Contents

For detailed design and installation guidelines, please refer to the 'Wavin Stormwater Management Design and Installation Manual'. To obtain a copy, please call 01249 766333 and quote ref. WM409.

CI/SfB
(52.5) (90.51)
Common Arrangement R12
Uniclass
JR12/JS10 L731/L71121/L2123
Sept 2003 WM415

Stormwater Management

A complete response

Cost effective systems to control stormwater:

- Re-creating a natural, sustainable water cycle
- Providing relief for over-burdened surface water sewer systems
- Reducing the risk of flooding
- Reinforcing and enhancing planning applications

To individual needs

The system may be used independently or may be linked, providing a tailor-made solution to meet the specific water management needs of individual housing developments, civil infrastructure and the local environment.

With comprehensive technical support

For technical support or detailed project planning assistance, please call Wavin Technical Services

Tel: 01249 766601
Fax: 01249 766653

For further literature, please call the Wavin Literature Department

Tel: 01249 766333
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wavin

AquaCell® and Garastor® Stormwater Management Systems

Effective, Modern Solutions for Housing and Local Infrastructure

General Introduction

Development of sites results in a large proportion of area being covered by impermeable surfaces such as roofs, car parks and roads. Surface water run-off therefore increases up to 80%. Regulators (Environment Agency, Scottish Environment Protection Agency and local authorities) are promoting the use of Sustainable Drainage Systems (SuDS) that control run-off to that of a greenfield site (around 20%).

Wavin Stormwater Management Systems have been developed to provide a method of source control in two ways:

- By providing temporary storage for excess flows and limiting outflow to streams and rivers.
- By providing soakaways to infiltrate stormwater back into the ground.

The modular nature of Wavin Stormwater Management Systems means that they can be tailored to suit the specific requirements of each site. They can be used to provide temporary storage, attenuation and infiltration capacity for run-off for all sizes and types of site: from individual houses up to the largest commercial developments.

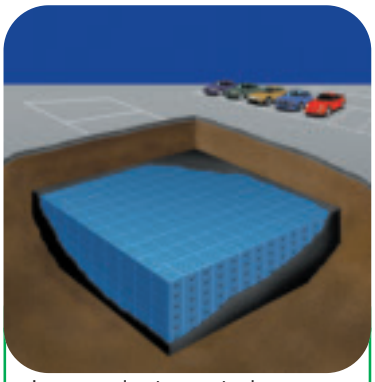
The systems comprise:

AquaCell Storage/Infiltration System

- Individual polypropylene modules assembled together to form an underground structure, used for stormwater storage or as a soakaway.

Small housing soakaway

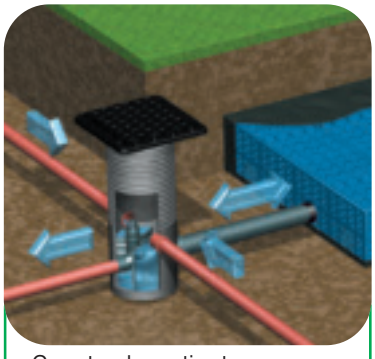
Highway drainage soakaway



Large scale storage tank

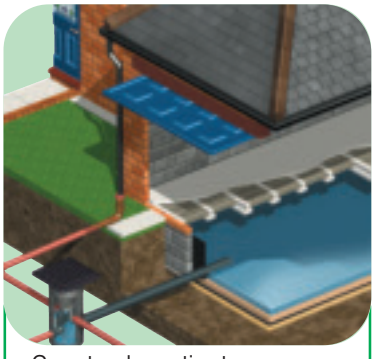
Garastor System

- A polypropylene flow control chamber connected to a water storage reservoir EITHER made up of AquaCell units or located in a void beneath the garage of individual houses.



Garastor domestic storage using AquaCell tank*

*__Note__:
Garastor can be used as a flow control device for any AquaCell storage system, no greater than one unit deep with a discharge of up to 1.4 l/s via the 30mm release flow orifice.



Garastor domestic storage using garage void

Introduction to AquaCell

The Wavin AquaCell Stormwater Management System comprises individual infiltration modules assembled together to form an underground structure which can either be used for stormwater storage or as an alternative to domestic soakaways. The AquaCell Stormwater Management System is fully BBA (British Board of Agrément) approved, Certificate No. 03/4018, and can meet with the Technical Requirements of NHBC.

Heavy storms and major cloudbursts are becoming more frequent, resulting in ever increasing volumes of stormwater flowing into conventional drainage systems and water courses. When the capacities of these systems are exceeded the consequences can be dramatic and damaging.

Stormwater must be controlled; either by limiting the outflow and providing temporary storage or where the ground conditions are suitable, providing soakaways for the stormwater to infiltrate back into the surrounding ground. This has the added benefit of recharging the local groundwater.

Both options can be achieved using the Wavin AquaCell Stormwater Management System.

Large scale AquaCell storage tank

Domestic AquaCell soakaway

AquaCell System Overview

AquaCell System

The Wavin AquaCell unit is modular in shape (1.0m x 0.5m x 0.4m), has a capacity of 190 litres and weighs 9Kg. It is 95% void and has a surface area that is 43% perforated. Conical columns within the unit ensure high strength and rigidity. The AquaCell units are clipped together in single layers and pegged together in multiple layers. Conventional pipework is connected to the units by means of a number of adaptors.

Control Manhole

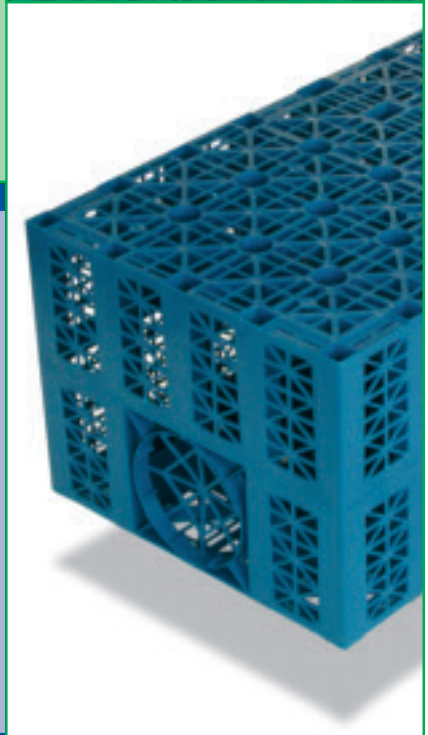
This manhole is designed to limit the downstream discharge using an outflow control and if necessary redirect the excess stormwater via an overflow control into the AquaCell units.

Geomembrane/Geotextile Wrap

An impermeable geomembrane wrap is required for storage solutions and a permeable geotextile wrap is required for soakaway solutions.

Manifold Configuration

A junctioned pipework assembly providing a controlled multiple feed of stormwater into the AquaCell Units. The configuration is tailored to suit the capacity required upon entry into the AquaCell Unit assembly and upon discharging to the control manhole.



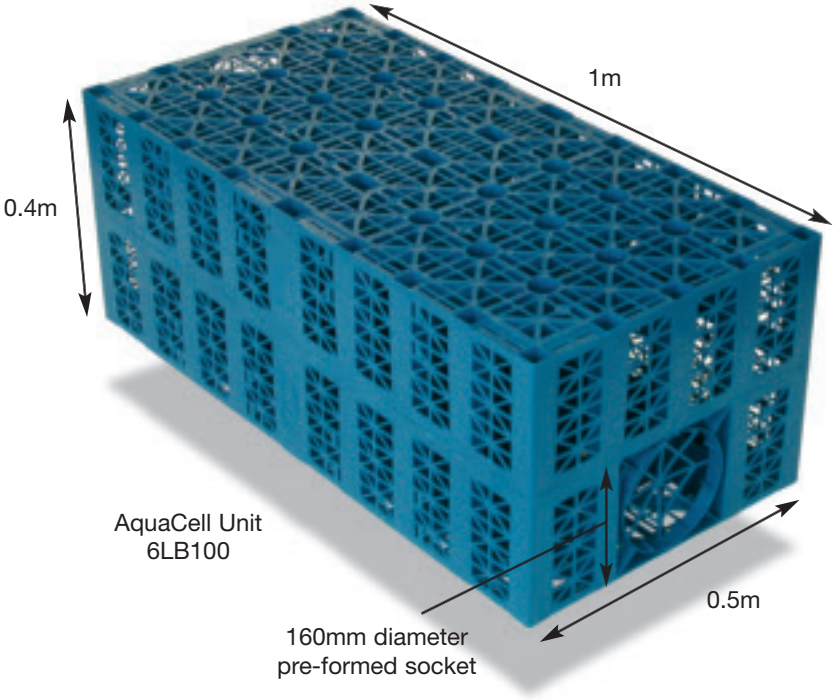
HOW IT WORKS

Stormwater exceeding the capacity of the conventional drainage system is attenuated by the control manhole and channelled into the AquaCell unit assembly. The internal structure of each unit is designed to bring surging water under control and hold it in temporary storage. If the wrap that envelopes the unit assembly is impermeable the water will remain in the unit assembly until such a time as it can flow back into the control chamber and discharge through the outflow control. However if the wrap is permeable, the temporarily stored water may be released into the surrounding ground; soil conditions permitting. By controlling the stormwater at source and recharging the local groundwater it not only eases the pressure on conventional drainage systems but benefits the local environment as well.

