Cowan Consultancy

STRUCTURAL, CIVIL AND BUILDING CONSULTANTS

BRAMLEYS
HORSEMERE GREEN LANE
CLIMPING
WEST SUSSEX
BN17 5QZ

DRAINAGE STRATEGY REPORT

For:

MAXWELL HOMES LTD

Cowan Consultancy Ltd
3 Turnberry House
4400 Parkway
Whiteley
Fareham
Hampshire

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Landguard Manor
Landguard Manor Road
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PO37 7JB

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TB/456040/eg
15 January 2024

ARUN DISTRICT COUNCIL CM/3/24/DOC

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1.0 INTRODUCTION

1.1 This report has been prepared by Cowan Consultancy Limited (CCL) for Maxwell Homes Ltd.

1.2 This drainage strategy report is required to supplement the drainage scheme for the subject site and forms part of the Discharge of Condition application relating to the drainage conditions.

2.0 GEOLOGY OF THE AREA

2.1.1 The site lies on OS grid reference (Eastings) 499575 (Northings) 102241 and Site GPS Coordinates 50.811170, -0.58804429.

2.1.2 By reference to the British Geological Maps, the site would be expected to lie within a bedrock of Lewes Nodular Chalk. Overlain by superficial deposits of River Terrace Deposits – Sand, silt and clay.

2.1.3 A site investigation carried out at another site along Horsemere Green Lane, less than 120m away, confirms the bedrock of Newes Nodular Chalk, but suggests that this is overlain by Head deposits. The Head deposits were present to a depth of 3.1m bgl.

2.1.4 The same site investigation report included winter ground water monitoring data. It showed that ground water reached a peak winter level of 0.33m bgl in February 2020

2.1.5 Further to this, Winter groundwater monitoring was carried out at the site (Bramleys, Climping), throughout December 2023 & January 2024. The highest groundwater level within this period was recorded as 0.16m bgl in January 2024.

3.0 SITE DESCRIPTION

3.1.1 The site for the proposed development consists of approximately 0.1029 ha and is considered to be a greenfield development site.

3.1.2 The site consists of mainly grass with some trees / hedges, but towards the south of the site are some static caravans. There is also an existing access into the site with a culverted ditch along the front boundary.

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3.1.3 The site is adjoined to the north by Horsemere Green Lane. the west and east of the site is existing residential properties and more static caravans. Further to the west there is a small pond.

3.1.4 The site is relatively flat but with a gradual slope from south east to north west.

3.1.5 The proposed access to the site is via the existing access.

3.1.6 The proposed site development consists of two four bedroom detached houses, together with detached single garages, associated landscaping, amenity space and parking.

4.0 SURFACE WATER DRAINAGE STRATEGY

4.1 Pre-Development

4.2 The site is currently mainly undeveloped land and its previous use is partly for a static caravan site. The current surface water drainage of the site is currently unknown but it is likely to discharge into the ditch along the north boundary.

4.3 The site slopes generally from south east to north west. Any rainfall which does not naturally permeate into the ground will ultimately discharge off site into the ditch on the north boundary which leads to the pond located to the west of the site.

4.4 Southern Water sewer record plans indicate that there are no public surface water or combined sewers in the vicinity of the site.

4.5 Post-Development

4.6 The site is currently undeveloped and therefore any proposed development will increase the impermeable area, thus increasing surface water runoff rates and volumes of water.

4.7 Referencing the trial pit logs and groundwater monitoring data, it would suggest that disposing of the surface water via infiltration on site is not feasible due to the Impermeable nature of the Head Deposits and the high groundwater encountered.

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4.8 Groundwater at 0.16m bgl would compromise the attenuation storage features if the underside and sides are permeable, therefore these have been designed as impermeable lined.

4.9 There is a ditch located at the north boundary of the development which currently has a piped watercourse piped in / out of it.

4.10 The piped watercourse has been subject to numerous improvement works in relation to developments up-stream of the site, one of the improvements was the clearing of the ditch along the site northern boundary. Therefore, it can be confirmed as a suitable discharge point for the site surface water to discharge into.

4.11 The drainage strategy utilises a shallow attenuation system for the surface water drainage, which conveys the surface water flows to the northern boundary of the site, where it discharges into a ditch. Via the ditch, the surface water enters the pond to the west

4.12 HR Wallingford Greenfield Run-off calculations show that a pre-development run-off rate for the site is 0.31 l/s (3.0 l/s/ha). Due to the risk of blockages at the discharge location in the ditch, then a minimum discharge rate of 1 l/s has applied to the design.

4.13 It is common for discharge rates to be set at 2 l/s to minimise the risk of blockages to orifices < 50mm, but, with the inclusion of Contraflow control chambers, trash screens and permeable paving, the risk of blockages is somewhat reduced and, therefore, the run-off rate can be limited to 1 l/s. A comprehensive management & maintenance regime shall be implemented to ensure that the risk of blockages is minimised.

4.14 Attenuation of the storm water will be provided by the access road / parking granular sub-base. Network calculations within Appendix B shows that there is sufficient storage within the system to prevent flooding in the 1 in 100 year storm event plus a 45% increase allowance for climate change.

4.15 A 325mm depth sub-base underneath permeable driveway and access road areas, has been designed to attenuate and convey the surface water. Water from roofs is drained to the permeable sub-base via Aco Multi-Drain channels & pipework through diffuser units, with a silt trap proceeding each connection into the sub-base. The permeable driveway sub-bases are piped into the ditch via Contraflow 500 series flow control chamber, with an orifice size of 25mm.

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4.16 The scheme has allowed for a climate change allowance of 45%. 10% urban creep has been applied to all impermeable areas except the access roads.

4.17 Site investigation and groundwater monitoring data already obtained for the adjacent site should suffice to accompany the drainage design on this proposed site.

4.18 The proposed Drainage Strategy can be seen in Appendix A

5.0 SUSTAINABLE URBAN DRAINAGE SYSTEMS

5.1 SuDS have been incorporated into the design to intercept rainfall and convey the water to the ditch outfall to the north-east of the site.

5.2 As well as providing storm water storage, the SuDS features are within the design to ensure the water quality entering the surface water body is acceptable.

