

The background image shows a modern building with a green roof. The building has multiple levels with large glass windows and black metal railings. The green roof is covered in lush green grass and small yellow flowers. A large, semi-transparent blue circle is overlaid on the right side of the image. In the foreground, a paved walkway is visible with two people walking. There are also some green plants in the bottom left corner.

SuDS 2022: next steps for sustainable drainage systems

wavin

Introduction

Sustainable drainage systems (SuDS) are both a practical part of urban planning and an aspiration for a greener approach to construction and living. They're designed to manage the flood and pollution risks resulting from urban runoff and to contribute wherever possible to environmental enhancement and place making.

To achieve this effectively, engineers, landscape architects, urban designers, local authorities, water companies and developers need to work together to get the best out of every site, in terms of water quantity, water quality, amenity and biodiversity benefits. Early engagement is crucial to a cost-effective solution, underlining the importance of embedding SuDS into site planning from the start. This early engagement can also help settle the issue of ongoing maintenance responsibilities, making sure SuDS schemes are adopted by whatever body, or combination of bodies, is best placed to manage them.

“To manage surface water, all the relevant authorities and contractors have to work in partnership - you cannot work in isolation.”

Ian Titherington, Lead Officer, City of Cardiff Council

Today, SuDS is moving into a new, exciting phase of development. Recent shifts in government approach, environmental and cost factors, as well as societal expectations, have prepared the ground for change.

Already, use cases for fresh SuDS approaches are up and running, giving insight into what the future will look like. But this growth in SuDS is currently outpacing the pool of experts available to support the projects, creating a skills gap and this makes it all the more important that, as an industry, we share expertise freely and widely.

As a result, in this whitepaper we will:

- explore how SuDS have reached this tipping point
- examine the specific shifts that are prompting change
- evaluate the future of SuDS, based on use cases.

“We need to keep the momentum of SuDS going. We want to be actively involved in this conversation and align ourselves with the future of SuDS – blue green infrastructure that will be delivered and managed in a holistic way.”

Martin Lambley, Product Manager, Wavin




“The construction and water industries are beginning to realise that SuDS can not only help manage local flood risk and deliver greater resilience, but can also deliver multiple benefits that improve the quality of our places and spaces. They see that SuDS also deliver on a number of other policy drivers like reducing carbon, and improving the health of our rivers and local communities.”

Paul Shaffer, Director of Innovation and Delivery, CIWEM

SuDS in brief

What are SuDS?

In essence, an effective SuDS solution enables a developed site to handle rainfall and surface water runoff as it would have done as a greenfield site. SuDS are designed to mimic natural drainage by managing surface water runoff as close to source and surface as possible, creating opportunities for runoff to naturally soak into the ground (infiltration), to evaporate from surface water and to provide transpiration from vegetation (evapo-transpiration).



“Well planned SuDs with effective stakeholder collaboration and the engagement of communities can overcome challenges and deliver other opportunities.”

Paul Shaffer, Director of Innovation and Delivery, CIWEM

A complex operating environment

Water management solutions, like SuDS, can operate in a complex environment where competing factors can pull decision-making in different directions. [Pioneering research by the EU](#) identified key challenges that can complicate responses:

- **Climate change**
Bringing increased intensity of rainfall and localised flooding, plus an increase in wider flooding events
- **Changes in public priorities**
In times of economic hardship, the focus can shift away from investing in environmental priorities. Alternatively, a sustainability drive can influence spending towards environmental projects
- **Intensifying urbanisation**
High density living leads to a loss of greenspace and natural water management capabilities
- **Governance and policies**
New institutional frameworks and legislation, plus changes in political direction, can make longer-term planning difficult
- **Increasing complexity in the operating environment**
As dependencies on IT systems and interlinkages between the water, energy and transport sectors grow, water management gets more difficult
- **Deterioration of infrastructure systems**
A lack of investment and ageing systems can increase pipe breakages, leading to increased water losses and wastewater leakage

Today, the stand out factors influencing SuDS development are urbanisation and climate change.

As the urban population keeps growing, so too does the importance of urban water management. [It's predicted that the urban population will be about 60% of the total global population by 2030.](#)

An environment with little natural green space, combined with the rise of intense rainfall incidents, makes SuDS critical in controlling surface water quantity and water quality to mitigate flooding and the risk of pollution.

“When you get it right, it's brilliant. It works better than people realise. But design has to be right for the location and the installation has to be absolutely spot on.”

Ian Titherington,
Lead Officer, City of Cardiff Council

What makes an outstanding SuDS solution?