KEY BENEFITS

- Significantly reduced risk of flooding and its consequences.
- Controlled and reduced volume discharge into existing main sewer systems and water courses.
- Aerobic purification stimulated within the system improves water quality.
- Sustainable, cost effective management of the water environment.
- Recharging the local groundwater.

AquaCell Principal Components



AquaCell Unit
6LB100

160mm diameter
pre-formed socket

6UR141
UltraRib S/S
Adaptor
(fits into pre-formed socket to connect to 150mm UltraRib)

6TW141
TwinWall S/S
Adaptor
(fits into pre-formed socket to connect to 150mm TwinWall)

6LB102
Shear Connector
(used to hold units together vertically)

6LB105
Clip
(used to hold units together horizontally)

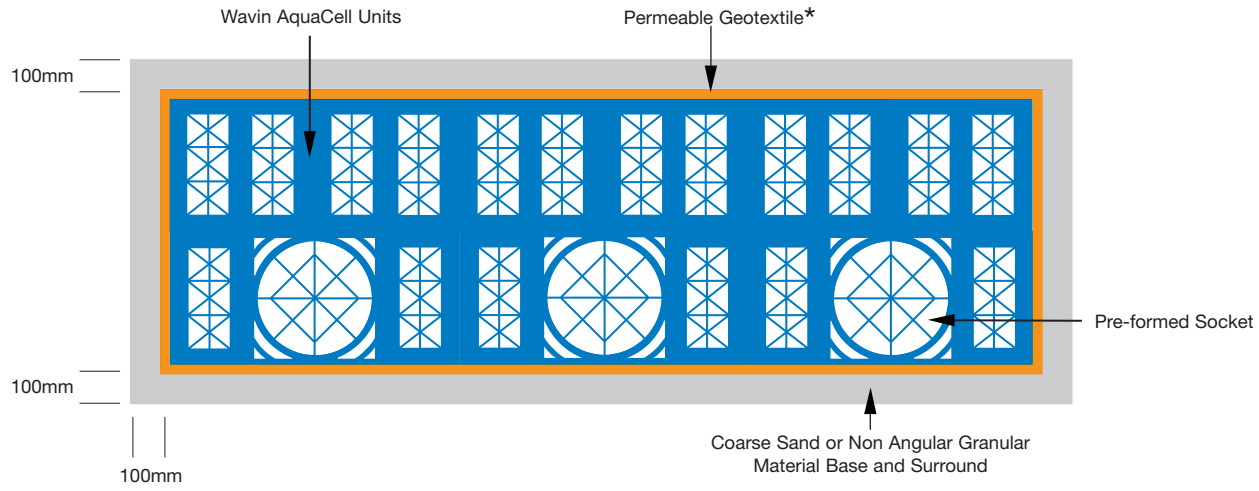
6D099
160mm x 110mm
OsmaDrain
S/S Reducer
(fits into pre-formed socket to connect to 110mm OsmaDrain)

Silt Trap
6LB600
(Extension Kit also available if required, see page 20 for details)

4D916
160mm OsmaDrain
P/E Adaptor
(fits into pre-formed socket as an extension connection piece)

6LB104
Flange Adaptor
(Adaptor to be used at points other than pre-formed socket to connect to 150mm UltraRib)

Typical Soakaway Installation Method



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 or non angular granular material, level and compact.

3. Lay the geotextile* over the base and up the sides of the trench.

4. 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). For single layer applications use the Wavin Clips and for multi layers use the Wavin Clips and the Wavin Shear Connectors.

5. Fix the Wavin Adaptors to the AquaCell Units as required and connect pipework.

6. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Wavin Silt Trap (6LB600) is installed prior to the inlet pipework - see page 8 for installation guidelines.

7. Wrap and overlap the geotextile covering the entire AquaCell structure.

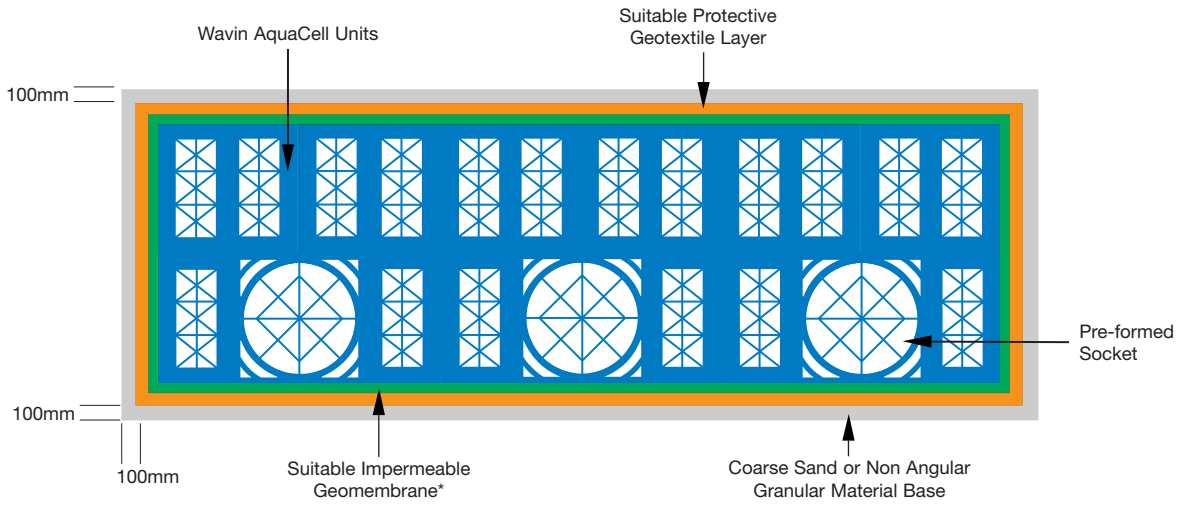
8. Lay 100mm of coarse sand or non angular granular material between the trench walls and the AquaCell structure and compact.

9. Lay 100mm of coarse sand or non angular granular material over the geotextile and compact. Backfill with stone free as-dug material.

10. Rainwater from roof areas may discharge directly into the soakaway but rainwater from carparks must discharge through a catchpit manhole or a petrol interceptor.

* The geotextile should be selected according to specific site conditions, however, typically a 300g material will be suitable. Specialist advice should be sought if surrounding soil characteristics exhibit a high degree of fines/low infiltration capacity and/or there is a high risk of damage from ground contaminants.

Typical Storage Tank Installation Method



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). For single layer applications use the Wavin Clips and for multi layers use the Wavin Clips and the Wavin Shear Connectors (vertical rods).

6. Wrap the geomembrane around the AquaCell structure and seal to manufacturers recommendations.*

7. Place the Wavin Flange Adaptor into position (at a point other than the pre-formed socket) and fix using self tapping screws. Drill a hole through the Flange Adaptor and connect pipework.

8. In order to prevent silt from entering the tank, clogging inlet pipework and reducing storage capacity, it is recommended that the Wavin Silt Trap (6LB600) is installed prior to the inlet pipework - see page 8 for installation guidelines.

9. Wrap and overlap the geotextile covering the entire AquaCell structure, to protect the geomembrane.

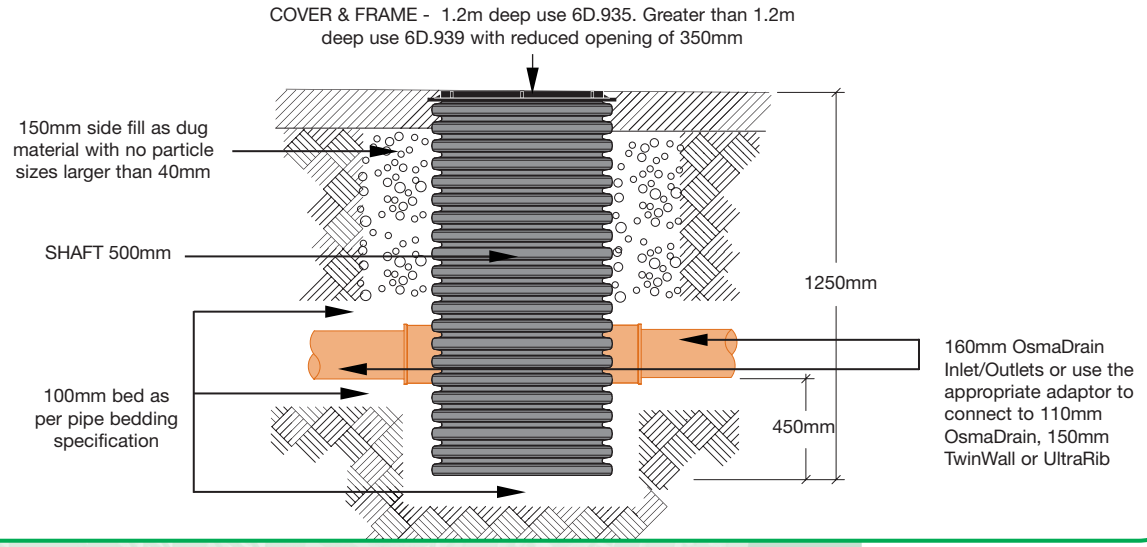
10. Lay 100mm of coarse sand between the trench walls and the Wavin AquaCell units and compact.