5.3 In accordance with section 26.3 of CIRIA C753 recommends the use of simple index approach for assessing the minimum water quality management requirements and this method has been used to assess the suitability of above proposals as follows:

(i) From table 26.2, residential roads runoff is considered low pollution hazard

(ii) From table 26.2 the following hazard indices are applicable;
Total suspended solids – 0.5
Metals – 0.4
Hydrocarbons – 0.4

(iii) From table 26.3, the indicative SuDS mitigation indices for permeable paving is as follows;
Total suspended solids – 0.7
Metals – 0.6
Hydrocarbons – 0.7

5.4 From the above it can be seen that the provision of permeable paving exceeds the pollution mitigation requirements.

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6.0 FOUL DRAINAGE STRATEGY

6.1 Pre-Development

6.2 The site is currently partly being used as a static caravan site. The Topo survey indicates some manholes within the site, which appear to be flowing towards Horsemere Green Lane.

6.3 Southern Water sewer record plans indicate that there is an existing 150mm diameter public foul sewer in Horsemere Green Lane.

6.4 Post-Development

6.5 The proposed site consists of 2 residential dwellings. Using the recommendations within Sewers for Adoption 7th Edition for an allowance of 4000 litres per unit per day, this will result in a peak flow of 0.09 l/s from the proposed development.

6.6 The proposals are to use the existing connection from the site, assuming that a CCTV survey shows that the existing pipework & connection are satisfactory



Signature.....

TIM BUTTON

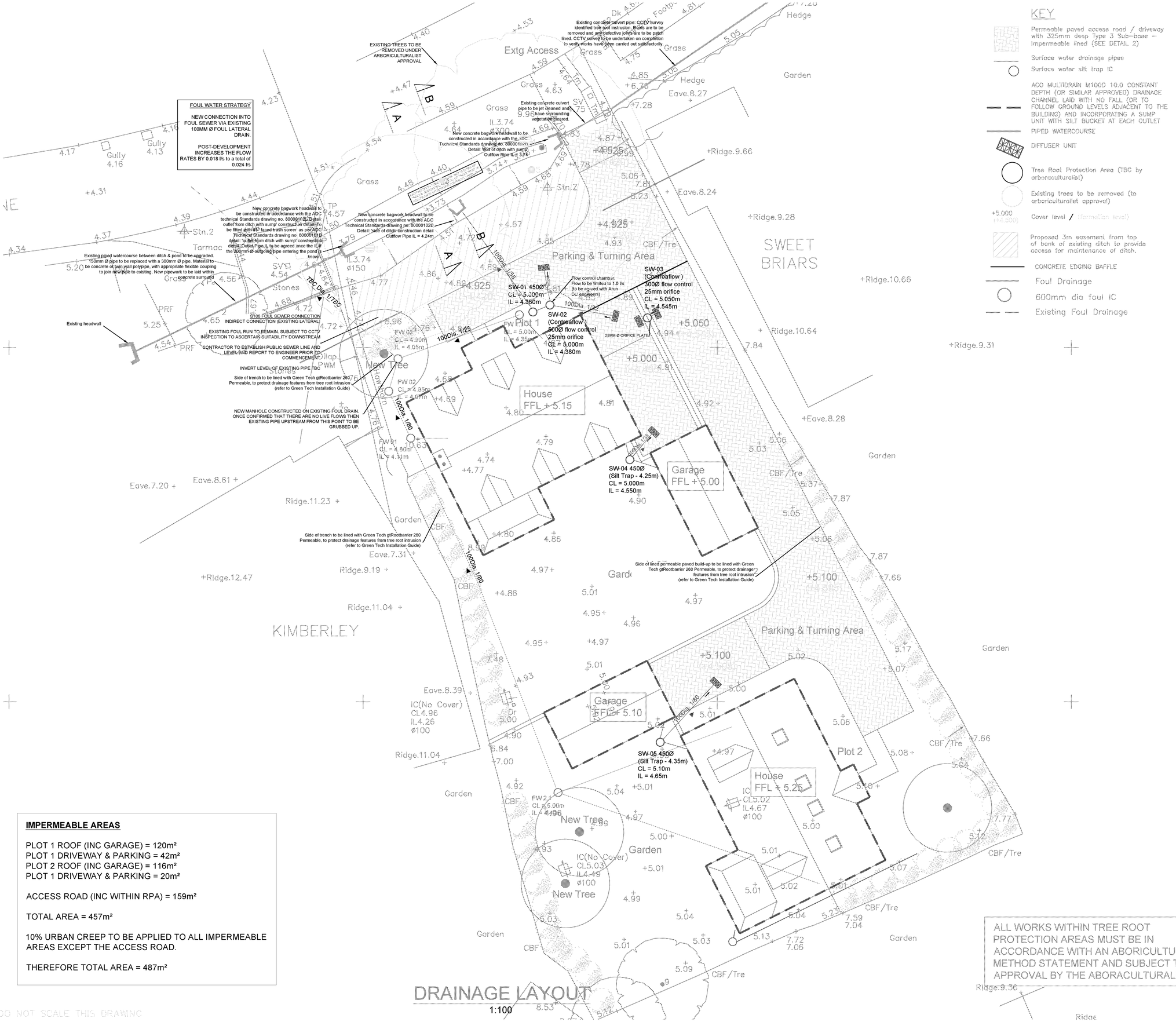
For and on behalf of Cowan Consultancy Limited

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APPENDIX A

DRAINAGE STRATEGY DRAWING

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KEY

- Permeable paved access road / driveway with 325mm deep Type 3 Sub-base — Impermeable lined (SEE DETAIL 2)
- Surface water drainage pipes
- Surface water silt trap IC
- ACO MULTIDRAIN M100D 10.0 CONSTANT DEPTH (OR SIMILAR APPROVED) DRAINAGE CHANNEL LAID WITH NO FALL (OR TO FOLLOW GROUND LEVELS ADJACENT TO THE BUILDING) AND INCORPORATING A SUMP UNIT WITH SILT BUCKET AT EACH OUTLET
- PIPED WATERCOURSE
- DIFFUSER UNIT
- Tree Root Protection Area (TBC by arboraculturalist)
- Existing trees to be removed (to arboriculturalist approval)
- +5.000 (34.000) Cover level / (formation level)
- Proposed 3m easement from top of bank of existing ditch to provide access for maintenance of ditch.
- CONCRETE EDGING BAFFLE
- Foul Drainage
- 600mm dia foul IC
- Existing Foul Drainage

! CDM 2015 - RESIDUAL RISKS !

In preparing the designs illustrated by this drawing we have fulfilled our duties in the role of Designer as defined in the Construction Design and Management Regulations 2015. We have undertaken a full Hazard Identification and Risk Analysis and have designed out any special risks associated with the work, so that as far as possible there are no residual risks.

