



ACO Water Management

SuDS products and applications overview



Introduction to the ACO Group

Throughout the world ACO branded drainage and surface water management systems are recognised for their innovative design, high quality manufacture, environmental excellence and industry leading performance.

Today the ACO Group has a research and production base that reaches across four continents. This unmatched resource pioneers the development of solutions that are tailored to individual applications, meeting the need for high performance, sustainable products that deliver optimum value throughout their operational life.

ACO Technologies plc

ACO operates as ACO Technologies plc in the United Kingdom. Founded over 30 years ago, the company has grown quickly on a reputation for design innovation and customer service.

There are now 2 divisions within ACO Technologies that serve every sector of the construction industry, providing solutions for applications as diverse as rail, highways, airports, landscaping, retail, distribution centres and environmentally sensitive projects.



To help architects, designers and contractors meet the legal requirements that now tightly control the way surface water is managed, ACO has created its unique system chain that combines a 'Surface Water Management Cycle' – Collect, Clean, Hold, Release, with the service support of Train, Design, Support and Care.

These processes enable ACO to offer a combination of product and service expertise necessary for the complete and sustainable management of surface water drainage.



The ACO Group / www.aco.com

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WHAT IS SuDS?

Sustainable drainage systems (SuDS) is a drainage process that tries to mimic the environments natural drainage cycle and can be defined as “a sequence of management practices, control structures and strategies designed to efficiently and sustainably drain surface water, while minimising pollution and managing the impact on water quality of local water bodies.”*

SuDS COMPONENTS

SuDS components consist of landscaped ‘soft’ components and ‘hard’ infrastructure components as a part of the treatment train, in order to infiltrate, attenuate and convey water. ACO is a world leader in the design, development and implementation of ‘hard’ surface water management systems that adhere to the SuDS principal that *“Managing surface water runoff at or close to source helps prevent high rates and volumes of runoff”* (SuDS Manual Page 70/968, 3.2.3.3).

MODELS OF SUSTAINABILITY

This brochure looks at real life SuDS projects where the combination of ‘soft’ and ‘hard’ solutions have been used to meet the 4 pillars of SuDS and then goes on to look at the ACO products that fall into ACO’s own model of products that embrace the entire surface water management cycle, Collect, Clean, Hold and Release, from the point where rain lands, right through to where it re-enters the natural water environment.

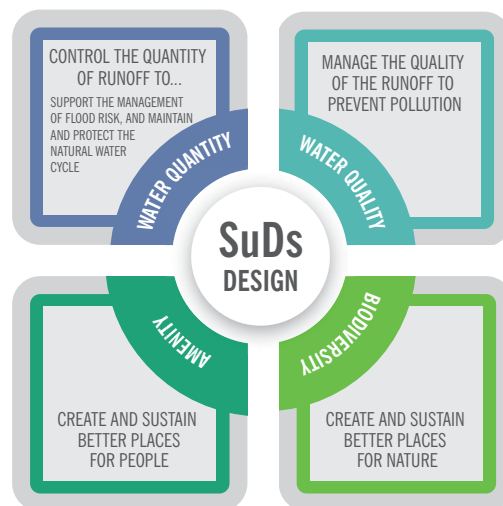
With our channel drainage systems water can be collected at source, conveyed to a SuDS treatment train, while being kept close to the surface, which aids in evapotranspiration. We also examine systems that control water quantity with attenuation tanks and Swale inlets as well as oil separators that can be featured as a part of improving water quantity. Biodiversity and amenity are also addressed with ACO’s range of Wildlife and aesthetic solutions.

TECHNICAL RESOURCES

Implementing SuDS in a full technical process is not part of the scope of this brochure. There are a number of resources for SuDS design and delivery – notably the CIRIA C753 SuDS Manual and the ‘SuDS route map’ ACO has produced working with ICE, which draws together relevant resources into one single place and signposts relevant resources.

For more on this go to [www.aco.co.uk/sustainable-drainage-systems-\(suds\)](http://www.aco.co.uk/sustainable-drainage-systems-(suds))

SuDS 4 PILLARS



ACO SUSTAINABILITY MODEL



ACO’s sustainability model, Collect, Clean, Hold and Release, embraces the entire surface water management cycle, from the point where rain lands, right through to where it re-enters the natural water environment.

A12 Norfolk with ACO KerbDrain®
feeding into ACO SuDS Swale inlets



THE IMPORTANCE OF SuDS

There are a number of key factors that have increased the demand for SuDS. First is urbanisation. The UK has seen both a dramatic increase in impermeable surfaces being created and a reduction in key wetland areas. 1% of land use changed over a recent 6 year period. If this land had all been made impermeable, it would be roughly equivalent to 2.5 days of water consumption for the whole population.*

Secondly population growth is providing a major challenge for UK infrastructure, with latest projections forecasting an increase of 3.6 million from 2016-2026**

Thirdly water inundation means that in 2016 about 16,000 houses in England were flooded during the wettest December in a century and The Environment Agency estimates that around three million people are at risk of surface water flooding in England and Wales.

