.085	0.9	16.9	O K
60 min Winter	0.107	0.107	1.2	26.9	Flood Risk
120 min Winter	0.125	0.125	1.4	36.7	Flood Risk
180 min Winter	0.134	0.134	1.5	41.9	Flood Risk
240 min Winter	0.139	0.139	1.6	45.0	Flood Risk
360 min Winter	0.143	0.143	1.6	47.8	Flood Risk
480 min Winter	0.145	0.145	1.6	49.1	Flood Risk
600 min Winter	0.146	0.146	1.6	49.9	Flood Risk
720 min Winter	0.146	0.146	1.6	50.2	Flood Risk
960 min Winter	0.146	0.146	1.6	49.7	Flood Risk
1440 min Winter	0.141	0.141	1.6	46.9	Flood Risk
2160 min Winter	0.133	0.133	1.5	41.3	Flood Risk
2880 min Winter	0.124	0.124	1.4	35.8	Flood Risk
4320 min Winter	0.107	0.107	1.2	26.8	Flood Risk
5760 min Winter	0.093	0.093	1.0	20.4	O K
7200 min Winter	0.082	0.082	0.9	15.8	O K
8640 min Winter	0.073	0.073	0.8	12.4	O K
10080 min Winter	0.065	0.065	0.7	10.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	20.252	0.0	33
60 min Winter	12.800	0.0	62
120 min Winter	7.926	0.0	120
180 min Winter	5.960	0.0	176
240 min Winter	4.862	0.0	232
360 min Winter	3.628	0.0	336
480 min Winter	2.939	0.0	378
600 min Winter	2.495	0.0	454
720 min Winter	2.183	0.0	532
960 min Winter	1.768	0.0	682
1440 min Winter	1.314	0.0	968
2160 min Winter	0.977	0.0	1384
2880 min Winter	0.791	0.0	1784
4320 min Winter	0.588	0.0	2548
5760 min Winter	0.476	0.0	3280
7200 min Winter	0.405	0.0	3968
8640 min Winter	0.354	0.0	4672
10080 min Winter	0.317	0.0	5352

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.510

Time From:	(mins) To:	Area (ha)
0	4	0.510

Model Details

Storage is Online Cover Level (m) 0.395

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00515	Width (m)	391.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	1411.9	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	0.300

Summary of Results for 30 year Return Period

Half Drain Time : 514 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.141	0.141	1.6	46.5	Flood Risk
30 min Summer	0.169	0.169	1.9	67.2	Flood Risk
60 min Summer	0.193	0.193	2.2	87.7	Flood Risk
120 min Summer	0.213	0.213	2.4	106.5	Flood Risk
180 min Summer	0.222	0.222	2.5	115.5	Flood Risk
240 min Summer	0.226	0.226	2.5	120.3	Flood Risk
360 min Summer	0.230	0.230	2.6	124.2	Flood Risk
480 min Summer	0.231	0.231	2.6	125.5	Flood Risk
600 min Summer	0.232	0.232	2.6	126.2	Flood Risk
720 min Summer	0.232	0.232	2.6	126.4	Flood Risk
960 min Summer	0.231	0.231	2.6	125.7	Flood Risk
1440 min Summer	0.228	0.228	2.5	121.6	Flood Risk
2160 min Summer	0.219	0.219	2.5	112.8	Flood Risk
2880 min Summer	0.210	0.210	2.4	103.6	Flood Risk
4320 min Summer	0.193	0.193	2.2	87.0	Flood Risk
5760 min Summer	0.177	0.177	2.0	73.5	Flood Risk
7200 min Summer	0.163	0.163	1.8	62.6	Flood Risk
8640 min Summer	0.152	0.152	1.7	54.0	Flood Risk
10080 min Summer	0.142	0.142	1.6	47.0	Flood Risk
15 min Winter	0.153	0.153	1.7	55.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	76.290	0.0	19
30 min Summer	49.584	0.0	34
60 min Summer	30.811	0.0	64
120 min Summer	18.584	0.0	122
180 min Summer	13.680	0.0	182
240 min Summer	10.960	0.0	242
360 min Summer	8.001	0.0	358
480 min Summer	6.397	0.0	410
600 min Summer	5.375	0.0	470
720 min Summer	4.661	0.0	530
960 min Summer	3.719	0.0	664
1440 min Summer	2.704	0.0	938
2160 min Summer	1.963	0.0	1344
2880 min Summer	1.563	0.0	1732
4320 min Summer	1.133	0.0	2508
5760 min Summer	0.901	0.0	3280
7200 min Summer	0.754	0.0	3968
8640 min Summer	0.652	0.0	4752
10080 min Summer	0.576	0.0	5448
15 min Winter	76.290	0.0	19

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.183	0.183	2.0	78.5	Flood Risk
60 min Winter	0.208	0.208	2.3	101.5	Flood Risk
120 min Winter	0.229	0.229	2.6	122.9	Flood Risk
180 min Winter	0.238	0.238	2.7	133.3	Flood Risk
240 min Winter	0.243	0.243	2.7	139.1	Flood Risk
360 min Winter	0.248	0.248	2.8	144.4	Flood Risk
480 min Winter	0.249	0.249	2.8	145.6	Flood Risk
600 min Winter	0.249	0.249	2.8	145.2	Flood Risk
720 min Winter	0.249	0.249	2.8	145.0	Flood Risk
960 min Winter	0.247	0.247	2.8	142.8	Flood Risk
1440 min Winter	0.240	0.240	2.7	135.0	Flood Risk
2160 min Winter	0.227	0.227	2.5	120.8	Flood Risk
2880 min Winter	0.214	0.214	2.4	107.0	Flood Risk
4320 min Winter	0.189	0.189	2.1	83.8	Flood Risk
5760 min Winter	0.168	0.168	1.9	66.2	Flood Risk
7200 min Winter	0.150	0.150	1.7	53.0	Flood Risk
8640 min Winter	0.135	0.135	1.5	43.1	Flood Risk
10080 min Winter	0.123	0.123	1.4	35.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	49.584	0.0	33
60 min Winter	30.811	0.0	62
120 min Winter	18.584	0.0	120
180 min Winter	13.680	0.0	178
240 min Winter	10.960	0.0	236
360 min Winter	8.001	0.0	346
480 min Winter	6.397	0.0	452
600 min Winter	5.375	0.0	490
720 min Winter	4.661	0.0	562
960 min Winter	3.719	0.0	714
1440 min Winter	2.704	0.0	1012
2160 min Winter	1.963	0.0	1448
2880 min Winter	1.563	0.0	1872
4320 min Winter	1.133	0.0	2640
5760 min Winter	0.901	0.0	3408
7200 min Winter	0.754	0.0	4112
8640 min Winter	0.652	0.0	4848
10080 min Winter	0.576	0.0	5552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.510

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.510

Model Details

Storage is Online Cover Level (m) 0.395

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00515	Width (m)	391.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	1411.9	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	0.300