NOTE: Residual risks are defined as those risks arising from identified hazards which cannot be designed-out, and which a competent and experienced building contractor is unlikely to encounter during normal construction activities. Ordinary risks arising from normal construction operations have not been included.

Where hazards have been identified, the risks from which it has not been possible to eliminate during the design process, these are indicated on the drawing. It will be the responsibility of the Principal Contractor to develop Safe Systems of Work and/or Method Statements to minimise any risks associated with such hazards.

1. This drawing is to be read in conjunction with all relevant Engineers and Architects drawings, and the Specification.

2. All dimensions are in millimetres unless noted otherwise. All levels are in Metres Above an arbitrary datum and not to Ordnance Datum.

3. In accordance with CDM 2015 the Contractor is to:
-Notify HSE of works.
-Comply with the requirements of Health and Safety Plan(if applicable)
-Provide risk accessments and method statements for all potential hazards relevant to this project.

4. The main contractor shall be responsible for the setting out and accuracy of all dimensions. They shall satisfy themselves that the information given is correct and any discrepancies should be noted to the Engineer immediately.

5. DO NOT SCALE. If discrepancy or query arises on dimensions consult Engineer.

6. The Contractor is responsible for specifying product and codes and ordering of drainage materials.

7. All drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.

8. Cover grades and gulley gratings are in accordance with BS497 Pt 1
Cover Grades :- D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

9. Sewer runs and manholes to be adopted are to be in accordance with Sewers for Adoption, 7th Edition.

10. Any drainage laid less than 600mm below FGL to be covered with minimum 150mm Gen 3 grade concrete to half diameter.

11. Drains are to be constructed using flexibly jointed vitrified clay pipes to BS EN 295- 1991 "super strength" specification (e.g. Hepworth Supersleve or similar) or uPVC drainage pipework to BS4660 & BS2494, bedded & backfilled in accordance with manufacturers instructions.

12. Provide 100x100 PCC lintel max span 650mm where svp exit the building.

13. ACO channels installed and bedded to manufacturers requirements.

14. Exact location of any sewers to be determined on site.

IMPERMEABLE AREAS

PLOT 1 ROOF (INC GARAGE) = 120m²
PLOT 1 DRIVEWAY & PARKING = 42m²
PLOT 2 ROOF (INC GARAGE) = 116m²
PLOT 1 DRIVEWAY & PARKING = 20m²

ACCESS ROAD (INC WITHIN RPA) = 159m²

TOTAL AREA = 457m²

10% URBAN CREEP TO BE APPLIED TO ALL IMPERMEABLE AREAS EXCEPT THE ACCESS ROAD.

THEREFORE TOTAL AREA = 487m²

ALL WORKS WITHIN TREE ROOT PROTECTION AREAS MUST BE IN ACCORDANCE WITH AN ABORICULTURAL METHOD STATEMENT AND SUBJECT TO APPROVAL BY THE ABORACULTURALIST.

DRAINAGE LAYOUT

1:100

DO NOT SCALE THIS DRAWING

Date	By	Revision	Ch'd	Ref
JAN 2024	TB	Revisions from LA drainage comments		8
DEC 2023	TB	Foul drainage added		7
NOV 2023	TB	Revisions from OWC comments		6
OCT 2023	TB	Revisions from OWC comments		5
SEP 2023	TB	Attenuation storage volume increased. pipe sizes / gradients added		4
SEP 2023	TB	Drainage scheme update & ditch works added to drawing		3
MAY 2023	TB	Trees removed from within ditch and therefore RPA construction removed		2
APR 2023	TB	3m ditch bank easement added		1

Status: PRELIMINARY

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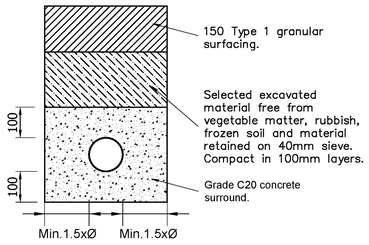
Client: Maxwell Homes

Project: Bramleys
Horsemere Green Lane

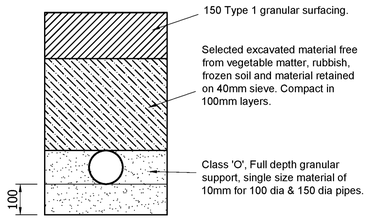
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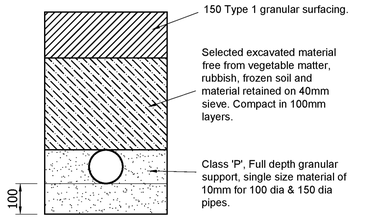
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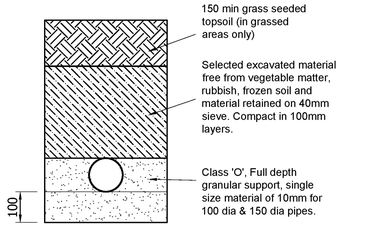
BEDDING FOR FLEXIBLE PIPES LESS THAN 900mm COVER UNDER ROADS
1:10



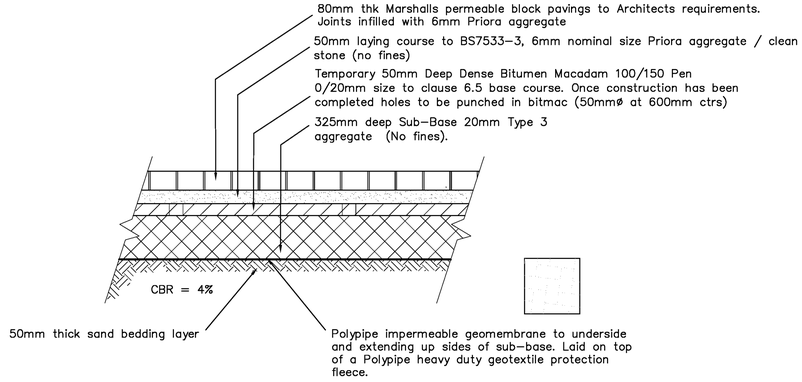
BEDDING FOR FLEXIBLE PIPES 900–1200mm COVER UNDER ROADS
1:10



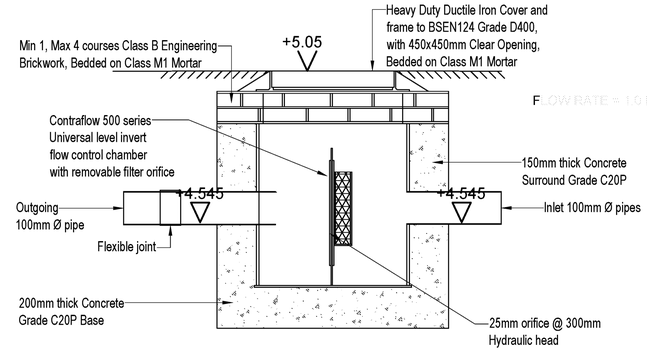
BEDDING FOR FLEXIBLE PIPES 1200–2000mm COVER UNDER ROADS
1:10



