



Land Adjacent to 10 Spring Bridge Road, Manchester M16 8PL

**SUDS for Condition Discharge
Appeal Ref: APP/B4215/W/22/3298650**

SUDS strategy: re-use existing system with betterment

United Utilities do not allow connection to combined system from online Source Control SUDS

February 2023

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EnviroSolution has expertise and experience in all aspects of environmental enforcement, regulation and assessment, working in conjunction with the HSE, Local Authorities and Environment Agency. With specific capability in environmental protection and planning policy and control, EnviroSolution has a core knowledge base to assist clients in dealing with Flood Risk issues.

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1.0 Scope

This report contains the details of a SUDS Drainage Strategy for condition discharge carried out by Envirosolution Ltd for Land Adjacent to 10 Spring Bridge Road, Manchester M16 8PL, henceforth referred to as “the site” in this report.

This report has been prepared for Mrs S Zakir and must not be relied upon by any other party without the explicit written permission of Envirosolution Ltd.

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2.0 Introduction

The information source used to undertake this FRA has been collected from the following sources:

- British Geological Survey Website and iGeology Website
- EA Website
- Manchester City Council SUDS Guidance
- Internet mapping and searches

3.0 Existing Site & Planning Status

3.1 Site Location and Status

The proposed development site measures approximately 0.038ha (380.0m²).

A site location plan is included in Appendix A.

The site currently comprises a vacant plot within a residential area.

3.2 Planning Status

The site has approval for a new dwelling as per the drawings included in this application.

It is approved under Appeal Reference: APP/B4215/W/22/3298650. This comprises:

“Erection of single storey dwellinghouse with associated car parking, amenity space and other works.”

3.3 Geology

Geology

According to online British Geological Survey (BGS) mapping the site is directly underlain by:

- Bedrock: Wilmslow Sandstone
- Superficial Deposits: Till, Devensian - Diamicton

Given the existing constrained site (not possible to meet 5.0m easement from footprint or 3.0m easement from site boundary), geology and proximity to other properties, the SUDS strategy necessarily needs to be hybrid to maximise Source Control without formal infiltration combined with storage on site with restricted discharge to existing system.

The Source Control measures proposed will result in discharge rates lower than 0.5l/s and

allows for low order storms to simply recharge the soil water.

No infiltration testing is required. It is an appropriate risk management strategy to design the SUDS as if infiltration were not feasible in order to oversize the SUDS storage.

It is considered that given the geology and site setting / constraints and requirements of the statutory consultees, there is no need to undertake BRE365 testing because a full formal soakaway is not an option.

3.4 Existing Drainage

Public sewer records have not been sourced however the site is adjacent to residential properties with connections to the sewers.

There are manholes adjacent to the site.

Gravity drainage is feasible.

There is no evidence of any existing SUDS.

The site currently discharges without attenuation, likely simply natural recharge to the soil.

An assessment of the Greenfield equivalent discharge for the site has been carried out. This has confirmed an average discharge rate (QBAR) of a nominal less than 0.29 l/s. This low rate is due to the relatively small nature of the site. A copy of the calculation output is included in Appendix C.

4.0 Assessment of Proposed Development

4.1 Proposed Development

The proposed development (Appendix B) comprises:

- New dwelling (roof area with gutters for surface water: standard arrangement)
- Porous garden areas: Source Control
- Permeable car parking area: Source Control
- Rain garden planters: Source Control
- Permeable car park with subbase of either or / or mix of granular storage and cellular storage
 - o This meets the mandatory requirements of United Utilities for a combined connection which cannot be changed as a result of the scheme
- Reduces flood risk overall and meets LLFA SUDS requirements
- SUDS to be of the highest in the hierarchy suitable for the constrained site, type of operation and adjacent surface water drainage system

4.2 Surface Water Drainage & Constraints

In accordance with the NPPF, PPG and LLFA policy requirements, sustainable drainage systems (SUDS) should be incorporated wherever possible to reduce positive surface water run-off and flood risk to other areas.

Constraints: easements and RPZ's

It is not possible to fit a soakaway on the site as there is not a location for a suitably sized soakaway that is 5.0m from footprint and 2.0m or 3.0m from the site boundary.

This is further constrained by the Root Protection Zones to the rear and to the side of the proposed dwelling. See Protection and Tree Impacts Plan in Appendix A.

4.3 SUDS Storage Calculations

Calculations have been prepared based on the Micro Drainage software package to assess the size of structure require, based on the following design criteria.

- Design event for storage - **100 year** (with climate change; see below)
- 100% of the roof area and impermeable areas + 10% = 150m²
- Climate change allowance - **40%**
- Use 1.0 l/s (lowest appropriate technically for pipe restriction)
- The storage calculation output is included within Appendix C.
 - o Storage required: 3.0m³

4.4 SUDS Specifications: SUDS Hierarchy Compliant

Formal SUDS Type	Source Control	Dimensions	Storage Volume
Porous amenity areas	Yes	n/a	n/a
Permeable Paving Access & Parking Area	YES	n/a	n/a
Planter with direct connection from RWP and integrated void storage No connection to sewer required (offline arrangement): hence this also reduces volume reaching the sewer not just restricting the rate	YES	Rear Rain Garden Planter 3.1m length 0.4m width Use 0.4m integrated void storage = 0.49m ³	0.49m ³
Planter with direct connection from RWP and integrated void storage Connection to sewer required	YES	Side Rain Garden Planter 3.6m length 0.4m width Use 0.4m integrated void storage = 0.58m ³	0.58m ³
Permeable Parking Area with extra depth Granular Storage Subbase Type 3 No Fines Lined Storage	YES	Use the 2 car parking areas = 12.25m ² x 2 = 24.5m ² Use 0.3m depth subbase of Type 3 No Fines = 7.35m ³ Assume only 30% void ratio = 2.20m ³	2.20m ³
		Total	3.27m ³ Greater than the already significantly oversized 3.0m ³ required
Permeable Parking Area with extra depth lined Cellular Storage	YES	Use the 2 car parking areas = 12.25m ² x 2 = 24.5m ² Use 0.2m depth Cellular Crate System = 4.9m ³ Assume only 95% void ratio = 4.65m ³	4.65m ³ Greater than the already significantly oversized 3.0m ³ required

The indicative layout plan included within Appendix B shows locations for the SUDS structures.

4.5 Planter Specifications

Off the shelf with integrated 0.4m void.

See Planting specification in Appendix B.

4.6 Green Roofs

The nature of such a lightweight and pitched roof structure means that green roofs are not suitable as they would in fact increase the embodied carbon without a commensurate increase in sustainability / future proofing.

The SUDS strategy has also been done in this way so there is no reliance on an unknown to demonstrate compliance.

4.7 Pipe Sizes / Manholes / Pipe Runs

The pipe sizes, runs, inverts and manholes will be undertaken to Building Regs and British Standards.

The locations shown in AppB have been determine with the design and construction team.

The exact locations will be confirmed as part of the on site works, contractor specifications / methodologies and also Manufacturer specifications.

The cellular specification has been suggested as Wavin, but there are lots of off the shelf specifications available; given the supply chain issues and changing prices / availability of materials and resources, it is not appropriate to specify an exact manufacturer, nor is it necessary given this is not a novel of complex system.

The point of this detail design stage is to verify the storage can be incorporated; the specifications are correct and will be installed and maintained.

4.8 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 will be the responsibility of the owner / management company. A SUDS maintenance schedule is included within Appendix D.

4.9 Sequencing / Implementation

Given the site is a vacant plot, dependent on the final contractor construction layout, the temporary phase / construction surface water management can rely on:

- Water Company final connection details
- Install as per water company requirements (water company contractor / preferred contractor)
- retaining as much existing porous surface on the site
- porous areas will need to be retained due to the Root Protection Zones and Protection Plan from the Arboricultural Impact Assessment
- minimizing the area of on-site storage and site compound
- secure container style site office / welfare facilities will have appropriate temporary surface water drainage incorporated (including pollution control)

APPENDICES

APPENDIX A

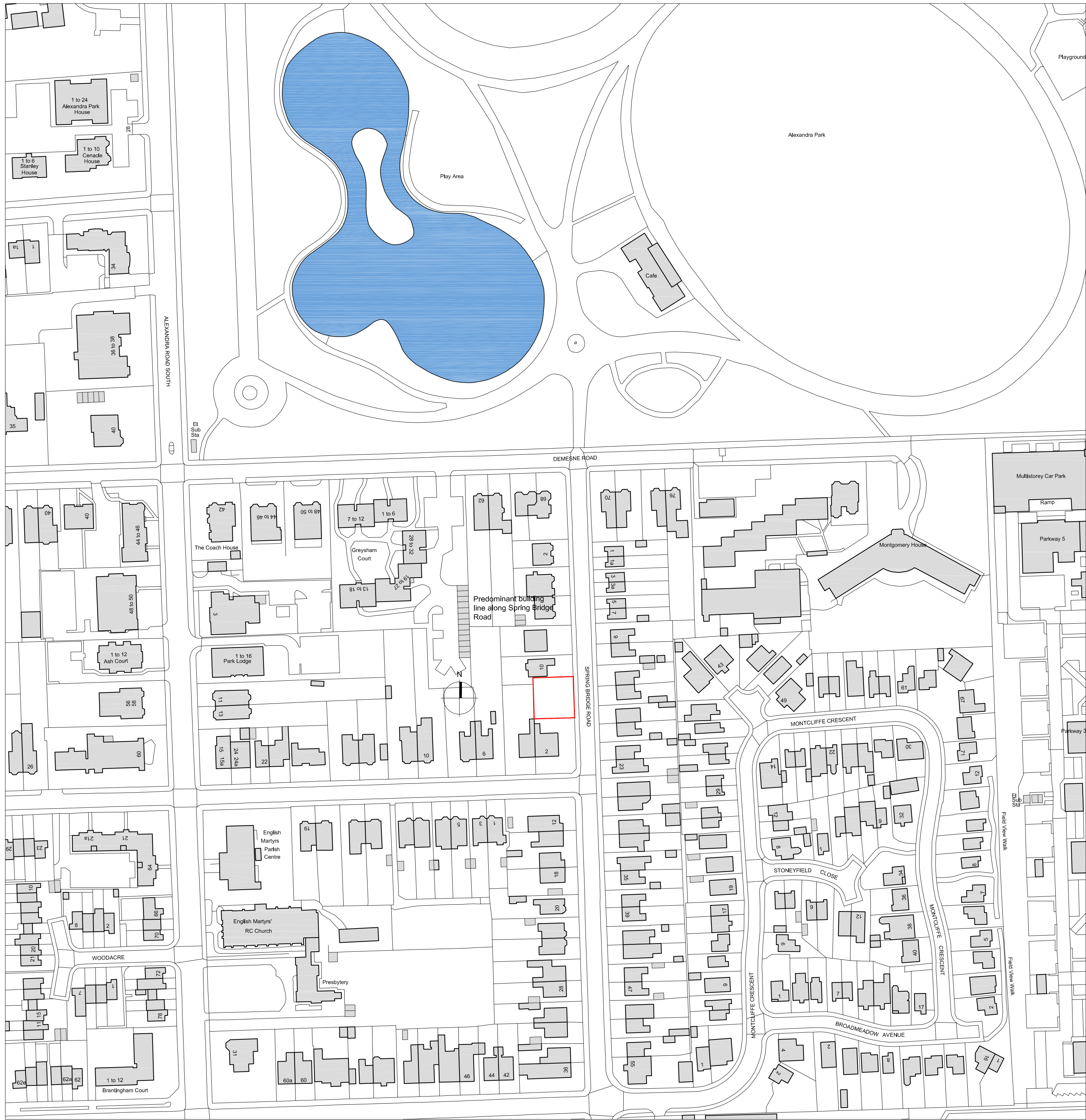
All dimensions are to be checked on site, any discrepancies are to be reported to the Architect before work commences. Do not scale from this drawing.

This drawing is to be read in conjunction with all relevant consultants and specialists drawings / documents, any discrepancies are to be reported to the Architect before the affected work commences.

All structural components shown are indicative only. Details / calculations of structural members are to be provided by the Structural Engineer.

This drawing is copyright.

A	First Issue	30/06/2021
B	General Amendments	28/07/2021
C	Design Amendments	09/08/2021
D	Submission for Planning Application	25/11/2021



Location Plan 1:1250

Scale Bar 1:1250



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Client:

Mrs. S Zakir

Project:
Land Adjacent to 10 Spring Bridge Rd,
Manchester M6 8PL

Drawing Title:
Location Plan

Scale: 1:1250 @ A1 Date: June 2021

Drawing No: 9722/001 Revision: D

Tree Categories

Trees are categorised in accordance with the cascade chart in Table 1 of the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'

Category 'U' - Trees in such condition that they cannot realistically be retained as living trees in context of the current land use for longer than 10 years.

Category 'A' - Trees of high quality with an estimated remaining life expectancy of at least 40 years.

Category 'B' - Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.

Category 'C' - Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.

Root Protection Area

In order to avoid damage to the roots or rooting environment of retained trees, the Root Protection Areas (RPAs) should be plotted around each of the category A, B and C trees. This is a minimum area in m² which should be left undisturbed around each retained tree.

The RPA is calculated using the British Standard BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'.