11. Lay 100mm bed of coarse sand over the geotextile and compact. Backfill with stone free as-dug 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 8 for design.

* For large scale, deep installations a 1mm thick geomembrane is recommended and joints should be sealed using proprietary welding techniques. However, for shallow, domestic installations it may be suitable to use a geomembrane with taped joints. For further details contact Wavin Technical Services.

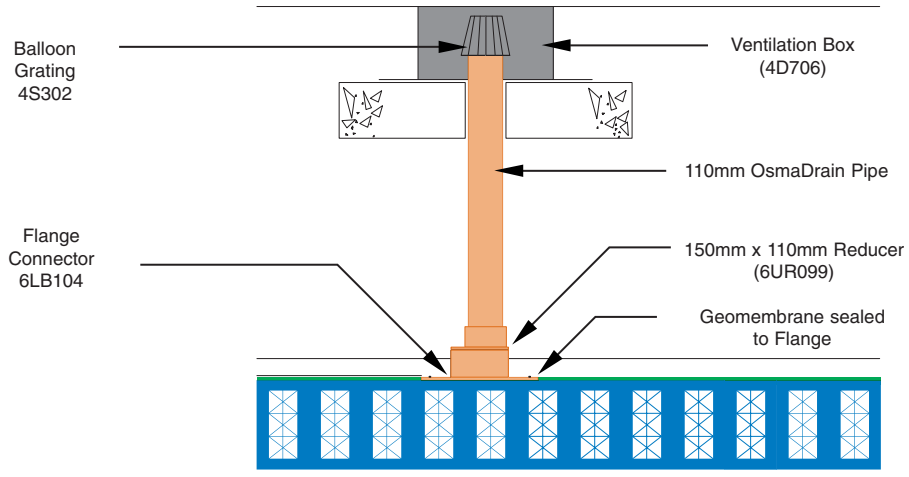
Typical Silt Trap Installation Method



1. Place the Silt Trap (6LB600) on a minimum of 100mm bed as per pipe bedding specification. Ensure that the unit is as close to AquaCell tank 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 according to the depth of unit:
   Up to and including 1.2m deep = 6D935
   Deeper than 1.2m = 6D939.

Notes:
When surrounded by a concrete plinth (150mm x 150mm) the cover can be used in situations with a loading of up to 30Kn (3 tonnes) i.e domestic driveways.
The silt trap can be extended (if required) using the 500mm Extension Kit (see details on page 20) in conjunction with a 500mm shaft of TwinWall cut to suit.

Typical Air Vent Design

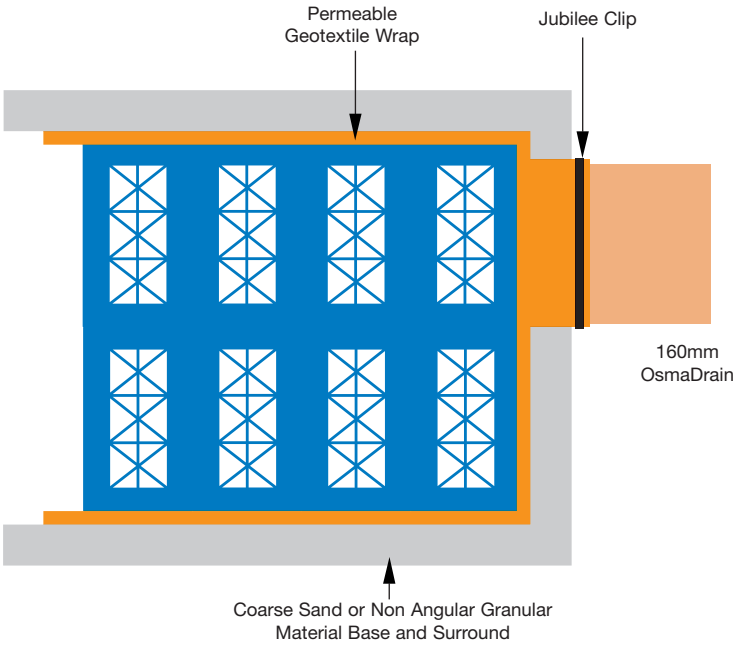


Note:
It is recommended that one vent pipe, 110mm in diameter, is provided per 7,500 square meters of impermeable catchment area on a site. Please contact Wavin Technical Services for further details.

Typical Connections to AquaCell

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.

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

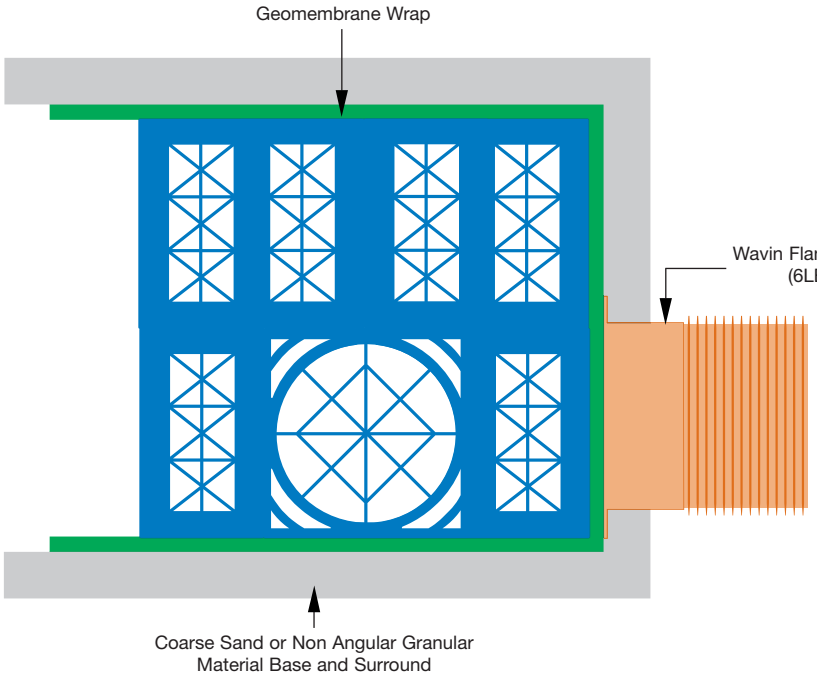


***Note**:

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: 110mm OsmaDrain Adaptor connects to 110mm OsmaDrain
- 4D916: 160mm OsmaDrain PE Adaptor connects to 160mm OsmaDrain
- 6UR141: UltraRib S/S Adaptor connects to 150mm UltraRib

Connection for storage application using flange adaptor at points other than pre-formed socket



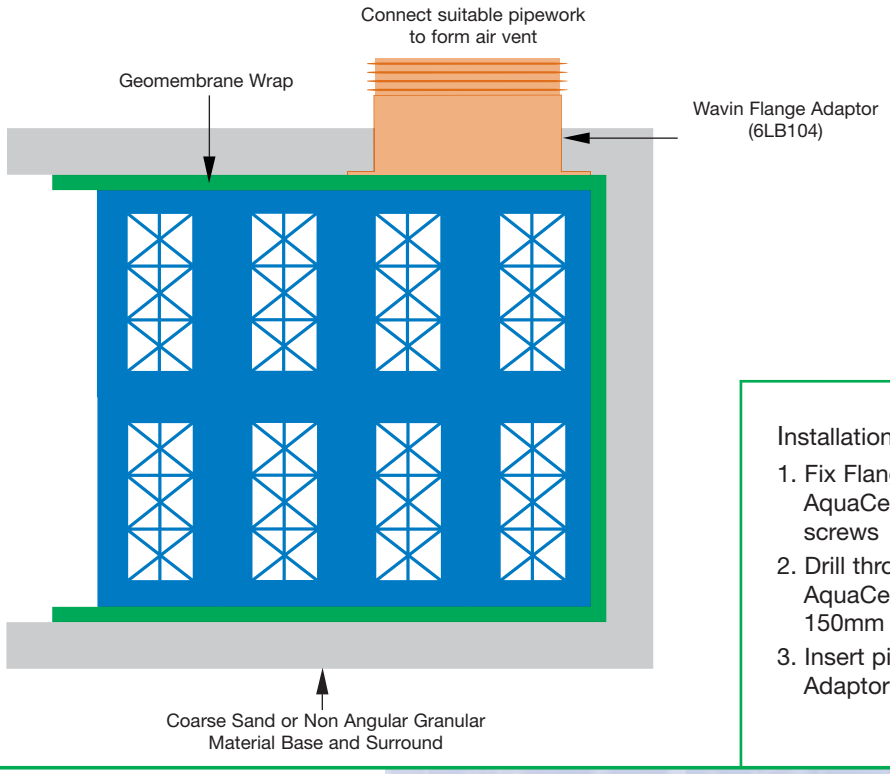
Installation Procedure:

