

CLIMATE RESILIENT CITIES WITH PERMAVOID SPORTS

nature-based solutions for multifunctional sports pitches

permavoid
the Foundation for our Future

PERMAVOID SOLUTIONS FOR SPORTS

Sports have shown a positive development in the past years in becoming an integral part of a healthy lifestyle in a world where over 50% of the world's inhabitants live in cities. This increase in popularity in combination with current urban changes creates a number of challenges when designing sports pitches.

Challenges

The increasing membership numbers for field sports require more training and game time, which can lead to increased wear of specifically natural grass pitches. The question becomes to either stay with natural grass or switch to synthetic turf. In all cases the athlete's health and safety must be guaranteed, which sparked recent discussions in conventional synthetic turf sports designs regarding the materials used in synthetic turf pitches, their tendency to overheat and the effect on player comfort, as well as the prevention of spreading (potential) polluting materials in the environment and the effect on surface water quality.

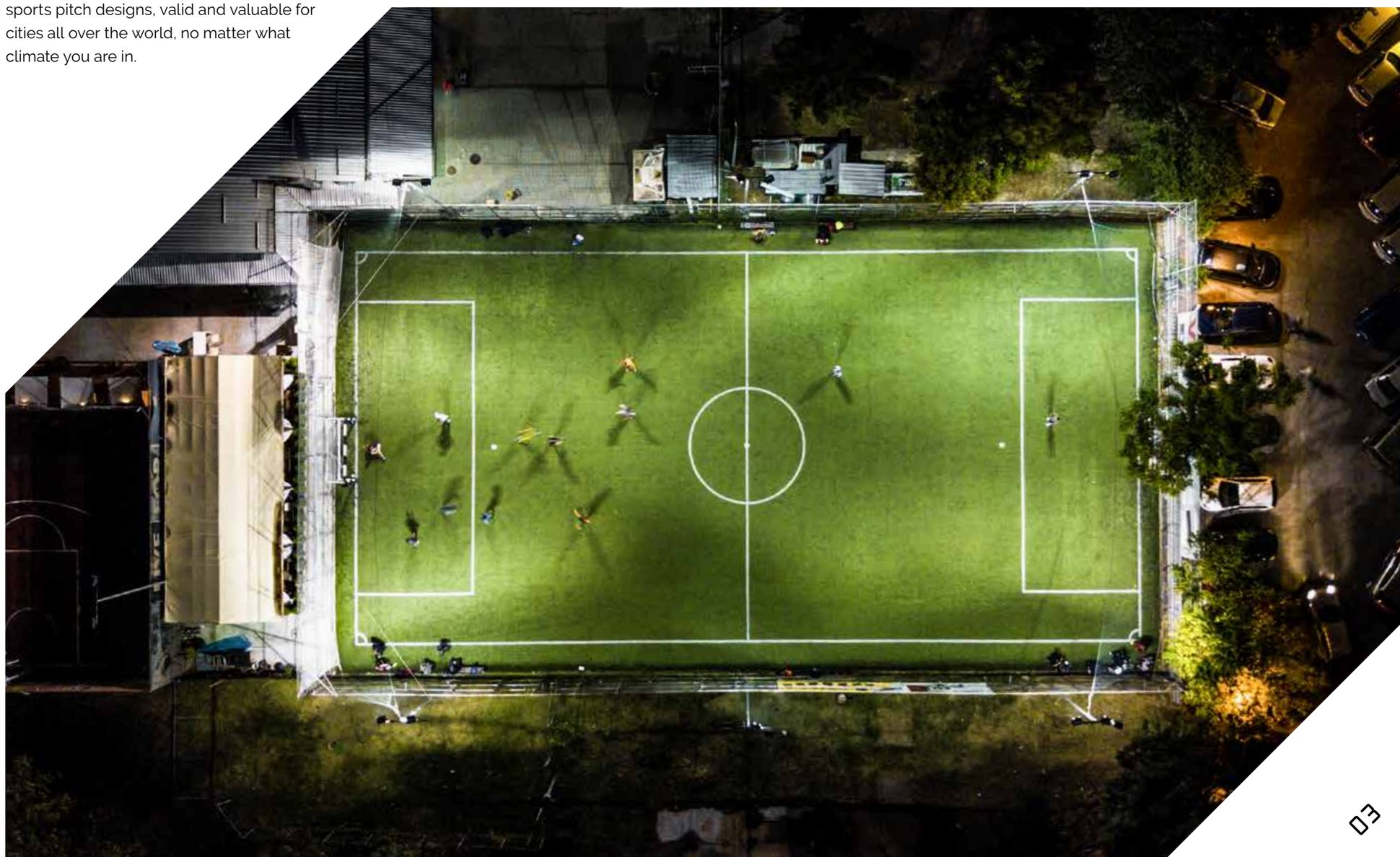
Sports and climate change

A second challenge for sports development is climate change. Sports pitches occupy a significant surface area in cities worldwide (for example, 3% in the City of Amsterdam) and based on design and material choice they can be a potential part of the solution in creating climate resilient cities for many generations to come.

Natural grass contributes to climate change mitigation by means of natural rainwater infiltration and evaporative cooling, while synthetic turf is advantageous with minimal water consumption during droughts.

These properties all connect to changing urban development goals. Opportunities like preventing urban flooding with sustainable urban drainage designs, reducing the Urban Heat Island (UHI) effect without using energy, minimising drinking water usage for irrigation and construction material circularity are all key ingredients in future-proof sports pitch designs, valid and valuable for cities all over the world, no matter what climate you are in.

In modern urban development, a sports pitch is no longer just there for sports. It's functionally integrated in water management of the city, assisting with climate change mitigation, while facilitating player health and safety and protecting the environment from harmful substances. Permavoid Sports Systems focus on successful sports and athlete health, combined with the integration of urban sustainable development goals in pitch design, based on natural and circular materials, with nature-based water management as connecting element.





NATURE AS SOURCE OF INSPIRATION

In a world where maximising the use of space in cities, energy conservation and water sensitive urban design is becoming ever more important, Permavoid uses ecosystem functioning as the most important source of inspiration for system design and product development. Design requirements like material recycling, on-site harvesting and use of rainwater, evaporative cooling, zero energy and limited transports of goods are mimicked from nature and at the core of all Permavoid Sports Systems.

