Wormald Burrows Partnership Limited
Civil Engineering Consultants
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Technical Note 1

Job No:	**E4114**
Planning Reference:	**APP/J1915/W/19/3222257**
Project:	**Chipping House, Chipping, Buntingford**
Subject:	**Surface Water Drainage - Condition 9**
Prepared by:	**Nick Kohli**
Date:	**30th August 2023**
Ref:	**E4114/TN/nk/300823**

1. Introduction

Planning permission was granted by East Herts District Council following appeal (APP/J1915/W/19/3222257) for the erection of 2no, four bed dwellings with associated access, parking and landscaping.

The planning permission included a number of planning conditions and this Technical Note has been prepared in support of an application to discharge planning Condition 9 which states: -

Neither of the approved dwellings shall be occupied until surface water drainage works have been implemented in accordance with details that have been submitted to and approved in writing by the local planning authority. Before these details are submitted an assessment shall be carried out of the potential for disposing of surface water by means of a sustainable drainage system, and the results of the assessment provided to the local planning authority. Where a sustainable drainage scheme is to be provided, the submitted details shall provide information about: the design storm period and intensity, the method employed to delay and control the surface water discharged from the site and the measures taken to prevent pollution of the receiving groundwater and/or surface waters; include a timetable for its implementation; and provide a management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime.

2. Surface Water Drainage Design

The site is underlain by granular materials and soakage tests included in **Appendix A** gave a rate 3.37x x 10^{-5} m/s, which demonstrates that the use of infiltration drainage techniques is viable. The proposed surface water drainage scheme utilises sustainable techniques, as it directs clean surface water runoff to soakaways in back gardens. Driveway areas will comprise of a permeable

construction using granular material, reinforced with a suitable geogrid product. (see drawing E4114/500 in **Appendix B**).

MicroDrainage modelling has been undertaken to demonstrate that the soakaways and permeable driveway have sufficient capacity for all storms up to and including the 1 in 100 year event plus 40% climate change and a copy of the results is included in **Appendix C**.

3. Surface Water Quality

As runoff is being directed to the ground, it is important to ensure that water quality is maintained to a suitable level. Consequently, the CIRIA Simple Index Approach tool has been used to assess levels of pollution and proposed mitigation measures. The results in **Appendix D** show that the level of treatment provided by the drainage scheme is suitable.

4. Ownership and Maintenance

The SuDS features will be maintained by the residents of the properties and they will be provided with a copy of the Maintenance Schedule included in **Appendix E**.

APPENDIX A

Hereditas ltd

Suite 103,The Spirella Building,Bridge Road

Letchworth Garden City,Hertfordshire sg6 4et

Telephone 01462 476196/07860 585119

Email hereditas@hotmail.com

Ref: houses a & b rear garden to chipping hall house

Chipping,buntingford,sg9 0pg

we thankyou for your request to undertake permeability testing at the above mentioned site and take pleasure in enclosing the results of this work.The investigation was undertaken on the 29th march 2022 in accordance with your instruction to proceed.This letter describes the work undertaken,presents the data obtained and discusses the results of the test.

FIELDWORK

The programme of this investigation included the excavation of two trial pits.The locations of the soakaway tests were selected by the structural engineer.

During this work,the soils encountered were logged in general accordance with BS 5930:1990,as amended in 2007,and full descriptions are given on records which are attached below.

REFERENCES

Building Research Establishment (BRE) digest 365,soakaway design,sept 1991

British Standards Institution (1999) BS5930:code of practice for site investigations BSI London

British Standards institution (2007) amendment no 1 BS5930:code of practice investigations,BSI London

We trust that this information is of interest and if you have any further requirements do not hesitate to contact me

Kind regards

Andy Benton

Hereditas Ltd
Suite 103, The spirilla building
Bridge road, Letchworth, Herts, Sg6 4et

Email Hereditas@hotmail.com Tel 07860 585119

Test project

		Revision	
Job No:	**22672**	Page:	**C/01**
Prepared By:	**andy benton**	Date:	**29/03/2022**

Section: **houses a&b rear to chipping hall house,chipping sg9**

ALTERNATIVE SOAKAWAY SIZES

	trench soakaways		
width of trench *[mm]*:	450	600	900
required trench length *[m]*:	20.41	16.24	11.66
	ring soakaways		
diameter of ring *[mm]*:	1050	1350	1500
required pit diameter *[m]*:	2.18	2.16	2.16

