SuDS Strategy Report

Proposed Residential Development at Monacnapa, Blarney, Co. Cork

Applicant:- Mr. Eoin Sheehan

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Prepared by:-
OLS Consulting Engineers & Project Management Ltd.
No.3 Saint Patrick's Place, Bandon, Co. Cork
Tel: 023 8843990 I Email: info@olsconsultingengineers.ie

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1.0 Introduction

1.1 General

OLS Consulting Engineers& Project Management Ltd. have beencommissioned by Mr. Eoin Sheehan to prepare a SuDS (Sustainable Urban Drainage Systems) Strategy Report to be included as part of the SHD Planning Application Documentation for a proposed residential development on lands at Monacnapa, Blarney, Co. Cork.

The subject site comprises c7.79 hectares to the northwest of Blarney village. The site is currently in agricultural use and slopes in a southerly direction towards the village. The site is bounded to the east by existing residential housing estates and by similar agricultural lands to the north and west. There is mature forestry to the south.

The proposed development will consist of a strategic housing development of 143no. residential units (8no. 1-bed; 38no. 2-bed; 71no. 3-bed; and 26no. 4-bed units), comprising 105no. houses (3no. detached; 42no. semi-detached; and 60no. terraced units) and 38no. apartments.

The proposed development will also consist of the demolition of an existing garage and southern boundary wall, to be replaced with a new southern boundary wall, as well as the lowering of the existing eastern boundary wall and pier, at no. 1 Sunberry Drive; a crèche; all associated ancillary site development and landscaping works, to include bin stores, bicycle and car parking, ground works and retaining structures, foul drainage, stormwater drainage, water supply, service ducting and cabling, public lighting, relocation of existing ESB substation, and all boundary treatments.

The proposed development is to be accessed via the existing Sunberry Heights/Sunberry Drive off the Blarney Relief Road (R617). An upgrade is proposed to the existing Sunberry Heights/Sunberry Drive and the existing access to the proposed strategic housing development, including the widening of the footpath at the junction with the Blarney Relief Road (R617), raised platforms, security barriers and fencing as necessary, road markings, and road resurfacing to facilitate improved pedestrian/cycle connectivity.

1.2 Scope of this Report

This document will demonstrate how the proposed development has been designed using best practice in relation to stormwater management. Guidance has been taken from the following publications/guidance documents:-

- Greater Dublin Regional Code of Practice for Drainage Works (GDRCoP)
- Greater Dublin Strategic Drainage Study (GDSDS)
- ôThe SuDS Manual (CIRIA C753,2015)
- IS EN752, ôDrain and Sewer Systems Outside Buildingsô

Consultation has taken part with the planning authority and in particular the Water Services & Drainage Department of Cork City Council through the S247 Consultation Process as part of the SHD Application Process.

Presented as part of this report are details of the site investigations carried out, pre and post development flow characteristics, storm attenuation storage capacities, pipe sizing and discharge rates. SuDS specific proposals and their implementation on site including maintenance considerations are discussed. A UKSuDS Site Evaluation Report has been carried out and is included in Appendix 1 of this report.

1.3The Receiving Environment

The project site is located within the River Shournagh sub-basin district in Hydrometric Area No. 19 of the Irish River Network. It is within the River Lee and Cork Harbour catchment.

A minor un-named stream occurs to the southwest of the project site and this will be the principal point of discharge for treated surface water from the project site. Discharge to this existing stream/watercourse shall be at a rate equal to the Greenfield Runoff Rate to ensure no significant changes in flow in the existing stream/watercourse. This un-named stream flows into the Knockacorbally Stream, which in turn flows into the River Martin. The River Martin is a tributary of the River Shournagh, which finally drains into the River Lee to the east of Ballincollig.

No water quality information is available for the receiving un-named stream or the Knockacorbally Stream. The nearest EPA water quality monitoring station to the project site is located downstream along the River Shournagh at Tower Bridge. Recent biological water quality monitoring at this monitoring station in 2011 and 2014 have return a result of Q4-5 indicating that water quality along this river is good.

In accordance with the Water Framework Directive (WFD), each river catchment within the SWRBD has been assessed and its risk of not achieving good status has been assigned. The WFD risk assessment for the Knockacorbally Stream, the section of the River Martin downstream and the River Shoumagh has been classed as ñNot at Riskò.

The second point of discharge for surface water shall be to the existing surface water sewer on Sunberry Drive. This discharge point shall only be used to serve the most south-easterly area of the site which can't be facilitated by the principal discharge due to levels. This point of discharge will accept circa 3.5% of the site runoff and this discharge will be limited to the greenfield runoff rate.

2.0 Stormwater Management Proposals

2.1 Site Investigation

The storm water management proposals for the site have been informed by site investigations carried out by Priority Geotechnical between March and May 2021 and reported on in August 2021.

The scope of the site investigation works was defined by OLS Consulting Engineers and comprised of:

- Rotary Boreholes
- Trial Pit Excavations.
- BRE 365 Soakaway Tests.
- In-situ Standard Penetration Testing.
- Associated Sampling
- Laboratory Testing.
- Associated Reporting.

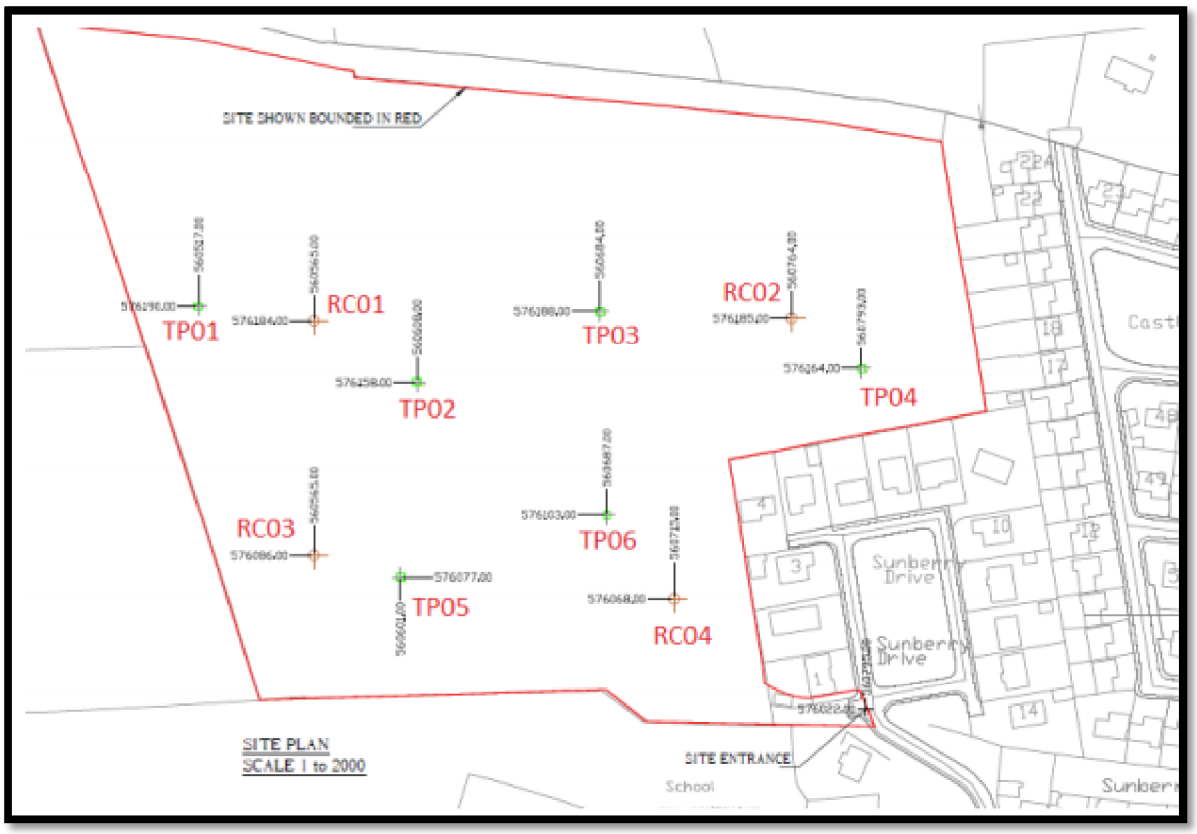

Figure 2.1 – Site Investigation Locations

The conceptual ground model derived from the site investigation comprised of Topsoil 100mm to 400mm thick overlay soft to firm slightly sandy gravelly SILT to a depth 0.8m, below existing ground level to 1.8m bgl.

Below this firm becoming stiff mixed glacial deposits slightly sandy gravelly CLAY with medium to high Cobble content were encountered to depths between 5.6m bgl (RC01) and 14.5m bgl (RC03). Stiffness increased with depth.

Medium strong SILTSTONE was encountered below the CLAY deposits 5.6m bgl to 8.9m bgl (RC01 and RC02); medium strong SANDSTONE was encountered 14.5m bgl at RC03.

There was no bedrock encountered within 15.0m bgl at exploratory hole location, RC04.

2.2 Groundwater & Storm Design

It was found that soil infiltration rates were of the order of 1.51×10^{-6} ms^{-1} (TP05) and 1.32×10^{-5} ms^{-1} (TP03). A particle size $d_{10} = 0.001$ was measured in the CLAY deposits, yielding an estimated permeability 1.0×10^{-8} ms^{-1} (Hazen, 1911), describing low permeability CLAY, mixed glacial deposits

Infiltration viability may be given full consideration where an infiltration coefficient of magnitude 10^{-5} ms^{-1} or greater exists (SUDS Manual C753, 2015).

In this instance, the calculated infiltration rates are considered low and in this regard infiltration in the form of soakpits for the disposal of some surface water within the curtilage of individual house plots has not been considered.

Therefore, all surface water shall be positively drained to the attenuation zones within the site.

No groundwater was encountered within the boreholes or trial excavations during the period of works. Groundwater conditions observed are those relating to the period of the investigation.

2.3 Greenfield Runoff Rates& Stormwater Attenuation

The greenfield run-off rate and associated on-site attenuation has been agreed in consultation with the Water & Services ódrainageô Department of Cork City Council.

Greenfield Runoff Rates have been based on the Wallingford Procedure for calculating Greenfield Runoff Rates.

The proposed site has been divided into three stormwater management zones and the greenfield runoff rate has been calculated for each zone accordingly. The Wallingford Calculation Sheets are contained in Appendix A of this report.

The design proposes to discharge at QBAR for all rainfall events up to and including the 1 in 100-year storm event plus a factor of 10% for climate change which is in line with the recommendation of the GDSDS.

The following table outlines the Greenfield Runoff rates applied to the various stormwater drainage networks which are based on the individual stormwater zones on the site (refer to Appendix A of this report for calculation sheets based on the Wallingford Procedure for each stormwater zone);

Table 2.1 – Greenfield Runoff Rates

Zone	Contributing Site Area (Hectares)	Greenfield Runoff Rate (litres/second) (Limited to Q_{BAR})
Zone 1	1.842	**6.18**
Zone 2	1.326	**4.45***
Zone 3	0.121	**0.41***

*In instances where the flow rate is less than 5.00 litres per second, the discharge rate shall be set at 5.00 litres per second to avoid blockage from vegetation and other material.

Based on the calculated greenfield runoff rates, the associated attenuation storage for all attenuated networks is shown in Table 2.2.

Table 2.2– Storage Volume Requirements &Wavin Aquacell Attenuation Proposals

Zone	Storage Volume Required (m^3)	Storage Volume Provided (m^3)*
Zone 1	1,356.00	**1,425.00** 30m x 25m x 2m Zone 7,500 Aquacell Plus Units laid in 5 Layers 1,500 Units/Layer
Zone 2	982.00	**570.00** 35m x 15m x 2m Zone 5,250 Aquacell Plus Units laid in 5 Layers 1,050 Units/Layer
Zone 3	25.00	**28.50** 5.0m x 5.0m x 1.2m Zone 150 Aquacell Plus Units laid in 3 Layers 50 Units/Layer
***Note Volume Provided is calculated on 95% Void Ratio for Aquacell Plus Units which have a volume of 0.19m^3/Unit**		

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2.4Site Specific SuDS Strategy

The site specific SuDS Strategy shall include the following provisions:-

- Discharge Rate to be limited to Q_{BAR} for all rainfall events up to and including the 1 in 100-year storm.
- Attenuation Storage shall be provided for rainfall events up to and including the 1 in 100-year storm plus a factor of 10% for climate change.
- Hydrocarbon interceptors and silt chambers shall be installed upstream of each attenuation chamber.

2.5Stormwater Management

As per Section 16 of the GDRCoP and in particular the criteria as set out in section 16.3, compliance with all 4 Criteria is summarised as follows:

- **Criterion 1 (River Water Quality Protection):**

Interception provided by way of:-

  - Surface water runoff to õWavin Aquacellô attenuation chambers which will be preceded with silt chambers and hydrocarbon interceptors.
  - Water Butts to rear gardens takingsome roof and drainage.

- **Criterion 2 (River Regime Protection):**

Discharge rate restricted to QBAR for all storm events up to and including the 1 in 100-year storm event.

- **Criterion 3 (Level of service (flooding) for the site):**

A review of the Office of Public Works (OPW) Flood Hazard Mapping online database indicated there are no recorded of flooding incidents at the site of the proposed development.

There are two reported flooding events in Blarney Village in November 2000 but these are unrelated to the proposed development site.

A copy of the Past Flood Event Local Area Summary Report is contained in Appendix 3 of this Report.

- **Criterion 4 (River Flood Protection):**

Maximum discharge rate of QBAR for all attenuated storage is proposed.

2.6Environmental Measures

It is expected that surface water run-off from site activities will be controlled by limiting the site top soil strip to individual phases as the construction phases progress. All site runoff associated with the construction stage will generally be directed to settlement ponds or percolate to ground during each of the construction phases. However, where construction works take place near surface water gullies in the existing surface water network, standard environmental controls will be implemented by the building contractor.

These controls will follow best practice as recommended by CIRIA 2010 and ISO 14001:2015 ï Environmental Management Systems.

The proposed measures include the following:

- To ensure that there will be no contamination of surface water, any excessexcavated material will be immediately removed (i.e. either used within thedevelopment for landscaping or removed to a licensed fill facility);

- The short term storage and removal/disposal of excavated material will be plannedand managed such that the risk of pollution from these activities is minimised;

- Silt fencing will be erected and maintained in place during the construction phaseand until such time as the integrity of the re-instated ground/material has been fullyestablished;

- The silt fencing will be checked twice daily during construction and once per daythereafter to ensure that it is working satisfactorily until such time as the re-instatedground/material has been fully established;

- Sediment traps (such as earthen berms and/or settlement ponds) and/or silt fences will be provided to prevent run-off from the site;

- Drainage channels beside construction roads will flow into settlement ponds orswales in series to allow primary and secondary settlement of sediment. Each swaleseries will have an outfall manhole directly downstream in which final settlementcan take place and the outflow to the existing network can be monitored. Outfallmanholes will be regularly emptied of sediment during periods of heavy rainfall.These measures will prevent run-off from the site and total suspended solid levels inall discharge shall be in compliance with the Quality of Salmonid Water Regulations(SI 293:1988);

- Through all stages of the construction phase the contractor will ensure that goodhousekeeping is maintained at all times and that all site personnel are made awareof the importance of the freshwater environments and the requirement to avoidpollution of all types;

- The storage of oils, hydraulic fluids etc. will be in a bunded facility with filling andtake off points within the bunded area in accordance with current best practice;

- The pouring of concrete, sealing of joints, application of water proofing paint etc. willbe completed in the dry to avoid pollution of the freshwater environment. As grout /cementitious materials are highly toxic to aquatic life all such works must becontained in complete isolation of all waters and storm water systems.

3.0 Conclusion

The storm water management proposals for the site have been informed by the relevant standards and comply with best practice in terms of SuDS (Sustainable Urban Drainage Design).

In advance of submitting to the Board, agreement has been reached with Cork City Councils Water Services and Drainage Department in terms of discharge location, discharge rate and SuDS measures proposed.

By providing the measures as outlined the impact of the proposed development on the Hydrological area has been minimised and results in a reduced risk of flooding downstream of the discharge points.

Appendix 1–UKSuDS Evaluation Report

Site Drainage Evaluation

Site name: Monacnapa SHD
Site location: Monacnapa, Blarney, Co. Cork

Report Reference: 1630406028311
Date: 31/8/2021

1. INTRODUCTION

This is a bespoke report providing initial guidance on potential implementation of SuDS for the development site in line with current best practice.

The use of this tool should be supplemented by more detailed guidance on SuDS best practice provided in a number of sources, principally the CIRIA SUDS Manual (2007), other CIRIA documents; the Use of SUDS in High Density Developments, HR Wallingford, (2005) and other HR Wallingford documents.

The objective is to provide some early guidance on the numbers and types of components that might be suitable for consideration within the site design. This may facilitate pre-application discussions with planners and other relevant authorities.

This guidance has been provided prior to the completion of the SUDS standards and the supporting guidance. However the principles of this tool are unlikely to be very different to the aims of the SUDS standards. HR Wallingford is not liable for the use of any output from the use of this tool and the performance of the drainage system. It is recommended that detailed design using appropriately experienced engineers professionals and tools is undertaken before finalising any drainage scheme arrangement for a site.

THE CONTENT OF THE REPORT

This report is split into 8 sections as follows:

2. Generic SuDS Best Practice Principles
3. Runoff Destination
4. Hydraulic Design Criteria
5. Water Quality Design Criteria
6. Site-Specific Drainage Design Considerations
7. SuDS Construction
8. SuDS Components Performance
9. Guidance on The Use of Individual Components

2. GENERIC SuDS BEST PRACTICE PRINCIPLES

To comply with current best practice, the drainage system should:

(i) manage runoff at or close to its source;
(ii) manage runoff at the surface;
(iii) be integrated with public open space areas and contribute towards meeting the objectives of the urban plan;
(iv) be cost-effective to operate and maintain.

The drainage system should endeavour to ensure that, for any particular site:

(i) natural hydrological processes are protected through maintaining Interception of an initial depth of rainfall and prioritising infiltration, where appropriate;
(ii) flood risk is managed through the control of runoff peak flow rates and volumes discharged from the site;
(iii) stormwater runoff is treated to prevent detrimental impacts to the receiving water body as a result of urban contaminants.

In addition, it is desirable to maximise the amenity and ecological benefits associated with the drainage system where there are appropriate opportunities. SuDS are green infrastructure components and can provide health benefits, and reduce the vulnerability of developments to the impacts of climate change.

3. RUNOFF DESTINATION

Introduction

Infiltration should be prioritised as the method of controlling surface water runoff from the development site, unless it can be demonstrated that the use of infiltration would have a detrimental environmental impact.

Groundwater (via Infiltration)
Infiltration may not be appropriate for managing runoff from this site. Robust studies are reqired to confirm the significance of the following constraints to infiltration:

(1) This is a steeply sloping site and full consideration must be given to the hydrogeological infiltration pathways, to ensure that there is no risk of water re-emerging on the site or on other sites and contributing to downstream flood risk.

(2) The subsurface geology is primarily impermeable and the use of infiltration is unlikely to be suitable. Where infiltration rates are confirmed via testing to be < 1 x 10-7 m/s, infiltration will be very limited. Where infiltration rates are between 1 x 10-7 and 1 x 10-5 m/s, then soils can still provide Interception and partial infiltration. If rates are confirmed to be > 1 x 10-5 m/s, full infiltration can be considered in the design.

The groundwater beneath the site is designated as *Principal Aquifer*, and this designation will define the treatment requirement for any infiltrated water (See Water Quality Design Criteria).

Surface water body
All runoff that cannot be discharged to groundwater will be managed on site and discharged to a surface water body.

The receiving surface water body for runoff from the site is: the *Existing Stream - West Boundary*. The riparian owner is: *Landowner.*

4. HYDRAULIC DESIGN CRITERIA

Introduction
Best practice criteria for hydraulic control require Interception, runoff and volume control.

Interception
To fulfill the requirements for Interception, there should normally be no runoff from the site for an initial depth of rainfall - usually 5mm. This is achieved through the use of infiltration, evapotranspiration, or rainwater harvesting.