The calculated RPA is capped to 707m², which is the equivalent to a circle with a radius of 15m. Where there appears to be restrictions to root growth the root protection area is reshaped to more accurately reflect the likely distribution of the roots.

Note: No unauthorised excavations are to be carried out within the RPAs of any retained trees. Any level changes must form part of a construction method statement & must protect the rooting environments of all retained trees.

The site plan illustrates the proposed dwelling and its relationship to existing trees and their Root Protection Areas (RPAs). The dwelling footprint is shown in the center, with internal rooms labeled: Kitchen, Dining, Living Room, Utility, and Stairs. A purple outline indicates the area where foundations are to be excavated, which is partially within the RPA of tree T1. Tree T1 is a large tree to the southwest, T2 is a medium tree to the west, and T3 is a small tree to the northeast. Group G1 is a cluster of trees to the east of the dwelling. The RPAs are shown as green outlines, with dashed red lines indicating the 15m circular boundary. A scale bar at the bottom indicates distances from 0m to 20m. A north arrow is located in the top right corner.

Issue: Proposed dwelling is partially situated within the RPA of tree no. T1
Solution: Foundations within the are to be excavated under arboricultural supervision.

A north arrow pointing towards the top right of the page, with a scale bar below it. The scale bar is marked with 0, 1, 3, 5, 10, 15, and 20 meters. The text 'Indicative only' is written below the scale bar.

Arboricultural Impacts

Impacts	Nos. of trees
Trees to be removed	0
Groups / Hedges to be removed (Partial removal of groups)	0 (0)
Trees with proposed incursions into RPAs	1
Groups / Hedges with proposed incursions into RPAs	0
Trees that will require pruning	0
Groups / Hedges that will require pruning	1
Trees to be transplanted	0
Groups / Hedges to be transplanted	0

No.	Species	Proposed structure	Incursion
T1	Sycamore	Dwelling	RPA

Tree Work Schedule

No.	Species	Works	Category
G1	Cherry laurel	Prune back to boundary	C1

All tree work is to be undertaken in accordance with British Standard BS 3998:2010 Tree work - Recommendations.
All arising's are to be removed and the site is to be left as found.
Care is to be taken of the ground around retained trees to make sure that it does not become compacted as a result of tree surgery operations. No equipment or vehicles such as timber lorries, tractors, excavators or cranes shall be parked or driven beneath the crowns of any retained trees, to prevent subsequent compaction and root death.

No. of individual trees to be removed

U	A	B	C
0	0	0	0

No. of groups / hedges to be removed

U	A	B	C
0 (0)	0 (0)	0 (0)	0 (0)

() = Partial removal of a groups

Arboricultural Method Statement

All tree work is to be undertaken in accordance with British Standard BS 3998:2010 Tree work - Recommendations.
Please refer to Arbtech Consulting Ltd. Tree Schedule, Arboricultural Method Statement and Tree Protection Plan, for full details of all surveyed trees and how all aspects of the development may be implemented without detriment to retained trees.

ARBTECH

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Project:

Land adj 10 Spring Bridge Road, Whalley Range, Manchester, M16 8PL.

Client:

Dr Zakir Khan

Drawing:

Arboricultural Impact Assessment

Based on:

9722-101 Rev D

Drawing No:

Arbtech AIA 01

Rev:

Date:

Jan 2022

Scale:

1:100 @ A1

Drawn:

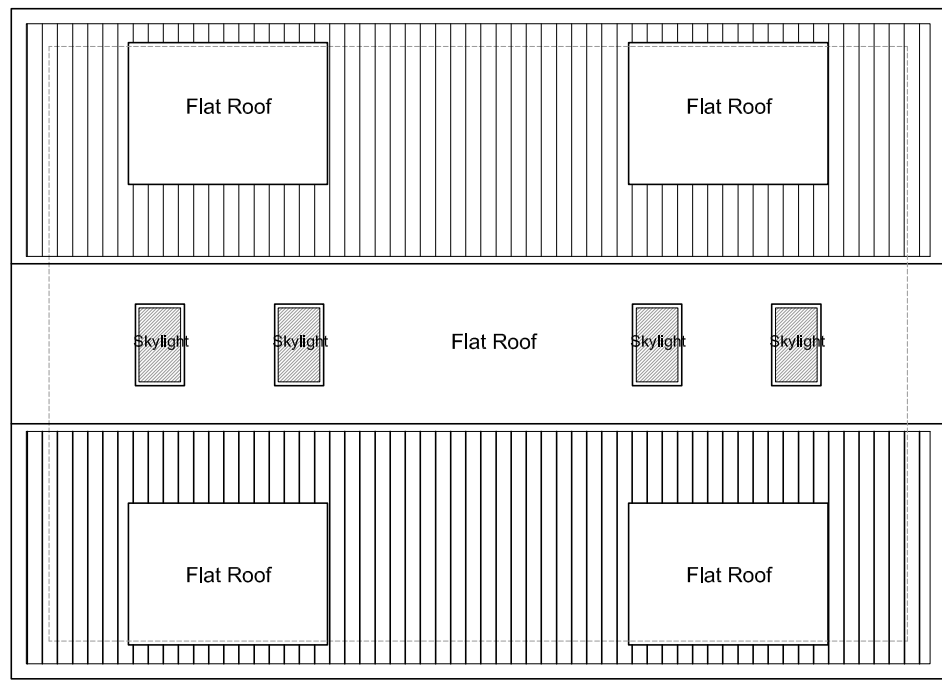
AST

Key:

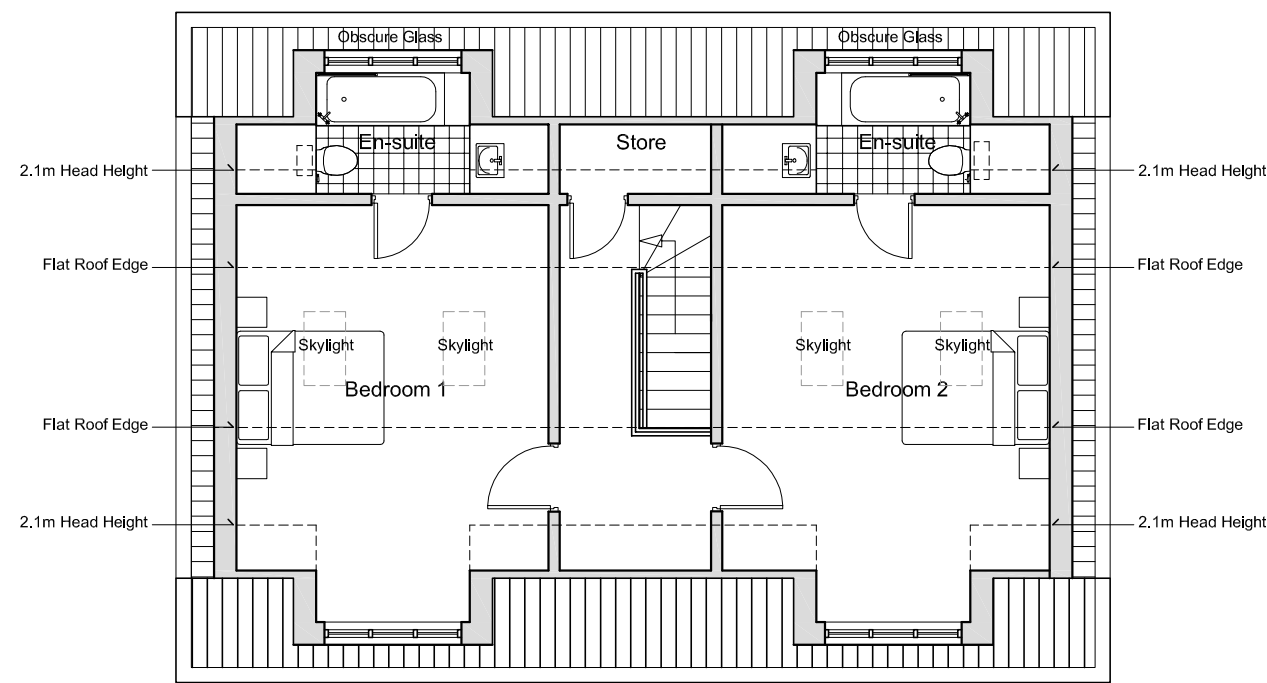
Tree Nos.:	T1	Tree Canopies:		Trunks:	
RPAs:		Category 'B' trees:		Category 'C' trees:	
Category 'C' groups:		Incursion - Structures:			

All dimensions should be checked on site. No dimensions are to be scaled from this drawing.
Please verify use of any discrepancies found. Arbtech Consulting Ltd. cannot be held responsible for inaccuracies in the base drawing in which this plan is based.
This drawing is designed to reflect the principles of the layout or design only, and relates only to the protection of retained trees.
This drawing is not to be read as a definitive part of the engineering or construction designs or method statement.
An architect or structural engineer should be contacted over any matters of construction, detailing or specification and for any standards or regulatory requirements relating to proposed structures, their siting or underground services.
This drawing was produced in colour - a monochrome copy should not be relied upon.

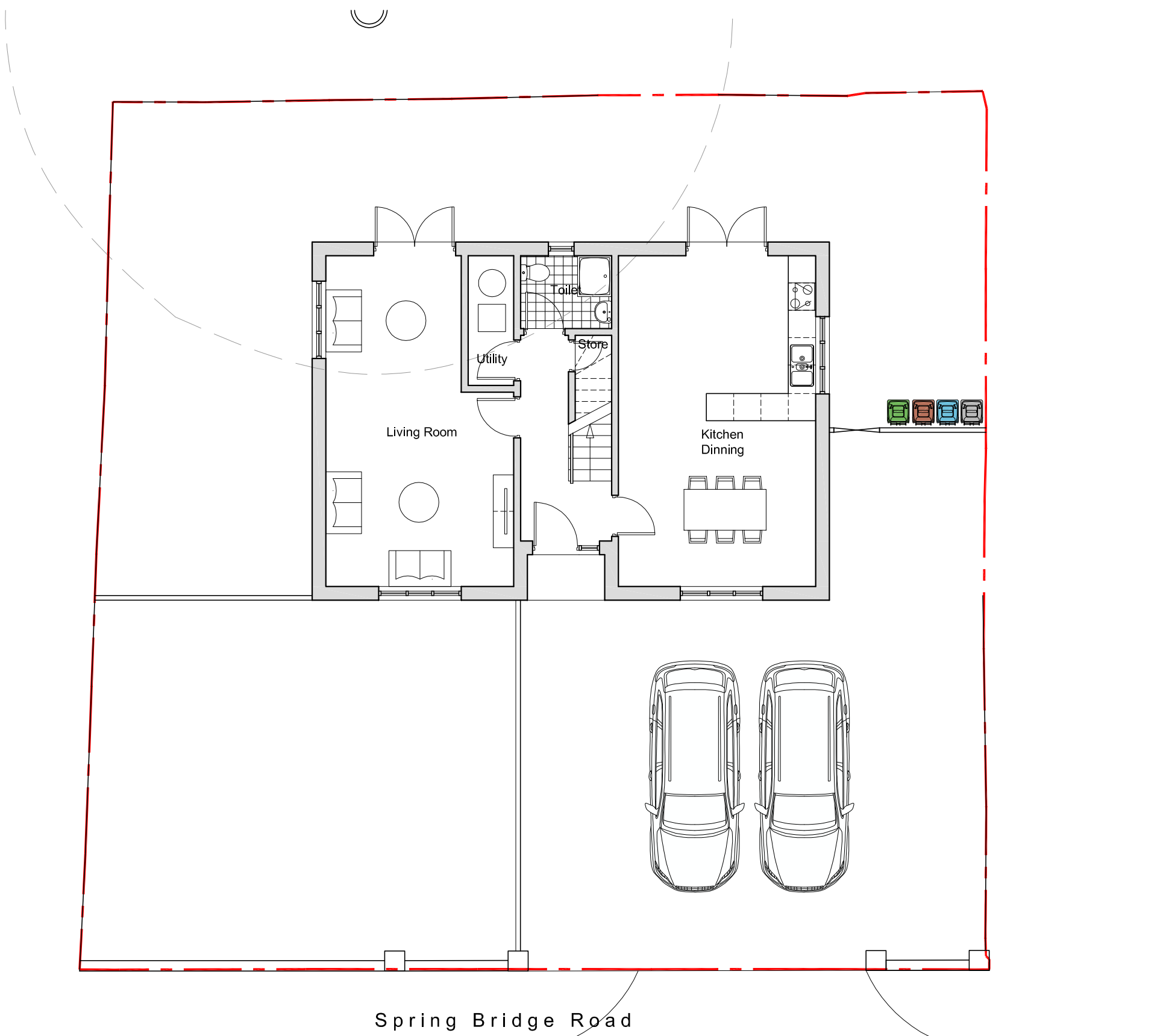
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Proposed Roof Plan 1:100



