SUDS DRAINAGE

Surface Water Management

Conditions Discharge Report

(Previously approved report for Condition 4 of DC/19/01978/FULL1 and Appeal APP/G5180/W/20/3245274)

New approved scheme: removal of lower ground areas

London Plan SUDS compliant for Policy SI.13.

AT

26 Copthorne Avenue, Bromley BR2 8NN

January 2024
Ark Environmental Consultancy Ltd

Table of Contents

If this report has been released electronically, the appendices referred to herein can be found in the annexed zip folder/s as .pdf or .dwg files. If this report has been released in hard copy the appendices will be bound into the back of this report. Plans may be annexed separately as A1 or A0 copies where a bound-in A3 copy is not appropriate.

Contents

1.0 Scope

This report contains the details of an SUDS Drainage Strategy for Conditions Discharge carried out by Ark Environmental Consulting Limited ("ARK Ltd") for 26 Copthorne Avenue, Bromley BR2 8NN, henceforth referred to as "the site" in this report.

This report has been prepared for Ashby Design Ltd and must not be relied upon by any other party without the explicit written permission of ARK Ltd.

All parties to this report do not intend any of the terms of the Contracts (Right of Third Parties Act 1999) to apply to this report.

Please note this report does not purport to provide definitive legal advice nor can it be used to demonstrate that the site will never flood in the future or provide exact specifications / warranties for the products used.

2.0 Introduction

The information source used to undertake this FRA & SUDS / Drainage Strategy has been collected from the following sources:

- British Geological Survey Website & iGeology App
- EA Website & Data
- Bromley Strategic Flood Risk Assessment (2015 / 2018);
- Bromley Council Website and Local Plan
- North London Joint SFRA
- London Plan
    - Policy SI.13
- Bromley as the Lead Local Flood Authority (LLFA) Surface Water Management Plan (SWMP)
- Internet mapping and searches

3.0 Existing Site Status and Environmental Setting

3.1 Site Location and Status

The site is located on the north side of Southborough Lane.

The site is currently occupied by an existing shed and part hard / soft landscaping.

The site is c. 0.0410ha (410m2).

3.2 Geology

Based on the known geology of the area and from BGS mapping and surrounding adjacent boreholes:

- Bedrock: London Clay
- Superficial deposits: none shown relevant

No lost / underground rivers documented at the site or near the site nor identifiable by the local geology mapping.

Given size of the site, the geology, proximity to other properties and nature of the type of scheme, the SUDS strategy is determined to be storage on site, oversized to store for all the impermeable areas plus additional betterment such that the pragmatic response is to use a hybrid system to allow some soakage to ground if conditions are site specifically favourable and with an ultimate overflow restricted discharge to sewer: there will be no surcharging as all the flow can be stored to the 1in100year+40% and discharged at a lower rate than existing to the sewer.

No infiltration testing is therefore required.

3.3 Planning Stage Approval / Existing Drainage

The scheme is an approved new dwelling with maximised porous and permeable areas.

The existing site is functioning in terms of drainage with connections to a separate surface water and separate foul sewer in Copthorne Avenue and a surface water only sewer also available in Knowle Road.

There are existing manholes which can be re-used / modified.

- Manholes 5857 / 5858 in Knowle Road
- Manhole 6968 in Copthorne
- All surface water sewers are c. 0.8m – 1.2m depth below ground level in this area

The connection to the existing operating surface water only sewer is appropriate given:

a) That is the connection highest up the hierarchy available to the site

- **a. Infiltration is not feasible**
- **b. No watercourse to connect to**
- **c. A Combined and foul are lower down the hierarchy**

b) the scheme significantly reduces the rate at which the surface water will reach this sewer, attenuating for 100% of the site discharging previously 100% unattenuated for the full 1in100year+40%.

So it is unequivocal:

- The scheme maximises porous and permeable areas
- This provides the required source control for existing, proposed and greater than proposed impermeable areas

The SUDS designs are:

- Swale and Rain garden planters: 100% Source Control
- Oversized SUDS storage below the area of parking / access
- Parking / driveway to also provide additional storage
- The scheme also includes a granular storage system, lined (hybrid system to allow informal soakage) and with connection to a control chamber but no formal restriction is required given the very low discharge as a function of the site being very small and ability to store for 100% of the 1in100year+40%cc

This scheme will reduce the existing discharge to the sewer hence there are no objections from Thames Water as the scheme has addressed the SUDS sequential approach and results in a betterment and reduces flood risk posed from the infrastructure to surrounding properties also.

4.0 Planning Conditions: Surface Water SUDS Designs

4.1 Area calculations

- Total site area = 410.0m2
- Proposed impermeable areas as a result of the scheme which includes the existing building = 180m2
- Calculations assume 100% of the site

4.2 Existing Rates: assume the worse case of Greenfield Runoff Rates

It is a fact that the site is very small (410m2).

It is impossible for even the whole site area (410m2) to discharge greater than 0.01 l/s in the Qbar.

The 1in200year itself is also only 0.03 l/s.

This is a simple fact: a function of the site being very small.

The output calculations are included in Appendix C.

4.3 SUDS Storage Calculations

Calculations were prepared based on the Micro Drainage software package to assess the size of structure required for the appropriate 100% amount of impermeable areas, climate change.

- Even though site will only be 43% impermeable
    - Assume 100% impermeable site for the calculations
- This addresses the 10% uplift for urban creep
- Plus an additional further 47% uplift for betterment
- Assume storage for the full 1in100year + 40%
    - (This is 40% for climate change allowance which is compliant)
- Assume 2.0 l/s as lowest possible discharge rate

The output calculation is provided in Appendix C.

- Oversized storage volume: 15.0m3

4.4 Connections and Inverts

The existing surface water connection to the surface water / combined manhole to the front of number 26 can be used / or the surface water sewer in Knowle Road adjacent to the access point.

Ultimate Invert: understood to be c. 1.1m below ground level both on Knowle Road and Copthorne Avenue based on Thames Water asset plans.

As per confirmation of the existing manhole invert level:

- Roof levels (gutters to rainwater downpipes) all new to be gravity drained to side of house
- All connections, pipe materials / sizes / falls as per Building Regs

4.5 SUDS Specifications

Formal SUDS Type	Source Control	Dimensions	Storage Volume
Porous and Permeable Areas Maximised	YES	n/a Scheme reduces impermeable areas by 20.0m2 Large grassed areas: these are naturally elevated c. 1.20m above the building ground footprint level so cannot be used for formal storage	n/a
Permeable paving	YES	All hardstanding to be maximized for permeable paving	n/a
Rain garden planters with integrated void storage	YES	<u>Planter 1</u> 3.0m by 0.6m by 0.8m height Use only 0.4m height as the void leaving 0.4m for soil growing stratum = 0.72m3 <u>Planter 2</u> 3.0m by 0.6m by 0.8m height Use only 0.4m height as the void leaving 0.4m for soil growing stratum = 0.72m3 <u>Planter 3</u> 4.0m by 0.6m by 0.8m height Use only 0.4m height as the void leaving 0.4m for soil growing stratum = 0.96m3 <u>Planter 4</u> 2.4m by 0.6m by 0.8m height Use only 0.4m height as the void leaving 0.4m for soil growing stratum = 0.57m3 **Total = 2.97m3**	2.97m3
Permeable Paving with lined granular storage Type 3 No Fine Angular Subbase: shallow to retain higher invert	YES	Area of 7.90m by 6.20m Outside of Root Protection Zone (See Appendix D) 48.98m2 in total Use 0.35m depth of granular storage = 17.14m3 Assume only 30% void space =5.14m3 (See cover and invert levels below)	5.14m3
Geocellular Storage to north of new dwelling	YES	Area available is 23.5m2 Use extra 0.4m of lined Wavin specification Eco / Aquacell (non-soakaway) = 9.4m3 Assume 95% void ratio for cellular 8.93m3	8.93m3
		Total	17.01m3 Greater than the already oversized 15.0m3 required
Swale as additional low order storm storage	YES	Area of c. 9.5m by 2.1m (average) Assume minimum of 0.15m depth to keep the invert outfall as high as is feasible = 2.99m3	2.99m3

Why Lined Granular rather than just Lined Geocellular?

This is a more sustainable form as the granular material can be reclaimed materials and also does not require more heavily engineered conveyance infrastructure.

Even though there are recycled plastic geocellular products on the market, these still require energy and emissions to produce.

Granular material is in lifecycle terms a much more sustainable approach.

All new permeable areas can be constructed to the EA guidance for permeable paving SUDS:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7728/pavingfrontgardens.pdf

But what about the void ratio of Granular vs Geocellular?

It is considered that given the actual volume of storage calculated has been significantly over calculated, this is appropriate to account for the lifetime silting up of the granular material.

It is considered therefore that this accommodates appropriately for the smaller void ratio of the granular material.

- Use existing drainage runs / extend where necessary
- NO soakaways required or feasible
- The scheme will also be attenuating for a larger amount of area that is existing unattenuated: immediate betterment:

Inverts of lowest storage for geocellular as evidence of suitable gravity connection:

- Cover level of 0.2m as a precaution
- Depth of cellular: 0.40m
- Invert of SUDS discharge = 0.60m depth (0.2m + 0.40m)
- Invert of 50.41mAOD (51.01mAOD – 0.60m)
    - Invert of existing surface water manhole for connection = 50.05mAOD
- This provides sufficient fall given the short distance hence gravity drainage is confirmed

The SUDS drainage layout plan included within Appendix D shows locations for the SUDS structures.

Note of SUDS Hierarchy for clarity

This SUDS approach has been approved on similar schemes based on the site specific flood and geology conditions and scheme specifics.

With respect to other SUDS techniques, the proposed buildings require part modifications / are pitched and thus are not considered suitable for the use of a green roof.

The pitched roofs are not suitable for sedum / green roofs and would require additional structural and foundation support in order to take the weight of surface water storage at height hence it is not considered commensurate with the scale and sensitivity of the scheme to incorporate a full formal green roof.

Whilst internal rainwater harvesting is not proposed, it is recommended that rainwater pipes are fitted with water butts wherever feasible. Whilst the use of water butts won't reduce the design criteria of the receiving

below ground drainage system, their use will reduce the time of entry and provide a supply of water for irrigation.

This is London Plan FRA & SUDS compliant for London Plan Policies SI.12 and SI.13.

It will be necessary for the surface water drainage system to comply with the Environment Agency's pollution prevention guidance:

- Roof run-off is classified as uncontaminated and, in accordance with EA pollution prevention guidance, will not require any treatment.
- Any surface water run-off draining through the permeable paving will receive an adequate level of filtration through the associated substrate.

4.6 Maintenance

With respect to maintenance, the proposed SUDS techniques should be maintained in accordance with the appropriate regimes set out within the SUDS manual and the manufacturers guidance and will be the responsibility of the owner / management company.

- **The specifications have been deliberately chosen to be low maintenance, resilient and easy to access inspect & clean.**

A SUDS maintenance schedule is included within Appendix E.

APPENDICES

APPENDIX A

Site Plan 1:200 @ A3

Knowle Road

Copthorne Avenue

No. 24

No. 26
DPC=50.93

Tarmac

Garage

Conc

Gravel

Grass

Soil

Greenhouse

Shed

Rockery

Pond

BPav

CPav

CPS

Culvert

Hedge 3H

Hedge 2.5H

Hedge 3.3H

Upper Level

Pipe

The White House

White Rose

COPTHORNE AVENUE

542600

165900

74.4m

Location Plan 1:1250 @ A3

N

0 2 3 4 5 M

RAME ARCHITECTS

Rame Architects Ltd
Residence Two
Royal William Yard, Plymouth PL1 3RP
E: info@ramearchitects.co.uk
T: 01752 223 859
W: www.ramearchitects.co.uk

CLIENT(S)

Novellus

PLANNING

Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect before proceeding.
No responsibility can be accepted for errors made by others in scaling from this drawing.

