

**PROPOSED REDEVELOPMENT TO
1 BEECH ROAD
HEDGE END
HAMPSHIRE
SO30 4FY**

Surface Water Drainage Design Calculations

For:

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**TB/466544/eg
20 August 2024**

1. SuDS Layout and Design

SuDS are an environmentally friendly approach to managing rainfall through the use of landscape features to conceal the surface water and its surroundings. The use of SuDS aims to: control the flow, volume and frequency of water leaving a development area; prevent pollution by intercepting silt and cleaning runoff from hard surfaces; provide attractive surroundings for the community, and; create, whenever possible, opportunities for wildlife.

Site ground investigations have been carried out by Cowan Consultancy Ltd and the findings of these are within this, the investigations confirmed an underlying geology consisting of chalk. Infiltration testing showed that infiltration to ground is feasible for this site, although testing showed that percolation towards the eastern side of the site was slower than the western side of the site. Following the SuDS hierarchy, discharge of the surface water via permeable paved areas and soakaways are the most suitable solution. The surface water has been designed to be attenuated and discharged on site, by incorporating SuDS.

The SuDS at 1 Beech Road have been designed to prevent flooding within the proposed development and surrounding areas and control discharge via underground drainage systems. Due to the nature of the proposed development site, special attention must be paid to the proposed drainage strategy to manage the quality of the site runoff and prevent pollution as much as reasonably practicable.

Thus, the proposed drainage strategy allows for the attenuation and discharge of the runoff event of a 1 in 100 year storm for the full site plus a 10% allowance for urban creep and a 45% allowance for climate change. Urban creep has not been applied to the access road.

The access road and driveway areas are to be of permeable asphalt surfacing with min. 360mm depth of granular sub-base. The 360mm depth of sub-base has been designed to attenuate the storm as it infiltrates to the ground beneath.

As well as providing storm water storage, the permeable build-up has been incorporated into the design to ensure the water quality discharging into the ground is acceptable.

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

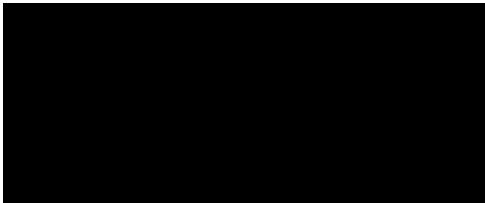
Metals – 0.6

Hydrocarbons – 0.7

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

Run-off from the roofs is drained direct to the domestic drainage system within each curtilage and is piped into soakaway units located within the gardens of each plot. Proceeding each connection into the soakaways is a silt trap inspection chamber with minimum 300mm sump.

All domestic drainage serving the roof run-off and driveways within each property curtilage is to be the responsibility of the individual property owners.



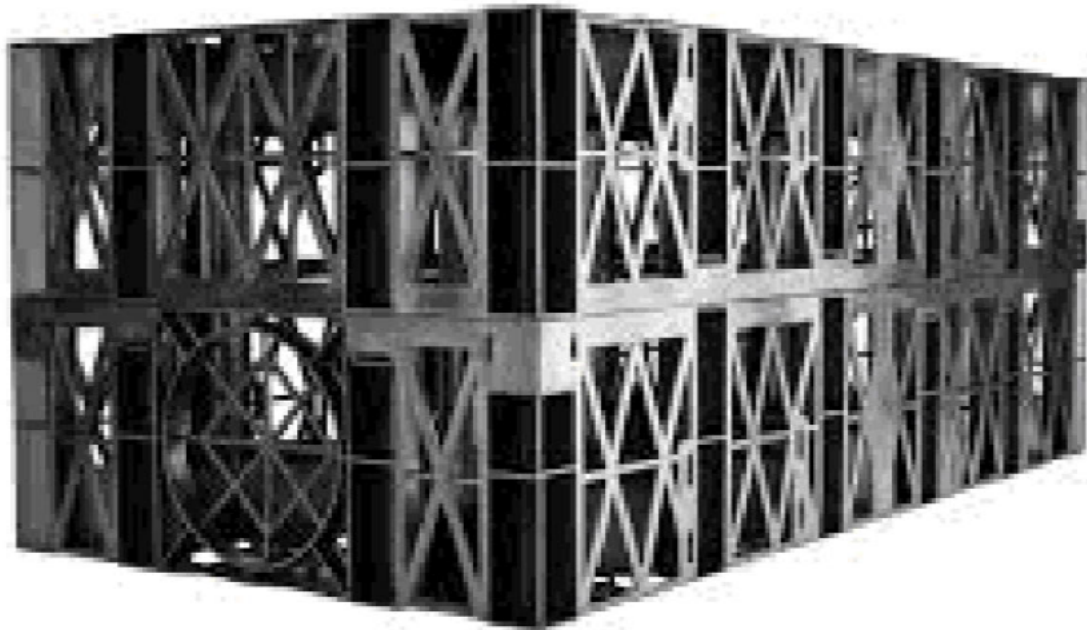
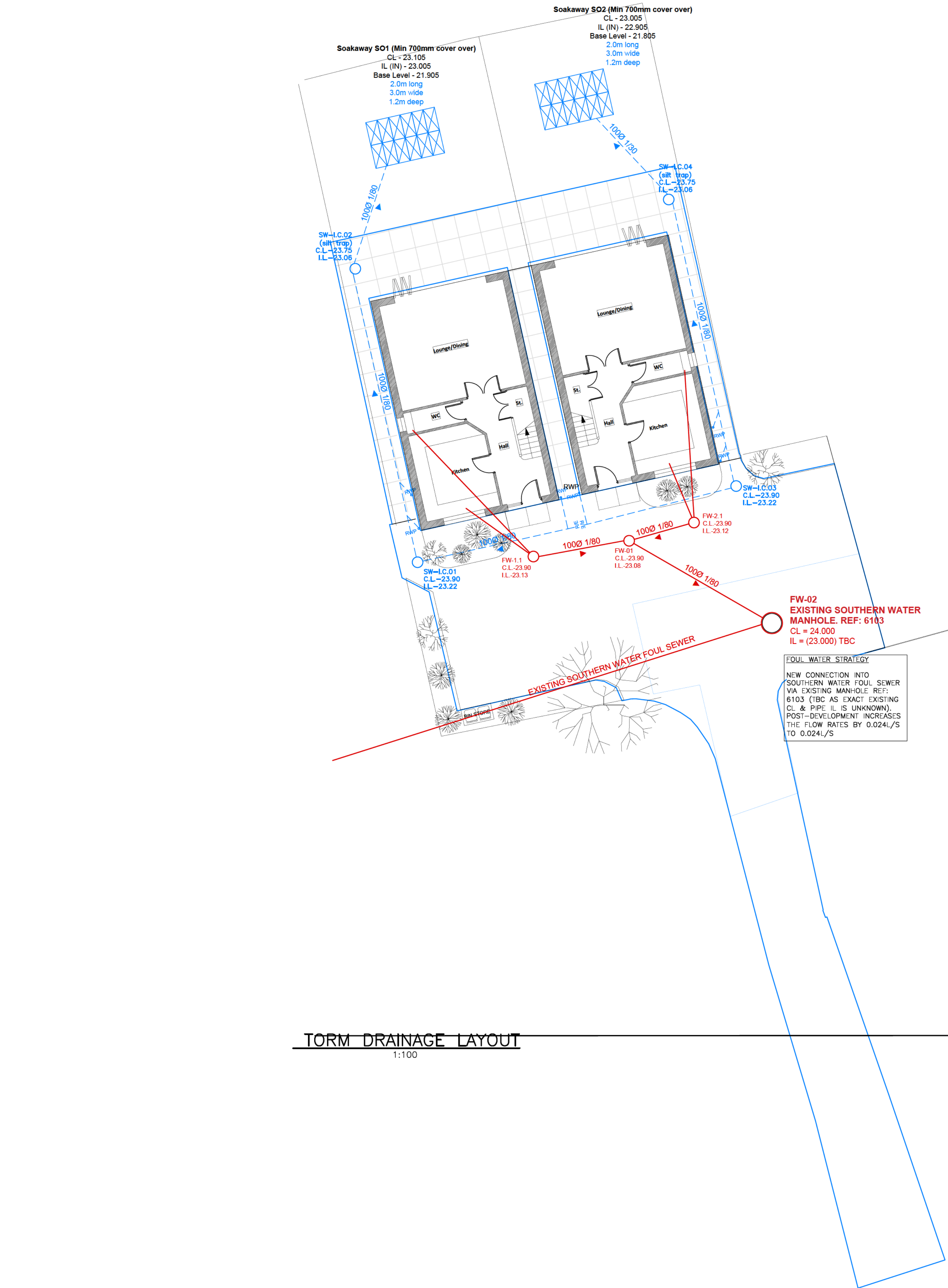
Signature.....