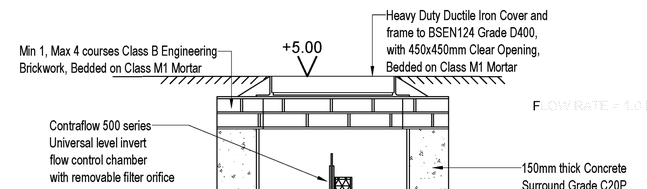
BEDDING FOR FLEXIBLE PIPES UP to 1500mm DEEP NOT UNDER ROADS
1:10



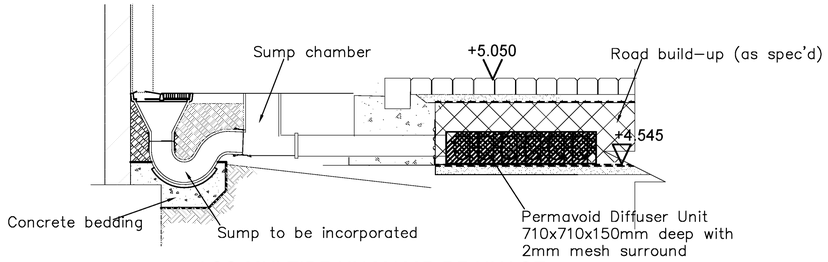
DETAIL 2 - DRIVEWAY & PARKING CONSTRUCTION - TYPICAL SECTION (IMPERMEABLE TANKED)
SCALE 1: 20



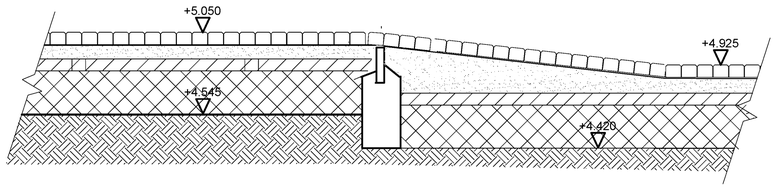
(SW-02) 300MM Ø CONTROFLOW FLOW CONTROL CHAMBER DETAIL
SCALE 1:15



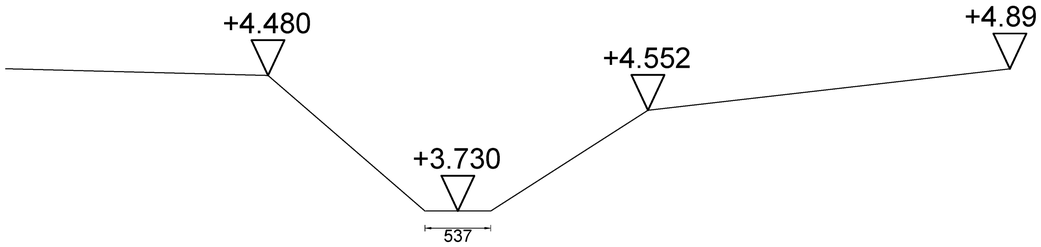
(SW-03) 500MM Ø CONTROFLOW FLOW CONTROL CHAMBER DETAIL
SCALE 1:15



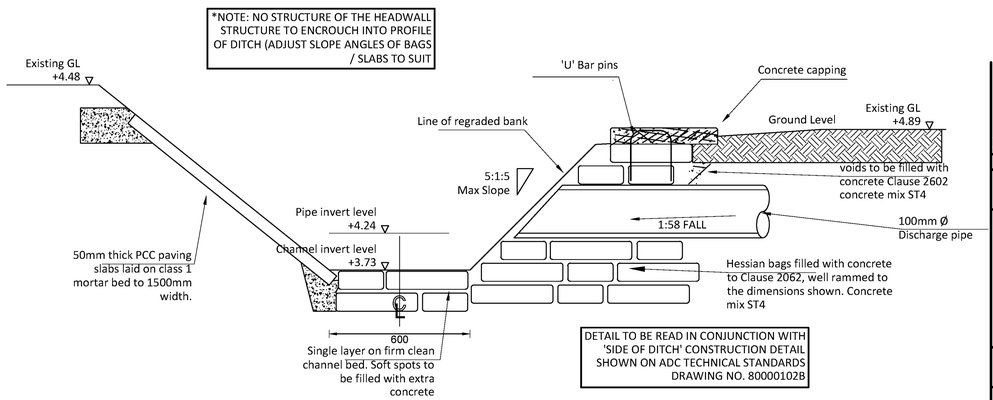
ACO MULTIDRAIN M100D DRAINAGE INTO TYPE 3 SUB-BASE ATTENUATION TYPICAL DETAIL
SCALE 1:15



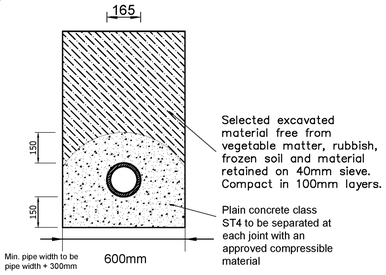
SECTION THROUGH STEP WITHIN PERVIOUS PAVEMENT INCORPORATING CONCRETE EDGING BAFFLE AT STEP POSITION
SCALE 1: 20



SECTION A-A - DITCH PROFILE
1:20



SECTION B-B (BAGWORK HEADWALL)
1:20



CONCRETE SURROUND TO BE USED WHERE COVER TO CROWN OF PIPE IS LESS THAN 1200MM IN VEHICULAR AREAS OR LESS THAN 900MM ELSEWHERE
1:10

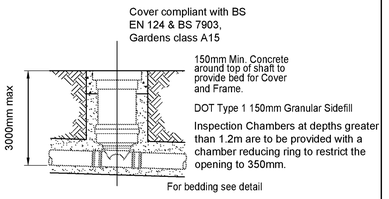
NOTES

1. This drawing is to be read in conjunction with all relevant Engineers drawings and specifications.

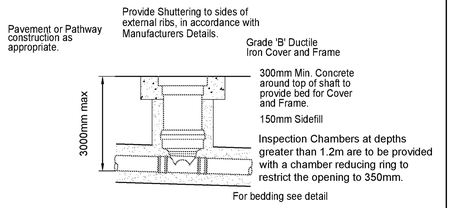
2. All dimensions are in milimetres unless noted otherwise.