Although there are a variety of solutions available, a robust SuDS programme will always reflect the four pillars of SuDS:

1. Managing water quantity

This is all about the volume and flow rate of surface water runoff, and using attenuation to reduce the rate of runoff to that of an equivalent greenfield site. Restricting the flow of surface water and slowing its movement to the next stage of the system tackles the impact of everyday rainfall and high-intensity storms.

2. Managing water quality

Surface water comes into contact with a variety of pollutants, particularly from roads and the vehicles that run on them. SuDS work to remove pollution from entering the natural environment and to improve the quality of water entering combined sewers.

3. Creating amenity

An effective SuDS project will improve the quality, character or overall enjoyment of an area. This could include, for example, providing green places within an urban environment, improving the air quality, or enhancing a streetscape.

4. Creating a habitat for biodiversity

Increasing urbanisation has disrupted natural wildlife habitats and ecosystems. SuDS can seek to replicate what would have existed in a greenfield site, benefiting water quality and urban wildlife.

A wide range of sustainable options

As SuDS gains momentum, the ways to achieve these four pillars are expanding, with SuDS development options including:

- green roofs
- rain gardens
- tree pits
- permeable paving
- filter drain/perforated pipes
- swales
- infiltration basins
- soakaways
- simple/advanced rainwater harvesting
- infiltration trenches
- filter strips
- constructed wetland
- retention (wet) ponds
- detention basins
- underground attenuation and storage.



Milestones leading to SuDS today

Starting from a two-speed uptake in the UK

Commercial developments have historically embraced SuDS to a far greater extent than residential developments have. Often not obvious to the casual observer, commercial sites frequently incorporate SuDS into their design via implementations such as porous parking areas, green strips between parking bays, living roofs and gravelled areas. There's an easy fit between commercial landscaping and SuDS, along with intensive planning procedures and resource for SuDS ownership, so take up has been high.

In the residential sector, SuDS have traditionally taken the form of feeding water into an underground plastic tank or poorly designed pond at the end of the site, a so-called 'end of pipe' SuDS solution that doesn't meet all four SuDS pillars. However, this is slowly changing, prompted by the events we take you through here.

The pain point of the 2007 floods

The summer of 2007 was the wettest on record. There was 414mm of rainfall across England and Wales from May to July - [more than in any period since records began in 1766](#). The government's best estimate of [the overall cost of the 2007 floods is £3.2 billion](#). Excessive runoff in residential areas overwhelmed the drainage system and the rivers the pipes discharged into, a situation that a wider use of SuDS could have mitigated. The scale of the flooding raised the issue of water management in the public consciousness and led to the commissioning of the Pitt Review.

The 2008 Pitt Review

The review focused on flood risk management, the resilience and vulnerability of critical infrastructure, the emergency response, emergency planning and the recovery phase. With reference to SuDS, it recommended:

- adopting a long-term approach to flood risk management, with priority given to adaptation and mitigation
- preventing householders from laying impermeable surfaces on front gardens
- removing the automatic right to connect surface water drainage from new developments to the sewerage system.

The 2010 Flood and Water Management Act

This Act was a direct result of the Pitt Review, passed with the intention of providing a more comprehensive management of flood risk for people, homes and businesses, protecting water supplies to the consumer and helping to safeguard community groups from unaffordable rises in surface water drainage charges.

Schedule 3 of the Act proposed changes with far-reaching consequences for SuDS:

- **Mandatory rather than preferred**
SuDS would become a legal requirement for any development over 100sq/m and would have to be implemented at the design stage of development.
- **Greater powers for local authorities**
It would remove the automatic right of developers to connect drainage systems to public sewers, designating the local authority the SuDS Approving Body (SAB), able to deny connections.
- **Designated ongoing responsibilities for SuDS**
It would require the SAB to adopt and maintain approved drainage systems that served more than one property and were not part of the public highway.

There are a significant number of policy and regulatory documents relevant to the delivery of sustainable drainage.

For a full list and links, please see the appendix.



Divergence over Schedule 3

Implementation of Schedule 3 varied across England and the devolved governments of Scotland and Wales. Their very different approaches highlight how the take up of SuDS is influenced by governance and legislation.

Wales's approach to Schedule 3

Schedule 3 came into effect in Wales in January 2019, and requires new developments over 100sq/m to include SuDS that comply with mandatory Welsh national standards.

SABs in Wales oversee a process that puts the onus on developers to demonstrate their compliance in their planning application. The SAB must approve the surface water drainage design, and it then monitors the installation phase. Upon completion and sign off, the surface water drainage system is adopted by the relevant local authority.

This approach gives the body that will ultimately be responsible for the SuDS control over their design and implementation.

“Ultimately, the local authority are the biggest stakeholders so why shouldn't they have management of it? Local flood risk management is the responsibility of the local authority, so this gives them the power to make sure it's done properly and then gives them control over it in the end.”