Climate change means that The Environment Agency has upgraded its mitigation guidance from +30% to +40% for the 1 in 100 year design criteria.

Water supply issues mean that England, Scotland and Wales are projected to be in deficit by 800 million to 3 billion litres per day by 2050, which works out at 5–16% of total demand.

THE LEGAL EFFECT

One of the results of this has been a catalyst for the introduction of legislation and non-statutory technical standards governing surface water management – most notably the Flood and Water Management Act for England and Wales, and the Flood Risk Management and Water Environment and Water Services Acts for Scotland. These policies have changed the way in which organisations manage surface run-off from both new and re-development sites, creating new approval procedures, legal requirements and industry standards.

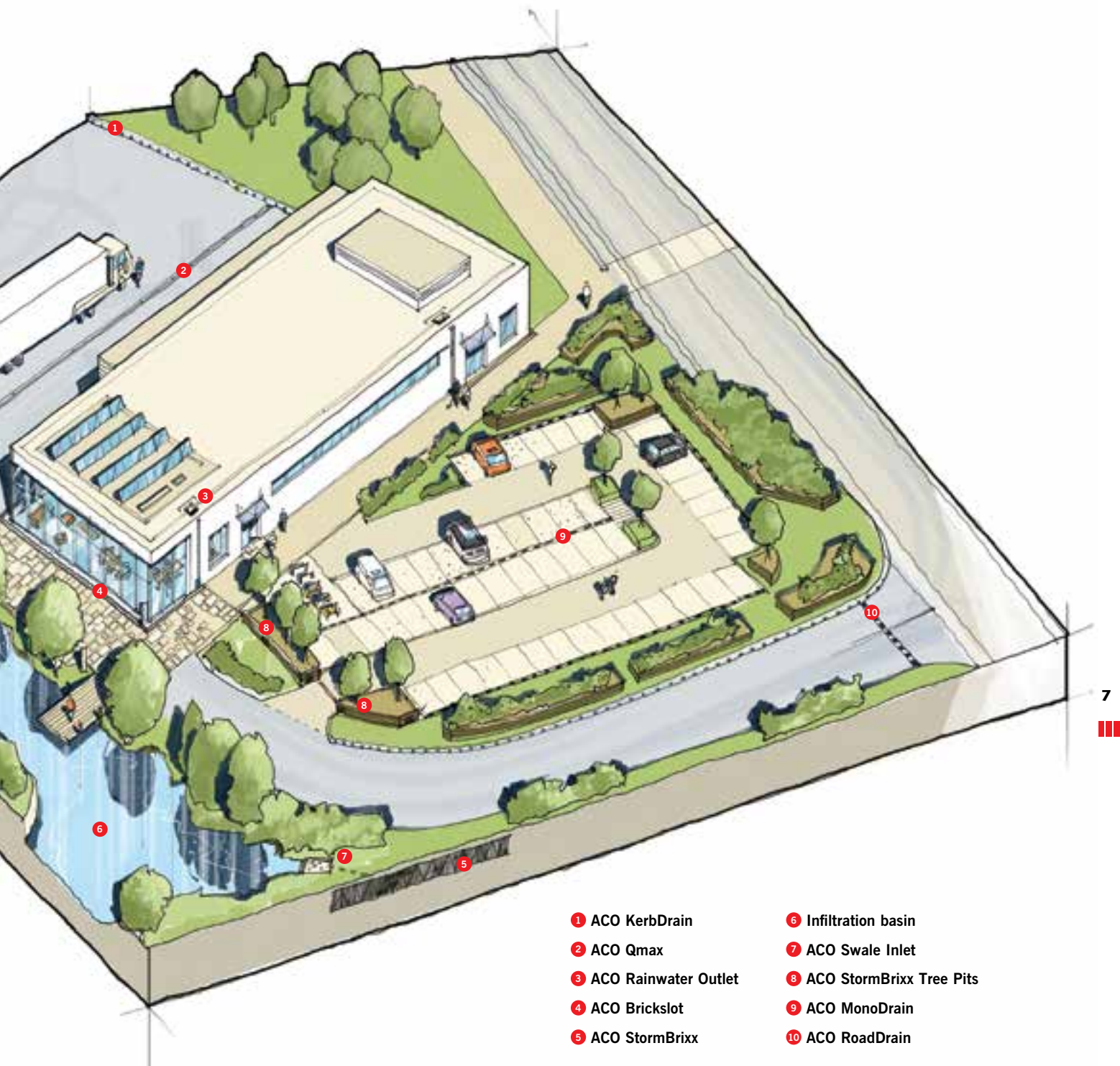
Across most new developments in England, Scotland, Wales and Northern Ireland it is required that SuDS is considered as part of proposed surface water management measures but the delivery mechanisms these vary substantially between nations. To find out more go to page 3 of the ICE ACO SuDS Route Map***



*The Coordination of Information on the Environment (CORINE) land-use change map details that 2,500 sq km of land was altered in a six-year period between 2006 -2012. If this land has all been made impermeable, the runoff caused by 10mm of rainfall is roughly equivalent to 2.5 days' worth of water consumption for the whole population (150 litres/day/person x 60 million).