The Permavoid Systems are based on circularity in both material choice and functionality and are characterized as nature-based solutions. Permavoid brings pitches closer to nature by integrating circular on-site water management in its foundation; capture, store and reuse. With stormwater reuse and minimal drinking water consumption we enable natural, hybrid and synthetic pitches to feel, cool and play like if they were all natural grass, optimising playability and turf quality on top.

With Permavoid reusing stormwater for irrigation, evaporative cooling or other uses is integrated in one reliable, coherent, zero energy, nature-based and proven system. Good for the city, better for the environment and healthy for the athletes.

THE PERMAVOID SPORTS SUBBASE

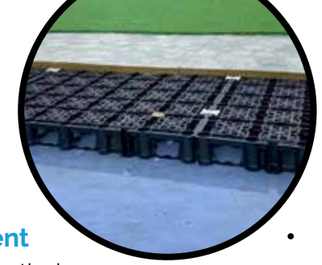
Supplemental to providing an optimal subbase for various sports surfaces, the Permavoid sports subbase bridges the gap between the current world of sports and the necessity to create healthy, circular and water sensitive solutions for sports. The system consists of 85 or 150 mm deep, high strength geo-cellular units with a 96% void ratio and creates a multitude of benefits for construction, field reliability and water management.

Factory made subbase

- Reliable and predictable product quality with manufacturing under strict Quality Control
- Approved as subbase for sports pitches by NOC*NSF accredited institutes like KIWA ISO Sport and SGS Intron
- Lightweight; easy to transport and quick to install without heavy machinery
- Reusable and suitable for temporarily applications

The pitch

- Every pitch is constructed identical, with the same materials, ensuring consistent playability
- Consistent full-field design, preventing 'weak spots'
- Tested and approved by STRI for stadium quality natural grass for drainage and capillary irrigation
- System approvals for FIFA Soccer and FIH field hockey



Full water management

- Full-field drainage effectively preventing pooling of rainwater on the surface
- Water can be stored, conveyed, measured, topped up, drained or infiltrated in the same subbase
- The build-in capillary fibre columns feed the capillary irrigation for natural grass and enable evaporative cooling in synthetic turf, without the use of energy
- Sustainable reuse of stormwater and reduced mains water usage
- Reduced flow in the system and reduced number of outfalls
- Full water management can be achieved with passive overflows, or pre-emptive with digital online sensors and artificial intelligent (AI) controls

Full air management

- Conveys and evenly diffuses airflow under the entire pitch
- Allows air temperatures > 40°C
- Slight overpressure with lightly heated air keeps the pitch ice-free
- By creating slight underpressure the pitch can be drained faster after heavy storms

Shallow construction

- Less excavation and material movement
- Less material transport to and from site
- No deep excavation for drainage/irrigation main lines needed
- No differences in compaction or potential delayed settlement
- Reduced construction time

Raft construction base

- Conically shaped PermaTies create a rigid raft structure in the subbase
- The raft's tensile strength allows for better load distribution
- Allowing for the pitch to be constructed over bad ground conditions such as on low load-bearing soils (peat), high ground water tables, landfills or contaminated sites



PERMAVOID SPORTS SOLUTIONS

Hybrid and Natural grass

Playing sports on natural grass is fantastic, healthy and cool. But in climate proof cities natural grass pitches can no longer 'just be pitches' to play on. Next to being a sports surface it is more often also regarded as multifunctional green infrastructure, providing essential ecosystem services for the city such as stormwater retention, rainwater infiltration, plant evaporation and with that Urban Heat Island (UHI) reduction.

Stormwater is a resource, not a nuisance

Natural or reinforced (hybrid) grass should never experience water shortages, potentially reducing grass health and growth (quality), which would increase recovery times and hamper Urban Heat Island mitigation by reduced evapotranspiration. In a world where fresh water is quickly becoming a scarce resource, irrigating grass with drinking water becomes unsustainable. At the same time, with rainstorms in summer months in most cities, users want to drain and discharge rainwater as soon as possible, to prevent root rot and water pooling on the playing surface.

This apparent contradiction of either too little or too much water for grass is the exact core of the Permavoid Sports System: full water management in the pitch subbase allows stormwater drainage to be transformed into stormwater retention, and normally discharged water is transformed into a source of valuable naturally available irrigation water.

System advantages

- High performance drainage to prevent flooding of, and pooling on the surface
- Capture and reuse rainwater for irrigation
- Minimise irrigation water needs from drinking water on average with 32%, by eliminating surface evaporation and deep drainage
- Natural capillary irrigation negates the use of surface-spray irrigation, requires no pumps or energy, it cannot break down and requires no maintenance
- 8000 m² of pitch creates 600.000 to 1.120.000 litres of water retention capacity
- The shallow build-up negates the need for deep excavation of the subbase and thus reduces the amount of materials being brought to and from site
- Complex systems of deep drainage channels are redundant, also preventing subsequent settlement of the drainage channel backfill
- Recycled and reusable materials
- Can be actively drained and heated using overpressure and slightly heated air in winter (prolonging the season)
- Water harvesting for other purposes
- Optimum soil depth at approximately 20 cm

Permavoid for natural and hybrid grass sports pitches: capture, store, irrigate and grow.





Tottenham Hotspur F.C.
The New White Hart Lane incorporated a retractable football pitch, allowing the football club to host Premier League football matches and NFL matches on separate dedicated pitches, in the same stadium. The Permavoid technology is incorporated not only to facilitate this great innovation, but also to maintain the finest quality playing surface for both the natural grass Premier League pitch and artificial turf NFL pitch.

Liverpool F.C.
In the Anfield Premier League stadium Permavoid is used as a shallow subbase to cope with high rock in the soil and to ensure rapid and even drainage of the soil and turf during peak rain events. The aeration capacity of the Permavoid system maintains healthy grass roots and air circulation within the Permavoid raft helps to prevent the surface from freezing.





The Permavoid system with capillary irrigation has been tested for more than five years by STRI in Australia, the United Kingdom and the Gulf region. Water savings up to 60% when compared to traditional pop-up systems were measured.

PERMAVOID SPORTS SOLUTIONS

Synthetic turf

For over ten years the Permavoid system is used as a multifunctional subbase for synthetic turf pitches, being both high-strength and lightweight. The shallow build-up speeds up the construction process and minimises the necessary excavation depth. Due to the completely open surface of the Permavoid units the pitch drains effectively and reliably over the entire surface, preventing standing water after peak rain events.