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-Notify HSE of works.
-Comply with the requirements of Health and Safety Plan (if applicable)
-Provide risk assessments and method statements for all potential hazards relevant to this project.



450mmø INSPECTION CHAMBER GRADE 'A' NON–LOAD BEARING INSTALLATION
1: 20



450mmø INSPECTION CHAMBER GRADE 'B' LOAD BEARING INSTALLATION
1: 20

Date	By	Revision	QA'D	Chk'd	Ref
JAN 2024	TB	Revisions from LA drainage comments			2
OCT 2023	TB	Revisions from OWC comments			1

Status: PRELIMINARY

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Client: Maxwell Homes

Project: Bramleys
Horsemere Green Lane

Title: Drainage Details

Date	Sep 2023	Scale	AS SHOWN @ A1	Drg. No.
Drawn	TB	Chk'd	EG	QA'D	456040–202P1

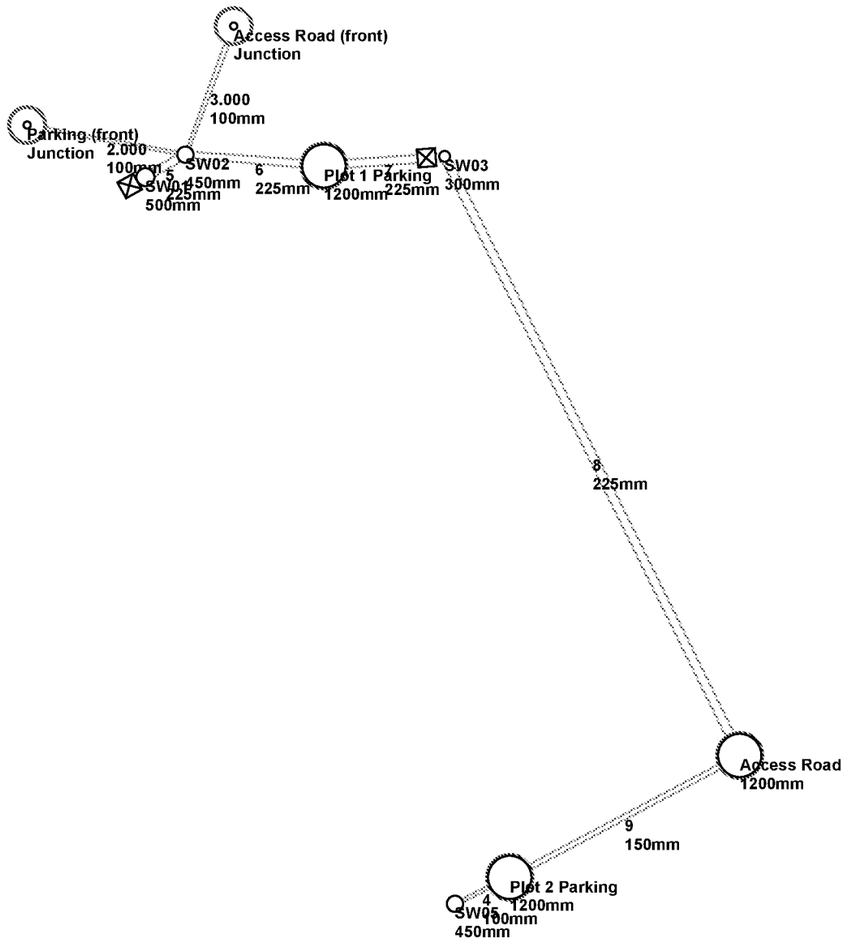
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APPENDIX B

NETWORK CALCULATIONS

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Flow+ v10.7 Copyright © 1988-2024 Causeway Technologies Ltd

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	0.250
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW05		5.00	5.100	450	1215.467	157.491	0.380
Access Road (front)	0.006	5.00	4.925		1209.342	181.872	0.505
SW01			5.000	500	1206.898	177.677	0.680
SW02	0.000	0.00	5.000	450	1208.006	178.301	0.640
Plot 1 Parking	0.016	5.00	5.000	1200	1211.840	177.987	0.500
SW03			5.050	300	1215.180	178.254	0.460
Access Road	0.010	5.00	5.100	1200	1223.347	161.613	0.500
Plot 2 Parking	0.015	5.00	5.100	1200	1216.982	158.226	0.490
Parking (front)	0.002	5.00	4.925		1203.625	179.124	0.505

Links (Results)

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5	2.328	92.6	8.9	0.415	0.455	0.049	0.0	47	1.487
6	2.505	99.6	7.5	0.275	0.415	0.041	0.0	42	1.492
7	2.150	85.5	4.6	0.235	0.275	0.025	0.0	35	1.145
8	0.265	11.7	4.6	0.275	0.235	0.025	0.0	97	0.276
9	0.367	6.5	2.7	0.340	0.350	0.015	0.0	68	0.351
4	1.984	15.6	0.0	0.280	0.390	0.000	0.0	0	0.000
3.000	0.667	7.6	1.1	0.405	0.540	0.006	0.0	25	0.682
2.000	0.604	7.0	0.4	0.405	0.540	0.002	0.0	15	0.459

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Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	✓	2 year (l/s)	0.3	500 year (l/s)	1.4
Summer CV	1.000	Drain Down Time (mins)	240	10 year (l/s)	0.5	Check Discharge Volume	✓
Winter CV	1.000	Additional Storage (m³/ha)	0.0	30 year (l/s)	0.7	100 year 360 minute (m³)	26
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	100 year (l/s)	1.0		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	10	0	0	100	45	0	0
10	40	0	0	500	45	0	0
30	40	0	0				

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.37	Growth Factor 100 year	3.19	Q 10 year (l/s)	0.5
Greenfield Method	IH124	Region	7	Growth Factor 500 year	4.49	Q 30 year (l/s)	0.7
Positively Drained Area (ha)	0.103	Growth Factor 2 year	0.88	Betterment (%)	0	Q 100 year (l/s)	1.0
SAAR (mm)	722	Growth Factor 10 year	1.62	QBar	0.3	Q 500 year (l/s)	1.4
Soil Index	3	Growth Factor 30 year	2.40	Q 2 year (l/s)	0.3		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	3	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.37	Climate Change (%)	0	PR	0.375
Positively Drained Area (ha)	0.103	CWI	108.444	Storm Duration (mins)	360	Runoff Volume (m³)	26