Summary of Results for 100 year Return Period

Half Drain Time : 612 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.170	0.170	1.9	68.0	Flood Risk
30 min Summer	0.202	0.202	2.3	96.1	Flood Risk
60 min Summer	0.230	0.230	2.6	123.8	Flood Risk
120 min Summer	0.252	0.252	2.8	149.1	Flood Risk
180 min Summer	0.262	0.262	2.9	161.1	Flood Risk
240 min Summer	0.267	0.267	3.0	167.2	Flood Risk
360 min Summer	0.271	0.271	3.0	172.3	Flood Risk
480 min Summer	0.272	0.272	3.0	173.2	Flood Risk
600 min Summer	0.272	0.272	3.0	173.4	Flood Risk
720 min Summer	0.272	0.272	3.0	173.1	Flood Risk
960 min Summer	0.270	0.270	3.0	171.5	Flood Risk
1440 min Summer	0.266	0.266	3.0	165.4	Flood Risk
2160 min Summer	0.256	0.256	2.9	153.5	Flood Risk
2880 min Summer	0.245	0.245	2.7	141.3	Flood Risk
4320 min Summer	0.225	0.225	2.5	119.3	Flood Risk
5760 min Summer	0.208	0.208	2.3	101.4	Flood Risk
7200 min Summer	0.193	0.193	2.2	87.1	Flood Risk
8640 min Summer	0.179	0.179	2.0	75.5	Flood Risk
10080 min Summer	0.168	0.168	1.9	65.8	Flood Risk
15 min Winter	0.184	0.184	2.1	79.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	99.025	0.0	19
30 min Summer	64.904	0.0	34
60 min Summer	40.510	0.0	64
120 min Summer	24.421	0.0	122
180 min Summer	17.920	0.0	182
240 min Summer	14.300	0.0	242
360 min Summer	10.377	0.0	360
480 min Summer	8.265	0.0	438
600 min Summer	6.922	0.0	494
720 min Summer	5.986	0.0	556
960 min Summer	4.756	0.0	682
1440 min Summer	3.434	0.0	954
2160 min Summer	2.475	0.0	1364
2880 min Summer	1.960	0.0	1760
4320 min Summer	1.409	0.0	2552
5760 min Summer	1.114	0.0	3296
7200 min Summer	0.927	0.0	4040
8640 min Summer	0.798	0.0	4760
10080 min Summer	0.703	0.0	5456
15 min Winter	99.025	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.217	0.217	2.4	110.8	Flood Risk
60 min Winter	0.246	0.246	2.8	142.0	Flood Risk
120 min Winter	0.270	0.270	3.0	170.8	Flood Risk
180 min Winter	0.280	0.280	3.1	184.5	Flood Risk
240 min Winter	0.286	0.286	3.2	191.9	Flood Risk
360 min Winter	0.291	0.291	3.3	198.7	Flood Risk
480 min Winter	0.292	0.292	3.3	200.5	Flood Risk
600 min Winter	0.292	0.292	3.3	199.6	Flood Risk
720 min Winter	0.291	0.291	3.3	198.3	Flood Risk
960 min Winter	0.288	0.288	3.2	195.2	Flood Risk
1440 min Winter	0.281	0.281	3.1	184.9	Flood Risk
2160 min Winter	0.266	0.266	3.0	166.5	Flood Risk
2880 min Winter	0.252	0.252	2.8	148.5	Flood Risk
4320 min Winter	0.224	0.224	2.5	117.9	Flood Risk
5760 min Winter	0.201	0.201	2.2	94.4	Flood Risk
7200 min Winter	0.181	0.181	2.0	76.4	Flood Risk
8640 min Winter	0.164	0.164	1.8	62.7	Flood Risk
10080 min Winter	0.149	0.149	1.7	52.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	64.904	0.0	33
60 min Winter	40.510	0.0	62
120 min Winter	24.421	0.0	120
180 min Winter	17.920	0.0	178
240 min Winter	14.300	0.0	236
360 min Winter	10.377	0.0	348
480 min Winter	8.265	0.0	458
600 min Winter	6.922	0.0	556
720 min Winter	5.986	0.0	578
960 min Winter	4.756	0.0	730
1440 min Winter	3.434	0.0	1036
2160 min Winter	2.475	0.0	1472
2880 min Winter	1.960	0.0	1900
4320 min Winter	1.409	0.0	2684
5760 min Winter	1.114	0.0	3464
7200 min Winter	0.927	0.0	4184
8640 min Winter	0.798	0.0	4928
10080 min Winter	0.703	0.0	5648

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.510

Time From:	(mins) To:	Area (ha)
0	4	0.510

Model Details

Storage is Online Cover Level (m) 0.395

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00515	Width (m)	391.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	1411.9	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	0.300

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 784 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.212	0.212	2.4	105.6	Flood Risk
30 min Summer	0.249	0.249	2.8	145.1	Flood Risk
60 min Summer	0.280	0.280	3.1	184.4	Flood Risk
120 min Summer	0.307	0.307	3.4	220.9	Flood Risk
180 min Summer	0.320	0.320	3.6	238.7	Flood Risk
240 min Summer	0.327	0.327	3.6	248.5	Flood Risk
360 min Summer	0.333	0.333	3.6	258.1	Flood Risk
480 min Summer	0.336	0.336	3.6	261.3	Flood Risk
600 min Summer	0.336	0.336	3.6	261.3	Flood Risk
720 min Summer	0.336	0.336	3.6	260.9	Flood Risk
960 min Summer	0.334	0.334	3.6	258.8	Flood Risk
1440 min Summer	0.329	0.329	3.6	251.3	Flood Risk
2160 min Summer	0.318	0.318	3.6	236.3	Flood Risk
2880 min Summer	0.307	0.307	3.4	220.4	Flood Risk
4320 min Summer	0.285	0.285	3.2	190.8	Flood Risk
5760 min Summer	0.266	0.266	3.0	165.8	Flood Risk
7200 min Summer	0.249	0.249	2.8	145.3	Flood Risk
8640 min Summer	0.234	0.234	2.6	128.3	Flood Risk
10080 min Summer	0.220	0.220	2.5	113.9	Flood Risk
15 min Winter	0.227	0.227	2.5	121.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	19
30 min Summer	90.866	0.0	34
60 min Summer	56.713	0.0	64
120 min Summer	34.190	0.0	122
180 min Summer	25.088	0.0	182
240 min Summer	20.020	0.0	242
360 min Summer	14.528	0.0	360
480 min Summer	11.570	0.0	480
600 min Summer	9.690	0.0	538
720 min Summer	8.380	0.0	598
960 min Summer	6.658	0.0	720
1440 min Summer	4.807	0.0	982
2160 min Summer	3.465	0.0	1388
2880 min Summer	2.744	0.0	1792
4320 min Summer	1.973	0.0	2596
5760 min Summer	1.559	0.0	3352
7200 min Summer	1.298	0.0	4112
8640 min Summer	1.118	0.0	4848
10080 min Summer	0.985	0.0	5552
15 min Winter	138.634	0.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.266	0.266	3.0	165.7	Flood Risk
60 min Winter	0.299	0.299	3.3	210.0	Flood Risk
120 min Winter	0.329	0.329	3.6	251.4	Flood Risk
180 min Winter	0.344	0.344	3.6	272.2	Flood Risk
240 min Winter	0.353	0.353	3.6	284.1	Flood Risk
360 min Winter	0.363	0.363	3.6	297.0	Flood Risk
480 min Winter	0.368	0.368	3.6	302.7	Flood Risk
600 min Winter	0.369	0.369	3.6	304.0	Flood Risk
720 min Winter	0.368	0.368	3.6	302.7	Flood Risk
960 min Winter	0.364	0.364	3.6	297.4	Flood Risk
1440 min Winter	0.354	0.354	3.6	285.3	Flood Risk
2160 min Winter	0.335	0.335	3.6	260.9	Flood Risk
2880 min Winter	0.318	0.318	3.6	236.8	Flood Risk
4320 min Winter	0.288	0.288	3.2	194.9	Flood Risk
5760 min Winter	0.262	0.262	2.9	161.2	Flood Risk
7200 min Winter	0.239	0.239	2.7	134.5	Flood Risk
8640 min Winter	0.220	0.220	2.5	113.2	Flood Risk
10080 min Winter	0.203	0.203	2.3	96.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	90.866	0.0	33
60 min Winter	56.713	0.0	62
120 min Winter	34.190	0.0	120
180 min Winter	25.088	0.0	180
240 min Winter	20.020	0.0	238
360 min Winter	14.528	0.0	352
480 min Winter	11.570	0.0	464
600 min Winter	9.690	0.0	574
720 min Winter	8.380	0.0	678
960 min Winter	6.658	0.0	770
1440 min Winter	4.807	0.0	1068
2160 min Winter	3.465	0.0	1512
2880 min Winter	2.744	0.0	1932
4320 min Winter	1.973	0.0	2764
5760 min Winter	1.559	0.0	3568
7200 min Winter	1.298	0.0	4320
8640 min Winter	1.118	0.0	5024
10080 min Winter	0.985	0.0	5752