To optimise local circumstances the system offers the option to either retain rainwater in the subbase for later use, or detain rainwater for on-site infiltration underneath the pitch. Either way, the pitch is drained promptly and rainwater is kept out of the sewers by incorporating on-site full water management in the subbase of any synthetic turf pitch.

A climatic challenge

With increasing urban density and growing populations worldwide, natural grass is no longer the obvious choice for field sports. Natural grass needs time to recover after use, limiting the allowable amount of playtime. This is where synthetic turf provides a solution; playable 24/7, with limited maintenance and theoretic zero water consumption for irrigation. One play-limiting factor is that synthetic turf tends to overheat when exposed to sunlight, because it absorbs and transforms incoming solar energy into heat.

Adiabatic cooling: a nature-based solution

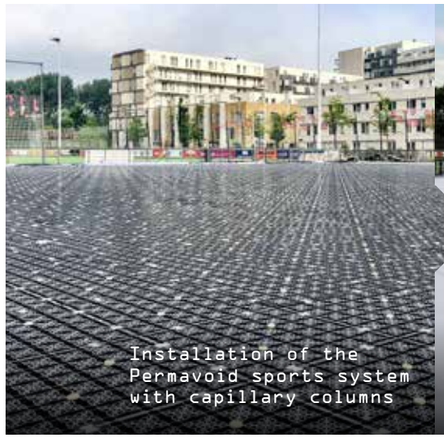
Cooling a synthetic pitch is a daunting task, especially if the goal is not to use exorbitant amounts of energy or drinking water. Luckily, we can learn from nature; natural grass cools itself by evaporating water.



With the Permavoid Sports System this adiabatic cooling is replicated by allowing water to evaporate from the natural infill in between the synthetic turf fibres. Stormwater can be harvested and stored in the Permavoid subbase. The capillary columns return water to the “BlueLay” water retaining shockpad, from where it is absorbed by the natural infill for evaporation. The evaporation of water creates an adiabatic cooling effect, reducing the surface temperature of the synthetic turf, without using energy, minimising the carbon footprint of the pitch.

By recreating the natural water management cycle for synthetic turf, the pitch cools itself by means of evaporation and feels like a natural grass pitch (learn more on page 27).

Permavoid for synthetic turf pitches: capture, store, evaporate and cool.



Installation of the Permavoid sports system with capillary columns



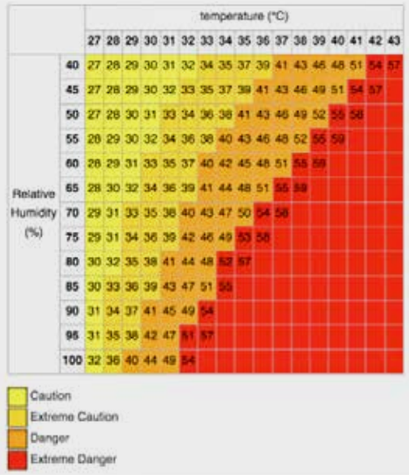
The “BlueLay” water carrier with shockpad functionality is placed on top



The synthetic turf with sand infill allows vertical water transportation, enabling evaporation on hot summer days

System advantages

- Optimal drainage and cooling capacity, therefore truly usable 24/7
- Suitable for various sports such as field hockey and soccer
- Suitable for wetted-surface pitches (field hockey)
- Uses natural capillary draw as water delivery system, eliminating the use of energy completely, reducing the pitch’s carbon footprint
- Eliminates stormwater run-off during peak rain events
- No other off-site or in-building tanks, swales or open water needed for water management
- Harvested rainwater can be used for irrigation of other pitches. One single Permavoid subbase can manage water for up to 3 pitches depending on local conditions
- Stored water can be used for toilet flushing or drinking water generation through microfiltration technology
- Shallow and lightweight construction
- Minimizing drinking water usage
- Consistent playability



Heat and Health: when is it too hot?

High outdoor temperatures can be dangerous to your body, especially when active. The combination of temperature and relative humidity largely determines the risk for heat exhaustion and is expressed in the Heat-Index. With temperatures ranging between 32° and 40°C (90° and 105°F), athletes can experience heat cramps and exhaustion. Between 40° and 54°C (105° and 130°F), heat exhaustion is more likely and The US Department of Labor advises to limit physical activities. Conventional synthetic turf pitches can easily display surface temperatures of over 60 °C (140°F).

With the Permavoid sports system it is possible to keep the synthetic turf temperature below the point of discomfort for the athlete, reducing the risk for heat related illnesses.

Source: https://www.weather.gov/safety/heat-index

Training fields, playgrounds and MUGA's

Parks, schoolyards and existing sports clubs are part of existing urban infrastructure used for physical activity, to spend time with friends, family and the community. It is possible to create energizing, high-end, small-scale sports facilities in existing infrastructure with training fields, playgrounds and/or Multi Use Games Areas (MUGAs) to facilitate sports and play in dense urban areas.

The Permavoid system is extremely suitable for training fields and smaller-scale sports arenas because of the lightweight and shallow construction. Existing underground infrastructure remains untouched; the pitch has integrated drainage and water management, can be outfitted to cool itself through evaporation and does not require heavy machinery for installation.

Being a completely self-sustained system, existing ground conditions such as reduced load bearing capacity, soil pollution or poor drainage become a non-issue. The modular build-up facilitates the creation of any pitch-size even in confined urbanized areas, for either temporary or permanent installations.

Compliance

The Permavoid system has proven to comply with international sport standards for soccer, field hockey and tennis. Further testing has proven that the Permavoid subbase under synthetic turf maintains safety and playability of the pitch throughout the year, while at the same time the pitch is integrated in sustainable stormwater management.

System advantages

- High performance drainage to prevent flooding of, and pooling on the surface
- Suitable for various sports
- Many sizes possible, can be fitted to dense urban areas
- Can be fitted with natural adiabatic cooling in combination with synthetic turf
- Independent of existing subbase conditions
- Shallow and lightweight construction
- Easy construction (and deconstruction)
- Safe playability



Playground with Permavoid subbase in Katowice, Poland.



Training facility in Shangai, China.



Permavoid MUGA in Nysa, Poland.