Proposed 1/F Plan 1:100



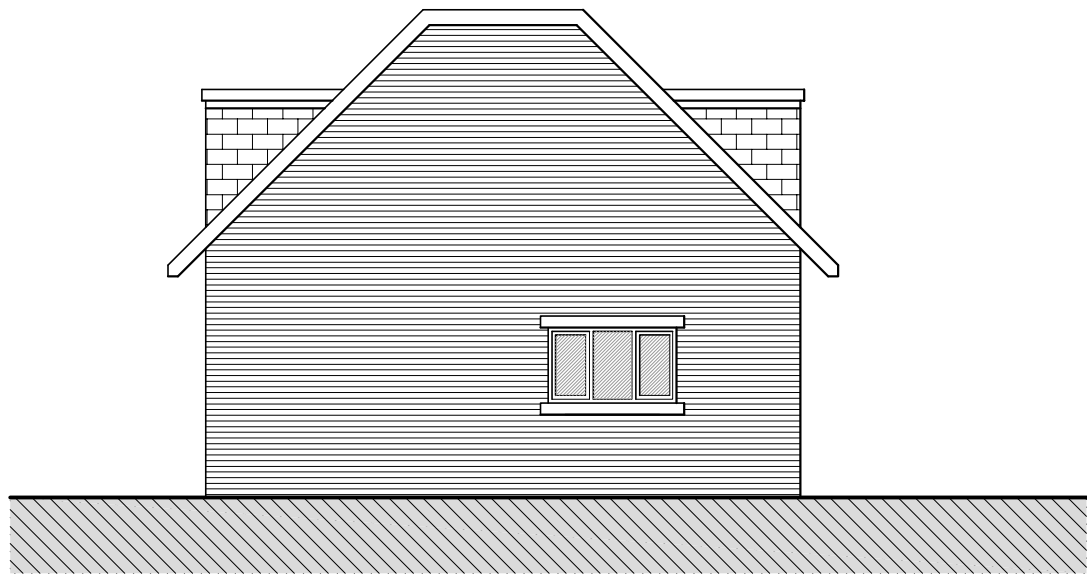
Proposed G/F Plan 1:100

Scale Bar 1:100

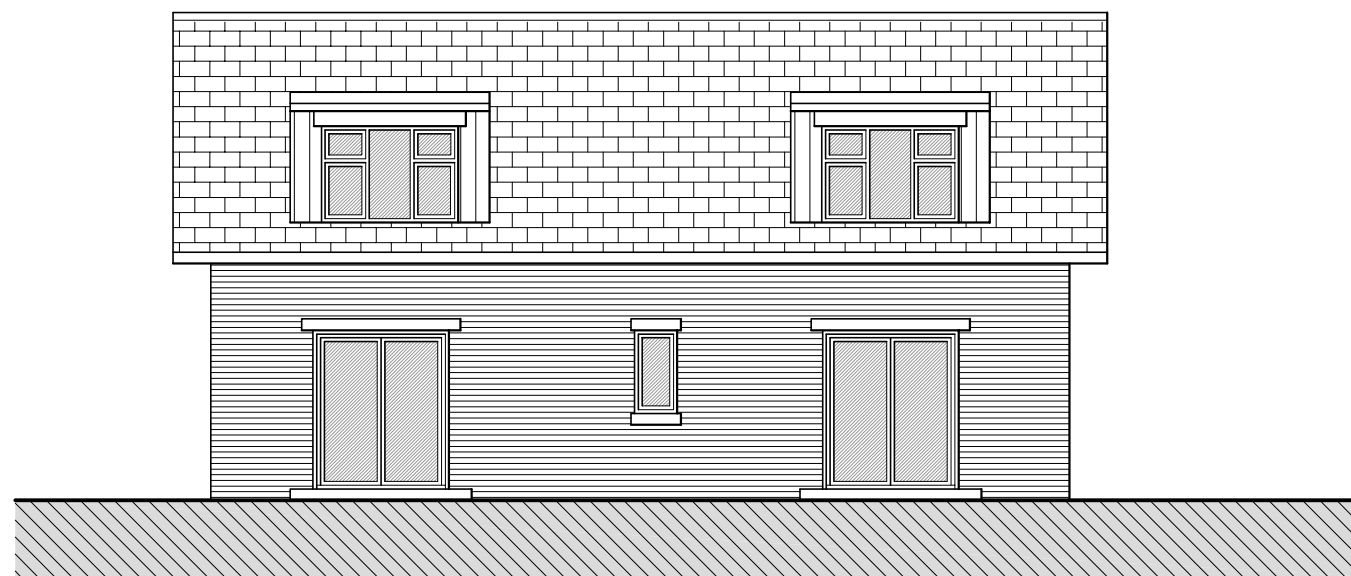
0 5 10m



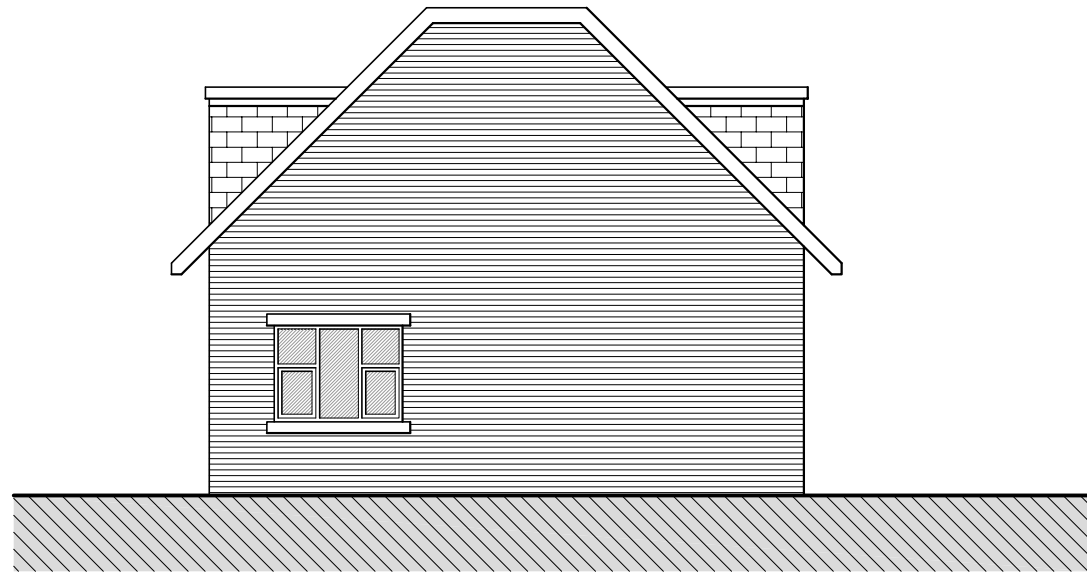
Proposed Spring Bridge Road Elevation 1:100



Proposed North Elevation 1:100



Proposed Rear Elevation 1:100



Proposed South Elevation 1:100

APPENDIX B

Surface Water Drainage				
Manhole No.	Invert (Metres bgl)	Type	Cover Size	Internal
SW01 (new)	0.2	B	450	450
SW02 (new)	0.3	B	450	450
SW03 (new)	0.2	B	450	450
SW04 (new)	0.4 - 0.6	A	600x600	1200
Final Manhole As Existing	tbc	tbc	tbc	tbc

MANHOLE TYPES

A: PC MANHOLE UNITS TO BS 5911 PART 200 KITE MARKED

B: POLYPROPYLENE INSPECTION CHAMBER-450 dia

POLYPROPYLENE INSPECTION CHAMBERS TO BE MANUFACTURED BY HEPWORTH OR SIMILAR APPROVED

All downpipes and gulleys to be roddable

This planter does not require connection as it will overflow naturally over the permeable patio area / grassed area .

Blue Solid Line Box: SUDS Formal Storage

Granular Storage lined (non-soakaway with overflow to sewer): storage and Source Control to address SUDS hierarchy.

Oversized storage to meet NPPF.

Refer to report for calculations and dimensions.

OR

Cellular Storage to maximise the storage if it is a combined connection.

Inspection chambers for overflow connections (if required)

Note: there will be catch / silt traps on all connections prior to communication with SUDS underground storage features

Orange Dashed Outline: SUDS Formal Storage

Rain Garden Storage: direct connection from RWP: storage and source control to address SUDS hierarchy.

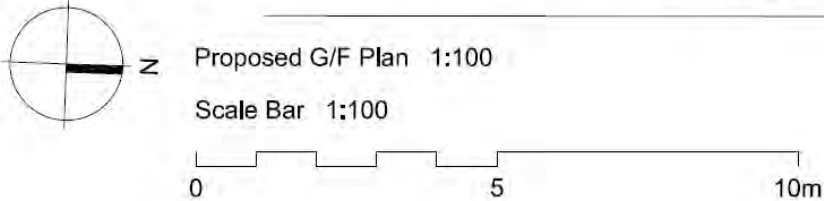
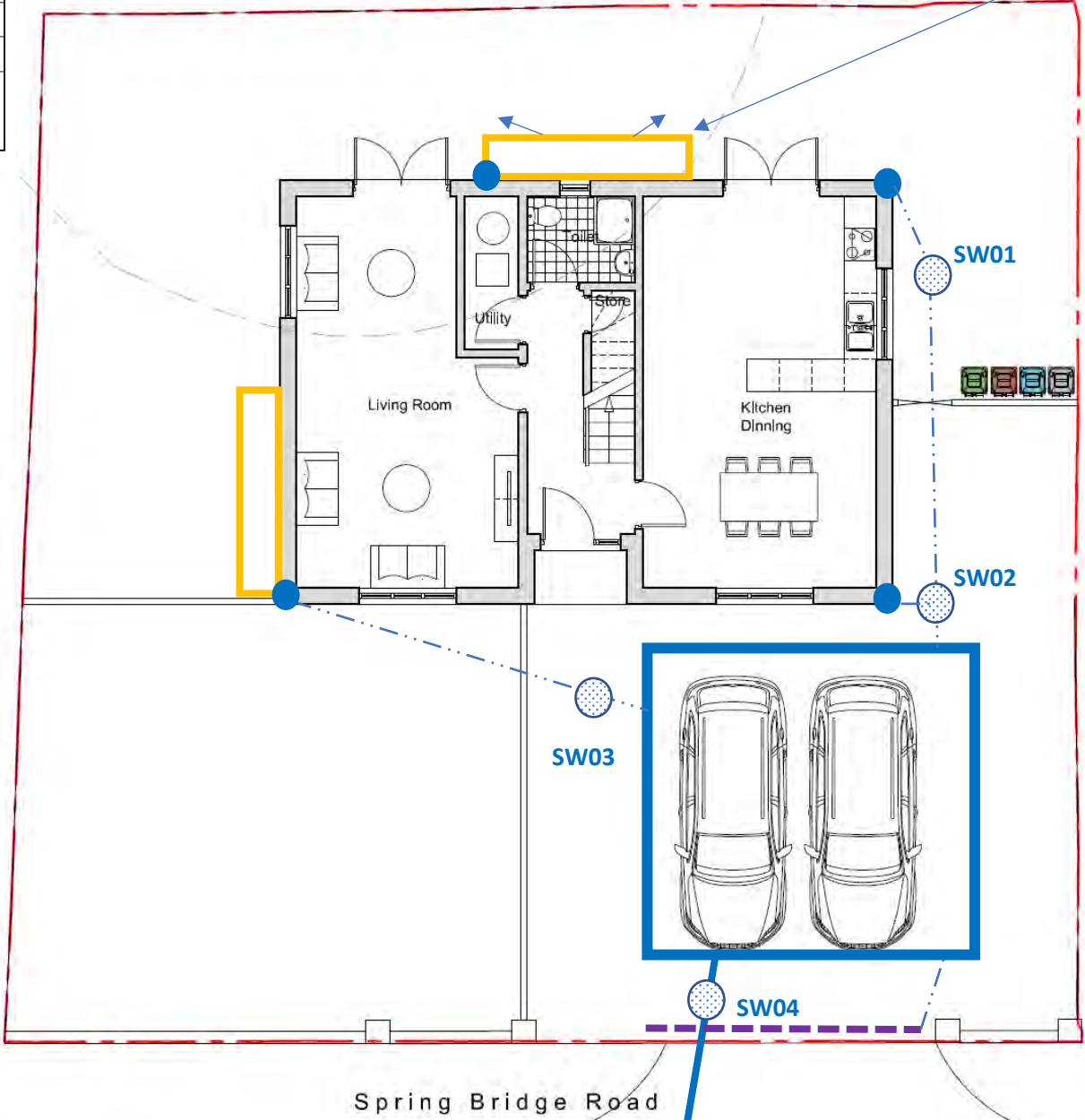
Blue Filled Circles

Rainwater Downpipe Locations

Either direct connection to Source Control SUDS or fitted with Diverter to discharge over rain garden planter