** Based on effective depth and number of pits as in Soakaway Data table*

SUMMARY OF CALCULATIONS

critical design rainfall duration 't_{crit}' =	120	*min*
required storage volume 'V_{req}' =	15.28	m^3
provided storage volume 'V_{prov}' =	15.30	m^3
utilisation factor =	**1.00**	***.OK***
required time to discharge 50% 't_{50}' =	4.48	*hours*
utilisation factor =	**0.19**	***.OK***

GENERAL DATA

site location: **England and Wales**
soakaway type: **geocellular units**

impermeable area drained to soakaway 'A' $[m^2]$ =	300
60 min rainfall depth of 5 year return period 'R' *[mm]* =	20
M5-60 to M5-2d rainfall ratio 'r' =	0.45
allowance for climate change:	30%

SOAKAWAY DATA

soakaway width 'W' [m] =	3.00
soakaway length 'L' [m] =	4.00
total depth from ground level 'D_b' *[m]* =	2.00
depth to drain invert level 'D_d' *[m]* =	0.50
soakaway effective depth 'D_{eff}' *[m]* =	1.50
free volume in infill aggregate *[%]* =	85

SOIL INFILTRATION DATA

allowance for infiltration through soakaway base: 30%
available on-site infiltration test results: ◉Yes ○No
use soakage trial pit table below

internal surface area of trial pit 'a_{p50}' [m^2] =	6.51
storage volume between 75-25% 'V_p' [m^3] =	0.77
time for water to fall from 75-25% 't_p' [min] =	58.20
soil infiltration rate 'f' [m/s] =	3.37E-05

SOAKAGE TRIAL PIT DATA

soakage trial pit width 'W_t' *[m]* =	0.30
soakage trial pit length 'L_t' *[m]* =	3.00
total depth from ground level 'D_{tb}' *[m]* =	1.80
depth to pipe invert level 'D_{tp}' *[m]* =	0.10
soakage trial pit effective depth 'D_{teff}' *[m]* =	1.70
free volume in infill aggregate *[%]* =	100

NOTE: faces of excavation assumed to be vertical

REQUIRED STORAGE CAPACITY PER RAINFALL DURATION

rainfall duration *[min]*	rainfall factor Z1	**M5-D** rainfalls *[mm]*	M10-D Z2	M10-D rainfalls *[mm]*	M10-D inflow $[m^3]$	M50-D Z2	M50-D rainfalls *[mm]*	M50-D inflow $[m^3]$	M100-D Z2	M100-D rainfalls *[mm]*	M100-D inflow $[m^3]$	outflow from soakaway $[m^3]$	required storage $[m^3]$
5	0.39	7.80	1.21	12.24	3.67	1.61	16.33	4.90	1.86	18.83	5.65	0.14	5.51
10	0.54	10.80	1.22	17.17	5.15	1.66	23.28	6.98	1.92	27.00	8.10	0.28	7.81
15	0.65	13.00	1.23	20.82	6.25	1.68	28.39	8.52	1.96	33.09	9.93	0.43	9.50
30	0.82	16.40	1.24	26.44	7.93	1.71	36.42	10.93	2.00	42.67	12.80	0.85	11.95
60	1.00	20.00	1.24	32.24	9.67	1.73	44.98	13.49	2.03	52.78	15.83	1.71	14.13
120	1.19	23.80	1.24	38.37	11.51	1.72	53.29	15.99	2.01	62.34	18.70	3.42	**15.28**
240	1.38	27.60	1.23	44.12	13.24	1.71	61.34	18.40	1.99	71.37	21.41	6.83	14.58
360	1.51	30.20	1.22	47.87	14.36	1.70	66.69	20.01	1.97	77.28	23.18	10.25	12.93
600	1.68	33.60	1.21	52.82	15.85	1.68	73.31	21.99	1.94	84.79	25.44	17.08	8.36
1440	2.03	40.60	1.19	62.74	18.82	1.64	86.37	25.91	1.89	99.50	29.85	41.00	0.00