**<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections>

***<https://www.ice.org.uk/getattachment/knowledge-and-resources/best-practice/sustainable-drainage-systems/ICE-SuDS-Route-Map-Booklet-Feb2018.pdf.aspx>



THE CHALLENGES WITH SuDS

A recent survey conducted by ACO revealed that 68% of construction professionals felt there was a lack of understanding of SuDS among key decision-makers. What's more, over 50% of SuDS experts recognised that "site constraints" posed a real difficulty in design and construction.

SuDS need to demonstrate three core attributes: economic viability, resilience and sustainability.

ECONOMIC VIABILITY

"Where SuDS are designed to make efficient use of the space available, they can often cost less to implement than underground piped systems. High quality SuDS designs that are integrated into the overall design of the development can attract tourism and investment, driving economic growth for the local area." (SuDS manual Page 36/968)

Combining soft and hard systems is a good way of making an economically viable system, as channel systems can be used to convey water where it falls to a vegetated system further away. This can save on space and provides a more practical solution where vegetated systems are not possible due to traffic for example.

RESILIENCE

Resilience in SuDS means expecting the unexpected, accepting that failure is inevitable, because of the nature of storms and the increasing frequency of large storm events. What matters is that a scheme "fails gracefully", not catastrophically, and the system is able to recover.

Systems such as Telford where a landscaped depression combines with an ACO StormBrixx geocellular attenuation tank to provide temporary ponding helps meet resilience demands for in a 1:100 year storm event. See pages 13-14 for the full details.

SUSTAINABILITY

Sustainability is about our balance with natural systems and rests on the 4 pillars of SuDS according to the CIRIA SuDS Manual (C753) It also means maintainability and all systems used should be built to last.

ACO's channel systems come with easily accessible silt and sump units allowing easy maintenance whereas some soft Suds elements can be subject to compaction, pollution, erosion, silt or sedimentation during the construction process and through the life-cycle. For example permeable paving requires regular maintenance to reduce the tendency of the top 15-25mm of the voids becoming obstructed and often requires complete replacement if a catastrophic spillage occurs.





CASE STUDY

ASDA LEICESTER

The collaborative work between Leicester City Council, Asda, ISG and ACO Water Management produced an integrated drainage solution that combines proprietary and vegetative systems to achieve effective surface water management, whilst introducing an increased level of biodiversity to the retail development. Water quality is improved through filtration, biodegradation, separation and exposure to sunlight and stormwater is successfully managed on or near the surface, in an area that would have typically been highly impermeable.



Working to strict planning guidelines that required two swale inlets to be incorporated onto the site, Asda's site feasibility team and ACO worked closely with ISG and the council's Landscape Architect, Chryse Tinsley, who is now the National SuDS champion, to move away from a more common permeable paving solution to achieve a cost effective, near to surface solution that required minimal ground works.

COLLECTING TREATMENT TRAIN

ACO Qmax, a high capacity slot drainage system was installed over an approximate 90m length in the car parking area, serving a catchment of over 4000m². A bespoke filter device was installed in the Qmax[®] outlet chambers, designed to filter particulates over 0.5mm; and polystyrene filled sacks were put in the gullies, providing adsorbent properties to which particulates bind.

CLEAN

The site's petrol filling station is drained via a conventional oil separator and to further treat the potentially high pollution load, a high performance surface water treatment plant was installed. The ACO Quadrceptor system (see pages 20-22 for more on ACO Quadrceptor) effectively removes the majority of sediments including smaller fractions of less than 100µm, and also treats dissolved metals such as copper and zinc. The system uses proprietary filters to remove and contain pollutants providing a point source for maintenance.