Purple Dashed

Aco- Drain for Permeable Areas



Connection subject to Sec 106 with Water Company

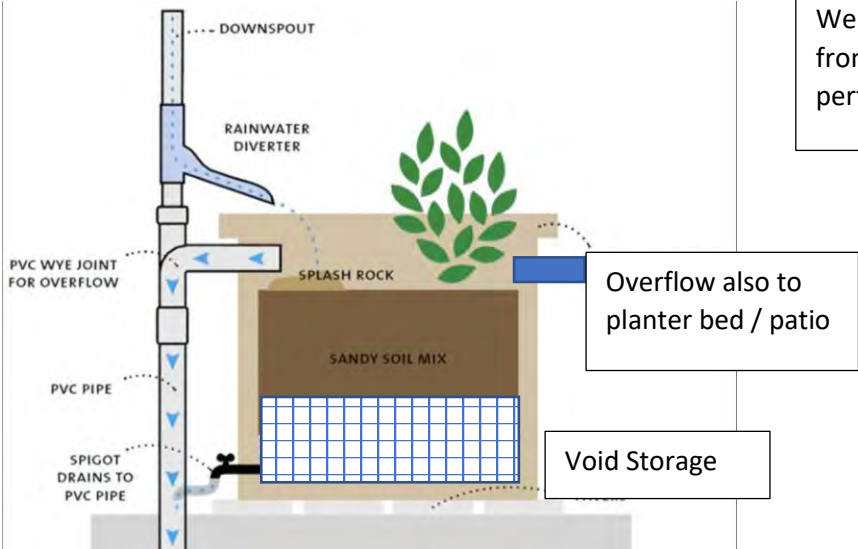
United Utilities do not allow connection from online Source Control SUDS to the combined sewer



Example Planters and Mechanisms for Connection

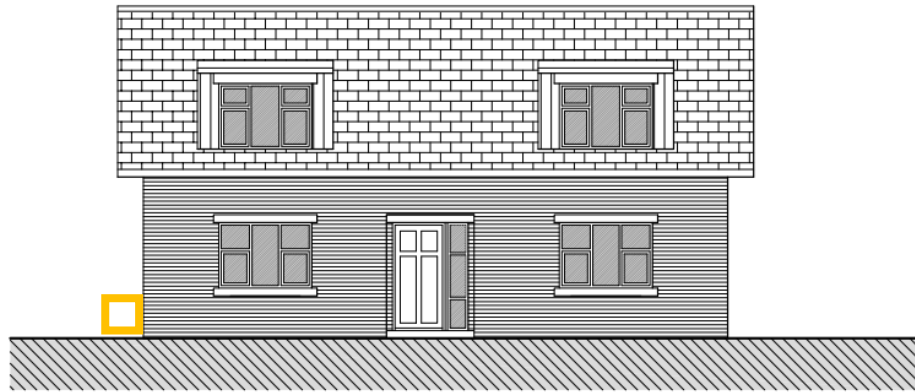
There are many off the shelf versions; client aesthetic requirements can confirm the exact specification; it is not necessary to commit to a type or design.

We include the exact specifications from one company to demonstrate the performance achievable

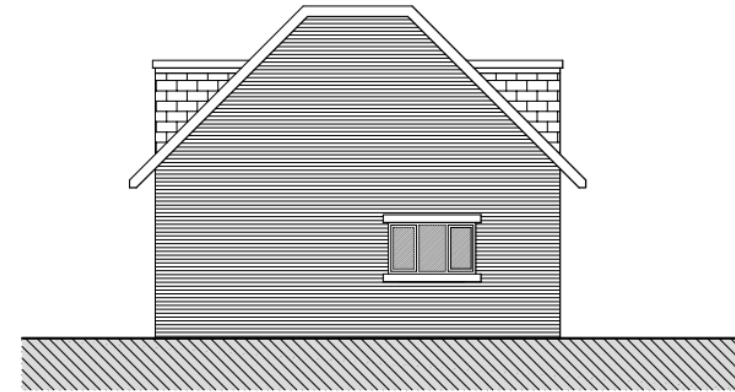


Example Diverter

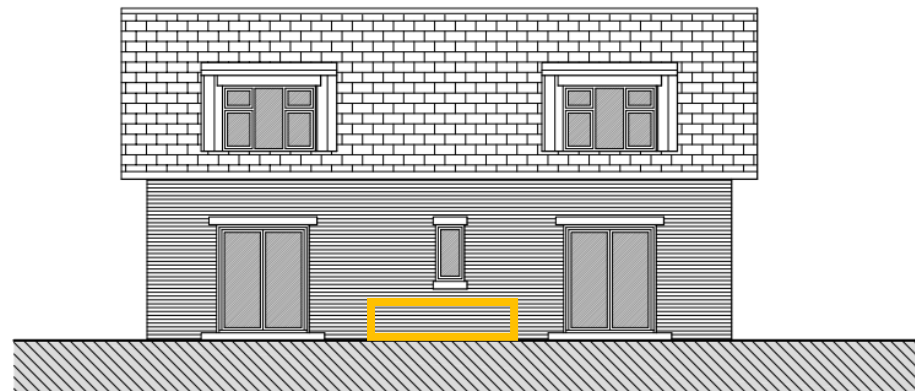
There are many off the shelf versions; client aesthetic requirements can confirm the exact specification; it is not necessary to commit to a type or design.



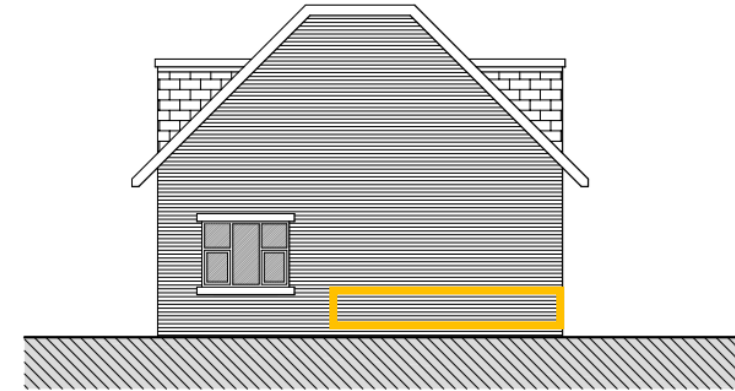
Proposed Spring Bridge Road Elevation 1:100



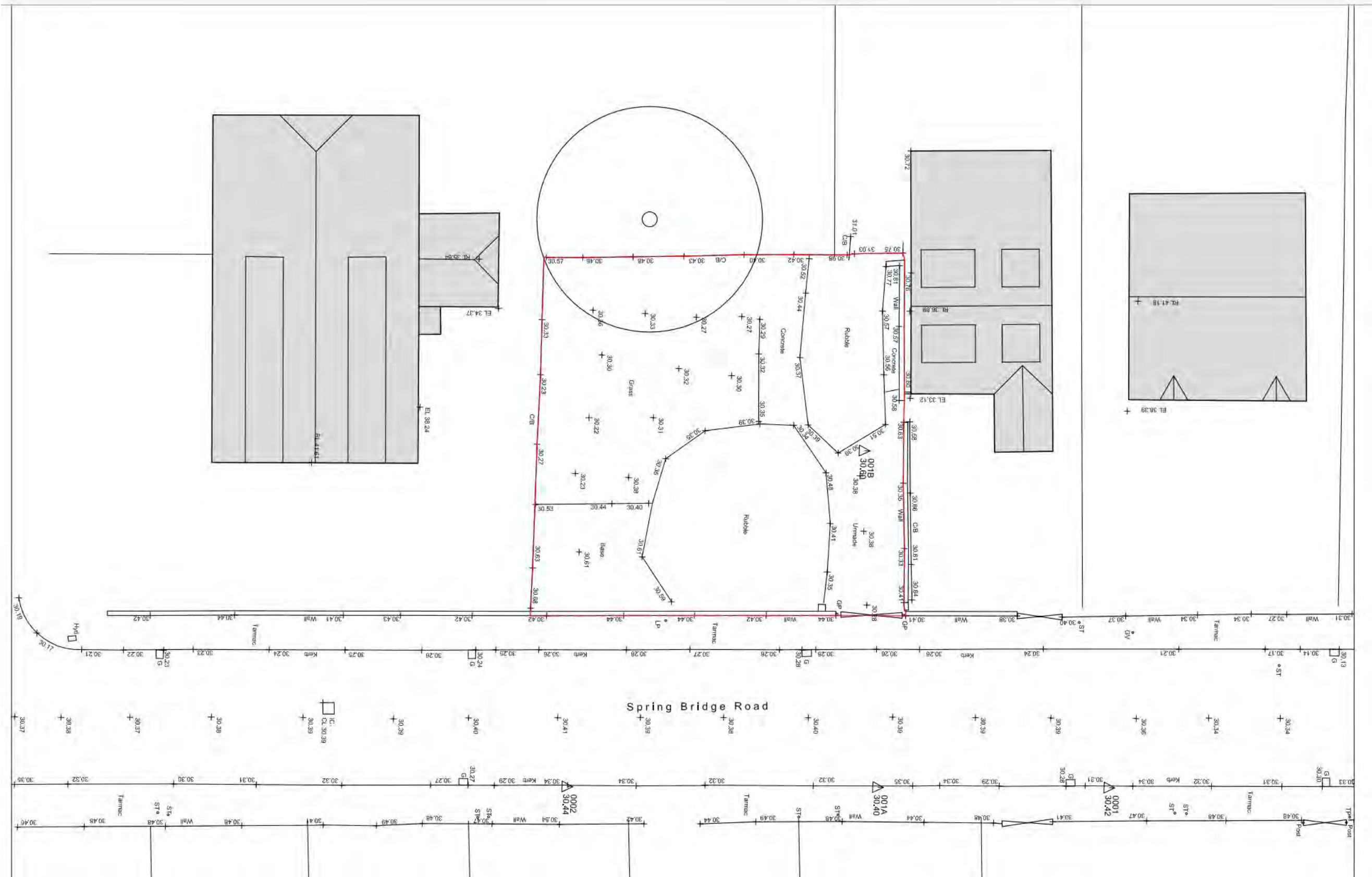
Proposed North Elevation 1:100



Proposed Rear Elevation 1:100



Proposed South Elevation 1:100

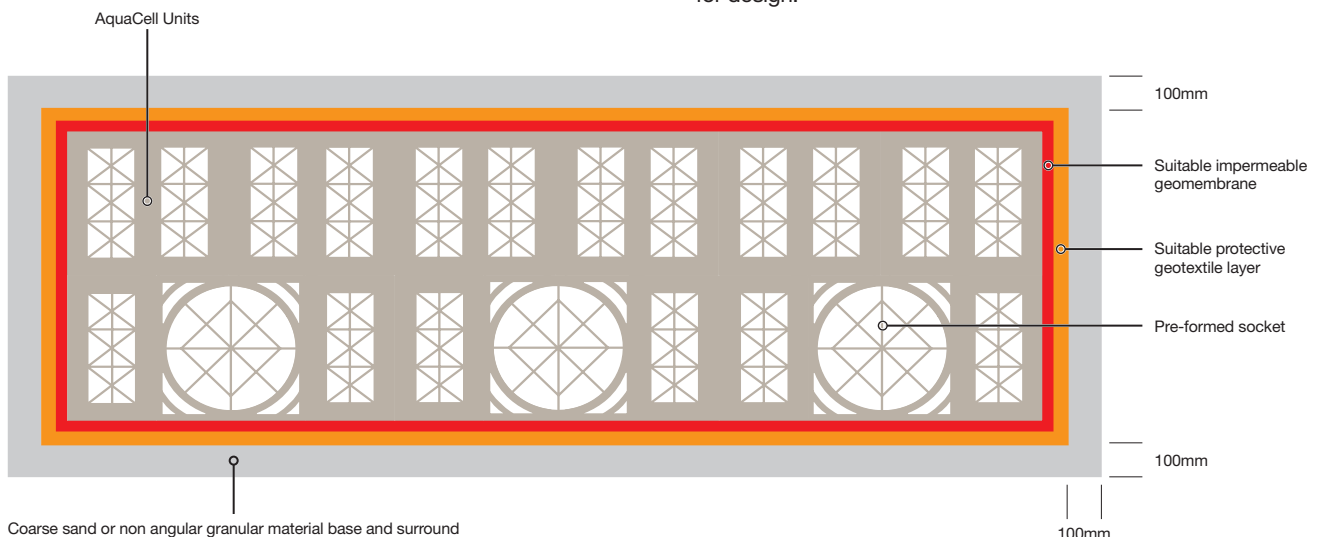


Typical Storage Tank Installation Method

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.



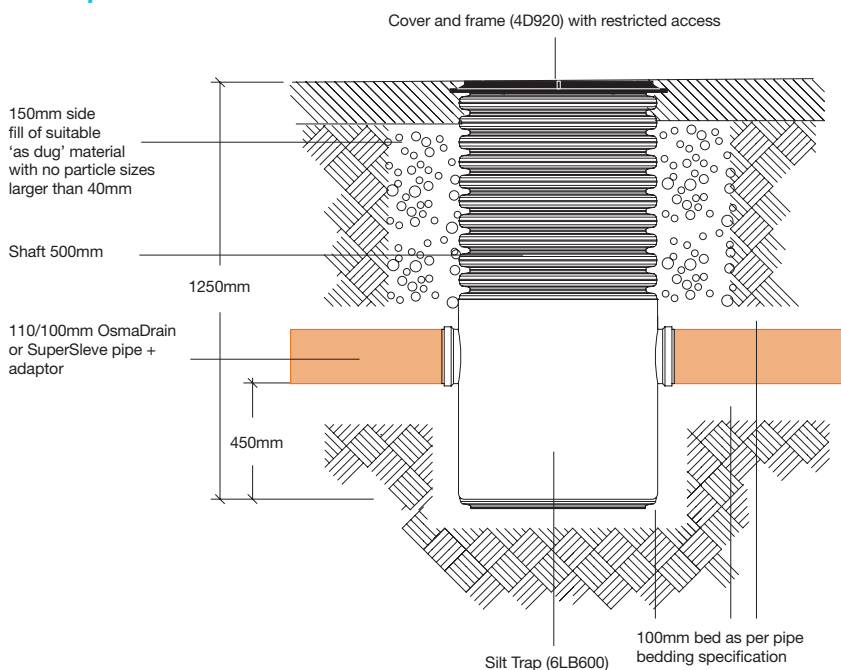
Example shows the use of AquaCell Prime. However, a storage tank can also be installed as shown using any of the other versions of AquaCell units (Eco, Core or Plus) as appropriate.