Flow and Volume Control
The site is a greenfield development, therefore runoff from the site needs to be constrained to the equivalent greenfield rates and volumes.

Attenuation and hydraulic controls will be used to manage flow rates.

Rainwater harvesting, or the use of Long Term Storage can be used to achieve greenfield runoff volume control. Where volume control is not practicable, flows discharged from the site will be constrained to Qbar or 2 l/s/ha (whichever is the greater).

5. WATER QUALITY DESIGN CRITERIA

Introduction
Current best practice takes a risk-based approach to managing discharges of surface runoff to the receiving environment. The following text provides guidance on the extent of water quality management likely to be appropriate for the site.

Hazard Classification
Runoff from clean roof surfaces (ie not metal roofs, roofs close to polluted atmospheric discharges, or roofs close to populations of flocking birds) is classified as Low in terms of hazard status.

Runoff from roads, parking and other areas of residential, commercial and industrial sites (that are not contaminated with waste, high levels of hydrocarbons, or other chemicals) is classified as Medium in terms of hazard status.

6. SITE-SPECIFIC DRAINAGE DESIGN CONSIDERATIONS

The site is a high density residential site. The HR Wallingford documenet 'SuDS for high density developments' is a useful guidance document for efficient drainage design where space is heavily constrained.

Components likely to be particularly suitable for high density sites include:

• permeable pavement parking areas which can often manage roof runoff as well as rainfall falling on the parking surface;
• green roofs which limit runoff from roof surfaces;
• bioretention areas integrated within impermeable zones;
• individual property soakaways;
• subsurface infiltration and/or detention systems (eg beneath functional, permeable surfaces);
• infiltration/detention/retention ponds/basins/channels integrated within public open space areas.

Where SuDS are being designed for sites with steep slopes, careful consideration of site layout planning and SUDS alignment is needed to minimise gradients of conveyance pathways and construction of large embankments, and to minimise flood risk when drainage systems are exceeded.

The design of SuDS with access to temporary or permanent water should consider public health and safety as well as issues associated with construction and operational management of the structures. Health and safety issues and risk mitigation features are presented in the CIRIA SuDS Manual.

Individual SuDS components should not be treated in isolation, but should be seen together as providing a suite of drainage features which are appropriate in different combinations for varying scales. It is always desirable to have a mix of SuDS components across the site as different components have different capacities for treatment of individual pollutants.

7. SuDS CONSTRUCTION

SuDS are a combination of civil engineering structures and landscaping practice. Due to the limited experience of building SuDS in the water industry, there are a number of key issues which need to be particularly considered as their construction requires a change in approach to some standard construction practices.

• SuDS components should be constructed in line with either the manufacturer's guidelines or best practice methods.
• The construction of SuDS usually only requires the use of fairly standard civil engineering construction and landscaping operations, such as excavation, filling, grading, top-soiling, seeding, planting etc. These operations are specified in various standard construction documents, such as the Civil Engineering Specification for the Water Industry (CESWI).
• Construction of soakaways is regulated by the Buildings Regulations part H (Drainage and waste disposal) which sets out the requirements for drainage of rainwater from the roofs of buildings.
• During construction, any surfaces which are intended to enable infiltration must be protected from compaction. This includes protecting from heavy traffic or storage of materials.
• Water contaminated with silt must not be allowed to enter a watercourse or drain as it can cause pollution. All parts of the drainage system must be protected from construction runoff to prevent silt clogging the system and causing pollution downstream. Measures to prevent this include soil stabilisation, early construction of sediment management basins, channelling run-off away from watercourses and surface water drains, and erosion prevention measures.
• After the end of the construction period and prior to handover to the site owner/operator:
  - Subsoil that has been compacted during construction activities should be broken up prior to the re-application of topsoil to garden areas and other areas of public open space to reinstate the natural infiltration performance of the ground;
  - Any areas of the SuDs that have been compacted during construction but are intended to permit infiltration must be completely refurbished;
  - Checks must be made for blockages or partial blockages of orifices or pipe systems;
  - Any silt deposited during the construction must be completely removed;
  - Soils must be stabilised and protected from erosion whilst planting becomes established.

Detailed guidance on the construction related issues for SuDS is available in the SuDS Manual and the associated Construction Site handbook (CIRIA, 2007).

8. SuDS COMPONENTS PERFORMANCE

	Interception	Peak flow control: Low	Peak flow control: High	Volume reduction	Volume control	Gross sediments	Fine sediments	Hydrocarbons/ PAHs	Metals	Nutrients
Rainwater Harvesting	Y	Y	S	Y	N	N	N	N	N	N
Pervious Pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y	Var
Filter Strips	Y	N	N	N	N	Y	N	Y	Y	Var
Swales	Y	Y	S	Y(*)	N	Y	Y(+)	Y	Y	Y(-)
Trenches	Y	Y	S	Y(*)	N	N	N	Y	Y	Y(-)
Detention Basins	Y	Y	Y	N	Y	Y	Y(+)	Y	Y	Var
Ponds	N	Y	Y	N	Y	N(~)	Y	Limited	Y	Var
Wetlands	N	Y	S	N	Y	N(~)	Y	Limited	Y	Y
Green Roofs	Y	Y	N	N	N	N	N	Y	N	N
Bioretention	Y	Y	S	Y(*)	N	N(~)	Y	Y	Y	Y

Systems										
Proprietary Treatment Systems	N	N	N	N	N	Y	Y	Y(!)	Y(!)	Y(!)
Subsurface Storage	N	Y	Y	N	Y	N(~)	N	N	N	N
Subsurface Conveyance Pipes	N	N	N	N	Y	N(~)	N	N	N	N

Notes:
S: Not normally with standard designs, but possible where space is available and designs mitigate impact of high flow rates.
Y(*): Where infiltration is facilitated by the design.
N(~): Gross sediment retention is possible, but not recommended due to negative maintenance and performance implications.
Y(+): Where designs minimise the risk of fine sediment mobilisation during larger events.
Y(!): Where designs specifically promote the trapping and breakdown of oils and PAH based constitutents.
Y("): Where subsurface soil structure facilitates the trapping and breakdown of oils and PAH based constituents.
Var: The nutrient removal performance is variable, and can be negative in some situations.
Y(-): Good nutrient removal performance where subsurface biofiltration systems with a permanently saturated zone included within the design.

9. GUIDANCE ON THE USE OF INDIVIDUAL COMPONENTS

Rainwater Harvesting

• *High density*
For large occupancy buildings (offices, supermarkets, etc.), communal rainwater harvesting systems may provide significant stormwater management benefits.

• *Roofs*
Rainwater harvesting systems can be used to effectively drain roofs and provide both water supply and stormwater management benefits.

Pervious Pavement

• *High density*
Pervious pavement systems provide an effective way to drain, store and treat the surface runoff, all within the footprint of the car park area. Larger areas of communal parking will provide the most cost effective systems.

• *Roofs*
Roof water can be drained into pervious pavement areas using diffusers to dissipate the point inflows. Detailed design of the pavement will need to take account of the additional impermeable roof area.

• *Roads*
Some types of pervious pavement can be used for relatively highly trafficked roads and pavement manufacturers should be consulted on the appropriate specification.

• *Car parks/other impermable surfaces*
Pervious pavements provide effective drainage, storage and treatment of car park surfacing,

• *Steep site*
Pervious pavements can be used on sloping sites, with the use of internal dams in order to attenuate and store the water effectively through a cascade system.

Filter Strips

• *High density*
Filter strips can be used as treatment for road or car park runoff where space allows.

• *Roads*
Filter strips can provide treatment for road runoff, upstream of swales or trench components. They can reduce the need for kerbing and runoff collection systems.

• *Car parks/other impermable surfaces*
Filter strips can provide treatment for runoff from impermeable surfaces, upstream of swales or trench components. They can reduce the need for kerbing and runoff collection systems.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
Filter strips can be used on sloping sites, where implemented parallel to the contours. The consequences of exceedance and flood flow paths will need to be considered.

Swales

• *High density*
Swales can be used for road or car park drainage where space allows. Underdrained swales (ie with a subsurface gravel filled conveyance and treatment trench) can provide a more efficient solution for hydraulic control and water quality treatment.

• *Roofs*
Swales can be used to convey roof water to other parts of the site.

• *Roads*
Swales provide treatment and conveyance of road runoff. There are a range of swale types - standard grass channels, underdrained swales, and wetland swales - depending on drainage requirements.

• *Car parks/other impermable surfaces*
Swales provide treatment and conveyance of runoff from impermeable areas. There are a range of swale types - standard grass channels, underdrained swales, and wetland swales - depending on drainage requirements.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
Swales can be used on sloping sites, where implemented parallel to the contours. The consequences of exceedance and flood flow paths will need to be considered.

Trenches

• *High density*
Trenches can provide treatment and runoff control for road or car park drainage.

• *Roofs*
Trenches can be used to convey roof water to other parts of the site.

• *Roads*
Trenches can provide treatment and conveyance of road runoff. They require effective pretreatment to minimise the risk of blockage.

• *Car parks/other impermable surfaces*
Trenches can provide treatment and conveyance of runoff for impermeable areas.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
Trenches can be used on sloping sites, where implemented parallel to the contours. The consequences of exceedance and flood flow paths will need to be considered.

Detention Basins

• *High density*
Detention basins can be used in high density developments when effectively integrated within public open space areas.

• *Roofs*
Detention basins can be used to attenuate and treat runoff.

• *Roads*
Detention basins can be used to attenuate and treat runoff.

• *Car parks/other impermable surfaces*

Detention basins can be used to attenuate and treat runoff.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria. A risk assessment should be used to determine the maximum appropriate depth of stored water in the basin.

• *Steep site*
Large basins may require embankments that may pose a safety risk to site residents.

Ponds

• *High density*
It is unlikely that a pond would be suitable for high density development, unless it is an integral amenity feature within the public open space area.

• *Roofs*
Ponds can be used to attenuate and treat roof runoff.

• *Roads*
Ponds can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in ponds for extended periods, nutrient concentrations can rise - particularly in the summer months, and the pond can become unattractive with poor amenity and biodiversity potential.

• *Car parks/other impermable surfaces*
Ponds can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in ponds for extended periods, nutrient concentrations can rise - particularly in the summer months, and the pond can become unattractive with poor amenity and biodiversity potential.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
Large ponds may require embankments that may pose a safety risk to site residents.

• *Other*
Ponds built in permeable soils will require lining to maintain the water level of the permanent pool. The lining may be finished 100 or 200 mm lower than the outlet invert to encourage some infiltration to take place to contribute to interception.

Wetlands

• *High density*
It is unlikely that a wetland would be suitable for high density development, unless it is an integral amenity feature within the public open space area.

• *Roofs*
Wetlands can be used to attenuate and treat roof runoff.

• *Roads*
Wetlands can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in wetlands for extended periods, nutrient concentrations can rise - particularly in the summer months, and the wetland can become unattractive with poor amenity and biodiversity potential.

• *Car parks/other impermable surfaces*
Wetlands can be used to attenuate and treat runoff. However, they are best implemented at the lower end of the treatment train as a 'polishing' component. They should not be used as sediment management devices, as sediment and wet vegetation is relatively costly to extract and dispose of. If poor quality water remains in wetlands for extended periods, nutrient concentrations can rise - particularly in the summer months, and the wetland can become unattractive with poor amenity and biodiversity potential.

• *Site size > 50 ha*
The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
It is likely that wetlands would require embankments that may pose safety risks to site residents.

Green Roofs

• *HighDensity*
Green roofs can be implemented most cost-effectively on larger roofs. They provide a range of benefits in addition to stormwater management, including combatting the heat island effect, biodiversity and amenity functions.

• *Roofs*
Green roofs can be designed to provide interception, management and treatment of rainfall up to specified rainfall depths.

Bioretention Systems

• *High density*
Biorention systems (either cells or linear systems) can be used for road or car park drainage where space allows.

• *Roofs*
Bioretention systems can be used to attenuate and treat roof runoff.

• *Roads*
Linear bioretention systems (ie biofiltration swales) can be used to attenuate and treat road runoff.

• *Car parks/other impermable surfaces*
Bioretention systems canbe used for car park drainage.

• *Site size > 50 ha*
Bioretention systems will tend to be suitable for managing small areas only.The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

• *Steep site*
Bioretention systems can be used on sloping sites, when implemented parallel to the contours. The consequences of exceedance and flood flow paths will need to be considered.

Proprietary Treatment Systems

• *High density*
Proprietary treatment systems may be appropriate to use particularly where there is no space for surface, vegetated treatment systems. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.

• *Roads*
Proprietary treatment systems can be used where surface vegetated systems are impracticable. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.

• *Car parks/other impermable surfaces*
Proprietary treatment systems could be used where surface vegetated systems are impracticable. However, regular monitoring needs to be ensured so that they are maintained so that they continue to function effectively.

• *Site size > 50 ha*
Proprietary treatment systems will tend to be suitable for managing small areas only. The size of area that can be drained will be limited by meeting the hydraulic and water quality criteria.

Subsurface Storage

• *High density*
Subsurface storage of runoff is likely to be needed for high density developments. This can be implemented via a range of proprietary high void systems, or within gravels beneath permeable pavements which provide treatment as well. Sub-surface storage allows the land above the storage system to be used for car parking or public open space areas.

• *Roofs*
Subsurface storage can be used to attenuate roof runoff.

• *Roads*
Subsurface storage can be used to attenuate road runoff.

• *Car parks/other impermable surfaces*
Subsurface storage can be used to attenuate car park runoff.

Subsurface Conveyance Pipes

• *High density*
Subsurface conveyance systems may be an important means of connecting drainage components together and routing flows downstream. Space constraints in high density developments are likely to constrain the use of surface conveyance options.

HR Wallingford Ltd, the Environment Agency and any local authority are not liable for the performance of a drainage scheme which is based upon the output of this report.

Appendix 2–Wavin Aquacell & Klargester Technical Literature

Uniclass
EPIC
JR12:L731/L71121/L2123
J3413:X721
CI/SfB
(52.5)
(H1)
October 2015 WM424

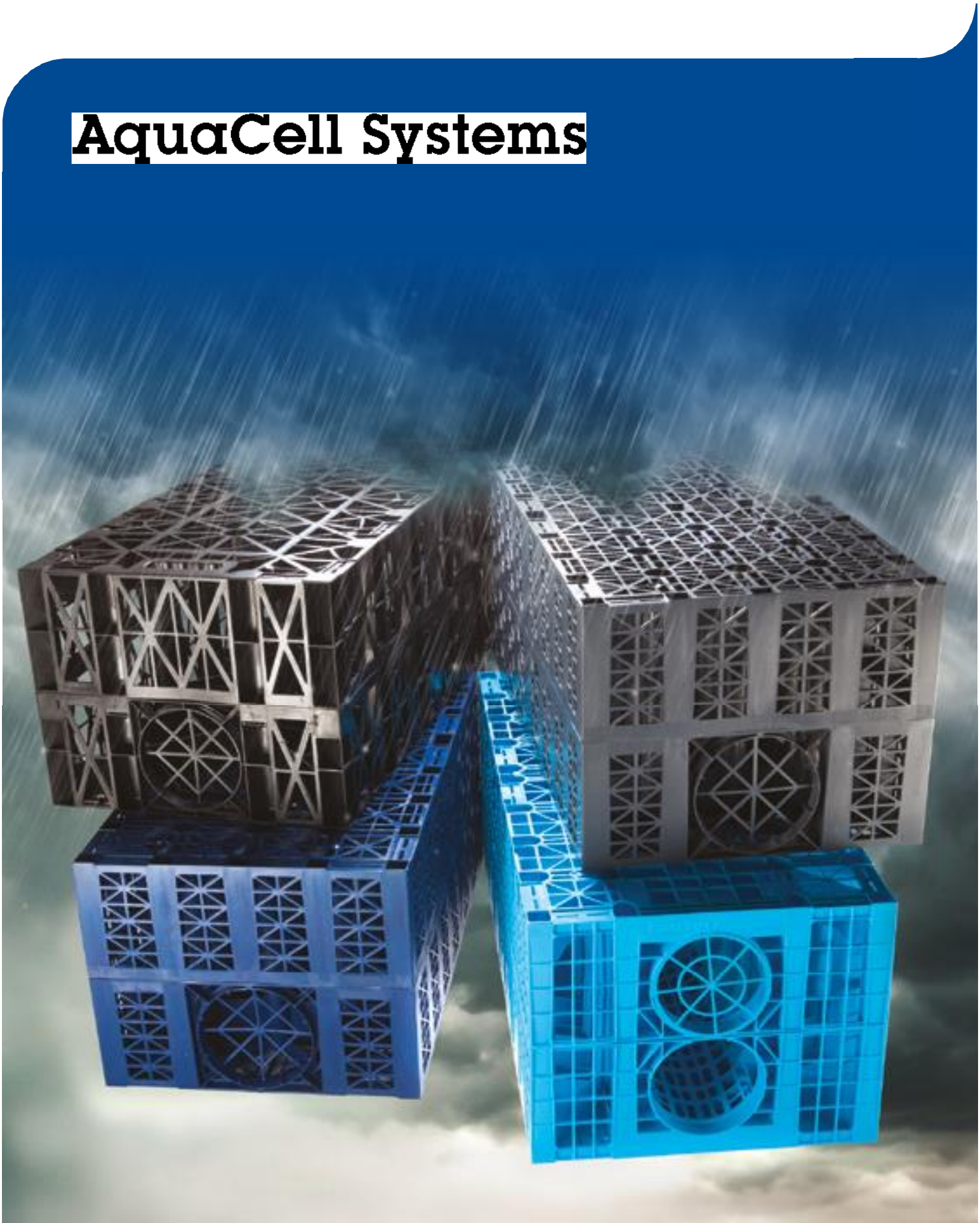
Water management

PRODUCT AND INSTALLATION MANUAL

wavin

CONNECT TO BETTER

AquaCell Systems



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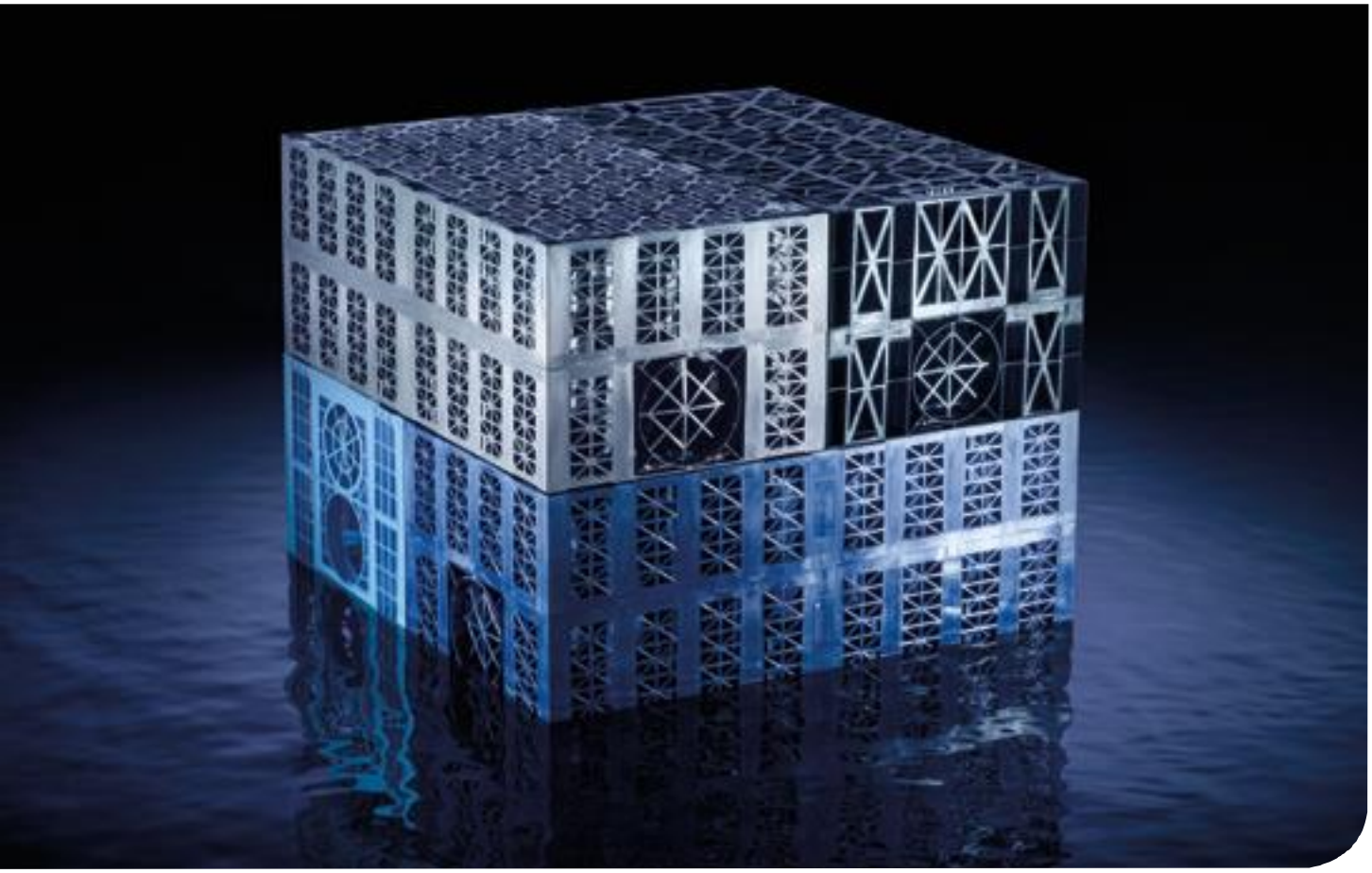
Contents
AquaCell Systems



Overview
AquaCell Systems

AquaCell units are a fully tried and tested modular technique for managing excessive rainfall. Units are assembled to create an underground structure as either a temporary storage tank or soakaway.