** Z2 is growth factor from M5 rainfalls*

SOAKAGE TRIAL PIT INFILTRATION TEST RESULTS

	water level measurement N°:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Soakage Trial 1	time *[min]* =	0	10	25	45	60	70	80	90	100	110	120	130	140						
	depth to water *[m]* =	0.10	0.54	0.88	1.13	1.21	1.42	1.51	1.58	1.64	1.68	1.72	1.75	1.80						
Soakage Trial 2	time *[min]* =	0	10	25	45	60	70	80	90	100	110									
	depth to water *[m]* =	0.10	0.62	0.92	1.19	1.28	1.46	1.59	1.65	1.74	1.80									
Soakage Trial 3	time *[min]* =																			
	depth to water *[m]* =																			

TRIAL PIT LOG tp1

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chipping hall house,chipping,sg9 0pg

trial pit dimensions 300m wide 3000mm long and 1800mm deep

depth	soak away suitabilty	
0.3m	good with good permabilty	dark brown loose top soil
1.0m	very poor permabilty	into dark clay with little to no stone little moisture
1.8m	good permabilty	into loose chalk

hereditas ltd

chipping hall house,chipping,sg9 0pg

TRIAL PIT LOG tp2

trial pit dimensions 300m wide 3000mm long and 1800mm deep

depth	soak away suitabilty	
0.3m	good with good permabilty	dark brown loose top soil
1.0m	very poor permabilty	into dark clay with little to no stone little moisture
1.72m	good permabilty	into loose chalk

NOTES:

1. DO NOT SCALE ANY DIMENSIONS FROM THIS DRAWING

SITE PLAN
1:150

REV	DATE	REVISION	CHKD
–	18.03.22	FIRST ISSUE	SMJ

CLIENT

MR & MRS TREWIN

PROJECT

PROPOSED DWELLINGS – HOUSES A & B,
REAR GARDEN TO CHIPPING HOUSE,
CHIPPING, BUNTINGFORD,
EAST HERTFORDSHIRE SG9 0PG

TITLE

TRIAL PIT DETAILS

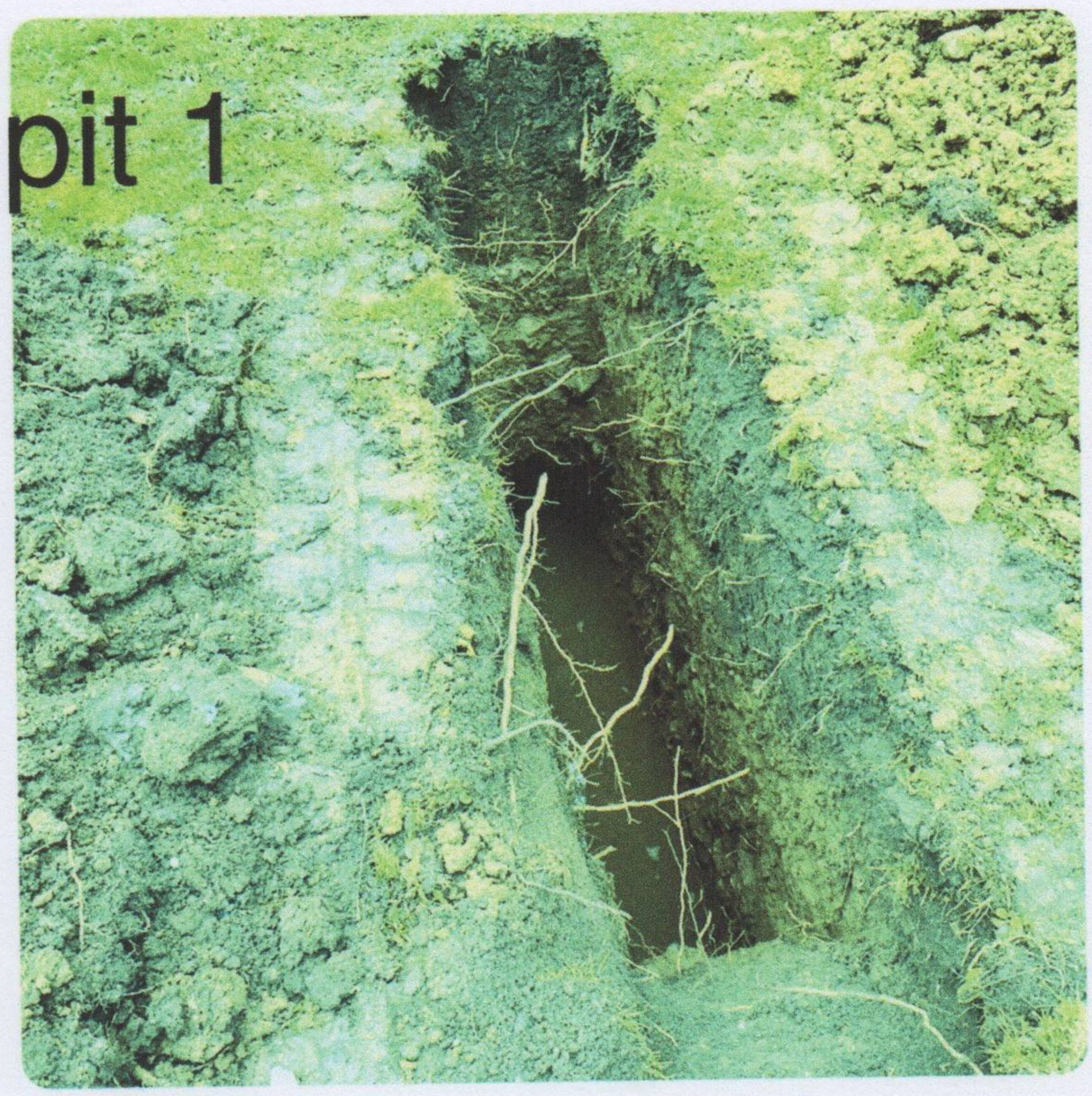
Stephen Johnson
Consulting Engineers Ltd