Martin Lambley, Product Manager, Wavin

Scotland's approach to Schedule 3

Scotland hasn't adopted Schedule 3, having long built a SuDS policy into local planning laws.

It takes guidance from the [Water Environment and Water Services \(Scotland\) Act 2003](#) which makes specific provision for promoting sustainable water use, ensuring the progressive reduction of pollution of groundwater, and mitigating the effects of floods.

The Scottish Environment Protection Agency (SEPA) holds responsibility for the protection of the water environment and stipulates that SuDS are built into new developments. SEPA also extracts guarantees of adoption of SuDS that lie beyond the boundaries of a private property by Scottish Water, the local authority or a public body. If a developer constructs SuDS to Scottish Water's standards, Scottish Water has a duty to adopt and become responsible for the SuDS, should the developer request it.

This approach achieves the aims of Schedule 3 via an alternative legislative route.

“Wales and Scotland have got this right; they're leading the way in terms of SuDS and have taken different approaches that England should consider.”

Martin Lambley, Product Manager, Wavin

England's approach to Schedule 3

England hasn't adopted Schedule 3, choosing instead to make amendments to the [National Planning Policy Framework](#). Section 14 sets out policy to make sure flood risk is taken into account at all stages of the planning process, and that development avoids areas at the highest risk of flooding. It states that developments should only be allowed in areas of flood risk if they incorporate SuDS, unless there is clear evidence that SuDS would be inappropriate.

The Framework stipulates that SuDS should be incorporated into developments of 10 dwellings or larger (or equivalent non-residential developments), unless demonstrated to be inappropriate by the developer.

The Local Planning Authority and the Lead Local Flood Authority (LLFA) must approve drainage schemes and make sure they are appropriately maintained, although the onus is on the developer to explore adoption and ownership possibilities as there is no single adoption route.

This approach made SuDS a mandatory part of planning, but allowed developers to object to SuDS if their inclusion compromised the ability to fully develop the site.

“The biggest difference is the lack of statutory or mandatory standards for SuDS. The non-statutory SuDS standards that are available primarily focus on managing the volume and flows of runoff and do not support the delivery of the four pillars of SuDS or multiple benefits.”

Paul Shaffer, Director of Innovation and Delivery, CIWEM

In 2018, the government published a review of the effectiveness of planning policy for SuDS. It revealed that planning policy was driving the implementation of SuDS in new developments, but that only 30% of local authorities check whether implementation happens once planning is granted, and that 70% of applications had no provision for maintenance. The report also found that the majority of objections developers raised to avoid implementing SuDS revolved around land-take or economic reasons. LLFAs and Local Planning Authorities commented in the report that developers weren't including SuDS in their planning proposals because of concerns about adoption and the cost of maintenance.

This divergence over the implementation of Schedule 3 meant that Wales and Scotland pulled ahead of England in terms of incorporating SuDS into the built landscape. This continued as the status quo until pressures for change in England intensified from 2020 onwards.

Catalysts for change in England

Catalyst #1 – DEFRA’s 2021 reports into SuDS

DEFRA’s report, ‘[Assessment of how strategic surface water management informs Sustainable Drainage Systems \(SuDS\) delivery through the planning system](#)’, put the question of SuDS implementation firmly back on the development agenda.

The report investigated the relationship between strategic surface water management activity and the planning system, including the opportunities for improvement. Its aim was to explore the potential to contribute to strategic (catchment or sub-catchment) surface water management through the planning system.

The five recommendations that emerged were strongly in favour of greater use of SuDS in England:

1. Data and data sharing

This aimed to create a shared body of comprehensive and consistent data that could be used to develop a strategic approach to surface water management.

The standardisation of metrics and methods of measurement would help bodies share experience and insight of flood events and SuDS outcomes. It would also bring information held by large private landowners in the public realm.

2. Evidence base and strategy

This recommendation focused on strengthening the evidence base for planning policy and pulling that robust information through into a strategy for surface water management.

It wanted to create links between evidence and the development of Strategic Flood Risk Assessments (SFRAs) that would support local planning authorities and LLFAs in building costed strategies for surface water interventions. LLFAs would become integral to the preparation of SFRAs, and drainage and wastewater management plans would take a more central role in planning.

3. Local planning system

This highlighted the importance of making sure that planning policy and development management deliver a strategic approach to surface water management.

The focus here was on giving LLFAs the powers they need to fulfil their statutory duty to manage local flood risk arising from surface water. It would start by upskilling planning officers to manage surface water management issues. Then, mechanisms to bring SuDS schemes into consideration early on in the planning process would be introduced to increase the likelihood that multifunctional SuDS would be incorporated into the built environment. This could include LLFAs being given specific powers to provide and to charge for preapplication advice. Importantly, LLFAs could become statutory consultees in plan-making.

