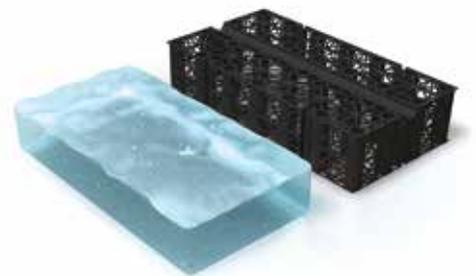


Rainwater Interception System



Water Management Solutions for Commercial Buildings



Source Control

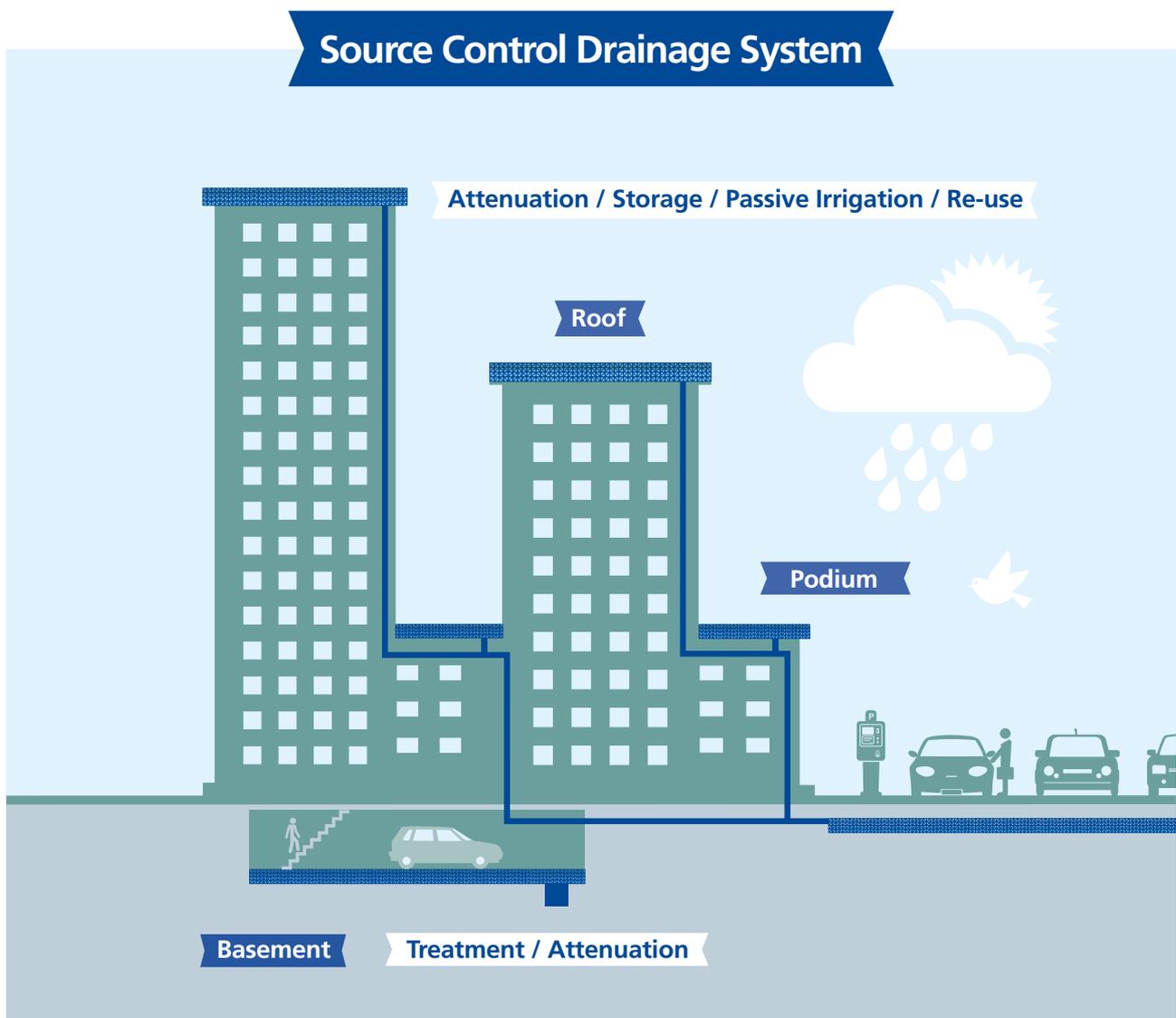
As space becomes even more limited in the urban environment we need to look to more sustainable ways of managing the flow of rainwater. By using Polypipe water management and source control systems on roofs and podiums in conjunction with the trusted Terrain above ground drainage systems, building service designers can utilise these areas to integrate effective water management at source and control the flow of water at a designated rate into the underground drainage system.