Brambles
Commander's Walk, Fairlight
Hastings, East Sussex
TN35 4BE
Tel: 01424 815289
Fax: 01424 815289
E mail:
info@sjce.engineering

Scales: 1:150		Drawn:	RPJ
Date: 18.03.22		Status:	FOR INFORMATION
Dwg Size: A1	Rev: –	Dwg No:	3685/TP01

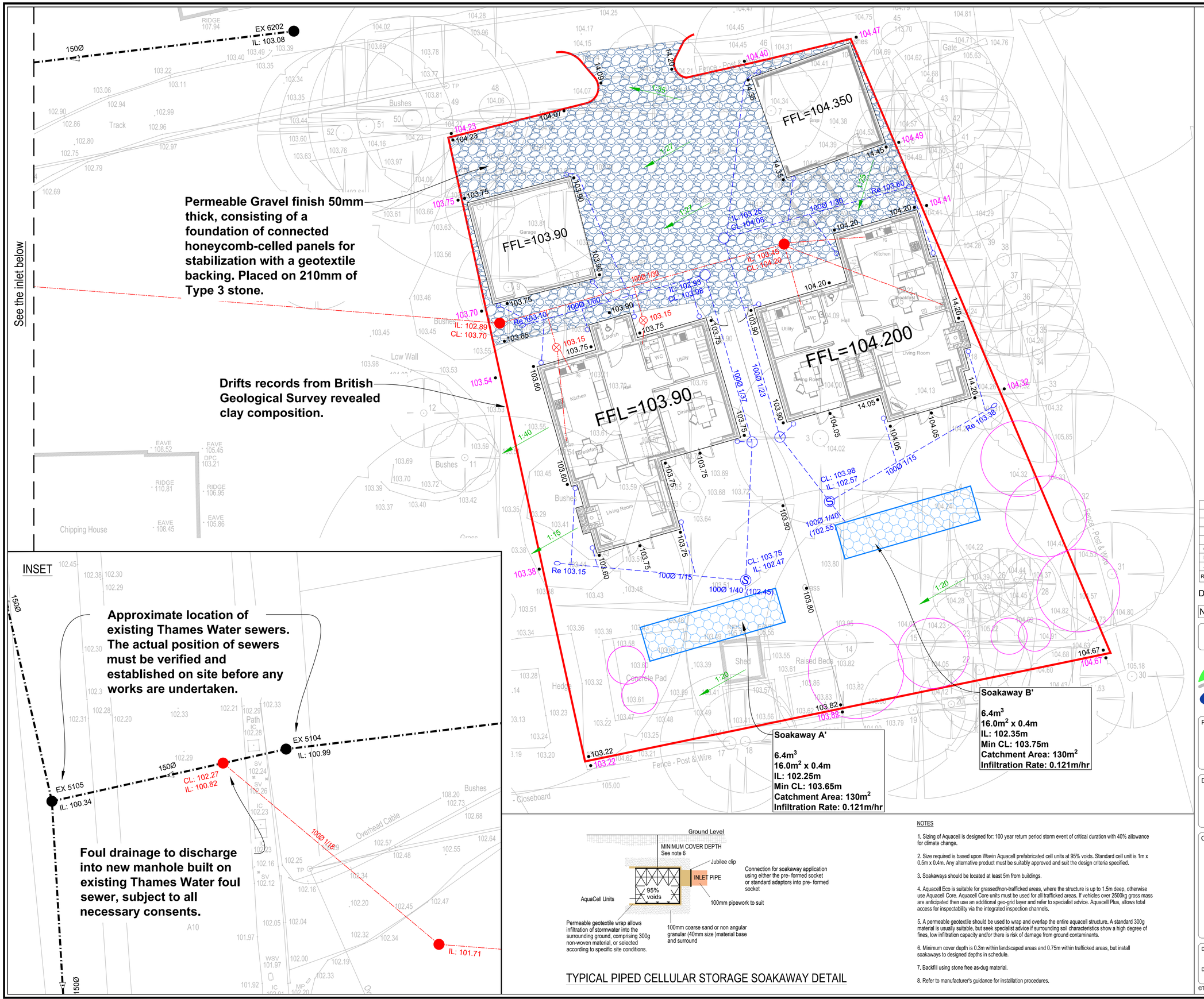
Houses a&b to chipping hall house
Chipping buntingford,sg9 0pg