4. Widening collaboration

This recommendation emphasised the need for partnership working in surface water management to help local planning authorities use information effectively in the planning system.

It called out the role of LLFAs as facilitators of a strategic approach to surface water management, specifically mentioned the need to bring in the highways authorities into the picture and focused on the role of the Environment Agency as a supporting body to the LLFAs. Water and sewerage companies (WaSCs) were also identified as potential statutory consultees on major planning applications, to complete the collaborative circle. Plus, government clarification of the contexts in which the right to connect to a public sewer might reasonably be withheld was requested.

5. National planning policy and guidance

This recommendation was centred around making planning policy and guidance clearer about the role of the planning system in delivering a strategic approach to surface water management.

This aimed to strengthen national planning policy by creating links between SFRAs identifying where reductions in surface water risk are needed, and planning policy powers that could achieve the reductions. It recognised that the national planning policy and guidance may need updating so design codes would specifically reflect the need to deliver a strategic approach to surface water management. The report noted that greater consistency would be needed in the SuDS adoption approach used by different organisations so that this diversity wouldn’t be a barrier to delivering a strategic approach to surface water management.

This report was complemented by DEFRA’s [Recommendations to Update Non-Statutory Technical Standards for Sustainable Drainage Systems \(SuDS\)](#), which aimed to evaluate and update the Non-Statutory Technical Standards (NSTS) in a way that helped provide for multiple benefit SuDS.

At their core, the reports’ recommendations sought to revive Schedule 3 in England to back its guidance with power, and to provide practical recommendations on creating multiple benefits from SuDS.

“England needs its own version of Schedule 3, which will be a better version than the Welsh one because England can learn from the Welsh experiences.”

Ian Titherington,
Lead Officer, City of Cardiff Council

Catalysts for change in England

Catalyst #2 – Ofwat Sewerage Sector Guidance 2020

This new [guidance](#) allowed England's nine water and sewerage companies to adopt a wider range of sewer types fulfilling specific design criteria, including those with some SuDS elements. It was an important step towards supporting Ofwat's decision to require all water and sewerage companies to commit to a single, mandatory national approach to sewer adoption.

The Design and Construction Guidance documentation set out that sewer elements in public open spaces will be potentially adoptable by the water and sewerage company if they serve more than one property. Detention basins, swales, rills, under-drained swales, ponds, wetlands, infiltration basins and soakaways are all suitable candidates for adoption. However, ultimately, the water and sewerage company has the power to assess the assets that are being offered for transfer and agree or refuse connection.

Currently some water companies are exercising these new rights to adopt SuDS schemes, and some are not.

Catalyst #3 – growing construction industry concern around ground issues

In the face of anecdotal evidence that the smooth flow of development was being affected by conflicting ground-related issues, the NHBC Foundation undertook workshops to look at the situation.

The 2011 report, '[Ground-related requirements for new housing: workshops to examine the issues faced by the industry](#)', highlighted how SuDS had become a key issue and that rationalisation of guidance and policy would be helpful if the industry was to move forward.

Key stats from the workshops show the general confusion and dissatisfaction amongst developers around SuDS:

- over 90% didn't believe that skills and experience for taking responsibility for SuDS existed in local authorities and SABs
- 80% believed WaSCs should remain responsible
- over 70% felt that more than a third of their sites would fall to orphaned surface sewers, with significant concerns about their future maintenance
- 70% were aware of the forthcoming legislative changes around sewers, but almost all believe these have not been effectively communicated and there was a lack of confidence about implementing them in their businesses.

Developers wanted clarification on the following key points:

- how to resolve the different requirements for sewage and surface infrastructure, and the inconsistent interpretation of different standards
- the impact of SuDS design standards on smaller sites and the possible withdrawal of underground storage which some developers wrongly believe makes brownfield and non-porous sites undevelopable
- how to navigate the complexity of the proposed changes and interaction with the numbers of WaSCs, highway authorities and SABs
- the future maintenance of SuDS and issues affecting shared drainage, with concerns that responsibilities would remain with developers
- how likely open drainage design approaches would result in health and safety liabilities for developers.

Developers are looking for regulatory action to clarify their obligations around SuDS.

"Some of the concerns raised in the report can be overcome with good practice guidance like the 2015 SuDS Manual."

Paul Shaffer, Director of Innovation and Delivery, CIWEM



Catalysts for change in England


Catalyst #4 – new information about the costs of SuDS

Defra sponsored comparative studies on the costs and benefits of traditional drainage and SuDS, and these showed that the inclusion of SuDS was cheaper than a traditional drainage system, particularly in terms of lifetime costs.