Continuing urban development, a changing climate and the consequences of intensified rainfall: all are increasingly prominent issues on the political and environmental agenda.

In combination, they represent a complex need for the most intelligent, effective Stormwater Management solutions possible.

There are 4 types of unit:

AquaCell Eco

AquaCell Eco is manufactured from specially reformulated, recycled material and has been designed for shallow, non-trafficked, landscaped applications (see page 6).

AquaCell Prime

AquaCell Prime is manufactured from specially reformulated, recycled material. It is ideal for use in both shallow and deep applications, subject to either regular traffic loading – such as car parks (for vehicles up to 12 tonnes) – or for landscaped areas (see page 7).

AquaCell Core

AquaCell Core has been designed for use in deep applications, subject to both regular and heavy traffic loadings, such as cars and HGV's (for vehicles up to 44 tonnes) – (see page 8).

AquaCell Plus

AquaCell Plus has been designed primarily for use in applications where inspectability is required, and is suitable for use in all applications from landscaped areas to heavily trafficked areas (for vehicles up to 44 tonnes) (see page 9).

For quick, versatile assembly

The lightweight polypropylene, high void units are securely linked together using special clips and shear connectors.

They can be assembled quickly on site into whatever configuration suits each specific location.

AquaCell geocellular systems also allow 'brick-bonding', which can give extra stability, without the need for additional connector pieces. See Installation Guidance page 12.

Wrapped for infiltration or storage

The complete assembly is wrapped in either geotextile sheet or a geomembrane:

For **pervious** soils, the geotextile option allows infiltration of stormwater into the surrounding ground.

For **impervious** ground (e.g. clay) or where infiltration is not desirable, the geomembrane holds stormwater in temporary storage until local drainage flows can accept it for normal disposal.

Benefiting community and environment

AquaCell units contribute the following benefits:

- Significantly reduced flooding risk
- Controlled, reduced-volume release of stormwater into existing sewer systems or watercourses
- Recharging of local groundwater (if infiltration/soakaway application)
- Aerobic purification to improve water run-off quality
- Sustainable, cost effective management of the water environment

Helping SUDS and planning approval

The proven qualities and performance of AquaCell systems not only support the achievement of SUDS, they can also help reinforce and enhance planning applications, and enable development to proceed.

Types of connections

There are a number of ways to provide a controlled feed into the AquaCell units to suit the required flow capacity.

These being:

1. Manifold Configuration – this configuration utilizes standard pipe and fittings (see page 20)
2. Box Configuration – this configuration utilizes the AquaCell units (see page 20)
3. Central Pipe Configuration – this configuration utilizes standard perforated TwinWall pipe and fittings (see page 20)

Box systems – select with care

Rising rainfall levels, and increased focus on SUDS compliance, have led to a sharp increase in the use of modular units to create underground structures for infiltration or, temporary storage of stormwater.

However, not all currently available systems have the proven performance characteristics necessary for the wide range of complex underground geocellular applications.

The Wavin range of AquaCell units however provide peace of mind since, all strength and hydraulic capabilities have been verified by independent testing.

Acceptance – British Board of Agrément

The AquaCell Infiltration and Attenuation units; Eco, Prime, Core and Plus have all been awarded British Board of Agrément approval under Certificate No. 03/4018.

The certificate covers the design data, technical specification, installation and maintenance aspects for each unit as follows:

AquaCell Eco

- Approved under BBA Agrément Certificate No. 03/4018, Product Sheet 4

AquaCell Prime

- Approved under BBA Agrément Certificate No. 03/4018, Product Sheet 5

AquaCell Core

- Approved under BBA Agrément Certificate No. 03/4018, Product Sheet 1

AquaCell Plus

- Approved under BBA Agrément Certificate No. 03/4018, Product Sheet 3

AquaCell features

The following AquaCell features are applicable to all units:

- Suitable for use when constructing either a soakaway or storage tank
- Modular, lightweight and versatile
- 95% void: holds 190 litres of water per unit
- Safer option than open or above ground storage structures
- Easy to handle and install
- Proven clip and peg system to secure units
- Allows "brickbonding" assembly for extra stability
- Full range of ancillaries including, silt traps and adaptors
- AquaCell units can be "mixed and matched" together (see pages 11-14 for details)

Principal Components
AquaCell Systems

AquaCell Eco Unit
6LB025

AquaCell Prime Unit
6LB075

AquaCell Core Unit
6LB100

AquaCell Plus Unit
6LB200

NOTE: All AquaCell units (Eco, Prime, Core and Plus) have identical dimensions: 1m (L) x 0.4m (H) x 0.5 (W)

Ancillary Components

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)

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

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

6LB105
Clip
(Used to hold units together horizontally)

6D916
160mm OsmaDrain P/E Adaptor
(Fits into pre-formed socket as an extension connection piece)

6D129
OsmaDrain S/S Adaptor – Thinwall Clay Spigot
(For use with 6D916 when connecting to a BS EN 295 Thinwall Clay Spigot)

SA15/2†
150mm SuperSleve Adaptor
(Fits into pre-formed socket to connect to 150mm SuperSleve)

TA/2†
150mm SuperSleve Adaptor
(For use with 6LB104 Flange Adaptor)

TA/4†
225mm SuperSleve Adaptor
(For use with 6LB106 Flange Adaptor)

6LB300
Domestic Silt Trap
(Bucket and extension piece available)

6LB600
Silt Trap
(Use extension kit if required)

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

6LB106**
225mm Flange Adaptor
(To connect to 225mm UltraRib)

6SC205
Extension Kit

*6LB104 – Can only be used when constructing an air vent, on the top surface of the unit, when installed with AquaCell Eco (6LB025).

**6LB106 – Not suitable for use with AquaCell Eco (6LB025).

All ancillary components can be used with any AquaCell unit, except the 225mm Flange Adaptor (6LB106) which must only be used with AquaCell Core or AquaCell Plus.

The 150mm Flange Adaptor (6LB104) should only be used when constructing an air vent on the top surface of an AquaCell Eco unit. The adaptor should not be used to connect inlet pipes to the side of the AquaCell Eco unit.

NOTE: All components on this page are not shown to scale
† Image not shown

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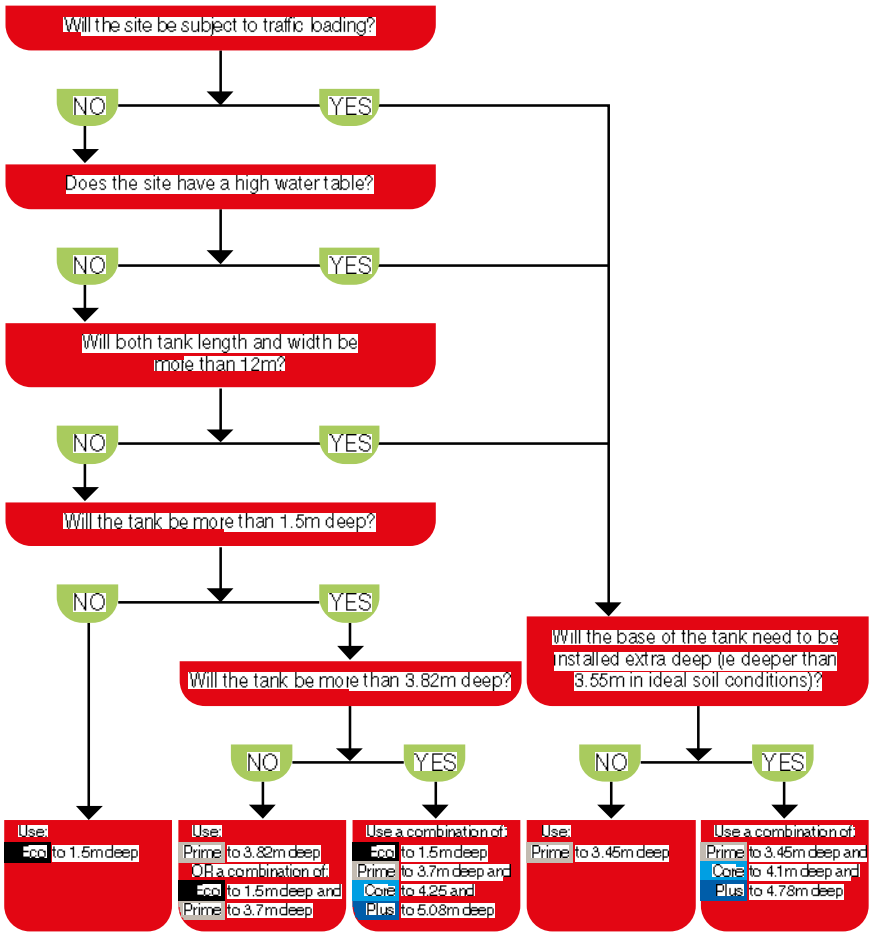
Unit Selector
AquaCell Systems

The following selector will help you to determine which AquaCell unit, or combination of units, is the correct choice for a particular project.



Eco AquaCell Eco (6LB025) *See page 6*

Prime AquaCell Prime (6LB075) *See page 7*

Core AquaCell Core (6LB100) *See page 8*

Plus AquaCell Plus (6LB200) *See pages 9 – 10*

AquaCell Eco

AquaCell Prime

AquaCell Core

AquaCell Plus

Notes:

- AquaCell Eco cannot be used directly with AquaCell Plus
- If tank needs to be inspectable, contact Wavin Technical Design on 0844 856 5161
- Maximum height of tank = 2m (5 units). Any height greater than 2m, please contact Wavin Technical Design on 0844 856 5161
- Allowable maximum depth to base of units is dependent on soil type, angle of shearing resistance, loading and groundwater level
- The above depths are based on 38° angle of shearing resistance and no groundwater. For tanks in high water tables, please contact Wavin Technical Design.

For typical specification of geomembrane, see table on page 13.

Product Details
AquaCell Eco

Application

AquaCell Eco is manufactured from specially reformulated, recycled material and has been specifically designed for shallow, non-trafficked, landscaped applications. AquaCell Eco is **NOT** suitable for locations subject to high water tables.

AquaCell Eco is typically suitable for installations to a maximum depth of 1.5 metres, to the base of the units from ground level, with a minimum cover depth of 0.3 metres, (Wavin recommendation, is to allow a cover depth of 0.5 metres).

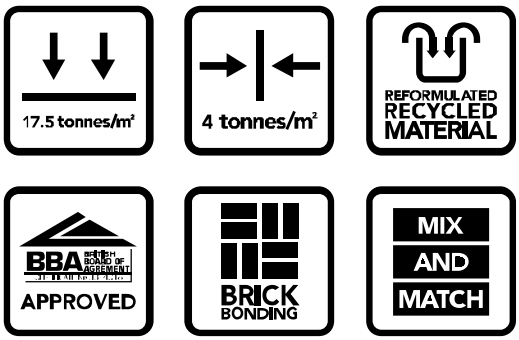
Any installation using AquaCell Eco must **NOT** be subjected to additional loading at any time. Trafficking by construction plant on site, including mechanical equipment, must be avoided.

If trafficking of the buried tank by construction plant or, other vehicles is unavoidable, the installation should be constructed using AquaCell Core units (see page 8).

The width of an AquaCell Eco installation should not exceed 12 metres to allow for mechanical backfilling without loading. There is no limit to the length of the installation.

Features and benefits

- Manufactured from specially reformulated, recycled material
- Suitable for both soakaway and attenuation applications
- Proven vertical loading capacity of: 17.5 tonnes/m²
- Proven lateral loading capacity of: 4.0 tonnes/m²
- Integral "hand holds" for ease of carrying/handling
- Black in colour, for ease of identification from other AquaCell units
- BBA approved – Certificate No 03/4018



AquaCell Eco

Maximum installation depths (to base units) and minimum cover depths (1)

Typical soil type	Typical angle of shearing	Maximum depth of installation (m)	Minimum cover depth (m)
Stiff over-consolidated clay (e.g. London clay)	24°	0.95	0.30
Normally consolidated silty, sandy clay (e.g. alluvium, made ground)	26°	1.05	0.30
Loose sand and gravel	29°	1.2	0.30
Medium dense sand and gravel	33°	1.5	0.30
Dense sand and gravel	38°	1.9	0.30

(1) These values relate to installations where the groundwater is a minimum of one metre below the base of the excavation. AquaCell Eco units should not be used where groundwater is present.

Source: BBA

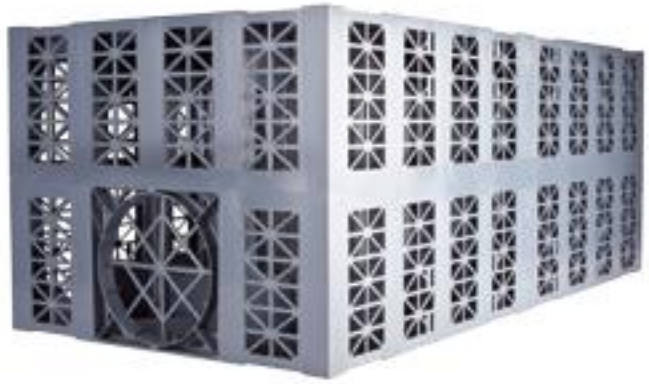
CONNECT TO BETTER

Product Details
AquaCell Prime

Application

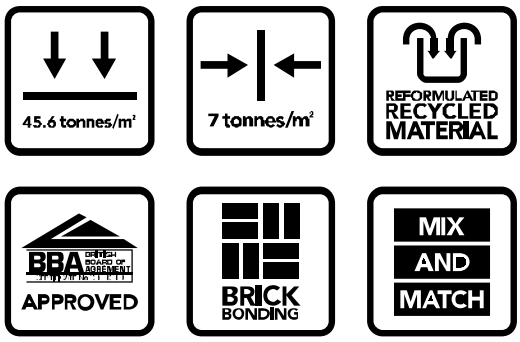
AquaCell Prime is manufactured from specially reformulated, recycled material. It is ideal for use in both shallow and deep applications, subject to either regular traffic loading – such as car parks (for vehicles up to 12 tonnes) or for landscape areas.

Typically AquaCell Prime is suitable for installations to a maximum depth of 3.70m (landscaped) and 3.45m (trafficked), to the base of the units from ground level, in best soil conditions.



Features and benefits

- Manufactured from specially reformulated, recycled material
- Suitable for both soakaway and attenuation applications
- Suitable for use in areas subject to regular traffic loading, i.e. car parks
- Proven vertical loading capacity of: 45.6 tonnes/m²
- Proven lateral loading capacity of: 7 tonnes/m²
- Grey in colour, for ease of identification from other AquaCell units
- BBA approved – Certificate No 03/4018
- Ideal for all types of projects including major attenuation and infiltration schemes



AquaCell Prime

Maximum installation depths (to base units)

Typical soil type	Typical angle of shearing resistance (1) (2) (φ)	Maximum depth of installation – to base of units (m)			
		With groundwater at 1m below ground level and units wrapped in geomembrane		Without groundwater below base of units (normal case)	
		Trafficked areas (cars only) (3)	Non-trafficked areas	Trafficked areas (cars only) (3)	Non-trafficked areas
Stiff over-consolidated clay (e.g. London clay)	24°	1.60	1.78	1.73	1.98
Normally consolidated silty, sandy clay (e.g. alluvium, made ground)	26°	1.75	1.78	2.01	2.27
Loose sand and gravel	30°	1.95	2.08	2.58	2.86
Medium dense sand and gravel	34°	2.04	2.16	2.98	3.24
Dense sand and gravel	38°	2.04	2.24	3.45	3.70

(1) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.

(2) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.

(3) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).

Assumptions made are:

- ground surface is horizontal
- shear planes or other weaknesses are not present within the structure of the soil

Source: BBA

Product Details
AquaCell Core

Application

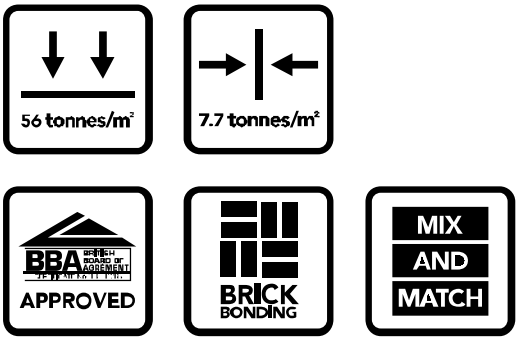
AquaCell Core has been designed for use in deep applications, subject to both regular and heavy traffic loadings, such as cars and HGV's (for vehicles up to 44 tonnes). In addition AquaCell Core can also be used for deep soakaways and landscaped applications.

Typically for use down to depths of 4.25m (landscaped), 4.1m (trafficked by cars) and 4m (trafficked by HGV's), to the base of the units from ground level, in best soil conditions.

Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 0.9 metres is in place.

Features and benefits

- Suitable for regular and heavy traffic loadings
- Proven vertical loading capacity of: 56 tonnes/m²
- Proven lateral loading capacity of: 7.7 tonnes/m²
- Dark blue in colour, for ease of identification from other AquaCell units
- BBA approved – Certificate No 03/4018
- Ideal for all types of shallow and deep projects including major attenuation and infiltration schemes



AquaCell Core

Maximum installation depths (to base units)

Typical soil type	Typical angle of shearing resistance (1) (2) (φ)	Maximum depth of installation – to base of units (m)			
		With groundwater at 1m below ground level and units wrapped in geomembrane		Without groundwater below base of units (normal case)	
		Trafficked areas (cars only) (3)	Non-trafficked areas	Trafficked areas (cars only) (3)	Non-trafficked areas
Stiff over-consolidated clay (e.g. London clay)	24°	1.65	1.75	2.35	2.50
Normally consolidated silty, sandy clay (e.g. alluvium, made ground)	26°	1.70	1.80	2.50	2.65
Loose sand and gravel	29°	1.80	1.90	2.85	2.95
Medium dense sand and gravel	33°	1.90	2.00	3.30	3.45
Dense sand and gravel	38°	2.05	2.15	4.10	4.25

(1) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.

(2) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.