RELEASE

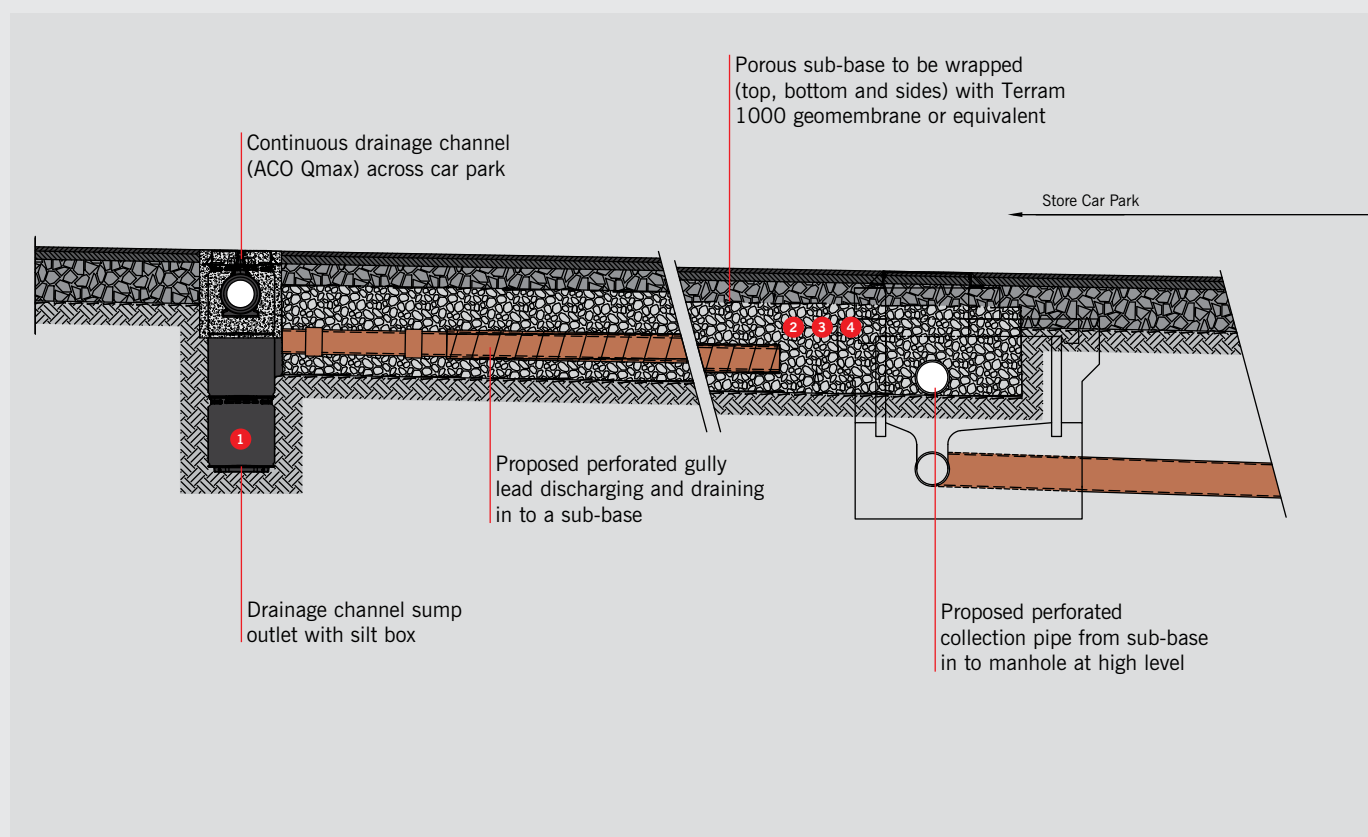
An ACO SuDS Swale Inlet unit links the proprietary conveyance drainage systems to the swale and serves to reduce erosion with its flared outlet that disperse water and reduces excessive flow velocities.

The planting regime in the swale area has provided opportunities for wildlife and biodiversity. For nearby domestic premises the trees, plants and water also provide a natural dividing line – quelling noise, whilst also providing a natural visual buffer.

CASE STUDY

ASDA LEICESTER

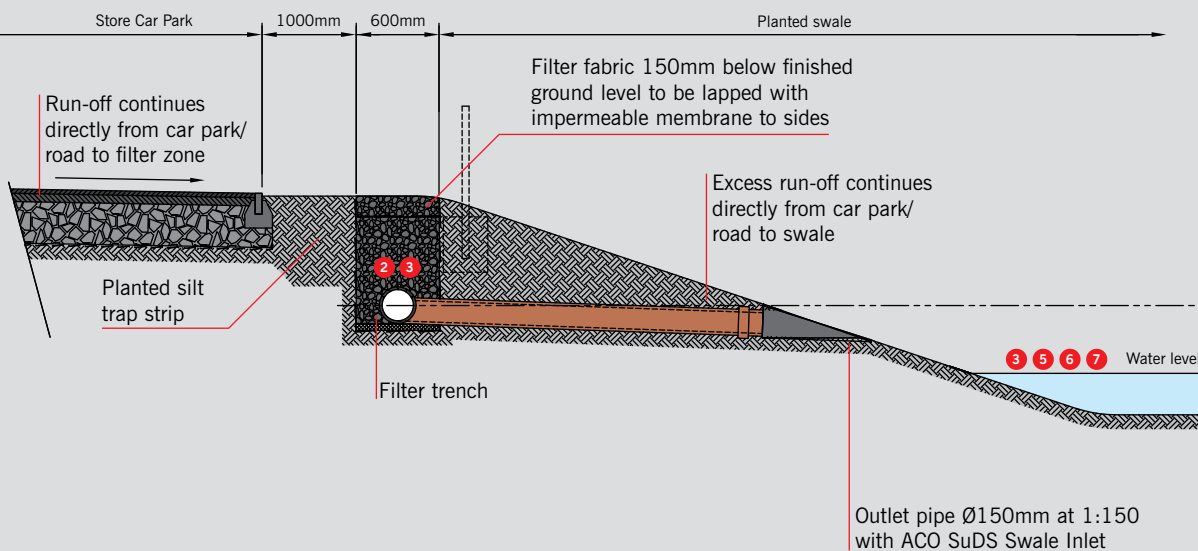
At the heart of Asda Leicester lay the SuDS treatment train, defined as a “sequence of components that collectively provide the necessary processes to control the frequency of runoff, the low rates and the volumes of runoff, and to reduce concentrations of contaminants to acceptable levels” (page 55/968 SuDS Manual).