Looking at quantification, one example in Cambridge suggested around a 10% saving on capital costs with the SuDS scheme. Potentially, the savings could have been greater if the SuDS layout had been considered earlier in the development process.

In pursuing these cost savings, developers are turning towards using numerous smaller water tanks dotted below ground around the site, rather than using one big tank. These smaller tanks are hidden under ponds and play areas, combining valuable biodiversity improvement with the reassurance of future-proofing the site against one-in-30-year and one-in-100-year storms and rainfall events.

Now SuDS can prove to be cheaper to install and maintain, developers are more interested in including them in their sites.



“Statutory SUDS just force you to have better design. It’s not about making development difficult or expensive - SuDS are not more expensive. The key is to think early on about how you manage surface water.”

Ian Titherington, Lead Officer, Cardiff City Council

Catalyst #5 – climate emergency and increasing sustainability awareness

The Met Office reports clear evidence that climate breakdown is impacting rainfall and flooding events. It projects warmer and wetter winters, because warmer air can hold more water, so rainfall is becoming more extreme and variable across the world. Since 1998, the UK has seen six of the ten wettest years on record. The winter storms in 2015 were at least 40% more likely because of climate change. Shorter, more intense rain events are becoming the norm in the UK.

Flooding is also more likely when heavy rainfall overwhelms drainage systems or burst river banks. Heavily concreted urban areas will be particularly affected because the water cannot soak directly into the soil.

Developers are increasingly aware of these factors and the need to adapt construction approaches to take intense rain events and surface flooding into account.

“If you install and design SuDS properly, they work really well. And because of climate change, because of the levels of pollution we’re seeing in urban areas, SuDS shouldn’t be the exception, SuDS have to be the norm.”

Ian Titherington,
Lead Officer, Cardiff City Council

Catalysts for change in England

Catalyst #6 – increasing consumer demand for more sustainable housing set in green environments

Established [research from the ONS](#) confirms that home buyers will pay more for houses and flats near green spaces. It found that houses and flats within 100 meters of green space cost 1.1% more than similar properties further away, and that being within 100 metres of a public green space attracted the highest premium for detached homes, adding 1.9% to the price.

This is even more true today, where green space is at a premium in high density housing developments. In response, developers are more interested in improving the amenity of an area with green spaces, trees, ponds and children's playgrounds that incorporate SuDS.

At the same time, [74% of UK consumers are looking at their homes differently](#) from how they did pre-pandemic, looking for increased sustainability. Almost four in every five people (79%) are considering how environmentally friendly their property is before deciding where to live, increasing the importance for developers to provide sustainability credentials.

Aspirations for sustainable housing aren't just about minimising the impact of development on a green or brownfield site. Biodiversity Net Gain is set to become an increasingly important concept, one that describes a development that leaves biodiversity in a better state than before – and there's already [a range of guidance](#) available on how to achieve this.

Here at Wavin, we believe there's a role for a water equivalent to an Energy Performance Certificate to provide key information about the sustainability credentials of a site to potential buyers, particularly relevant for new build housing.

“When SuDS are done right, they don't cost more, they look amazingly green and people want to work there, people want to live there, people want to go there for coffee - but at the same time it's brilliant for sustainability.”

[Ian Titherington](#), Lead Officer, Cardiff City Council

Catalysts for change in England

Catalyst #7 – strengthening planning policy

As cities increasingly recognise that their ageing drains and sewers are struggling to cope with growing populations and shrinking green surfaces, they're taking action. They're realising that they need to change how their drainage systems operate if they're to manage the increased risk of flooding, and are embedding the need for sustainable drainage into their planning systems.

The London Sustainable Drainage Action Plan, for example, addresses a specific need to promote the awareness, and the retrofitting, of sustainable drainage systems right across London.

London – an extreme case in point

The surface water runoff challenge in London is two-fold, combining the more frequent and intense storms the whole of the UK is experiencing, with managing pressure on a 150-year-old sewer and drain network built for a smaller city that is at, or near, capacity in many areas. Existing high-density housing and continual pressure to find more sites for development in the capital mean that there is little or no capacity to free-up the land space that SuDS require.

SuDS in London need to maximise use of the existing streetscape while, where possible, improving the public realm. Bodies such as local authorities and Transport for London are [increasingly defining](#) and implementing cross-London flood and drainage strategies to promote the use of SuDS.

There's a city-wide focus on preserving the 47% of green space and 22% of tree canopy cover London's green infrastructure provides. There's also a coordinated SuDS development process that includes consulting utility providers to make sure existing assets aren't damaged by new SuDS schemes.