(3) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
Assumptions made are:
- ground surface is horizontal
- shear planes or other weaknesses are not present within the structure of the soil

Source: BBA

CONNECT TO BETTER

Product Details
AquaCell Plus

Application

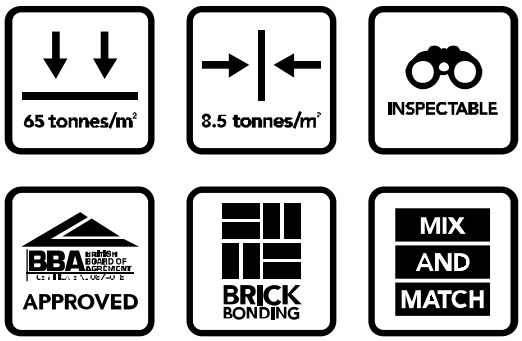
AquaCell Plus has been designed primarily for use in applications where inspectability is required, and is suitable for use in all applications from landscaped areas to heavily trafficked areas (for vehicles up to 44 tonnes) The units can be used in combination with AquaCell Prime and Core (and with Eco if there is at least one layer of AquaCell Prime or Core in between the Plus and Eco layer).

Extra lateral loading capacity allows installation at greater depths. Integral inspection channels in each unit combine to create viewing channels for the full length of the installed structure.

Typically for use down to depths of 5.08m (landscaped), 4.78m (trafficked by cars) and 4.48m (trafficked by HGV's), to the base of the units from ground level, in best soil conditions. Trafficking by heavy construction plant on site, including mechanical equipment, must be avoided until the minimum cover depth of 0.9 metres is in place.

Features and benefits

- Suitable for extra deep installations
- Inspectable (supplied with end cap for use when an inspection channel is not required
- Proven vertical loading capacity of: 65 tonnes/m²
- Proven lateral loading capacity of: 8.5 tonnes/m²
- Light blue in colour, for ease of identification from other AquaCell units
- BBA approved – Certificate No 03/4018



AquaCell Plus

Maximum installation depths (to base units)

Typical angle of shearing resistance [1] [2] (φ)	Maximum depth of installation – to base of units (m)		
	Non-trafficked areas	Trafficked areas	
		Cars [3]	HGV
24°	2.96	2.65	2.35
26°	3.18	2.88	2.57
28°	3.42	3.12	2.82
30°	3.69	3.39	3.08
32°	3.98	3.68	3.38
34°	4.31	4.01	3.71
36°	4.68	4.38	4.07
38°	5.08	4.78	4.48

(1) Loosening of dense sand or softening of clay by water can occur during installation. The designer should allow for any such likely effects when choosing an appropriate value of φ.

(2) The design is very sensitive to small changes in the assumed value of φ, therefore, it should be confirmed by a chartered geotechnical engineer. In clay soils, it may be possible to utilise cohesion in some cases.

(3) Applicable for car parks or other areas trafficked only by cars or occasional refuse collection trucks or similar vehicles (typically one per week).
Assumptions made are:
- ground surface is horizontal
- shear planes or other weaknesses are not present within the structure of the soil

Source: BBA

Product Details
AquaCell Plus

AquaCell Plus: for Inspectability

By aligning AquaCell Plus units end-to-end, full length viewing channels can be created – allowing for CCTV inspection if required. These are created in the bottom layer of an AquaCell tank installation.

The units can be used in combination with AquaCell Prime and Core (and with Eco if there is at least one layer of AquaCell Prime or Core in between the Plus and Eco layer).

NOTE: For any AquaCell Plus units on the perimeter of a structure that are NOT required for inspection access, the open ends of the integral inspection tunnels should be fitted with the end caps provided.

Inspection chambers

An inspection chamber should precede the inlet pipework for the AquaCell structure.

A silt trap or hydro-dynamic separator prior to the inspection chamber is also recommended.

For on-line installations the following Chambers are recommended:
- (down to 3m) Wavin Non-Entry Inspection Chambers
- (down to 5m) Wavin Range: 600 Non-Entry Inspection Chamber or, a traditional manhole*

**where inlet pipework is replaced by AquaCell units acting as flow conduit.*

For off-line installations:
– Manhole with in-built flow control

Recommendation: If installing any Wavin Non-Entry Inspection Chamber, deeper than 1.2 metres, ensure that the cover and frame includes a 350mm restrictor to prevent man entry.

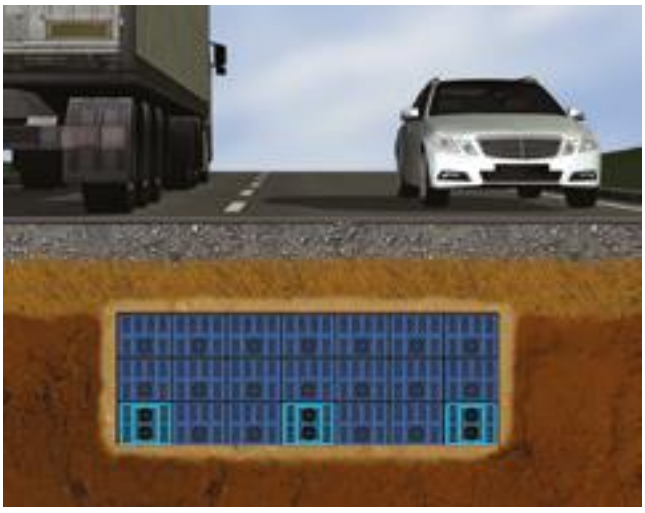
Inspection and maintenance

CCTV inspection at every inspection point is recommended:
- after every major storm
- at regular intervals according to the specific maintenance plan for the site

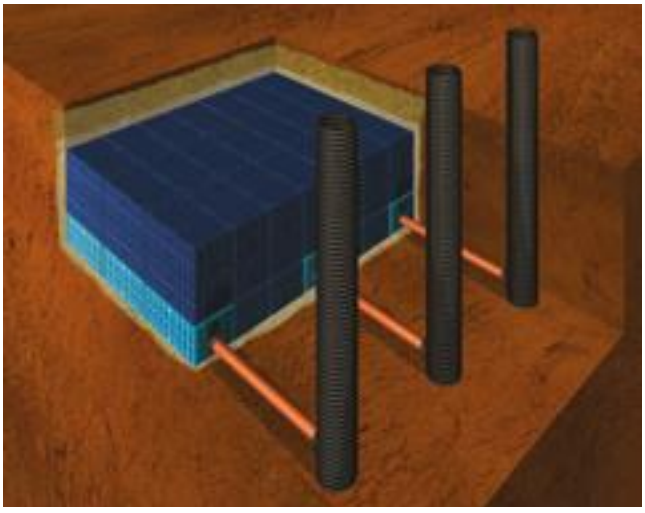
Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank. It is important to prevent construction silt from entering the AquaCell structure.

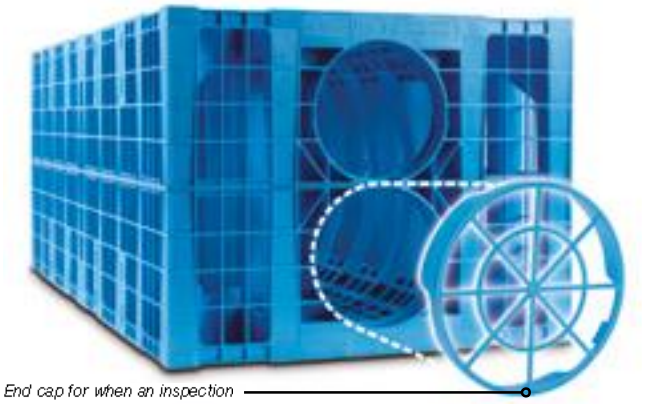
Inspectability scenarios

AquaCell Core and AquaCell Plus



Trafficked tank installation with inspection chambers





End cap for when an inspection channel is not required

AquaCell Plus 6LB200

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Design Guidance
AquaCell Units

Hydraulic and structural design

All AquaCell units have identical dimensions: 1m x 0.4m x 0.5m, with a nominal void ratio of 95%. Hydraulic calculations are accordingly the same for AquaCell Eco, Prime, Core and Plus.

Structural design however, requires careful consideration of loading factors specific to each location – see CIRIA C680.

Location type	Minimum cover depth			
	AquaCell Eco	AquaCell Prime	AquaCell Core	AquaCell Plus
Landscaped/non-trafficked areas	0.3m[b]	0.3m[b]	0.3m[b]	0.3m[b]
Car parks, vehicle up to 12000 kg[a] gross mass	n/a	0.71m	0.75m	0.75m
HA/HGV loading [a]	n/a	n/a	1.2m	1.1m
Maximum depth to base of unit (Landscaped)	1.5m	3.7m	4.25m[c]	5.08m
Maximum depth to base of unit (Trafficked)	n/a	3.45m	4.1m	4.78m

(a) For specific advice on cover depths for heavier loadings/HGV applications, contact Wavin Technical Design on 0844 856 5161.

(b) 0.3 is minimum depth for AquaCell Eco, although 0.5m cover is recommended to prevent accidental damage. If construction plant is to be used on site, extra protection may be needed.

(c) Allowable maximum depth to base of bottom layer of units is dependent on soil type, angle of shearing resistance, loadings, and groundwater level. The above depths are based on 38° angle of shearing resistance and no groundwater.

Installation and cover depths

After deciding which AquaCell unit is correct for the project location (using the System Selector on page 5), see Table for the recommended maximum installation depths and minimum cover depths.

The diagram also shows the depth parameters for each unit, and so gives guidance on combining two or more of the AquaCell units.

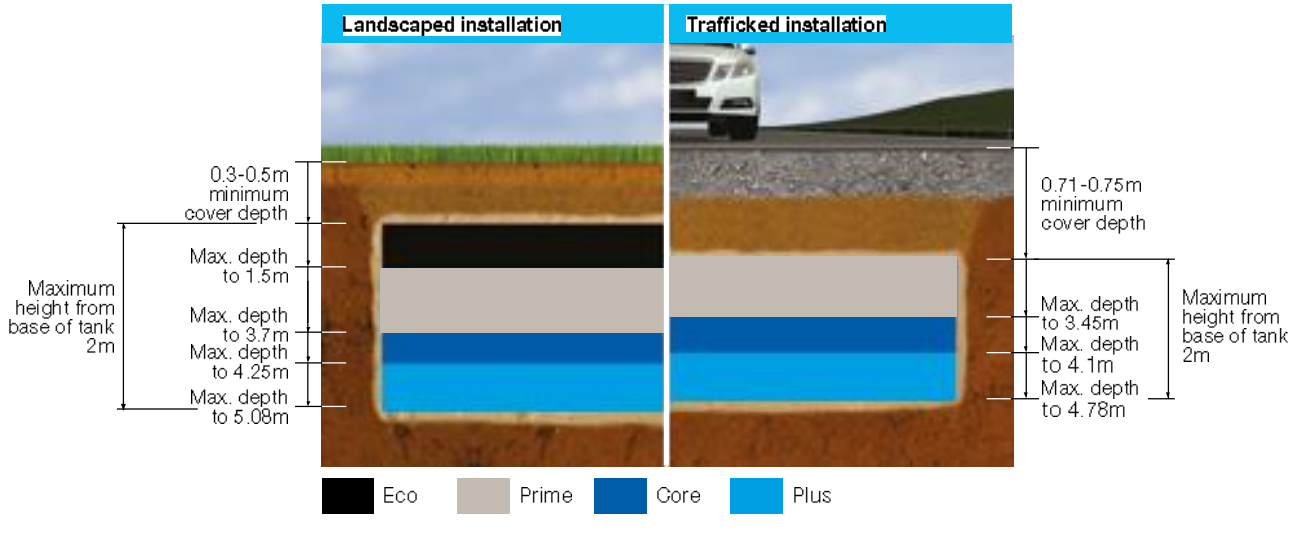
AquaCell systems: Installation depths

Each AquaCell unit has been designed to have specific loading capacities (see pages 6-10) that define the maximum depth parameters for which they are suitable.

Minimum depth of cover varies according to whether or not the installation will be subject to trafficking by cars/HGVs. In each case, the cover depths shown in the diagram include both absolute minimum and recommended minimum cover depths.

However, in some situations, installations may have to be located with greater cover depths. Reasons may include:

- Deep-running drainage network
- Other buried services running above tank location
- Installation into banked/ sloping ground
- Upper layer of clay preventing infiltration



Mixing AquaCell units together

Design Guidance
AquaCell Units

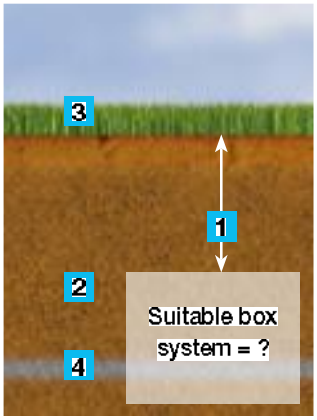
Geocellular structures

Important design considerations
To guarantee the structural integrity of an engineered drainage system, any underground structure must be strong enough to support the loads to which it will be subjected without any unacceptable deflection.

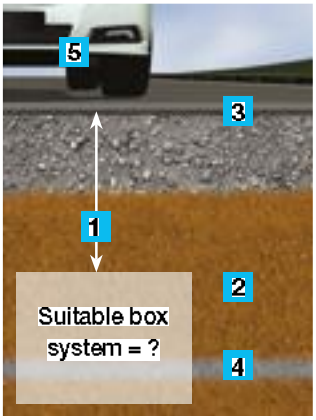
The correct choice of geocellular unit must have appropriate proven top (vertical) and side (lateral) load bearing capacity and deflection characteristics to suit site conditions.

The five key site considerations to be noted when designing a geocellular structure are:
1. Depth of cover (See page 11)
2. Soil type
3. Surface finishing
4. Presence of groundwater
5. Type of traffic/loading

Non-trafficked



Trafficked



The combination of these 5 factors effectively means that the required characteristics of a geocellular structure to be installed under a trafficked location (for example) will be very different from that under a landscaped/low-loaded location. Two typical examples are given below.

EXAMPLE A: Landscaped/non-trafficked location and 0.3m cover depth. Typically requires minimum vertical strength of 17.5 tonnes/m^2

EXAMPLE B: Car park with occasional light delivery traffic and between 0.71 – 0.75m cover depth. Typically requires minimum vertical strength of 40 tonnes/m^2

These factors have already been taken into consideration within the System Selector on page 5 for the four AquaCell units, and in the cover depth and installation depth guidance on page 11.

'Brick-bonding' unit assembly

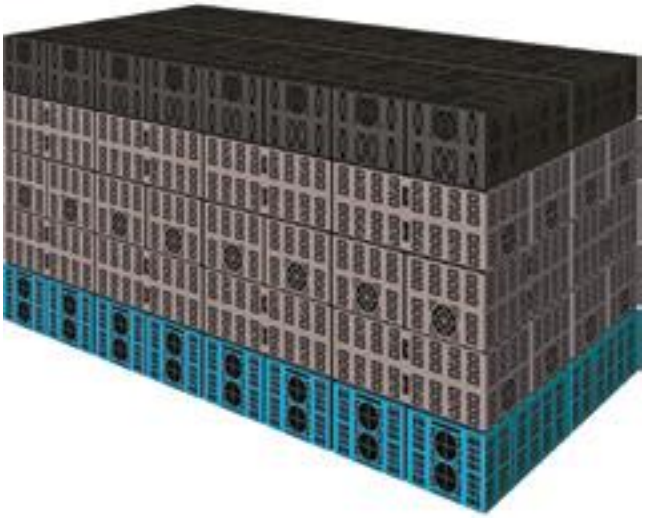
Recommended for extra stability
When assembling a geocellular structure that comprises two or more layers, it is recommended that AquaCell units are placed in a 'brick-bonded' configuration.

This helps minimise continuous vertical joints in the assembly, and gives the structure extra stability.

No extra connectors required with AquaCell
A significant advantage of AquaCell unit design is that brick-bonding placement does not require extra connectors.

All four AquaCell units may be placed in this way, unless inspection channels and cleaning access are required using AquaCell Plus.

AquaCell Plus units incorporate integral inspection channels. These are designed for combined alignment to create viewing tunnels at the base of an assembled structure (see page 10).



Soakaway or tank?

Checking site suitability

Infiltration criteria

A site is suitable for infiltration (soakaway) provided that BOTH of the following are confirmed:

- The underlying soil surrounding the proposed installation is sufficiently permeable
- The seasonally high water table is a minimum of 1 metre below the base of the proposed installation

If either of these criteria is not the case, or cannot be confirmed for any reason, a soakaway system may not be suitable for the application.

Storage tank

If infiltration is not possible, the system may be wrapped in an impermeable geomembrane to create a storage tank which would discharge at a fixed flow rate via a flow restriction device to a permissible outflow point.

This may be designed to be online or offline (see pages 22-28 for typical details).

However, if the site is subject to groundwater or a high water table, it is important to ensure that the tank is not vulnerable to flotation. Sufficient weight from soil, or other covering placed over the AquaCell units, must be sufficient to counter any buoyancy uplift force from the rising groundwater level.

Site assessment

Ground conditions may be established as part of a geotechnical assessment. This may include tests for infiltration and ground water level.

If there is no confirmation that such assessments have been conducted, or resulting conclusions are unavailable, a trial pit will be required in accordance with BRE 365.

For information and guidance, please contact the Wavin Technical Design Team.

Typical specification for a polypropylene geomembrane

Property	Value	Test method
Thickness +/- (mm)	1.0	ASTM D 751
Density (minimum) ($g \cdot cm^{-3}$)	0.9	ASTM D 792
Tensile stress at break (minimum) ($N \cdot mm^{-2}$)	18	ASTM D 638
Elongation break (%)	> 700	ASTM D 638
Puncture resistance (minimum) (N)	150	FTMS 101C, Method 2065
Tear resistance (minimum) (N)	60	ASTM D 1004
Dimensional stability (maximum) (% change)	+/- 2.0	ASTM D 1204, 1h at 100°C
Stress crack resistance (%)	100	ASTM D 5397
Volatile loss, 5% loss (maximum)	0.2	ASTM D 1203
Ozone resistance	No cracks	ASTM D 1149
Carbon black content (%)	2 to 3	ASTM D 1603
Moisture vapour ($g \, m^{-2} day^{-1}$)	< 0.1	ASTM E 96
Friction angle (non-woven geotextile)	21°	Shear box
Methane permeability ($g \, m^{-2} day^{-1} atm^{-1}$)	0.11	European Standard
Methane transmission rate ($m^3 m^{-2} s^{-1} atm^{-1}$)	0.8×10^{-9}	BRE
Permeability coefficient	1.8×10^{-12}	–
Application temperature (°C)	> 4	–

Source: BBA

Installation Guidance
AquaCell Units

AquaCell Prime, Core and Plus: Construction Loads

Construction plant such as excavators can impose significant loads on any AquaCell unit. The following guidelines should be observed:

- Tracked excavators (not exceeding 21 tonnes weight) should be used to place fill over the AquaCell units when the geotextile or geomembrane wrapping has been completed
- At least 300mm of fill should be placed before the excavators or trucks delivering the backfill are allowed to traffic over the installed units
- Compaction plant used over the AquaCell units should not exceed 2300kg/metre width. This will allow the compaction of Type 1 sub-base in 150mm layers over the units in accordance with the Specification for Highways Works
- All other construction plant should be prevented from trafficking over the system once it is installed and surfacing completed, unless a site specific assessment demonstrates that it is acceptable
- In particular cranes should not be used over, or place their outriggers over the system

AquaCell Eco: Construction Loads

As AquaCell Eco is designed for landscaped and non-loaded applications, certain precautions are recommended on site to prevent damage to the units through excess loading.

Manual assembly

Whilst assembling the tank, it may be necessary to walk on top of previously laid AquaCell units. Therefore care should be taken not to damage the edges of the units.

Backfilling

When backfilling AquaCell Eco installations:

- Machines placing the material must be located OFF the units
- Only light compaction should be applied to the material
- Backfill with suitable, stone-free, as-dug material
- First layer should be 300mm thick before using any compaction plant
- NO vibratory mechanism should be used for compacting this first layer
- Compaction plant must not exceed 2300kg per metre width

Construction traffic on site

If construction plant (e.g. excavators or loaders) are likely to run over the installation:

- MINIMUM protective cover should be 500mm well-compacted granular material
- Only tracked excavators can be used and MUST NOT weigh more than 14 tonnes.
- HGVs MUST NOT run over installed AquaCell Eco units

Manual assembly

All ancillaries and adaptors (see page 8) can be used with either the AquaCell Eco, Prime, Core or Plus units, except the 225mm Flange Adaptor (6LB106) which must only be used with AquaCell Prime, Core or Plus.

