

POLYPIPE INFRAGREEN

Intelligent water management solutions for a more resilient future



Evolving to meet the challenges of climate change



To some, it may seem a little out of kilter for a company called ‘Polypipe’ to produce a brochure all about Green Infrastructure. But it’s not as left field as one might think. Throughout our history, we have been at the forefront of surface water drainage innovation – as this brochure serves to further demonstrate.

We’re continually evolving our systems and products to challenge the events brought on by an ever-changing climate, working to reduce the impact it has on our towns, cities and urban areas – as well as helping to make the people who live within these areas have a more comfortable and environmentally secure future.

Traditional piped drainage systems still have an important role to play, however, in ensuring the resilience of our towns and cities, but that said, they are now only part of the solution. Increasingly Planners, Developers, Designers and Installers are looking to employ alternative drainage strategies. Those based on nature, which control and manage rainwater where it falls, (at source), but also protect and enhance the urban environment. Modern drainage solutions now need to provide more than just conveyance, they have to be smart, delivering multifunctional benefits whilst making space for water to turn challenges into solutions.

The development of systems from Polypipe provide innovative drainage solutions that not only intercept and manage storm water; helping to prevent flooding, but that are also able to reuse it. Capture and clean it as part of a permeable pavement system, for example. Use it to protect and allow inner-city trees to thrive as part of a planted drainage system. Repurpose it to naturally irrigate green surfaces from below; thus saving on potable water and easing the strain on our sewer systems. And managing it efficiently and effectively with vegetation to help create evaporative cooling by evapotranspiration from plants and soils – helping to cool inner cities, offset the urban heat island effect and ultimately, help to create places where people want to be and where biodiversity can thrive.

These are truly modern times, and we need truly modern water management solutions to keep up.

Jason Shingleton
Marketing and Development Director at Polypipe

The foresight and experience to make the difference

Since 2004 we have been successfully manufacturing engineered Sustainable Urban Drainage Systems (SuDS) to support the construction industry at every stage of its growth – and helping it to move forward with solutions that demonstrate exceptional performance. With continuous research and development, we have become the market leader in water management solutions – designing drainage systems that successfully meet the requirements of today’s construction markets.

Historically – and naturally – we’ve been a company of innovators, problem solvers and solution providers, and so appreciate we will always need systems that deliver more. The increase in urbanisation has pushed our innovation skills further to develop new technology. To engineer enhanced systems that make space for water. And develop systems that create and sustain important Green Infrastructure.

Drawing from what we know already, we’ve been able to implement water management know-how into creating important Green Infrastructure. It’s an area where we can add real value – not simply from a financial perspective but, more importantly, from a health and wellbeing point of view. Indeed, whatever system our customers install, we’ll ensure it includes an element of biophilic design wherever possible, helping to reconnect human life and wellbeing through that of nature, by including planting and vegetation within our water management systems to create a more natural and sustainable drainage solution.

Polypipe InfraGreen provides solutions that allow natural drainage through plant roots as part of a planted drainage system and consist of products which complement and support natural vegetation to be able to achieve this. Trees, in particular, can be located in otherwise restricted areas – such as inner city squares and streets – thanks to tree boxes and geocellular units below the road surface, which allow the roots to spread without damaging the surface above.

And to help vegetation self-manage water efficiently and effectively, Permavoid units can include products such as Capillary Cones or Permafoam, which provide the plants with important nutrients and water – creating natural irrigation without using pumps, hoses, or energy; just like nature. Whilst traditional engineered solutions can enhance the biophilic design to deliver a successful Green Infrastructure, water management and drainage solution. The benefits can also include helping to control service water run-off which can earn valuable BREEAM points, helping towards a faster, more successful planning approval.

With an accomplished career spanning over 30 years collectively, Andy Cullum, Sales & Marketing Director for Polypipe Civils and Sean Robinson, Specification Director for Water Management Solutions, are at the leading edge of research and development. A civil engineer himself, Andy leads his team with a customer-focused approach and understands precisely the needs of the industry, to be able to complete schemes effectively, efficiently and to manage water intelligently. Working alongside Andy, Sean, with his technical know-how supported by a degree in science, has a tenacity to find alternative solutions to help with the challenges the industry faces. Whilst helping design products and systems that allow schemes to include Blue-Green Infrastructure and biophilic design.



Andy Cullum



Sean Robinson

With the cause for resilient cities a world-wide initiative, intelligent water management solutions – whether engineered SuDS or Green Infrastructure applications – are more important than ever to ensure a more sustainable future for our cities and urban spaces.

What. How. And why.

A multifunctional approach to Green Infrastructure.

Introducing effective Sustainable Drainage Systems (SuDS) solutions that incorporate Green Infrastructure, can deliver multifunctional benefits such as rooftop amenity and the cooling of urban environments. Urban Planners are discovering innovative ways to adopt a multifunctional approach to Green Infrastructure. Our aspiration is to work with them to develop those innovations – particularly when designing new developments, where there's an opportunity to maximise multifunctional space.

Combined with clever water management solutions, such as our geocellular systems, we can create much needed amenity – including rooftop cafés or small on-site parks for example. And directives, such as National Capital Accounting and the Balanced Scorecard Approach, are 'tools' by which the construction industry can refer to and implement, ensuring Blue-Green Infrastructure is included in procurement processes whilst achieving value for money and creating assets for all to enjoy.



Making space for people

The loss of parks, sports pitches, playgrounds and other amenities can have an adverse effect on human wellbeing. Research shows we recover faster from illness when we have access to such spaces – reducing the cost of healthcare. Also, limited access to open green spaces, trees and nature in general is associated with a lower life expectancy.¹ Simply having a view of a tree through a window, for example, is enough to lower stress and blood pressure.²

A sense of wellbeing and community can be achieved with Green Infrastructure; and making space for water helps to not only reduce the impact of rainwater run-off, but reuses it to create important amenity such as green link cycle paths, green corridors and Blue-Green roofs – sustainable green spaces for people to use, even where space is at a premium. And all the while it is reducing the stress on potable water consumption and sewer networks.

Blue-Green Infrastructure not only helps to make our cities more resilient, but also the people who live in them.

Research shows we recover faster from illness when we have access to green spaces.



Understanding the way forward

Green Infrastructure isn't new – nature has provided it since the beginning of time. But with human needs and expectations, natural green spaces have taken a back seat in the name of progress.

With ever-new challenges from an increasing urban sprawl and with population growth within cities showing little sign of slowing down,³ our urban spaces are increasingly more compromised. Buildings are becoming taller and hard surfaces are replacing our green spaces, resulting in high levels of Urban Heat Island (UHI) effect. Through a lack of Green Infrastructure, biodiversity is depleting and clean air is deteriorating; the effects exacerbated by the increasing regularity of flooding incidents caused by climate change.

Blue-Green Infrastructure is the solution, but it isn't about simply adding greenery to urban developments. It's also about incorporating water management solutions into the design of projects, understanding ways in which to deliver health and amenity benefits whilst making space for water to help mitigate the risks of flooding and reduce the impacts of climate change.

Making space for water

Green Infrastructure is about making space for water to create important green spaces. When it rains, particularly in extreme cases, the rainwater needs to go somewhere. Unfortunately, in many urbanised environments at least, rainwater run-off finds its way into our sewer systems causing extreme flooding – and in turn can disrupt natural soakaways, resulting in saturation and further flooding downstream. It's therefore imperative to design projects that include areas where water can be intercepted and stored.

We design and develop engineered Sustainable Urban Drainage Systems (SuDS) – and we understand that the most sustainable schemes are those that use a combination of these systems; not simply drainage systems for conveyance, but those that can irrigate green spaces above via wicking technology using our Capillary Cones for example. Systems that provide gardens and amenity at roof level. Bioretention systems, detention basins and rain gardens that can accommodate rainwater run-off whilst attracting biodiversity. And swales – natural and engineered working together, permeable pavements and even sports pitches; which capture, store, attenuate and irrigate whilst cooling the air through evaporation, making that all-important space for, and an intelligent way to, manage water.

No green without blue

In simple terms, there can be no green without blue – because without water, nothing can grow or survive. Green Infrastructure is green space, whether it's a park, a natural woodland, a Green Roof or a suburban front lawn. What creates Blue-Green Infrastructure (or BGI) are the systems that make space for water to create that Green Infrastructure, and why we refer to some Green Roofs as Blue-Green Roofs for the same reason. So for BGI and Blue-Green Roofs, innovative water management systems are installed to capture rainwater at source, then stored and reused for passive irrigation using our unique Capillary Cones, in-house utilities or car washing – or controlled and released at a reduced rate to reduce the strain on sewer systems and the risk of flooding.

Global energy demand is expected to double or even triple by 2050, by which time over 70% of the world's population will be living in cities.³

Arup, Five minute guide, Energy in Cities.