“London’s flood board became very practical and forward thinking. A number of organisations in London with responsibilities for flooding and drainage began to collaborate and work together to develop and implement a cross-London strategy where all boroughs were working from the same page and working together to ease flooding across Greater London. The Greater London Authority made this a focus issue because flooding has been so significant, particularly in vulnerable boroughs like Hammersmith and Fulham where a huge amount of the surface water they deal with is coming in from adjacent boroughs.”

Martin Lambley, Product Manager, Wavin

Here are some examples of SuDS in action in London:

- **a green roof initiative**
Provision of green roofs and walls are particularly important in Islington due to its high-density urban pattern of development with relatively few green and open spaces. The council specifies that “developments should maximise the provision of green roofs and the greening of vertical surfaces as far as reasonably possible”. Green roof systems and biodiverse surface finishes meet the four pillars of SuDS and achieve an environmental rating of BREEAM Excellent
- **enhancement of cycle paths**
Planting is designed to accept runoff from the highways and footway, reducing surface water flow to the combined sewer, and a deep bioretention basin provides underground attenuation. Porous cycle surfaces also draw surface water away from the existing highway gully
- **retrofitting SuDS in a housing estate environment**
This includes combining visual improvements to the green areas with incorporating green roofs, a bioretention basin, a detention basin, and permeable paved road surfaces to regenerate the estate through integrated SuDS design
- **creating rain meadow spaces**
This involves re-purposing existing green spaces for surface water interception and infiltration by directing road runoff to the meadow, reducing the volume of water that drains from the grass to the nearby road gully
- **adapting pedestrianised carriageways**
In these projects, surface water flow is directed towards rain gardens and trees, trees are planted in linked trenches that incorporate below-ground attenuation and permeable paving allows infiltration

As a high-density urban area, London is an ideal testbed for the effectiveness of SuDS in city environments – if it can work in London, it's likely to be applicable in other UK cities. London is a prime example of what England can achieve in the SuDS arena – England now just needs the appropriate legislation to make London's achievements the norm, rather than the exception.

The future of SuDS

Understandably, the conventional, historic approach to water management has been to do whatever's necessary to meet supply, so citizens can turn on a tap and be guaranteed a flow of clean water. The overall goal for water supply in a city is to provide a safe, reliable and affordable supply in sufficient quantities for all.

However, the sustainability of the technologies and methods used are in many cases questionable, particularly when it comes to reusing water. [The Sustainable Water Management in the City of the Future \(SWITCH\) project](#) carried out pioneering work to drive more sustainable urban water management. It revealed that a conventional approach to the management of stormwater was unfit for the needs of the urban environments of the future.

The basis of the conventional approach is to move stormwater away from the urban environment as quickly as possible, channelling it into a combined sewer system where the stormwater is mixed with effluent before being treated, or into a surface water system that only handles stormwater and directs it to rivers, usually without treatment. The primary focus is to manage local flooding, and this can often be at the expense of environments downstream.