Node Ditch Headwall Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		

Applies to All storms

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Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.990	1440	0.990

Node SW01 Online Orifice Control

Flap Valve	x	Invert Level (m)	4.320	Design Flow (l/s)	1.0	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.500	Diameter (m)	0.026		

Node SW03 Online Orifice Control

Flap Valve	x	Invert Level (m)	4.590	Design Flow (l/s)	0.9	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.500	Diameter (m)	0.024		

Node Parking (front) Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	3.870	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.420	Length (m)	3.870	Inf Depth (m)	0.325
Safety Factor	2.0	Time to half empty (mins)	56	Slope (1:X)	500.0		

Node Plot 1 Parking Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	5.200	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.500	Length (m)	5.200	Inf Depth (m)	0.320
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node Access Road Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	10.150	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.600	Length (m)	10.150	Inf Depth (m)	0.320
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

Node Plot 2 Parking Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	4.470	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.610	Length (m)	4.470	Inf Depth (m)	0.320
Safety Factor	2.0	Time to half empty (mins)	0	Slope (1:X)	500.0		

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Node Access Road (front) Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	7.480	Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.420	Length (m)	7.480	Inf Depth (m)	0.325
Safety Factor	2.0	Time to half empty (mins)	56	Slope (1:X)	500.0		

Approval Settings

Node Size	✓	Minimum Backdrop Height (m)	0.200	Return Period (years)	100
Node Losses	✓	Maximum Backdrop Height (m)	1.500	Time to Half Empty	✓
Link Size	✓	Full Bore Velocity	✓	Return Period (years)	2
Minimum Diameter (mm)	100	Minimum Full Bore Velocity (m/s)	1.000	Discharge Rates	✓
Link Length	✓	Maximum Full Bore Velocity (m/s)	3.000	2 year (l/s)	0.3
Maximum Length (m)	100.000	Proportional Velocity	✓	10 year (l/s)	0.5
Coordinates	✓	Return Period (years)	2	30 year (l/s)	0.7
Accuracy (m)	1.000	Minimum Proportional Velocity (m/s)	0.750	100 year (l/s)	1.0
Crossings	✓	Maximum Proportional Velocity (m/s)	3.000	500 year (l/s)	1.4
Cover Depth	✓	Surcharged Depth	✓	Discharge Volume	✓
Minimum Cover Depth (m)	0.250	Return Period (years)	2	100 year +45% 360 minute (m^3)	37
Maximum Cover Depth (m)	3.000	Maximum Surcharged Depth (m)	0.100		
Backdrops	✓	Flooding	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% CC 15 minute summer	127.507	36.080	2 year +10% CC 240 minute summer	24.748	6.540
2 year +10% CC 15 minute winter	89.478	36.080	2 year +10% CC 240 minute winter	16.442	6.540
2 year +10% CC 30 minute summer	82.413	23.320	2 year +10% CC 360 minute summer	19.009	4.892
2 year +10% CC 30 minute winter	57.834	23.320	2 year +10% CC 360 minute winter	12.356	4.892
2 year +10% CC 60 minute summer	55.776	14.740	2 year +10% CC 480 minute summer	14.905	3.939
2 year +10% CC 60 minute winter	37.056	14.740	2 year +10% CC 480 minute winter	9.903	3.939
2 year +10% CC 120 minute summer	38.539	10.185	2 year +10% CC 600 minute summer	12.132	3.318
2 year +10% CC 120 minute winter	25.604	10.185	2 year +10% CC 600 minute winter	8.289	3.318
2 year +10% CC 180 minute summer	30.796	7.925	2 year +10% CC 720 minute summer	10.746	2.880
2 year +10% CC 180 minute winter	20.018	7.925	2 year +10% CC 720 minute winter	7.222	2.880

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +10% CC 960 minute summer	8.735	2.300	30 year +40% CC 60 minute summer	184.545	48.770
2 year +10% CC 960 minute winter	5.786	2.300	30 year +40% CC 60 minute winter	122.607	48.770
2 year +10% CC 1440 minute summer	6.282	1.684	30 year +40% CC 120 minute summer	112.332	29.686
2 year +10% CC 1440 minute winter	4.222	1.684	30 year +40% CC 120 minute winter	74.630	29.686
10 year +40% CC 15 minute summer	316.646	89.600	30 year +40% CC 180 minute summer	85.112	21.902
10 year +40% CC 15 minute winter	222.208	89.600	30 year +40% CC 180 minute winter	55.325	21.902
10 year +40% CC 30 minute summer	206.810	58.520	30 year +40% CC 240 minute summer	66.407	17.549
10 year +40% CC 30 minute winter	145.130	58.520	30 year +40% CC 240 minute winter	44.119	17.549
10 year +40% CC 60 minute summer	139.710	36.921	30 year +40% CC 360 minute summer	49.492	12.736
10 year +40% CC 60 minute winter	92.820	36.921	30 year +40% CC 360 minute winter	32.171	12.736
10 year +40% CC 120 minute summer	87.508	23.126	30 year +40% CC 480 minute summer	38.154	10.083
10 year +40% CC 120 minute winter	58.138	23.126	30 year +40% CC 480 minute winter	25.348	10.083
10 year +40% CC 180 minute summer	67.164	17.283	30 year +40% CC 600 minute summer	30.676	8.391
10 year +40% CC 180 minute winter	43.658	17.283	30 year +40% CC 600 minute winter	20.960	8.391
10 year +40% CC 240 minute summer	52.760	13.943	30 year +40% CC 720 minute summer	26.906	7.211
10 year +40% CC 240 minute winter	35.052	13.943	30 year +40% CC 720 minute winter	18.082	7.211
10 year +40% CC 360 minute summer	39.535	10.174	30 year +40% CC 960 minute summer	21.513	5.665
10 year +40% CC 360 minute winter	25.699	10.174	30 year +40% CC 960 minute winter	14.251	5.665
10 year +40% CC 480 minute summer	30.557	8.075	30 year +40% CC 1440 minute summer	15.082	4.042
10 year +40% CC 480 minute winter	20.302	8.075	30 year +40% CC 1440 minute winter	10.136	4.042
10 year +40% CC 600 minute summer	24.618	6.734	100 year +45% CC 15 minute summer	532.752	150.750
10 year +40% CC 600 minute winter	16.820	6.734	100 year +45% CC 15 minute winter	373.861	150.750
10 year +40% CC 720 minute summer	21.631	5.797	100 year +45% CC 30 minute summer	356.564	100.895
10 year +40% CC 720 minute winter	14.537	5.797	100 year +45% CC 30 minute winter	250.220	100.895
10 year +40% CC 960 minute summer	17.362	4.572	100 year +45% CC 60 minute summer	243.867	64.447
10 year +40% CC 960 minute winter	11.501	4.572	100 year +45% CC 60 minute winter	162.020	64.447
10 year +40% CC 1440 minute summer	12.236	3.279	100 year +45% CC 120 minute summer	145.603	38.479
10 year +40% CC 1440 minute winter	8.224	3.279	100 year +45% CC 120 minute winter	96.735	38.479
30 year +40% CC 15 minute summer	409.239	115.801	100 year +45% CC 180 minute summer	109.824	28.261
30 year +40% CC 15 minute winter	287.186	115.801	100 year +45% CC 180 minute winter	71.388	28.261
30 year +40% CC 30 minute summer	272.029	76.975	100 year +45% CC 240 minute summer	85.582	22.617
30 year +40% CC 30 minute winter	190.898	76.975	100 year +45% CC 240 minute winter	56.859	22.617