The 150mm Flange Adaptor (6LB104) should only be used when constructing an air vent on the top surface of an AquaCell Eco unit. The adaptor should not be used to connect inlet pipes to the side of an Eco unit.

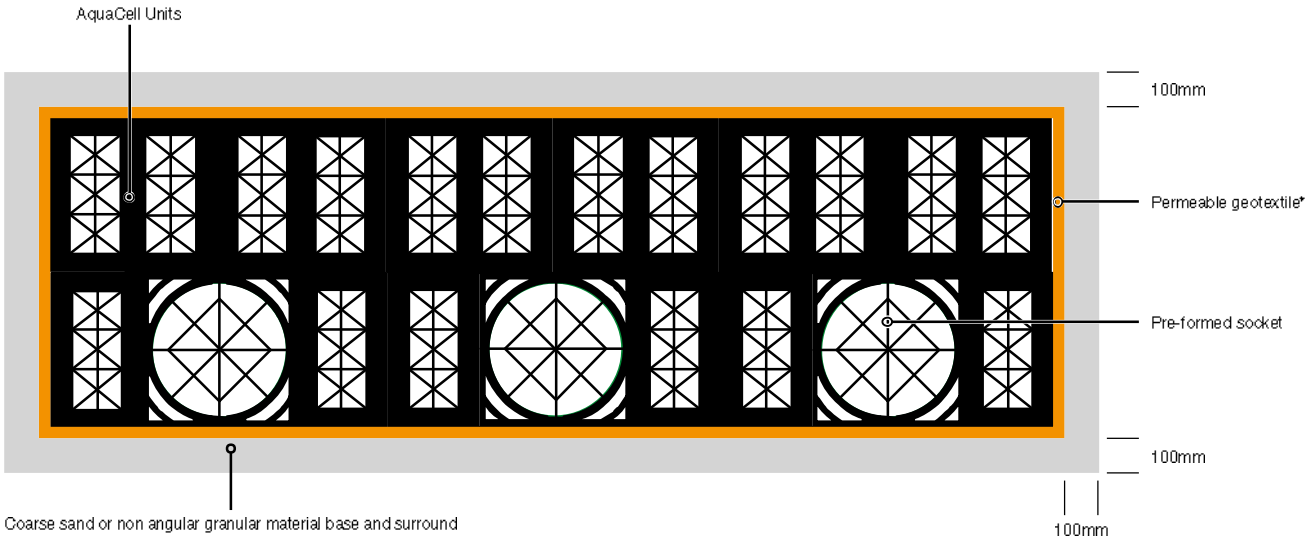
CONNECT TO BETTER

Installation
AquaCell Units

Typical Soakaway 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 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) – see page 12. For single layer applications use the AquaCell Clips and for multi layers use the AquaCell Clips and the AquaCell Shear Connectors (vertical rods).
5. Fix the 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 Domestic Silt Trap (6LB300) or the standard Silt Trap (6LB600) is installed prior to the inlet pipework – see page 17 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.
10. Backfill with suitable material.
11. Rainwater from roof areas may discharge directly into the soakaway but rainwater from carparks must discharge through a catchpit manhole and/or a petrol interceptor.



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

**The geotextile should be selected according to specific site conditions. Typically, however, a 300g non-woven 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.*

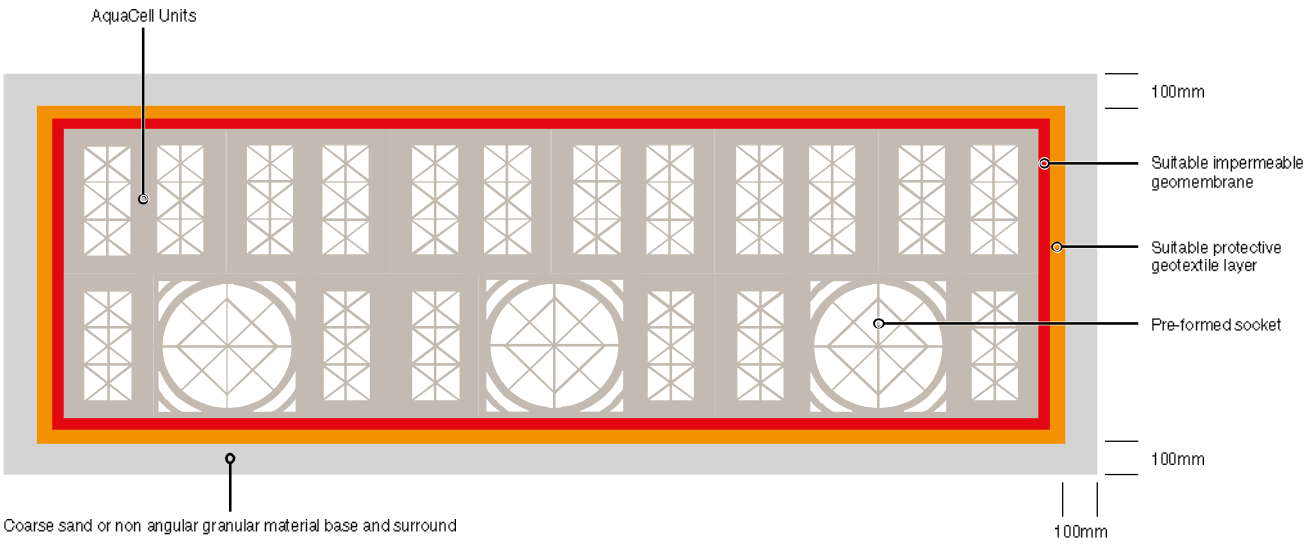
Installation
AquaCell Units

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 12. 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 17 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 17 for design.

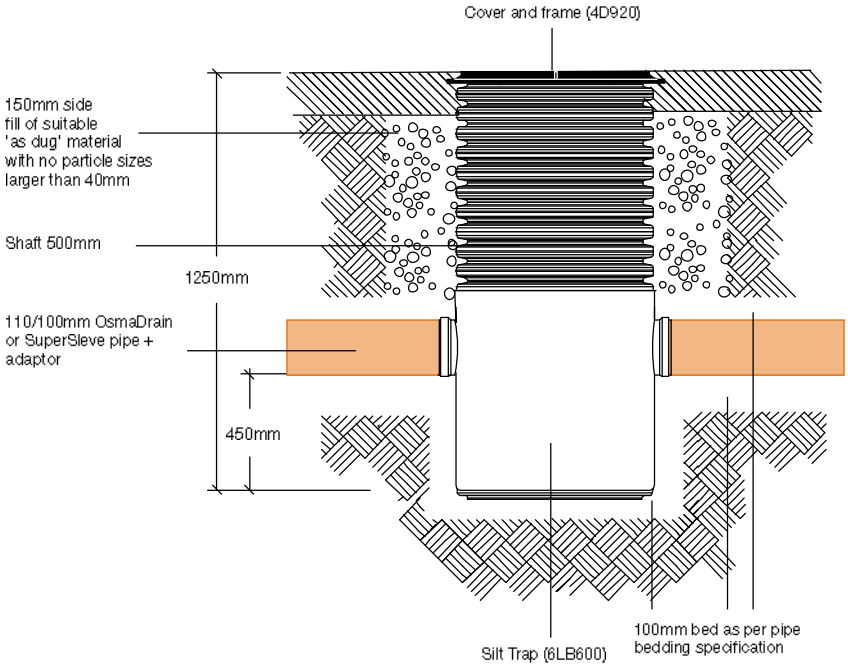


Example shows the use of AquaCell Prime. However, a storage tank can also be installed as shown using any of the other versions of AquaCell units (Eco, Core or Plus) as appropriate.

**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.*

Silt Trap and Air Vent Termination

Silt Trap

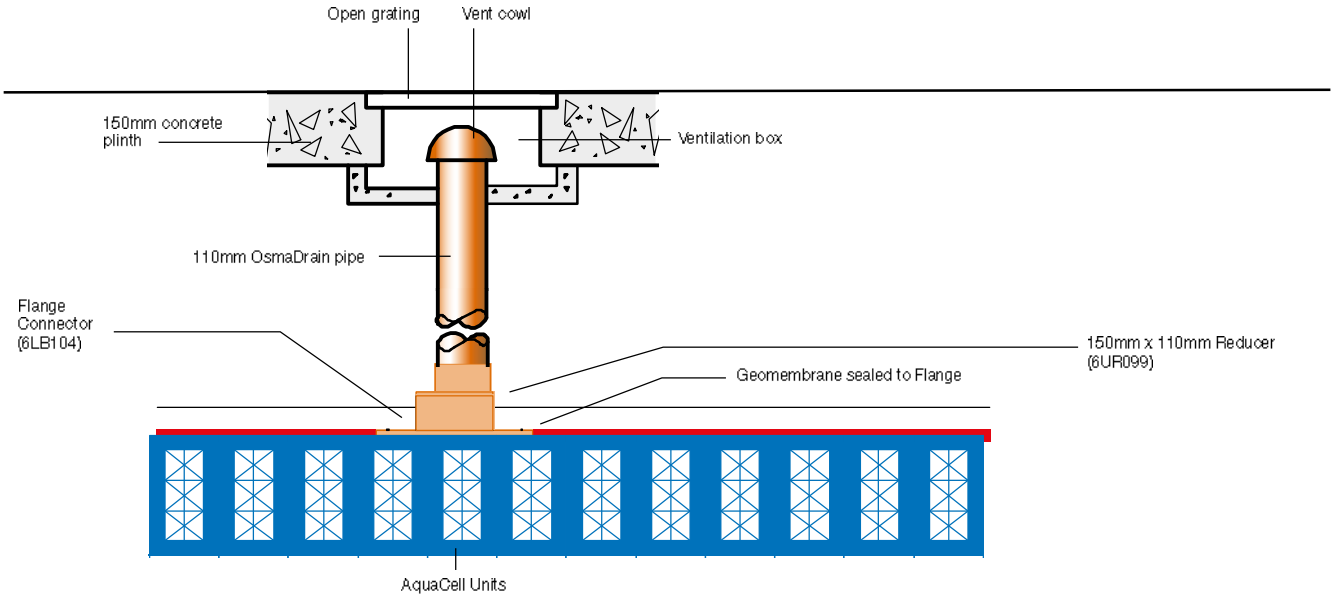


Typical Installation procedure

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.

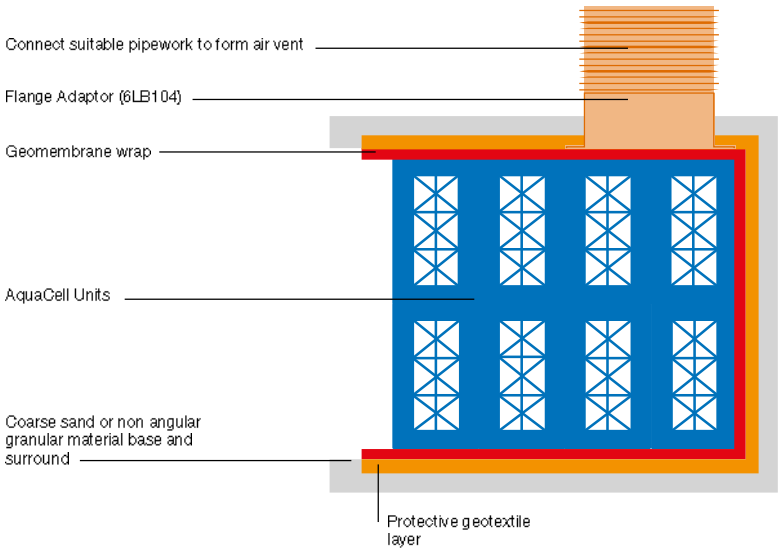
Adhesive or double sided tape should be used between the geomembrane and the flange plate to ensure a watertight seal.

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

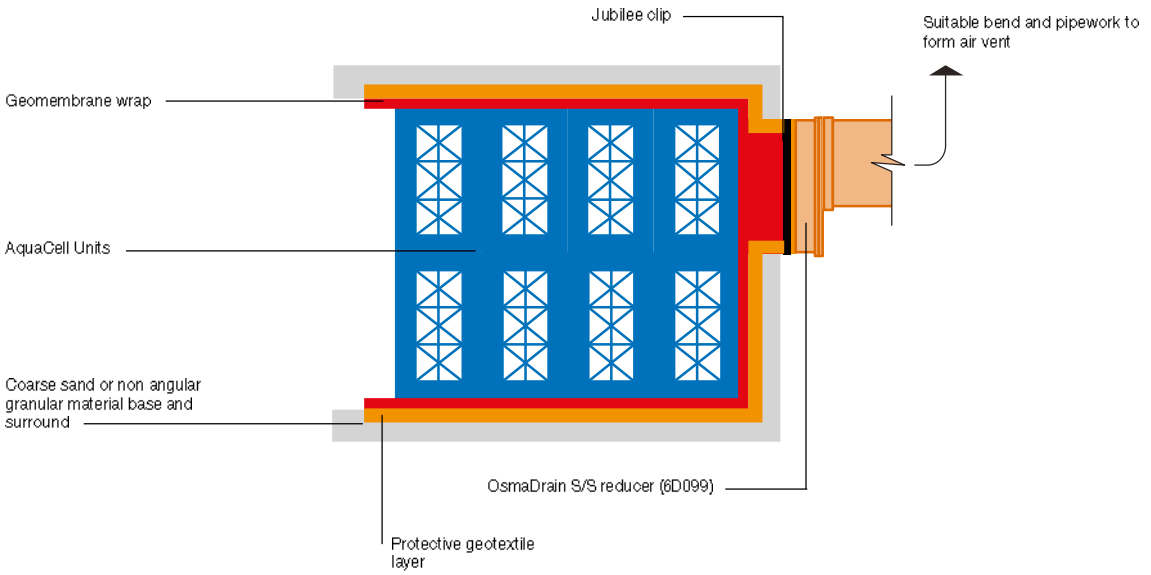
1. Fix Flange Adaptor to the AquaCell unit with self tapping screws.
2. Cut through the geomembrane.
3. Insert pipework into Flange Adaptor to form air vent.

Side Connection for Air Vent

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

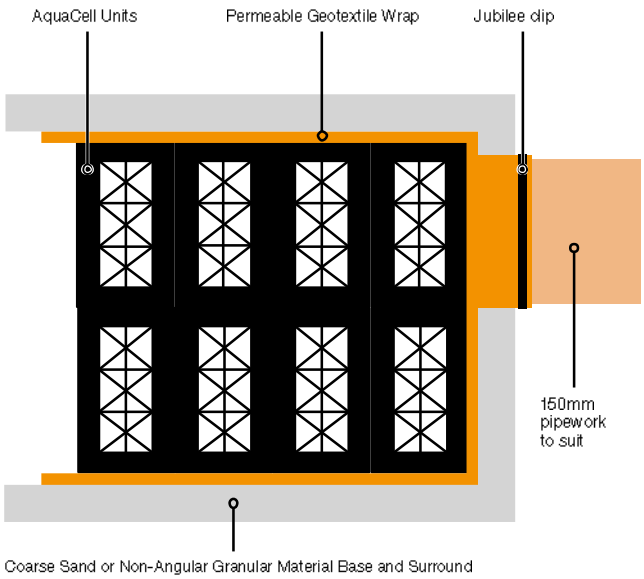
Typical Installation procedure

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

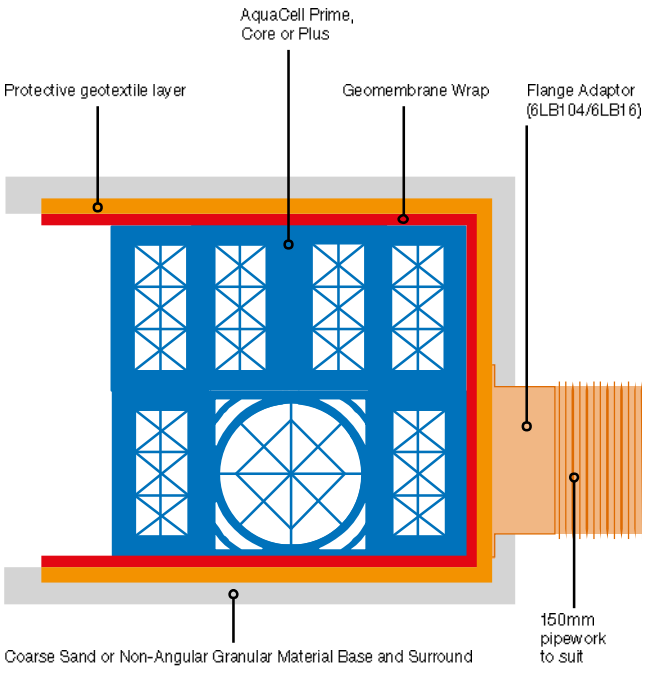


Connections to AquaCell Units

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



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



*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)

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.

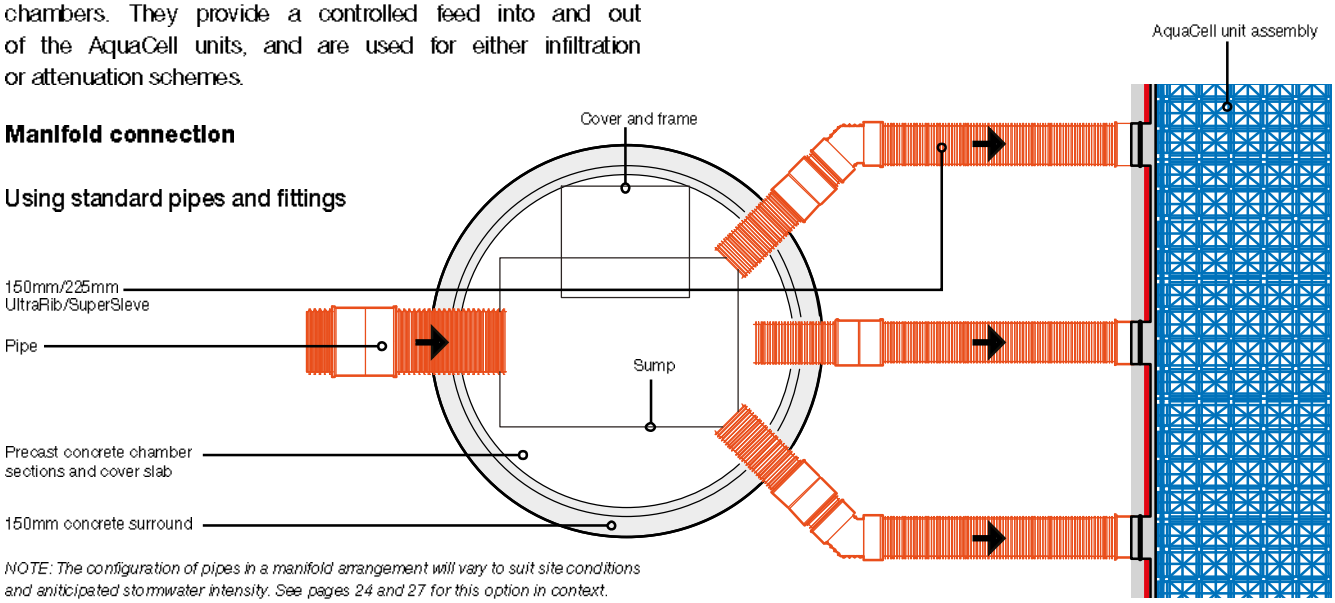
Typical Details
AquaCell Units

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

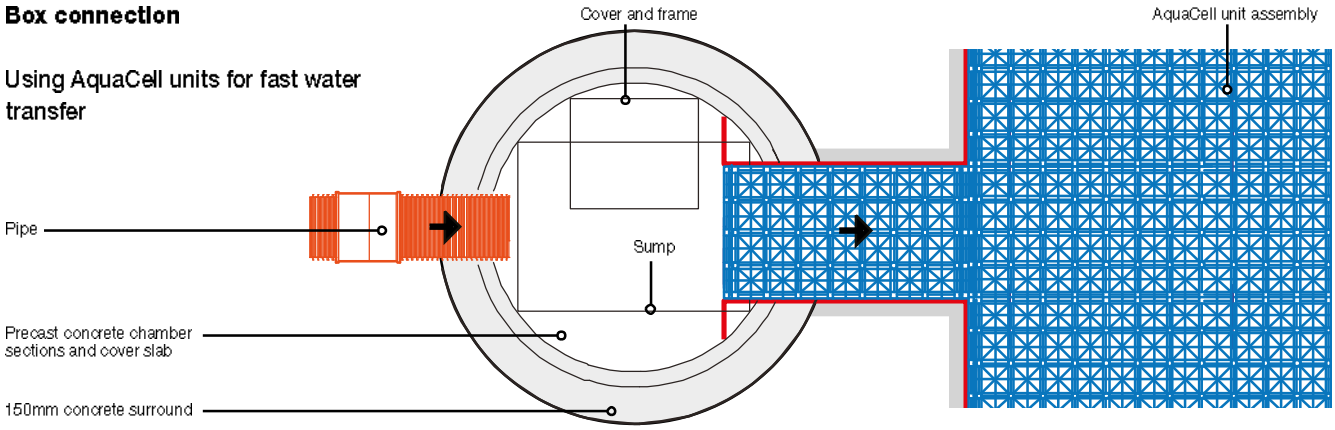
Using standard pipes and fittings



NOTE: The configuration of pipes in a manifold arrangement will vary to suit site conditions and aniticipated stormwater intensity. See pages 24 and 27 for this option in context.