By 2050, the human population will have reached 9 billion; of this, 75% are expected to be living in cities¹ with London alone set to rise from 8.63 million (2016) to more than 11 million by 2036.

World Population Review, 2017.



The tipping point

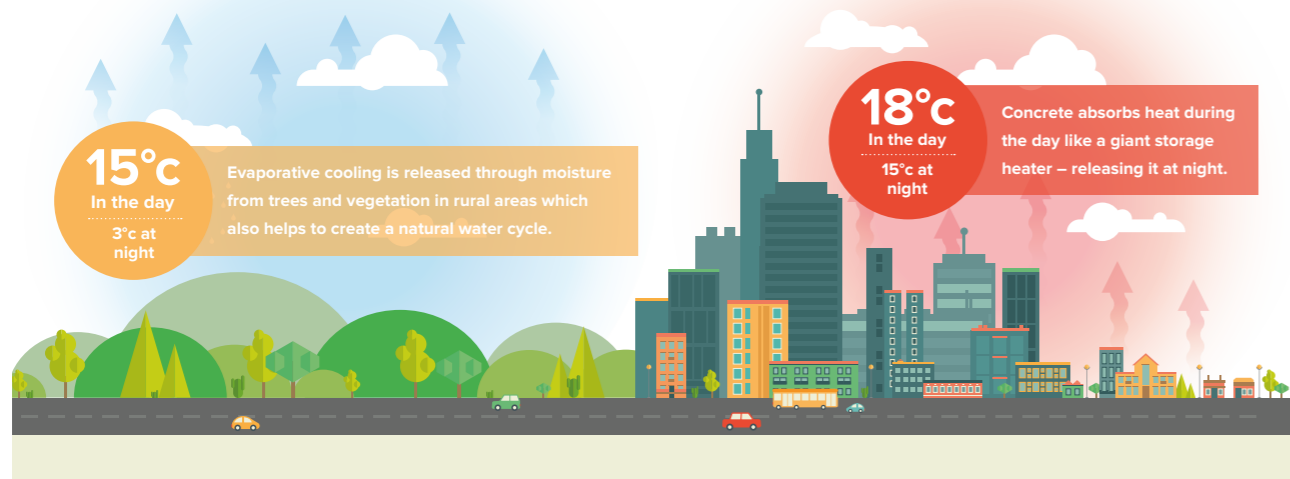
As cities have developed quickly to accommodate more and more people, vegetation has been lost in favour of hard man-made surfaces and buildings.



Urban heat Island (UHI) effect, in particular, is reaching critical levels in developed cities worldwide. Buildings and streets and grey infrastructure, can create confined spaces, trapping heat and pollution. Combined with the lack of vegetation, the heat is simply absorbed into the concrete without respite from trees and other plants to clean and cool the air – with temperatures potentially reaching up to 12°C higher than rural areas at night as the concrete releases the 'stored' heat.

As a result, there's a significant reduction in air quality which can lead to serious illness, such as chronic asthma and bronchitis¹¹ and even increase the mortality rate – especially within the older community. Plants, especially large canopy trees, help to absorb harmful pollutants¹⁰ in the air whilst helping to reduce UHI through shading and evaporative cooling.

A developed country city of 1 million people can experience temperatures 1°C to 3°C higher than its surrounding areas, and up to 12°C more at night when UHI effects are strongest.⁴



Larger trees make a bigger difference

In a 2014 report, it was concluded that London's trees provided at least £133m of benefits every year⁵ in terms of air pollution removal, carbon sequestration and reducing the amount of water going into drains. Whilst a similar study, carried out in the US by The Nature Conservancy (TNC), reported that the average reduction of particulate matter near a tree was between 7% and 24%⁹ and that these microscopic particles – which become trapped in the lungs of people breathing contaminated air – could claim an estimated 6.2 million lives each year by 2050.⁹

The loss of green space has a significant impact on human health and wellbeing¹ and ecologically sensitive areas are slowly being eroded or disappearing, leading also to the destruction of natural wildlife habitats.

Continuing to plan-in GI and make space for rainwater, will help to reduce the strain on our sewers, reduce rainwater run-off, reintroduce green spaces and biodiversity and help to reuse it to better effect.

11. Cities Alive – Economic Benefits, Arup, 2017. 4. Global Report on Human Settlements, Cities and Climate Change, United Nations, pg 69 2011. 5. www.forestry.gov.uk/pdf
9. Planting Healthy Air, The Nature Conservancy 10. Question Time - May, Architect's Choice, 2014. 12. Cities – Walkonomics: the High Line effect, Arup, 2015.

More than
90% of people
feel that green
spaces help
encourage
them or others
to **keep fit and
healthy.**

The Value of our Green Space, The Land Trust, 2016.



Turning cities around

Already, there's positive movement towards making cities in the UK, and around the world more resilient. We're seeing structures like green walls and Blue-Green roofs – welcoming amenity and leisure to otherwise unusable spaces. Natural swales and rain gardens along our roadsides intercept water run-off, whilst permeable pavements allow water to pass through to the soil below. Trees sit atop underground car parks. And rainwater is intercepted at ground level for reuse on rooftops and inside our tallest buildings. All helping to mitigate the impact on climate change, and reinforcing a positive outcome for a growing population.

GI together with clever water management could be effective in mitigating climate change. Planting large-canopy trees next to south facing buildings can provide enough shade to significantly reduce UHI effect. Using greenery to cool a building can also conserve energy, reduce the need for air conditioning and cut carbon emissions in the process.⁷

Evolving to meet the challenges

Adopting a holistic approach to SuDS allows cities to turn rainwater into a valuable resource. Installing SuDS can help reduce the strain on sewers, for example whilst repurposing rainwater can also help lessen the strain on potable water. Buried drainage can still be used for effective irrigation, but SuDS above ground can also be used to help with storage and create multifunctional benefits through applications such as roof gardens, public amenity using podium decks, and so on.

Water storage and reuse can help limit the effects of heatwaves on vegetation by feeding from beneath using unique Capillary Cones. This is an effective solution which draws water upward to feed the vegetation, allowing it to evaporate and condense, promoting CO₂ absorption and cooler air. Together, they work towards restoring a natural water cycle.⁸ And it's a philosophy that works exceptionally well in the design of new sports fields and football pitches. Geocellular units below capture rainwater at source, store it and reuse it for irrigation whilst also mitigating the risk of flooding. Projects like this also provide much-needed amenity and could help towards addressing sedentary lifestyles whilst improving health and wellbeing.

Through clever design, seemingly traditionally unused areas such as roofs can become vibrant meeting places, relaxing oasis and usable spaces for bars and other business opportunities. Consequently, building owners can add value to their properties, whilst adding valuable sustainable attributes and a state of wellbeing to those who visit.

We can achieve all of this simply by making space for water – which is why we need to continue to develop innovative ways to capture, store and reuse rainwater. After all, there can be no green without blue.

Solving the problem with Polypipe

We understand the water management problems cities face and so the earlier we're involved in projects, the better we can work together to achieve innovative Blue-Green Infrastructure with multifunctional benefits for the people who'll depend on it most.

From roof to river

With hard man-made surfaces dominating our cities, managing run-off from heavy rainfall is vital to mitigating the risk of surface-water flooding. That's why we've designed and manufactured systems to act as soakaways or to capture water at source and store it above and below ground. Our gravity and siphonic systems also allow for storage and filtration for reuse, whilst our attenuation solutions release water gradually to lessen the impact of heavy rainfall on nearby watercourses.

We strive to achieve positive outcomes like these, designing products that protect and allow inner-city trees to thrive as part of a drainage system, for example. To intercept, store, treat and attenuate rainwater on a large scale – at source and further afield; saving on potable water and easing the strain on our sewer systems. Making space for water by using Polypipe Geocellular systems including Capillary Cones for wicking will help to create such amenities as roof gardens, parkland above underground car parks and greener spaces within cities.