**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

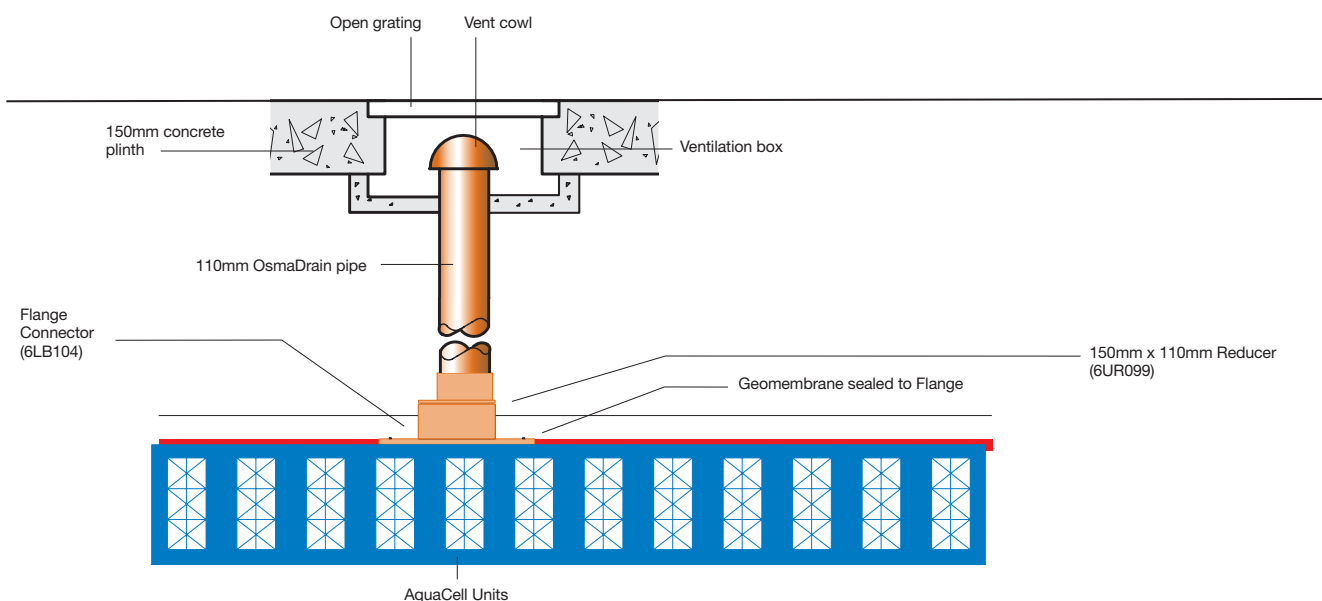


Typical installation procedure

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.

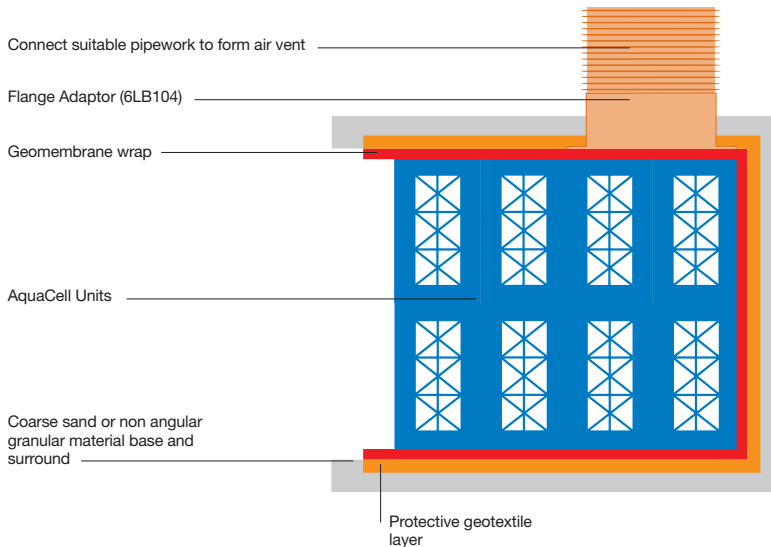
Adhesive or double sided tape should be used between the geomembrane and the flange plate to ensure a watertight seal.

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.

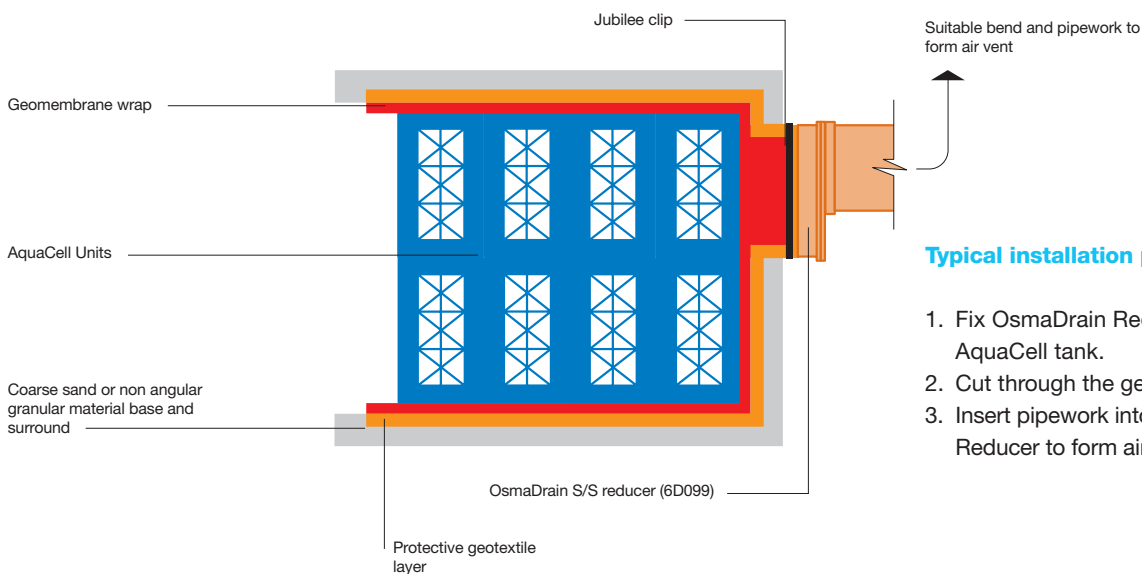


Typical installation procedure

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

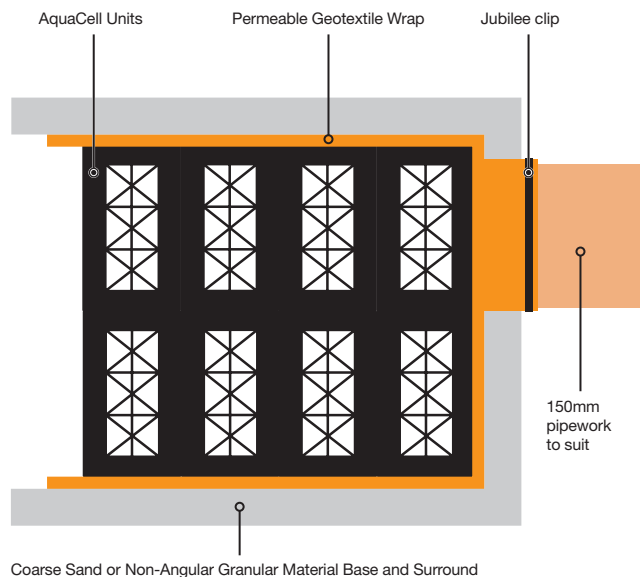
Connect into the side of the AquaCell tank unit using standard Reducer.



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

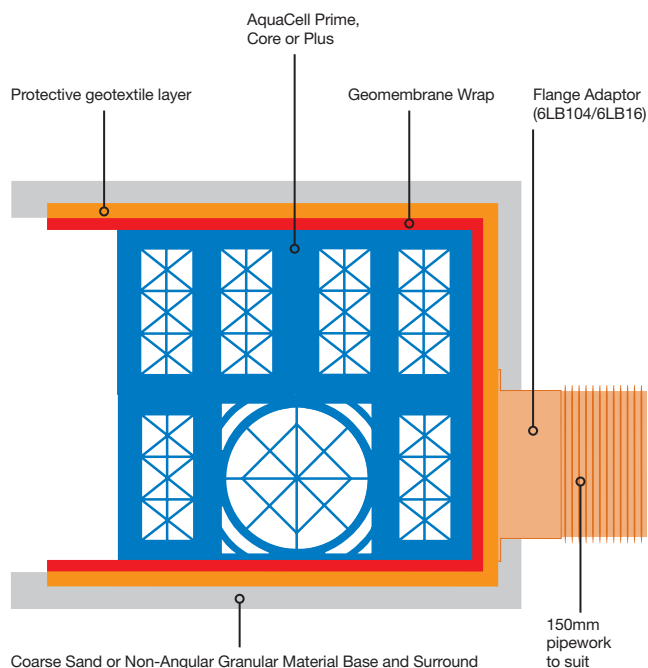


Connections to AquaCell Units

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 SuperSleeve 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.

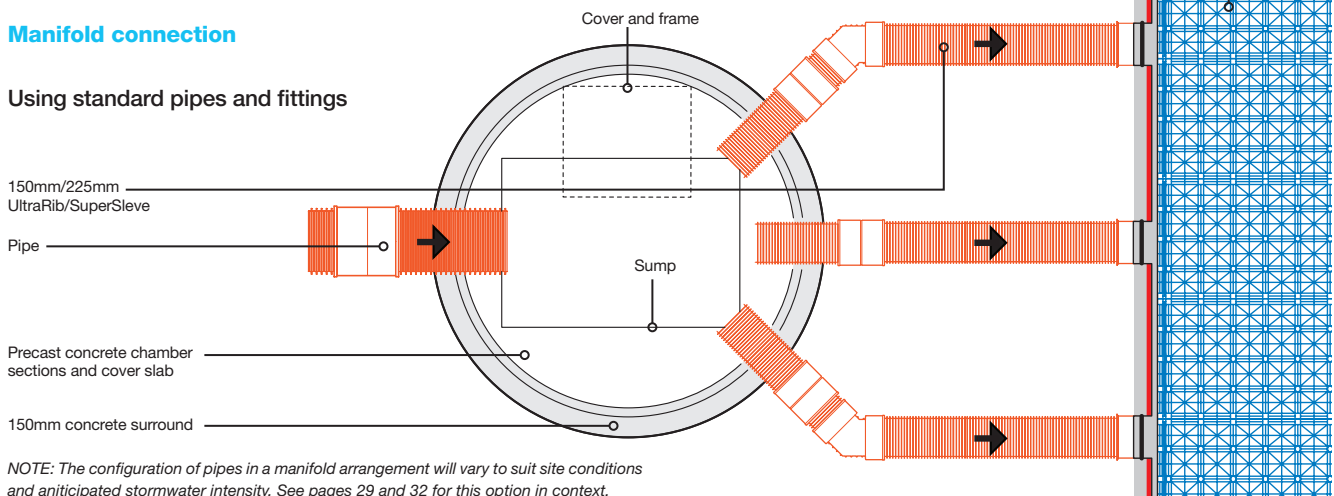
*NOTE: AquaCell Eco is not suitable for side connection using a Flange Adaptor.

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.