1. Fix Flange Adaptor to the AquaCell unit with self tapping screws
2. Drill through geomembrane and AquaCell unit with a long 150mm Crown Drill Bit Cutter
3. Insert pipework into Flange Adaptor

Typical Air Vent Connections

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.

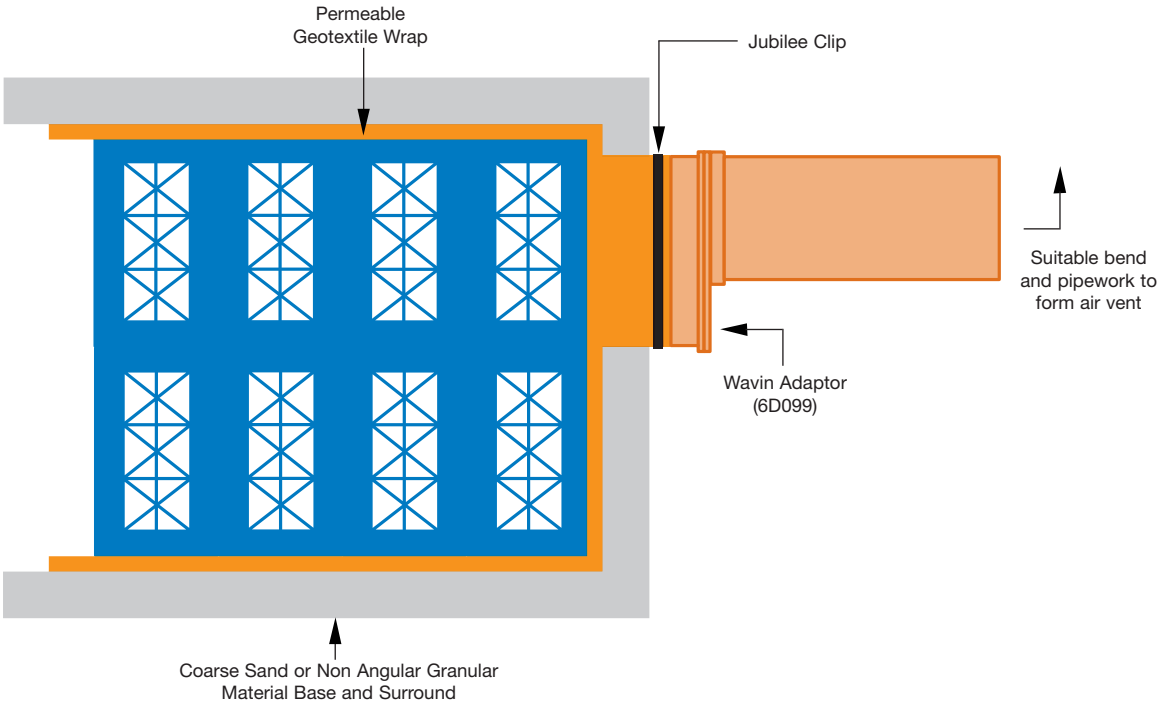
Connection onto top of AquaCell unit using Flange Adaptor



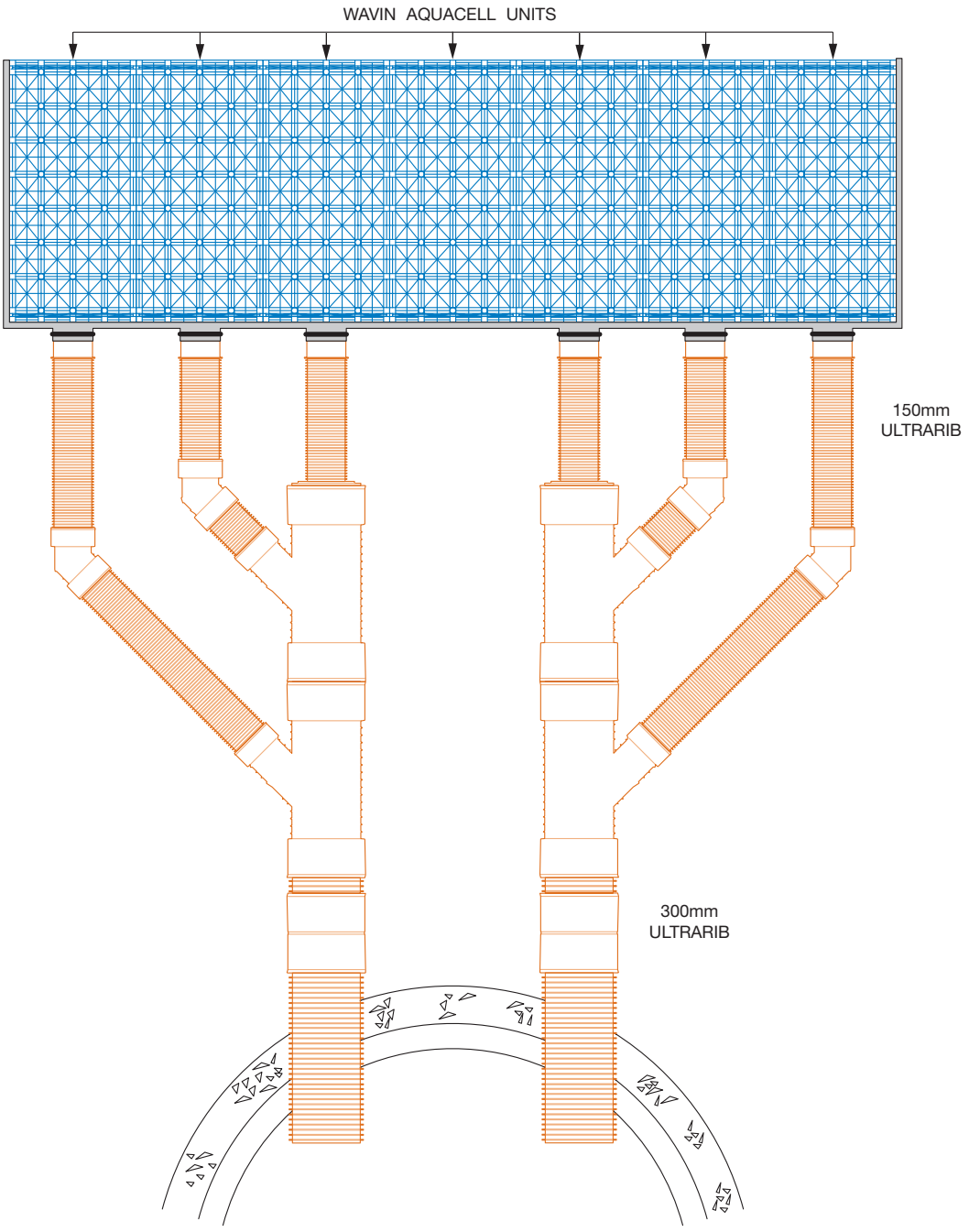
Installation Procedure:

1. Fix Flange Adaptor to the AquaCell Unit with self tapping screws
2. Drill through geomembrane and AquaCell unit with a long 150mm Crown Drill Bit Cutter
3. Insert pipework into Flange Adaptor to form air vent

Connection into side of AquaCell unit using standard adaptors



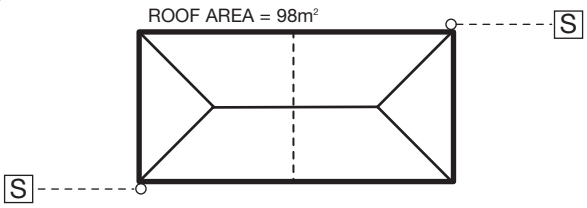
Typical Manifold Configuration



Note:

Pipe configuration is dependent on maximum flow. Alternative pipe systems such as Wavin TwinWall and OsmaDrain can be used. Please contact Wavin Technical Services for further details.