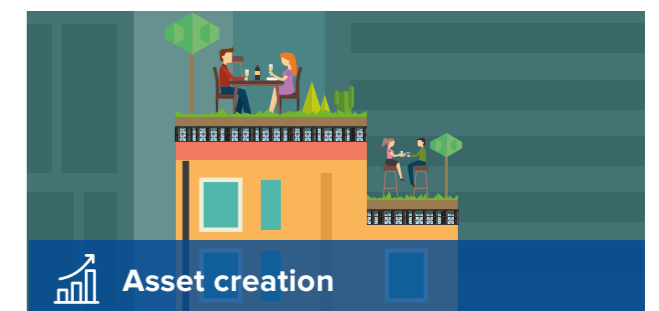
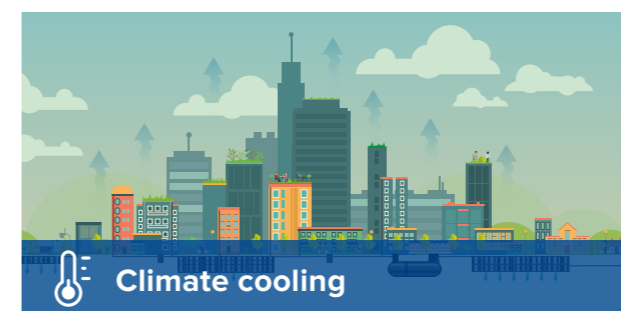
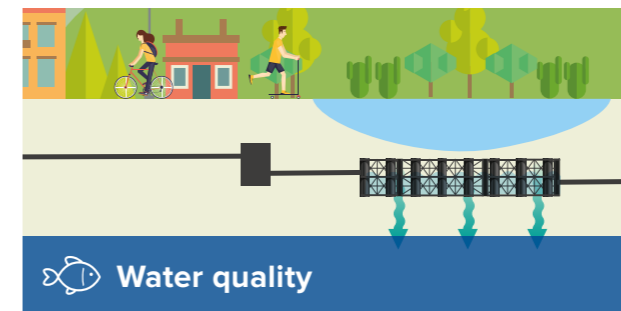
Blue-Green roof applications absorb rainwater at source, reducing run-off whilst enabling water to evaporate more effectively – up to 60% – which helps to cool the surrounding environment. When creating green spaces for people to use like playgrounds for children, community gardens, green corridors that include cycle paths and walkways – it can be challenging to achieve the right balance.

Our engineered water management solutions combined with soft SuDS techniques can regulate attenuation to ensure the land around natural ponds is suitable for areas that people can enjoy; usable spaces of greenery, where under normal circumstances, would be wasted land. Permeable paving allows rainwater to filter through to geocellular attenuation tanks below – storing and reusing rainwater for self-sustainable landscaping. Both commercial and residential developments, new build or refurbishment, can benefit from intelligent water management solutions too. BGI can transform retail spaces to increase trade by up to as much as 40%.¹² Whilst a more vibrant green environment has been found to boost property prices by 2.6% to 11.3%.¹³

Everything above board

And when it comes to legislation, we are committed to ensuring all our products and systems comply with the latest directives. Through quality research and development, we're able to intelligently engineer systems that are designed to meet the most stringent legislation, helping you to succeed when applying for planning approval. With Polypipe as your Green Infrastructure partner, we can successfully make space for water – creating a sustainable approach to land use, amenity, water management and biodiversity.

Our systems don't just convey water – they manage it.



Creating a natural water cycle – on-site

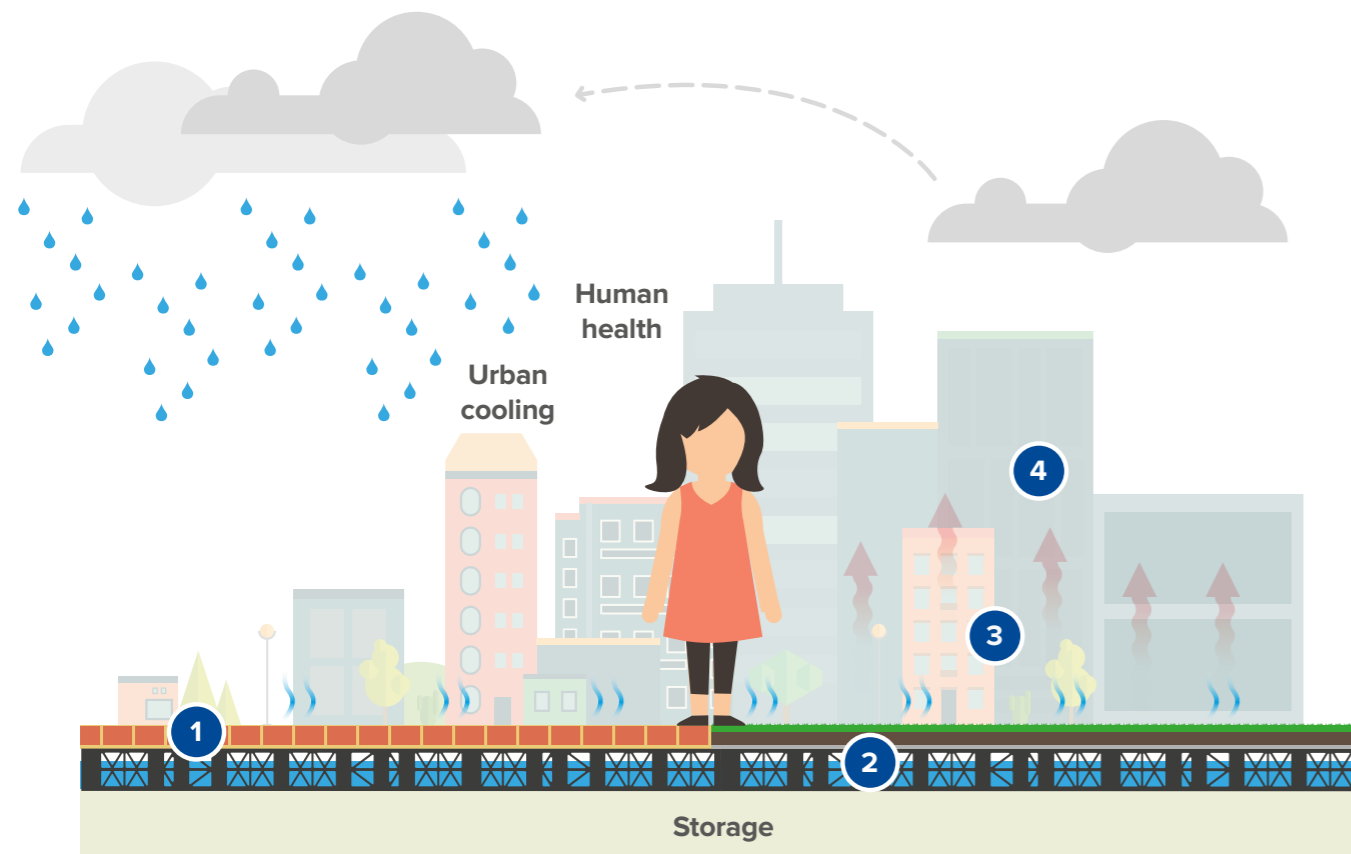
With a culmination of climate change and severe weather events, our urban areas – cities in particular – are at risk of succumbing further to the effects of flooding, drought and the Urban Heat Island effect.

These are challenges that need to be embraced, solutions implemented and positivity reinstated. Our natural water cycle is how life is sustained – and it can only exist with the presence of water in the first place. Green Infrastructure with intelligent water management can self-irrigate, cool the air around it, promote evaporative cooling, create amenity, attract biodiversity and reduce flooding.

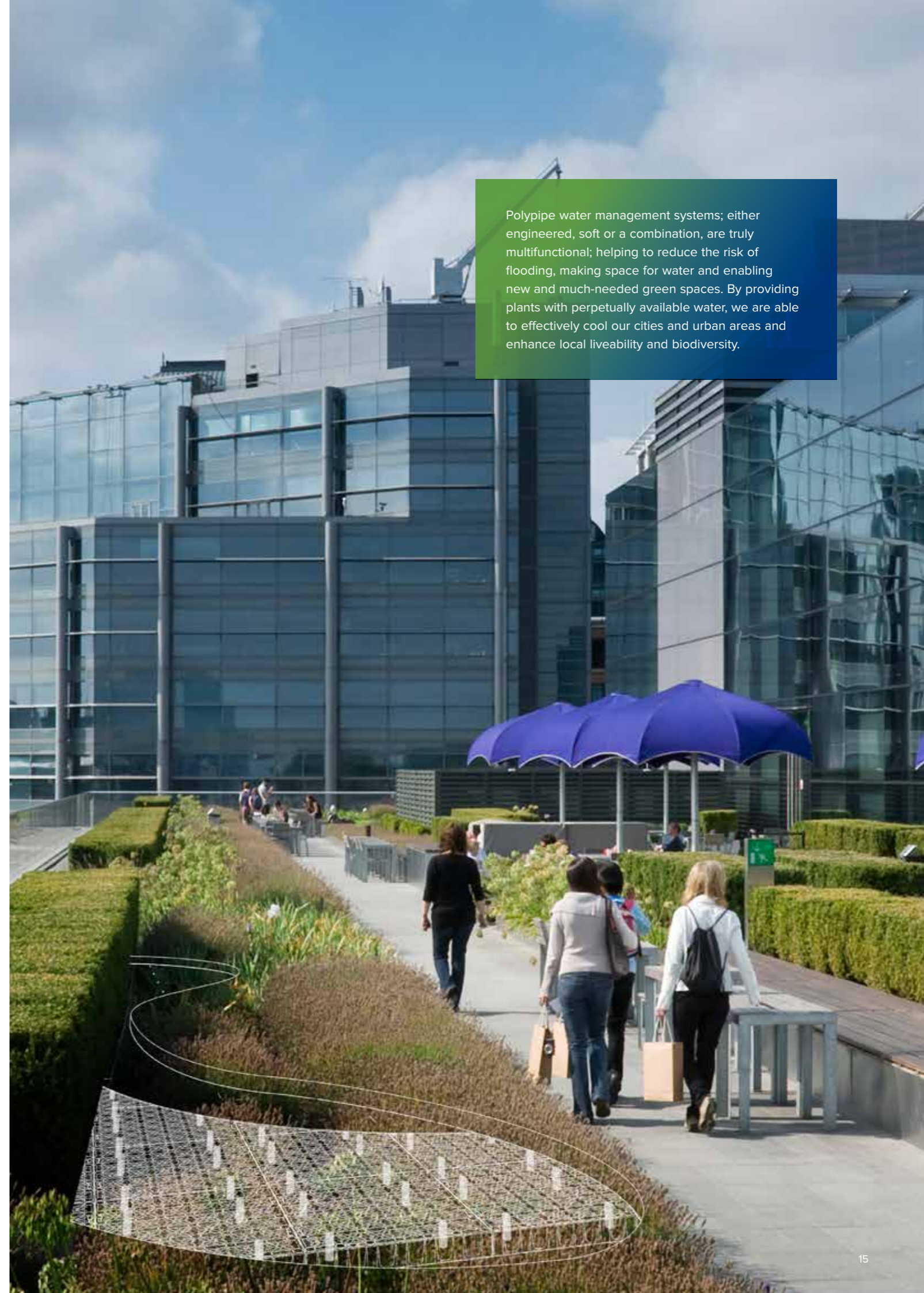
Polypipe water management solutions include robust geocellular units combined with a number of innovative additional products to enable on-site catchment, storage, treatment and reuse of rainwater.