Box connection

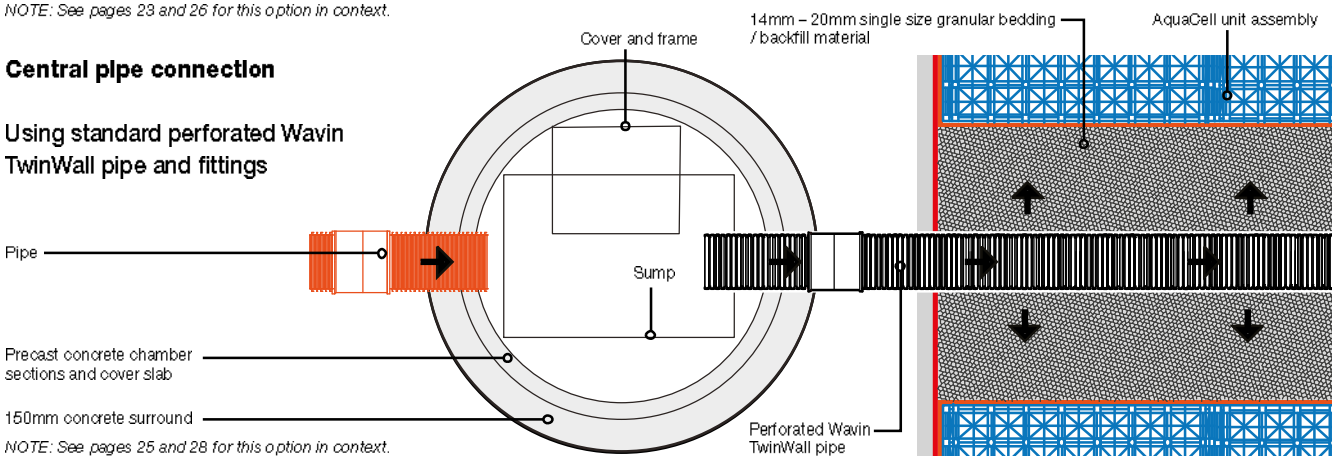
Using AquaCell units for fast water transfer



NOTE: See pages 23 and 26 for this option in context.

Central pipe connection

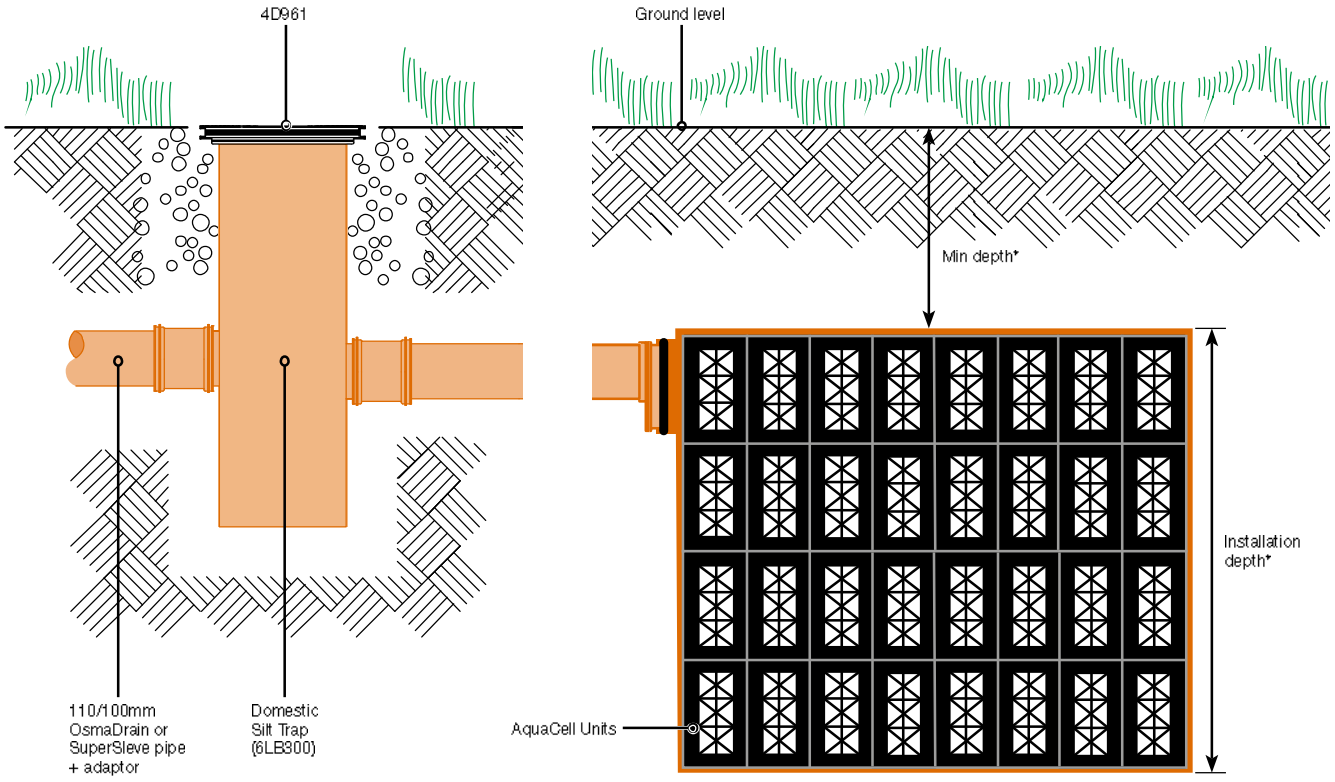
Using standard perforated Wavin TwinWall pipe and fittings



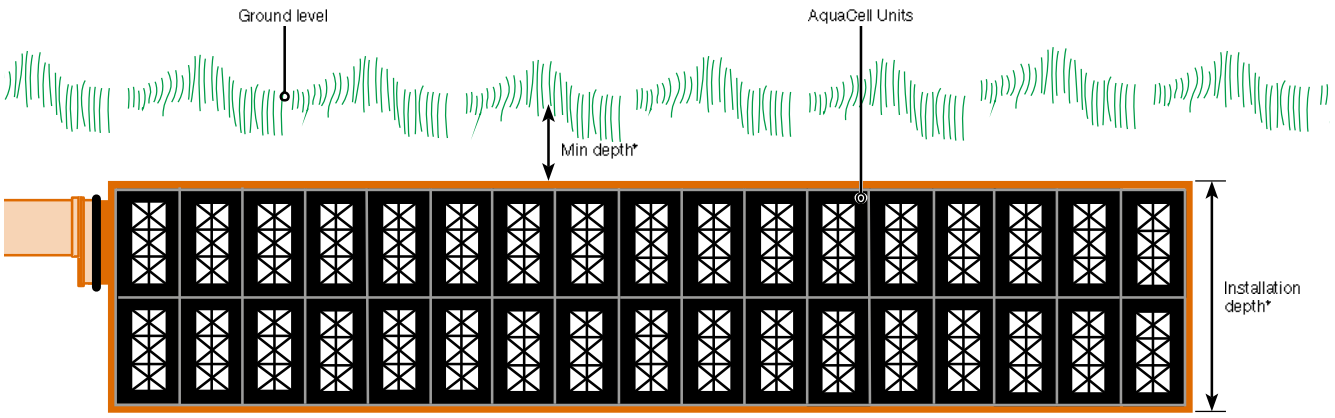
NOTE: See pages 25 and 28 for this option in context.

Soakaway – Non-Traffic Loading

Soakaway



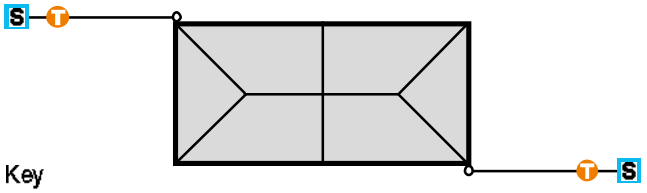
Trench soakaway



Notes

1. Soakaways should be sited at least 5m away from the building (Ref BS EN 752-4).
2. The exact size and shape of the soakaways are to be determined once all the necessary calculations have been produced.

*For information regarding cover depths and installation depths, see page 11.



Key

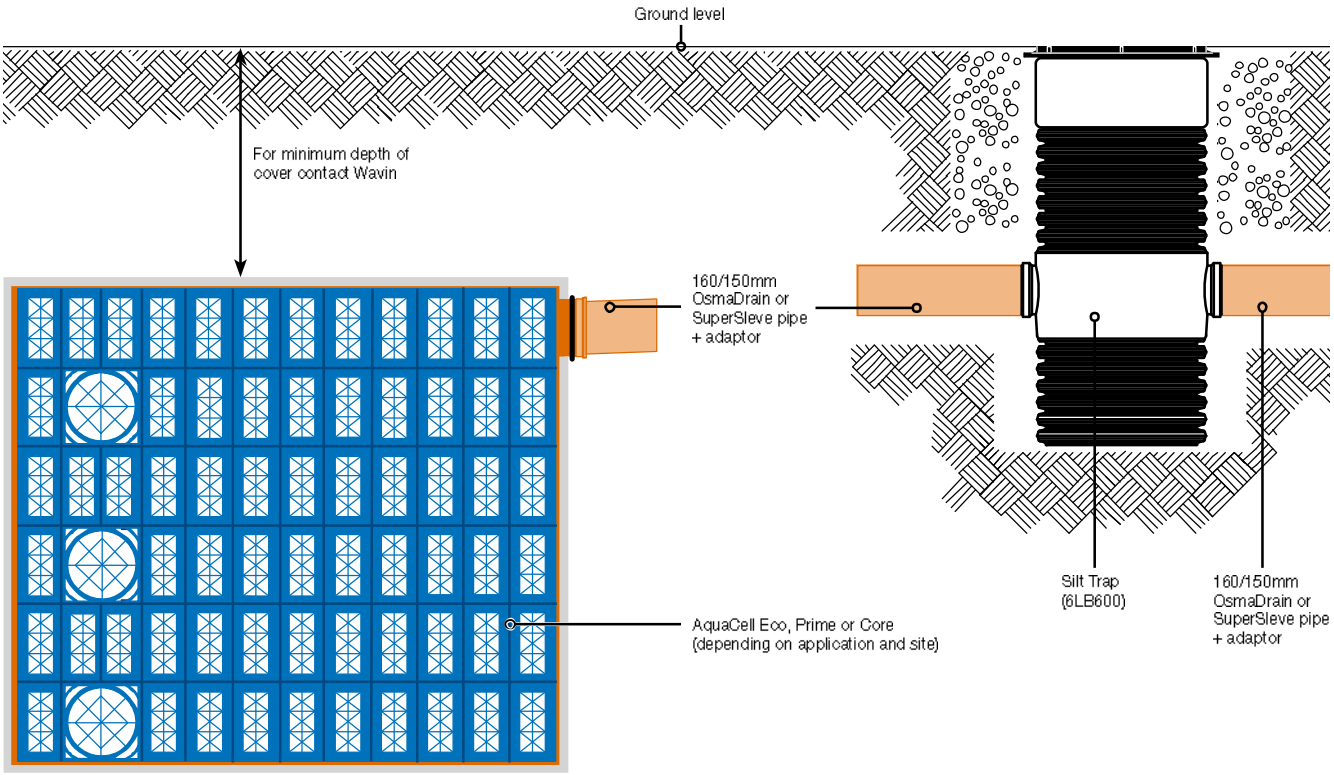
S = AquaCell units soakaway (See note 2)

T = 250mm Dia Silt Trap

Typical Details
AquaCell Units

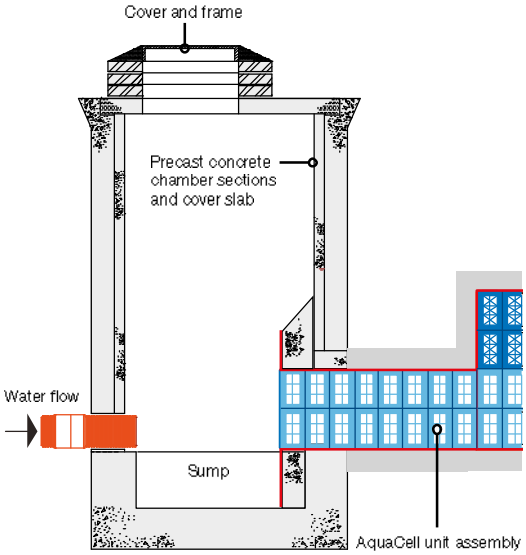
Soakaway – Traffic Loading

Soakaway

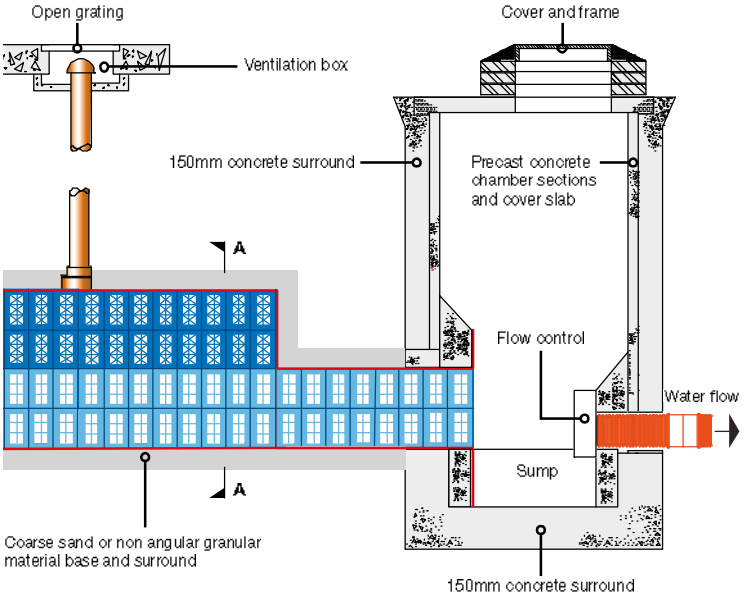


On-Line Storage – Box Feed

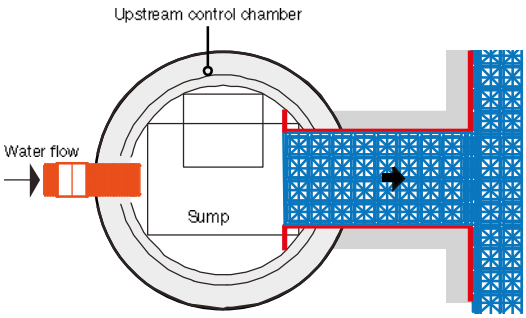
Long section

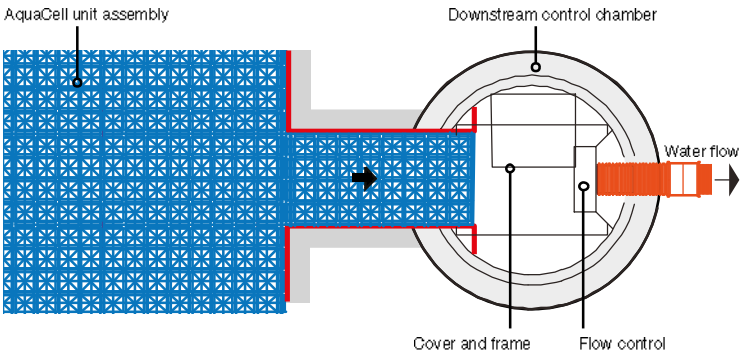


Typical vent detail

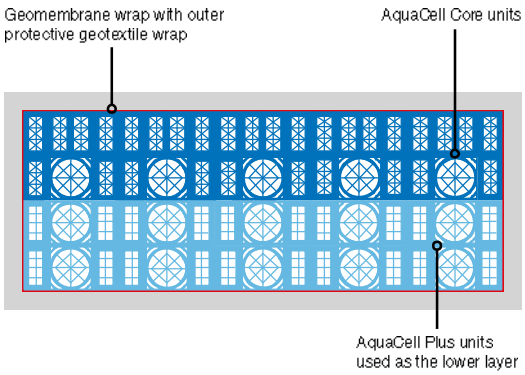


Plan





Cross section A-A



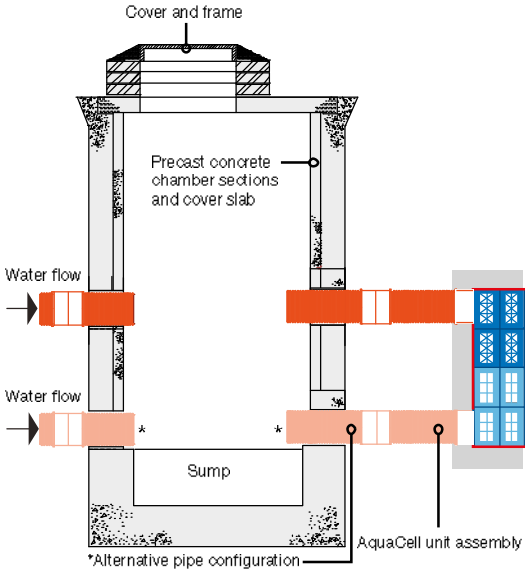
What happens to the water?

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.