Trial pit 1



Trial pit 2

APPENDIX B



Connection for soakaway application using either the pre- formed socket or standard adaptors into pre- formed socket

TYPICAL PIPED CELLULAR STORAGE SOAKAWAY DETAIL

NOTES

1. Sizing of Aquacell is designed for: 100 year return period storm event of critical duration with 40% allowance for climate change.
2. Size required is based upon Wavin Aquacell prefabricated cell units at 95% voids. Standard cell unit is 1m x 0.5m x 0.4m. Any alternative product must be suitably approved and suit the design criteria specified.
3. Soakaways should be located at least 5m from buildings.
4. Aquacell Eco is suitable for grassed/non-trafficked areas, where the structure is up to 1.5m deep, otherwise use Aquacell Core. Aquacell Core units must be used for all trafficked areas. If vehicles over 2500kg gross mass are anticipated then use an additional geo-grid layer and refer to specialist advice. Aquacell Plus, allows total access for inspectability via the integrated inspection channels.
5. A permeable geotextile should be used to wrap and overlap the entire aquacell structure. A standard 300g material is usually suitable, but seek specialist advice if surrounding soil characteristics show a high degree of fines, low infiltration capacity and/or there is risk of damage from ground contaminants.
6. Minimum cover depth is 0.3m within landscaped areas and 0.75m within trafficked areas, but install soakaways to designed depths in schedule.
7. Backfill using stone free as-dug material.
8. Refer to manufacturer's guidance for installation procedures.

0 5m 10m 20m

Scale 1:200

LEGEND

- Proposed Foul Water Drain (1000 1/80)
- Existing Thames Water Foul Sewer (1000 1/80)
- Proposed Surface Water Drain (1000 1/80)
- Cellular Crate Soakaway
- 450mmØ Inspection Chamber with Invert Level (15.00)
- 250mmØ Inspection Chamber with Invert Level (15.00)
- 450mmØ Inspection Chamber with Sump (S 15.00)
- Proposed Rodding Eye with Invert Level (Re 15.00)
- Permeable Gravel
- Existing Tree to be retained
- Indicative Existing Spot Level (104.45)
- Proposed Spot Level (104.05)
- Surface Fall and Gradient

Rev	Description	Date	Drawn	Checked
C	Soakaways amended and note updated to permeable driveway area	30.08.23	TJB	NK
B	Updated preliminary drainage strategy	05.04.22	AG	NK
A	Surface Drainage Strategy	22.10.21	IO	NK