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.510

Time From:	(mins) To:	Area (ha)
0	4	0.510

Model Details

Storage is Online Cover Level (m) 0.395

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00515	Width (m)	391.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	1411.9	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	0.300

Summary of Results for 1 year Return Period

Half Drain Time : 1260 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.141	0.141	0.0	0.5	Flood Risk
30 min Summer	0.157	0.157	0.0	0.6	Flood Risk
60 min Summer	0.172	0.172	0.0	0.8	Flood Risk
120 min Summer	0.187	0.187	0.0	0.9	Flood Risk
180 min Summer	0.195	0.195	0.0	1.0	Flood Risk
240 min Summer	0.200	0.200	0.0	1.1	Flood Risk
360 min Summer	0.207	0.207	0.0	1.2	Flood Risk
480 min Summer	0.210	0.210	0.0	1.2	Flood Risk
600 min Summer	0.213	0.213	0.0	1.3	Flood Risk
720 min Summer	0.214	0.214	0.0	1.3	Flood Risk
960 min Summer	0.216	0.216	0.0	1.3	Flood Risk
1440 min Summer	0.218	0.218	0.0	1.3	Flood Risk
2160 min Summer	0.219	0.219	0.0	1.3	Flood Risk
2880 min Summer	0.218	0.218	0.0	1.3	Flood Risk
4320 min Summer	0.215	0.215	0.0	1.3	Flood Risk
5760 min Summer	0.211	0.211	0.0	1.2	Flood Risk
7200 min Summer	0.207	0.207	0.0	1.2	Flood Risk
8640 min Summer	0.203	0.203	0.0	1.1	Flood Risk
10080 min Summer	0.199	0.199	0.0	1.1	Flood Risk
15 min Winter	0.147	0.147	0.0	0.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	31.093	0.0	19
30 min Summer	20.252	0.0	34
60 min Summer	12.800	0.0	64
120 min Summer	7.926	0.0	124
180 min Summer	5.960	0.0	182
240 min Summer	4.862	0.0	242
360 min Summer	3.628	0.0	362
480 min Summer	2.939	0.0	482
600 min Summer	2.495	0.0	600
720 min Summer	2.183	0.0	720
960 min Summer	1.768	0.0	856
1440 min Summer	1.314	0.0	1096
2160 min Summer	0.977	0.0	1492
2880 min Summer	0.791	0.0	1904
4320 min Summer	0.588	0.0	2724
5760 min Summer	0.476	0.0	3568
7200 min Summer	0.405	0.0	4328
8640 min Summer	0.354	0.0	5112
10080 min Summer	0.317	0.0	5944
15 min Winter	31.093	0.0	19

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.164	0.164	0.0	0.7	Flood Risk
60 min Winter	0.180	0.180	0.0	0.8	Flood Risk
120 min Winter	0.196	0.196	0.0	1.0	Flood Risk
180 min Winter	0.204	0.204	0.0	1.1	Flood Risk
240 min Winter	0.210	0.210	0.0	1.2	Flood Risk
360 min Winter	0.217	0.217	0.0	1.3	Flood Risk
480 min Winter	0.221	0.221	0.0	1.4	Flood Risk
600 min Winter	0.224	0.224	0.0	1.4	Flood Risk
720 min Winter	0.226	0.226	0.0	1.5	Flood Risk
960 min Winter	0.228	0.228	0.0	1.5	Flood Risk
1440 min Winter	0.229	0.229	0.0	1.5	Flood Risk
2160 min Winter	0.229	0.229	0.0	1.5	Flood Risk
2880 min Winter	0.228	0.228	0.0	1.5	Flood Risk
4320 min Winter	0.222	0.222	0.0	1.4	Flood Risk
5760 min Winter	0.216	0.216	0.0	1.3	Flood Risk
7200 min Winter	0.210	0.210	0.0	1.2	Flood Risk
8640 min Winter	0.204	0.204	0.0	1.1	Flood Risk
10080 min Winter	0.198	0.198	0.0	1.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	20.252	0.0	33
60 min Winter	12.800	0.0	62
120 min Winter	7.926	0.0	122
180 min Winter	5.960	0.0	180
240 min Winter	4.862	0.0	238
360 min Winter	3.628	0.0	354
480 min Winter	2.939	0.0	470
600 min Winter	2.495	0.0	584
720 min Winter	2.183	0.0	694
960 min Winter	1.768	0.0	906
1440 min Winter	1.314	0.0	1140
2160 min Winter	0.977	0.0	1600
2880 min Winter	0.791	0.0	2052
4320 min Winter	0.588	0.0	2940
5760 min Winter	0.476	0.0	3800
7200 min Winter	0.405	0.0	4616
8640 min Winter	0.354	0.0	5448
10080 min Winter	0.317	0.0	6248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.008

Model Details

Storage is Online Cover Level (m) 0.400

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	23.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	60.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 30 year Return Period

Half Drain Time : 1665 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.204	0.204	0.0	1.1	Flood Risk
30 min Summer	0.227	0.227	0.0	1.5	Flood Risk
60 min Summer	0.247	0.247	0.0	1.8	Flood Risk
120 min Summer	0.265	0.265	0.0	2.2	Flood Risk
180 min Summer	0.274	0.274	0.0	2.4	Flood Risk
240 min Summer	0.280	0.280	0.0	2.5	Flood Risk
360 min Summer	0.287	0.287	0.0	2.7	Flood Risk
480 min Summer	0.291	0.291	0.0	2.8	Flood Risk
600 min Summer	0.294	0.294	0.0	2.8	Flood Risk
720 min Summer	0.296	0.296	0.0	2.9	Flood Risk
960 min Summer	0.298	0.298	0.0	2.9	Flood Risk
1440 min Summer	0.298	0.298	0.0	2.9	Flood Risk
2160 min Summer	0.297	0.297	0.0	2.9	Flood Risk
2880 min Summer	0.296	0.296	0.0	2.9	Flood Risk
4320 min Summer	0.291	0.291	0.0	2.7	Flood Risk
5760 min Summer	0.285	0.285	0.0	2.6	Flood Risk
7200 min Summer	0.279	0.279	0.0	2.5	Flood Risk
8640 min Summer	0.274	0.274	0.0	2.4	Flood Risk
10080 min Summer	0.268	0.268	0.0	2.2	Flood Risk
15 min Winter	0.214	0.214	0.0	1.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	76.290	0.0	19
30 min Summer	49.584	0.0	34
60 min Summer	30.811	0.0	64
120 min Summer	18.584	0.0	124
180 min Summer	13.680	0.0	184
240 min Summer	10.960	0.0	242
360 min Summer	8.001	0.0	362
480 min Summer	6.397	0.0	482
600 min Summer	5.375	0.0	602
720 min Summer	4.661	0.0	722
960 min Summer	3.719	0.0	960
1440 min Summer	2.704	0.0	1210
2160 min Summer	1.963	0.0	1580
2880 min Summer	1.563	0.0	1988
4320 min Summer	1.133	0.0	2808
5760 min Summer	0.901	0.0	3632
7200 min Summer	0.754	0.0	4464
8640 min Summer	0.652	0.0	5272
10080 min Summer	0.576	0.0	6048
15 min Winter	76.290	0.0	19