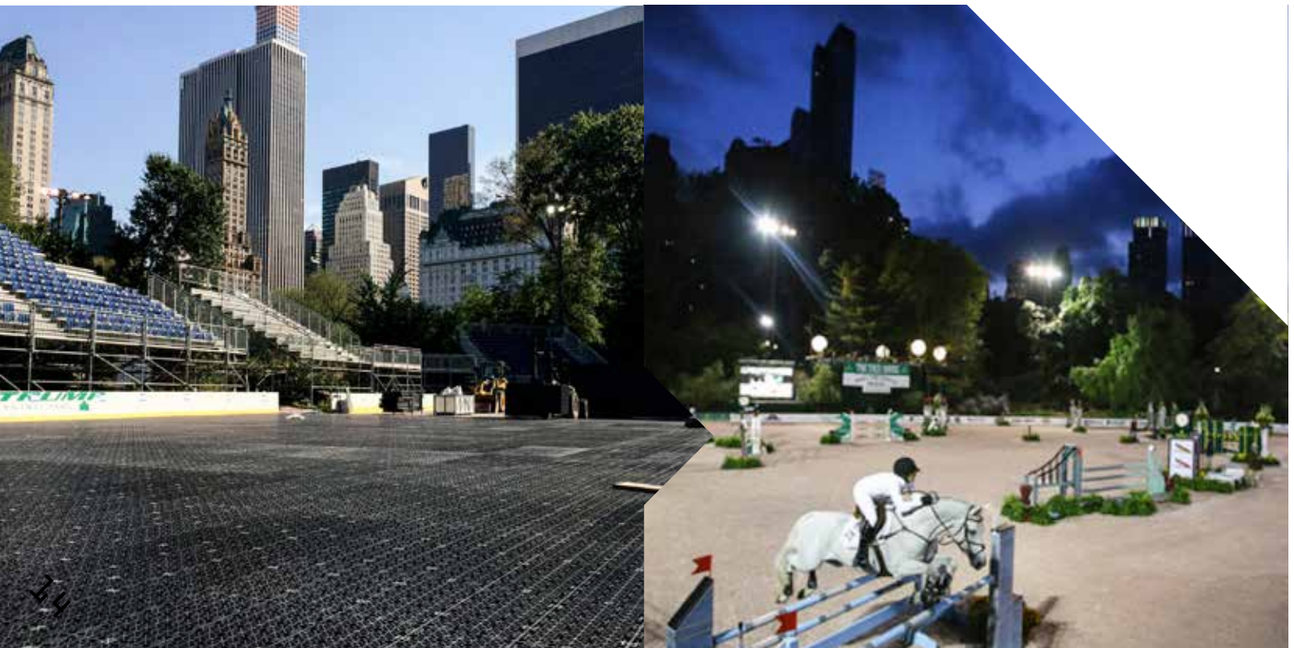
PERMAVOID SPORTS SOLUTIONS

Temporary solutions

More and more large sports events require temporary playing surfaces only for the duration of the event or tournament without making any concessions to the quality of the pitch. Up until now it was not possible to quickly change the playing surface in existing stadiums or change paved inner-city areas into a temporary sports pitch. With the Permavoid subbase it is possible to create any desired sports surface, on existing surfaces, for a specific amount of time. In these temporary pitch constructions, the Permavoid units allow for a relatively shallow build-up, protecting the existing surface beneath, while at the same time doubling as a water management layer for the temporary pitch. It is now possible to create temporary natural grass, synthetic turf pitches and equestrian arenas without changing the existing surface; saving time and money.

The geo cellular subbase units are delivered on-site and installed properly, after which the soil and/or synthetic turf can be applied. In cooperation with local companies, facilities for spectators surrounding the pitch can be constructed as well. During the event, turf can be irrigated with capillary irrigation from the Permavoid subbase, which also acts as drainage system, quickly draining rainwater to minimise field-down-time due to wet weather conditions. When the event is over the process is reversed. All materials, including soil and Permavoid subbase, can be disconnected, stacked, taken back in stock and reused with the next project. Nothing is wasted and the site returns to business-as-usual.

Permavoid for temporary sports solutions: Any time. Any place. Anywhere.







Big Stadium Hockey
For the 2019 FIH Pro League double-header finals in June, Great Britain vs. New Zealand, the Twickenham Stoop stadium pitch was converted to an all-weather, temporary hockey pitch. This was world's first temporary pitch in a rugby venue for an international hockey event, without having to change, dig up or restore the original underlying pitch. The FIH approved temporary pitch was constructed and removed in two days each. A1 materials have been taken back in storage and reused for another project elsewhere in the UK.

After the success of The Stoop, Big Stadium Hockey was back in november that year, allowing hockey to break free from the limitations of existing venues and break attendance records for women's international sporting events in Dublin, Ireland. Big Stadium Hockey received the SAPCA prize and is shortlisted for the Cutting Edge Sports Industry Award.

System advantages

- High performance drainage to prevent flooding of, and pooling of water on the surface
- Shallow build up on existing surfaces
- Creates a predictable, tested and reliable surface
- Quick installation and deconstruction
- Integrated fencing systems available
- No materials are wasted, everything is taken back and reused
- Lightweight; easy handling

BIG STADIUM HOCKEY

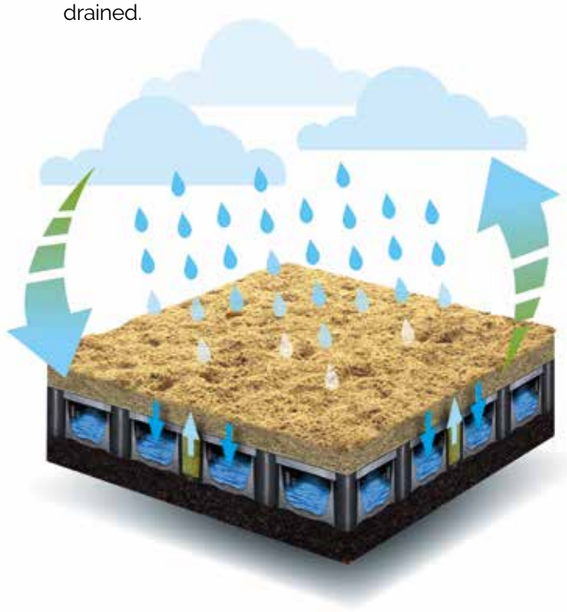
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Equestrian arenas

A professional equestrian arena needs to meet the highest standards for the riders and horses to run their courses safely. Moisture content in the sand is essential in maintaining a consistent surface performance. Never too hard (too wet) or too soft (too dry).