Dealing with rainwater run-off

Reducing rainwater run-off adds significant value to Sustainable Urban Drainage Systems (SUDS). By intercepting rainwater at source, it can be used as a resource.

The majority of rainfall events in the UK are less than 5mm in depth. However, in more extreme events it can overwhelm

existing systems. Traditionally, rainwater can be collected and removed from the building but with heavier rainfall there is now the need for surface-based systems that provide storage, treatment, flow control, evaporation and passive irrigation. Each of these systems is critical to the performance of source control drainage systems.



Rainwater Interception Components

A comprehensive source control solution

The Polypipe Rainwater Interception System comprises of the following components: high strength modular cells, robust geotextiles (to provide treatment), geomembranes, rainwater outlets incorporating flow control services and engineered Terrain PVCu and HDPE pipework systems.

The system can enhance the effectiveness of both 'green' and 'brown' roof applications, and can even provide a 'blue' roof attenuation system. Due to the inherent strength of Permavoid modular geocellular units, this system can be incorporated into a wide range of SUDS solutions.

The Polypipe system comprises of:



Permavoid
(85mm and 150mm)

Geocellular storage system that fits together to form an interlocking raft of exceptional high compressive and tensile strength.



Permavoid Rainwater Diffuser Unit

Permavoid units encapsulated with a 2mm mesh fabric diffuse the collected run-off into the surroundings.



Permafilter Geotextile

A non-woven geotextile designed for hydrocarbon pollution treatment.



Permavoid Wicking Geotextile

A non-woven geotextile formulated to provide passive irrigation to soft and landscaped areas.



Geomembrane

An impermeable membrane that wraps around Permavoid structures to form watertight tanks.



Terrain Rainwater Interception Outlets

Designed to control the rainwater run off from roof areas and podium decks.



Terrain PVC Pipework

A comprehensive range of pipes and fittings offering flexible installation and good chemical resistance.



Terrain FUZE HDPE Pipework

A top-to-bottom solution for all above ground drainage and many chemical waste applications.

Applications & Benefits

The Permavoid system provides a flexible modular geocellular water management solution for a wide range of source control applications. These include:

Podium and roof areas

The Permavoid System provides an effective water storage and flow control solution for impermeable and permeable surfaces such as podiums and roofs, including car parks.

Treatment and passive irrigation

The Permavoid solution also provides treatment at source and can be used as a passive capillary irrigation system, re-using captured rainwater at source. This makes it ideal for creating sub-catchments within the building perimeter and enhancing the effectiveness of:

- Green and brown roofs
- Soft landscape areas
- Amenity and leisure
- Bioretention systems

Multifunction and urban landscapes

SUDS are an integral function of Water Sensitive Urban Designs (WSUD). Permavoid offers an efficient storage and treatment system to help achieve improved stormwater management, particularly when incorporated into urban applications.

Sub-base replacement

Due to its high compressive strength and bending resistance within joints, Permavoid cells create a horizontal consistent structural raft providing a stable structure. This means it can act as both a sub-basement replacement system and drainage component, giving maximum attenuation and storage.