The levels of treatment required in a water management train vary depending on the load and particular site circumstances. At Asda Leicester the finished system allows surface run-off through three treatment components en-route to an eventual outfall, as required by the Planning Authority.

Firstly a maintainable mesh filter was installed in the ACO Qmax® slot drainage system (see pages 18-19 for more on ACO Qmax) then water flows through a perforated pipe through a gravel sub-base. Finally it flows into a swale with vegetated cleaning via an ACO Swale Inlet (see pages 24-25 for more on the ACO Swale Inlet).

ASDA LEICESTER SuDS TREATMENT TRAIN



KEY

- | | | |
|--|---|--|
| <p>1 SuDS Policy Objective 1
Mechanical filtration (cleanable silt filter) between run-off (channel) collection and water exiting</p> <p>2 SuDS Policy Objective 2
Stone filtration and anaerobic treatment between run-off (channel) collection and water exiting</p> | <p>3 SuDS Policy Objective 3
Natural attenuation</p> <p>4 SuDS Policy Objective 4
Wetted void volume contribution to interception of 1st 5mm of rainfall, ie. not entering drainage systems</p> <p>5 SuDS Policy Objective 5
Filtration via swale planting and anaerobic treatment</p> | <p>6 SuDS Policy Objective 6
Habitat creation zone (invertebrate, mammal and bird)</p> <p>7 SuDS Policy Objective 7
Evapotranspiration (natural and due to planting) and contribution to interception of first 5mm of rainfall (ie. not entering drainage systems)</p> |
|--|---|--|

CASE STUDY

TELFORD ATTENUATION

At Telford Co-Operative Academy a design for exceedance scheme was created, utilising a landscaped depression that provided temporary ponding on the surface, combining with ACO StormBrixx geocellular attenuation tanks. The result was a system that could manage a 1:100 year rainfall event, including an uplift of 30%, to account for climate change and equating to around 1000m³ of surface water.



At Telford the site sat on clay, meaning that topsoil infiltration into the ground naturally was not possible. Additionally connecting to the highway surface water sewer would have meant exceedance of the discharge limit of 5 l/s due to a substantial drop of 3m at 200m from the receiving sewer. And finally adjacent contaminated land meant deep excavation was undesirable.

A combination of SuDS 'soft' and 'hard' engineering proved to be the solution. Utilising spoil from the construction of the academy, a landscaped depression was combined with ACO StormBrixx attenuation tanks acting as the main attenuation system. The depression enabled the team to reduce the underground storage to just 175m³ of StormBrixx, meeting a design storm return period of the two elements of 1:100, whilst avoiding the need for deep drilling.

A concrete man-access chamber means that long term viability for the SuDS system is assured with easy access for inspections and maintenance. Furthermore the landscaped depression is used a football pitch under normal circumstances, providing additional amenity for the local community.



Design Storm Return Periods

- 1:30
- 1:100



CASE STUDY

NORFOLK A12 BYPASS

The A12 bypass around Great Yarmouth not only deals with the chronic congestion at the gateway to Great Yarmouth but provides a SuDS scheme that drains water into parallel swales on either side of the carriageway via ACO KerbDrain® and ACO SuDS Swale Inlets.



Mott MacDonald proposed a design to Norfolk Country Council that saw ACO KerbDrain® units, a combined drainage and kerb system, line the A12, collecting the surface water and then linking directly to ACO SuDS Swale Inlets and into a gravel lined swale. This simple treatment train was possible because the area was within a low-risk flood zone and did not affect any major watercourses.

The ACO SuDS Swale Inlets had outfalls at 10m centres along the road, and the surface finish and flared outlet of the swale inlets encouraged water dispersion and reduced excessive flow velocities into the swales. This protected the surrounding environment from erosion as well as meeting the flow rate guidance in CIRIA C697.

The gravel top lined swales slowed the infiltration rate further, and combined with the vegetation, trapped organic and mineral particles that were then incorporated into the soil.