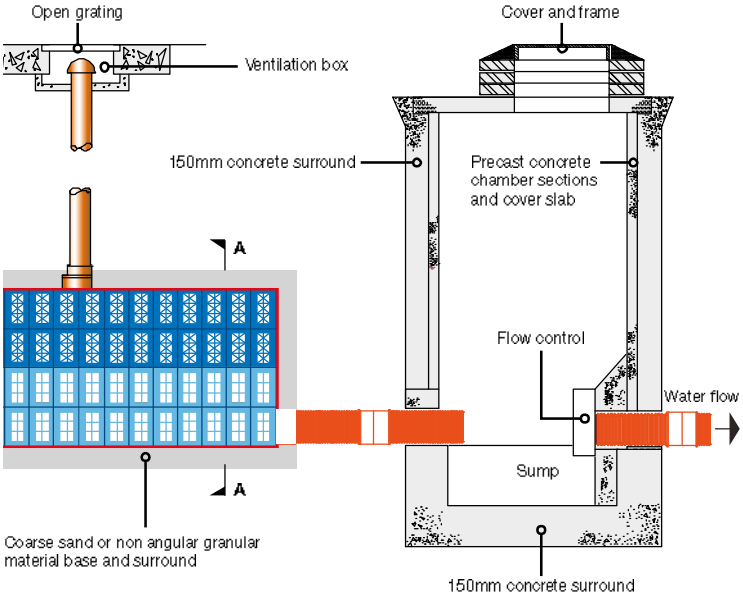
Typical Details
AquaCell Units

On-Line Storage – Manifold Feed

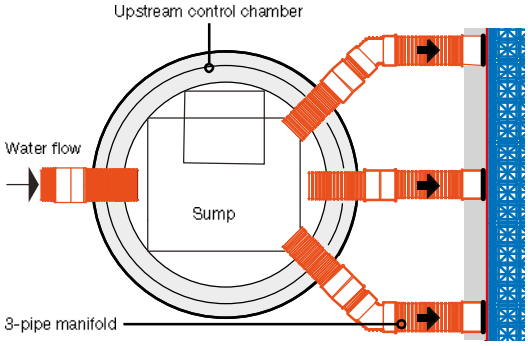
Long section

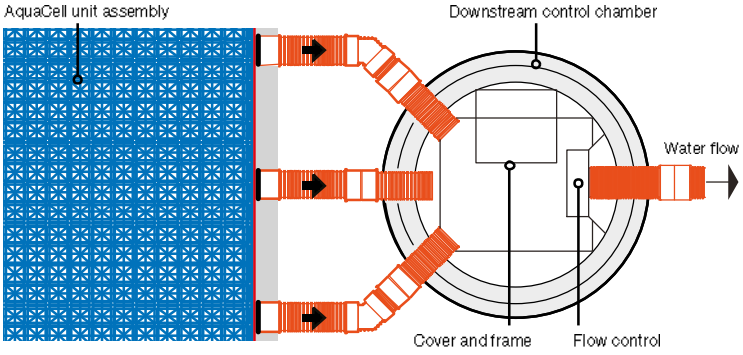


Typical vent detail

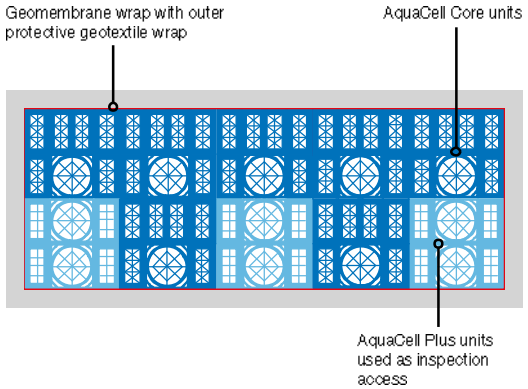


Plan





Cross section A-A

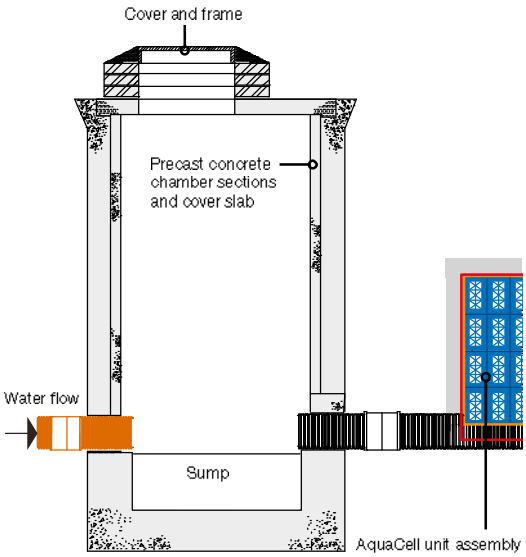


What happens to the water?

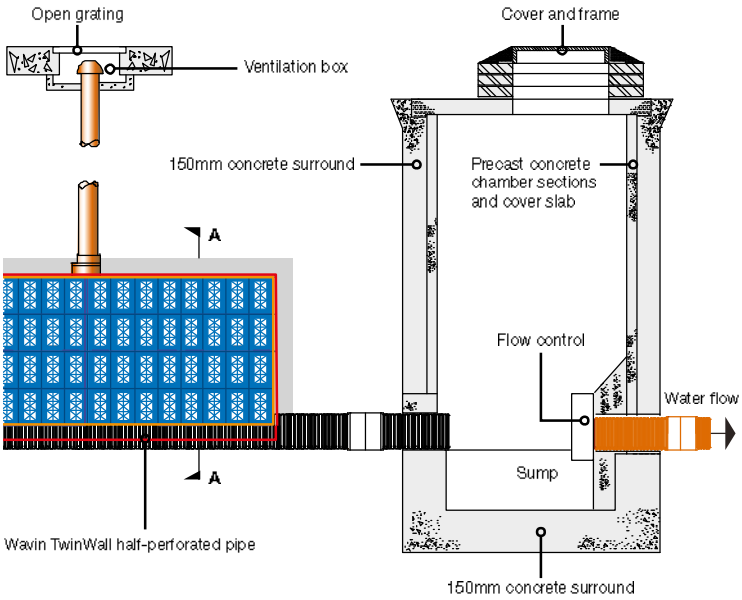
1. The water level in the upstream control chamber rises.
2. During a storm event, the AquaCell storage assembly fills with water via the manifold feed connection.
3. After storm event, water flows back out of the AquaCell storage assembly, finding its own level, and into the downstream control chamber.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

On-Line Storage – Central Pipe Feed

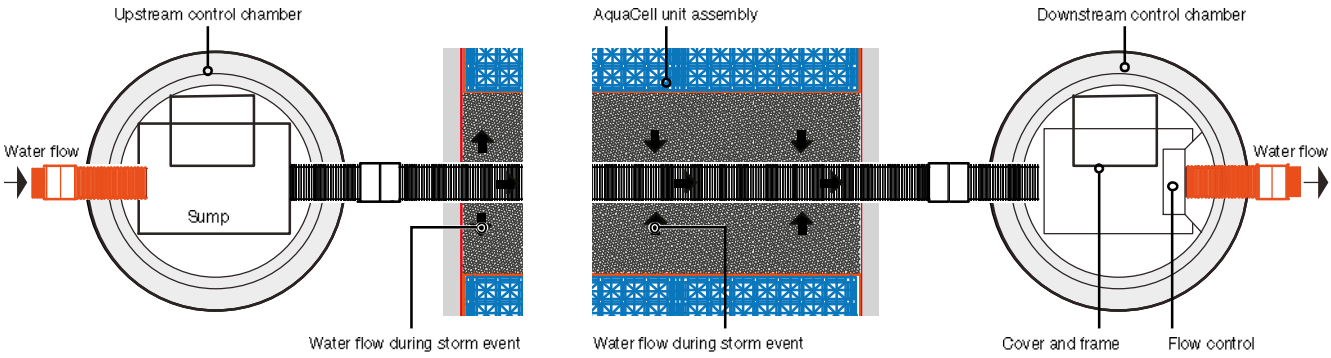
Long section



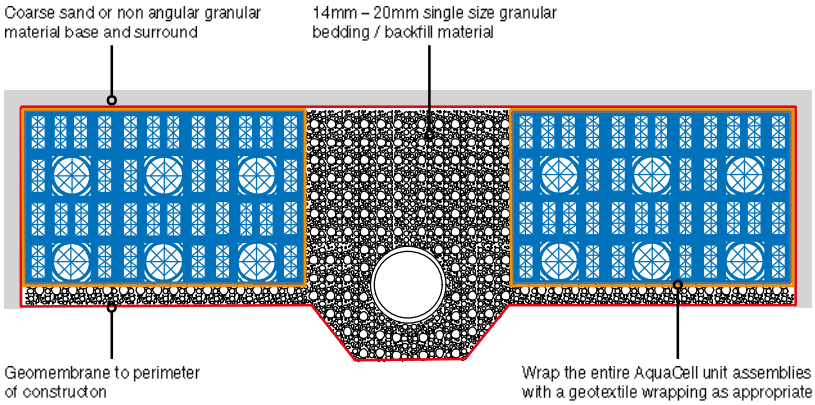
Typical vent detail



Plan



Cross section A-A



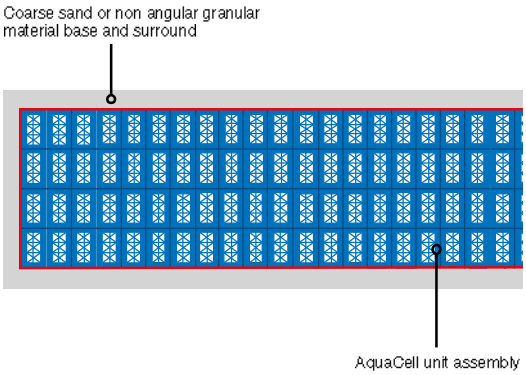
What happens to the water?

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.

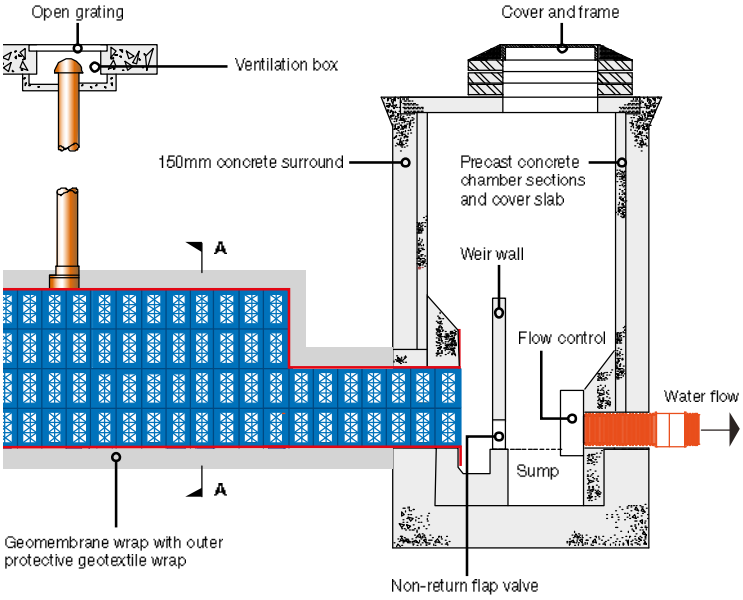
Typical Details
AquaCell Units

Off-Line Storage – Box Feed

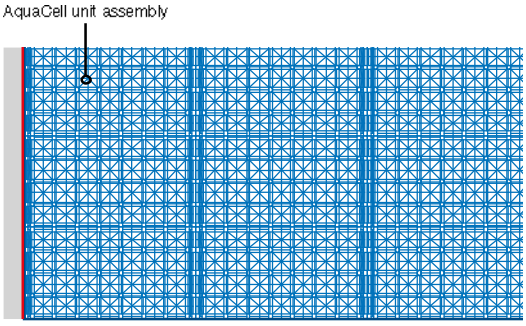
Long section

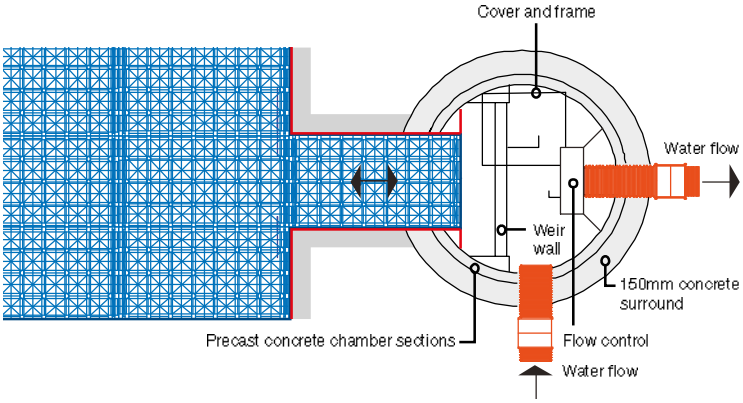


Typical vent detail

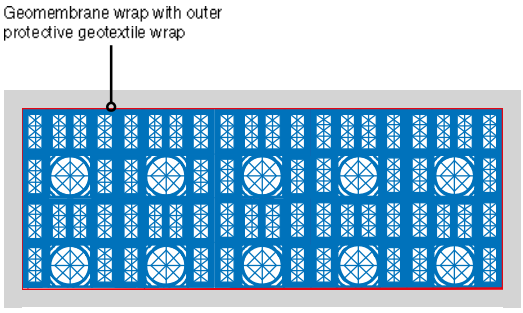


Plan





Cross section A-A

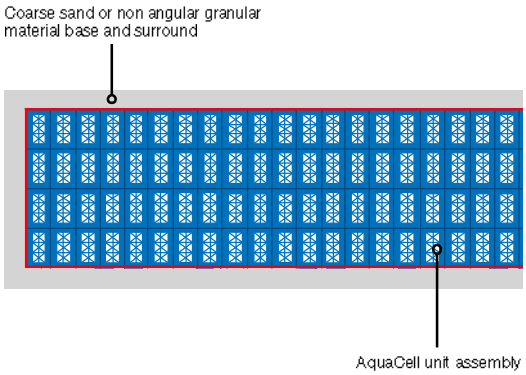


What happens to the water?

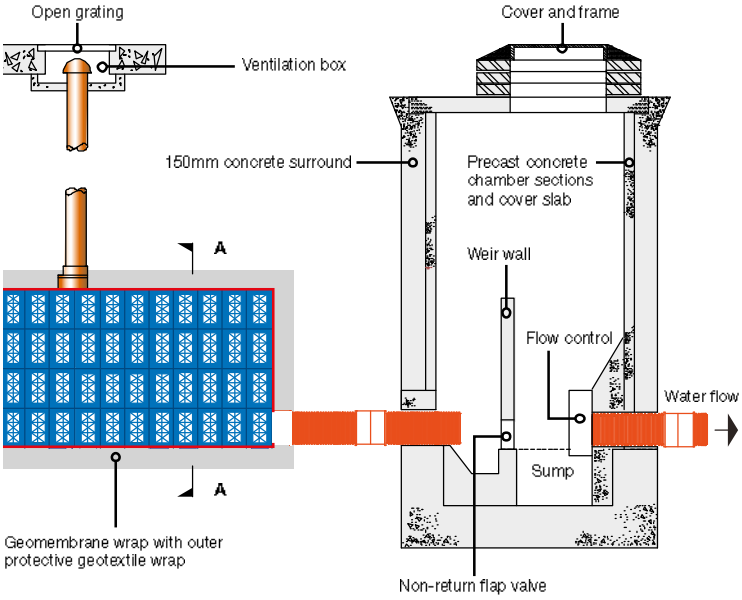
1. Control chamber fills with water, up to the top of the weir wall.
2. The water overflows the weir wall and enters the AquaCell storage assembly via the AquaCell connection.
3. The AquaCell storage assembly fills with water.
4. After storm event, water flows back out of the AquaCell storage assembly,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

Off-Line Storage – Manifold Feed

Long section



Typical vent detail



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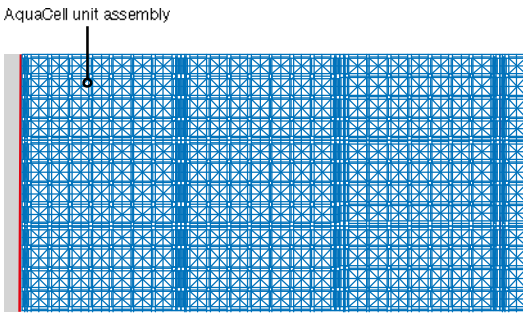
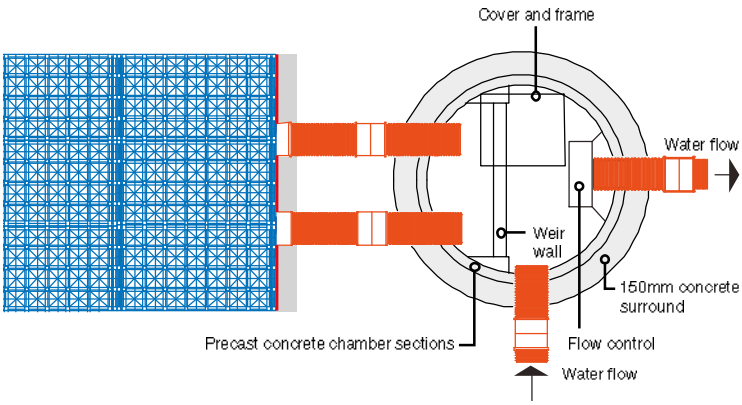
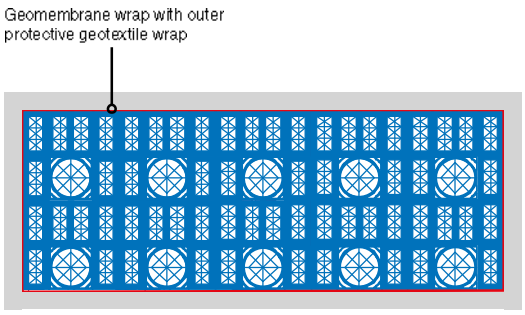




Cross section A-A



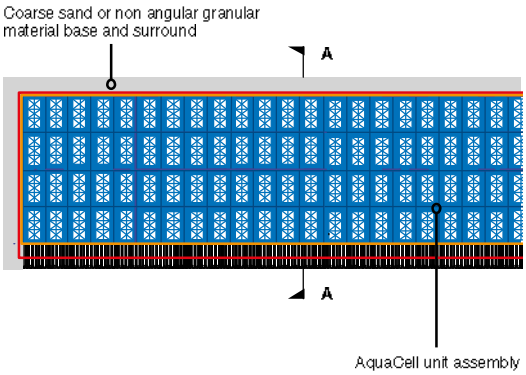
What happens to the water?

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.