Drawing Approval Status:-

N/A Section 104 N/A Section 38 N/A Section 278

FOR APPROVAL

Wormald Burrows Partnership Ltd
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Web: www.wormburp.com
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Project:
Chipping House, Chipping

Drawing Description:
Drainage Strategy

Client:
3PM Construction Ltd
20 Littlecotes Close
Spaldwick
Huntingdon
PE28 0UL

Drawing Number: E4114/500/C

Client Reference:

Scale: 1:200 @ A1

Designed By:	Drawn By:	Checked By:
Date:	AG Date: 21.03.22	NK Date:

afaq ISO 9001 Quality — UKAS MANAGEMENT SYSTEMS 022

Certified by Afnor UK

APPENDIX C

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

Half Drain Time : 158 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	102.479	0.229	0.3	3.5	O K
30 min Summer	102.544	0.294	0.4	4.5	O K
60 min Summer	102.592	0.342	0.4	5.2	O K
120 min Summer	102.638	0.388	0.4	5.9	O K
180 min Summer	102.650	0.400	0.4	6.1	O K
240 min Summer	102.648	0.398	0.4	6.1	O K
360 min Summer	102.629	0.379	0.4	5.8	O K
480 min Summer	102.603	0.353	0.4	5.4	O K
600 min Summer	102.575	0.325	0.4	4.9	O K
720 min Summer	102.548	0.298	0.4	4.5	O K
960 min Summer	102.499	0.249	0.4	3.8	O K
1440 min Summer	102.420	0.170	0.3	2.6	O K
2160 min Summer	102.343	0.093	0.3	1.4	O K
2880 min Summer	102.304	0.054	0.3	0.8	O K
4320 min Summer	102.288	0.038	0.2	0.6	O K
5760 min Summer	102.280	0.030	0.2	0.5	O K
15 min Winter	102.508	0.258	0.4	3.9	O K
30 min Winter	102.582	0.332	0.4	5.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	157.248	0.0	24
30 min Summer	103.572	0.0	38
60 min Summer	64.302	0.0	64
120 min Summer	41.216	0.0	116
180 min Summer	31.262	0.0	148
240 min Summer	25.410	0.0	180
360 min Summer	18.604	0.0	248
480 min Summer	14.732	0.0	316
600 min Summer	12.215	0.0	384
720 min Summer	10.444	0.0	452
960 min Summer	8.105	0.0	582
1440 min Summer	5.625	0.0	828
2160 min Summer	3.880	0.0	1172
2880 min Summer	2.986	0.0	1496
4320 min Summer	2.084	0.0	2208
5760 min Summer	1.632	0.0	2936
15 min Winter	157.248	0.0	25
30 min Winter	103.572	0.0	38

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
60 min Winter	102.639	0.389	0.4	5.9	O K
120 min Winter	103.400	1.150	0.4	6.8	Flood Risk
180 min Winter	103.596	1.346	0.4	7.0	Flood Risk
240 min Winter	103.553	1.303	0.4	7.0	Flood Risk
360 min Winter	103.120	0.870	0.4	6.6	O K
480 min Winter	102.643	0.393	0.4	6.0	O K
600 min Winter	102.603	0.353	0.4	5.4	O K
720 min Winter	102.565	0.315	0.4	4.8	O K
960 min Winter	102.496	0.246	0.4	3.7	O K
1440 min Winter	102.389	0.139	0.3	2.1	O K
2160 min Winter	102.302	0.052	0.3	0.8	O K
2880 min Winter	102.290	0.040	0.2	0.6	O K
4320 min Winter	102.278	0.028	0.2	0.4	O K
5760 min Winter	102.272	0.022	0.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	64.302	0.0	64
120 min Winter	41.216	0.0	120
180 min Winter	31.262	0.0	170
240 min Winter	25.410	0.0	194
360 min Winter	18.604	0.0	270
480 min Winter	14.732	0.0	344
600 min Winter	12.215	0.0	416
720 min Winter	10.444	0.0	486
960 min Winter	8.105	0.0	620
1440 min Winter	5.625	0.0	866
2160 min Winter	3.880	0.0	1148
2880 min Winter	2.986	0.0	1476
4320 min Winter	2.084	0.0	2208
5760 min Winter	1.632	0.0	2944