BREEAM

The sustainability benefits of using our rainwater interception system offer innovative, cost-effective solutions that minimise the environmental impact on buildings. When measured against BREEAM it offers potential solutions for sections:

- WAT 04 water efficient equipment
- POL 03 surface water run-off

Benefits

Design

- Designed and tested for storage and attenuation on
 - Podium Decks
 - Roofs
 - Basements
 - Urban streetscapes
- Provides effective source control
- Provides passive irrigation for soft landscaping areas
- Allows sub-catchment areas to be created within the urban environment
- Provides treatment to remove silt and hydrocarbon deposits at source
- Can be used in combination with site wide SUDS scheme

Installation

- Interlocking raft for rigidity and a high compressive and tensile strength under load
- Suitable for use beneath porous and non-porous surfaces
- Extensive range of components to facilitate solutions for many applications

Roof Applications

Our rainwater interception system can be used within the following roof applications:

Green roofs

A green roof is one that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane and incorporating drainage and irrigation systems. Green roofs slow the rate of rainfall to the drainage system and can store and attenuate water.

There are two types of green roofs:

Intensive roofs:

These roofs are typically a minimum depth of approx 13 cm, and supporting a wide variety of plants. These designs are heavier and require regular maintenance.

Extensive roofs:

These roofs are shallow, ranging in depth from 2cm to 13cm, they are lighter than intensive green roofs and require minimal maintenance.

The benefits created by a green roof, apart from helping with a stormwater management system, include:

- Providing insulation
- Creating a habitat for wildlife
- A natural usable space providing amenity
- Reducing lower urban air temperatures and mitigating the heat island effect

Brown roofs

Brown roofs, also known as biodiverse roofs, are similar to green roofs except they incorporate locally sourced materials to form the natural growing medium, usually locally sourced aggregate and soils. The roofs are allowed to self-colonise with plants or can be seeded with native species to increase their biodiversity potential.

Blue roofs

A blue roof is specifically designed to store water, intercepting rainwater at source and reducing peak flows using flow control outlets. Blue roofs can be open water surfaces, storage within a porous media or beneath a surface within a proprietary modular geocellular system. Stored water is treated (where required) and reused for the irrigation of green/brown roofs, amenity/recreation and biodiversity. It can also be re-used internally for laundry, car washing and toilet flushing. Blue roofs are an effective solution for making space for water in urban sustainable drainage schemes.



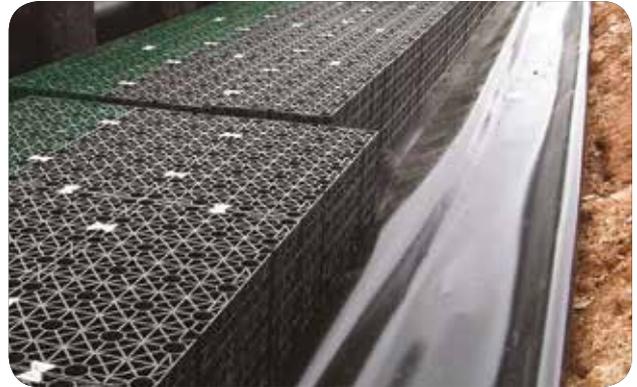
Plazas and podiums

Many buildings incorporate landscaped basements and roofs known as plazas or podiums, the basement usage can vary from habitable space or storage, to car parking. Increasingly these areas are being landscaped using both vegetation and hard standing materials and can be designed to incorporate a rainwater interception system.