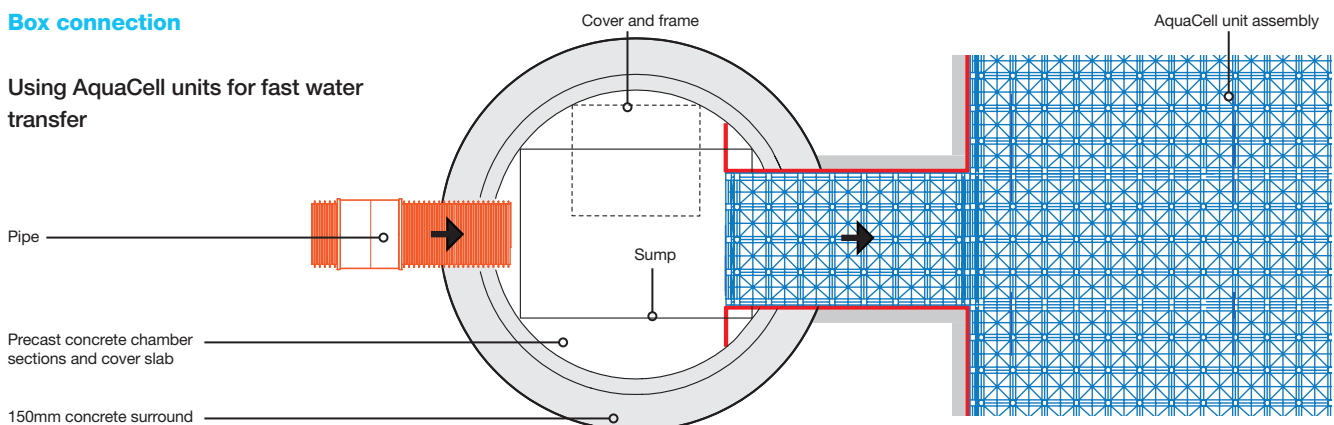
Manifold connection

Using standard pipes and fittings



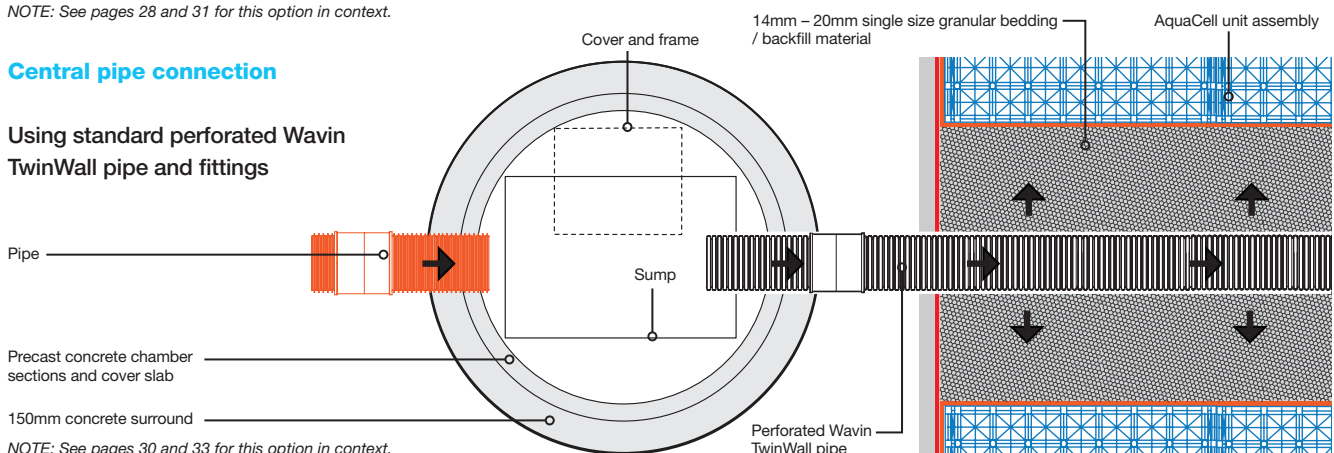
Box connection

Using AquaCell units for fast water transfer



Central pipe connection

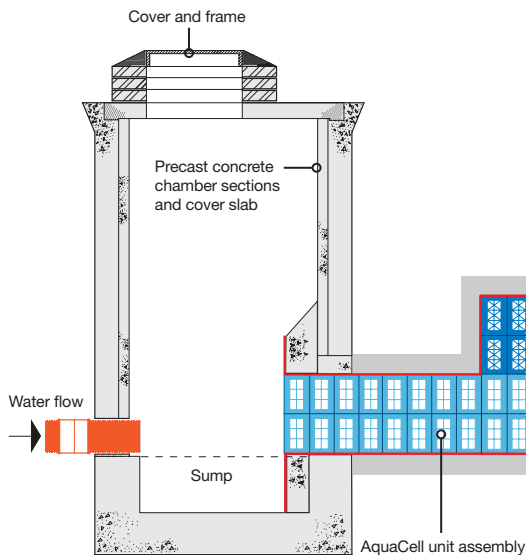
Using standard perforated Wavin TwinWall pipe and fittings



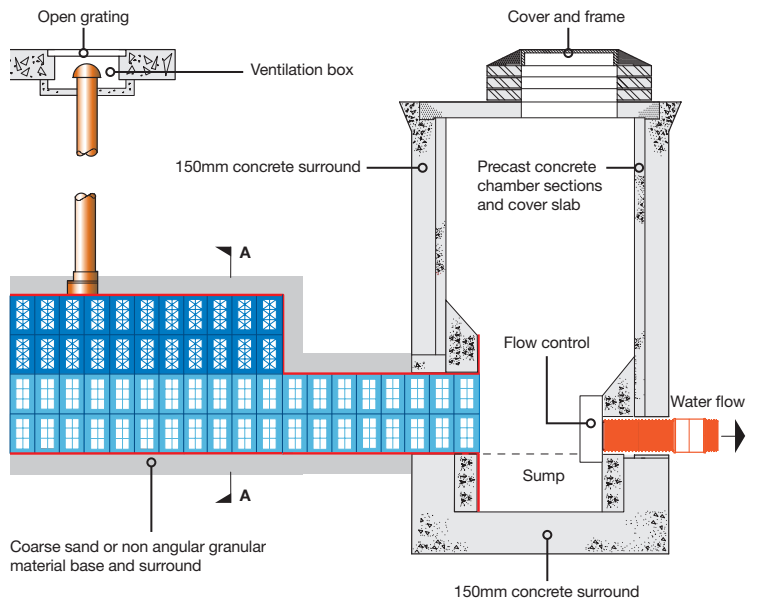
Typical Details AquaCell Units

On-Line Storage – Box Feed

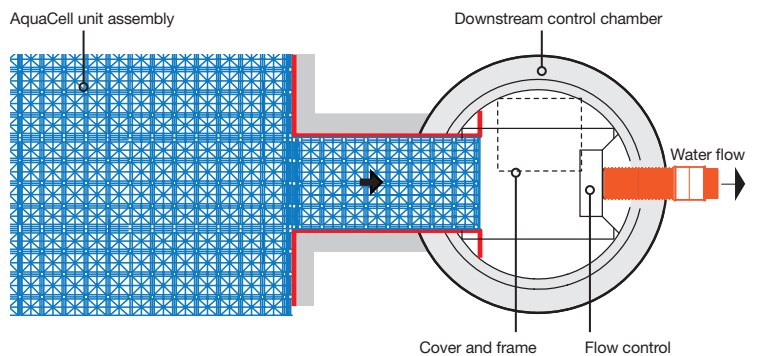
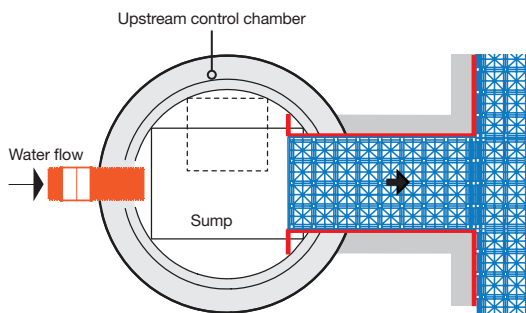
Long section



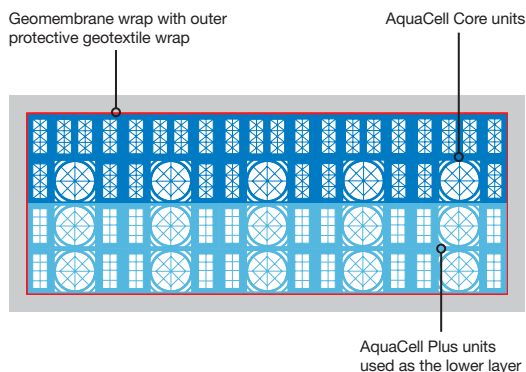
Typical vent detail



Plan



Cross section A-A

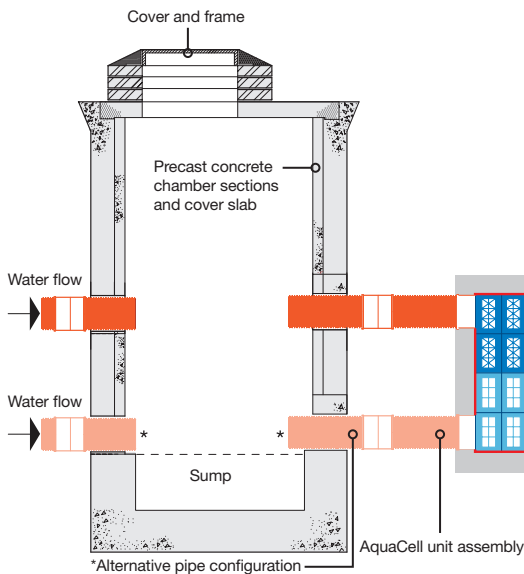


What happens to the water?

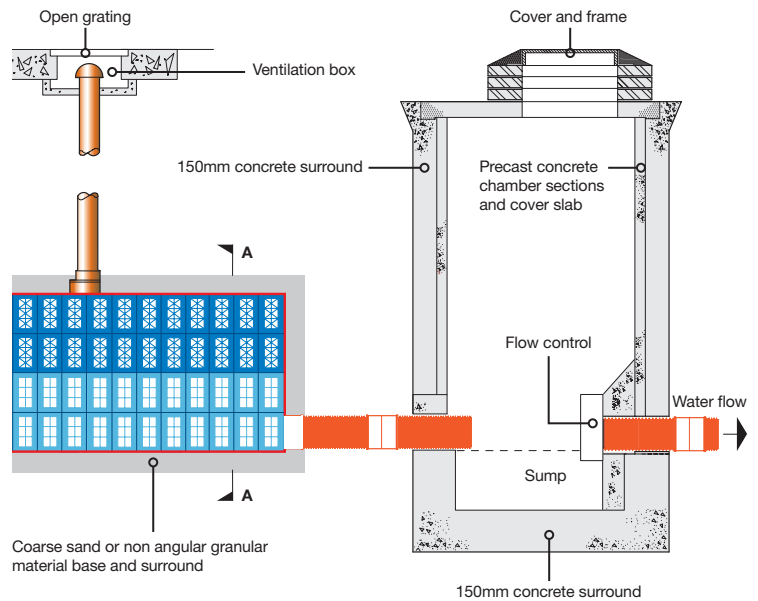
1. The water level in the upstream control chamber rises.
2. Then, during a storm event, the AquaCell storage assembly quickly fills with water via the AquaCell feed connection.
3. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and into the downstream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

On-Line Storage – Manifold Feed

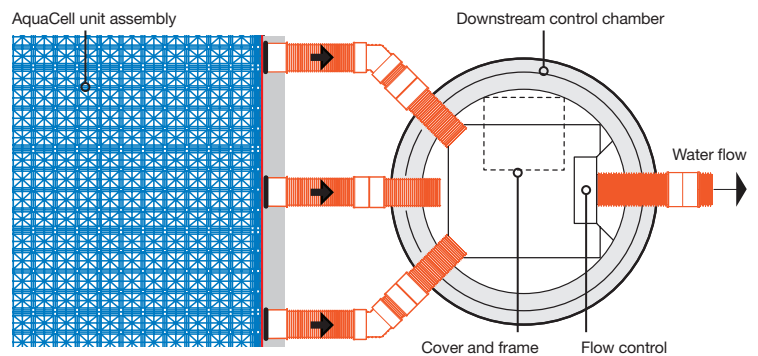
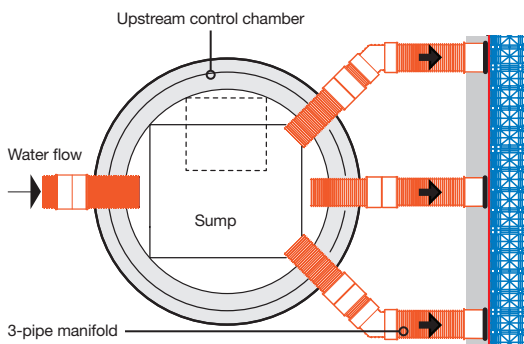
Long section



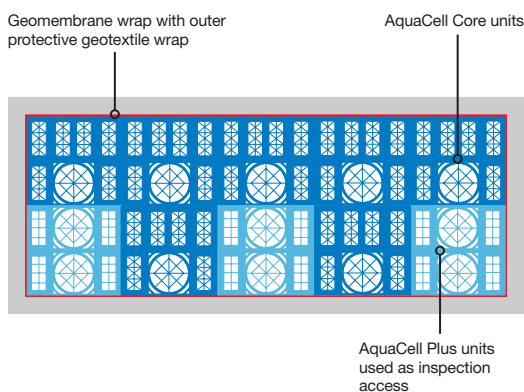
Typical vent detail



Plan



Cross section A-A



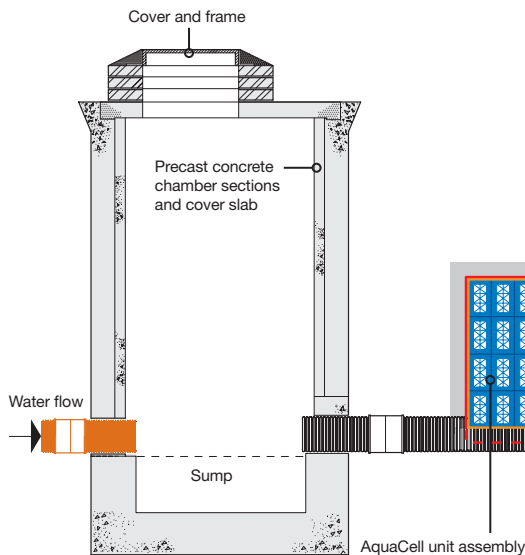
What happens to the water?