REVISION		BY	CHK'D	DATE
A	Ownership Boundaries updated.	SWN		10.08.18

DRAWING: EXISTING SITE PLAN AND LOCATION PLAN

PROJECT: **Proposed Detached Dwelling on land adjacent to: 26 Copthorne Avenue, Bromley BR2 HNN**

PROJECT No.	DRAWING No.
R17/39	01
REVISION: A	SCALE: as noted
DRAWN BY: **SWN**	DATE: **Feb 2018**

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2021_4553885

0 10 20 40 60 80 Meters

Scale:	1:1792
Width:	500m
Printed By:	G1KANAGA
Print Date:	07/12/2021
Map Centre:	542787,165880
Grid Reference:	TQ4265NE

Comments:

ALS/ALS Standard/2021_4553885

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
701A		
601D		
5922		
5001	71.99	70.46
6102	71.39	69.77
60MQ		
6829		
6004	71.88	69.6
78KP		
78KM		
60MN		
60KT		
6925		
5153	71.68	70.59
9160	72.13	70.69
9004	74.23	72.22
6005	71.97	69.9
7831		
69KO		
6051	72.03	71.15
6151	71.41	70.61
61LP		
5923		
60LS		
9001	72.79	70.76
6924		
9005	74.08	72.36
6968		
7001	71.94	70.08
9009	74.65	72.11
9011	74.01	73.01
5858		
6926		
5963		
68NM		
5152	71.43	70.54
8154	71.29	69.64
68NP		
68NQ		
50KR		
5050	72	70.82
68NK		
511A		
601E		
9007	72.83	71.12
7002	72.34	70.62
9008	73.36	71.65
591C		
701C		
591B		
60MT		
61LR		
6001	70.978	68.848
501D		
501E		
501B		
591D		
501J		
60LP		
60LN		
69MR		
801A		
601C		
68ON		
681A		
901A		
681C		
68OK		
781B		
781C		
911C		
801D		
801E		

REFERENCE	COVER LEVEL	INVERT LEVEL
701B		
61KP		
5857		
6006	71.65	69.55
68NS		
68NT		
6869		
78KL		
7870		
70KO		
69KL		
60MK		
6967		
9002	73.36	71.25
9010	74.25	72.55
9006	73.8	72.51
7871		
9159	72.22	70.05
60LR		
6052	71.61	70.56
61KO		
61KN		
7151	70.31	69.04
60LT		
9158	72.05	68.85
6964		
6828		
7803		
7050	71.93	70.73
9103		
7051	72.32	71.3
5051	72.24	71.27
5964		
6053	71.36	69.93
5103	71.47	70.04
5924		
6003	71.51	69.28
68NR		
6050	71.49	70.08
50KQ		
68NL		
6966		
501A		
5002	72.23	70.78
7927		
6965		
0101		
601A		
591A		
60MR		
60ML		
6002	71.37	69.14
501C		
5104	71.61	70.26
60LL		
501F		
501I		
501K		
60LO		
60LM		
68OQ		
68OR		
9003	74.61	71.78
68OM		
901B		
681B		
781A		
68OL		
601F		
791A		
801C		
801B		

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

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

2) All measurements on the plans are metric.

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

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

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

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0800 009 4540.

APPENDIX B

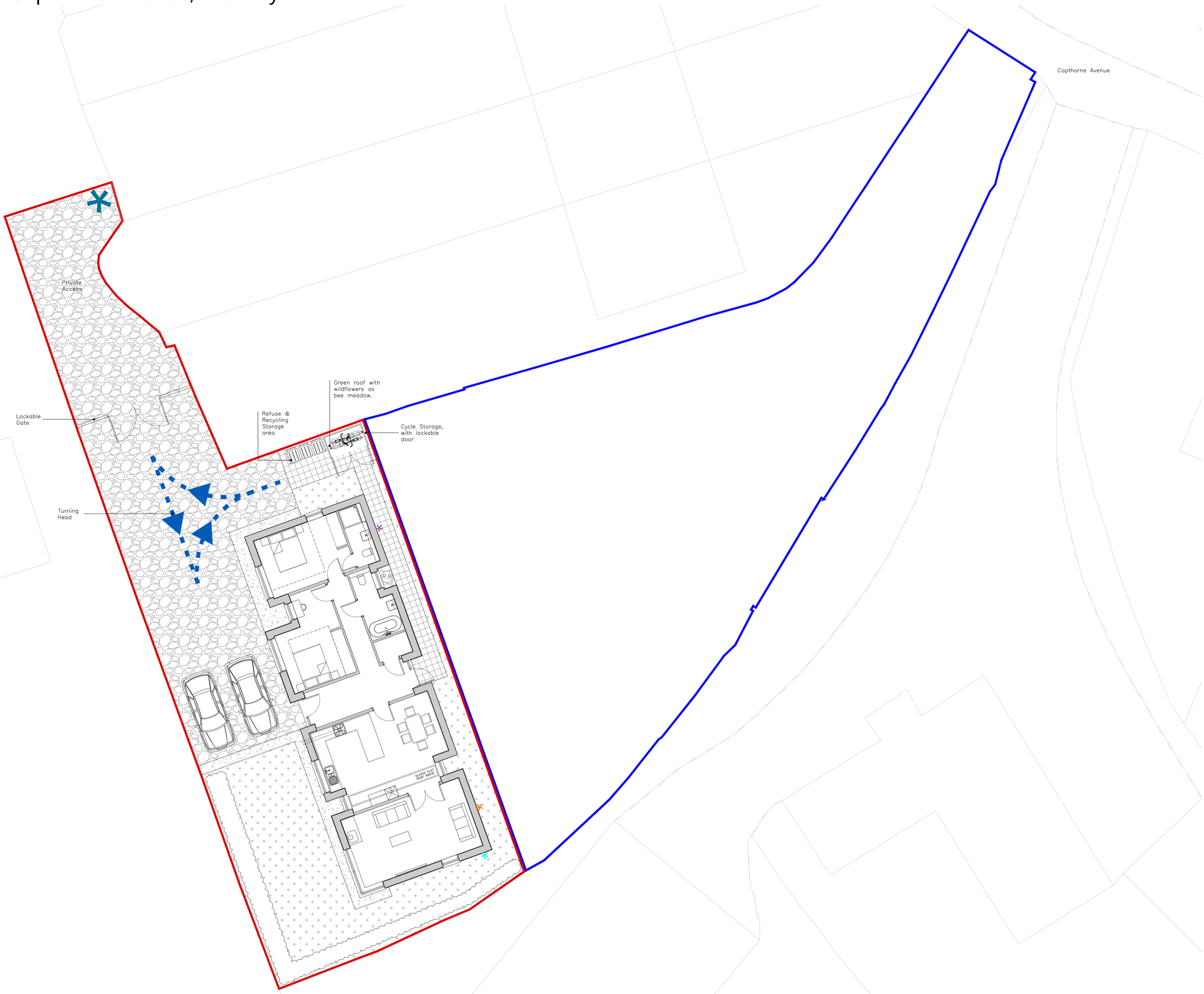
26 Copthorne Avenue, Bromley

Planning

N

0m 2m 4m 6m 8m 10m

SCALE 1:100



Block Plan Key:

- Boundary Line
- Existing Hedges
- Refuse & Recycling Store
- Refuse Collection Point
- Secure Cycle Storage
- Gravel
- Low Level Planting
- Grass Area
- Bird Boxes – Indicative location
- R.B. Rainwater Butt
- Bat Boxes – Indicative location
- Bee Hotel – Indicative location

ASHBY DESIGN

13 Arm & Sword Lane
Old Hatfield · Herts · AL9 5EH
www.AshbyDesign.co.uk
01707 270 077

Project
26 Copthorne Avenue,
Bromley, BR2 8NN

Title
Proposed Block Plan

Scale	Date	Drawn	Checked
1:100 @ A3	Oct' 23	CP	LS

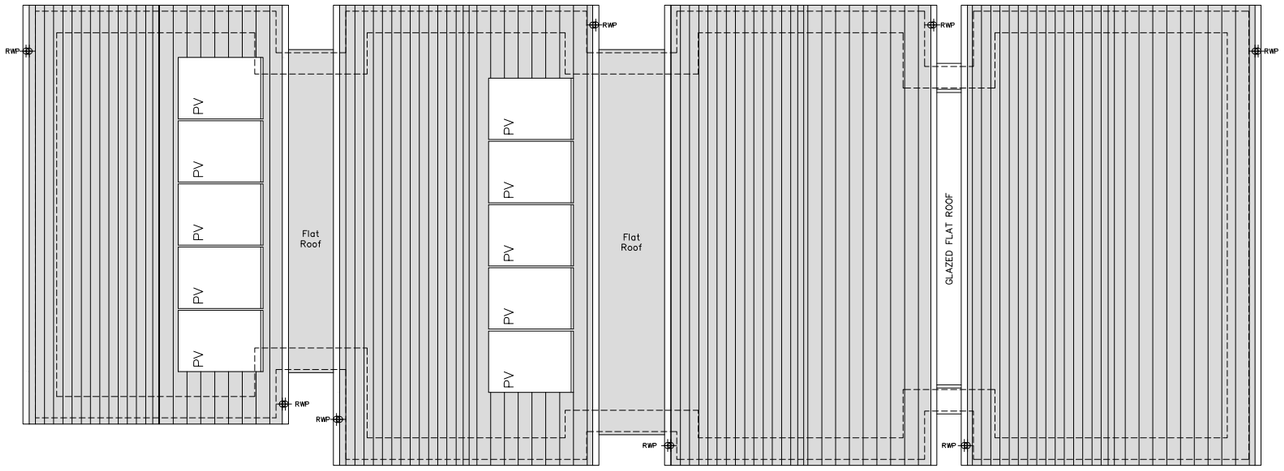
Drawing No. 470/23/S73/PL1002

Revision -

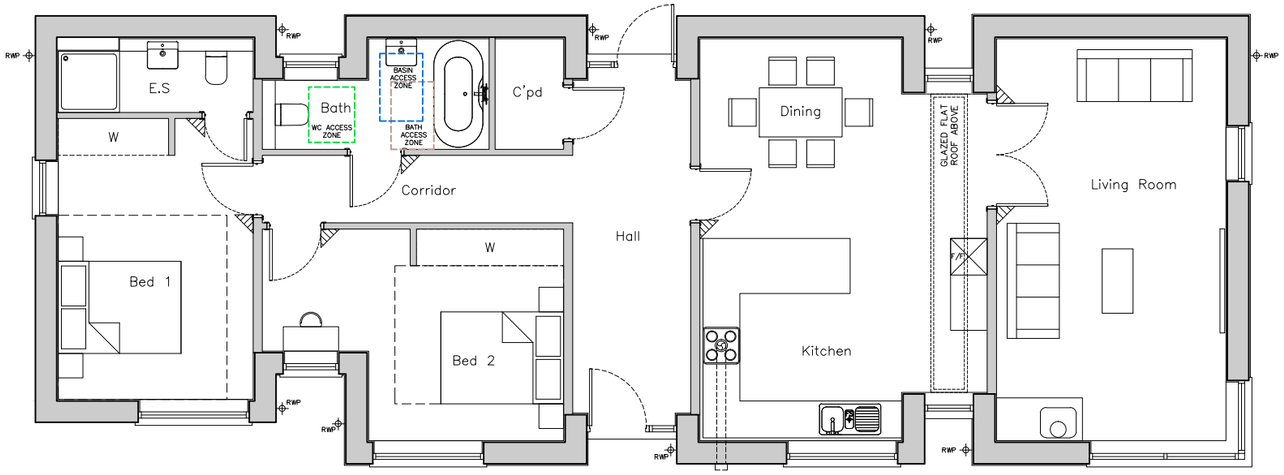
Proposed Block Plan

26 Copthorne Avenue, Bromley, BR2 8NN

Planning



Roof Plan



Ground Floor Plan

- -

../../..

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ASHBY DESIGN

13 Arm & Sword Lane
Old Hatfield - Herts - AL9 5EH
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Project
26 Copthorne Avenue,
Bromley, BR2 8NN

Title
Proposed Ground Floor & Roof Plans

Scale	Date	Drawn	Checked
1:100 @ A1	October '23	CP	LS

Drawing No.
470/23/S73/PL10.01

Revision
-

Proposed Ground Floor & Roof Plans

APPENDIX C

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	George Locke
Site name:	26 Copthorne, BR2 8NN
Site location:	26 Copthorne, BR2 8NN

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:	51.37400° N
Longitude:	0.04685° E
Reference:	3631925188
Date:	Jun 26 2023 20:19

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.0410

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm):	720	720
Hydrological region:	6	6
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):	0.01	0.01
1 in 1 year (l/s):	0.01	0.01
1 in 30 years (l/s):	0.02	0.02
1 in 100 year (l/s):	0.02	0.02
1 in 200 years (l/s):	0.03	0.03

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	George Locke
Site name:	26 Copthorne, BR2 8NN
Site location:	26 Copthorne, BR2 8NN

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.37401° N
Longitude:	0.04689° E
Reference:	1297102879
Date:	Jun 26 2023 20:18

Site characteristics

Total site area (ha):	0.0410
Significant public open space (ha):	0
Area positively drained (ha):	0.041
Impermeable area (ha):	0.0410
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.04
Net impermable area for storage volume design (ha):	0.04
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	1
SPR:	0.1	0.1

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	97.79
FEH / FSR conversion factor:	1.27	1.27
SAAR (mm):	720	720
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.4		Growth curve factor 100 years:	3.19	3.19
Urban creep allowance factor:	1.1		Q_{BAR} for total site area (l/s):	0.01	0.01
Volume control approach	Use long term storage		Q_{BAR} for net site area (l/s):	0.01	0.01
Interception rainfall depth (mm):	5				
Minimum flow rate (l/s):	2				

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2	2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	15	15
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	15	15