Our Permavoid system is ideal for shallow ground level sites whereby large trees can be planted; with root systems contained and managed and helping towards passive irrigation with Polypipe Capillary Cones.

Sports pitches benefit too, capturing rainwater and storing it below the grassed area for irrigation of the pitch; and reused after infiltration for non-potable washroom facilities at the venue. Whilst at roof and podium levels, the geocellular system makes for amenity and green and healthy places to meet and enjoy. Ultimately, the system, at any level, serves to create a natural water cycle on-site.



- 1** Rain intercepted via permeable paving and captured using geocellular units below to reduce run-off
- 2** Geotextile stores water and uses Capillary Cones to absorb the water, drawing it up to irrigate vegetation above
- 3** Vegetation attracts biodiversity whilst absorbing CO₂ and creating a healthier atmosphere
- 4** Vegetation helps cool the air. As the water evaporates from its leaves, it carries the heat away with it



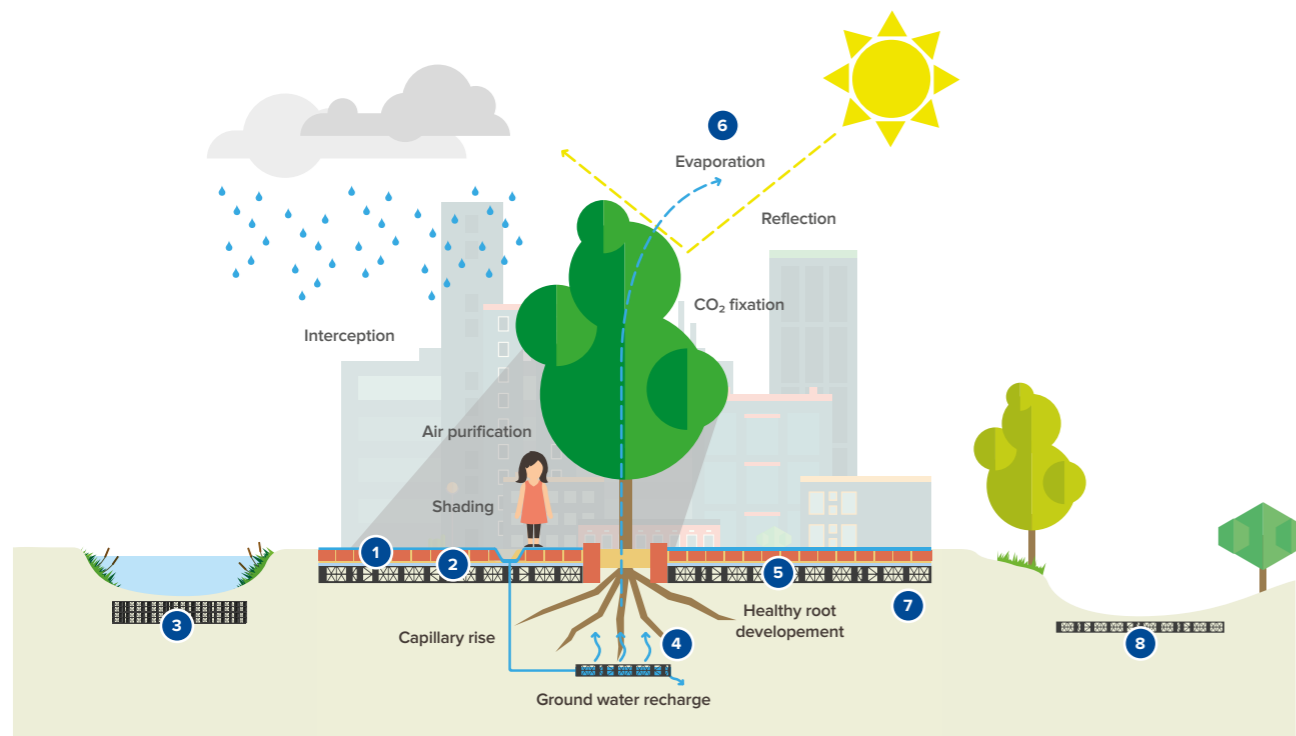
Polypipe water management systems; either engineered, soft or a combination, are truly multifunctional; helping to reduce the risk of flooding, making space for water and enabling new and much-needed green spaces. By providing plants with perpetually available water, we are able to effectively cool our cities and urban areas and enhance local liveability and biodiversity.

Inspiration from evapotranspiration

It's often said that 'nature finds a way'. Indeed, if left to its own devices, nature would take over our cities, our urban areas and everywhere in between. Of course, allowing this to happen wouldn't be practical for modern human life. With the continued need to conserve water and bring wellbeing, wildlife and aesthetics back into our cities, trees; especially large canopy varieties and plants, are more precious a commodity than ever.

The common denominator is water. Without it, there is no Green Infrastructure, no trees, no plants and no natural structure. Evapotranspiration from leaves cools the air, helping to reduce the Urban Heat Island effect; which is why larger canopy trees are preferable; as they can provide these benefits more efficiently and effectively than smaller varieties. Larger varieties also create shade, further cooling the area beneath and the buildings adjacent.