TIMOTHY BUTTON

For and on behalf of Cowan Consultancy Limited

Appendix A

DRAINAGE LAYOUTS



Provide 3.0m long x 2.0m wide
x 1.2m deep soakaways (1no.
per plot).

1000lg x 500w x 400dp
AquaCell Eco unit

Soakaway 01 - 36 total units
Soakaway 02 - 36 total units

! 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.

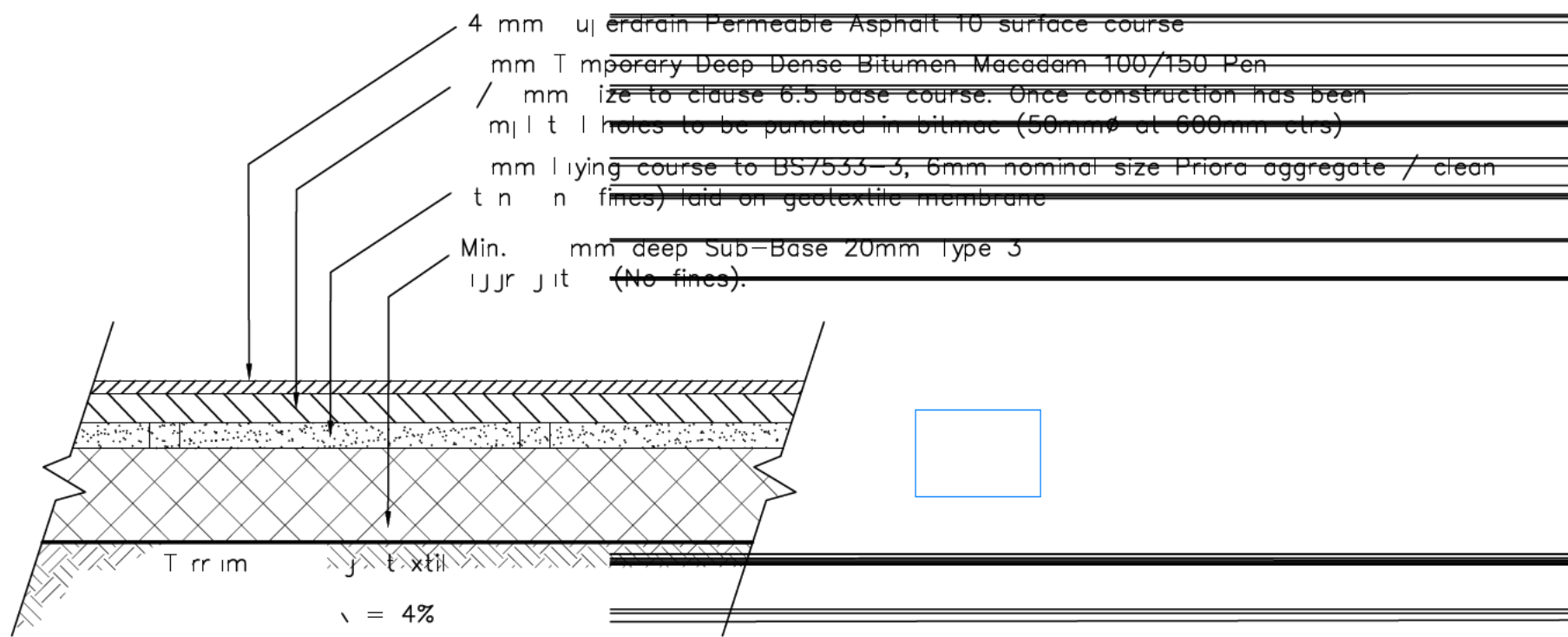
NOTE: Residual risks are defined as those risks arising from identified hazards which cannot be designed-out, and which a competent and experienced building contractor is unlikely to encounter during normal construction activities. Ordinary risks arising from normal construction operations have not been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

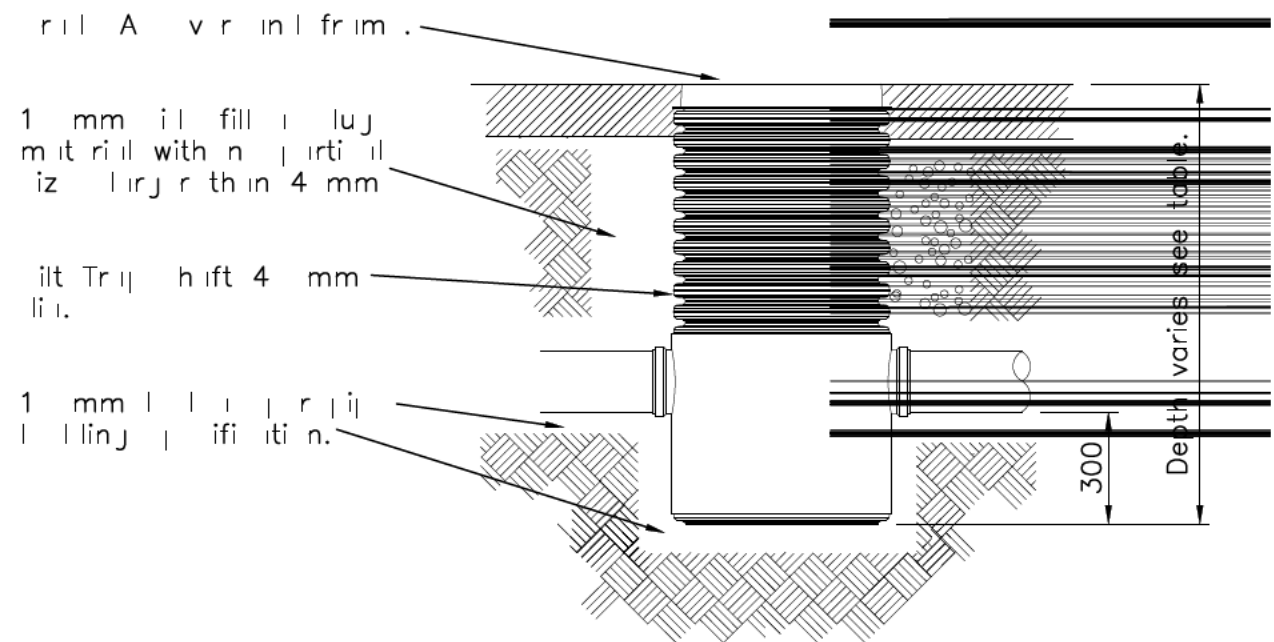
NOTES

1. This drawing has been prepared using information supplied by the client in AutoCAD format.
2. This drawing is to be read in conjunction with all relevant Engineers' and Architects' drawings and specifications.
3. All dimensions are in millimetres unless noted otherwise. All levels are in metres.
4. In accordance with The Construction (Design and Management) Regulations 2015 (CDM 2015) the Principle Designer and Contractor are to:
 - 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.
5. 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.
6. DO NOT SCALE. If discrepancy or query arises on dimensions consult Engineer.
7. The Contractor is responsible for specifying product and codes and ordering of drainage materials.
8. All uPVC drainage to be installed to BS5955 Pt6 and in strict accordance with the manufacturers instructions.
9. All uPVC drainage pipes within development site to be 100mm dia unless shown otherwise.
10. Cover grades are in accordance with BS497 Pt 1
Cover Grades : D400 - carriageways.
B125 - carriageways for slow traffic.
A15 - inaccessible to vehicles