APPENDIX D

26 Copthorne
SUDS Conditions Discharge Appendix D

Route the guttering to communicate all new build guttering to selected RWP

This retains all surface water at height then direct discharge to the oversized granular storage, thence to Geocellular

Exceedance routes shown below

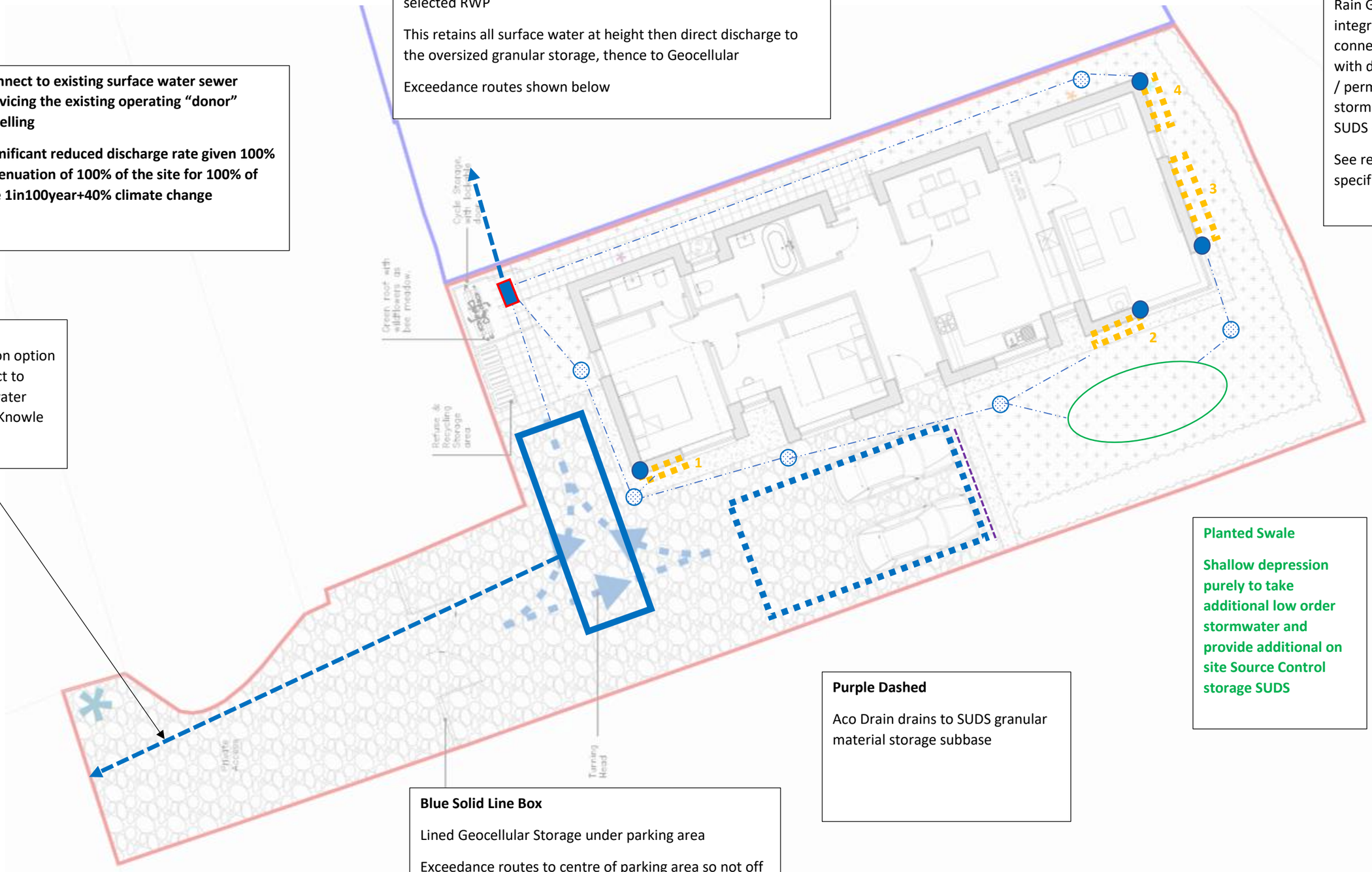
Connect to existing surface water sewer servicing the existing operating "donor" dwelling

Significant reduced discharge rate given 100% attenuation of 100% of the site for 100% of the 1in100year+40% climate change

Orange Dashed Box

Rain Garden Planters with integrated void storage connected direct to RWP with discharge over porous / permeable areas and storm flow connection to SUDS storage

See report for dimensions, specifications and inverts



Back up connection option to connect to surface water sewer in Knowle Road

Planted Swale

Shallow depression purely to take additional low order stormwater and provide additional on site Source Control storage SUDS

Purple Dashed

Aco Drain drains to SUDS granular material storage subbase

Blue Solid Line Box

Lined Geocellular Storage under parking area

Exceedance routes to centre of parking area so not off site

See report for dimensions, specifications and inverts

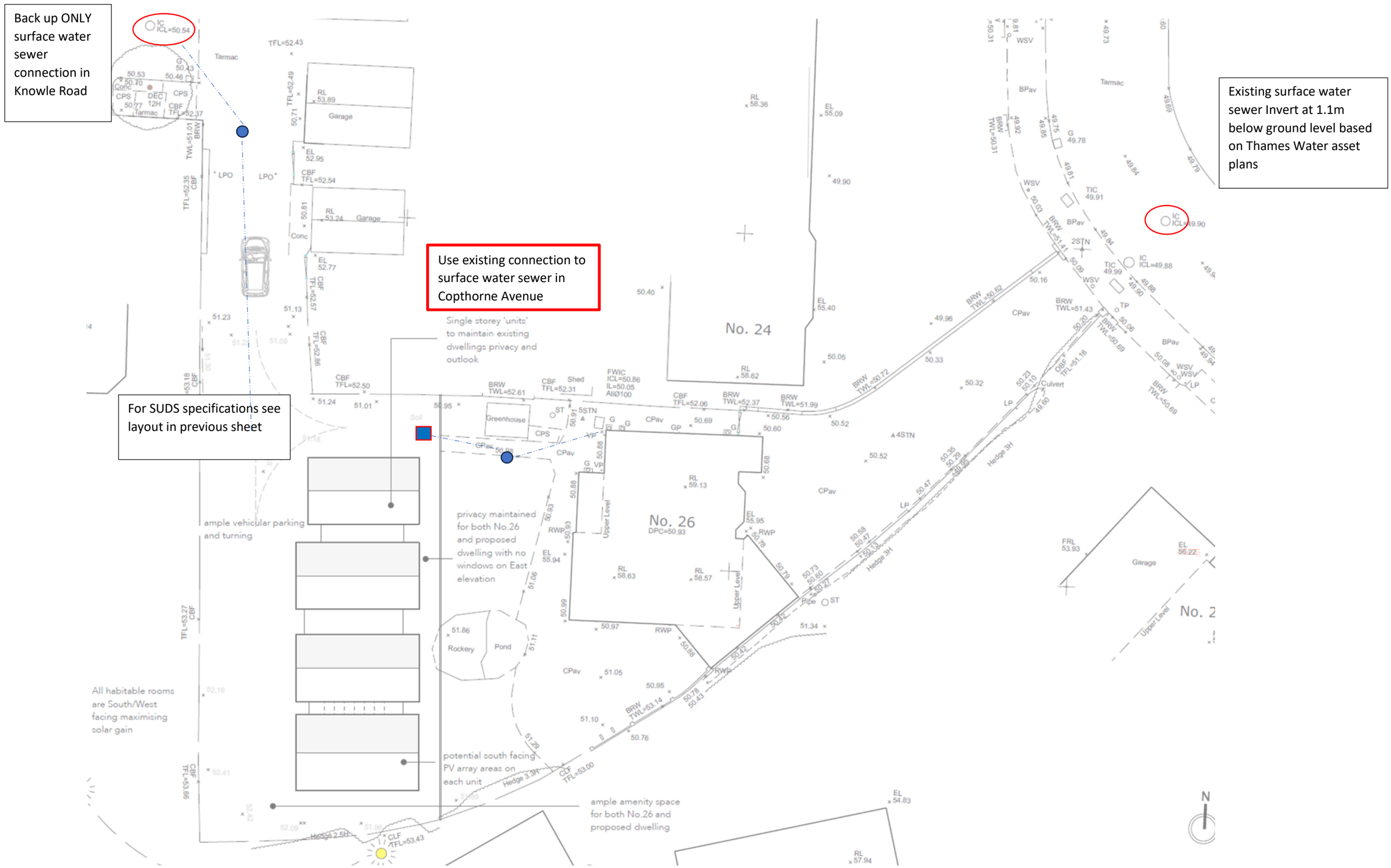
Blue Dashed Box

Lined Granular Storage under access area

Exceedance routes to centre of area so not off site

See report for dimensions, specifications and inverts

26 Copthorne
SUDS Conditions Discharge Appendix D



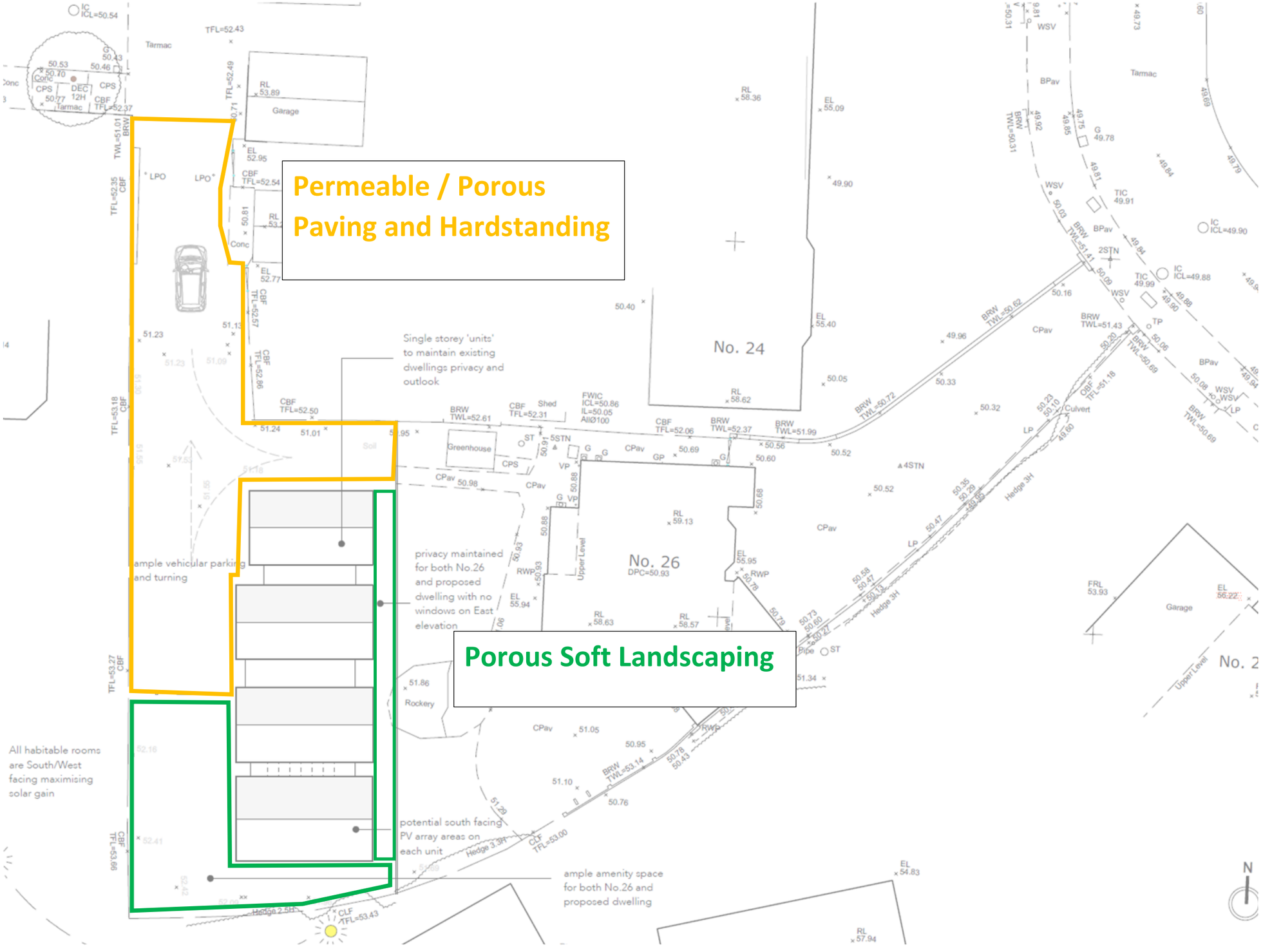
Design for Exceedance

All flows away from lower ground void

All flows retained on site in porous / permeable areas

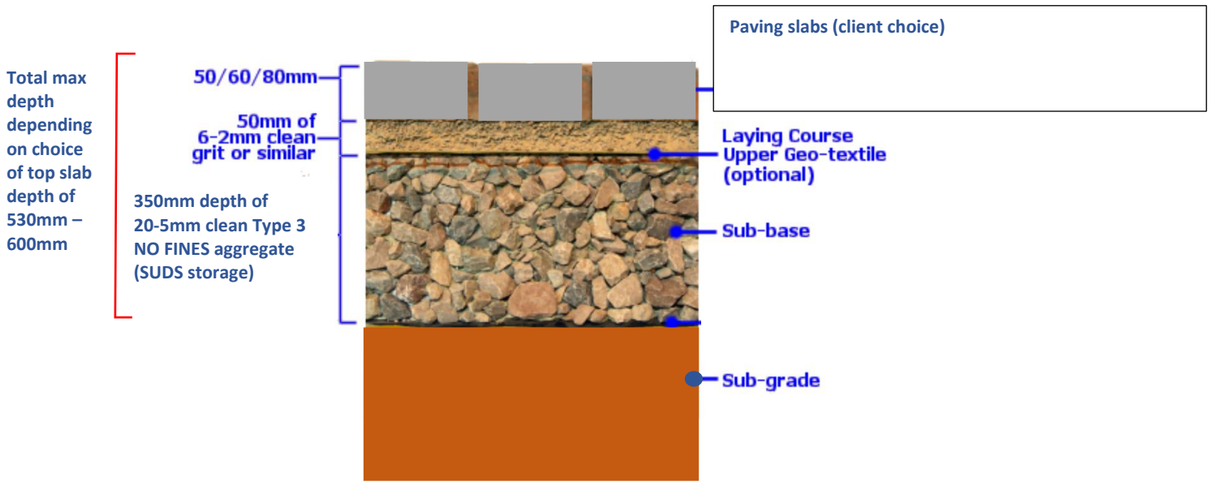
SUDS store for 100% of the site for 100% of the 1in100year+40% cc hence no exceedance off site