Optimizing soil moisture content

Being outdoor events mainly, weather is always an important factor in the quality of the arena. In order for the event to run on time, prompt drainage of the arena surface after rain, or sufficient water added quickly during droughts, are essential not to have to stop and restart the event several times during the day. With the Permavoid system beneath the temporary or permanent equestrian arena, the system of sub-surface capillary irrigation naturally maintains the desired soil moisture content, while during rainfall excess water is quickly drained.



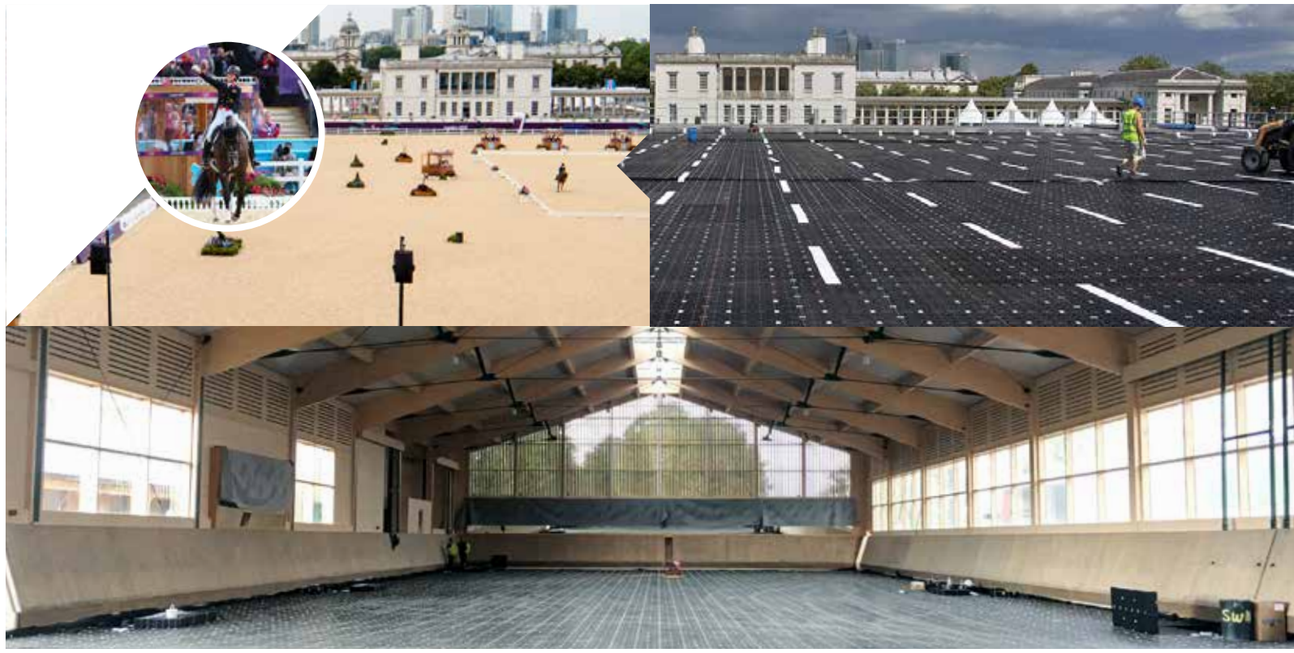
Intelligent and remote water level control in the Permavoid subbase allows adjusting the surface's consistency from a mobile device, to suit the event, taking actual current weather into consideration.

The Permavoid system has been used at the highest level, from the equestrian arenas in Greenwich Park for the 2012 London Olympics to a temporary arena in New York's Central Park. It comes into its own for gallops, arenas and canter tracks for professional dressage, show jumping and racing yards, but is equally valuable for commercial arenas such as riding schools, livery yards and colleges. Indoors, and outdoors too.

System advantages

- Reduced surface spray needs
- Reduced down time after rain
- Reduced drinking water usage
- Reduced maintenance cycle of the riding surface
- Circular water management: the harvested and stored rainwater can be used for other purposes as well
- Healthy and safe for horse and rider

Construction of the Equaflow equestrian arena for the 2012 London Olympics in Greenwich Park. The build-up of the riding surface required no excavation, levelled existing gradients to within international standards, protected the root systems of numerous protected trees in the area and provided a zero discharge source control water management system capable of handling a 100-year storm event. The lightweight Permavoid units reduced truck cycles for construction and removal to a minimum and the reusable units were all used in other sports pitch construction projects after the event.



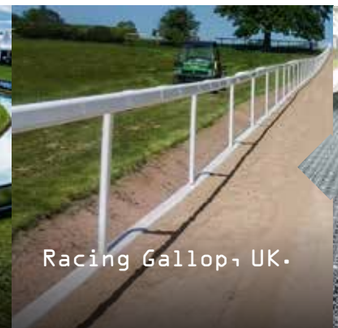
A 60 x 20 m private indoor Equestrian Centre constructed with the Permavoid 150 subbase. Here the entire arena surface is used as 180.000 l. rainwater harvesting and balancing "tank". Passive irrigation through capillary columns is used for zero-energy surface conditioning. The harvested rainwater is also used to condition the outdoor arena, washing horses and toilet flushing. Intelligent Cloud Water Control monitors and controls all water levels in the different parts of the system to maintain surface moisture content according with weather- and use conditions.



Permavoid equestrian arena in Florida, USA.



Bolesworth Castle Equestrian Arena, UK.



Racing Gallop, UK.



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Rooftop sports facilities

Sports with a view

The Permavoid lightweight design makes it a superb subbase underneath sports facilities on rooftops or podium decks, where the load bearing capacity is usually the most important limiting factor. Conventional, deep, crushed rock foundations are often impossible and impractical in these locations.

The way the units connect during construction and how they can be disconnected again at any later stage ensures that the roof membrane is always within reach, without having to move large quantities of materials. Next to natural grass and synthetic turf, various surface materials for sports can be used. Running track surfacing or fall-dampening surfacing used beneath playground equipment for children can be applied.

The White Collar Factory incorporated a novel and innovative rooftop running track, utilising the limited rooftop space between the Building Maintenance Units tracks. The Permavoid system made this running track possible for the following reasons:

- Lightweight – limited roof loading
- Modular and interlocking – limited access to the roof during construction (no crane required)
- High performance drainage – prevent flooding of, and pooling on, the track surface





The Hotel Football rooftop pitch and event space offers an amazing view of Manchester United fans' favourite stadium, located only 200m away.