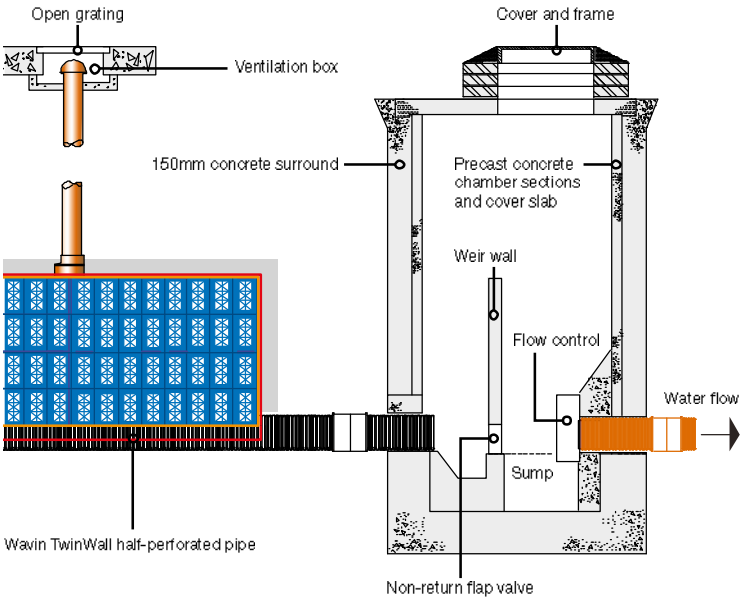
Typical Details
AquaCell Units

Off-Line Storage – Central Pipe Feed

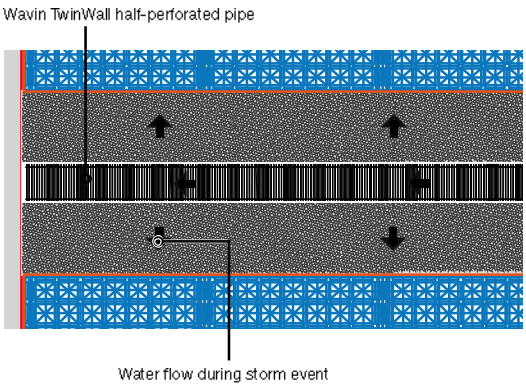
Long section

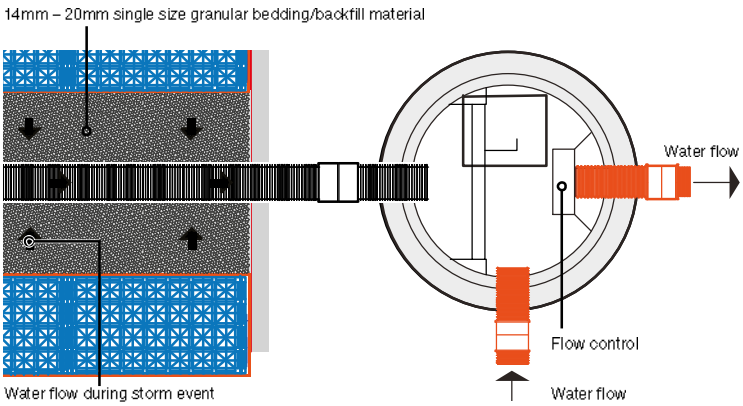


Typical vent detail

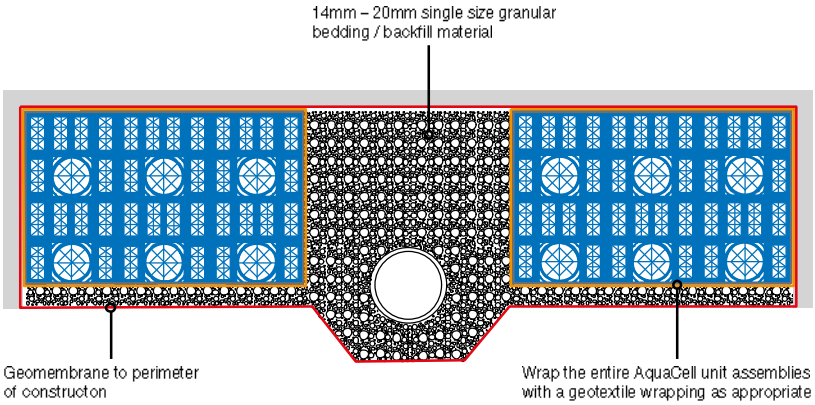


Plan





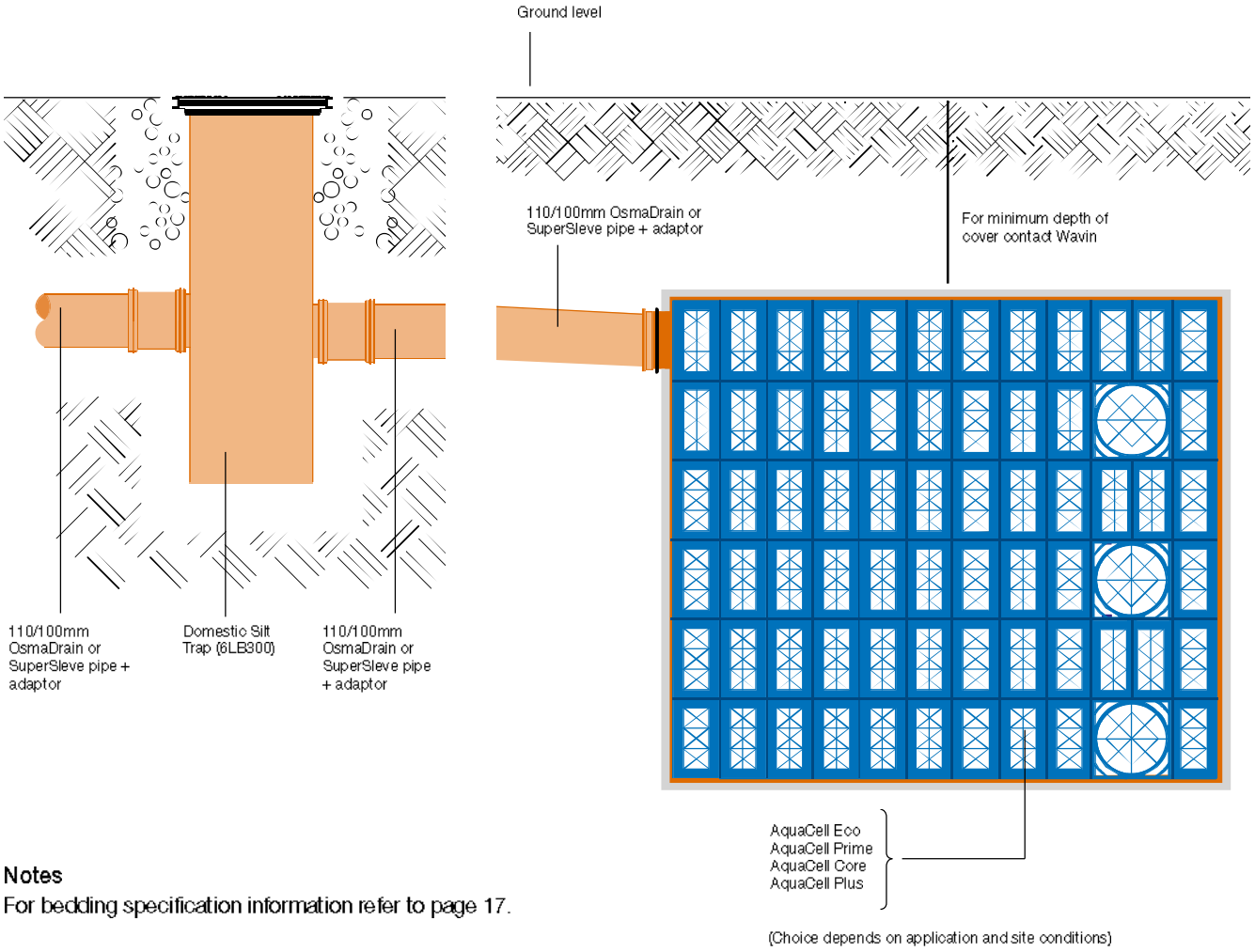
Cross section A-A



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

Soakaway or Storage Tank – With Silt Trap



Notes

For bedding specification information refer to page 17.

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

Wavin Stormwater Management
AquaCell Systems

To Achieve Optimum Stormwater Management

The Wavin Stormwater Management System represents a combination of specialist expertise and technology from Wavin. This is specifically focused on achieving the optimum solution for each project requiring effective and sustainable management of stormwater.

Such a solution may be entirely based on a tailored combination of our engineered systems.

In other cases, Wavin Stormwater Systems can be integrated with 'soft' SUDS techniques, such as ponds and swales, to help achieve the optimal solution.

Other Wavin Stormwater Systems

Oil Separators

A comprehensive range of NS Oil Separators, tested to EN 858 Class 1 standard and complying with PPG-3 legislation for England and Wales.

Channel Drainage

Environmentally-friendly polyester concrete systems to cover all EN 1433 load classes. With outstanding chemical resistance and low water absorption:

- PolyChannel SK range: general purpose channel for applications up to E600
- PolyChannel SKS range: heavy duty channel for applications up to F900

Plastic Pervious Paving

High performance, plastic pervious paving system, for use in all types of Sustainable Drainage systems (SUDS).

- AquaGrid 50 – for use in landscape projects
- AquaGrid 75 – for use in car parking areas

Flow Control Valves

The Wavin+Mosbaek range of vortex flow control valves are manufactured from stainless steel and are custom-built to meet exact site requirements:

- Self-activating with no moving parts or power requirements
- Unique integral by-pass/drain down features to suit all types of applications

Anti-flood Valves

- Anti-Flood Valves that comply with EN 13546-1, and Part H1– Sections 2.8-2.12 of Building Regulations

Below Ground Water Transportation

Wavin Stormwater installations can draw from an extensive choice of plastic and clay water conveyance systems, including:

- OsmaDrain solid wall PVC-U pipe system
- Structured wall plastic UltraRib and TwinWall pipe systems
- SuperSleve and HepSeal clay pipe systems

Other options include perforated pipe for land drainage: WavinCoil plastic and HepLine clay – and a full range of Wavin Non-Entry Inspection Chambers.

Rainwater Re-Use

The Wavin Stormwater Water Range can also exploit stored rainwater. These reduce the use of potable mains water for nonpotable purposes.

Below ground domestic rainwater re-use systems are available.

The Wavin Stormwater Service

Precision and Performance

The Wavin Stormwater team are ready to contribute to any stormwater management project.

This may be at the very earliest stage – or when initial plans have already been developed. There are no pre-conditions with regards to you requesting Wavin to become involved.

We are ready to:

- Originate project design
- Comment on an existing design
- Help validate a specification – or, where we see an opportunity to do so, to suggest how it may be enhanced
- Check, clarify and confirm maximum cost-efficiency, performance capability and regulatory compliance

This involvement is a core part of the Wavin principle. It extends beyond the systems and components.

To discuss your stormwater management project, call 0844 856 5161 or email technical.design@wavin.co.uk.

CONNECT TO BETTER

General Information
AquaCell Systems

Descriptions

Descriptions and illustrations in this publication are for guidance only. No responsibility can be accepted for any errors, omissions or incorrect assumptions. Refer to the product itself if more detailed information is required. Due to the continuing programme of product improvement the Company reserves the right to amend any published information or to modify any product without prior notice.

Dimensions

Unless otherwise stated all dimensions are in millimetres (mm).

Symbols

a) British Standard Kitemark
Identifies pipes and fittings which are manufactured under the B.S.I. Certification Scheme.

b) British Board of Agrément
Identifies non-Kitemarked fittings which are covered by a British Board of Agrément Certificate.

Colour

AquaCell Eco – Black
AquaCell Prime – Grey
AquaCell Core – Dark Blue
AquaCell Plus – Light Blue

Supply

All AquaCell components are supplied through a nationwide network of merchant distributors. For further information contact Customer Services on 0844 856 5152.

Technical Advice

The AquaCell System is backed by Wavin's comprehensive technical advice service. This is available to provide expert assistance at every stage of a project, from planning and product selection to installation and maintenance.

Contact Wavin Technical Design Department:

Tel: 0844 856 5165

Email: technical.design@wavin.co.uk or via online enquiry at wavin.co.uk

Literature

The following Wavin publications are also available from the Literature Department at Chippenham.

General
- Wavin Below Ground & Civils System: Trade Price List

Stormwater Management Systems
- Wavin AquaCell System: Product and Installation Guide
- Wavin Flow Control Range: Product and Installation Guide
- Wavin Commercial Rainwater Re-use System: Product Summary
- Wavin Poly-Concrete Channel Systems: Product and Installation Guide
- Wavin Quickstream Siphonic Roof Drainage Systems: Product and Installation Guide

Gravity Drain and Sewer Systems
- OsmaDrain System: Product and Installation Guide
- Osma UltraRib System: Product and Installation Guide
- Osma Non Man-Entry Inspection Chamber Range: Product and Installation Guide

To request details with regards to any of the above components and/or for any technical enquires please contact:

Literature Request
Tel: 01249 766333
Email: literature@wavin.co.uk

Technical Design
Tel: 0844 856 5165
Email: technical.design@wavin.co.uk

Wavin Online
The complete range of Wavin/Osma product and installation guides are also available online at: wavin.co.uk

Discover our broad portfolio at
www.wavin.co.uk

Water management | Plumbing and heating | Waste water drainage
Water and gas distribution | Cable ducting

Wavin Limited
Registered Office
Edlington Lane
Doncaster | DN12 1BY
Tel. 0844 856 5152
www.wavin.co.uk | info@wavin.co.uk

For further product information visit: wavin.co.uk

wavin
CONNECT TO BETTER

WM424 – October 2015

Kingspan Klargester

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

ADVANCED ROTOMOULDED CONSTRUCTION ON SELECTED MODELS!

Let us help!
Free professional site visit with friendly support and advice.
helpingyou@klargester.com
to make the right decision
or call 028 302 66799

Kingspan Environmental

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention or bypass separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

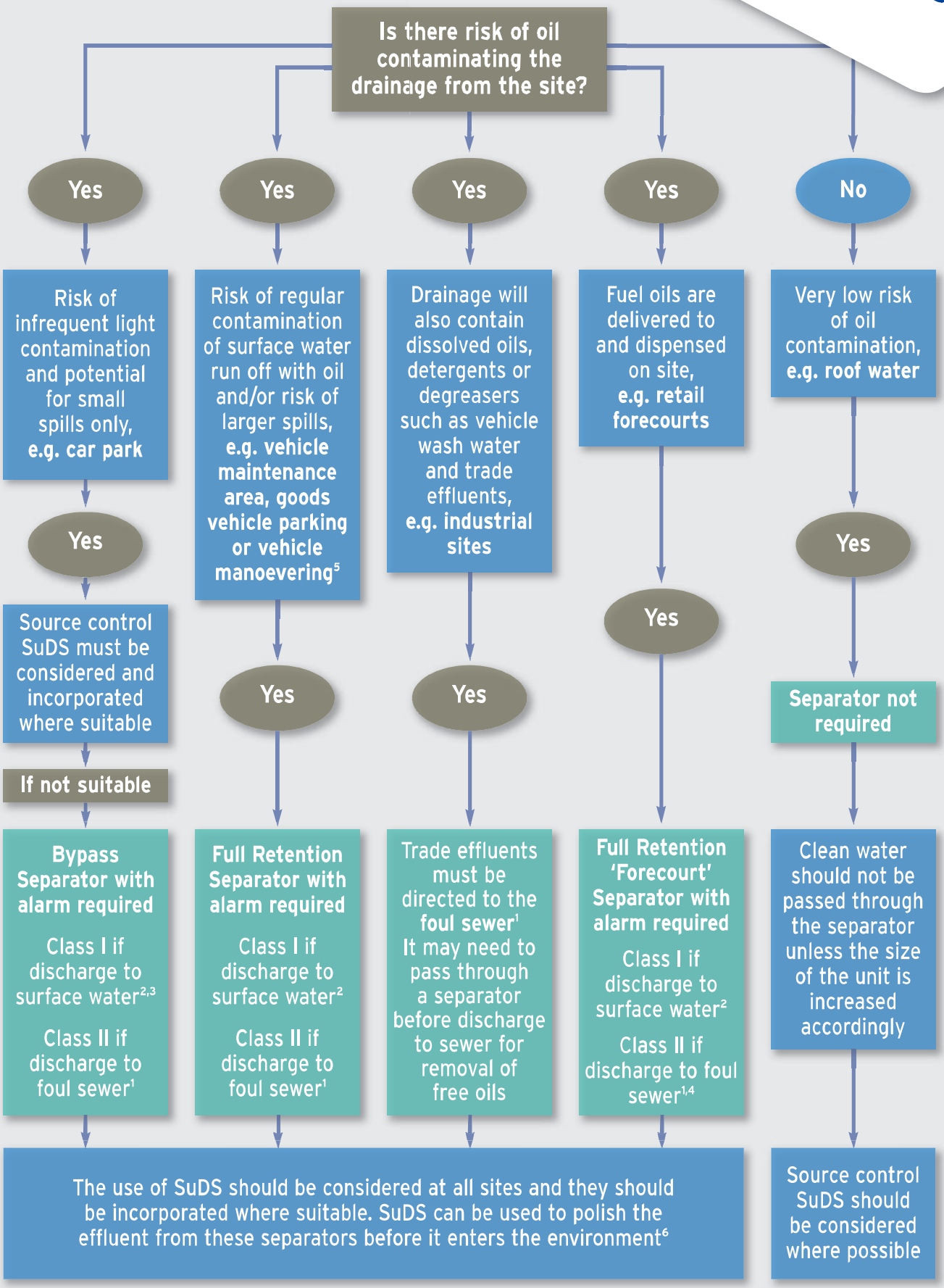
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 *You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.*
2 *You must seek prior permission from the relevant environmental body before you decide which separator to install.*
3 *In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.*
4 *In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.*
5 *Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.*
6 *In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.*

Bypass NSB RANGE

APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

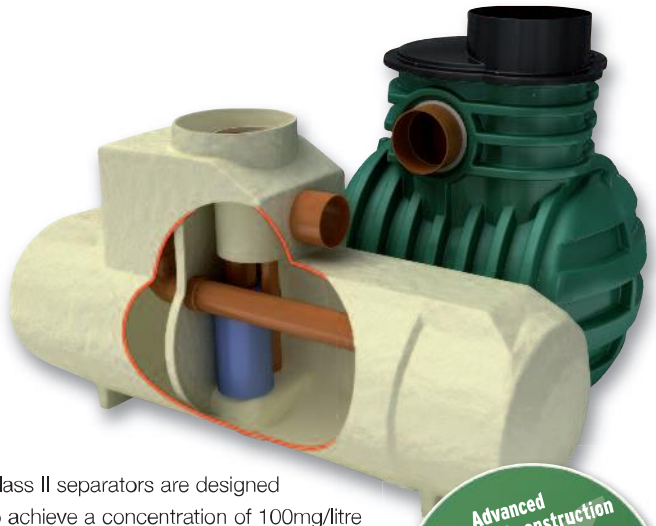
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Klargester full retention separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.



Class II separators are designed to achieve a concentration of 100mg/litre of oil under standard test conditions.

Advanced rotomoulded construction on selected models
- Compact and robust
- Require less backfill
- Tough, lightweight and easy to handle

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped .
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m^2)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction *GRP chamber construction* ** Some units have more than one access shaft – diameter of largest shown.*

Appendix 3–OPW Past Flood Event Local Area Summary Report

Past Flood Event Local Area Summary Report

Report Produced: **14/9/2021 12:23**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

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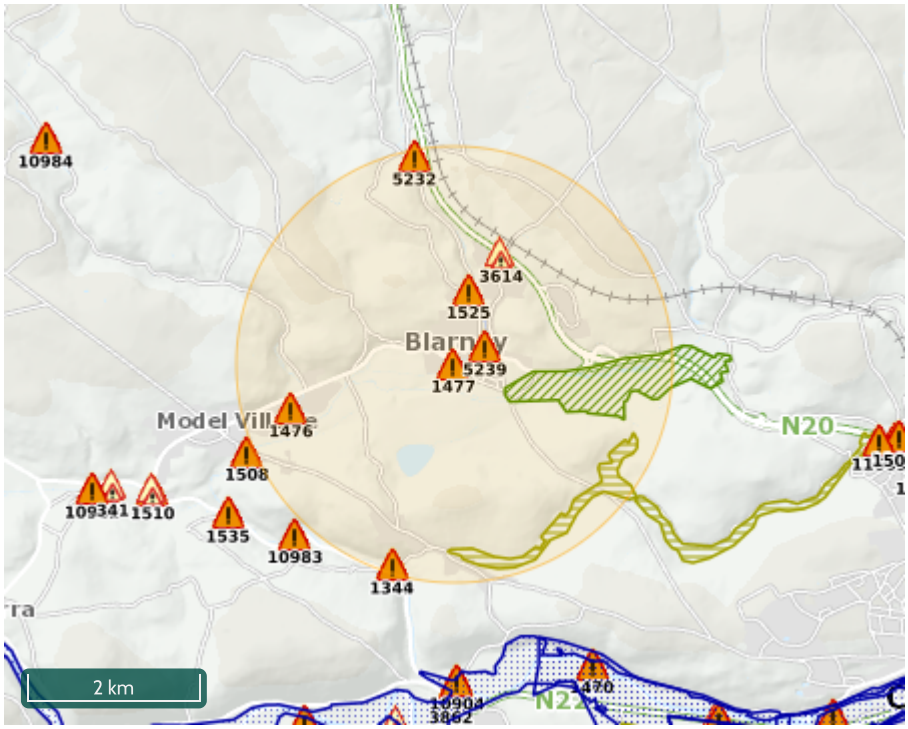

Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

8 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Shournagh Cork August 1986 (ID-1344)	05/08/1986	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Shournagh Lee Nov 2000 (ID-1349)	28/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Shournagh/Martin Riverview estate Blarney Feb 1990 (ID-1476)	06/02/1990	Approximate Point
	Additional Information: Reports (5) Press Archive (0)		
4.	Martin Blarney Village Cork Feb 1990 (ID-1477)	06/02/1990	Approximate Point
	Additional Information: Reports (4) Press Archive (0)		
5.	Martin River Waterloo Junction Blarney Nov 2000 (ID-1525)	05/11/2000	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
6.	N20 at Dairygold, Co. Cork recurring (ID-3614)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Martin River Putlands Bridge Blarney Nov 2000 (ID-5232)	05/11/2000	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
8.	Martin River Blarney Shamrock Terrace Nov 2000 (ID-5239)	05/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		