26 Copthorne
SUDS Conditions Discharge Appendix D

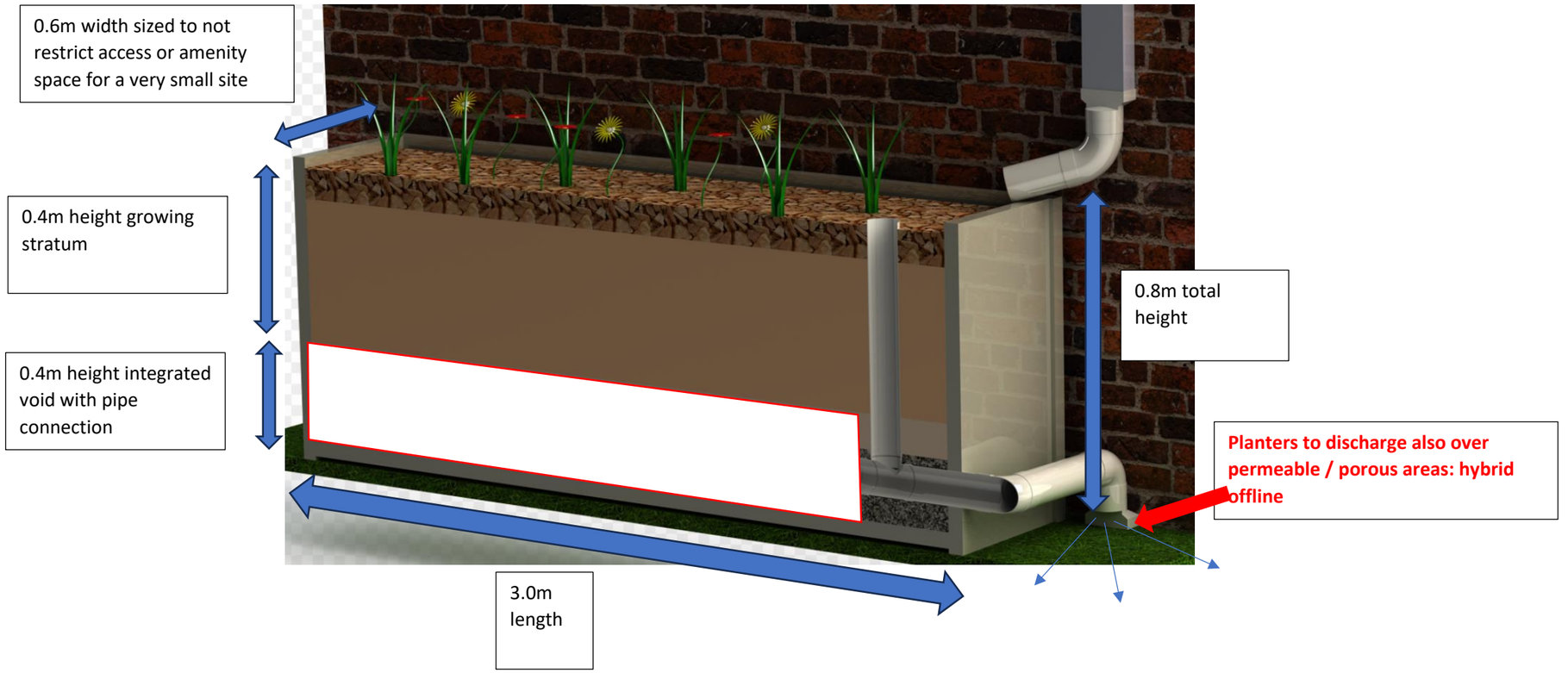


26 Copthorne
SUDS Conditions Discharge Appendix D

Granular Cross Section Specification



Indicative Planter Specification: see report and above for the 4 dimensions to be used

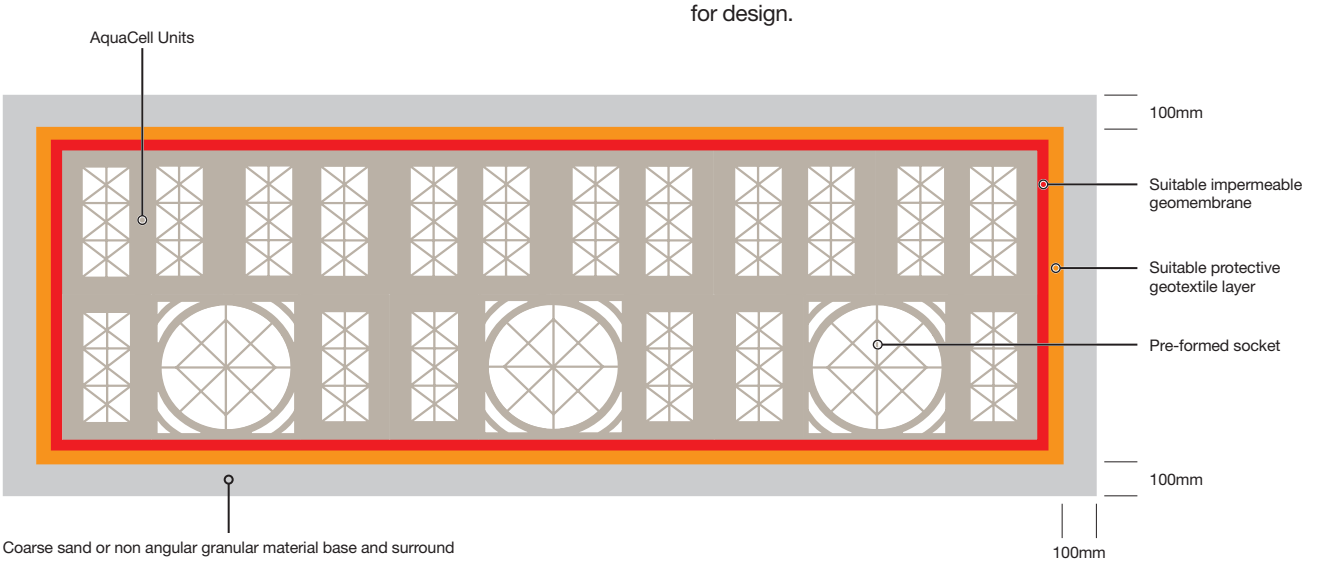


Typical Storage Tank Installation Method

Typical installation procedure

1. Excavate the trench to the required depth ensuring that the plan area is slightly greater than that of the AquaCell units.
2. Lay 100mm bed of coarse sand, level and compact.
3. Lay the geotextile over the base and up the sides of the trench.
4. Lay the geomembrane on top of the geotextile over the base and up the sides of the trench.
5. Lay the AquaCell units parallel with each other. In multiple layer applications, wherever possible, continuous vertical joints should be avoided. AquaCell units can be laid in a 'brick bonded' formation (i.e. to overlap the joints below) – see page 18. For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
6. Wrap the geomembrane around the AquaCell structure and seal to manufacturers recommendations.*
7. If side connections into the AquaCell units is required, (other than the preformed socket), use the appropriate Flange Adaptor (6LB104 or 6LB106). Fix the flange adaptor to the unit using self-tapping screws. Drill a hole through the Flange Adaptor and connect the pipework. (6LB106 should not be used with AquaCell Eco).
8. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework – see page 22 for installation guidelines.
9. Wrap and overlap the geotextile covering the entire AquaCell structure, to protect the geomembrane.
10. Lay 100mm of coarse sand between the trench walls and the AquaCell units and compact.
11. Lay 100mm bed of coarse sand over the geotextile and compact. Backfill with suitable material. .

NB: A storage tank must be vented, and it is recommended that one vent pipe, 110mm in diameter is provided per 7,500 square metres of impermeable catchment area on a site, see page 22 for design.



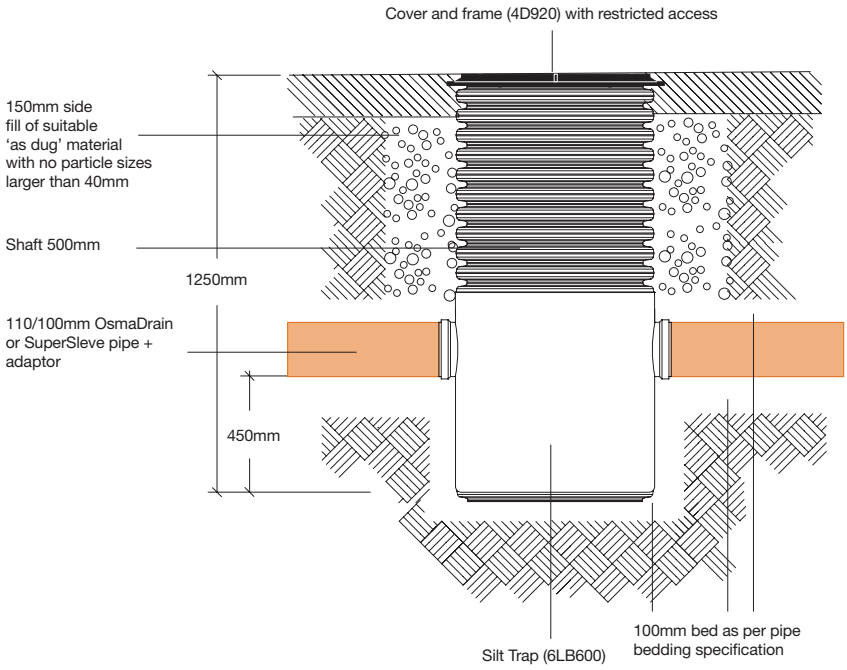
Example shows the use of AquaCell Prime. However, a storage tank can also be installed as shown using any of the other versions of AquaCell units (Eco, Core or Plus) as appropriate.