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.238	0.238	0.0	1.7	Flood Risk
60 min Winter	0.258	0.258	0.0	2.0	Flood Risk
120 min Winter	0.277	0.277	0.0	2.4	Flood Risk
180 min Winter	0.287	0.287	0.0	2.6	Flood Risk
240 min Winter	0.293	0.293	0.0	2.8	Flood Risk
360 min Winter	0.301	0.301	0.0	3.0	Flood Risk
480 min Winter	0.305	0.305	0.0	3.1	Flood Risk
600 min Winter	0.309	0.309	0.0	3.2	Flood Risk
720 min Winter	0.311	0.311	0.0	3.2	Flood Risk
960 min Winter	0.313	0.313	0.0	3.3	Flood Risk
1440 min Winter	0.313	0.313	0.0	3.3	Flood Risk
2160 min Winter	0.312	0.312	0.0	3.3	Flood Risk
2880 min Winter	0.309	0.309	0.0	3.2	Flood Risk
4320 min Winter	0.302	0.302	0.0	3.0	Flood Risk
5760 min Winter	0.294	0.294	0.0	2.8	Flood Risk
7200 min Winter	0.286	0.286	0.0	2.6	Flood Risk
8640 min Winter	0.278	0.278	0.0	2.4	Flood Risk
10080 min Winter	0.270	0.270	0.0	2.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	49.584	0.0	34
60 min Winter	30.811	0.0	64
120 min Winter	18.584	0.0	122
180 min Winter	13.680	0.0	180
240 min Winter	10.960	0.0	240
360 min Winter	8.001	0.0	356
480 min Winter	6.397	0.0	472
600 min Winter	5.375	0.0	588
720 min Winter	4.661	0.0	700
960 min Winter	3.719	0.0	924
1440 min Winter	2.704	0.0	1342
2160 min Winter	1.963	0.0	1664
2880 min Winter	1.563	0.0	2132
4320 min Winter	1.133	0.0	3028
5760 min Winter	0.901	0.0	3920
7200 min Winter	0.754	0.0	4760
8640 min Winter	0.652	0.0	5616
10080 min Winter	0.576	0.0	6360

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Model Details

Storage is Online Cover Level (m) 0.400

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	23.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	60.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 100 year Return Period

Half Drain Time : 1829 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.227	0.227	0.0	1.5	Flood Risk
30 min Summer	0.253	0.253	0.0	1.9	Flood Risk
60 min Summer	0.276	0.276	0.0	2.4	Flood Risk
120 min Summer	0.295	0.295	0.0	2.9	Flood Risk
180 min Summer	0.305	0.305	0.0	3.1	Flood Risk
240 min Summer	0.311	0.311	0.0	3.3	Flood Risk
360 min Summer	0.319	0.319	0.0	3.5	Flood Risk
480 min Summer	0.323	0.323	0.0	3.6	Flood Risk
600 min Summer	0.326	0.326	0.0	3.7	Flood Risk
720 min Summer	0.328	0.328	0.0	3.7	Flood Risk
960 min Summer	0.330	0.330	0.0	3.8	Flood Risk
1440 min Summer	0.330	0.330	0.0	3.8	Flood Risk
2160 min Summer	0.328	0.328	0.0	3.7	Flood Risk
2880 min Summer	0.326	0.326	0.0	3.7	Flood Risk
4320 min Summer	0.320	0.320	0.0	3.5	Flood Risk
5760 min Summer	0.314	0.314	0.0	3.3	Flood Risk
7200 min Summer	0.307	0.307	0.0	3.2	Flood Risk
8640 min Summer	0.301	0.301	0.0	3.0	Flood Risk
10080 min Summer	0.295	0.295	0.0	2.8	Flood Risk
15 min Winter	0.238	0.238	0.0	1.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	99.025	0.0	19
30 min Summer	64.904	0.0	34
60 min Summer	40.510	0.0	64
120 min Summer	24.421	0.0	124
180 min Summer	17.920	0.0	184
240 min Summer	14.300	0.0	242
360 min Summer	10.377	0.0	362
480 min Summer	8.265	0.0	482
600 min Summer	6.922	0.0	602
720 min Summer	5.986	0.0	722
960 min Summer	4.756	0.0	960
1440 min Summer	3.434	0.0	1254
2160 min Summer	2.475	0.0	1620
2880 min Summer	1.960	0.0	2016
4320 min Summer	1.409	0.0	2852
5760 min Summer	1.114	0.0	3680
7200 min Summer	0.927	0.0	4472
8640 min Summer	0.798	0.0	5272
10080 min Summer	0.703	0.0	6056
15 min Winter	99.025	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.265	0.265	0.0	2.2	Flood Risk
60 min Winter	0.288	0.288	0.0	2.7	Flood Risk
120 min Winter	0.309	0.309	0.0	3.2	Flood Risk
180 min Winter	0.319	0.319	0.0	3.5	Flood Risk
240 min Winter	0.326	0.326	0.0	3.7	Flood Risk
360 min Winter	0.334	0.334	0.0	3.9	Flood Risk
480 min Winter	0.339	0.339	0.0	4.1	Flood Risk
600 min Winter	0.342	0.342	0.0	4.2	Flood Risk
720 min Winter	0.344	0.344	0.0	4.2	Flood Risk
960 min Winter	0.346	0.346	0.0	4.3	Flood Risk
1440 min Winter	0.347	0.347	0.0	4.3	Flood Risk
2160 min Winter	0.344	0.344	0.0	4.2	Flood Risk
2880 min Winter	0.341	0.341	0.0	4.1	Flood Risk
4320 min Winter	0.333	0.333	0.0	3.9	Flood Risk
5760 min Winter	0.324	0.324	0.0	3.6	Flood Risk
7200 min Winter	0.315	0.315	0.0	3.4	Flood Risk
8640 min Winter	0.307	0.307	0.0	3.1	Flood Risk
10080 min Winter	0.298	0.298	0.0	2.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	64.904	0.0	34
60 min Winter	40.510	0.0	64
120 min Winter	24.421	0.0	122
180 min Winter	17.920	0.0	180
240 min Winter	14.300	0.0	240
360 min Winter	10.377	0.0	358
480 min Winter	8.265	0.0	474
600 min Winter	6.922	0.0	590
720 min Winter	5.986	0.0	702
960 min Winter	4.756	0.0	930
1440 min Winter	3.434	0.0	1356
2160 min Winter	2.475	0.0	1688
2880 min Winter	1.960	0.0	2160
4320 min Winter	1.409	0.0	3068
5760 min Winter	1.114	0.0	3928
7200 min Winter	0.927	0.0	4824
8640 min Winter	0.798	0.0	5624
10080 min Winter	0.703	0.0	6456