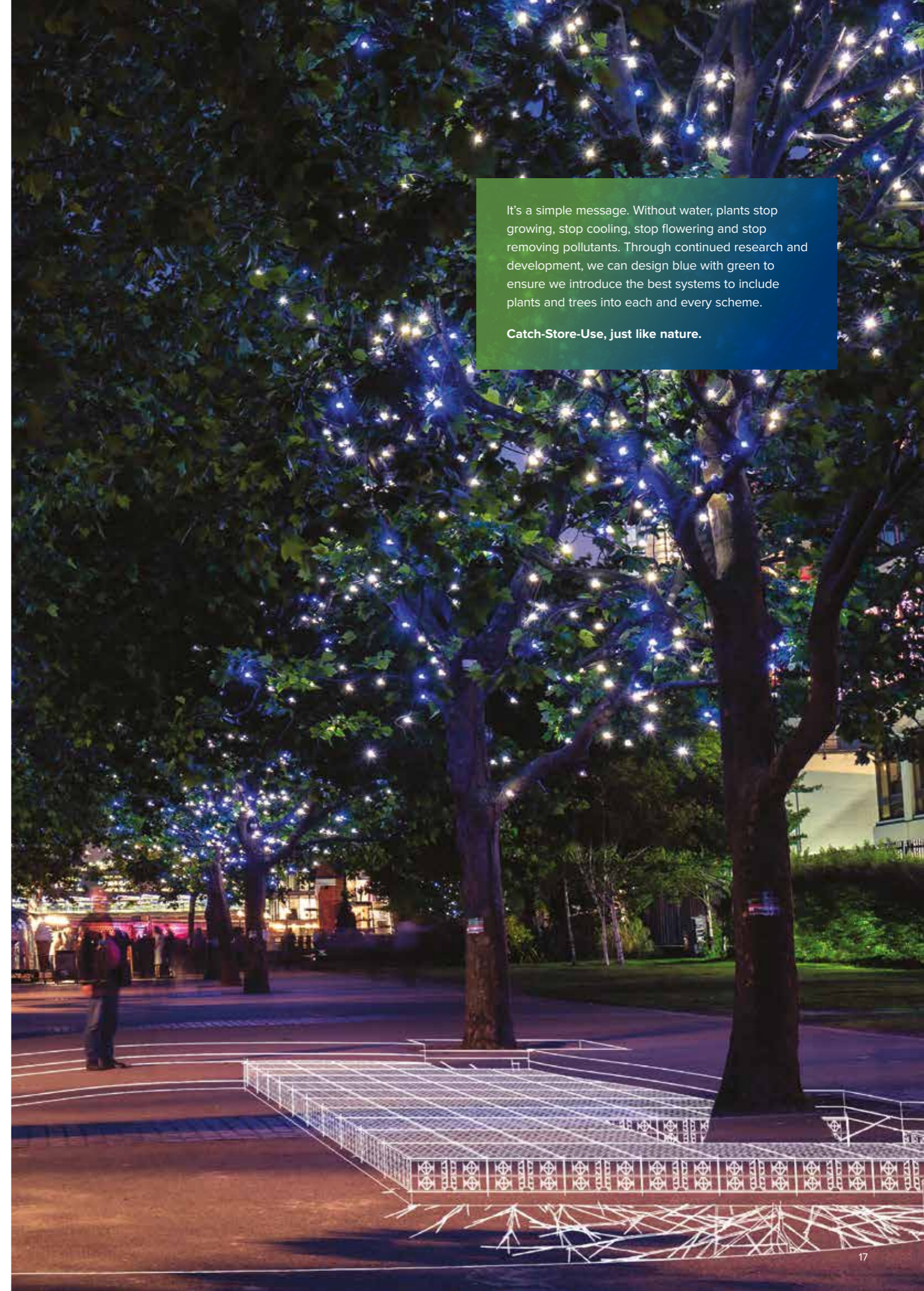
Leaves also cleverly filter pollution, trapping and absorbing harmful fine particles (known as PM10s – PM relating to Particulate Matter) on the surface of the leaves.¹⁰ Just as important, green space has a relaxing effect on the human mind and a positive effect on human health, with people preferring to live where they can see trees and green spaces.⁶



- 1 Rain intercepted via permeable paving and rain garden to reduce run-off
- 2 Geotextile removes oil and other road contaminants
- 3 Polystorm system stores and attenuates water preventing flooding from above natural ponds
- 4 Permavoid units provide space for water and use Capillary Cones to irrigate trees above
- 5 Air gap to allow roots room to grow without causing damage to surface and protects roots from damage
- 6 Helps cool through evaporation and shading
- 7 Soil is naturally recharged with water and also helps cool with evaporation
- 8 Natural swales controlled using Permavoid units beneath to store and attenuate

It's a simple message. Without water, plants stop growing, stop cooling, stop flowering and stop removing pollutants. Through continued research and development, we can design blue with green to ensure we introduce the best systems to include plants and trees into each and every scheme.

Catch-Store-Use, just like nature.



Key markets and placemaking

Having built our business around the residential, commercial, civils and infrastructure markets, we have a detailed understanding of the applications in which our systems are used, enabling the movement of water and air throughout the built environment – helping to deliver health benefits, usable places where people want to be and sustainable results for a resilient outcome.

We understand the pressures developers face in the construction industry today, both in terms of approvals and the challenges associated with climate change. That's why we share our knowledge to provide carefully tailored solutions for every project. Water management at source, for example – introducing geocellular systems below permeable driveways to capture, store and reuse water whilst reducing high volumes of run-off to sewers. And providing SuDS to intercept water around residential developments, resulting in on-site amenities utilising land that would otherwise be unusable.

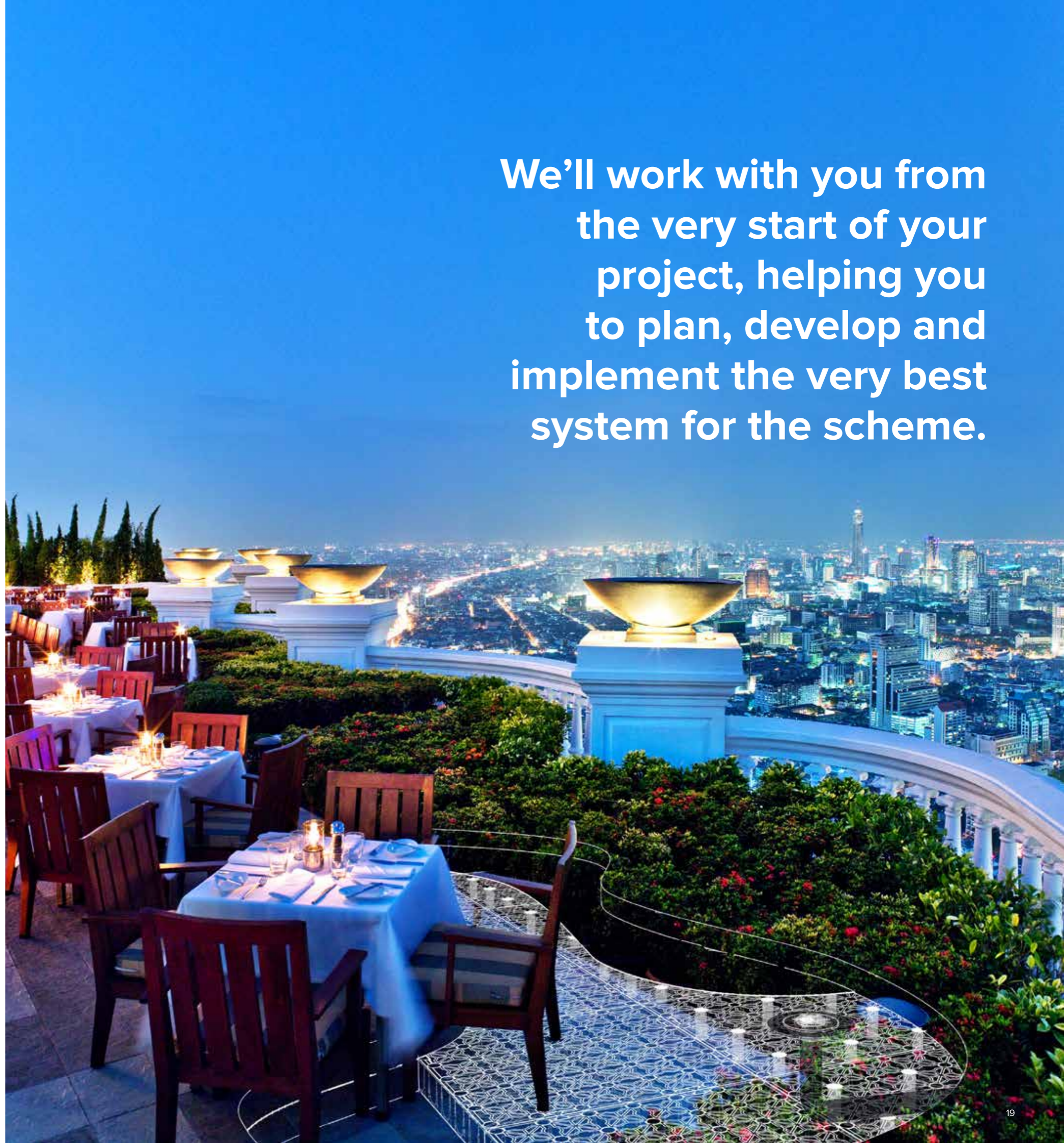
Our expertise in understanding the drainage requirements for tall buildings is extensive and we use our knowledge to engineer unique solutions from the ground up – and back down again. Our gravity and siphonic systems, for instance allow for storage and filtration for reuse. We have Blue-Green roof systems that can provide areas of living vegetation at roof level where the capture of rainwater at source can be used for the purposes of irrigation to the vegetation. As a result, space is transformed into a place for amenity and, depending on the area size and vegetation used, could provide important biodiversity and evaporative cooling.

Making places, better places to be

Designing GI with water management solutions, particularly at the early stages of a project, not only delivers a project that enhances a city's resilience, but brings prosperity through added value. Simple design solutions such as creating a network of green corridors between urban areas, for example, can encourage more activity, make for more interesting environments en-route whilst improving ecological connectivity and providing important habitats to attract biodiversity. And sports pitches have the ability to conceal and capture immense volumes of rainwater, whilst the geocellular tanks irrigate the pitch above allowing the grass to reduce temperatures through evaporative cooling.