**For large scale, deep installations a 1mm thick geomembrane is recommended and joints should be sealed using proprietary welding techniques. For further details contact Wavin Technical Design.*

Installation
AquaCell Units

Silt Trap and Air Vent Termination

Silt Trap

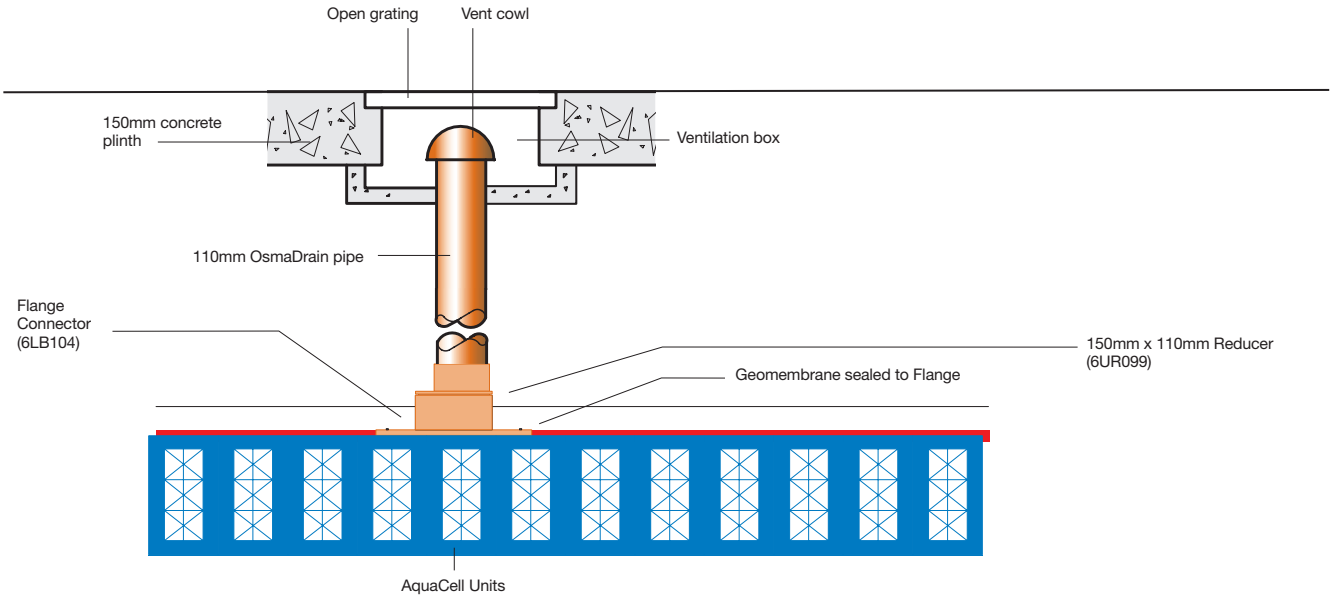


Typical installation procedure

1. Place the Silt Trap (6LB600) on a minimum of 100mm bed as per pipe bedding specification. Ensure that the trap is as close to the AquaCell unit as possible and in a suitable position to allow pipework connection.
2. Connect the relevant pipework in accordance with standard pipe installation guidelines.
3. Surround the sides of the Silt Trap with 150mm of 'as dug' material, with no particle sizes larger than 40mm.
4. Fit relevant cover and frame.

NOTE: When surrounded by a concrete plinth (150mm x 150mm) the 4D920 Cover and Frame can be used in situations with a loading of up to 50kN (5 tonne).

Typical Air Vent design



NOTE: It is recommended that all connections and air vent installations in storage applications (using geomembrane) are made using a Flange Adaptor.

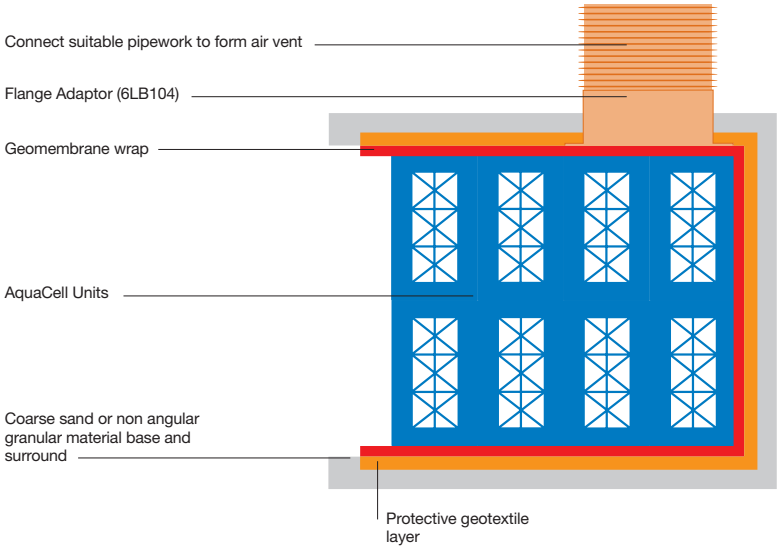
Adhesive or double sided tape should be used between the geomembrane and the flange plate to ensure a watertight seal.

NOTE: It is recommended that one vent pipe, 110mm in diameter, is provided per 7,500 square meters of impermeable catchment area on a site. Please contact Wavin Technical Design for further details.

Typical Details
AquaCell Units

Top Connection for Air Vent

Connect into the top of the AquaCell unit, using Flange Adaptor.

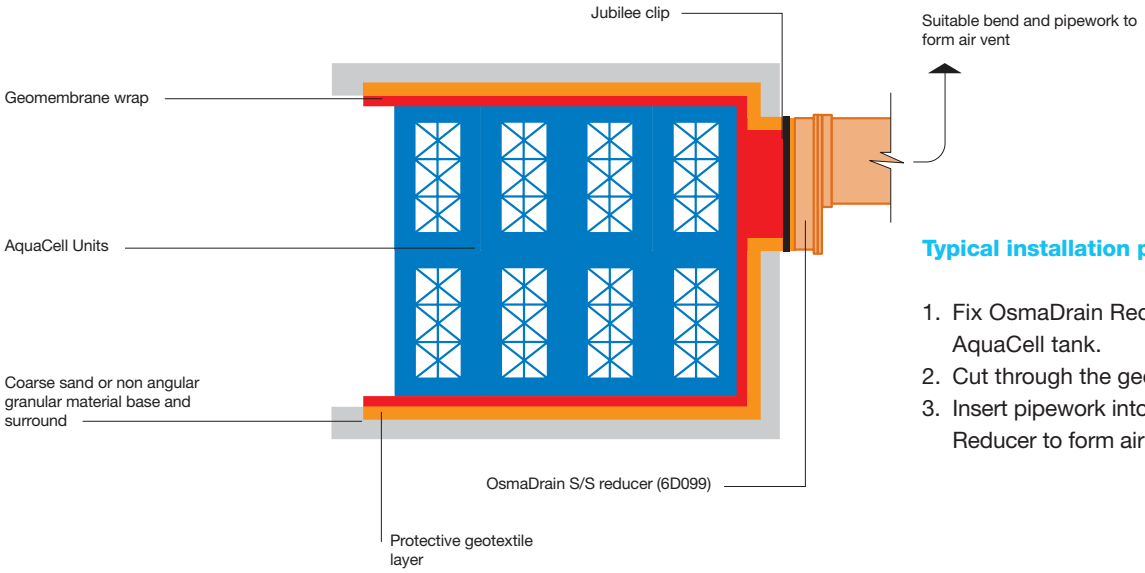


Typical installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor to form air vent.

Side Connection for Air Vent

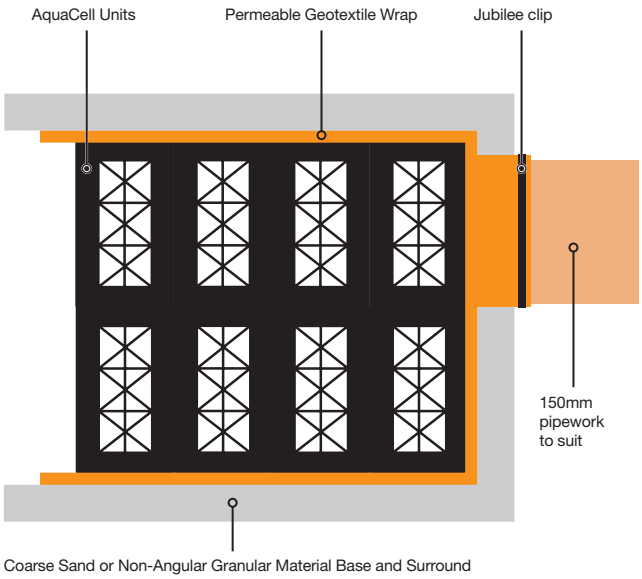
Connect into the side of the AquaCell tank unit using standard Reducer.



Typical installation procedure

1. Fix OsmaDrain Reducer to the AquaCell tank.
2. Cut through the geomembrane.
3. Insert pipework into OsmaDrain Reducer to form air vent.

Typical Details
AquaCell Units

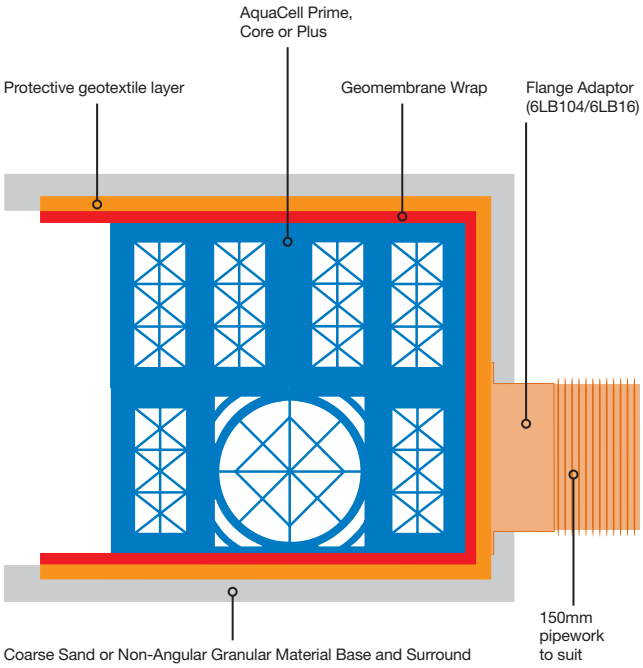


Connections to AquaCell Units

Connection for soakaway application using either the pre-formed socket (as shown below) or standard adaptors into pre-formed socket*.

*NOTE: For pipework other than 160mm OsmaDrain, these adaptors can be used to connect to the following:

- 6TW141: TwinWall S/S Adaptor connects to 150mm TwinWall
- 6D099: OsmaDrain Adaptor connects to 110mm OsmaDrain
- 4D916: OsmaDrain PE Adaptor connects to 160mm OsmaDrain
- 6UR141: UltraRib S/S Adaptor connects to 150mm UltraRib
- 6D129: OsmaDrain S/S Adaptor connects to 150mm SuperSleve clay. (Use an appropriate reducer, as required, e.g. 6D099)



Connection for storage application using Flange Adaptor at points other than pre-formed socket, (for AquaCell Prime, Core or Plus).

Installation procedure

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor.

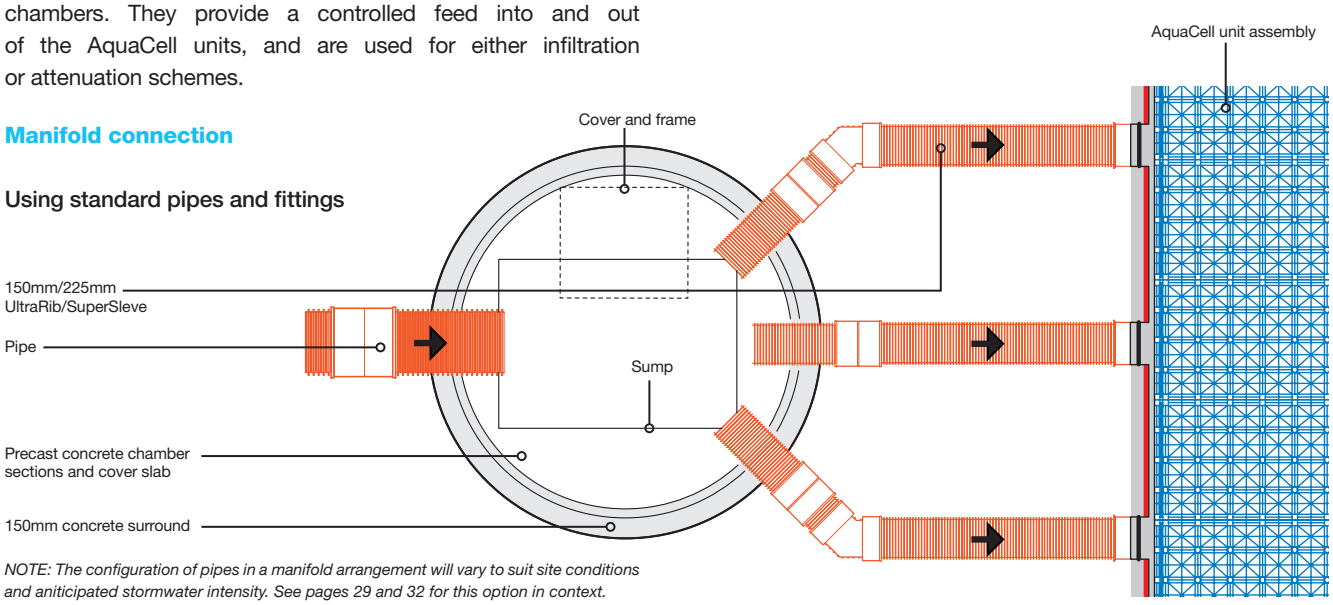
*NOTE: AquaCell Eco is not suitable for side connection using a Flange Adaptor.

Connection Configurations

The connections shown here in schematic form, are the typical options used to connect AquaCell units to control chambers. They provide a controlled feed into and out of the AquaCell units, and are used for either infiltration or attenuation schemes.