Typical Soakaway Detail: Non-Traffic Loading



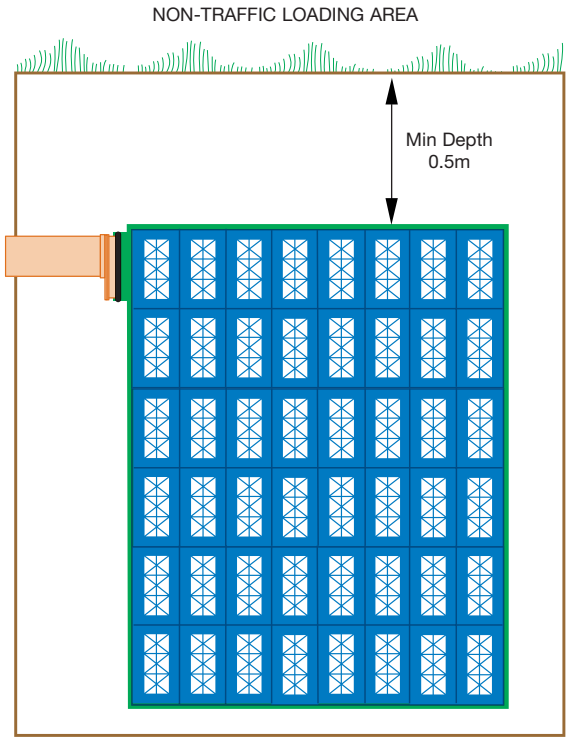
KEY:

S = AquaCell Soakaway (see note 2)

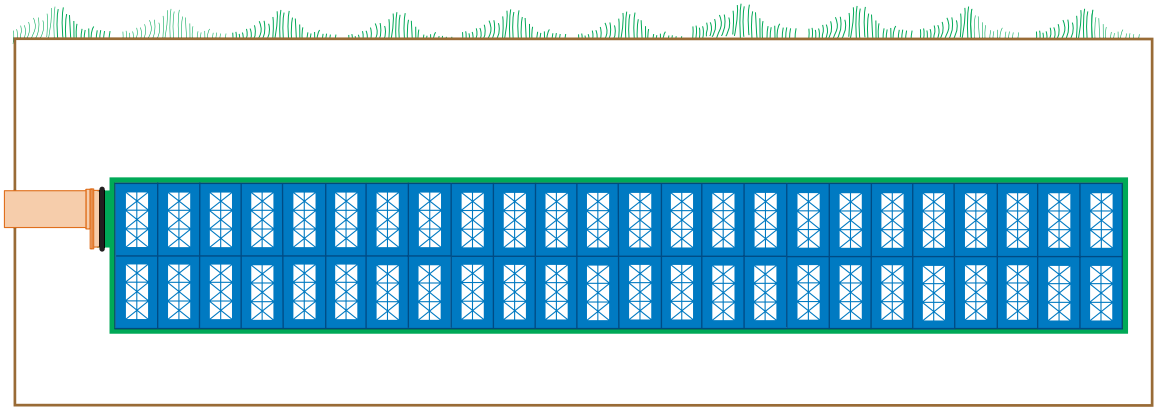
Notes:

1. Soakaways should be sited at least 5m away from the building. (Ref BS8301)
2. The exact size and shape of the soakaways are to be determined once all the necessary calculations have been produced.