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.008

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.008

Model Details

Storage is Online Cover Level (m) 0.400

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	23.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	60.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2090 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.260	0.260	0.0	2.1	Flood Risk
30 min Summer	0.289	0.289	0.0	2.7	Flood Risk
60 min Summer	0.315	0.315	0.0	3.4	Flood Risk
120 min Summer	0.337	0.337	0.0	4.0	Flood Risk
180 min Summer	0.348	0.348	0.0	4.4	Flood Risk
240 min Summer	0.355	0.355	0.0	4.6	Flood Risk
360 min Summer	0.364	0.364	0.0	4.9	Flood Risk
480 min Summer	0.370	0.370	0.0	5.1	Flood Risk
600 min Summer	0.374	0.374	0.0	5.2	Flood Risk
720 min Summer	0.376	0.376	0.0	5.3	Flood Risk
960 min Summer	0.379	0.379	0.0	5.4	Flood Risk
1440 min Summer	0.379	0.379	0.0	5.4	Flood Risk
2160 min Summer	0.378	0.378	0.0	5.4	Flood Risk
2880 min Summer	0.376	0.376	0.0	5.3	Flood Risk
4320 min Summer	0.371	0.371	0.0	5.1	Flood Risk
5760 min Summer	0.365	0.365	0.0	4.9	Flood Risk
7200 min Summer	0.358	0.358	0.0	4.7	Flood Risk
8640 min Summer	0.352	0.352	0.0	4.5	Flood Risk
10080 min Summer	0.345	0.345	0.0	4.3	Flood Risk
15 min Winter	0.272	0.272	0.0	2.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	19
30 min Summer	90.866	0.0	34
60 min Summer	56.713	0.0	64
120 min Summer	34.190	0.0	124
180 min Summer	25.088	0.0	184
240 min Summer	20.020	0.0	244
360 min Summer	14.528	0.0	362
480 min Summer	11.570	0.0	482
600 min Summer	9.690	0.0	602
720 min Summer	8.380	0.0	722
960 min Summer	6.658	0.0	960
1440 min Summer	4.807	0.0	1344
2160 min Summer	3.465	0.0	1688
2880 min Summer	2.744	0.0	2072
4320 min Summer	1.973	0.0	2896
5760 min Summer	1.559	0.0	3696
7200 min Summer	1.298	0.0	4536
8640 min Summer	1.118	0.0	5360
10080 min Summer	0.985	0.0	6152
15 min Winter	138.634	0.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.302	0.302	0.0	3.0	Flood Risk
60 min Winter	0.329	0.329	0.0	3.8	Flood Risk
120 min Winter	0.352	0.352	0.0	4.5	Flood Risk
180 min Winter	0.364	0.364	0.0	4.9	Flood Risk
240 min Winter	0.372	0.372	0.0	5.2	Flood Risk
360 min Winter	0.381	0.381	0.0	5.5	Flood Risk
480 min Winter	0.387	0.387	0.0	5.7	Flood Risk
600 min Winter	0.391	0.391	0.0	5.9	Flood Risk
720 min Winter	0.394	0.394	0.0	6.0	Flood Risk
960 min Winter	0.397	0.397	0.0	6.1	Flood Risk
1440 min Winter	0.399	0.399	0.0	6.2	Flood Risk
2160 min Winter	0.397	0.397	0.0	6.1	Flood Risk
2880 min Winter	0.394	0.394	0.0	6.0	Flood Risk
4320 min Winter	0.386	0.386	0.0	5.7	Flood Risk
5760 min Winter	0.378	0.378	0.0	5.4	Flood Risk
7200 min Winter	0.369	0.369	0.0	5.0	Flood Risk
8640 min Winter	0.360	0.360	0.0	4.7	Flood Risk
10080 min Winter	0.351	0.351	0.0	4.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	90.866	0.0	34
60 min Winter	56.713	0.0	64
120 min Winter	34.190	0.0	122
180 min Winter	25.088	0.0	182
240 min Winter	20.020	0.0	240
360 min Winter	14.528	0.0	358
480 min Winter	11.570	0.0	474
600 min Winter	9.690	0.0	590
720 min Winter	8.380	0.0	706
960 min Winter	6.658	0.0	934
1440 min Winter	4.807	0.0	1370
2160 min Winter	3.465	0.0	1752
2880 min Winter	2.744	0.0	2192
4320 min Winter	1.973	0.0	3112
5760 min Winter	1.559	0.0	3984
7200 min Winter	1.298	0.0	4896
8640 min Winter	1.118	0.0	5712
10080 min Winter	0.985	0.0	6552

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.008

Time From:	(mins) To:	Area (ha)
0	4	0.008

Model Details

Storage is Online Cover Level (m) 0.400

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	23.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	60.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 1 year Return Period

Half Drain Time : 1568 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.079	0.079	0.0	0.9	O K
30 min Summer	0.095	0.095	0.0	1.1	O K
60 min Summer	0.112	0.112	0.0	1.4	O K
120 min Summer	0.129	0.129	0.0	1.7	O K
180 min Summer	0.139	0.139	0.0	1.9	O K
240 min Summer	0.146	0.146	0.0	2.0	O K
360 min Summer	0.154	0.154	0.0	2.2	O K
480 min Summer	0.160	0.160	0.0	2.3	O K
600 min Summer	0.163	0.163	0.0	2.4	O K
720 min Summer	0.166	0.166	0.0	2.5	O K
960 min Summer	0.168	0.168	0.0	2.5	O K
1440 min Summer	0.171	0.171	0.0	2.6	O K
2160 min Summer	0.172	0.172	0.0	2.6	O K
2880 min Summer	0.172	0.172	0.0	2.6	O K
4320 min Summer	0.169	0.169	0.0	2.6	O K
5760 min Summer	0.165	0.165	0.0	2.5	O K
7200 min Summer	0.160	0.160	0.0	2.3	O K
8640 min Summer	0.155	0.155	0.0	2.2	O K
10080 min Summer	0.150	0.150	0.0	2.1	O K
15 min Winter	0.086	0.086	0.0	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	31.093	0.0	19
30 min Summer	20.252	0.0	34
60 min Summer	12.800	0.0	64
120 min Summer	7.926	0.0	124
180 min Summer	5.960	0.0	182
240 min Summer	4.862	0.0	242
360 min Summer	3.628	0.0	362
480 min Summer	2.939	0.0	482
600 min Summer	2.495	0.0	602
720 min Summer	2.183	0.0	720
960 min Summer	1.768	0.0	960
1440 min Summer	1.314	0.0	1210
2160 min Summer	0.977	0.0	1580
2880 min Summer	0.791	0.0	1988
4320 min Summer	0.588	0.0	2812
5760 min Summer	0.476	0.0	3640
7200 min Summer	0.405	0.0	4464
8640 min Summer	0.354	0.0	5272
10080 min Summer	0.317	0.0	6056
15 min Winter	31.093	0.0	19

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
30 min Winter	0.104	0.104	0.0	1.3	O K
60 min Winter	0.122	0.122	0.0	1.6	O K
120 min Winter	0.140	0.140	0.0	1.9	O K
180 min Winter	0.150	0.150	0.0	2.1	O K
240 min Winter	0.158	0.158	0.0	2.3	O K
360 min Winter	0.167	0.167	0.0	2.5	O K
480 min Winter	0.173	0.173	0.0	2.6	O K
600 min Winter	0.177	0.177	0.0	2.7	O K
720 min Winter	0.180	0.180	0.0	2.8	O K
960 min Winter	0.184	0.184	0.0	2.9	O K
1440 min Winter	0.187	0.187	0.0	3.0	O K
2160 min Winter	0.187	0.187	0.0	3.0	O K
2880 min Winter	0.186	0.186	0.0	3.0	O K
4320 min Winter	0.181	0.181	0.0	2.8	O K
5760 min Winter	0.174	0.174	0.0	2.7	O K
7200 min Winter	0.167	0.167	0.0	2.5	O K
8640 min Winter	0.159	0.159	0.0	2.3	O K
10080 min Winter	0.152	0.152	0.0	2.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
30 min Winter	20.252	0.0	33
60 min Winter	12.800	0.0	64
120 min Winter	7.926	0.0	122
180 min Winter	5.960	0.0	180
240 min Winter	4.862	0.0	240
360 min Winter	3.628	0.0	356
480 min Winter	2.939	0.0	472
600 min Winter	2.495	0.0	588
720 min Winter	2.183	0.0	700
960 min Winter	1.768	0.0	924
1440 min Winter	1.314	0.0	1342
2160 min Winter	0.977	0.0	1668
2880 min Winter	0.791	0.0	2136
4320 min Winter	0.588	0.0	3068
5760 min Winter	0.476	0.0	3928
7200 min Winter	0.405	0.0	4824
8640 min Winter	0.354	0.0	5624
10080 min Winter	0.317	0.0	6456