To find out more
about ACO products
go to www.aco.co.uk

Surface water channel systems offer perhaps the most efficient way of collecting and conveying water close to the surface and close to the point of source, allowing evaporation to occur. They can be integrated easily into urban environments, designed to collect a large volume of surface water runoff, whilst being safe for pedestrian and vehicle traffic with a covered inlet. While primarily being a conveyance system to vegetated systems the use of silt buckets and sumps introduce cleaning elements that mitigate water quality issues.

COLLECT



ACO Qmax

ACO have a wide range of channel drainage products that can be used as part of SuDS.

Grated channel systems include **ACO MultiDrain® MD** which is the top selling ACO Surface channel drainage product. It is the perfect urban all-rounder with a wide range of channel depths to manage water close to the surface.

ACO S Range is a heavy-duty grated channel drainage system. With good accessibility and F900 Load class strength it is often specified in petrol station forecourts linked in with oil separators. The collected and cleaned water can then be used to fulfil SuDS schemes as it can then be safely discharged into retention ponds or swales.

Monocast systems include **ACO MonoDrain™** and **ACO RoadDrain®** which have D400 load class and F900 load class respectively, the latter fully compliant with national highways and transport agencies (UK) and National Roads Authority (ROI) requirements for motorway and major trunk roads.

Combined Kerb **ACO KerbDrain®** has been used extensively in SuDS projects such as the A12 previously mentioned as well as A612 Burton Joyce where the Council retrofitted a sustainable drainage solution based on water flowing to soakaways located under the grass verges behind the kerb line on each side of the road.

High capacity slot drainage, **ACO Qmax®**, can also attenuate in stormwater conditions, as well as convey water.

Servisni Centar - Croatia
ACO H Range monocast channel drainage



To find out more
about ACO products
go to www.aco.co.uk

The Simple Index Approach (SIA) is the basis for assessing the water quality requirements, and to determine if the proposed treatment train is sufficient to manage each pollutants category (total suspended solids, metals and hydrocarbons). Proprietary treatment systems, such as hydro dynamic separators, can form part of this treatment train to ensure water is cleaned before entering final SuDS components or the water environment.

CLEAN



ACO Quadraceptor



ACO Q-ceptors

ACO Q-ceptor is a hydrocarbon bypass separator. It can treat polluted surface water to performance Class 1 of the Environment Agency's PPG guidelines, (less than 5mg/ litre of oil under standard test conditions), manage silt deposition and be used as part of The Simple Index Approach (SIA) in a SuDS treatment train.

ACO QuadraCeptor is a specialist rainwater and surface water runoff filtration system for the removal of suspended solids, hydrocarbon and heavy metals before infiltration into the soil or discharge into nearby water courses. The system has been designed to remove, in a four stage process, heavy particles, silt, nutrients and dissolved materials, such as heavy metals, from the surface water as part of The Simple Index Approach (SIA) in a SuDS treatment train.

ACO Q-Cepto[®] can be used to clean collected surface water in petrol forecourts before entering final SuDS elements





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about ACO products
go to www.aco.co.uk

The hierarchy of discharge from the SuDS manual prioritises infiltration as the first area where surface water runoff should be discharged, therefore systems that hold and infiltrate water are a vital component in a SuDS scheme. (SuDS Manual Page 69/968 3.2.3.1)

HOLD

ATTENUATION/SOAKAWAY

The use of ACO StormBrixx modular geocellular stormwater management system as a soakaway fulfils the first priority of the discharge hierarchy, with a high void ratio and its storage ability increased surface water volume control. Available in SD (standard duty) and HD (heavy duty) models both have a number of configurations for attenuation and infiltration needs, including soakaway and draindown for adaption to the SuDS specific conditions.

For long term sustainability the whole system, including all the extremities can be inspected and maintained from just a few access points thanks to the open cell structure. StormBrixx HD has additional man access units for the more comprehensive maintenance requirements of Local Authorities and Water Companies.

TREE PITS

In the Rushden Lakes retail project a different use for the modular ACO StormBrixx was found; for use as Tree pits. While primarily being designed for attenuation and infiltration the flexible, high porosity and high strength crates were used by the Landscape Architects to help prevent oxygen-starving soil compaction and root damage to the paved areas, whilst still being strong enough to deal with the vertical loads from site traffic above.

Tree pits are also a biofilter and listed as such in the SuDS manual C753. They treat the water but also offer additional storage due to the void in un-compacted soil.