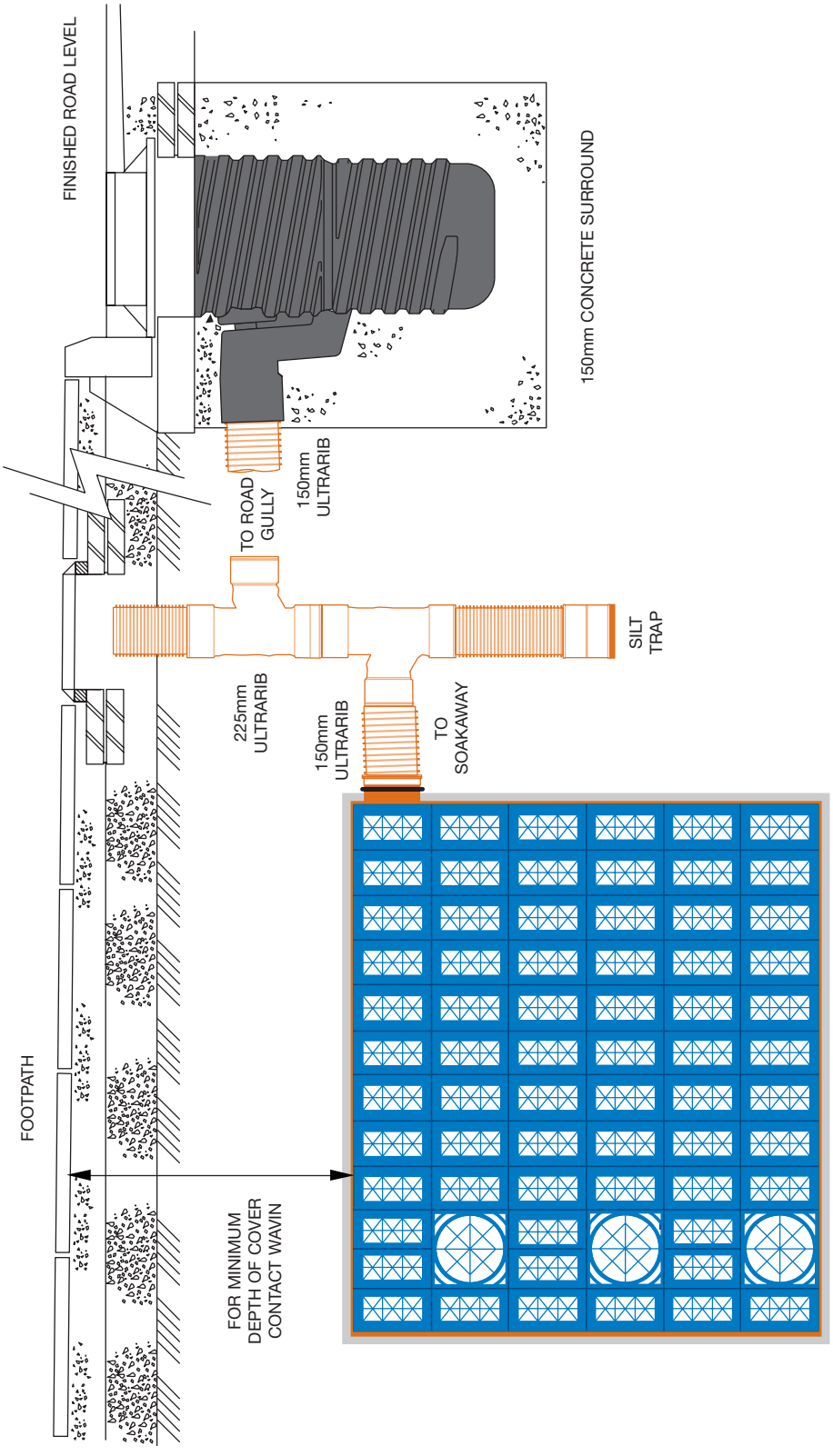
WAVIN DEEP SOAKAWAY



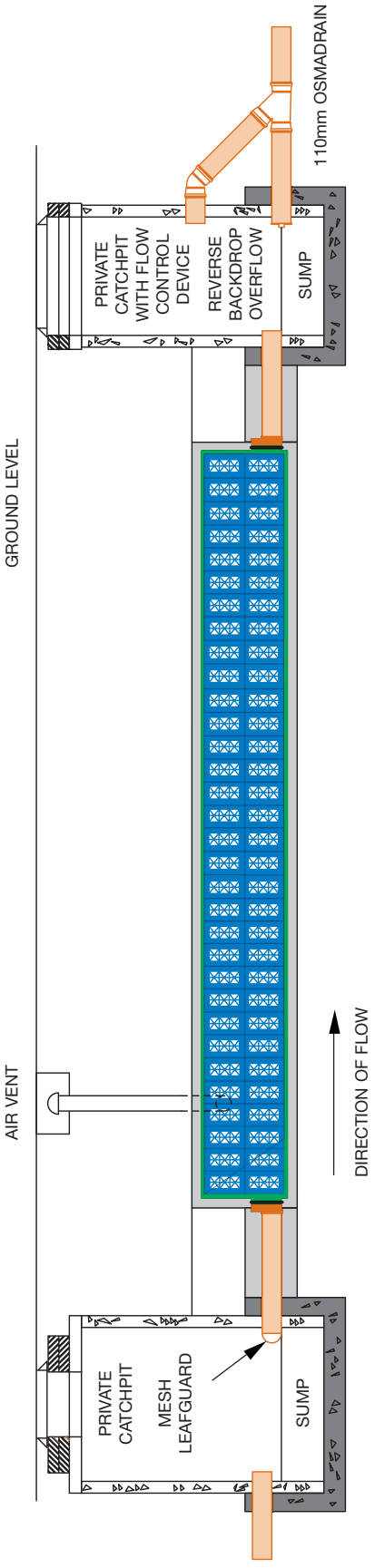
WAVIN TRENCH SOAKAWAY



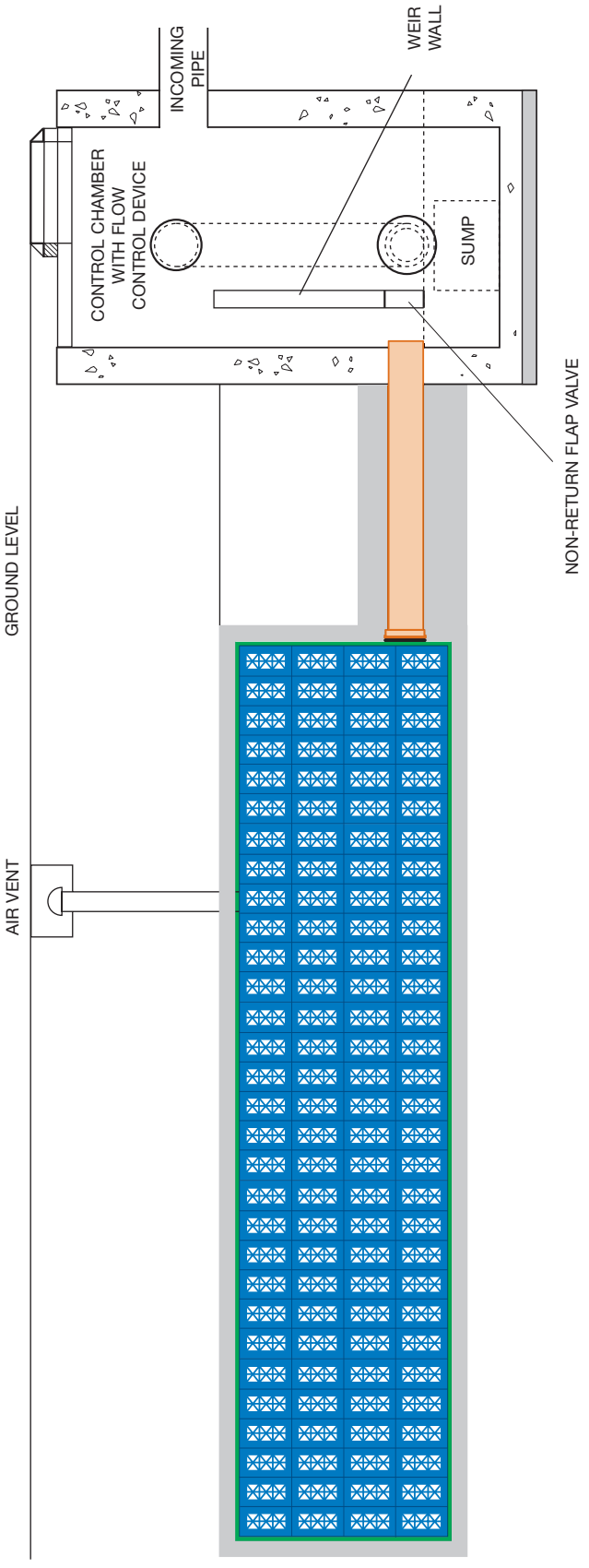
Typical Soakaway Detail - Highway



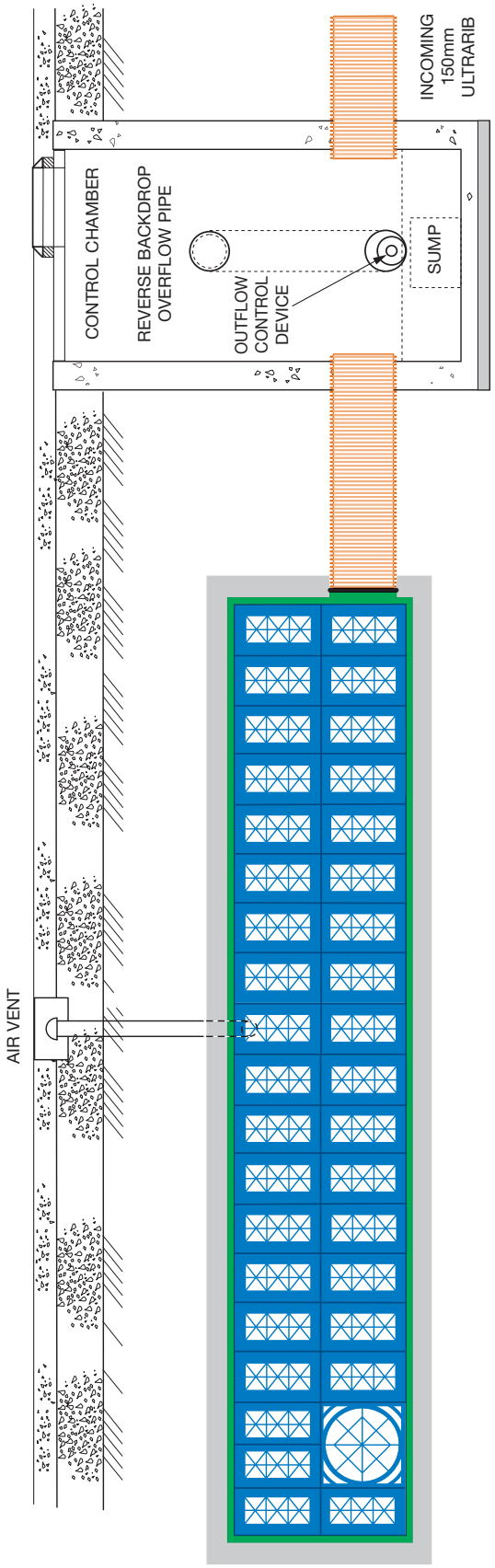
Typical On-Line Water Storage Detail



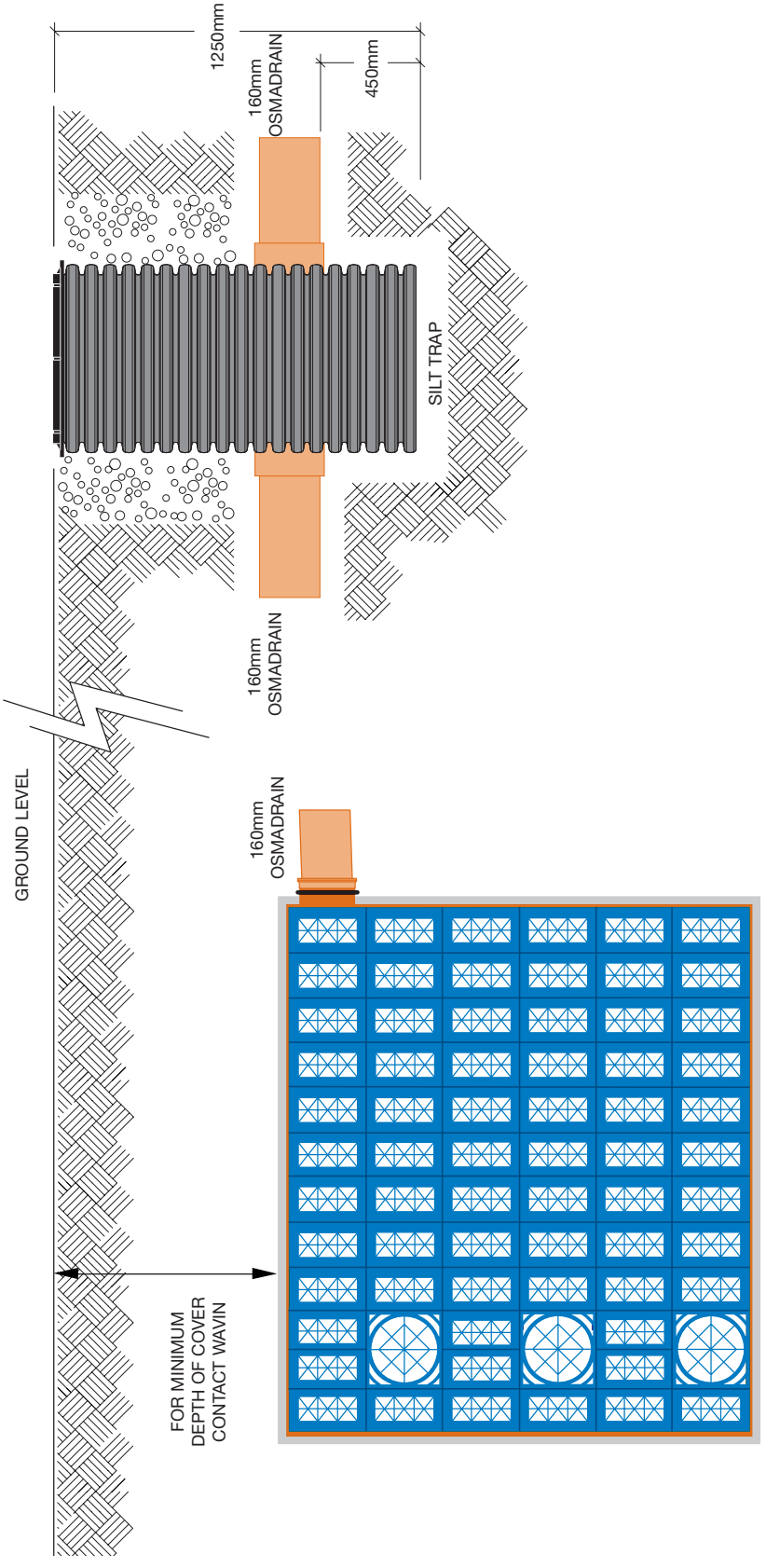
Typical Off-Line Water Storage Detail



Hydraulically Designed On-Line Water Storage System Installed Off-Line



Typical Soakaway Detail with Silt Trap



Notes:

For bedding specification information refer to page 8.

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

Introduction to Garastor

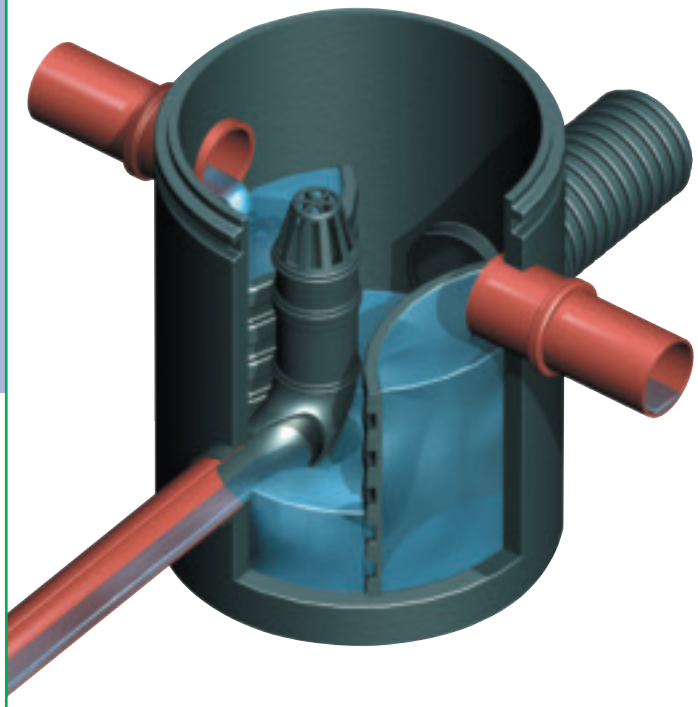
Development of sites results in a large proportion of area being covered by impermeable surfaces such as roofs, car parks and roads. Surface water run-off therefore increases up to 80%. Building Regulations and guidance now requires a sustainable approach to development, which minimises the effects of run-off to that of a greenfield site (20%).

Developed in collaboration with Bryant Homes, Garastor (polypropylene control chamber) represents a house by house, rather than a development wide approach, to stormwater management. Garastor controls the flow of water at source by temporarily storing water under a soft landscaped area using the AquaCell system or in the void space under the floor slab of a residential garage. It eliminates the need for costly, space-hungry, on-site communal water-storage structures or ponds which enables better use of developable land.

During high intensity rainfall, water from the roof or hardstanding areas is diverted via the Garastor control unit into the storage void. As the storm subsides the rainwater can be slowly released back into the main drainage system.

Note:
Garastor can be used as a flow control device for any AquaCell storage system, no greater than one unit deep with a discharge of up to 1.4 l/s via the 30mm release flow orifice.