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.

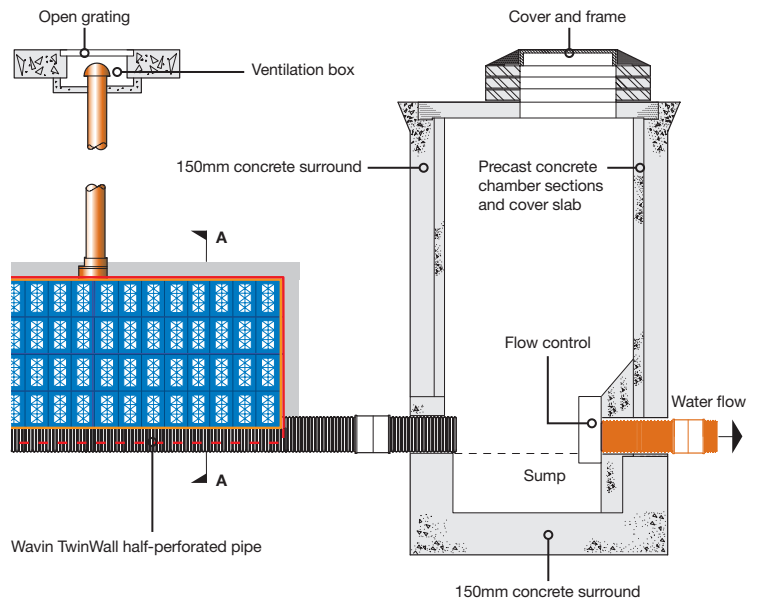
Typical Details AquaCell Units

On-Line Storage – Central Pipe Feed

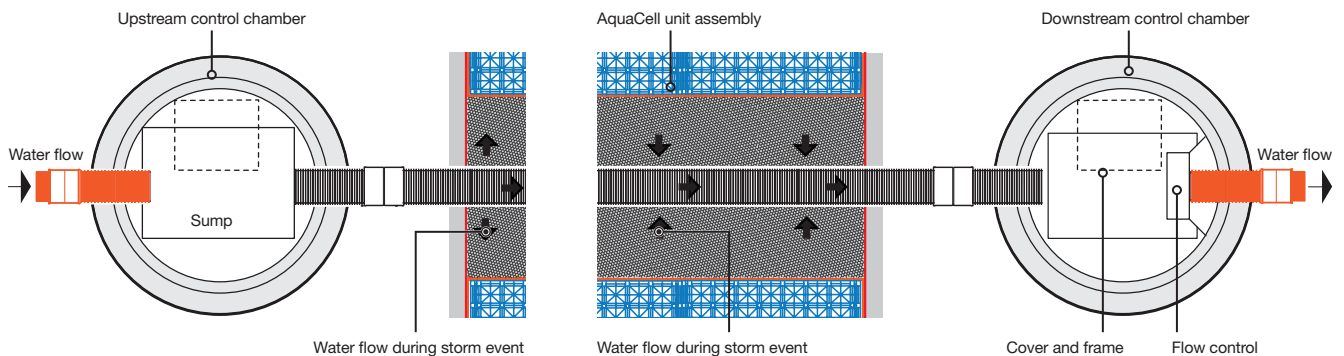
Long section



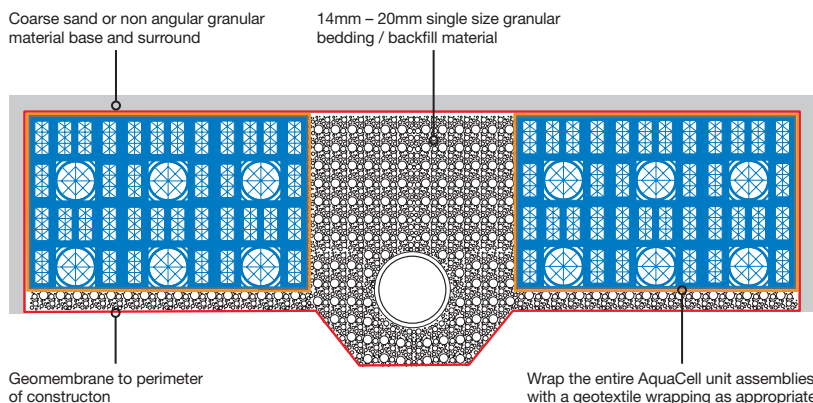
Typical vent detail



Plan



Cross section A-A

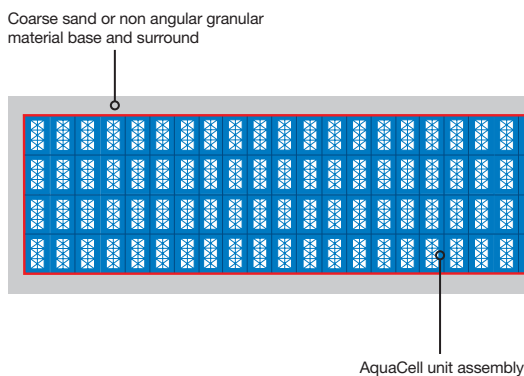


What happens to the water?

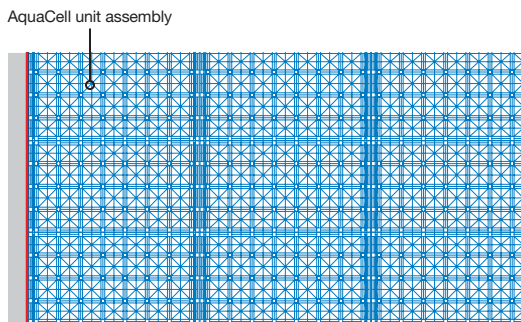
1. The water level in the upstream control chamber rises.
2. AquaCell storage assemblies fill with water via the central pipe connection and percolate's through the granular bedding material.
3. After storm event, water flows back out of the AquaCell storage assemblies, finding its own level, and into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

Off-Line Storage – Box Feed

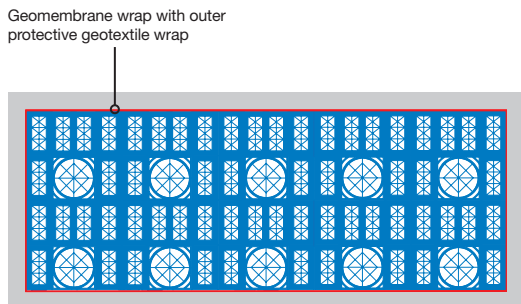
Long section



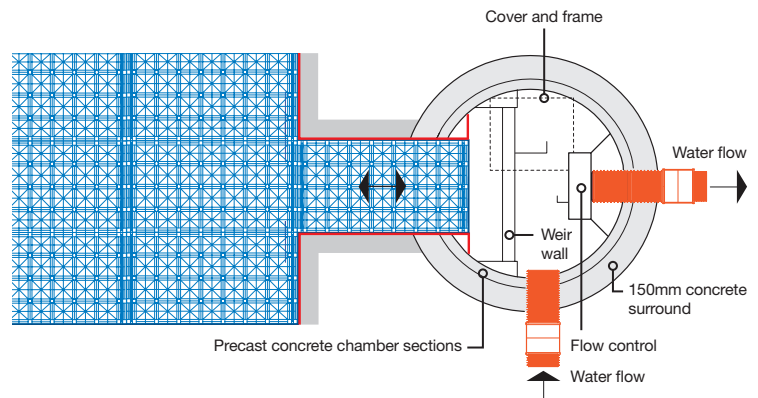
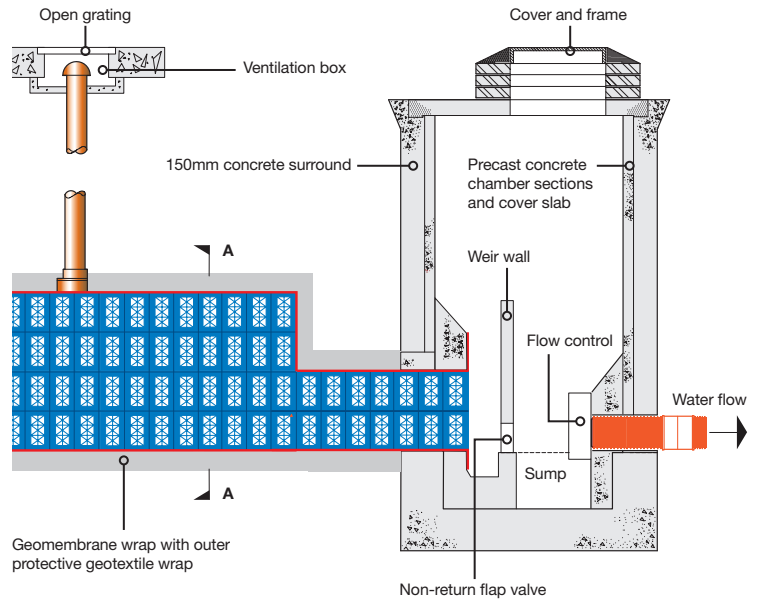
Plan



Cross section A-A



Typical vent detail



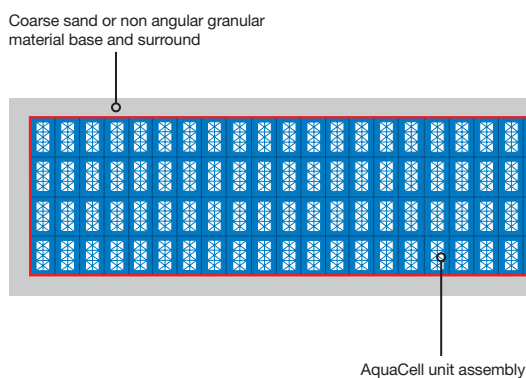
What happens to the water?

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.

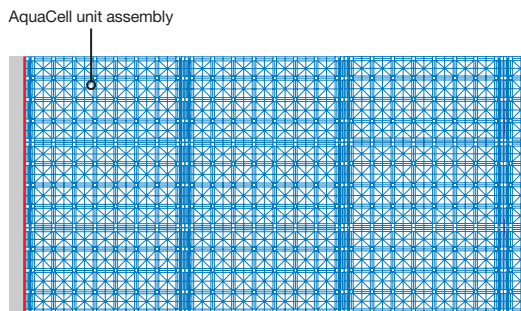
Typical Details AquaCell Units

Off-Line Storage – Manifold Feed

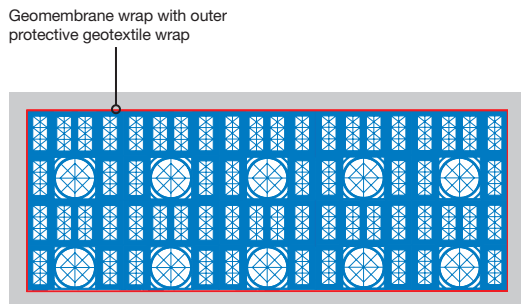
Long section



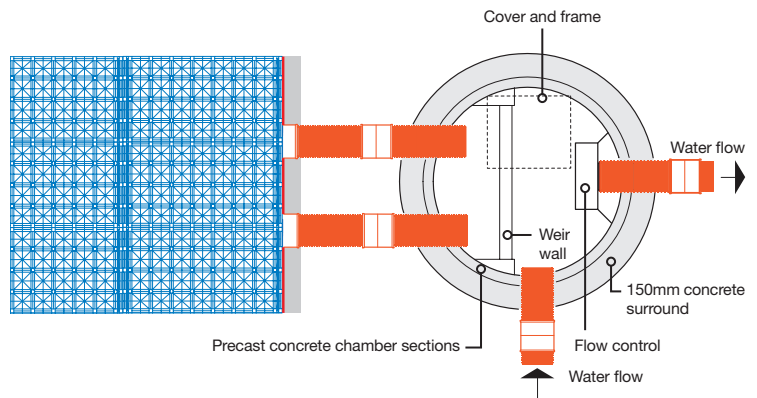
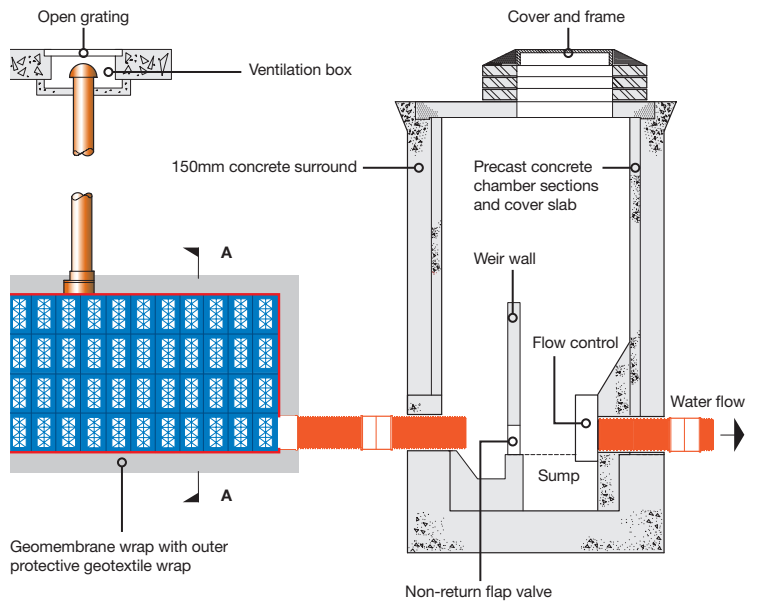
Plan



Cross section A-A



Typical vent detail

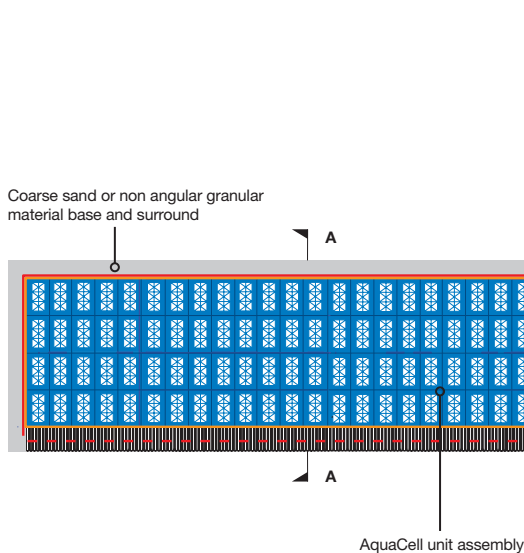


What happens to the water?