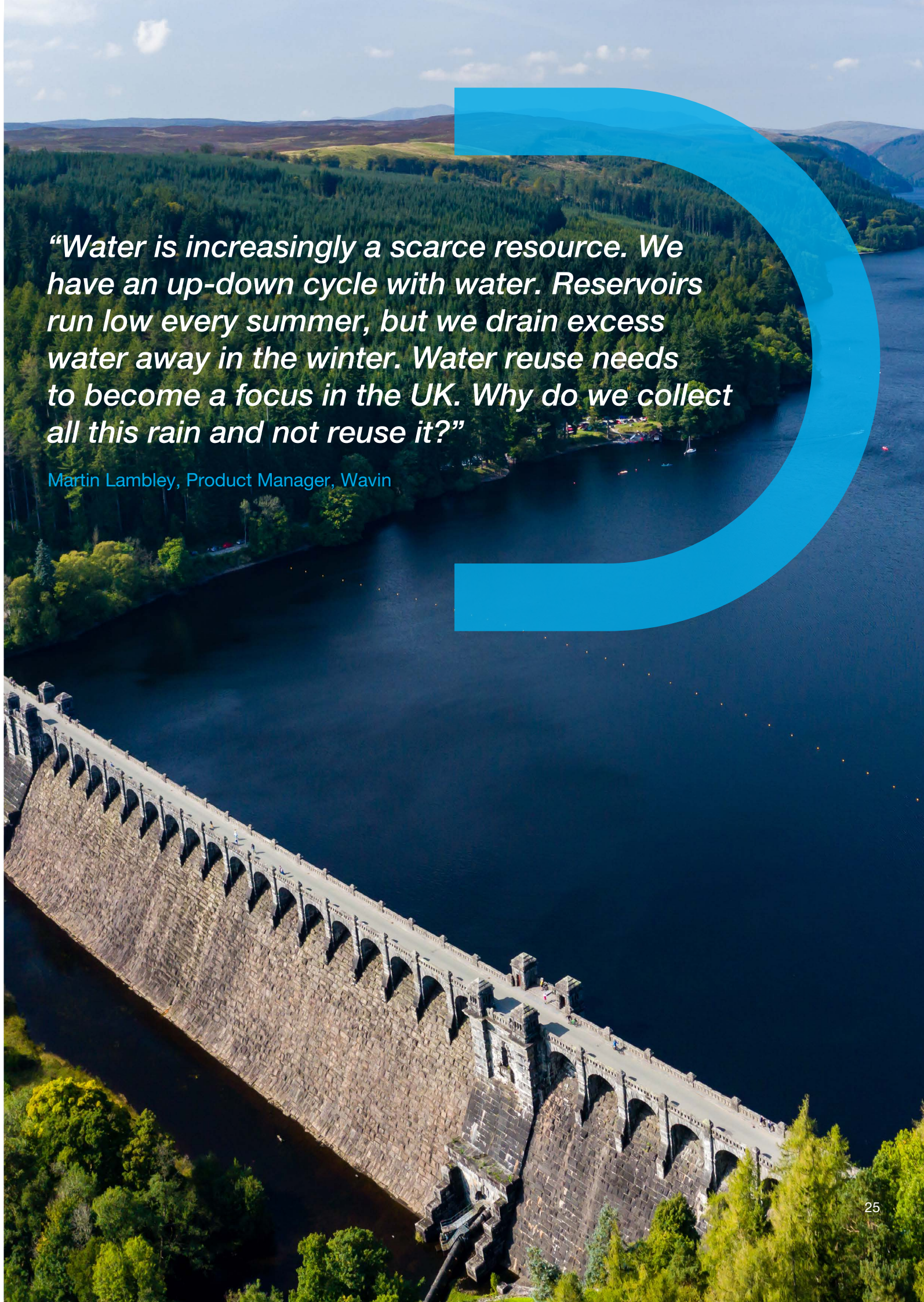
As intense rain events increase, this conventional approach is creaking under the strain, and isn't providing opportunities to reuse water:

- rapid removal of rainwater prevents it from being used for non-potable water supply uses and urban landscaping
- heavy rainfall causes combined sewers to overflow, pushing untreated water into the environment
- rapid runoff from roads, roofs and car parks sweeps pollutants into receiving water bodies

- rapid runoff from gardens and parks also directs pollutants into receiving waterways
- generally, rapid runoff causes erosion and sedimentation in streams, rivers and estuaries
- increasing impermeable surfaces prevents natural recharging of the water table
- rapid surface water removal reduces evapotranspiration, increasing urban temperatures.

As part of addressing these unsustainable issues, the SWITCH project adopted a 'grey to green' approach. This focused on the importance of green infrastructure, such as green spaces and clean rivers, as an essential part of underpinning the functioning of urban communities.

Similar to [CIRIA guidance on delivering better water management through the planning system](#), the SWITCH approach emphasised the value of collaborative, cross-agency planning and working to deliver sustainable solutions. It brought together social, economic and environmental aspects within a long-term perspective, considering the interaction between different elements of the urban water system alongside structural and human factors.



“Water is increasingly a scarce resource. We have an up-down cycle with water. Reservoirs run low every summer, but we drain excess water away in the winter. Water reuse needs to become a focus in the UK. Why do we collect all this rain and not reuse it?”

Martin Lambley, Product Manager, Wavin

Building a Blue Green Infrastructure

SWITCH pointed the way to an urban future that centred on planning and building a Blue Green Infrastructure (BGI).

BGI is [defined by the European Commission](#) as a ‘strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem service’.

In essence, it brings together the blue benefits of good water management with green sustainability credentials. BGI occurs where water elements like rivers, canals, ponds, wetlands, floodplains and water treatment facilities work together with the trees, lawns, hedgerows, parks and fields of the green environment.

SuDS are a key part of BGI that address many of the negatives of the conventional approach to surface water management:

- intercepting runoff so combined sewers aren’t overwhelmed
- holding runoff so that it can drain back to the water table
- using the natural environment to filter pollutants out from water and to improve the quality of water entering combined sewers
- capturing runoff so it can be managed through evapotranspiration.

“SuDS take pressure off the combined drainage network, green up the environment, take pollutants out of the water and even catch micro-plastics.”

Ian Titherington, Lead Officer, Cardiff City Council



Encouraging BGI

Increasingly, as water sustainability moves up the agenda, citizens, local authorities and government will require proof that BGI such as SuDS have been included in a development.