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 360 minute summer	63.776	16.412	500 year +45% CC 120 minute summer	191.055	50.490
100 year +45% CC 360 minute winter	41.456	16.412	500 year +45% CC 120 minute winter	126.933	50.490
100 year +45% CC 480 minute summer	49.252	13.016	500 year +45% CC 180 minute summer	144.677	37.230
100 year +45% CC 480 minute winter	32.722	13.016	500 year +45% CC 180 minute winter	94.043	37.230
100 year +45% CC 600 minute summer	39.663	10.849	500 year +45% CC 240 minute summer	113.374	29.961
100 year +45% CC 600 minute winter	27.100	10.849	500 year +45% CC 240 minute winter	75.323	29.961
100 year +45% CC 720 minute summer	34.835	9.336	500 year +45% CC 360 minute summer	85.427	21.983
100 year +45% CC 720 minute winter	23.411	9.336	500 year +45% CC 360 minute winter	55.530	21.983
100 year +45% CC 960 minute summer	27.896	7.346	500 year +45% CC 480 minute summer	66.501	17.574
100 year +45% CC 960 minute winter	18.479	7.346	500 year +45% CC 480 minute winter	44.181	17.574
100 year +45% CC 1440 minute summer	19.567	5.244	500 year +45% CC 600 minute summer	53.842	14.727
100 year +45% CC 1440 minute winter	13.150	5.244	500 year +45% CC 600 minute winter	36.788	14.727
500 year +45% CC 15 minute summer	686.541	194.267	500 year +45% CC 720 minute summer	47.462	12.720
500 year +45% CC 15 minute winter	481.783	194.267	500 year +45% CC 720 minute winter	31.898	12.720
500 year +45% CC 30 minute summer	465.694	131.775	500 year +45% CC 960 minute summer	38.158	10.048
500 year +45% CC 30 minute winter	326.803	131.775	500 year +45% CC 960 minute winter	25.277	10.048
500 year +45% CC 60 minute summer	321.744	85.027	500 year +45% CC 1440 minute summer	26.749	7.169
500 year +45% CC 60 minute winter	213.759	85.027	500 year +45% CC 1440 minute winter	17.977	7.169

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Results for 2 year +10% CC Critical Storm Duration. Lowest mass balance: 97.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SW05	1	4.720	0.000	0.0	0.0000	0.0000	OK
180 minute summer	Access Road (front)	148	4.543	0.123	1.2	1.9368	0.0000	SURCHARGED
180 minute summer	SW01	140	4.547	0.227	1.9	0.0446	0.0000	OK
180 minute summer	SW02	140	4.547	0.187	2.8	0.0297	0.0000	OK
180 minute summer	Plot 1 Parking	148	4.543	0.043	1.6	0.3456	0.0000	OK
360 minute summer	SW03	240	4.698	0.108	0.4	0.0076	0.0000	OK
360 minute summer	Access Road	240	4.698	0.098	1.1	2.7834	0.0000	OK
360 minute summer	Plot 2 Parking	240	4.698	0.088	0.8	0.5983	0.0000	OK
180 minute summer	Parking (front)	148	4.543	0.123	0.4	0.5353	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SW05	4	Plot 2 Parking	0.0	0.000	0.000	0.0041	
180 minute summer	Access Road (front)	3.000	SW02	-0.7	0.252	-0.096	0.0298	
180 minute summer	SW01	Orifice		0.7				11.6
180 minute summer	SW02	5	SW01	1.9	0.388	0.021	0.0477	
180 minute summer	Plot 1 Parking	6	SW02	1.8	0.467	0.018	0.0774	
360 minute summer	SW03	Orifice	Plot 1 Parking	0.4				
360 minute summer	Access Road	8	SW03	0.4	0.091	0.033	0.3267	
360 minute summer	Plot 2 Parking	9	Access Road	0.6	0.215	0.097	0.0823	
180 minute summer	Parking (front)	2.000	SW02	0.4	0.093	0.061	0.0349	

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Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 97.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW05	224	4.832	0.112	0.0	0.0178	0.0000	FLOOD RISK
120 minute winter	Access Road (front)	116	4.710	0.290	2.0	4.7453	0.0000	FLOOD RISK
120 minute winter	SW01	116	4.710	0.390	2.5	0.0765	0.0000	OK
120 minute winter	SW02	116	4.710	0.350	2.7	0.0557	0.0000	FLOOD RISK
120 minute winter	Plot 1 Parking	116	4.710	0.210	3.0	1.8521	0.0000	OK
240 minute winter	SW03	188	4.832	0.242	0.6	0.0172	0.0000	FLOOD RISK
240 minute winter	Access Road	188	4.832	0.232	2.1	7.0364	0.0000	FLOOD RISK
240 minute winter	Plot 2 Parking	188	4.832	0.222	1.5	1.5535	0.0000	FLOOD RISK
120 minute winter	Parking (front)	116	4.710	0.290	0.9	1.2859	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	SW05	4	Plot 2 Parking	0.0	-0.009	-0.003	0.0132	
120 minute winter	Access Road (front)	3.000	SW02	-1.0	0.221	-0.138	0.0298	
120 minute winter	SW01	Orifice		0.9				15.4
120 minute winter	SW02	5	SW01	2.5	0.327	0.027	0.0506	
120 minute winter	Plot 1 Parking	6	SW02	2.7	0.539	0.027	0.1508	
240 minute winter	SW03	Orifice	Plot 1 Parking	0.5				
240 minute winter	Access Road	8	SW03	0.6	0.105	0.049	0.7372	
240 minute winter	Plot 2 Parking	9	Access Road	1.1	0.186	0.172	0.1269	
120 minute winter	Parking (front)	2.000	SW02	-0.6	0.092	-0.084	0.0349	