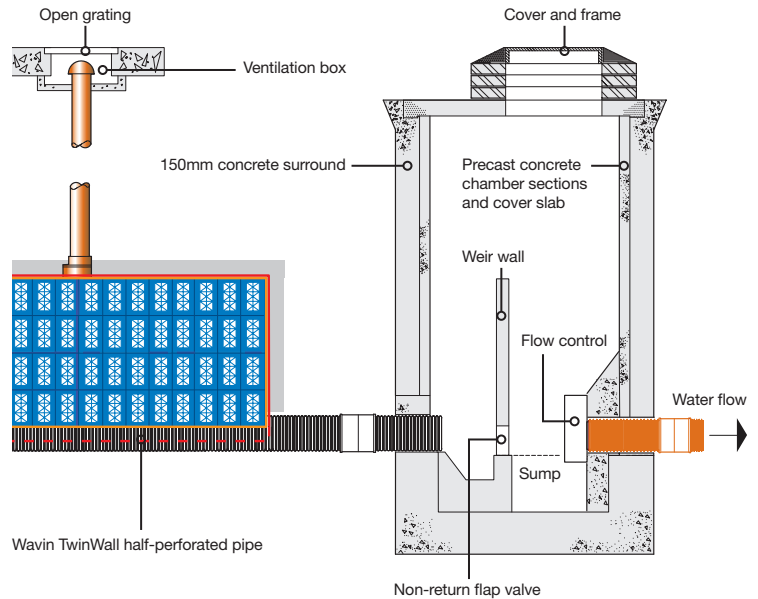
1. Control chamber fills with water, up to the top of the weir wall.
2. The water overflows the weir wall and enters the AquaCell storage assembly via the manifold connection.
3. The AquaCell storage assembly fills with water.
4. After storm event, water flows back out of the AquaCell storage assembly, 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

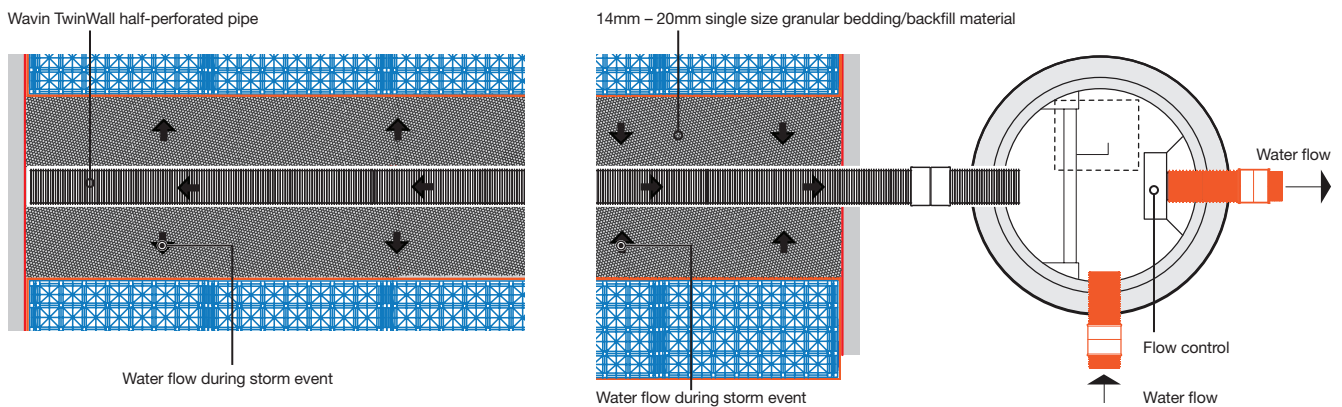
Long section



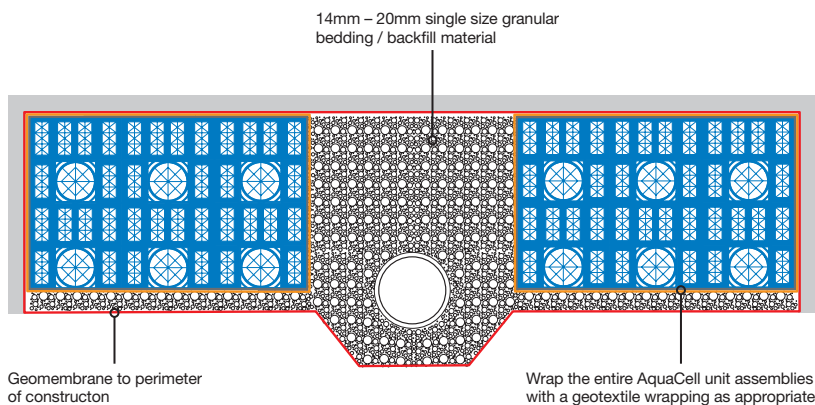
Typical vent detail



Plan



Cross section A-A

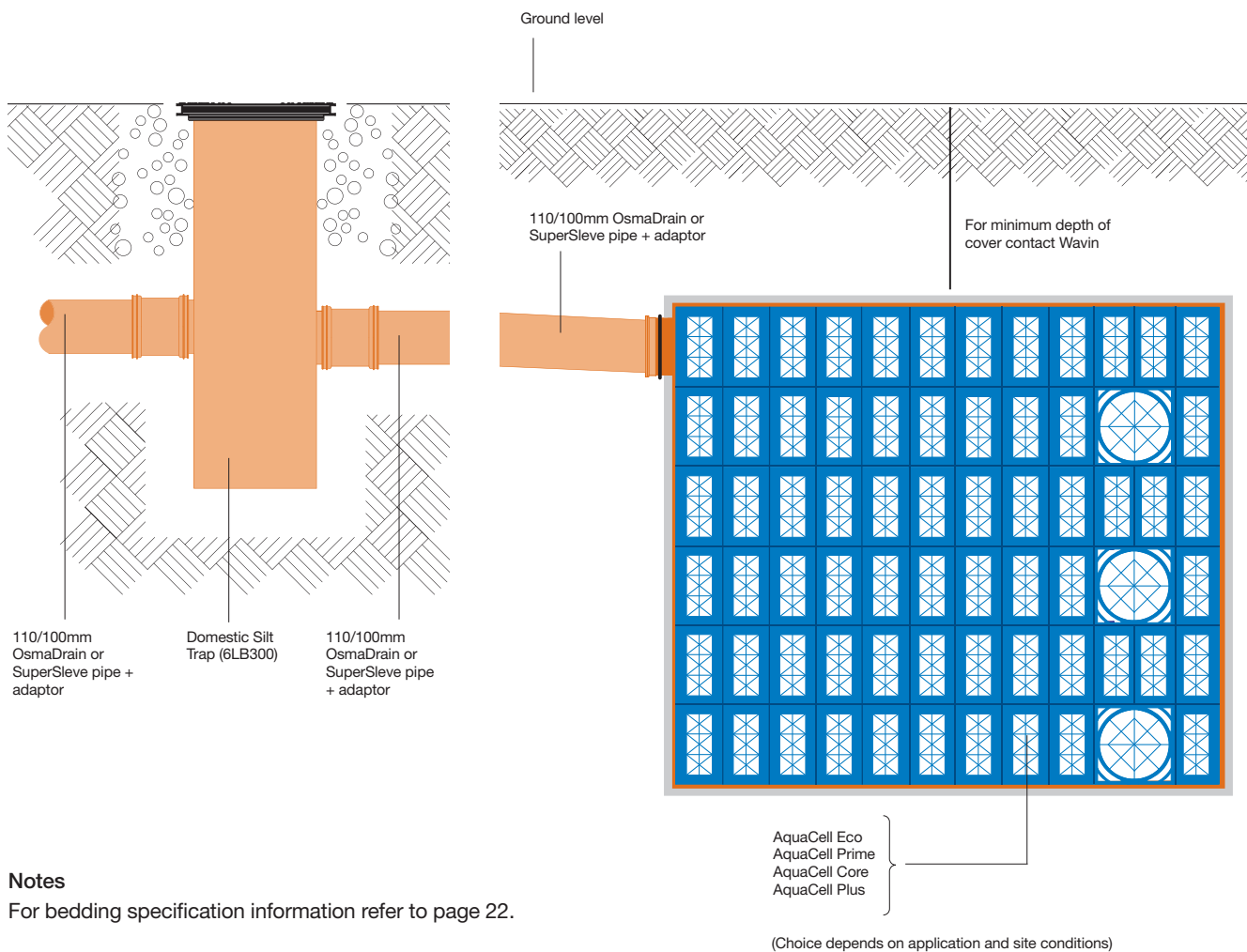


What happens to the water?

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 C

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.uksubs.com | Greenfield runoff toolCalculated by: Site name: Site location:

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: Longitude: Reference: Date: Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method: SPR estimation method:

Soil characteristics

SOIL type: HOST class: SPR/SPRHOST:

Hydrological characteristics

SAAR (mm): Hydrological region: Growth curve factor 1 year: Growth curve factor 30 years: Growth curve factor 100 years: Growth curve factor 200 years:

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

Q_{BAR} (l/s): 1 in 1 year (l/s): 1 in 30 years (l/s): 1 in 100 year (l/s): 1 in 200 years (l/s):

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

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:

Site name:

Site location:

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:

Longitude:

Reference:

Date:

Site characteristics		Methodology		
Total site area (ha):	0.015	esti	IH124	
Significant public open space (ha):	0	Q _{BAR} estimation method:	Calculate from SPR and SAAR	
Area positively drained (ha):	0.015	SPR estimation method:	Calculate from SOIL type	
Impermeable area (ha):	0.015	Soil characteristics	Default Edited	
Percentage of drained area that is impermeable (%):	100		SOIL type:	4 4
Impervious area drained via infiltration (ha):	0		SPR:	0.47 0.47
Return period for infiltration system design (year):	10	Hydrological characteristics	Default Edited	
Impervious area drained to rainwater harvesting (ha):	0		Rainfall 100 yrs 6 hrs:	-- 60
Return period for rainwater harvesting system (year):	10		Rainfall 100 yrs 12 hrs:	-- 71.82
Compliance factor for rainwater harvesting system (%):	66	FEH / FSR conversion factor:	1.14 1.14	
Net site area for storage volume design (ha):	0.02	SAAR (mm):	853 853	
Net impermeable area for storage volume design (ha):	0.02	M5-60 Rainfall Depth (mm):	17 17	
Pervious area contribution to runoff (%):	30	'r' Ratio M5-60/M5-2 day:	0.4 0.4	
* 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.		Hydrological region:	10 10	
		Growth curve factor 1 year:	0.87 0.87	
		Growth curve factor 10 year:	1.38 1.38	
		Growth curve factor 30 year:	1.7 1.7	
		Growth curve factor 100 years:	2.08 2.08	
Design criteria		Q _{BAR} for total site area (l/s):	0.09 0.09	
Climate change allowance factor:	1.4	Q _{BAR} for net site area (l/s):	0.12 0.12	
Urban creep allowance factor:	1.1			
Volume control approach:	Use long term storage			
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	1.0			

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	1	1	Attenuation storage 1/100 years (m³):	3	3
1 in 30 years (l/s):	1	1	Long term storage 1/100 years (m³):	0	0
1 in 100 year (l/s):	1	1	Total storage 1/100 years (m³):	3	3

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

APPENDIX D

SUDS Maintenance Schedule

Installation	Maintenance Required	Frequency	Responsibility
Granular Storage (Type 3 No Fines) (If used rather than geocellular)	n/a	n/a	n/a
Rain Garden Planter & Permeable Paving (Patio and Access / Parking) Geocellular Storage System: storage of soakway depending on final detailed design arrangements Sedum roof collection system if included in final scheme (incl. associated distribution pipework and sump chambers)	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. Geocellular and associated infrastructure: to manufacturer specifications	Estate/Building Management Company