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 531600 268350 TL 31600 68350
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.013

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.004	4	8	0.004	8	12	0.004

Model Details

Storage is Online Cover Level (m) 103.650

Cellular Storage Structure

Invert Level (m) 102.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.12132 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.12132

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	16.0	16.0	0.401	0.0	24.0
0.400	16.0	24.0			

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

Half Drain Time : 23 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	99.954	0.214	2.1	4.1	Flood Risk
30 min Summer	99.976	0.236	2.4	4.9	Flood Risk
60 min Summer	99.984	0.244	2.4	5.3	Flood Risk
120 min Summer	99.985	0.245	2.4	5.3	Flood Risk
180 min Summer	99.975	0.235	2.3	4.9	Flood Risk
240 min Summer	99.963	0.223	2.2	4.4	Flood Risk
360 min Summer	99.938	0.198	2.0	3.5	Flood Risk
480 min Summer	99.917	0.177	1.8	2.8	Flood Risk
600 min Summer	99.900	0.160	1.6	2.3	Flood Risk
720 min Summer	99.885	0.145	1.4	1.9	Flood Risk
960 min Summer	99.861	0.121	1.2	1.3	Flood Risk
1440 min Summer	99.830	0.090	0.9	0.7	Flood Risk
2160 min Summer	99.805	0.065	0.6	0.4	Flood Risk
2880 min Summer	99.791	0.051	0.5	0.2	Flood Risk
4320 min Summer	99.782	0.042	0.4	0.2	Flood Risk
5760 min Summer	99.777	0.037	0.3	0.1	Flood Risk
15 min Winter	99.970	0.230	2.3	4.7	Flood Risk
30 min Winter	99.992	0.252	2.5	5.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	157.248	0.0	16
30 min Summer	103.572	0.0	25
60 min Summer	64.302	0.0	42
120 min Summer	41.216	0.0	76
180 min Summer	31.262	0.0	108
240 min Summer	25.410	0.0	140
360 min Summer	18.604	0.0	202
480 min Summer	14.732	0.0	264
600 min Summer	12.215	0.0	322
720 min Summer	10.444	0.0	382
960 min Summer	8.105	0.0	502
1440 min Summer	5.625	0.0	736
2160 min Summer	3.880	0.0	1100
2880 min Summer	2.986	0.0	1468
4320 min Summer	2.084	0.0	2200
5760 min Summer	1.632	0.0	2872
15 min Winter	157.248	0.0	16
30 min Winter	103.572	0.0	26

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
60 min Winter	99.997	0.257	2.6	5.9	Flood Risk
120 min Winter	99.991	0.251	2.5	5.6	Flood Risk
180 min Winter	99.975	0.235	2.4	4.9	Flood Risk
240 min Winter	99.958	0.218	2.2	4.2	Flood Risk
360 min Winter	99.925	0.185	1.9	3.1	Flood Risk
480 min Winter	99.899	0.159	1.6	2.2	Flood Risk
600 min Winter	99.878	0.138	1.4	1.7	Flood Risk
720 min Winter	99.861	0.121	1.2	1.3	Flood Risk
960 min Winter	99.837	0.097	1.0	0.8	Flood Risk
1440 min Winter	99.808	0.068	0.7	0.4	Flood Risk
2160 min Winter	99.789	0.049	0.5	0.2	Flood Risk
2880 min Winter	99.783	0.043	0.4	0.2	Flood Risk
4320 min Winter	99.776	0.036	0.3	0.1	Flood Risk
5760 min Winter	99.771	0.031	0.2	0.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
60 min Winter	64.302	0.0	46
120 min Winter	41.216	0.0	82
180 min Winter	31.262	0.0	116
240 min Winter	25.410	0.0	148
360 min Winter	18.604	0.0	210
480 min Winter	14.732	0.0	270
600 min Winter	12.215	0.0	330
720 min Winter	10.444	0.0	388
960 min Winter	8.105	0.0	502
1440 min Winter	5.625	0.0	738
2160 min Winter	3.880	0.0	1084
2880 min Winter	2.986	0.0	1468
4320 min Winter	2.084	0.0	2164
5760 min Winter	1.632	0.0	2856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 531600 268350 TL 31600 68350
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.021