To see the full case study on Rushden Lakes go to www.aco.co.uk/case-studies



Rushden Lakes ACO StormBrixx used as tree pits

ACO StormBrixx being installed
in the Llyn Peninsula, Wales





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Release is the control of flow to greenfield rates
“The drainage system should be designed so that the peak runoff rates for extreme rainfall events (normally specified as a 1:100 year event) are constrained to the greenfield rates of runoff for the same event” (SuDS Manual page 46 3.3.2)

RELEASE



ACO Q-Brake Vortex

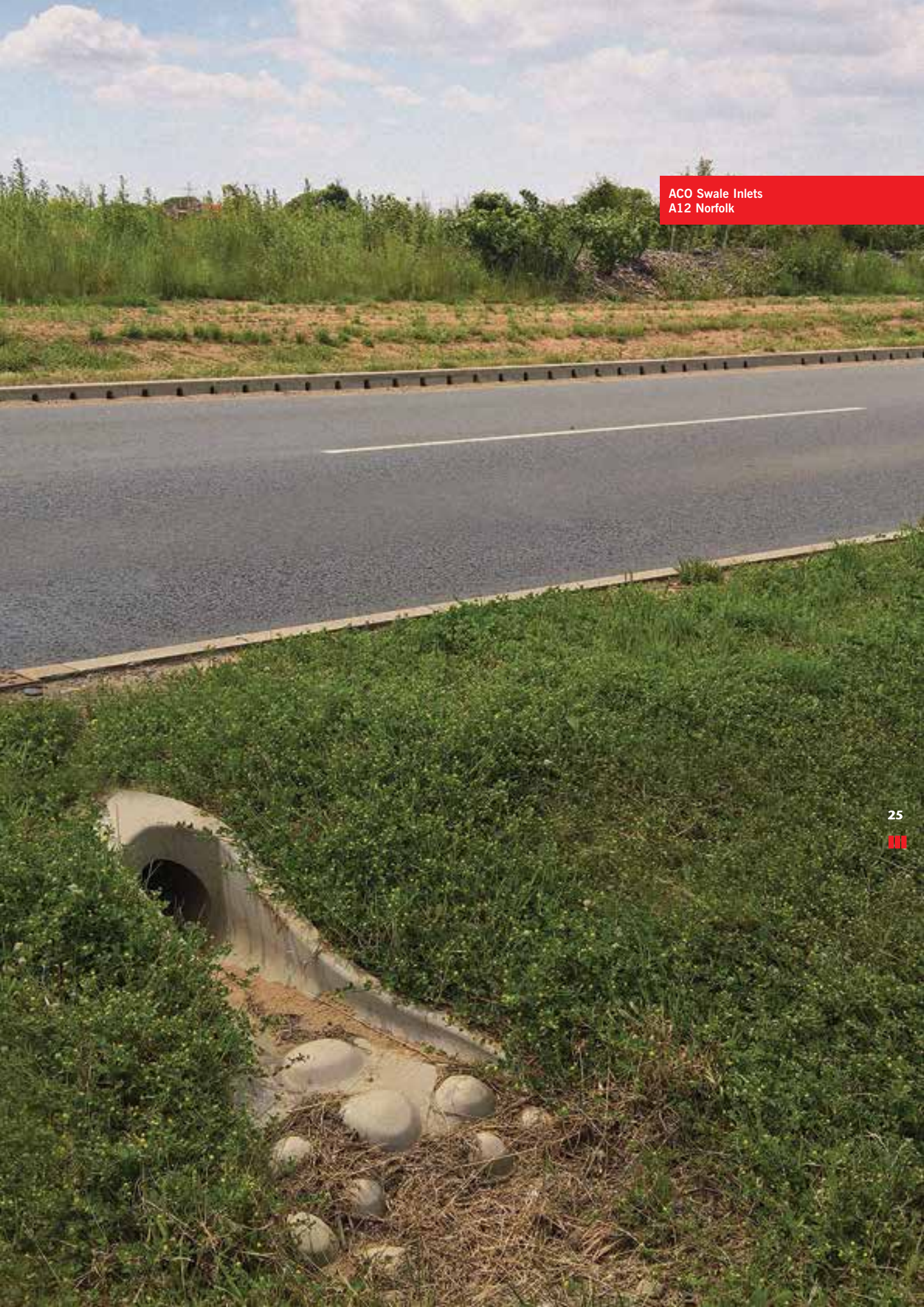
For SuDS sites, where the flow rates are higher, vortex flow controls are needed, which can be sized to match the previous greenfield runoff rate. **ACO Q-Brake Vortex** is a horizontal vortex flow control designed to prevent downstream flooding by controlling the release of storm water before it discharges into a SuDS scheme. Designed to regulate storm water flows from 2 -100 litres per second, it addresses planning and connection requirement of Floods and Water Management Act.

ACO Q-Plate is designed to regulate storm water flows in projects where a vortex flow control is not the most effective solution, or where flows are greater than 100l/s. The Q-plate has no limitations on design flow. Remote access to the system can be provided by the optional bypass door and the emergency drain facility - simplifying access and removing the need for direct man access to sewer manholes.

The **ACO SuDS Swale Inlet** unit links proprietary conveyance drainage systems to vegetated infiltration features such as swales, basins, ponds and water courses. The surface finish and the flared outlet of the unit encourages water dispersion and reduces excessive flow velocities.