Permavoid rooftop training facility, London UK.



A CLOSER LOOK: GREENSOURCE SPORTS FOR WATER

GREENSOURCE

Client : GreenSource Consortium
Project Partners : Dutch Ministry of Foreign Affairs, TenCate, Drain Products Europe, Pentair, Saxion University, Mmapula Community Development, Ammon, Royal Turf
Goal : Development of twenty stormwater managing and potable water generating synthetic turf sports pitches with educational program for local communities
Pitch size : Twenty pitches, 800m² (20x40m) each
Location : South Africa
Construction : 2016-2020

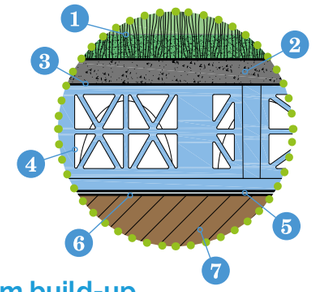
Twenty Greensource community pitches in South Africa

During the FIFA World Cup hosted by South Africa in 2010, visiting engineers from the Netherlands identified the growing water problem and started working towards an innovative way of addressing these water challenges. In the spirit of the great sport of football the GreenSource Sports for Water project was born, further researched, tested and ready for implementation in 2016.

This ongoing project to create twenty Greensource systems (hardware) complemented by an educational program for the local community (software) in South Africa is an exciting public-private partnership between top innovative companies from the Netherlands and the Dutch Ministry of Foreign Affairs.

Technology explained

Playing sports provides important benefits for people all around the world, ranging from improvement in fitness and health to the development of team spirit and feelings of accomplishment. High quality sports pitches contribute to this by providing a safe and fun playground. The Greensource system transforms a synthetic turf sports pitch in to a (storm) water catchment, storage, distribution and potable water supply system. The system allows sports facilities to reuse stored water for irrigation and maintenance, or to transform it on-site to potable water using membrane and ultra-filtration technology. This is of particular importance in areas where water shortages prevail or only polluted water is available. Greensource creates a safe water storage basin, which makes clean and safe water available for the whole community.



System build-up

1. Synthetic turf + infill
2. Shockpad
3. Capillary geotextile
4. Permavoid panels 85 mm
5. Prefab waterproof membrane
6. Protection geotextile
7. Sub soil



Greensource in New Delhi, India

Since the realization of the first community pitch in Rustenburg much international attention focused on the GreenSource project, resulting in the installation of the first Greensource system in New Delhi, India. In a bilateral partnership between the Indian Government, the Dutch Government and a consortium of Dutch companies (Drain Products, Heras, Philips, KNVB WorldCoaches, Pentair, Amsterdam Arena, ZJA Architects and TenCate) working under the organization Dutch Sports Infrastructure (DSI), India and the Netherlands have since launched the first so-called Colourfield concept at JLN Stadium in New Delhi, India.

The value of the Greensource system is not limited to sports, but positively affects the health of the entire community surrounding the pitch. A sports pitch should be far more than only a surface to play sports on, it can be the centre point of any community to come together, play sports and enjoy clean water.

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Skills transfer program.



Health improvement.



Access to potable water.



Water storage capacity: 64.000 litres.

“LESS CHILDREN HAVE TO VISIT THE HOSPITAL AND CAN ATTEND SCHOOL NOW”

SITE MANAGER MICHAEL MOEDWILL SCHOOL SA

“WE WANT TO DO MORE WITH THE WATER, SO WE ARE DEVELOPING A PLAN TO SELL BOTTLED WATER FROM THE PITCH TO PEOPLE FROM SURROUNDING COMMUNITIES”

CHIEF AT GREENSOURCE TSHISAHULU SA



Sports & play.



A CLOSER LOOK: TKI-PROJECT CITYSPORTS

Name : TKI-Project CitySports
Goal: : Stormwater managing and capillary cooled synthetic turf sports pitch
Project Partners: : KWR Water Research Institute, City of Amsterdam, Bureau Marineterrein, DutchBlue, Drain Products Europe, Veolia, Waternet. This project is supported by the Top Consortia for Knowledge and Innovation programme of the Water & Maritime Top Sector
Location: : Amsterdam, The Netherlands
Design: : 2019
Construction: : Winter 2019/2020
Research Results: : Expected November 2020. Full paper in November 2021
Website: : www.projectcitysports.com

Worldwide it is recognized that synthetic turf has the tendency to overheat on sunny days, up to the point where the athlete's health is threatened. Earlier research has shown that evaporative or adiabatic cooling of the turf is the only option to cool the pitch down.

The challenge became to innovate a system which would deliver water from below, negating the use of spray-irrigation canons on the surface, and with such a water storage capacity that the cooling effect would last for days, rather than minutes. Secondly the goal was to develop a system which retains and reuses rainwater as much as possible, to reduce drinking water usage and uses no energy in its functioning to maintain a low carbon footprint for the operational pitch.

Technology description

This innovative project uses the shallow Permavoid 85mm subbase as stormwater catchment basin beneath the pitch, while using capillary cones and the water retaining BlueLay shockpad to naturally bring water from storage to the infill in the carpet for evaporation and adiabatic cooling. The system uses stormwater instead of drinking water, does not use energy, communicates with stormwater management in its surroundings, eliminates the use of crumb rubber infill by using natural materials only and speeds up the installation process, because of its shallow depth and lightweight construction.

Independent research

Pre-research in to the evaporative adiabatic cooling capacity of the system was done at the laboratory of KWR to assess the suitability of various selected infills and synthetic turf combinations under controlled circumstances.Actual field-testing is done at two locations in Amsterdam: an active and operational 1.400m² training pitch at Soccer Club VVA Spartaan for water management monitoring, system validation (ISA Sport) and play quality. Four smaller R&D pitches are installed at the Marineterrein for detailed evaporation and cooling measurements.

Research into the efficacy of the water management system and water model is being done scientifically independent and peer reviewed by KWR Water Cycle Institute, supported by the Dutch Government under the TKI Topsector Water program.