Manifold connection

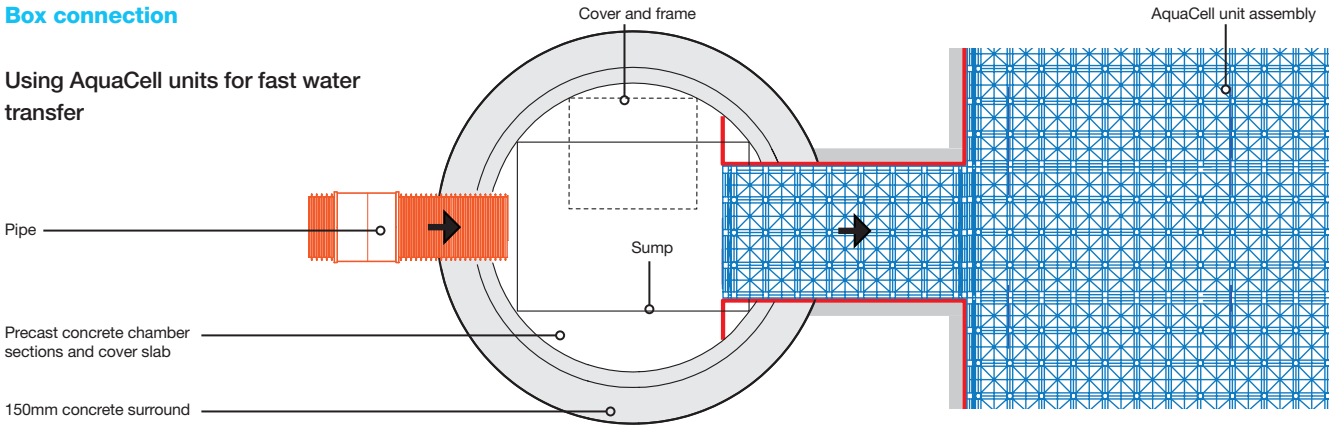
Using standard pipes and fittings



NOTE: The configuration of pipes in a manifold arrangement will vary to suit site conditions and aniticipated stormwater intensity. See pages 29 and 32 for this option in context.

Box connection

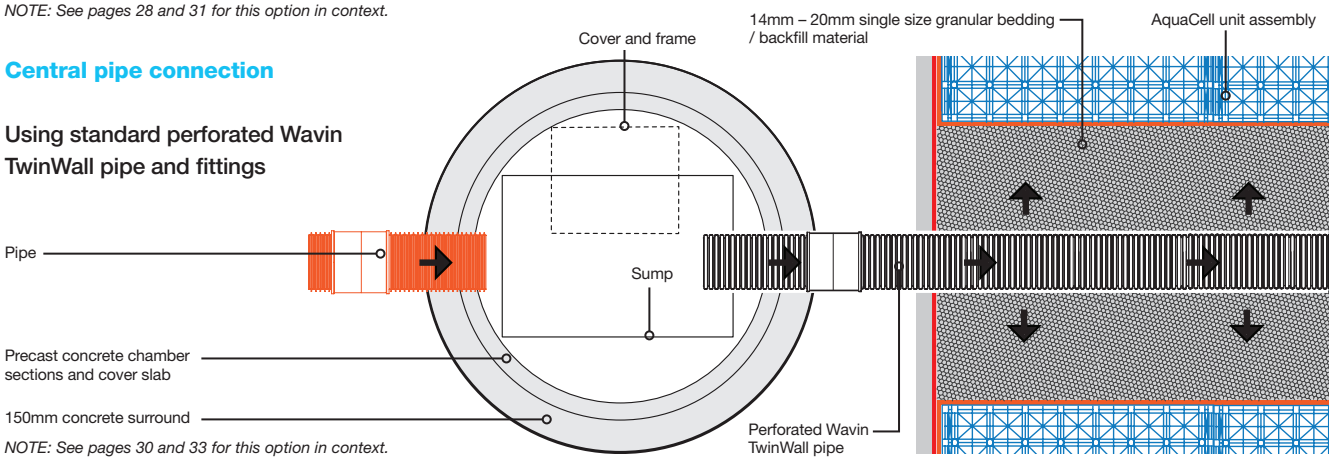
Using AquaCell units for fast water transfer



NOTE: See pages 28 and 31 for this option in context.

Central pipe connection

Using standard perforated Wavin TwinWall pipe and fittings

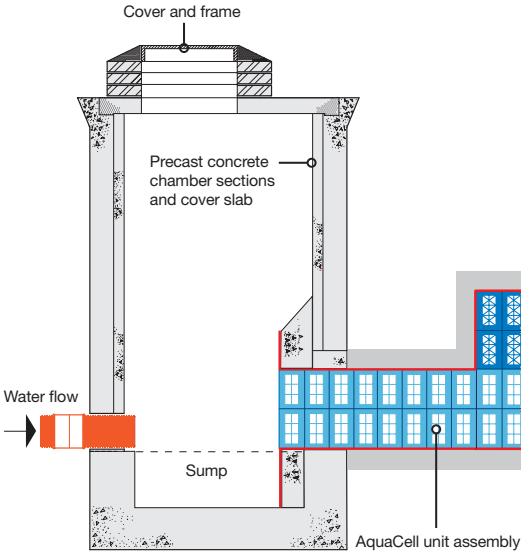


NOTE: See pages 30 and 33 for this option in context.

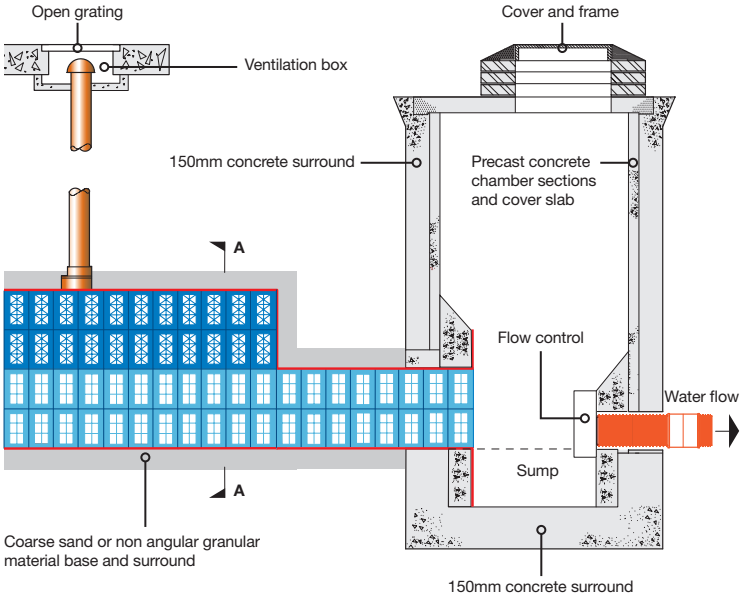
Typical Details
AquaCell Units

On-Line Storage – Box Feed

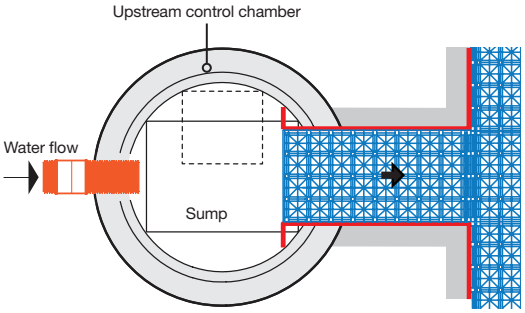
Long section

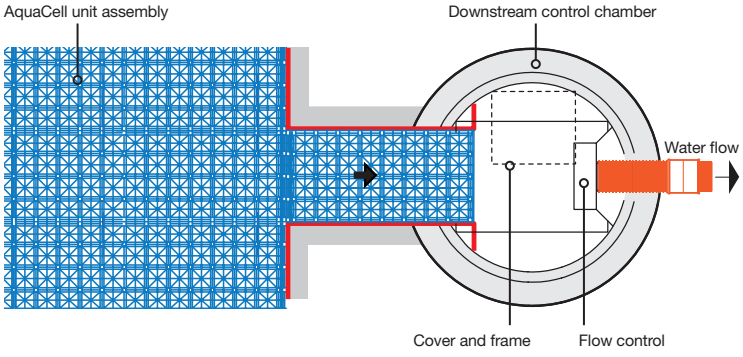


Typical vent detail

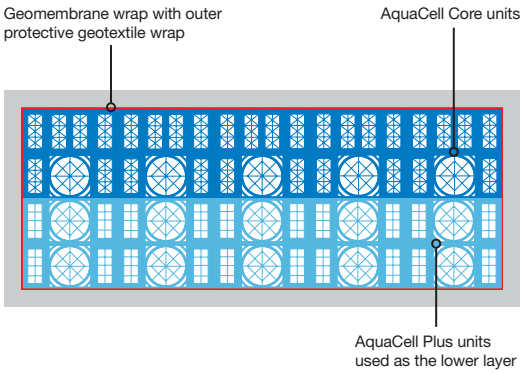


Plan





Cross section A-A

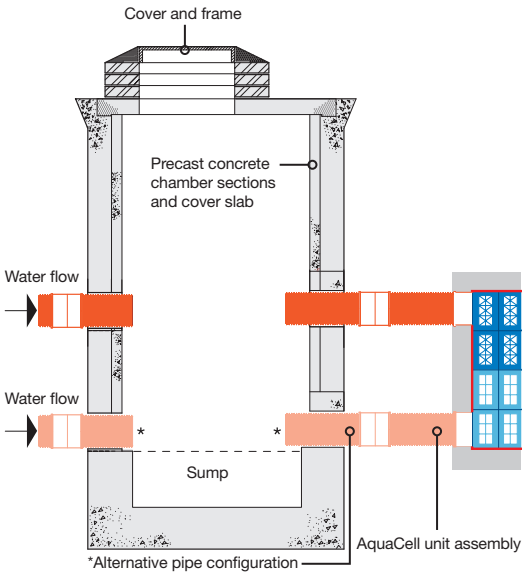


What happens to the water?

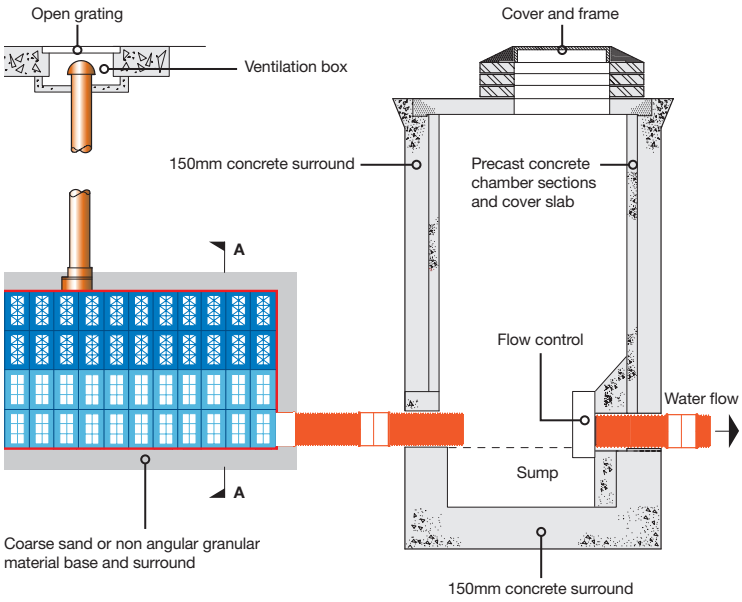
1. The water level in the upstream control chamber rises.
2. Then, during a storm event, the AquaCell storage assembly quickly fills with water via the AquaCell feed connection.
3. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and into the downstream control chamber.
4. The water then flows through the vortex flow control valve.