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.015

Time From:	(mins) To:	Area (ha)
0	4	0.015

Model Details

Storage is Online Cover Level (m) 0.500

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	15.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 30 year Return Period

Half Drain Time : 2416 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.150	0.150	0.0	2.1	O K
30 min Summer	0.178	0.178	0.0	2.8	O K
60 min Summer	0.205	0.205	0.0	3.4	Flood Risk
120 min Summer	0.229	0.229	0.0	4.1	Flood Risk
180 min Summer	0.242	0.242	0.0	4.5	Flood Risk
240 min Summer	0.251	0.251	0.0	4.7	Flood Risk
360 min Summer	0.262	0.262	0.0	5.1	Flood Risk
480 min Summer	0.270	0.270	0.0	5.3	Flood Risk
600 min Summer	0.275	0.275	0.0	5.5	Flood Risk
720 min Summer	0.279	0.279	0.0	5.6	Flood Risk
960 min Summer	0.284	0.284	0.0	5.7	Flood Risk
1440 min Summer	0.287	0.287	0.0	5.9	Flood Risk
2160 min Summer	0.286	0.286	0.0	5.8	Flood Risk
2880 min Summer	0.284	0.284	0.0	5.8	Flood Risk
4320 min Summer	0.279	0.279	0.0	5.6	Flood Risk
5760 min Summer	0.272	0.272	0.0	5.4	Flood Risk
7200 min Summer	0.265	0.265	0.0	5.2	Flood Risk
8640 min Summer	0.258	0.258	0.0	4.9	Flood Risk
10080 min Summer	0.251	0.251	0.0	4.7	Flood Risk
15 min Winter	0.162	0.162	0.0	2.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	76.290	0.0	19
30 min Summer	49.584	0.0	34
60 min Summer	30.811	0.0	64
120 min Summer	18.584	0.0	124
180 min Summer	13.680	0.0	184
240 min Summer	10.960	0.0	244
360 min Summer	8.001	0.0	362
480 min Summer	6.397	0.0	482
600 min Summer	5.375	0.0	602
720 min Summer	4.661	0.0	722
960 min Summer	3.719	0.0	962
1440 min Summer	2.704	0.0	1440
2160 min Summer	1.963	0.0	1820
2880 min Summer	1.563	0.0	2188
4320 min Summer	1.133	0.0	2984
5760 min Summer	0.901	0.0	3808
7200 min Summer	0.754	0.0	4616
8640 min Summer	0.652	0.0	5448
10080 min Summer	0.576	0.0	6256
15 min Winter	76.290	0.0	19

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.192	0.192	0.0	3.1	O K
60 min Winter	0.220	0.220	0.0	3.8	Flood Risk
120 min Winter	0.246	0.246	0.0	4.6	Flood Risk
180 min Winter	0.261	0.261	0.0	5.0	Flood Risk
240 min Winter	0.270	0.270	0.0	5.3	Flood Risk
360 min Winter	0.282	0.282	0.0	5.7	Flood Risk
480 min Winter	0.291	0.291	0.0	6.0	Flood Risk
600 min Winter	0.296	0.296	0.0	6.2	Flood Risk
720 min Winter	0.301	0.301	0.0	6.3	Flood Risk
960 min Winter	0.306	0.306	0.0	6.5	Flood Risk
1440 min Winter	0.311	0.311	0.0	6.7	Flood Risk
2160 min Winter	0.310	0.310	0.0	6.7	Flood Risk
2880 min Winter	0.307	0.307	0.0	6.6	Flood Risk
4320 min Winter	0.301	0.301	0.0	6.3	Flood Risk
5760 min Winter	0.292	0.292	0.0	6.0	Flood Risk
7200 min Winter	0.282	0.282	0.0	5.7	Flood Risk
8640 min Winter	0.272	0.272	0.0	5.4	Flood Risk
10080 min Winter	0.262	0.262	0.0	5.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	49.584	0.0	34
60 min Winter	30.811	0.0	64
120 min Winter	18.584	0.0	122
180 min Winter	13.680	0.0	182
240 min Winter	10.960	0.0	240
360 min Winter	8.001	0.0	358
480 min Winter	6.397	0.0	476
600 min Winter	5.375	0.0	592
720 min Winter	4.661	0.0	708
960 min Winter	3.719	0.0	940
1440 min Winter	2.704	0.0	1386
2160 min Winter	1.963	0.0	2016
2880 min Winter	1.563	0.0	2280
4320 min Winter	1.133	0.0	3200
5760 min Winter	0.901	0.0	4104
7200 min Winter	0.754	0.0	5040
8640 min Winter	0.652	0.0	5880
10080 min Winter	0.576	0.0	6752

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.015

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.015

Model Details

Storage is Online Cover Level (m) 0.500

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	15.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 100 year Return Period

Half Drain Time : 2743 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.179	0.179	0.0	2.8	O K
30 min Summer	0.212	0.212	0.0	3.6	Flood Risk
60 min Summer	0.244	0.244	0.0	4.5	Flood Risk
120 min Summer	0.272	0.272	0.0	5.4	Flood Risk
180 min Summer	0.287	0.287	0.0	5.9	Flood Risk
240 min Summer	0.297	0.297	0.0	6.2	Flood Risk
360 min Summer	0.309	0.309	0.0	6.6	Flood Risk
480 min Summer	0.318	0.318	0.0	6.9	Flood Risk
600 min Summer	0.323	0.323	0.0	7.1	Flood Risk
720 min Summer	0.328	0.328	0.0	7.3	Flood Risk
960 min Summer	0.333	0.333	0.0	7.5	Flood Risk
1440 min Summer	0.337	0.337	0.0	7.6	Flood Risk
2160 min Summer	0.335	0.335	0.0	7.6	Flood Risk
2880 min Summer	0.332	0.332	0.0	7.5	Flood Risk
4320 min Summer	0.326	0.326	0.0	7.2	Flood Risk
5760 min Summer	0.318	0.318	0.0	6.9	Flood Risk
7200 min Summer	0.310	0.310	0.0	6.7	Flood Risk
8640 min Summer	0.302	0.302	0.0	6.4	Flood Risk
10080 min Summer	0.294	0.294	0.0	6.1	Flood Risk
15 min Winter	0.192	0.192	0.0	3.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	99.025	0.0	19
30 min Summer	64.904	0.0	34
60 min Summer	40.510	0.0	64
120 min Summer	24.421	0.0	124
180 min Summer	17.920	0.0	184
240 min Summer	14.300	0.0	244
360 min Summer	10.377	0.0	362
480 min Summer	8.265	0.0	482
600 min Summer	6.922	0.0	602
720 min Summer	5.986	0.0	722
960 min Summer	4.756	0.0	962
1440 min Summer	3.434	0.0	1440
2160 min Summer	2.475	0.0	1928
2880 min Summer	1.960	0.0	2280
4320 min Summer	1.409	0.0	3064
5760 min Summer	1.114	0.0	3864
7200 min Summer	0.927	0.0	4688
8640 min Summer	0.798	0.0	5528
10080 min Summer	0.703	0.0	6352
15 min Winter	99.025	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.228	0.228	0.0	4.1	Flood Risk
60 min Winter	0.262	0.262	0.0	5.0	Flood Risk
120 min Winter	0.292	0.292	0.0	6.0	Flood Risk
180 min Winter	0.308	0.308	0.0	6.6	Flood Risk
240 min Winter	0.318	0.318	0.0	7.0	Flood Risk
360 min Winter	0.332	0.332	0.0	7.5	Flood Risk
480 min Winter	0.341	0.341	0.0	7.8	Flood Risk
600 min Winter	0.347	0.347	0.0	8.0	Flood Risk
720 min Winter	0.352	0.352	0.0	8.2	Flood Risk
960 min Winter	0.358	0.358	0.0	8.5	Flood Risk
1440 min Winter	0.364	0.364	0.0	8.7	Flood Risk
2160 min Winter	0.364	0.364	0.0	8.7	Flood Risk
2880 min Winter	0.359	0.359	0.0	8.5	Flood Risk
4320 min Winter	0.351	0.351	0.0	8.2	Flood Risk
5760 min Winter	0.342	0.342	0.0	7.8	Flood Risk
7200 min Winter	0.331	0.331	0.0	7.4	Flood Risk
8640 min Winter	0.320	0.320	0.0	7.0	Flood Risk
10080 min Winter	0.309	0.309	0.0	6.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	64.904	0.0	34
60 min Winter	40.510	0.0	64
120 min Winter	24.421	0.0	122
180 min Winter	17.920	0.0	182
240 min Winter	14.300	0.0	240
360 min Winter	10.377	0.0	358
480 min Winter	8.265	0.0	476
600 min Winter	6.922	0.0	594
720 min Winter	5.986	0.0	710
960 min Winter	4.756	0.0	942
1440 min Winter	3.434	0.0	1398
2160 min Winter	2.475	0.0	2052
2880 min Winter	1.960	0.0	2424
4320 min Winter	1.409	0.0	3244
5760 min Winter	1.114	0.0	4200
7200 min Winter	0.927	0.0	5112
8640 min Winter	0.798	0.0	5968
10080 min Winter	0.703	0.0	6856