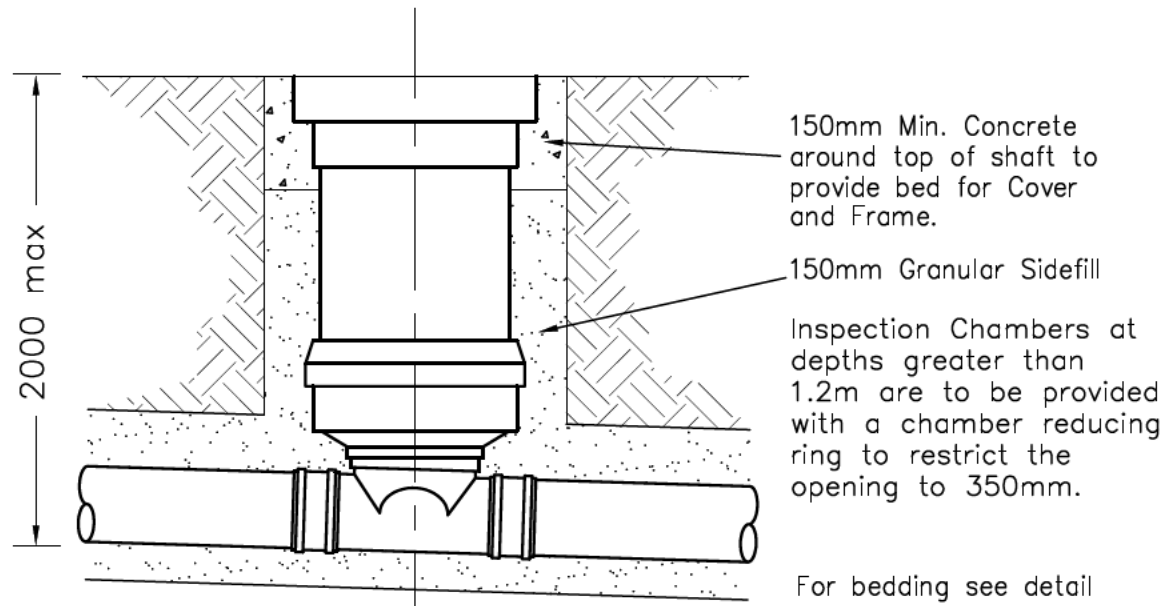
Date	By	Revision	QA'd	chk'd	Ref
Status					
PRELIMINARY					
STRUTURAL CIVIL AND BUILDING CONSULTANTS 3 Turnberry House 4400 Parkway Whiteley Fareham Hampshire PO15 7FJ Also at: Landguard Manor Landguard Manor Road Shanklin Isle of Wight PO37 7JB Tel: 01489 577488 Fax: 01489 579873 consultants@cowanconsult.co.uk www.cowanconsult.co.uk					
Client					
MAXWELL HOMES					
Project					
NEW DWELLINGS, 1 BEECH ROAD, HEDGE END, EASTLEIGH, HAMPSHIRE, SO30 4FY.					
Title					
DRAINAGE GA					
Date	JUL 2024	Scale	AS SHOWN @ A1	Drw. No.	
Drawn	CMW	chk'd	IB	QA'd	IB
466544/2019					



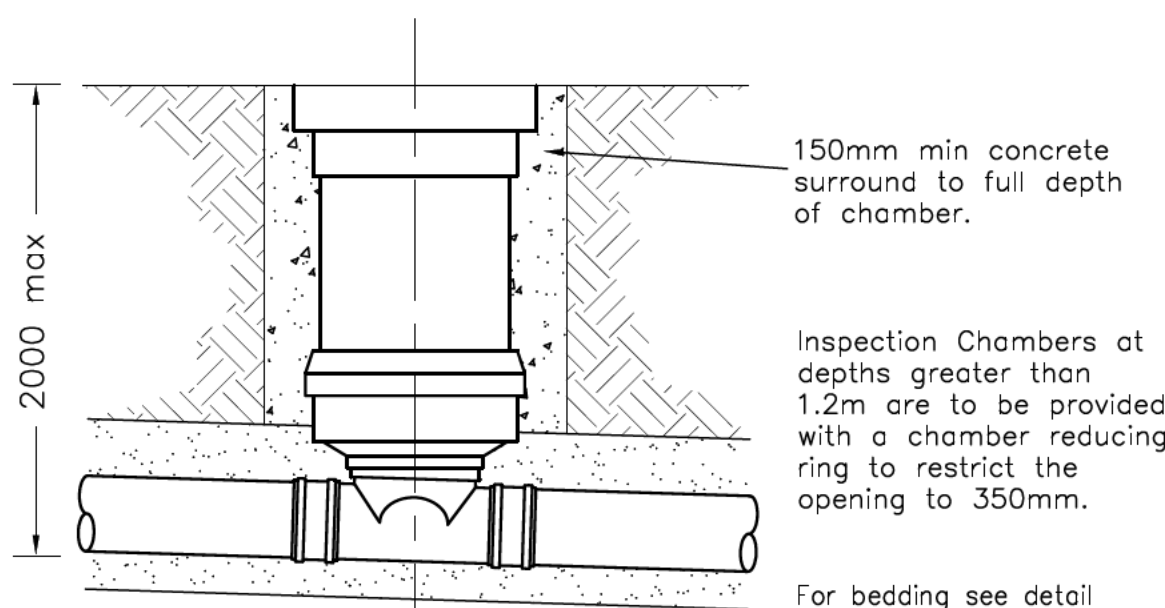
TYPICAL EXTERNAL DRAINAGE DETAIL
1:



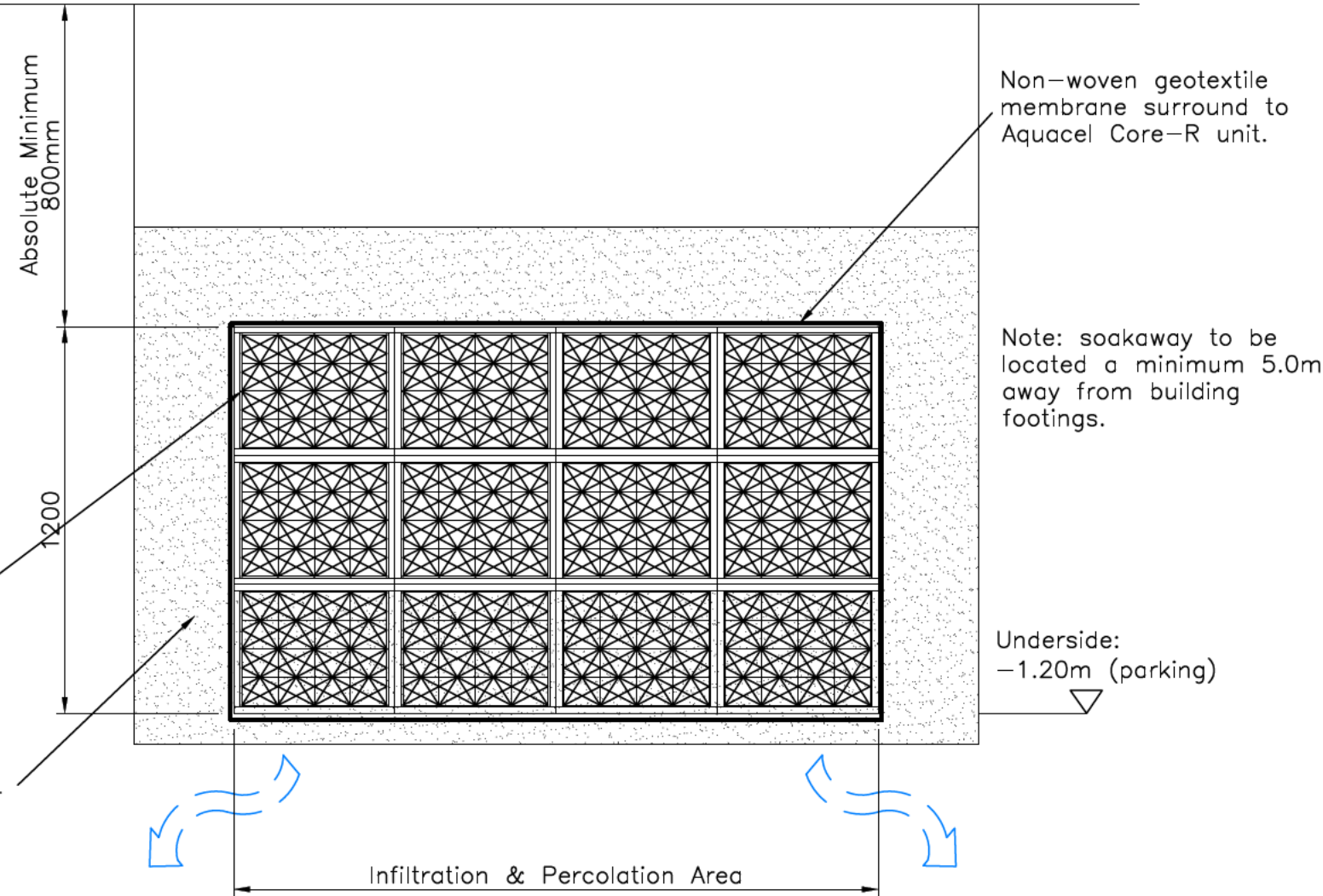
TYPICAL DETAIL OF DRAINAGE TRAP
1:



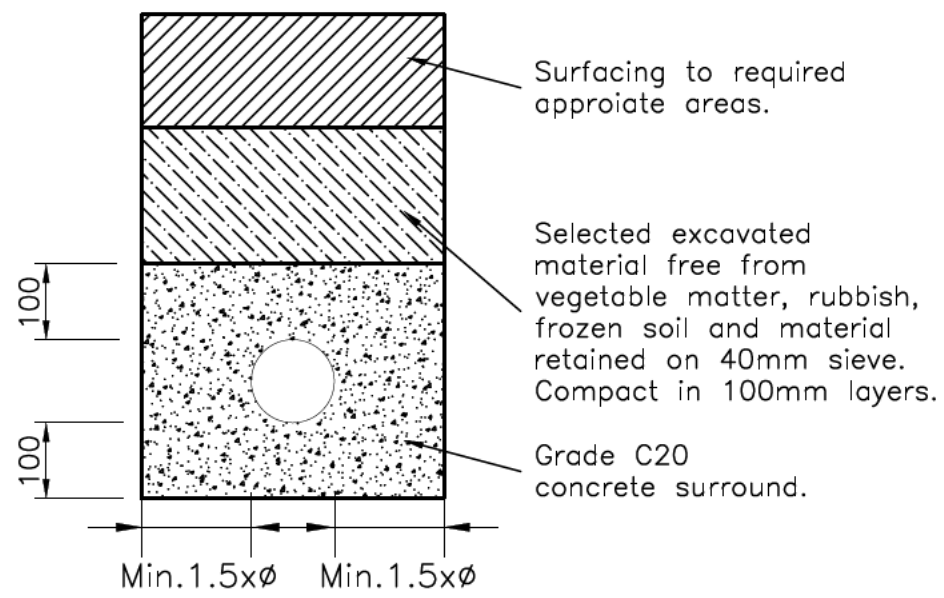
450mm dia INSPECTION CHAMBER
NON-LOAD BEARING INSTALLATION (TYPE A)
1:10



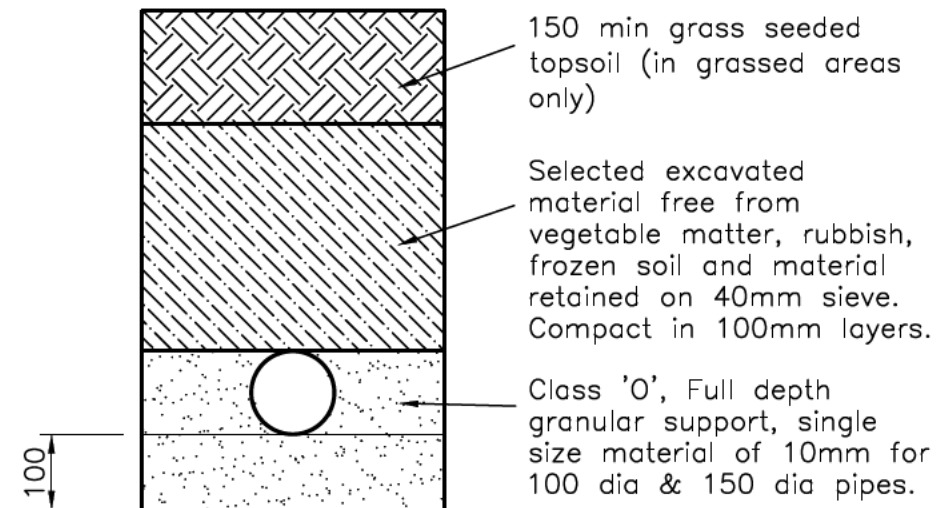
450mm dia INSPECTION CHAMBER
LOAD BEARING INSTALLATION (TYPE B)
1:10



TYPICAL SECTION
STORM WATER SOAKAWAY DETAIL
1:20



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



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

! CDM 2015 - RESIDUAL RISKS !

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20.08.24	CMW	Soakaway detail revised to Eco crates			P2
22.07.24	CMW	Permeable block change to permeable asphalt.			P1
Date	By	Revision	QA'd	Chk'd	Ref
Status PRELIMINARY					
Cowan Consultancy STRUCTURAL, CIVIL AND BUILDING CONSULTANTS 3 Turnberry House 4400 Parkway Whiteley Fareham Hampshire PO15 7FJ Also at: Landguard Manor Landguard Manor Road Shanklin Isle of Wight PO37 7JB Tel: 01489 577488 Fax: 01489 579873 consultants@cowanconsult.co.uk www.cowanconsult.co.uk					
Client MAXWELL HOMES					
Project NEW DWELLINGS, 1 BEECH ROAD, HEDGE END, EASTLEIGH, HAMPSHIRE, SO30 4FY.					
Title STORM WATER DRAINAGE DETAILS					
Date	JUL 2024	Scale	AS SHOWN @ A1	Org. No.	
Drawn	CMW	Chk'd	IB	QA'd	IB

Appendix B

GROUND INVESTIGATION DATA

466544
1 BEECH ROAD, HEDGE END, EASTLEIGH,
HAMPSHIRE

TRIAL PIT LOG

3rd July 2024

TP1

- | | |
|-----------|---|
| 0-350 | Scrub/hardcore over dense moist sandy silty FILL with stones and brick fragments. |
| 350-900 | Firm moist brown/orange/grey mottled silty sandy CLAY with roots from removed hedge. |
| 900-1200 | Firm moist brown/orange/grey mottled sandy SILT with old roots.
PP @ 1000 = 1.00, SV @ 1000 = 46 |
| 1200-1400 | Dense moist orange/grey silty SAND with fine old roots. |