On-Line Storage – Manifold Feed

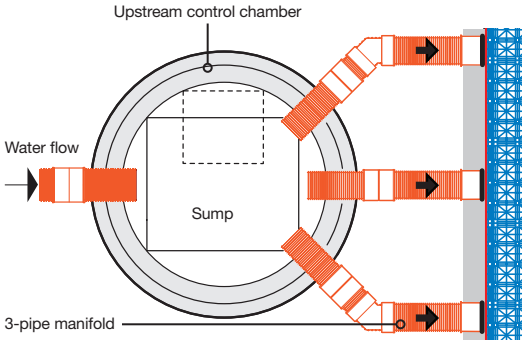
Long section

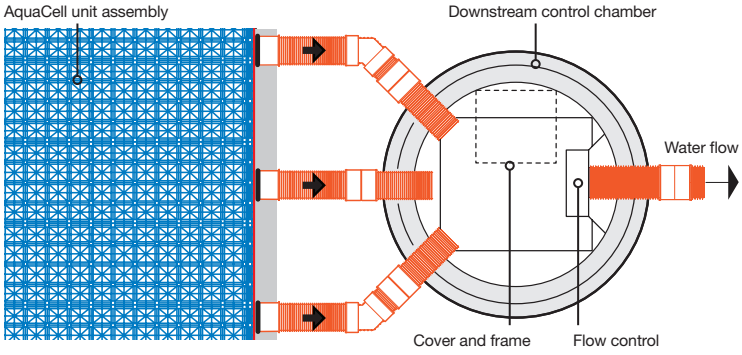


Typical vent detail

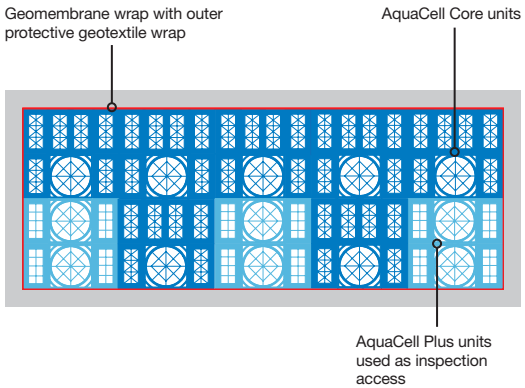


Plan





Cross section A-A



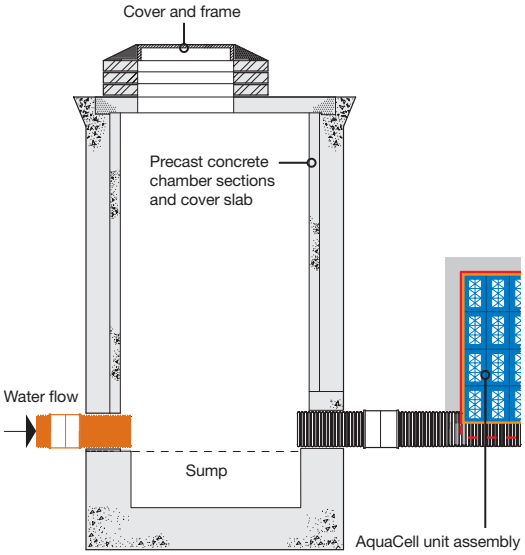
What happens to the water?

1. The water level in the upstream control chamber rises.
2. During a storm event, the AquaCell storage assembly fills with water via the manifold feed connection.
3. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and into the downstream control chamber.
4. The water then flows through the vortex flow control valve.

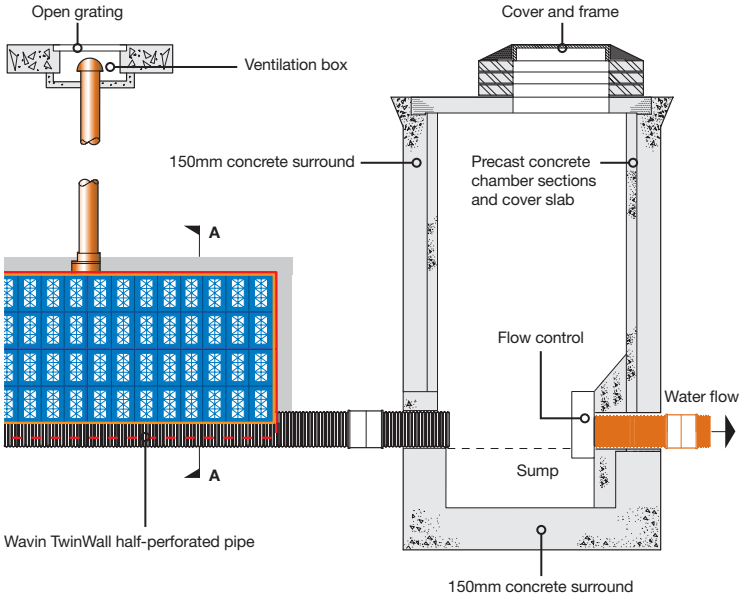
Typical Details
AquaCell Units

On-Line Storage – Central Pipe Feed

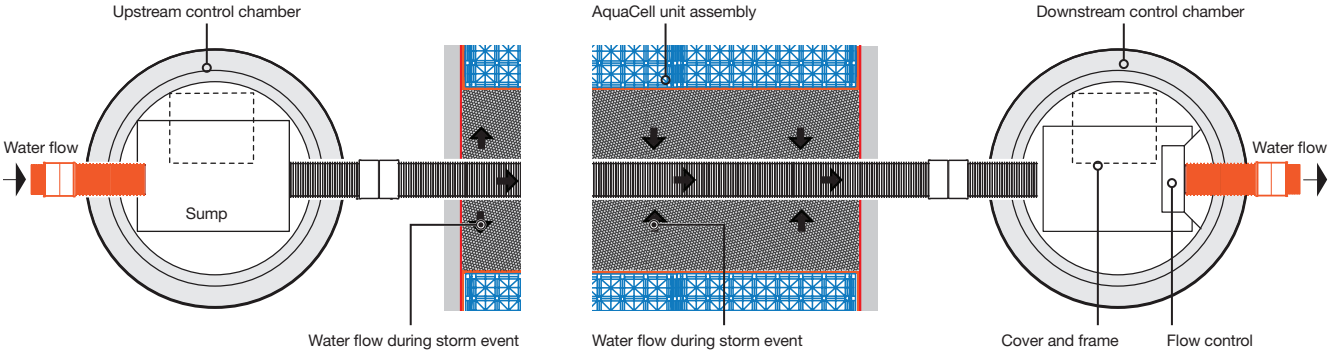
Long section



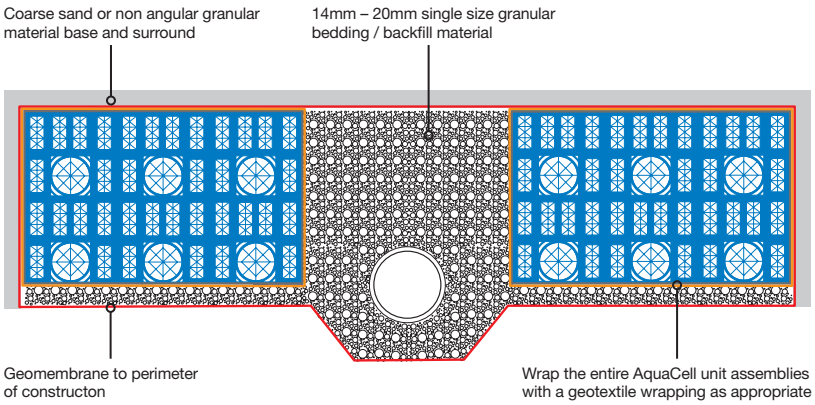
Typical vent detail



Plan



Cross section A-A

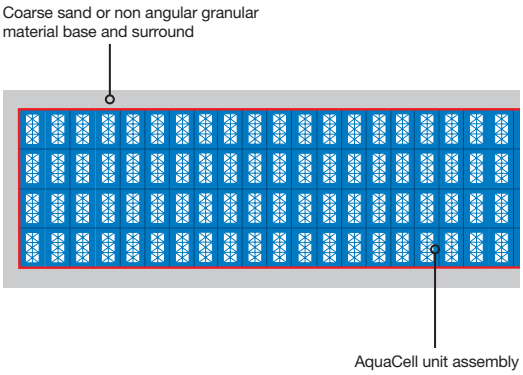


What happens to the water?

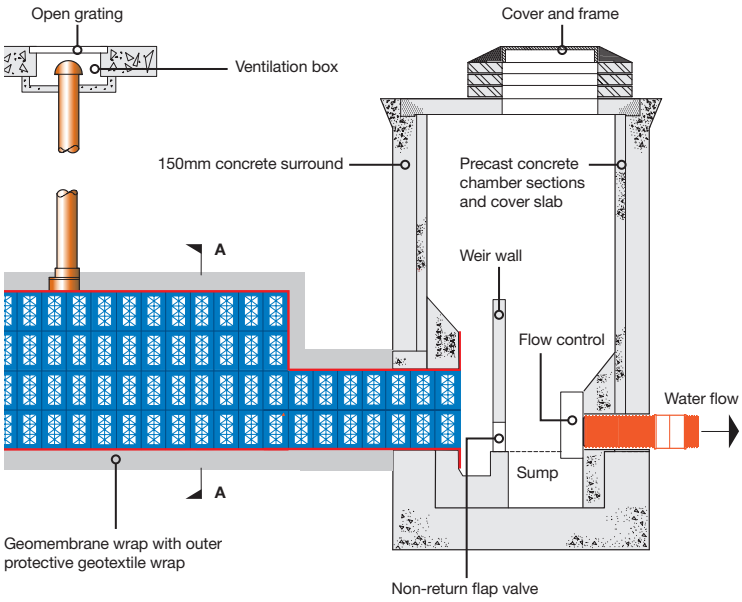
1. The water level in the upstream control chamber rises.
2. AquaCell storage assemblies fill with water via the central pipe connection and percolate's through the granular bedding material.
3. After storm event, water flows back out of the AquaCell storage assemblies, finding its own level, and into the downstream control chamber.
4. The water then flows through the vortex flow control valve.

Off-Line Storage – Box Feed

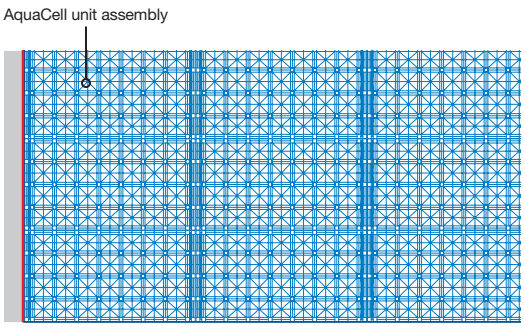
Long section

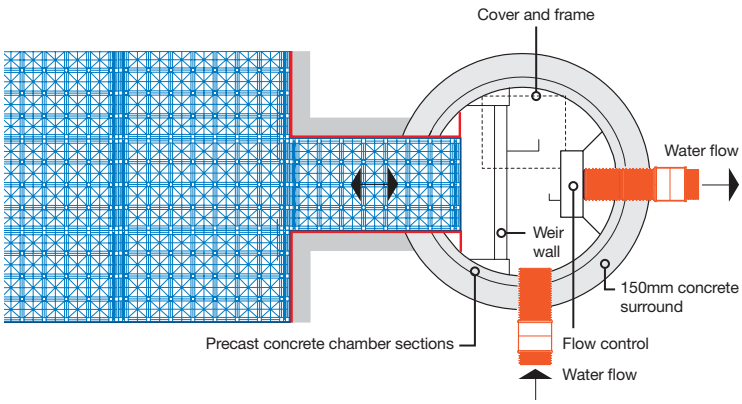


Typical vent detail

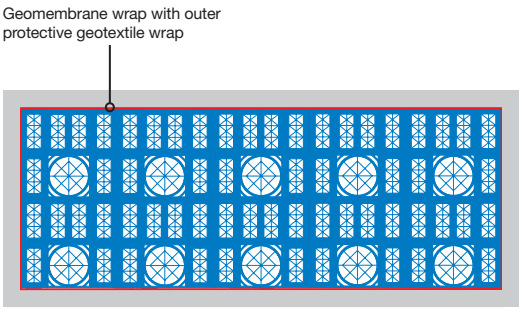


Plan





Cross section A-A



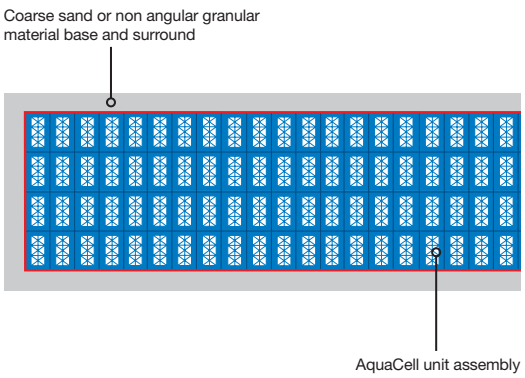
What happens to the water?

1. Control chamber fills with water, up to the top of the weir wall.
2. The water overflows the weir wall and enters the AquaCell storage assembly via the AquaCell connection.
3. The AquaCell storage assembly fills with water.
4. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and through the non-return flap valve at the bottom of the weir wall.
5. The water then flows through the vortex flow control valve.