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.015

Time From:	(mins) To:	Area (ha)
0	4	0.015

Model Details

Storage is Online Cover Level (m) 0.500

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	15.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 3335 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.222	0.222	0.0	3.9	Flood Risk
30 min Summer	0.263	0.263	0.0	5.1	Flood Risk
60 min Summer	0.300	0.300	0.0	6.3	Flood Risk
120 min Summer	0.335	0.335	0.0	7.6	Flood Risk
180 min Summer	0.353	0.353	0.0	8.3	Flood Risk
240 min Summer	0.365	0.365	0.0	8.7	Flood Risk
360 min Summer	0.380	0.380	0.0	9.4	Flood Risk
480 min Summer	0.391	0.391	0.0	9.8	Flood Risk
600 min Summer	0.398	0.398	0.0	10.1	Flood Risk
720 min Summer	0.404	0.404	0.0	10.4	Flood Risk
960 min Summer	0.411	0.411	0.0	10.7	Flood Risk
1440 min Summer	0.418	0.418	0.0	11.0	Flood Risk
2160 min Summer	0.419	0.419	0.0	11.1	Flood Risk
2880 min Summer	0.417	0.417	0.0	10.9	Flood Risk
4320 min Summer	0.411	0.411	0.0	10.7	Flood Risk
5760 min Summer	0.403	0.403	0.0	10.4	Flood Risk
7200 min Summer	0.396	0.396	0.0	10.0	Flood Risk
8640 min Summer	0.388	0.388	0.0	9.7	Flood Risk
10080 min Summer	0.379	0.379	0.0	9.3	Flood Risk
15 min Winter	0.239	0.239	0.0	4.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	138.634	0.0	19
30 min Summer	90.866	0.0	34
60 min Summer	56.713	0.0	64
120 min Summer	34.190	0.0	124
180 min Summer	25.088	0.0	184
240 min Summer	20.020	0.0	244
360 min Summer	14.528	0.0	364
480 min Summer	11.570	0.0	482
600 min Summer	9.690	0.0	602
720 min Summer	8.380	0.0	722
960 min Summer	6.658	0.0	962
1440 min Summer	4.807	0.0	1442
2160 min Summer	3.465	0.0	2144
2880 min Summer	2.744	0.0	2452
4320 min Summer	1.973	0.0	3196
5760 min Summer	1.559	0.0	3984
7200 min Summer	1.298	0.0	4824
8640 min Summer	1.118	0.0	5624
10080 min Summer	0.985	0.0	6456
15 min Winter	138.634	0.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.282	0.282	0.0	5.7	Flood Risk
60 min Winter	0.322	0.322	0.0	7.1	Flood Risk
120 min Winter	0.359	0.359	0.0	8.5	Flood Risk
180 min Winter	0.378	0.378	0.0	9.3	Flood Risk
240 min Winter	0.390	0.390	0.0	9.8	Flood Risk
360 min Winter	0.407	0.407	0.0	10.5	Flood Risk
480 min Winter	0.419	0.419	0.0	11.0	Flood Risk
600 min Winter	0.427	0.427	0.0	11.4	Flood Risk
720 min Winter	0.433	0.433	0.0	11.7	Flood Risk
960 min Winter	0.442	0.442	0.0	12.1	Flood Risk
1440 min Winter	0.450	0.450	0.0	12.5	Flood Risk
2160 min Winter	0.453	0.453	0.0	12.6	Flood Risk
2880 min Winter	0.451	0.451	0.0	12.5	Flood Risk
4320 min Winter	0.443	0.443	0.0	12.1	Flood Risk
5760 min Winter	0.434	0.434	0.0	11.7	Flood Risk
7200 min Winter	0.423	0.423	0.0	11.2	Flood Risk
8640 min Winter	0.413	0.413	0.0	10.8	Flood Risk
10080 min Winter	0.402	0.402	0.0	10.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	90.866	0.0	34
60 min Winter	56.713	0.0	64
120 min Winter	34.190	0.0	122
180 min Winter	25.088	0.0	182
240 min Winter	20.020	0.0	240
360 min Winter	14.528	0.0	358
480 min Winter	11.570	0.0	476
600 min Winter	9.690	0.0	596
720 min Winter	8.380	0.0	712
960 min Winter	6.658	0.0	944
1440 min Winter	4.807	0.0	1400
2160 min Winter	3.465	0.0	2072
2880 min Winter	2.744	0.0	2708
4320 min Winter	1.973	0.0	3368
5760 min Winter	1.559	0.0	4272
7200 min Winter	1.298	0.0	5192
8640 min Winter	1.118	0.0	6128
10080 min Winter	0.985	0.0	6960

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.404	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.015

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.015

Model Details

Storage is Online Cover Level (m) 0.500

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00515	Length (m)	15.0
Infiltration Coefficient Side (m/hr)	0.00515	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	0.000	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Appendix E

Surface Water Drainage Pro-Forma

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our "Surface Water Drainage; Local Guidance for Planning Applications" note. It is expected that applicants/developers should complete and submit the pro-forma to present a summary of the surface water drainage strategy for the site and demonstrate compliance with the National Planning Policy Guidance and Non-Statutory Technical Standards. The pro-forma will then be used to support the LPA in making a decision on the suitability of the proposal and, if the LPA is minded to find the completed pro-forma acceptable, then it may be used as an evidence base for a relevant surface water condition to be appended to the decision notice, stating that the developments drainage proposal will be constructed in accordance with the details set out in the relevant pro-forma.

It must however be noted that this pro-forma submitted alone, will not be considered a suitable surface water drainage strategy. It should be clearly referenced within the pro-forma where in the other submission documents the details provided are taken from.

The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management. and uses the storage calculator on www.UKsuds.com. The pro-forma should be considered alongside other supporting SuDS Guidance, but focuses on ensuring flood risk is not made worse elsewhere. This proforma is based upon current industry standard practice.