Our range of engineered water management products are designed to manage water in any application. Lighter in weight than traditional materials, they're easy to manage and install, and include above and below ground rainwater capture and reuse systems. Ultimately, our expert team can help you design with water management solutions to include Blue-Green Infrastructure in your next project – to help make the 'resilient cities' dream a reality.

We'll work with you from the very start of your project, helping you to plan, develop and implement the very best system for the scheme.





There will be challenges to overcome. We understand these challenges – not only with the logistics of the project, but with meeting legislation and the Balanced Scorecard Approach.

Support to achieve the right balance

Directives, such as National Capital Accounting and the Balanced Scorecard Approach, are ‘tools’ by which the construction industry can ensure Blue-Green Infrastructure is included in procurement processes whilst achieving value for money and creating assets – plus non-financial benefits for all – for each project. Understanding such tools will help to explode the myth that designing with Green Infrastructure is difficult.

To ensure projects meet Balanced Scorecard criteria; product innovation and quality of expertise and experience go hand in hand. Our sector-specific specialists understand what’s required from the planning stages right through to the finished development. And because legislation and directives can fluctuate depending on each local authority, it’s good to know we have local teams right at the heart of the matter who understand the area, its challenges and individual legislation requirements. This means taking into account social, economical and environmental factors, the value offered by suppliers, contractors and sub-contractors, the designs put forward, technical specification and contract performance conditions linked to the subject criteria of the contract.

Value-added facts

As with all sectors of our business and indeed the industry, legislation is an area that can affect outcomes. We’re actively part of TEPPFA and BPF, so we’re best placed to receive prior knowledge of new legislation and therefore able to be a part of the discussions for industry best practice. We also understand how to get the best from the Balanced Scorecard Approach and how your project can benefit through providing value on a financial level, whilst providing places that generate the richness of mindfulness, relaxation and non-financial value. Simply, budgets and logistics can dictate how projects are managed, what materials are used and the time it takes to achieve the end goal. And with the demand for comprehensive water management solutions more prevalent than ever before, Polypipe is well positioned to help provide solutions that satisfy legislation and, just as important, satisfy the wellbeing of the population – making space for water to deliver a greener, more sustainable environment.

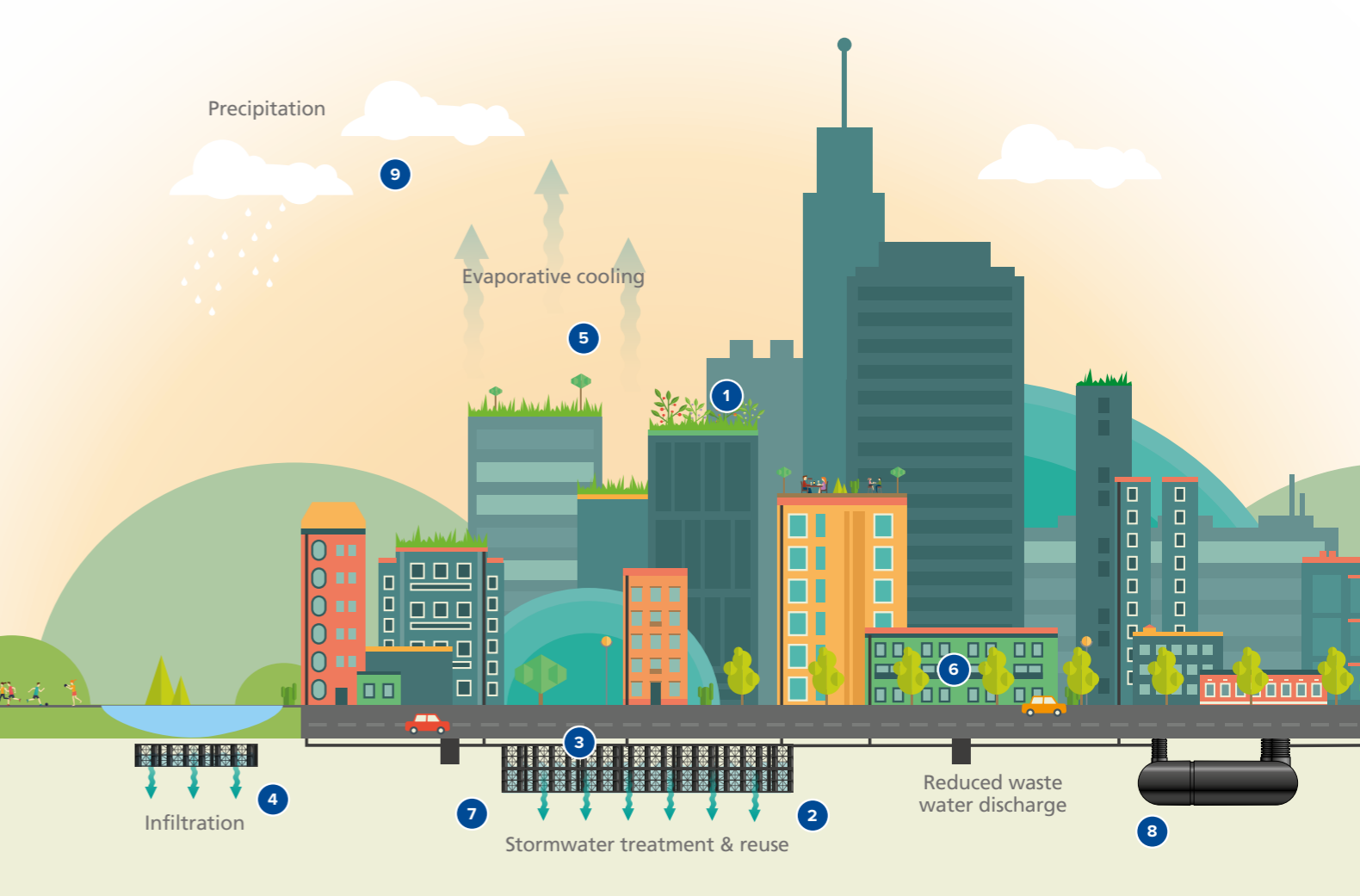
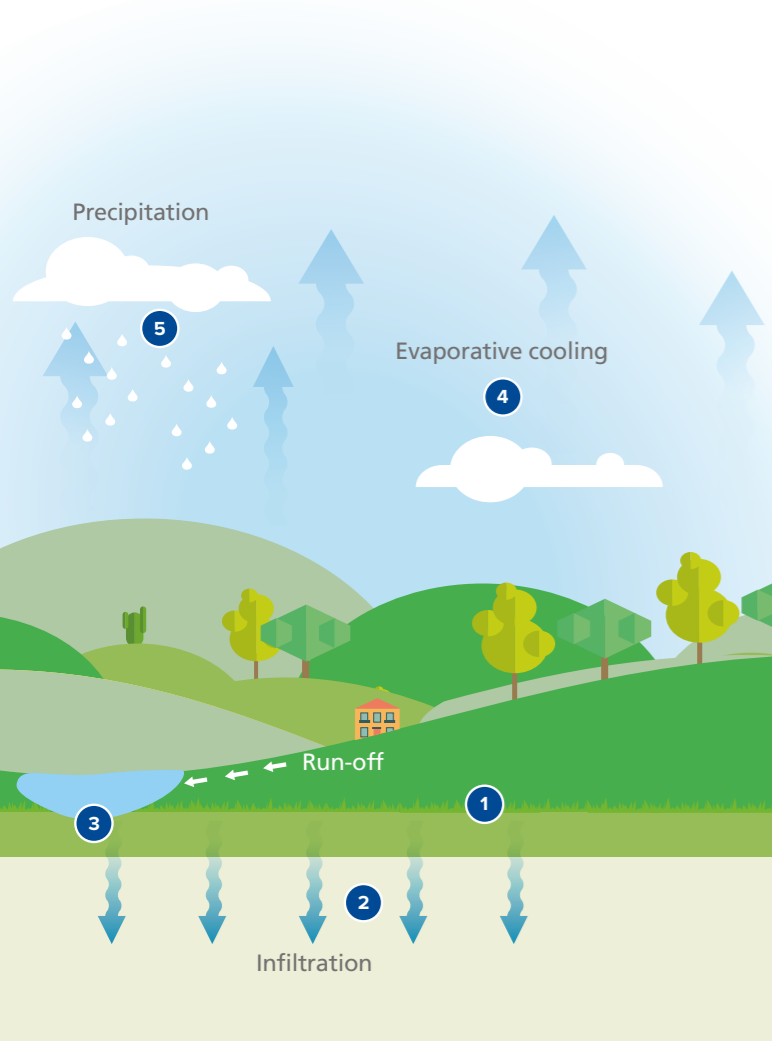
Helping you hit the mark

Our in-house research and development facility is one of the most advanced of its kind and includes our UKAS accredited Laboratory. This gives us the knowledge and expertise to produce the most advanced range of water management products and solutions that comply with the very latest regulations and standards – whilst delivering optimum performance and exceptional value.