In comparison to traditional in-situ structures and concrete headwalls, the low profile unit provides a natural looking interface between proprietary and vegetated drainage solutions, complementing the surrounding environment.

The consistent product appearance makes the product ideal for phased or retrofit installation, and the 1 in 3 gradient profile can be used to help construct swales to satisfy the CIRIA C697 guidance (Design Criteria for Swales).



ACO Swale Inlets
A12 Norfolk

BIODIVERSITY

Biodiversity creates and sustains better places for nature. Increased use of SuDS components enable clean and well managed water that nourishes wildlife and plants. There is an opportunity for wildlife to flourish, increasing diversity of species and plant types.



ACO Guide Walls and ACO Climate Tunnels are animal guidance systems that protect species, and amphibians in particular, from obstructions created by construction projects. These can impede seasonal migration from animal habitats to their vital spawning grounds and enables the safe movement of wildlife through urban environments.

ACO Guide Walls provide a firm, consistent floor area clear of vegetation that amphibians can travel along without restriction. The ACO Climate Tunnel System safely guides small animals underneath the road and ACO Wildlife Kerbs allow amphibians to follow the recess in the front of the kerb and not fall through the gully grating.

ACO Wildlife Refuges are another option designed to shelter different types of small mammals and amphibians. These include nest boxes or bat boxes that can be built in to new walls during construction or fitted to old walls retrospectively.



STAFFORDSHIRE WILDLIFE TUNNEL

When Staffordshire County Council began the development of a new £10m business park, the last thing it expected to find was a population of one of Europe's protected amphibious species. However, during the development stage it emerged that a small part of the proposed site was home to a population of Great Crested Newts, a species which— along with their eggs, breeding sites and resting places – is protected under law.

Newt populations are dependent on the ability to travel between closely located ponds, linked by a suitable land habitat. Government guidance outlines that any building work which disconnects or isolates habitats by splitting them can cause great harm to Great Crested Newt populations.

In order to deliver a system that balanced the needs of the amphibians with the functionality of necessary road access to site, Staffordshire County Council installed ACO's Climate Tunnel system. This is an enclosed series of polymer concrete tunnels which can be installed to sit flush with the road surface, to allow amphibians' safe passage across potential 'risk' areas, such as roads and footpaths. The solution successfully protected the biodiversity of the site.

To find out more about wildlife solutions and case studies go to www.aco.co.uk/wildlife

FURTHER LEARNING

DESIGN SUPPORT SERVICES

Surface water management system design can often be a complex task. Success in combining products and processes requires a thorough understanding of how these different elements work together.

The ACO Design Services Team is able to work closely with you through the entire design process to ensure accurate and cost-effective product selection is made.

Services we offer include (free and without obligation):

- Whole system design, from collection to the attenuation of surface water
- Hydraulic calculations and AutoCAD detailing
- Parts schedules

Try Our Free Hydraulic Design Software

Our unique hydraulic design software enables the efficient and accurate hydraulic design of surface water management schemes using channels as means of conveyance. Here are some of the features it includes:

- Powerful project-based software
- Create catchment models that are fully editable
- Cloud based – All designs are stored on our server
- PDF summary document output

www.aco.co.uk/quad-hydraulic-design-2.0



ACO PROFESSIONAL DEVELOPMENT

ACO has recognised that knowledge transfer is fundamental in keeping up-to-date with the latest advancements in surface water management and has a unique training offer that can be accessed online, in-house or at the state-of-art training facility at the ACO Water Management Academy.

IN COMPANY



ACO offer face-to-face professional development sessions. These are carefully designed to last up to 1 hour, so they can be undertaken across a lunch break.

A member of our team will contact you directly to discuss your requirements and will tailor the session to meet your needs.

WEBINARS



ACO have developed a series of webinars that will keep you up to date with surface water management trends, bringing you technical expertise as well as more specific product information. Whatever your involvement from specification to installation, there will be a webinar to meet your needs and further your learning.

ACO ACADEMY DAYS



ACO's training facility at our UK head office in Bedfordshire has a theatre-style facility that can hold up to 50 people for large groups and a number of breakout rooms for small groups.

Professional Development training can be combined with more in-depth product training at the on-site learning zone.

SEMINARS



ACO is bringing the experts to you with our programme of regional events, sharing information from key influencers within the industry as well as more specific product information. ACO's seminar events will include brilliant opportunities to enhance existing knowledge as well as network and discuss thoughts and ideas with other delegates.





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- ▶ Climate change means that The Environment Agency has upgraded its mitigation guidance from +30% to +40% for the 1 in 100 year design criteria.
- ▶ Water supply issues mean that England, Scotland and Wales are projected to be in deficit by 800 million to 3 billion litres per day by 2050, which works out at 5–16% of total demand.

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ACO Technologies plc

- ACO Water Management
Civils + Infrastructure
Building + Landscape
- ACO Building Drainage
- ACO Sport
- ACO Wildlife

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ACO. creating the future of drainage

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