SOAKAGE TEST 1 600 wd x 1000 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	800	800
20	670	930
40	601	999
60	530	1070
80	480	1120
100	380	1220
120	300	1300
140	230	1370
160	175	1425
180	155	1445
200	85	1515
220	65	1535
240	60	1540
260	55	1545
280	50	1550
300	50	1550
320	50	1550
340	45	1555
360	45	1555
380	45	1555
400	0	1600

SOAKAGE TEST 2 600 wd x 1000 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	800	800
20	680	920
40	605	995
60	535	1065
80	485	1115
100	390	1210
120	310	1290
140	235	1365
160	185	1415
180	165	1435
200	90	1510
220	75	1525
240	65	1535
260	60	1540
280	55	1545
300	55	1545
320	55	1545
340	50	1550
360	50	1550
380	45	1555
400	45	1555

SOAKAGE TEST 3 600 wd x 1000 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	800	800
20	690	910
40	610	990
60	540	1060
80	485	1115
100	395	1205
120	315	1285
140	240	1360
160	190	1410
180	170	1430
200	95	1505
220	85	1515
240	70	1530
260	65	1535
280	60	1540
300	60	1540
320	60	1540
340	55	1545
360	55	1545
380	50	1550
400	50	1550

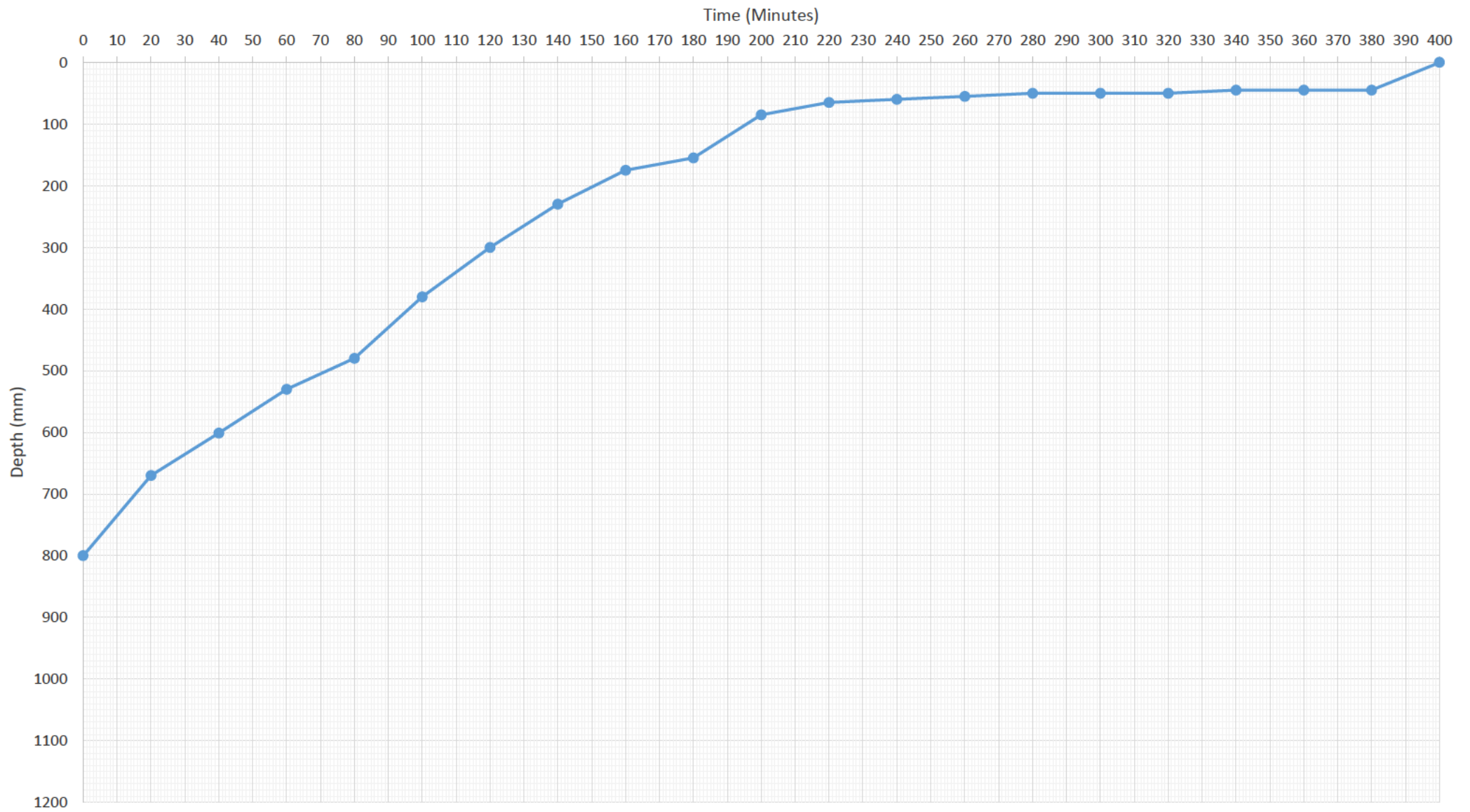
SOAKAGE PIT 1

NOTE: soakage results supplied by the Contractor

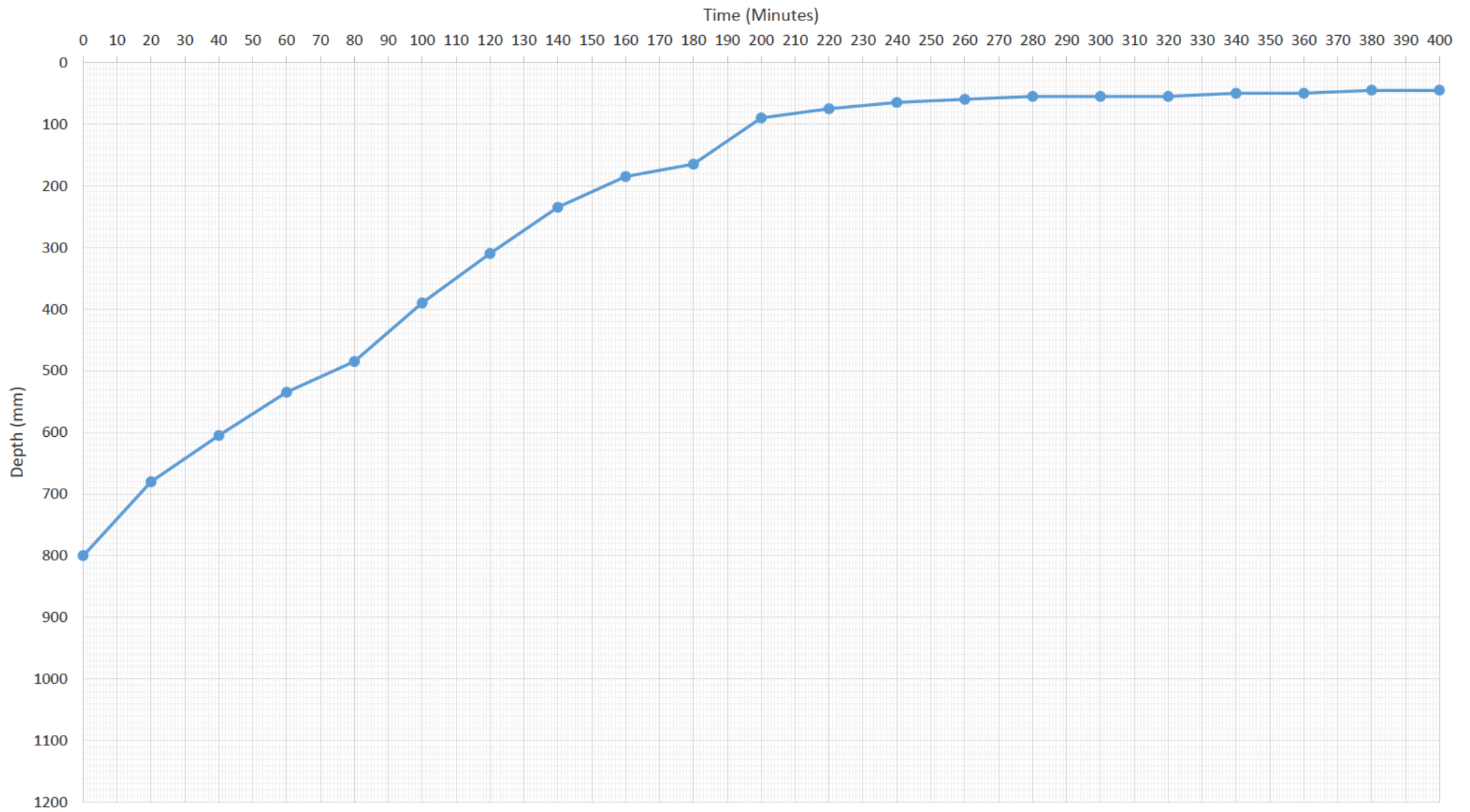
SOAKAGE TEST RESULTS

Site @ 1 Beech Road, Hedge End, Eastleigh, SO30 4FY.