Time (mins) From:	To:	Area (ha)
0	4	0.021

Model Details

Storage is Online Cover Level (m) 100.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.12130	Width (m)	22.0
Membrane Percolation (mm/hr)	1000	Length (m)	9.3
Max Percolation (l/s)	56.8	Slope (1:X)	27.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	99.740	Membrane Depth (m)	0

APPENDIX D

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Hazard Level*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Residential roofing	Very low	0.2	0.2	0.05
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Very low**	**0.2**	**0.2**	**0.05**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	None	0	0	0
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None	0	0	0
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None	0	0	0
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 3B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → 300 mm minimum depth of soils with good contamination attenuation potential	0.4	0.3	0.3
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0.4**	**0.3**	**0.3**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

1: All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level.
Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events

2: The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance).
Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.4**	**0.3**	**0.3**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but interception requires separate evaluation.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	Sufficient	Sufficient

DESIGN CONDITIONS: 1

1: Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Hazard Level*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Residential parking	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description		*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	User defined indices	Enter User Defined Indices in row below			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None		0	0	0
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None		0	0	0
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:	Granular material with 30% voide ratio	SuDS Component 1	0.3	0.3	0.3
	Aggregated Surface Water Pollution Mitigation Index		**0.3**	**0.3**	**0.3**

DESIGN CONDITIONS: 1 | 2 | 3

Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices.
Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at '=0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 3B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: →	300 mm minimum depth of soils with good contamination attenuation potential	0.4	0.3	0.3
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
	Groundwater Protection Pollution Mitigation Index	**0.4**	**0.3**	**0.3**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level.
Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be suspended in subsequent events

The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance).
Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.5**	**0.45**	**0.45**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at '=0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but interception requires separate evaluation.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	Sufficient	Sufficient

DESIGN CONDITIONS: 1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

APPENDIX E

Below Ground Drainage Pipes Operation and Maintenance Plan

Below Ground Drainage Pipes Operation and Maintenance Plan		
Maintenance Schedule	**Required Action**	**Frequency**
Regular Maintenance	Inspect and identify and areas that are not operating correctly. Take remedial action if required.	Monthly for three months, then annually.
	Remove debris from the catchment surfaces. (where it may cause risk to performance).	Monthly.
	Remove sediment from inspection chambers.	Annually, or as required
	Maintain vegetation to designed limits in the vicinity of below ground drainage pipes and soakaways to avoid damage to drainage system.	Monthly, or as required.
Remedial Actions	Repair physical damage if necessary.	As required
Monitoring	Inspect all inlets and outlets to ensure they are in good condition and operating as designed.	Annually.
	Survey inside of pipe runs for sediment build up and remove is necessary.	Every five years, or as required.

Inspection Chambers Operation and Maintenance Plan

Inspection Chambers		
Maintenance Schedule	**Required Action**	**Frequency**
Regular Maintenance	Check there is no physical damage. Strim vegetation 1m min. surround to chambers.	Monthly and following a flood event
	Remove covers and inspect ensuring water is flowing freely and that the exit routes for water are unobstructed. Remove debris and silt.	Annually and following a significant rainfall event
Occasional Maintenance	Undertake inspection after leaf fall in autumn	Annually and following a significant rainfall event
Remedial Actions	Check chambers and repair or replace as design detail as necessary.	As required

Bodpave 85 System Operation and Maintenance Plan		
Maintenance Schedule	**Required Action**	**Frequency**
Regular Maintenance	Remove litter, debris and trash	Monthly
Occasional Maintenance	Inspect surface for fuel/oil contamination from vehicles.	6 monthly (or as required)
	Inspect surface for siltation.	6 monthly (or as required)
Remedial Actions	Lift and replace any affected areas of Bodpave and underlying granular materials affected by fuel/oil	As required
	Lift and replace any areas of Bodpave and underlying granular materials affected by siltation	As required
	Lift and replace or wash any areas of Bodpave and underlying granular materials affected by siltation following a rainfall event that results in any flooding.	As required
Monitoring	Inspect surface for fuel/oil contamination from vehicles.	Monthly/after a spillage
	Inspect surface for siltation.	Monthly/after large storms