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Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 97.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	SW05	180	4.916	0.196	0.1	0.0312	0.0000	FLOOD RISK
180 minute winter	Access Road (front)	172	4.802	0.382	2.0	6.2910	0.0000	FLOOD RISK
180 minute winter	SW01	172	4.802	0.482	1.7	0.0945	0.0000	OK
180 minute winter	SW02	172	4.802	0.442	2.3	0.0703	0.0000	FLOOD RISK
180 minute winter	Plot 1 Parking	172	4.802	0.302	2.8	2.6890	0.0000	FLOOD RISK
180 minute winter	SW03	176	4.917	0.327	0.7	0.0232	0.0000	FLOOD RISK
180 minute winter	Access Road	176	4.917	0.317	3.3	9.7349	0.0000	FLOOD RISK
180 minute winter	Plot 2 Parking	180	4.916	0.306	2.3	2.1571	0.0000	FLOOD RISK
180 minute winter	Parking (front)	172	4.802	0.382	0.8	1.6997	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	SW05	4	Plot 2 Parking	-0.1	-0.016	-0.005	0.0132	
180 minute winter	Access Road (front)	3.000	SW02	-1.1	0.210	-0.146	0.0298	
180 minute winter	SW01	Orifice		1.0				19.7
180 minute winter	SW02	5	SW01	1.7	0.270	0.018	0.0506	
180 minute winter	Plot 1 Parking	6	SW02	2.0	0.481	0.020	0.1530	
180 minute winter	SW03	Orifice	Plot 1 Parking	0.5				
180 minute winter	Access Road	8	SW03	0.7	0.118	0.056	0.7372	
180 minute winter	Plot 2 Parking	9	Access Road	1.7	0.230	0.255	0.1269	
180 minute winter	Parking (front)	2.000	SW02	-0.5	-0.063	-0.070	0.0349	

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 97.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SW05	236	5.040	0.320	0.1	0.0508	0.0000	FLOOD RISK
180 minute winter	Access Road (front)	172	4.923	0.503	2.2	8.3151	0.0000	FLOOD RISK
180 minute winter	SW01	172	4.923	0.603	2.2	0.1181	0.0000	OK
180 minute winter	SW02	172	4.923	0.563	2.5	0.0895	0.0000	FLOOD RISK
180 minute winter	Plot 1 Parking	172	4.923	0.423	3.5	3.7931	0.0000	FLOOD RISK
240 minute winter	SW03	236	5.040	0.450	0.6	0.0319	0.0000	FLOOD RISK
240 minute winter	Access Road	236	5.040	0.440	3.3	13.6649	0.0000	FLOOD RISK
240 minute winter	Plot 2 Parking	236	5.040	0.430	2.4	3.0343	0.0000	FLOOD RISK
180 minute winter	Parking (front)	172	4.923	0.503	0.7	2.2416	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	SW05	4	Plot 2 Parking	-0.1	-0.013	-0.006	0.0132	
180 minute winter	Access Road (front)	3.000	SW02	-1.0	0.194	-0.135	0.0298	
180 minute winter	SW01	Orifice		1.1				22.1
180 minute winter	SW02	5	SW01	2.2	0.443	0.023	0.0506	
180 minute winter	Plot 1 Parking	6	SW02	2.5	0.526	0.026	0.1530	
240 minute winter	SW03	Orifice	Plot 1 Parking	0.5				
240 minute winter	Access Road	8	SW03	0.6	0.116	0.054	0.7372	
240 minute winter	Plot 2 Parking	9	Access Road	1.7	0.217	0.260	0.1269	
180 minute winter	Parking (front)	2.000	SW02	-0.5	-0.058	-0.065	0.0349	

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Results for 500 year +45% CC Critical Storm Duration. Lowest mass balance: 97.22%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	SW05	82	5.058	0.338	0.2	0.0537	0.0000	FLOOD RISK
240 minute winter	Access Road (front)	140	4.925	0.505	2.4	8.3513	4.1089	FLOOD
120 minute summer	SW01	72	4.930	0.610	1.7	0.1195	0.0000	OK
120 minute summer	SW02	72	4.930	0.570	5.2	0.0906	0.0000	FLOOD RISK
120 minute summer	Plot 1 Parking	72	4.931	0.431	8.5	3.8642	0.0000	FLOOD RISK
360 minute winter	SW03	216	5.050	0.460	2.9	0.0327	7.2970	FLOOD
120 minute winter	Access Road	82	5.055	0.455	7.1	14.1472	0.0000	FLOOD RISK
120 minute winter	Plot 2 Parking	82	5.058	0.448	5.2	3.1624	0.0000	FLOOD RISK
240 minute winter	Parking (front)	140	4.925	0.505	1.5	2.2514	2.4734	FLOOD

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	SW05	4	Plot 2 Parking	-0.2	-0.026	-0.013	0.0132	
240 minute winter	Access Road (front)	3.000	SW02	-1.3	0.223	-0.166	0.0298	
120 minute summer	SW01	Orifice		1.1				19.7
120 minute summer	SW02	5	SW01	-1.9	0.571	-0.020	0.0506	
120 minute summer	Plot 1 Parking	6	SW02	5.2	0.585	0.053	0.1530	
360 minute winter	SW03	Orifice	Plot 1 Parking	0.5				
120 minute winter	Access Road	8	SW03	5.7	0.146	0.490	0.7372	
120 minute winter	Plot 2 Parking	9	Access Road	3.5	0.325	0.544	0.1269	
240 minute winter	Parking (front)	2.000	SW02	-1.1	-0.147	-0.163	0.0349	

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APPENDIX C

HR WALLINGFORD GREENFIELD RUN-OFF RATE CALCUALTIONS

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Print | Close Report

HR Wallingford
working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Hedwilena Silva
Site name:	Bramleys
Site location:	Climping

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

Site Details

Latitude:	50.81115° N
Longitude:	0.58802° W
Reference:	1616936126
Date:	Feb 08 2023 16:05

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.1029

Methodology

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

Soil characteristics	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics	Default	Edited
SAAR (mm):	722	722
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.31	0.31
1 in 1 year (l/s):	0.26	0.26
1 in 30 years (l/s):	0.7	0.7
1 in 100 year (l/s):	0.98	0.98
1 in 200 years (l/s):	1.15	1.15

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