Garastor - polypropylene control chamber

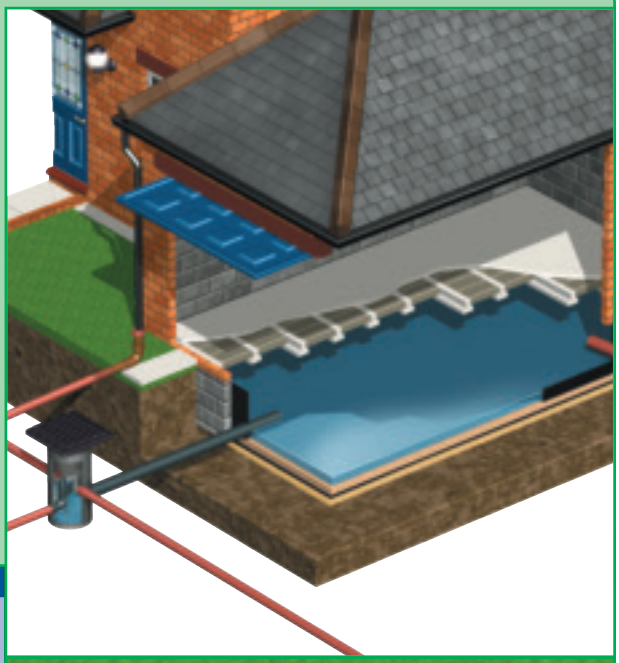


Internal view of Garastor

Garastor System Overview

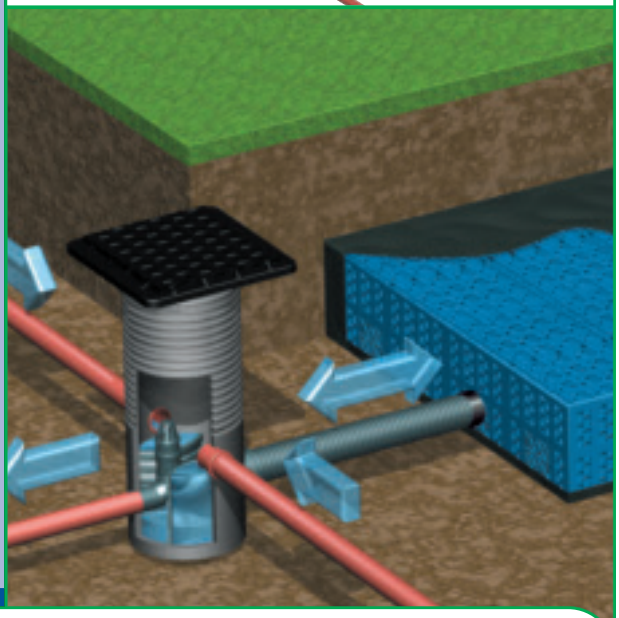
Garastor System

The Garastor unit is a polypropylene chamber that connects to a water storage reservoir. There are two versions of the Garastor available both of which are 500mm in diameter, the 6SC500 version is 1m deep for garage installations (with a 300mm storage depth capacity) and the 6SC501 is 1.25m deep for use with AquaCell (with a 400mm storage depth capacity). When Garastor is used in conjunction with an AquaCell tank the configuration of units must be no deeper than 1 AquaCell unit. If site conditions are such that a deeper Garastor unit is required then the 500mm Extension Kit (6SC205 - consisting of a coupler and two ring seals) can be used in conjunction with a shaft of 500mm Twinwall cut to suit, to extend the Garastor unit.



HOW IT WORKS

Storm or surace water flows through two 110mm diameter incoming pipes. If the flow is light to moderate, the water is simply stored in the chamber before being slowly released through a 30mm orifice. However, if the inflow is heavy, excess water in the chamber discharges through a 150mm diameter pipe into the water storage area (either the undercroft of a garage or an AquaCell tank). The water is temporarily stored until the water level inside the chamber has dropped sufficiently, and the water can flow out to the drainage system via the 110mm outflow pipe. Inside the Garastor chamber there are specially designed weir walls that ensure that the hydraulics of the unit work to the optimum levels.



KEY BENEFITS

- No use of valuable, developable land.
- Safer than open/above ground storage structures.
- Caters for 1 in 150 year storm.
- Spreads cost of water storage over the development period.
- Maintenance free, with no moving parts or filters.
- Run-off reverts to that of a greenfield site.