CLIMATE RESILI ENT CITIES WITH PERMAVOID SP ORTS SOLUTIONS



Sport characteristics

- Increased total playable hours
- Consistent play characteristics of the pitch
- Healthy synthetic turf: not overheated but naturally cool (< 40°C), like natural grass
- No pooling of water on surface
- System approval for natural grass, hybrid, synthetic turf and equestrian sports surfaces
- Increased weather resiliency
- Non-toxic materials

Water

- Cyclic on-site water management as a nature-based solution: Capture - Store - Reuse
- Transform water management from 'discharge to harvest'
- Reduce rainwater discharge during peak rain events
- Improved water quality to prevent pollution of open water
- Optimal drainage capacity
- Mains water usage reduction

Substainable urban drainage design

- Rainwater detention and retention without on-site tanks or bioswales
- Sports integrated in city-wide SuDS schemes
- Retention of other sources of rainwater (e.g. rooftops) in the same system
- On-site water management and reuse (irrigation and cooling)
- Optional Artificial Intelligent on-line water monitoring and control

Economics

- Realise water compensation requirements for up to 3 pitches in just one pitch's subbase.
- Increased use of existing sports facilities
- Better exploit space on rooftops and podium decks
- Increase real estate value
- Local health improvement
- Drinking water usage reduction

permavoid

Construction

- Lightweight
- Panels are safe, quick and easy to install without heavy machinery
- Shallow construction
- Suitable for new and renovation of existing pitches
- Low lateral flow rates in the Permavoid subbase, minimizing number of outfalls in the system
- Reduced carbon footprint: minimal material volume and weight, reducing truck movements up to factor 20

Climate change mitigation

- Pitches become an integral part of climate resilient cities
- Temperate regions: reduce sewer loading with on-site water retention in pitches, up to 1.200.000 litres per full size pitch
- Arid regions: reduce irrigation water usage with 32% on average by preventing surface evaporation losses, deep drainage, run-off and overwatering
- Urban Heat Island reduction: evaporative adiabatic cooling in open sand, grass, hybrid and synthetic turf applications

City and urban planning

- Supports creation of multifunctional sports pitches
- Professional sports turf quality in a lightweight construction
- Podium deck and rooftop sports applications
- Approved temporary pitch construction for professional sports events
- Shallow pitch construction on contaminated or low load bearing soil
- Reusable construction in nowadays fast changing cities

Permavoid for sports pitches:
capture, store, evaporate and cool.

OUR SUSTAINABLE JOURNEY

Circular thinking forms the basis of all our products and designs. This concerns both the materials used and functionality of our systems. For urban water management we collect, store and reuse rainwater on location as much as possible and minimise use of drinking water.

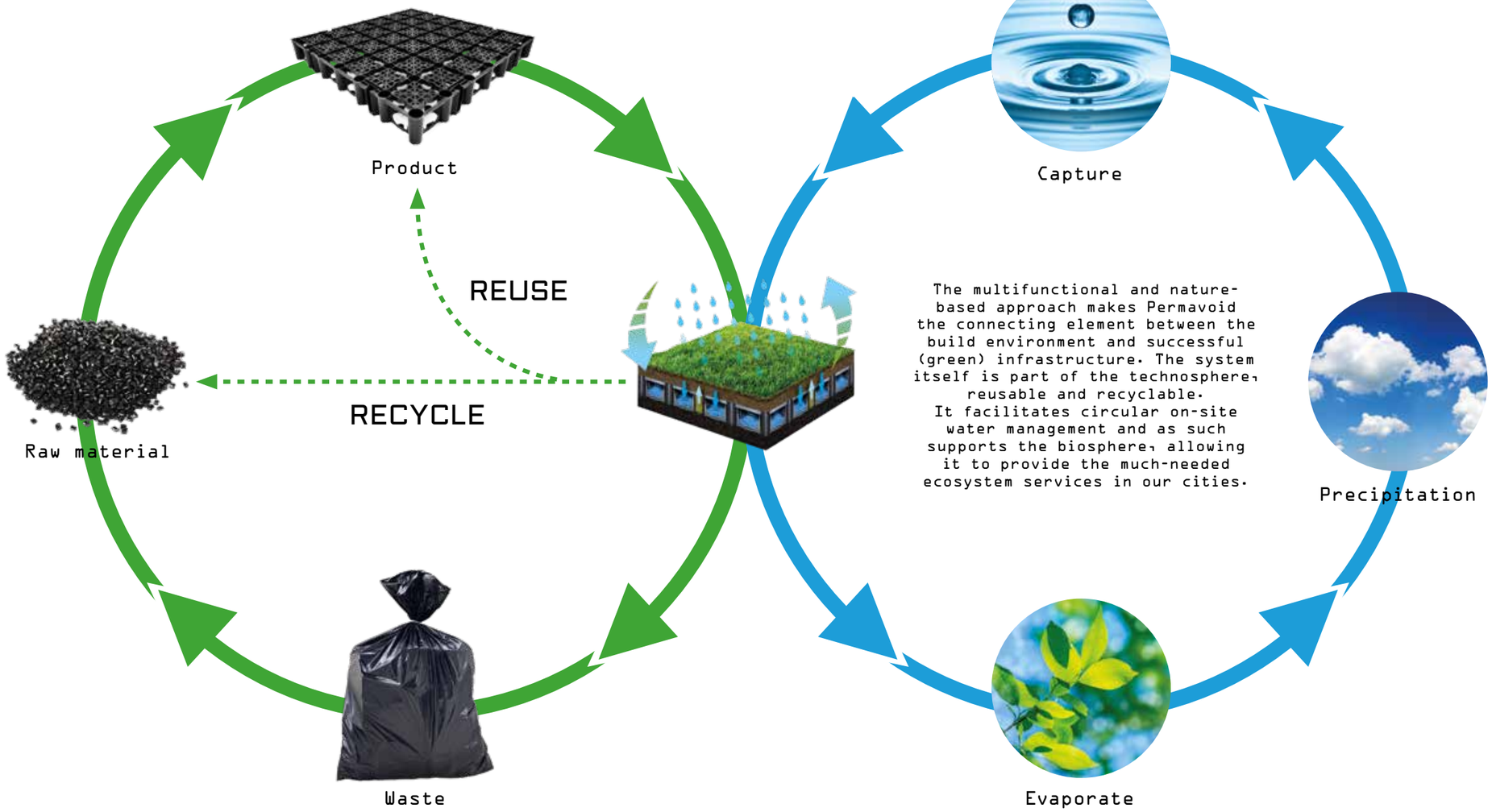
The units are made from high quality recycled materials and therefore fit 100% in the cradle-to-cradle philosophy. The plastics used can be fully recycled, but in practice they rarely are since the units can easily be disconnected and reused elsewhere thanks to their construction and the removable PermaTies. We aim at local manufacturing, preventing unnecessary worldwide shipping, shortening transport distances, further reducing our carbon footprint.