Setting the scene

Water management solutions within urban landscapes are imperative if a natural water cycle is to be retained. As the illustration shows, rainwater within the natural landscape is allowed to run-off into ponds and filtrate naturally into the soil.

The vegetation and trees then use the water to cool the air through evaporative cooling to create a natural water cycle. Installing water management solutions into our cities shows how we can help mitigate some of the challenges of climate change and urbanisation.



Natural landscape

- 1 Rain intercepted via grass and soil
- 2 Soil quality retained through infiltration
- 3 Run-off captured and naturally controlled via ponds and wetlands
- 4 Evaporative cooling achieved through vegetation and tree leaves
- 5 Oxygen released and cooler air condenses causing precipitation

Urban landscape

- 1 Rain trapped on hard surfaces causing large quantities of poor-quality run-off
- 2 Large amounts of rainwater intercepted via sewers – adding strain and flooding
- 3 Flooding on roads and other hard surfaces
- 4 Reduced infiltration creating poor soil quality
- 5 Significantly suppressed evaporative cooling leading to poor precipitation
- 6 Trapped and stored heat within concrete causing urban heat island effect

Sustainable landscape

- 1 Rain captured at source via roof gardens, geocellular tanks and ponds
- 2 Large amounts of rainwater intercepted via permeable pavements, gulleys and filter strips allowing filtration into the soil below or into geocellular tanks
- 3 Geomembrane used to treat and remove oil and road contaminants
- 4 Sewers relieved of over-saturation with ponds discharging into soil below and geocellular units
- 5 Evaporative cooling achieved through Capillary Cones drawing water from geocellular units to irrigate vegetation and trees above
- 6 Urban heat island effect reduced through shading from trees and evaporative cooling
- 7 Soil quality retained through infiltration
- 8 Run-off captured, stored and reused for non-potable purposes
- 9 Evaporative cooling achieved to create precipitation



Making the connection with Water Management Solutions

Without water management systems in place – capturing water at source, controlling it and reusing it – rainwater run-off would simply drain into sewers, travel beneath the roadway and continue to the river and waterways – bringing with it contaminants and oils from the road surfaces.

This cityscape could quite easily align to that scenario, with its urban concrete construction, hard surfaces, road ways and suburban development. However, aside from its aesthetic appeal; trees, green roofs, rain gardens and so on, it also demonstrates where we are able to add Green Infrastructure – and how it can be achieved simply and effectively.

Whilst drainage for conveyance is still important, making space for water to include Green Infrastructure is key to help towards the resilience of our urban landscapes and the capture and management of stormwater run-off for reuse to create amenity, attract biodiversity and help with sustainability and wellbeing.

Of course, the design of intelligent water management systems can be influenced by the density of the environment. High density city landscapes for example, where space is limited and hard surfaces more prevalent, would benefit from Blue-Green Roofs. Geocellular systems beneath podium decks can create rain gardens at roof level to attract biodiversity and create places for people to meet and relax such as roof-top bars and cafés. Permeable paving at street level can intercept rainwater run-off at source and filter it through to storage units below ground – including car parks.

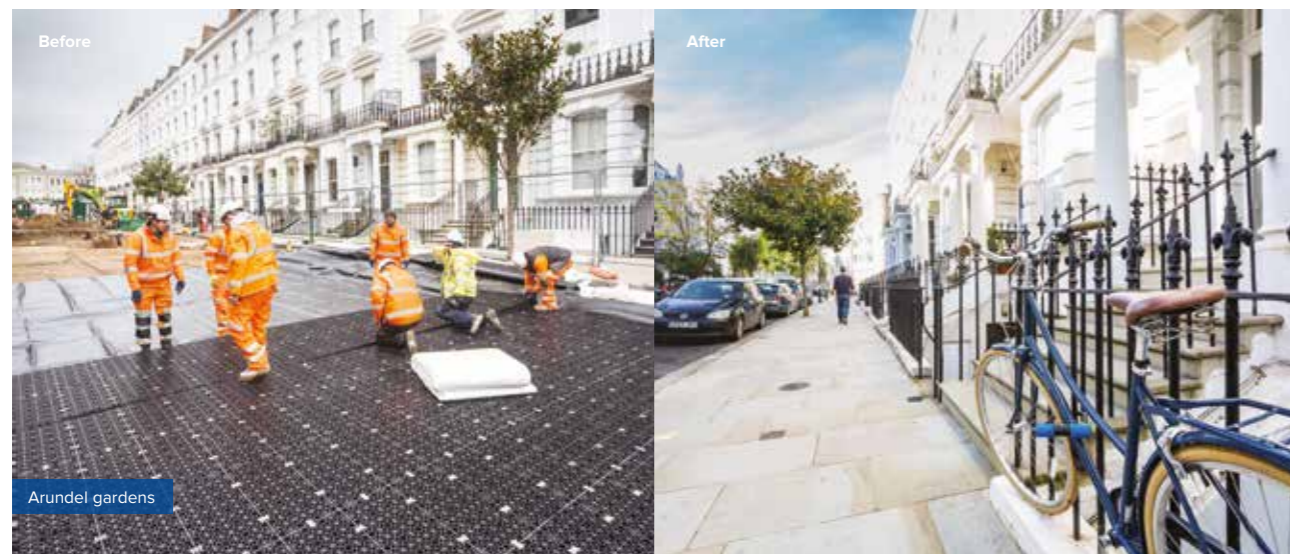
Low density environments such as housing estates and out-of-town shopping centres can also benefit from water management solutions – complementing soft SuDS to help create playgrounds and parks where land would otherwise be unusable.

This is just a small insight to how and where to include Green Infrastructure to make a difference to the resilience of our urban landscapes and the people who live in them. It looks like the future. But it's simply good water management.

To find out how our systems work to help bring Green Infrastructure to urban environments, please go onto our interactive 3D urban landscape where you can take the time to look at all the various solutions with information on how to plan them into your schemes. Just go to www.polypipe.com/greeninfrastructure

Our capability

From retrofit solutions to brand new schemes, we've been busy putting sustainable water management solutions into practice. The following case studies show how careful and considered design can help towards flood mitigation, manage stormwater run-off, treat rainwater and irrigate trees within busy environments. Our engineered SuDS together with soft SuDS have been used to control rainwater at a new residential development – both at source and off-site. By planning in Green Infrastructure at the early stages, we've projects that include vegetation to encourage biodiversity whilst delivering multifunctional benefits, placemaking opportunities and amenity.



Installing a passive irrigation solution whilst controlling rainwater run-off.

To help alleviate the risk of flooding from West London's combined sewer system which has been built over existing river culverts – known as Counter's Creek – Polypipe have designed a combination of engineered and soft SuDS to form the Green Streets Scheme.

Taking in Arundel Gardens, in Kensington, as part of the scheme; and an area of London rich with conservation areas, we retrofitted our Permavoid Geocellular system below the road surface to provide flood alleviation and passive irrigation.