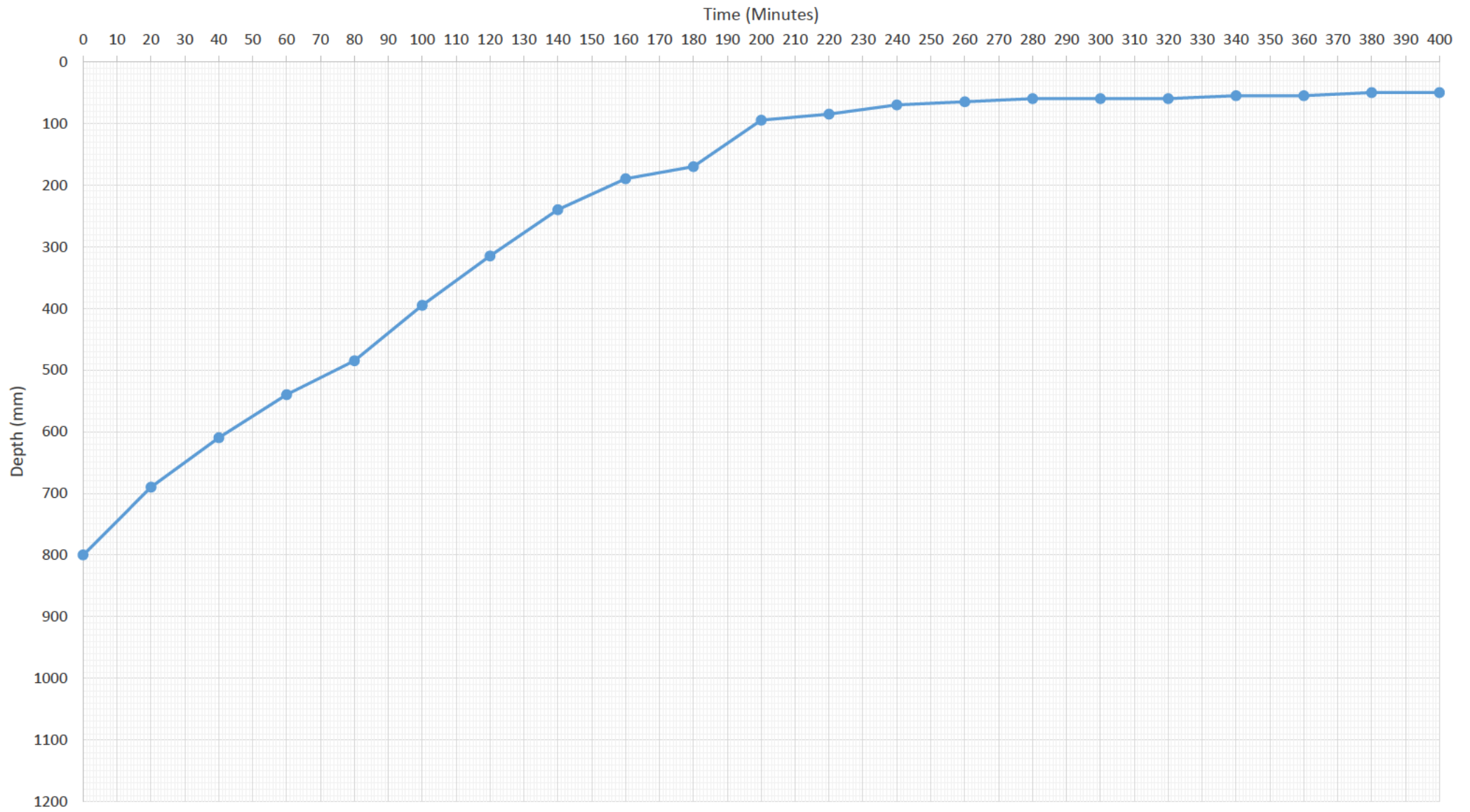
SOAKAGE PIT 1 - TEST 1



SOAKAGE PIT 1 - TEST 2



SOAKAGE PIT 1 - TEST 3



Soakage Pit 1 Test 1	Storage volume 75% to 25%	0.600	wide	
		1.000	long	
		0.400	deep	
	Total	0.24	m3	
	Surface area 50% inc. base	0.600 x 1.000	0.600	
		0.600 x 0.400	0.240	
		0.600 x 0.400	0.240	
		1.000 x 0.400	0.400	
		1.000 x 0.400	0.400	
	Total	1.880	m2	
	Time for water to drop from 75% to 25%	75%	40	
		25%	150	
		Total	110	mins
			6600	secs
	Soil infiltration rate	1.93E-05		

NOTE: soakage results supplied by the Contractor

SOIL INFILTRATION RATE CALCULATIONS

Site @ 1 Beech Road, Hedge End, Eastleigh, SO30 4FY.

Soakage Pit 1 Test 2	Storage volume 75% to 25%	0.600	wide	
		1.000	long	
		0.400	deep	
	Total	0.24	m3	
Surface area 50% inc. base	0.600 x 1.000	0.600		
	0.600 x 0.400	0.240		
	0.600 x 0.400	0.240		
	1.000 x 0.400	0.400		
	1.000 x 0.400	0.400		
	Total	1.880	m2	
Time for water to drop from 75% to 25%	75%	39		
	25%	155		
	Total	116	mins	
		6960	secs	
Soil infiltration rate		1.83E-05		

NOTE: soakage results supplied by the Contractor

SOIL INFILTRATION RATE CALCULATIONS

Site @ 1 Beech Road, Hedge End, Eastleigh, SO30 4FY.

Soakage Pit 1 Test 3	Storage volume 75% to 25%	0.600	wide	
		1.000	long	
		0.400	deep	
	Total	0.24	m3	
Surface area 50% inc. base	0.600 x 1.000	0.600		
	0.600 x 0.400	0.240		
	0.600 x 0.400	0.240		
	1.000 x 0.400	0.400		
	1.000 x 0.400	0.400		
	Total	1.880	m2	
Time for water to drop from 75% to 25%	75%	42		
	25%	156		
	Total	114	mins	
		6840	secs	
Soil infiltration rate		1.87E-05		

NOTE: soakage results supplied by the Contractor

SOIL INFILTRATION RATE CALCULATIONS

Site @ 1 Beech Road, Hedge End, Eastleigh, SO30 4FY.