1. Site Details

Site	New Technical Site, Bicester Heritage
Address & post code or LPA reference	A4421, Bicester OX26 5HA
Grid reference	SP 59258 24680
Is the existing site developed or Greenfield?	Greenfield
Total Site Area	1.61 Hectares
Total Site Area served by drainage system (excluding open space) (Ha)*	1.08 Hectares
Pre-application sought? (Ref)	

* The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	0 Hectares	1.08 Hectares	1.08 Hectares	If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	Infiltration	Infiltration	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Justification and Evidence that this is possible	Notes for developers
Infiltration	X		Soakage tests have been carried out within Bicester Heritage. Infiltration rate 1.43x10^{-6} m/s	Soakage tests will need to be provided and results included in drainage strategy. Section 7 (infiltration) must be filled in if infiltration is proposed.
To watercourse		X		If infiltration is not possible - is there a watercourse nearby? Have the EA or IDB provided input where necessary?
To surface water sewer		X	.	This should be a last resort. If required, has sewer provider confirmed that sufficient capacity exists for this connection? Has an appropriate connection detail been agreed?
Combination of above		X		e.g. part infiltration, part discharge to sewer or watercourse. Provide evidence as above.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	Notes for developers
Greenfield QBAR	0.5 l/s	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 7 (QBAR) is proposed.
1 in 1	0.5 l/s	0 l/s	-0.5 l/s	Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. E.g. discharging all flow from site at the existing 1 in 100 event increases flood risk during smaller events.
1 in 30	1.2 l/s	0 l/s	-1.2 l/s	
1in 100	1.6 l/s	0 l/s	-1.6 l/s	
1 in 100 plus climate change	N/A	0 l/s	-1.6 l/s	To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. - Where lifetime of development is 100 years (residential) 30% should be added to the peak rainfall intensity. - Where lifetime of development is 60 years (residential) 20% should be added to the peak rainfall intensity.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of storm water that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1	16.946 m^3	0 m^3	-16.946 m^3	Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	54.053 m^3	0 m^3	-54.053 m^3	
1in 100	62.554 m^3	0 m^3	-62.554 m^3	
1 in 100 plus climate change	N/A	0 m^3	-62.554 m^3	To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk will increase under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
What Storage Attenuation volume (Flow rate control) is required to retain rates as existing (m^3) **Where is the storage to be accommodated on site?**	3No. new cellular soakaways will be installed under parking area and soft area to attenuate and infiltrate runoff volume from roof area and adjacent hard paving. In addition, permeable paving for all car parks will drain and infiltrate runoff water from this area. New access road to the south of the site will drain into 2 No. swales and infiltrate into the ground	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	Outside SPZ	- Infiltration rates are highly variable, soakage tests should be comprehensive. - Avoid infiltrating in made ground. - Refer to Environment Agency website to identify and source protection zones (SPZ)
	Infiltration Rate (m/s)?	1.43×10^{-6} m/s	Infiltration rates should be no lower than 1×10^{-6} m/s.
	State the distance between a proposed infiltration device base and the ground water	No recorded	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure

	(GW) level		GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?	Infiltration test.	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	No.	Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	Yes.	If infiltration is not feasible how will the additional volume be stored? The applicant should consider the following options in the next section.

Storage requirements

The developer must confirm one of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at **QBAR** (Mean annual flow rate). This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	new cellular soakaways with volumes of 310.08 m^3, 54.72 m^3 and 158.40 m^3 will be installed under soft landscape area to attenuate and infiltrate runoff volume from roof and adjacent. In addition, permeable sub-base in car parks will drain and infiltrate runoff water	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

	from this area. The new access road to the south will drain into 2No. swales located to both sides of the road.	

8. Please confirm

		Notes for developers
1. Which Drainage Systems measures have been used? Provide an overview of the SuDS design scheme used? - Is the runoff managed at, or close to, the surface wherever possible. - Where the system serves more than one property, is public space used and integrated with the drainage system in an appropriate and beneficial way?	- Permeable paving - Cellular tanks - Swales	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
2. Functionality Are the design features sufficiently durable to ensure structural integrity over the system design life (residential 100 years and commercial 60 years), with reasonable maintenance requirements?	Yes	
Are all parts of the SuDS system outside any areas of flood risk?	Yes	If not, provide justification and evidence that performance will not be adversely affected.
Has runoff and flooding from all sources (both on and off site) been considered and taken into account in the design?	Yes	
Has residual risk been addressed?	Yes refer Drainage strategy	• Does the drainage system contain the 1 in 30 storm event without any flooding (include description of how any exceedance of surface water systems will be routed exceptional rain fall away from property)? • Are 1 in 100 year flows contained or stored on-site within safe exceedance storage areas and flow paths? • Is any flooding between 1 in 30 and 100 +CC storm events safely contained on site, without causing property flooding or a hazard to site users? • Has it been ensured that there is no flooding from the system to downstream property or access routes for the 100 year + climate change event?

How are rates being restricted (hydro brakes etc.)?	No rates to be restricted	- Hydrobrakes to be used where rates are between 2l/s to 5l/s. - Orifices not to be used below 5l/s as the pipes may block. - Pipes with flows < 2l/s are prone to blockage.
3. Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	Bicester Heritage Hotel	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained? An acceptable maintenance plan, clearly defining the operating and maintenance requirements of the drainage system will need to be submitted and approved.	The drainage drawings and schedules will form part of the O&M manual along with a post completion CCTV survey to ensure the system if fully operational at handover.	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than those above, please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all element of the proposed drainage system must be provided. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your pro-forma, in particular exceedance routes, ownership and location of SuDS (maintenance access strips etc.)

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	Drainage Strategy	1, Appendix A &C
Section 3	Drainage Strategy	Appendix C
Section 4	Drainage Strategy	Appendix B &D
Section 5	Drainage Strategy	Appendix B&D
Section 6	Drainage Strategy	Appendix C

Section 7	Drainage Strategy	Appendix A & C

The above form is completed using factual information and evidence from the Surface Water Drainage Strategy, Flood Risk Assessment and site plans and can be used as a summary of the surface water drainage strategy on this site, clearly showing that the proposed surface water rate and volume will not be increasing as a result of the development. Where an increase in rate or volume is shown the appropriate sections of the pro-forma have been completed setting out how the additional rate/volume is being dealt with, to ensure no increased flood risk on or off site.

Where the pro-forma is found to be acceptable to the Local Planning Authority then the surface water drainage system design must be built in accordance with the details provided here.

Form completed by: Graham Taylor

Qualification of person responsible for signing of this pro-forma: IEng MICE

Company: AKS Ward

On behalf of (Client's details): Bicester Heritage

Date 18.07.18

Appendix F

SuDS Maintenance Schedule

Cellular Tanks Operation & Maintenance Requirements

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems.

Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Modular systems – operation and maintenance requirements

Maintenance schedule	Required action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet , overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

Maintenance activities should be detailed in the health and safety plan and a risk assessment should be undertaken.

Permeable Paving Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of pervious pavements. The facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Manufacturers' recommendations should always be followed.

A brush cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in using vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geo-textile filter layer.
3. Inspect sub-base and remove, and replace if required.
4. Renew any geo-textile layers.
5. Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Pervious pavement operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilize and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements

Maintenance schedule	Required action	Frequency
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting, and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every ten to fifteen years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hrs after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

Swales Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of swales as designed.

Adequate access must be provided to all swale areas for inspection and maintenance, including for appropriate equipment and vehicles. Operation and maintenance requirements for swales are described below.

Swales operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets, and overflows for blockages and clear of required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48hrs	Monthly, or when required
	Inspect vegetation coverage	Monthly for six months, quarterly for two years, then bi-annually
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits, and prevent compaction of the soil surface	As required
	Remove buildup of sediment on upstream gravel trench, flow spreader of the soil surface	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly

Maintenance schedule	Required action	Frequency
	Inspect infiltration surfaces for ponding, compaction, silt accumulation. Record areas where water is ponding for >48 hours	Monthly, or when required
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Half yearly

Sediments excavated from swales that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can be safely disposed of by either land application or land filling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

Many of the specific maintenance activities for swales can be undertaken as part of a general landscaping contract and so if landscape management is already required at site, should have marginal cost implications.

Maintenance activities should be detailed in the health and safety plan and a risk assessment should be undertaken.