Delivery & Storage

Permavoid cells

- Permavoid cells will be delivered to site on pallets. Palletised load measurements are approx 1.2m x 1.1m x 2.3 m high and each pallet will contain 72nr Permavoid
- Pallet weight circa 220kg
- Deliveries shall be unloaded using mechanical handling equipment



Geotextile/Geomembrane

- Delivery shall be unloaded using mechanical handling equipment

Storage

- Position pallets on stable, even level ground
- Stacking of pallets is not recommended
- Store away from direct source of heat or ignition
- Transit banding not to be removed until at point of installation

Geosynthetic	Permafilter	Permatex	Permawick	Geomembrane
Material	Polyester Blend	Modified Polyester	Polyester Blend	Polypropylene
Roll Size	24 x 100m	4 x 100m	2 x 25m	3 x 100m or 6 x 100m
Weight	300g/m ²	160g/m ²	52g/m ²	0.9kg/m
Delivery	Single Rolls 5. No/Pallet	Single Rolls	Single Rolls 4. No/Pallet	Single Rolls

Pipework and Fittings

Good site practice

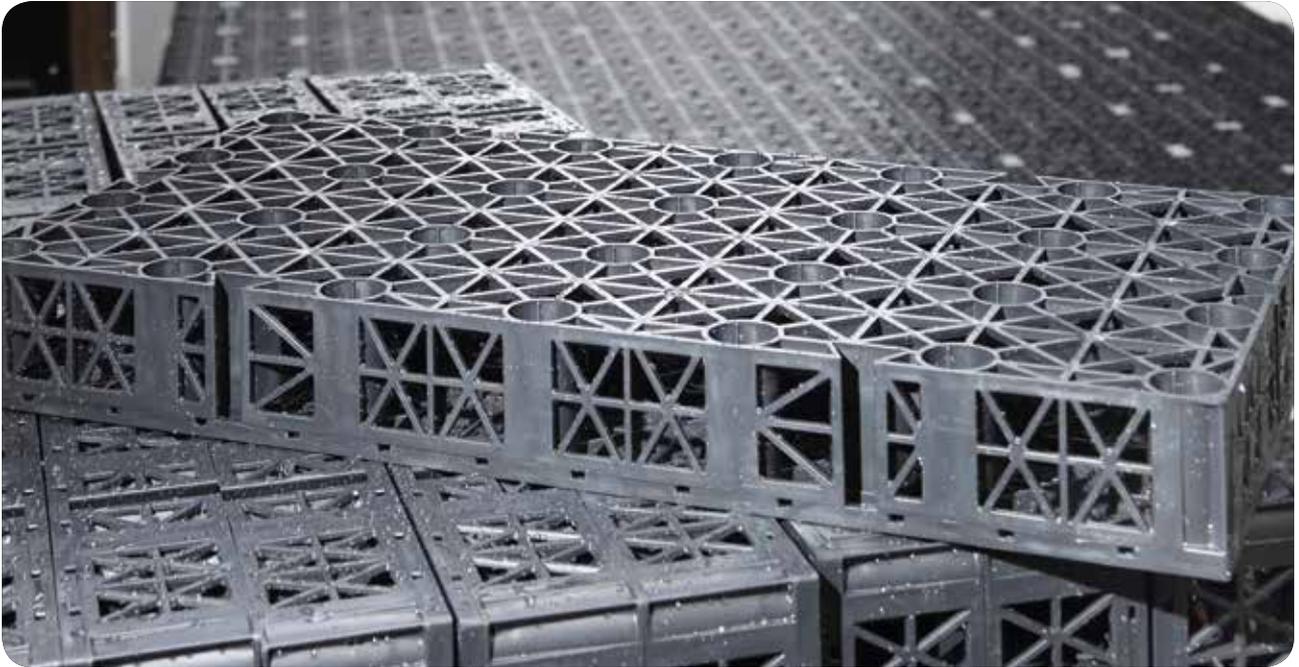
- Take all reasonable care when handling PVCu particularly in cold conditions when the impact strength of the material is reduced
- Do not throw or drop pipes, or drag them along hard surfaces
- In the case of mechanical handling, use protective slings and padded supports. Metal chains and hooks should not make contact with the pipes

On-site storage

- Stack pipe lengths either on a flat base, on level ground or on 75mm x 75mm wide battens at 1m centres
- Maximum stack (normal conditions): seven layers high
- Ideally, stacks should contain one diameter pipe size only. Where it is not possible, stack largest diameter pipes at base of stack. Small pipes may be nested inside larger pipes
- If stored in the open for long periods or exposed to strong sunlight, cover the stack with opaque sheeting

For further information on site storage for Terrain pipe and fittings please see the Terrain Soil & Waste Technical manual.