Appendix C

CALCULATIONS

Job No.	466544	Sheet	Date	Jul-24
Job	I Beech Road	By	CMW	Checked TB

Soakaway Design for Roofs - Plots 1 (Plot 2 repeated)

Area	60.000 m ²
Urban Creep	1.100
	66.000 m ²

10 year return period

		Storm duration (Min.)
R5	0.009 m	5
R10	0.012 m	10
R15	0.015 m	15
R30	0.020 m	30
R60	0.025 m	60
R120	0.030 m	120
R240	0.036 m	240
R360	0.041 m	360
R600	0.047 m	600
R1440	0.058 m	1440

Inflow to attenuation system

I5	0.57 m ³
I10	0.82 m ³
I15	1.01 m ³
I30	1.29 m ³
I60	1.64 m ³
I120	2.00 m ³
I240	2.40 m ³
I360	2.70 m ³
I600	3.08 m ³
I1440	3.81 m ³

Outflow from Tank

f	1.88E-05 m ³ /s
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Soakaway dims:

Length	3 m
Width	2 m
Depth	1.2 m

As50	6
Void ratio	95 %

Outflow from Tank:

O5	0.0338 m ³
O10	0.0677 m ³
O15	0.1015 m ³
O30	0.2030 m ³
O60	0.4061 m ³
O120	0.8122 m ³
O240	1.6243 m ³
O360	2.4365 m ³
O600	4.0608 m ³
O1440	9.7459 m ³

Storage required:

S5	0.54 m ³
S10	0.75 m ³
S15	0.91 m ³
S30	1.09 m ³
S60	1.23 m ³
S120	1.19 m ³
S240	0.77 m ³
S360	0.26 m ³
S600	-0.99 m ³
S1440	-5.93 m ³

Time to drain:

ts50	0.67 hours
ts50	0.92 hours
ts50	1.12 hours
ts50	1.34 hours
ts50	1.52 hours
ts50	1.46 hours
ts50	0.95 hours
ts50	0.32 hours
ts50	-1.21 hours
ts50	-7.30 hours

Storage provided	6.8 m ³
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Critical storm =	S60
Storage required =	1.24
Time to discharge =	1.52 Hours
	0.06 Days

Soakaway size proposed is satisfactory

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60 mm
Extra rain during storage	0.01 m ³

Proposed soakaway material requires a void ratio $\geq 95\%$.
The use of AquaCell Plus stormwater systems is recommended. Proposed design includes for 40% increase due to Climate Change.

Job No.	466544	Sheet	Date	Jul-24
Job	1 Beech Road	By TB	Checked	CMW

Soakaway Design for Roofs - Plots 1 (Plot 2 repeated)

Area	60.000 m ²
Urban Creep	1.100
	66.000 m ²

30 year return period + 45%

		Storm duration (Min.)
R5	0.023 m	5
R10	0.029 m	10
R15	0.032 m	15
R30	0.040 m	30
R60	0.050 m	60
R120	0.061 m	120
R240	0.075 m	240
R360	0.085 m	360
R600	0.099 m	600
R1440	0.127 m	1440

Inflow to attenuation system

I5	1.51 m ³
I10	1.89 m ³
I15	2.14 m ³
I30	2.66 m ³
I60	3.28 m ³
I120	4.04 m ³
I240	4.97 m ³
I360	5.60 m ³
I600	6.50 m ³
I1440	8.39 m ³

Outflow from Tank

f	1.88E-05 m ³ /s
---	----------------------------

Soakaway dims:

L	3 m
W	2 m
Depth	1.2 m

As50	6
Void ratio	95 %

Outflow from Tank:

O5	0.0338 m ³
O10	0.0677 m ³
O15	0.1015 m ³
O30	0.2030 m ³
O60	0.4061 m ³
O120	0.8122 m ³
O240	1.6243 m ³
O360	2.4365 m ³
O600	4.0608 m ³
O1440	9.7459 m ³

Storage required:

S5	1.47 m ³
S10	1.82 m ³
S15	2.04 m ³
S30	2.46 m ³
S60	2.88 m ³
S120	3.23 m ³
S240	3.35 m ³
S360	3.16 m ³
S600	2.44 m ³
S1440	-1.35 m ³

Time to half drain:

ts50	1.82 hours
ts50	2.24 hours
ts50	2.51 hours
ts50	3.02 hours
ts50	3.54 hours
ts50	3.98 hours
ts50	4.12 hours
ts50	3.90 hours
ts50	3.01 hours
ts50	-1.67 hours

Storage provided	6.8 m ³
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Critical storm =	S240
Storage required =	3.35
Time to half discharge =	4.12 Hours (Acceptable time as 1/30 year storm)

Soakaway size proposed is satisfactory

For increase from 10 year storm to 30 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.333333	0.015764	0.022857307 R5
0.166667	0.333333	0.01971	0.02857988 R10
0.25	0.333333	0.022402	0.032483485 R15
0.5	0.333333	0.02778	0.040281636 R30
1	0.333333	0.034318	0.049761211 R60
2	0.333333	0.042265	0.061284753 R120
4	0.333333	0.051926	0.075292981 R240
6	0.333333	0.058516	0.084848578 R360
10	0.333333	0.07	0.09854993 R600
24	0.333333	0.087685	0.127142549 R1440

Job No.	466544	Sheet	Date	Jul-24
Job	1 Beech Road	By TB	Checked	CMW

Soakaway Design for Roofs - Plots 1 (Plot 2 repeated)

Area	60.000 m ²
Urban Creep	1.100
	66.000 m ²
100 year return period + 45%	
R5	0.034 m
R10	0.042 m
R15	0.047 m
R30	0.058 m
R60	0.071 m
R120	0.088 m
R240	0.107 m
R360	0.121 m
R600	0.140 m
R1440	0.180 m

Storm duration (Min.)

5
10
15
30
60
120
240
360
600
1440

For increase from 10 year storm to 100 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.1	0.023154	0.033572958 R5
0.166667	0.1	0.028694	0.04160602 R10
0.25	0.1	0.032473	0.047085706 R15
0.5	0.1	0.040022	0.058032361 R30
1	0.1	0.0492	0.071339314 R60
2	0.1	0.060356	0.087515488 R120
4	0.1	0.073917	0.107179538 R240
6	0.1	0.083168	0.120593207 R360
10	0.1	0.10	0.139826482 R600
24	0.1	0.124113	0.179963372 R1440

Inflow to attenuation system

I5	2.22 m ³
I10	2.75 m ³
I15	3.11 m ³
I30	3.83 m ³
I60	4.71 m ³
I120	5.78 m ³
I240	7.07 m ³
I360	7.96 m ³
I600	9.23 m ³
I1440	11.88 m ³

Outflow from Tank

f 1.88E-05 m³/s

Soakaway dims:

L	3 m
W	2 m
Depth	1.2 m

As50 6
Void ratio 95 %

Outflow from Tank:

O5	0.0338 m ³
O10	0.0677 m ³
O15	0.1015 m ³
O30	0.2030 m ³
O60	0.4061 m ³
O120	0.8122 m ³
O240	1.6243 m ³
O360	2.4365 m ³
O600	4.0608 m ³
O1440	9.7459 m ³

Storage required:

S5	2.18 m ³
S10	2.68 m ³
S15	3.01 m ³
S30	3.63 m ³
S60	4.30 m ³
S120	4.96 m ³
S240	5.45 m ³
S360	5.52 m ³
S600	5.17 m ³
S1440	2.13 m ³

Time to half drain:

ts50	2.69 hours
ts50	3.30 hours
ts50	3.70 hours
ts50	4.47 hours
ts50	5.30 hours
ts50	6.11 hours
ts50	6.71 hours
ts50	6.80 hours
ts50	6.36 hours
ts50	2.62 hours

STORAGE IN PIPES

Total length of pipework	20 m
Pipe diameter	100 mm
Volume in pipework	0.157 m ³

Storage provided 7.0 m³

(inc pipework storage)

Critical storm = S360

Storage required = 5.52

Time to half discharge = 6.80 Hours (Acceptable time as 1/100 year storm)

Soakaway size proposed is satisfactory

Job No.	466544	Sheet	Date	Jul-24
Job	I Beech Road	By	CMW	Checked TB

Permeable Access Road

Area	299.000 m ²
Urban Creep	1.000 m ²
	299.000 m ²

10 year return period

		Storm duration (Min.)
R5	0.009 m	5
R10	0.012 m	10
R15	0.015 m	15
R30	0.020 m	30
R60	0.025 m	60
R120	0.030 m	120
R240	0.036 m	240
R360	0.041 m	360
R600	0.047 m	600
R1440	0.058 m	1440