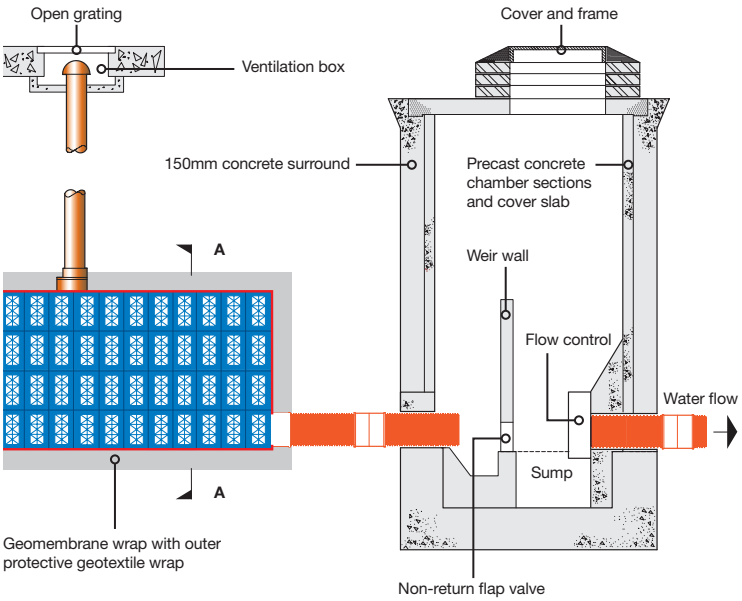
Typical Details
AquaCell Units

Off-Line Storage – Manifold Feed

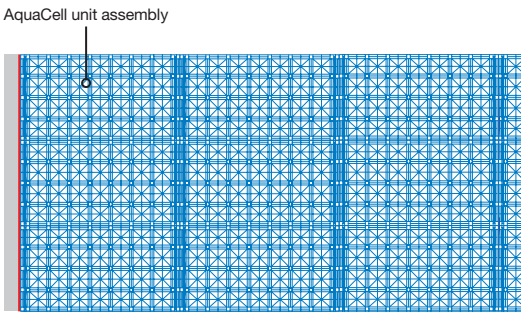
Long section

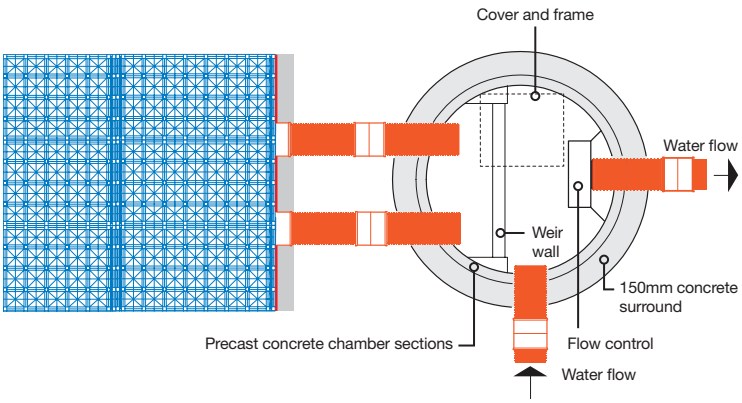


Typical vent detail

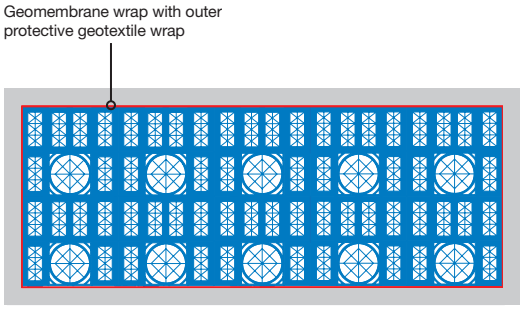


Plan





Cross section A-A

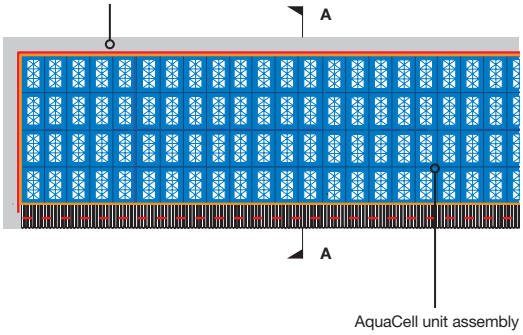


What happens to the water?

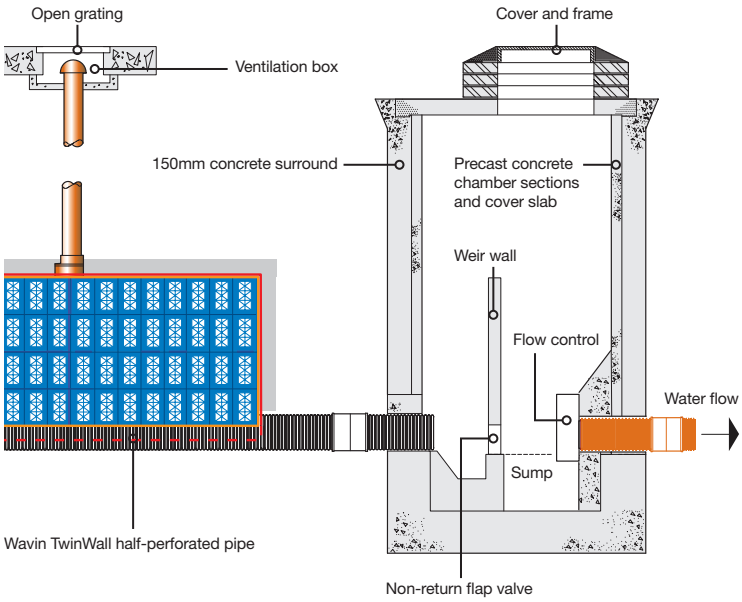
1. Control chamber fills with water, up to the top of the weir wall.
2. The water overflows the weir wall and enters the AquaCell storage assembly via the manifold connection.
3. The AquaCell storage assembly fills with water.
4. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and through the non-return flap valve at the bottom of the weir wall.
5. The water then flows through the vortex flow control valve.

Off-Line Storage – Central Pipe Feed

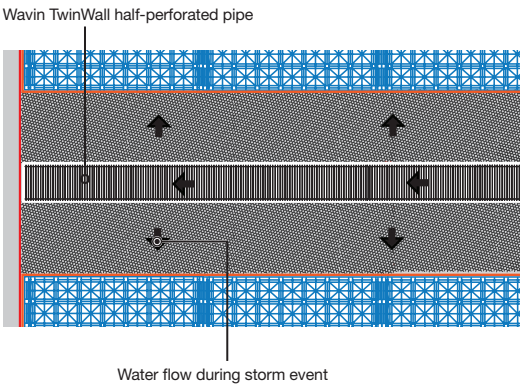
Long section

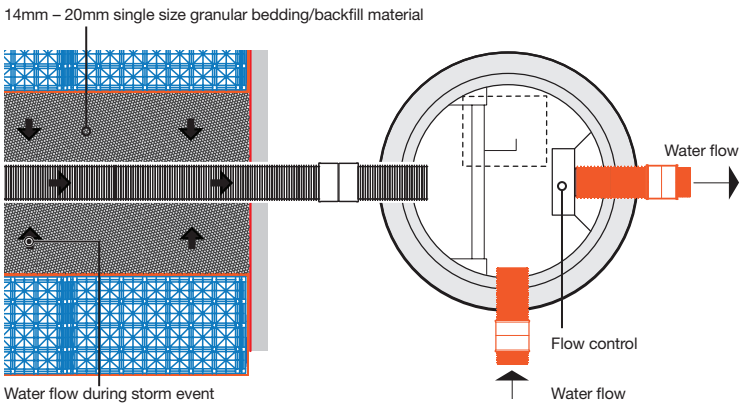


Typical vent detail

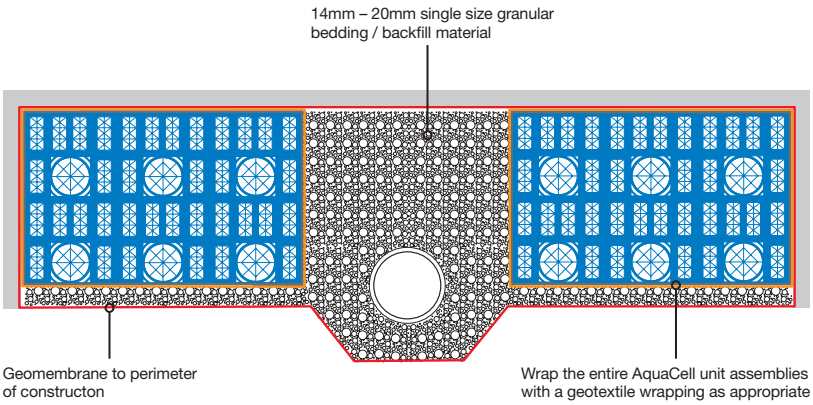


Plan





Cross section A-A

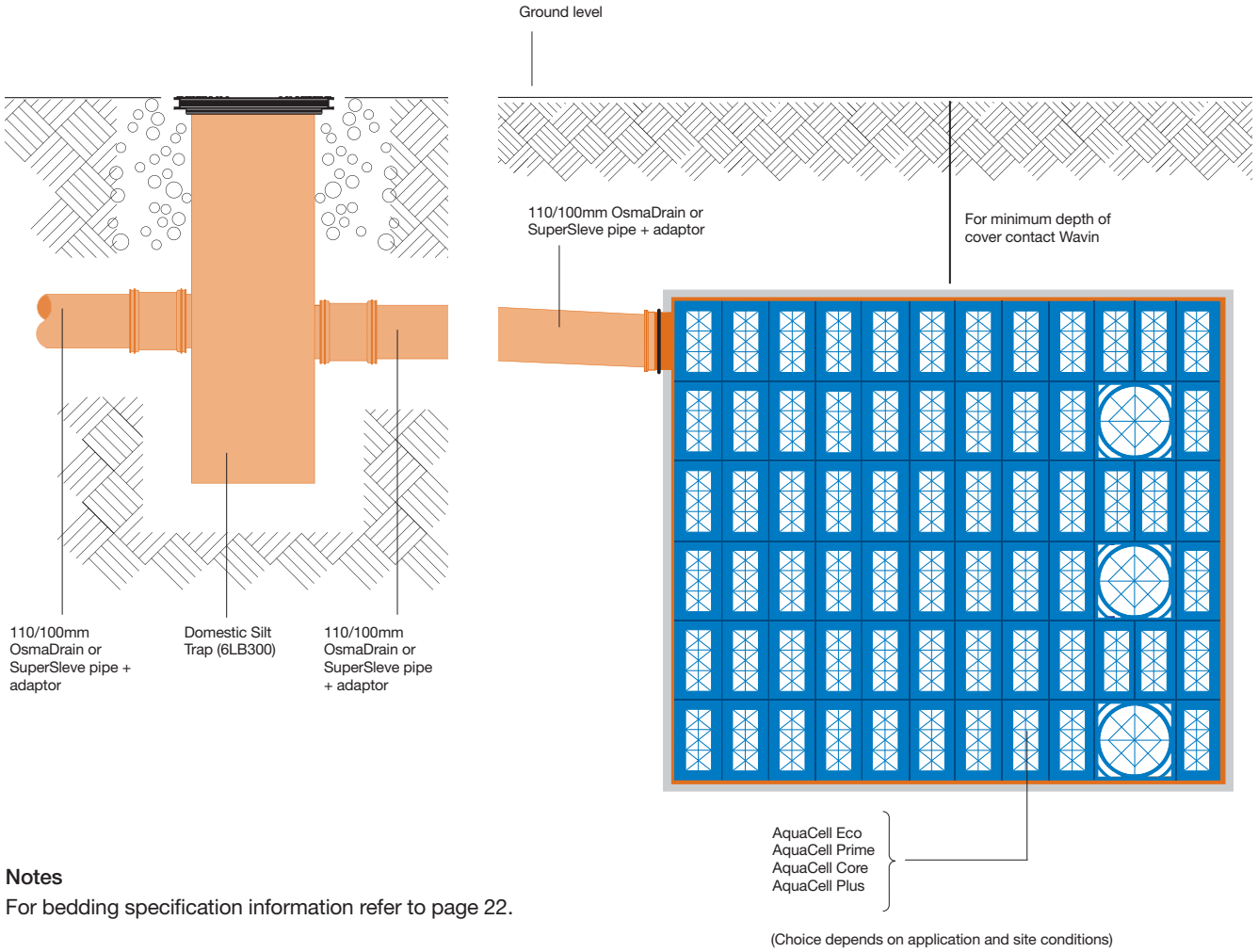


What happens to the water?

1. Control chamber fills with water, up to the top of the weir wall.
2. The water overflows the weir wall and enters the AquaCell storage assemblies via the central pipe connection and percolate's through the granular bedding material.
3. The AquaCell storage assembly fills with water.
4. After storm event, water flows back out of the AquaCell storage assemblies, finding its own level, and through the non-return flap valve at the bottom of the weir wall.
5. The water then flows through the vortex flow control valve

Typical Details
AquaCell Units

Soakaway or Storage Tank – With Silt Trap



Notes

For bedding specification information refer to page 22.

The silt trap can be used in conjunction with a soakaway (as shown) or a storage tank.

APPENDIX E

SUDS Maintenance Schedule

Installation	Maintenance Required	Frequency	Responsibility
Permeable Parking Area Swale	Inspection, weeding, etc	Annually or as per supplier's recommendations	Supplier (via a maintenance/service package) or Estate Management Company
Permeable Paving (incl. associated distribution pipework and sump chambers) Cellular Storage and pipe work / IC's Rain garden planters with void storage	Inspection, debris removal and jetting	Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary.	Estate/Building Management Company