Installation



Base

The Podium Deck or roof slab should be smooth and free from sharp objects and projections. This will create an even formation free from undulations. Any irregularities must be excavated and replaced with compacted granular fill material.

Tolerance

The formation should be graded to achieve a maximum deviation of 5mm in 3.0m in any direction. This will prevent the formation of voids below the installation which will cause Permavoid units to 'rock'. A blinding layer may be used to achieve required tolerances.

Blinding

If required, a blinding layer of either 20/6 clean crushed stone or sand (to BS EN13242:2002) should be used to achieve a suitable bedding surface, as noted on the engineer's drawings.

Laying

First, the membrane should be clean and free from debris before Permavoid is laid and the installation plan or details checked to confirm its orientation. Then, laying should commence in the corner of the installation area, working forwards in a diagonal line to the opposite corner. This should continue until the layer is complete, then repeated for further layers.

Permatie

Adjacent Permavoid units are connected using Permatie interlocking pins, which have integral creep resistance. Permaties must be inserted into all available slots where units butt together, up to a maximum of 5nr Permaties per Permavoid unit. The Permatie provides rigidity and minimises deflections.



Anti-shear pin

Multi-layered Permavoid tank configurations should be fixed with proprietary anti-shear connectors between each layer interface, to maintain rigidity and minimise lateral displacement. A minimum of four anti-shear connectors per square meter at layer interface is recommended.

Drainage connections

Proprietary drainage connections are available where a drainage connection is needed for the Permavoid installation. There are several different options, subject to the type of tank encapsulation and whether the connection is at invert or centrally located.

Installation

Attenuation applications

Where required, all penetrations through an impermeable encapsulation should be sealed. An impermeable seal can be formed using a rigid aproned spigot tank adaptor. These adaptors comprise of a rigid body and spigot with a flexible outer membrane and are manufactured from a material compatible to the geomembrane covering the tank. Adaptors are available as either invert or standard types, and come in a range of diameters. The adaptors are fully welded to the main tank encapsulation. All joints should be sealed, using proprietary techniques recommended by the manufacturer and advice on seam testing procedures is given in CIRIA Report SP124.

Protection

Permatex Protection geotextile should be installed on the outside face of the base, top and sides of the installation.

Geotextile for infiltration

In this instance, Permafilter SUDS heavy-duty geotextile, non-woven, needle-punched with specific oil treatment properties should be used. The geotextile should be laid either with a minimum overlap of 300mm or to the lap marker. It should be applied to all external surfaces of the Permavoid drainage units.

Flow control outlets

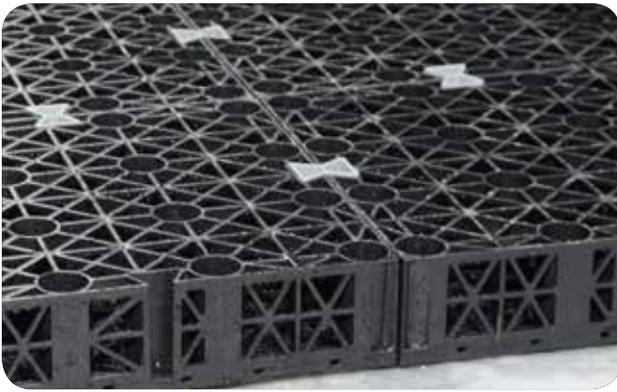
Do not remove from packaging until required. Install in locations as indicated on engineer's drawings. If installed for temporary drainage, remove orifice plate. Before refitting, ensure the rainwater outlet is clean and all surfaces are dust free. Outlets should be connected to pipework system as per manufacturer's recommendations.