Inflow to attenuation system

I5	2.60 m ³
I10	3.71 m ³
I15	4.57 m ³
I30	5.86 m ³
I60	7.42 m ³
I120	9.06 m ³
I240	10.85 m ³
I360	12.23 m ³
I600	13.93 m ³
I1440	17.28 m ³

Outflow from Tank

f	1.88E-05 m ³ /s
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Soakaway dims:

Length	17.75 m
Width	17.75 m
Depth	0.36 m

As50	12.78
Void ratio	30 %

Outflow from Tank:

O5	0.0721 m ³
O10	0.1442 m ³
O15	0.2162 m ³
O30	0.4325 m ³
O60	0.8650 m ³
O120	1.7299 m ³
O240	3.4598 m ³
O360	5.1897 m ³
O600	8.6495 m ³
O1440	20.7588 m ³

Storage required:

S5	2.53 m ³
S10	3.56 m ³
S15	4.36 m ³
S30	5.43 m ³
S60	6.55 m ³
S120	7.33 m ³
S240	7.39 m ³
S360	7.04 m ³
S600	5.28 m ³
S1440	-3.48 m ³

Time to drain:

ts50	1.46 hours
ts50	2.06 hours
ts50	2.52 hours
ts50	3.14 hours
ts50	3.79 hours
ts50	4.24 hours
ts50	4.27 hours
ts50	4.07 hours
ts50	3.05 hours
ts50	-2.01 hours

Storage provided	34.0 m ³
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Critical storm =	S240
Storage required =	7.53
Time to discharge=	4.27 Hours

0.18 Days

Sub-base depth proposed is satisfactory

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60 mm
Extra rain during storage	0.14 m ³

Proposed soakaway material requires a void ratio ≥30%.
The use of Type 3 Granular sub-base, no fines. Proposed design includes for 40% increase due to Climate Change.

Job No.	466544	Sheet	Date	Jul-24
Job	I Beech Road	By TB	Checked	CMW

Permeable Access Road

Area	299.000 m ²
Urban Creep	1.000 m ²
	299.000 m ²

30 year return period + 45%

		Storm duration (Min.)
R5	0.023 m	5
R10	0.029 m	10
R15	0.032 m	15
R30	0.040 m	30
R60	0.050 m	60
R120	0.061 m	120
R240	0.075 m	240
R360	0.085 m	360
R600	0.099 m	600
R1440	0.127 m	1440

Inflow to attenuation system

I5	6.83 m ³
I10	8.55 m ³
I15	9.71 m ³
I30	12.04 m ³
I60	14.88 m ³
I120	18.32 m ³
I240	22.51 m ³
I360	25.37 m ³
I600	29.47 m ³
I1440	38.02 m ³

Outflow from Tank

f	1.88E-05 m ³ /s
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Soakaway dims:

L	17.75 m
W	17.75 m
Depth	0.36 m

As50 12.78

Void ratio 30 %

Outflow from Tank:

O5	0.0721 m ³
O10	0.1442 m ³
O15	0.2162 m ³
O30	0.4325 m ³
O60	0.8650 m ³
O120	1.7299 m ³
O240	3.4598 m ³
O360	5.1897 m ³
O600	8.6495 m ³
O1440	20.7588 m ³

Storage required:

S5	6.76 m ³
S10	8.40 m ³
S15	9.50 m ³
S30	11.61 m ³
S60	14.01 m ³
S120	16.59 m ³
S240	19.05 m ³
S360	20.18 m ³
S600	20.82 m ³
S1440	17.26 m ³

Time to half drain:

ts50	3.91 hours
ts50	4.86 hours
ts50	5.49 hours
ts50	6.71 hours
ts50	8.10 hours
ts50	9.59 hours
ts50	11.01 hours
ts50	11.67 hours
ts50	12.03 hours
ts50	9.98 hours

Storage provided 34.0 m³

Critical storm = S600

Storage required = 20.82

Time to half discharge = 12.03 Hours (Acceptable time as 1/30 year storm)

Sub-base depth proposed is satisfactory

For increase from 10 year storm to 30 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.333333	0.015764	0.022857307 R5 0.0087 m
0.166667	0.333333	0.01971	0.02857988 R10 0.0124 m
0.25	0.333333	0.022402	0.032483485 R15 0.0153 m
0.5	0.333333	0.02778	0.040281636 R30 0.0196 m
1	0.333333	0.034318	0.049761211 R60 0.0248 m
2	0.333333	0.042265	0.061284753 R120 0.0303 m
4	0.333333	0.051926	0.075292981 R240 0.0363 m
6	0.333333	0.058516	0.084848578 R360 0.0409 m
10	0.333333	0.07	0.09854993 R600 0.0466 m
24	0.333333	0.087685	0.127142549 R1440 0.0578 m

Job No.	466544	Sheet	Date	Jul-24
Job	I Beech Road	By TB	Checked	CMW

Permeable Access Road

Area	299.000 m ²
Urban Creep	1.000 m ²
	299.000 m ²

100 year return period + 45%

		Storm duration (Min.)
R5	0.034 m	5
R10	0.042 m	10
R15	0.047 m	15
R30	0.058 m	30
R60	0.071 m	60
R120	0.088 m	120
R240	0.107 m	240
R360	0.121 m	360
R600	0.140 m	600
R1440	0.180 m	1440

Inflow to attenuation system

I5	10.04 m ³
I10	12.44 m ³
I15	14.08 m ³
I30	17.35 m ³
I60	21.33 m ³
I120	26.17 m ³
I240	32.05 m ³
I360	36.06 m ³
I600	41.81 m ³
I1440	53.81 m ³

Outflow from Tank

f	1.88E-05 m ³ /s
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Soakaway dims:

L	17.75 m
W	17.75 m
Depth	0.36 m

As50 12.78

Void ratio 30 %

Outflow from Tank:

O5	0.0721 m ³
O10	0.1442 m ³
O15	0.2162 m ³
O30	0.4325 m ³
O60	0.8650 m ³
O120	1.7299 m ³
O240	3.4598 m ³
O360	5.1897 m ³
O600	8.6495 m ³
O1440	20.7588 m ³

Storage required:

S5	9.97 m ³
S10	12.30 m ³
S15	13.86 m ³
S30	16.92 m ³
S60	20.47 m ³
S120	24.44 m ³
S240	28.59 m ³
S360	30.87 m ³
S600	33.16 m ³
S1440	33.05 m ³

Time to half drain:

ts50	5.76 hours
ts50	7.11 hours
ts50	8.01 hours
ts50	9.78 hours
ts50	11.83 hours
ts50	14.13 hours
ts50	16.53 hours
ts50	17.84 hours
ts50	19.17 hours
ts50	19.11 hours

Storage provided 34.0 m³

Critical storm = S600

Storage required = 33.16

Time to half discharge = 19.17 Hours (Acceptable time as 1/100 year storm)

Sub-base depth proposed is satisfactory

For increase from 10 year storm to 100 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.1	0.023154	0.033572958 R5 0.0087 m
0.166667	0.1	0.028694	0.04160602 R10 0.0124 m
0.25	0.1	0.032473	0.047085706 R15 0.0153 m
0.5	0.1	0.040022	0.058032361 R30 0.0196 m
1	0.1	0.0492	0.071339314 R60 0.0248 m
2	0.1	0.060356	0.087515488 R120 0.0303 m
4	0.1	0.073917	0.107179538 R240 0.0363 m
6	0.1	0.083168	0.120593207 R360 0.0409 m
10	0.1	0.10	0.139826482 R600 0.0466 m
24	0.1	0.124113	0.179963372 R1440 0.0578 m