Developing multifunctional systems can only be accomplished in close corporation with valued partners. Based on equality and willingness to share, we work with market leaders in R&D like KWR-Water, STRI, University of Coventry and Wageningen University and Research, manufactures like Veolia, Ten Cate, Sioen and Lapinus and distributors like Polypipe, Optigruen, Perflow, ABT and many others. Together with local stakeholders, governments, cities and institutes we invest in pilot projects to ascertain the local challenges and create perfectly adapted multifunctional solutions.

The solutions designed with Permavoid can function for decades and will continue to fulfil their function for generations. The materials and designs used by Permavoid have been thoroughly tested by independent institutes for strength, reliability, pollution and temperature resistance and have been approved and used for subbase replacement in structural engineering for more than twenty years.

In our vision waste is upcycled to integrated solutions for future-proof cities.
C.H. van Raam, 2020.

MATERIALS (TECHNOSPHERE)



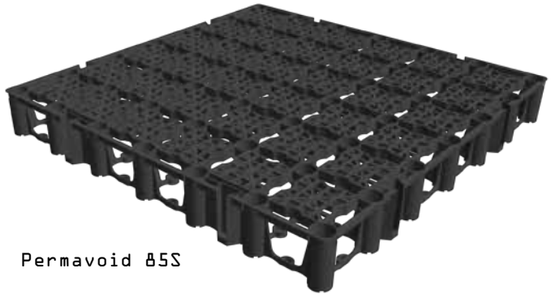
The multifunctional and nature-based approach makes Permavoid the connecting element between the build environment and successful (green) infrastructure. The system itself is part of the technosphere, reusable and recyclable.
It facilitates circular on-site water management and as such supports the biosphere, allowing it to provide the much-needed ecosystem services in our cities.

WATER (BIOSPHERE)

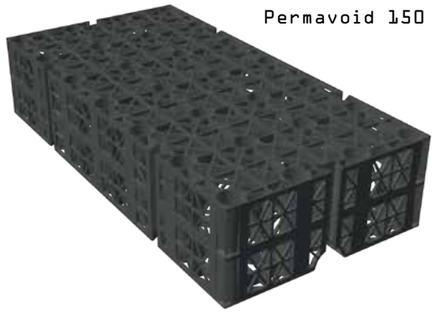
PRODUCTS

Permavoid units

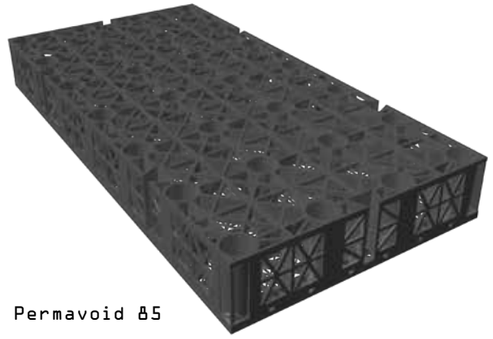
Permavoid units are high strength, lightweight hollow subbase units able to support sports, landscaped and paved surfaces on rooftops, podium decks and at ground level. In combination with the Permavoid capillary columns the system can be used in water sensitive urban designs, enabling stormwater attenuation, conveyance, infiltration and natural capillary (passive) irrigation.



Permavoid 85S



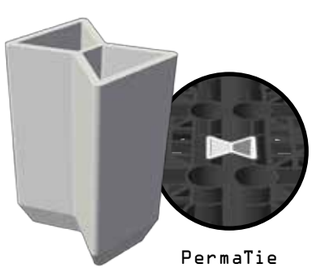
Permavoid 150



Permavoid 85

Ancillaries

Various Permavoid ancillaries are used to tie units/panels together into stable rafts, create stable stacks, enable capillary irrigation and allow the attachment of components and products directly to the Permavoid units.



PermaTie



PermaLock

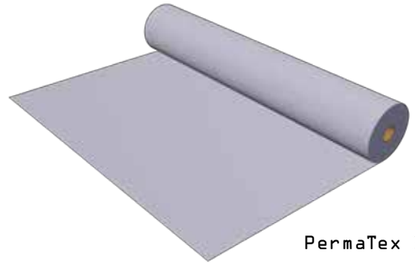


Capillary Column

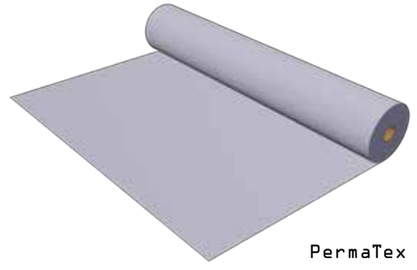
The products displayed are a selection of the full range of Permavoid products most relevant to the applications discussed in this brochure.

Geotextiles and membranes

Geotextiles are an integral part of every Permavoid design, protecting the waterproof membrane from punctures, determining the water infiltration rates and quality and facilitating successful capillary irrigation. The waterproof membrane is used to determine the attenuation, retention or detention functionality of the designed system.



PermaTex 300HD



PermaTex CAP



Permavoid Flex 700

PVOD components

Permavoid "PVOD" components are designed to provide easy to install connections and access points into the Permavoid system, essential for reliable integration in SuDS schemes and access for maintenance.



Sealed Tank Adaptor



Sealed Tank Adaptor

Full product range information and detailed datasheets are available upon request.

permavoid

THE FOUNDATION FOR OUR FUTURE

The Permavoid range of products and systems are capable of creating circular, nature-based solutions for sustainable water management in metropolitan areas. Solutions encompass urban trees, Blue-Green roofs, podium decks, gardens, sports pitches and SuDS aiming at water-sensitive design.

Permavoid source control ensures that no precious water goes to waste by catching, storing and reusing stormwater for irrigation, evaporation or infiltration. For more information about Permavoid solutions please contact us or visit permavoid.com to find your local Permavoid distributor.

Other solutions by Permavoid



Permavoid civils

Blue-Green roofs

Permavoid trees

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