Maintenance

Like any conventional drainage system, Sustainable Urban Drainage Systems (SUDS) should be inspected regularly and correctly maintained to ensure optimum performance.

This should be initiated by drafting routine maintenance plans that suit the installation site. A pre-handover inspection should be carried out and the Permavoid installation cleaned prior to final handover.



Routine inspection and maintenance should include:

- Inspection of system components
- Removal of silts
- Decanting of oils and hydrocarbons
- Water sampling and testing at point of discharge (if required)

Excess silt/debris held within catchpits should be cleared manually. We do not recommend pressure led cleaning.

Maintenance plan

To implement a robust maintenance plan, the following should be considered:

- Pre-handover inspection and cleaning of completed Permavoid installations
- Preparation of routine maintenance plan
- Decanting of oils and hydrocarbons
- Removal of silts

Routine maintenance

Catchpit and flow control outlets

The following routine maintenance procedures are required:

- 3 monthly inspections of channels for signs of blockage and oil spillage
- Remove litter and blockages as required
- Clear roof outlets annually in particular during Autumn to keep clear of leaves
- Every 12 months sweep external surfaces
- Remove silt as required but at least every year
- Records of inspections and maintenance undertaken should be kept by the client

Accidental spillages

If accidental spillages of oil or other substances (e.g. a car sump failure leading to spillages on car park surfaces) that can cause water pollution occur, they should be dealt with immediately. A spillage kit appropriate to the size of the car park should be kept by the site caretaker. This should include absorbent pads and socks and rain seals.

As soon as a spillage is identified, the drain inlets in that area should be covered to prevent pollution entering the system. The pollution should then be cleared from the car park surface. The local pipework system receiving the spillage should be emptied of all pollution that has entered. The Environment Agency should be informed of the spillage and the actions taken if the drainage system connects to a natural watercourse.

Unite Stratford student accommodation



Permavoid Podium Deck has been specified for use within a large scale East London student accommodation project with a challenging restricted external ground area.

Working alongside main contractor Westfield Construction and M&E contractor Dimension Data Advanced Infrastructure, Polypipe helped to develop a rainwater attenuation system capable of managing the site's drainage requirements in the event of a '1 in 100' year + 30% storm event.

Although a large buried attenuation structure may have met the drainage needs of the site, a lack of external ground area made this impractical. As such Polypipe worked closely with the Environmental Protection Group (EPG) to provide a practical two-tiered attenuation system at podium level to collect water run off.

Discharge from the selected Permavoid Podium deck system was conveyed using flow control outlets leading into a small 30m³ buried attenuation tank, which was formed of Polystorm geocellular units. Using Polystorm in this way ensured that a discharge rate of 42 l/s could be maintained.

Permavoid Podium Deck provides ideal first stage rainwater interception and source control that can be easily integrated into an overall SUDS solution.

Having a 95% void ratio, Permavoid can collect and retain three times more water than aggregate sub-bases, making it ideal for projects where depths and loadings are a major consideration such as at Unite Stratford.

Glen Loftus from Dimension Data Advanced Infrastructure said: "Having to reconsider the drainage needs of the project during the build stage could have been an issue, however working with Polypipe and EPG on an appropriate podium level solution minimised disruption and went some way to making the project the success it was."

Work on the Unite Stratford ONE project completed in August 2014, allowing the building to open for its first intake of students in September. The accommodation houses more than 1,000 students across 28 floors.



CASE STUDY

Project

Unite Stratford student accommodation

Client

Westfield Construction

Application

First stage source control

Products

Permavoid Podium Deck

**Bespoke rainwater
management systems**

Rainwater Interception System



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