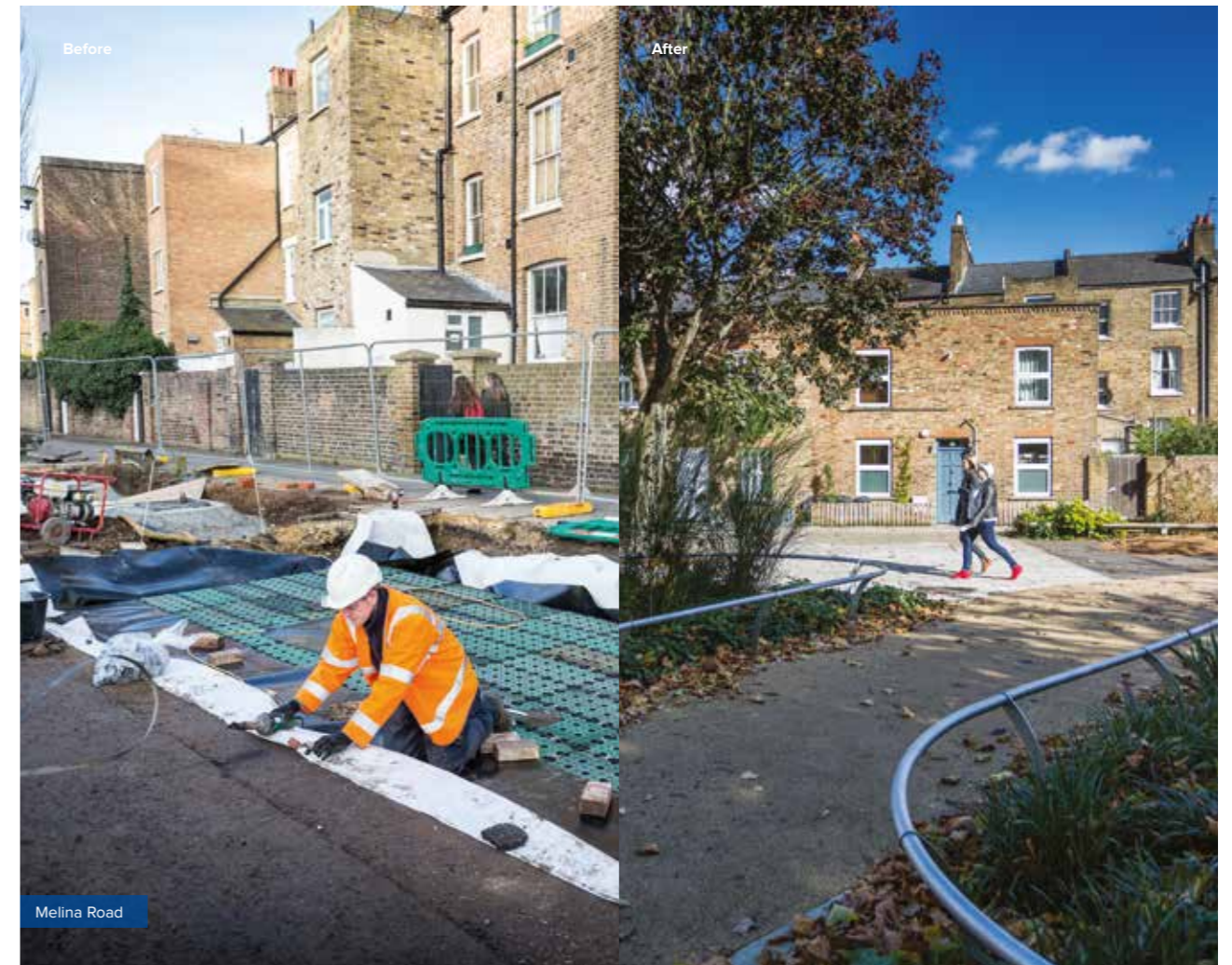
The surface rainwater is captured at source and channelled to the units below the road surface to create an attenuation solution, with the benefit of passive irrigation capability – feeding established magnolia trees lining the road.

During rainfall events, the Permavoid tanks provide storage for large volumes of surface water whilst restricting the flow into the existing sewer system.

And unique Capillary Cones draw water from below to feed the trees above, helping to attract biodiversity, cool the air and help to reduce CO₂.

The geocellular tanks are wrapped in hydrophilic geotextile to further enhance the irrigation properties of the system providing a long-term and efficient multi-functional flood alleviation solution at Arundel Gardens.

Polypipe Permavoid Capillary Cones were used to draw water from the Permavoid tanks through to the ecosystem living above the system, to help maintain soil moisture between 15% and 45% by volume.



The beauty of rain gardens, the innovation of good water management.

As part of the Green Streets Scheme in London, Melina Road in Shepherd's Bush, has embraced Polypipe's Permavoid system – which has helped the residential street capture, store and reuse rainwater to mitigate the risk of flooding.

Using a combination of products that have been designed to complement the Permavoid system – such as Permatex, Permafoam and Permafilter – has allowed the project to introduce and maintain rain gardens – whilst having the ability to filter and treat the water before it enters the vast geocellular tanks beneath.

2,345 Permavoid cells were installed to create four separate storage tanks to sit beneath the new rain gardens. The tanks are able to store 88m³ of rainwater captured at source via permeable paving, whilst each of the tanks feature a top layer of Permafoam – a highly absorbent and water retentive material, providing 31 litres of water storage to upwardly irrigate the rain gardens above.

Each rain garden is also connected to the local sewer network to allow excess water to discharge back into the network at a lower flow rate, managing water at source.

A total of 430 Permafoam cells were installed to cover a combined area of 108m² and provide water supply for vegetation above. This technique mitigates flood risk during storm events, while sustaining plant growth and providing additional green space in the local urban environment.



Stormwater storage with a cleaner outcome.

Just like Arundel Gardens and Melina Road, Mendora Road in Fulham has benefitted from Polypipe's Permavoid system, helping to alleviate flooding by making space for water.

Polypipe Permavoid geocellular units are manufactured and designed to be durable enough to withstand heavy loads, and so the system was ideal for installation beneath permeable paving and beneath the car parking bays on both sides of Mendora Road.

The permeable paving captures rainwater run-off at source, directing it to the units below.

Permafilter, with its hydrophilic properties, intercepts contaminants and oil from the road surface above, whilst allowing for the attenuation of the treated, cleaner stormwater back into the sewer system at a controlled rate.

Thames Water approved the Polypipe Permavoid system for its light-in-weight construction, allowing for a faster, more efficient installation whilst providing an intelligent multifunctional solution to prevent the historical sewers from flooding.

Harnessing Permavoid's 95% void ratio, 3,600 cells form two attenuation tanks providing 136m³ of stormwater storage.



Water management right on track

To help our urban landscapes become more resilient to climate change and subsequent severe weather events, making space for water to capture and control stormwater run-off and reuse it to create Green Infrastructure, should all be part of the design process for any project.

Before 294 homes could be built to create one of London's most prestigious new developments, stormwater run-off problems at the former greyhound track site at Walthamstow Stadium needed addressing as part of the project design. With the Environment Agency stating that there was a requirement to make space for water to reduce 80% of the surface water run-off, Polypipe stepped in to work with the Developer to design a system to meet the criteria. Whilst at the same time – creating a system that also included Green Infrastructure to make places for people to relax and enjoy and attract biodiversity, whilst treating and managing water for reuse. Using our Permavoid Geocellular system, the site captures and stores 1.5 million litres of stormwater via a permeable paving installation – capable of managing a 1-in-100-year storm event. Complemented by Polypipe Permachannel and Permavoid Biomat, surface water run-off is captured, treated and attenuated at a controlled rate.

Beforehand, the original site would simply discharge surface water, unrestricted and directly into the adjacent river, taking with it surface contaminants whilst also contributing to an already high water table.

However, the success of the project doesn't simply lie in achieving the Environment Agency's objectives; making space for water also allowed us to deliver a project that included Green Infrastructure. Providing lush, green gardens for people to look out on, to walk around, sit and relax amongst – and, ultimately, feel good about. Using our Capillary Cones, which are unique to Polypipe Geocellular systems, the stored rainwater is reused to irrigate the gardens and trees above – creating evaporative cooling and cleaning the air whilst saving on potable water.

The result exceeded the original requirement and delivered a project that makes space for water, helps alleviate the strain on sewers and nearby water courses, creates places for people to enjoy and helps to maintain a cleaner, healthier environment.

Using our Permavoid Geocellular system, the site captures and stores 1.5 million litres of stormwater.

Quality people to support your project from start to finish

With our leading-edge design expertise, innovative technology, detailed understanding within our sectors and our own award-winning delivery fleet, we're able to provide the support and service you need to bring whole life value to your projects. We're also best placed to provide systems that are engineered to deliver Blue-Green Infrastructure to improve quality of life for people and the resilience of our urban environments.

Of course we provide your projects with expertly engineered products and systems, but our support goes much deeper. We have expert teams who'll help you at the design stage to ensure you receive the maximum performance and value from your system selection. And with such a wide range of engineered solutions, we can help you design out cost from the start of your project – helping you to plan ahead with confidence.

Through constant innovation and focused research and development, we are the authority on plastic drainage, plumbing and water management systems. We are uniquely positioned to offer solutions that help deal with the pressures placed on urban environments and natural resources in the residential, commercial, civils and infrastructure markets, both within the UK and across the globe.

Our focus on the management and movement of water and air has influenced the development of our range of systems, enabling us to offer products and systems that help to contribute to a safer, healthier, and more sustainable built environment whilst helping to respond to the trends of global warming and increased urbanisation.



Further support to make a difference

To help you get the best from your next project by including Green Infrastructure, we've got the tools to help including a design guide and an interactive website, providing useful information that covers the challenges mentioned here and the solutions in more depth. You can register your details to reserve your copy simply by visiting the website.

Design Guide

You'll find all the information you'll need to design a sustainable project in our new Design Guide – a detailed document that includes technical product information, the multifunctional benefits of including Green Infrastructure and, where possible, Biophilic Design, and the reasons why making space for water is as important now as it's ever been.



Pre-register to reserve your copy at polypipe.com/green-infrastructure

Website

Polypipe has developed a comprehensive range of systems that make space for water, working with soft SuDS and Biophilic Design to create natural drainage systems and helping you to deliver a more sustainable project. Visiting our website will ensure you have all the up-to-date information you need providing an interactive and intuitive experience and includes news, technical and product detail and everything Green Infrastructure, ensuring your project contributes to a more resilient future.



To find out more visit polypipe.com/green-infrastructure



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