Garastor Principal Components

6D935 < 1.2m deep
6D939 > 1.2m deep
Covers and Frames

150mm TwinWall Socket
(for connection to other pipe materials, a small section of 150mm TwinWall is required, alternatively use the 150mm Garastor Connection Kit (6SC200 - consisting of a short section of 150mm TwinWall pipe and two ring seals)

500mm diameter

1m (6SC500)
1.25m (6SC501)

Garastor
6SC500 (for use with garage undercroft)
6SC501 (for use with AquaCell)

6SC205
Extension Kit
(a shaft of 500mm TwinWall pipe or an Inspection Chamber Shaft (6D938 - 3.0m length / 6D934 - 1.5m length) cut to suit will also be required)

6TW141
TwinWall S/S
Adaptor
(150mm TwinWall socket x 160mm OsmaDrain spigot for connection of 150mm TwinWall pipe directly into the AquaCell pre-formed socket)

6TW142
TwinWall D/S
Adaptor
(150mm TwinWall socket x 160mm OsmaDrain socket for connection of 150mm TwinWall pipe to 160mm OsmaDrain pipe)

6TW145
TwinWall S/S
Adaptor
(150mm TwinWall socket x 150mm UltraRib spigot for connection of 150mm TwinWall pipe directly to 150mm UltraRib socket)

6TW148
TwinWall D/S
Adaptor
(150mm TwinWall socket x 150mm UltraRib socket for connection of 150mm TwinWall pipe to 150mm UltraRib pipe)

Typical Garastor Installation Methods

1. Place the Garastor Unit (6SC500 or 6SC501) on a minimum of 100mm “as-dug” or granular material. Ensure that the unit is as close to the garage undercroft or AquaCell structure as possible and in a suitable position to allow pipework connection.

   Note:
   It is important to ensure that the chamber is placed in a level position and that the invert of the 150mm pipe connection is level with the base of the concrete undercroft or the base of the AquaCell units.

2. Connect pipework in accordance with standard pipe installation guidelines.

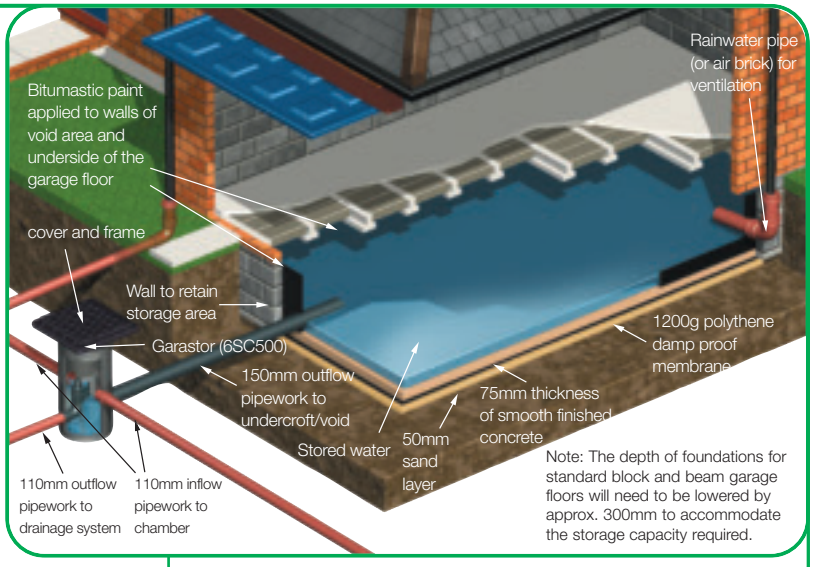
3. Surround the Garastor unit with 150mm of similar material to that used for the bedding.

4. Fit relevant cover and frame according to depth of unit:

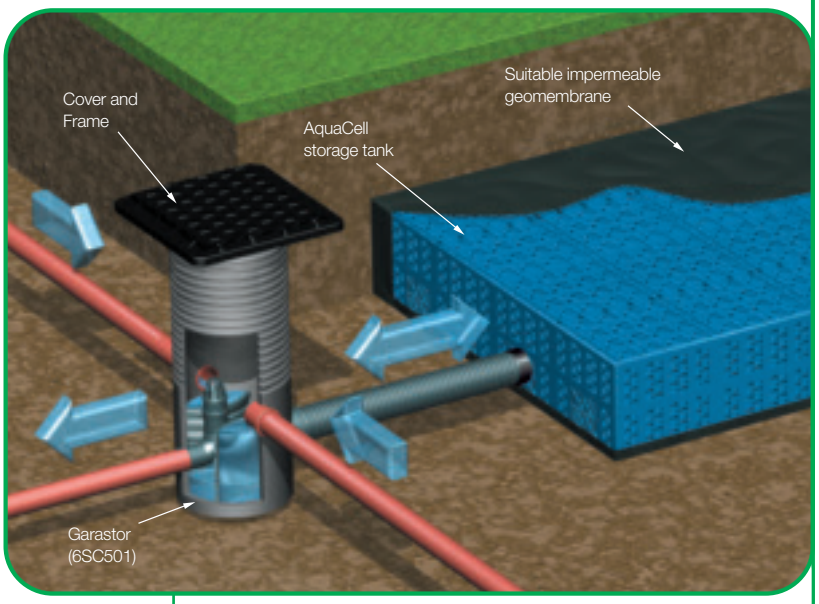
Up to and including 1.2m deep	6D935
Deeper than 1.2m	6D939

   Note:
   When surounded by a concrete plinth (150mm x 150mm) the cover can be used in situations with a loading of upto 30Kn (3 tonnes) i.e. domestic driveways.

5. Adequate ventilation must be provided:
   - to the garage undercroft using either air bricks or rainwater downpipes connected directly into the storage area.
   - to the AquaCell structure using an air vent (NB. One air vent is required per 7,500 square metres of impermeable area to be drained).



Garastor installation using garage void



Garastor installation using AquaCell

Notes:
When using Garastor with the undercroft/void of a garage, it is the responsibility of the designer to ensure that the enhancement to the garage undercroft/void and drainage works comply with current prevailing Building Regulations.
Also to prevent softening of the soils below the foundations or loss of fines leading to settlement, the void beneath the garage should be lined as follows:

- Underneath the concrete base of the void area there should be a 1200g polythene damp proof membrane
- Bitumastic paint should be applied to the walls of the void area and to the underside of the reinforced garage floor beams.

Casestudies

The sky's the limit for Wavin Plastics

THE CLIENT:
Birmingham Airport

THE PROBLEM:
To prevent flooding on a new long-stay car park covered with paving, and help the Airport to comply with its policy of sustainable development.

THE SOLUTION:
Over 7,000 AquaCell infiltration modules were installed on the site providing a robust and long life infiltration base. A permeable geotextile was the only other component required to complete the installations.

THE QUOTE:
"Wavin's solution to stormwater management combines practical and operational benefits over the alternative methods available to the developer. Its system proved to be economically and functionally favourable whilst providing storage of over 1,300 cubic metres of surface water run-off."

AquaCell passes toughest tests during worst storms for 50 years

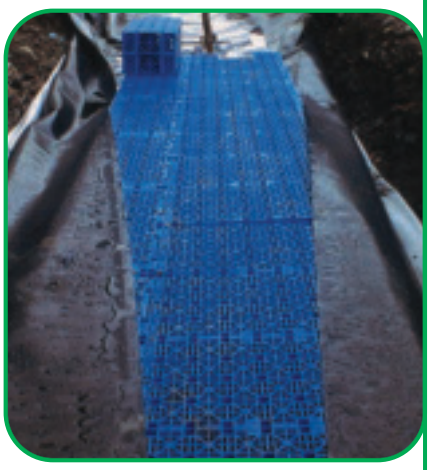
THE CLIENT:
Ilchester Cheese Company

THE PROBLEM:
Controlling flooding/water on a regularly flooded area.

THE SOLUTION:
In order to control stormwater at the Ilchester site, a system which comprised of 1,352 AquaCell units was installed to limit the outflow and provide temporary storage.

THE QUOTE:
"What we have seen at the Cheese Company over the past fortnight is evidence of a highly successful system. The surrounding area is completely waterlogged with the river only half a mile down the road. Our site is bone dry - any risk of damaged land has been alleviated".

Weathering the storm on Brownfield Land



THE CLIENT:
Graham & Brown Wallcovering

THE PROBLEM:
How to manage/control storm or flood water on a low lying brownfield site, adjacent to a river with a history of flooding, and prevent the leaching of contaminants into the high water table from the site which used to be a power station.

THE SOLUTION:
To collect stormwater from the development in a trench surrounding the new factory filled with 2,000 Wavin AquaCell units clipped together, encapsulated in a robust fully welded hydrocarbon resistant geomembrane, which in turn was wrapped in a non-woven needle-punched geotextile.

THE QUOTE:
"The 95% void capacity of Wavin's system was a key factor for us. The original proposal for the site was based on installing stone-filled trenches with a maximum void capacity of 30%."