A simple solution would be a water certificate that examines and certifies how a build manages overall water resilience, covering key elements such as:

- is the property on a combined or separate sewer?
- are low water use fittings in place?
- what SuDS are on site?
- have low-flush toilets been fitted?
- are rainwater harvesting methods in place?

However, an initiative like this will need cross-agency agreement and will need to be spearheaded by a prominent organisation. The question today is, who will step forward?

“A water performance certificate needs to become part of standard house-buying documents. Particularly on new builds. But this needs to be driven nationally.”

Martin Lambley, Product Manager, Wavin

SuDS in action



Portland, USA

Portland set out to tackle significant levels of river pollution that had been exacerbated by decades of combined sewerage overflows. Alongside new drainage pipes, the city introduced a Green Streets programme that relied heavily on SuDS systems and included rain gardens, roadside swales, surface water street planters, green roofs and an incentivised downspout disconnection programme.

The Bureau of Environmental Services encouraged residential areas around NE to accept kerb extended and multiple benefit surface water planters, and the initiative's popularity spread.

As part of promoting SuDS, Portland created a cycling tour around the city centre that takes in SuDS implementation sites, with explanations of how the techniques work that empower the public in a cost-effective and multiple beneficial way.

Sheffield, UK

Sheffield created a network of green corridors, parks, recreational areas and green spaces within the city to promote the free movement of wildlife, leisure, recreation, walking and cycling.

One element transformed an almost redundant former inner ring road from a barrier to a green corridor with a SuDS system at its heart, including segregated cycle lanes and public art.

The SuDS replaced hard surfaces with meadows, rain gardens and other vegetation, reconnecting the highway surface to its natural catchment, the River Don. Soils and plants filter out pollution before it reaches the river.

“Blue Green Infrastructure is a term we’re going to see more and more.”

Martin Lambley,
Product Manager, Wavin

Wales

By implementing Schedule 3, Wales is leading the way in ‘greenification’ – that is, it’s blazing a trail for SuDS inclusion in ways that support all four SuDS pillars. The Welsh success stems from adopting surface water drainage systems that consider technical elements as well as human nature - ensuring that communities are able to embrace SuDS and that they offer maximum benefits with minimal maintenance. There’s a distinct focus on managing roof, driveway and highway drainage when planning new build developments, alongside a range of strong practices that England could take inspiration from for its own version of Schedule 3. There are also learnings from the Welsh experience that could help England prevent loopholes that have been exploited in Wales.

In Grangetown, Cardiff, for example, a SuDS project set out to remove surface water that entered the combined sewer network from a network of 12 streets. 108 rain gardens and tree pits containing native trees and plants, improved water quality through the physical and biological treatment of surface water runoff before it was discharged into the nearby river. As part of installing permeable paving and combined kerb drainage and channel drainage, the project seized the opportunity to improve amenity by installing a new cycle path, a new footway and 14 safer road junctions.

Moving SuDS forward

SuDS have achieved significant momentum within the urban environment, and it's now up to every organisation involved in urban planning, maintenance and management to keep it going.

All water management stakeholders must come together to shape legislation and regulations that will deliver a coordinated, effective strategy for surface water. SuDS need to become a mainstream part of surface water management – a compulsory stage in developments and a key consideration in schemes to regenerate or improve existing urban environments.

We need to actively seek out opportunities to deploy SuDS. Be ingenious. Be creative. Embrace the Blue Green movement.

“With the introduction of Biodiversity Net Gain and the recognised benefits of SuDS, there is growing recognition of the value of SuDS. This, coupled with concerns about nutrient neutrality should mean that the drivers for SuDS will continue to grow. It needs strong local planning policy to be introduced by Local Planning Authorities that include policies and requirements for multi-beneficial SuDS that deliver the four pillars and more.”

Paul Shaffer, Director of Innovation and Delivery, CIWEM

Stormwater solutions from Wavin

Wavin manufactures a wide range of plastic rainwater and stormwater harvesting drainage pipe systems for industrial, commercial and residential industries. These include:

Geocellular tanks

Our geocellular systems can be used to control and manage rainwater surface water runoff either as a soakaway or as a storage tank. Their modular/honeycomb structure means that they can be tailored to suit the specific requirements of any site and can be easily combined with other SuDS methods.

Roof drainage systems

From half-round guttering that integrates seamlessly to residential, commercial and industrial buildings, to roof drainage systems for flat roofs and complex roof areas, we offer a wide range of solutions to capture rainwater.

Surface drainage

Our range of channel drains and gullies help you manage surface water efficiently by collecting and transporting excess water on roads, car parks or industrial sites. Products include permeable paving, channel drainage and non-mechanical means of managing stormwater discharge from attenuation tanks for single dwellings.

Subsurface conveyance

Our plastic drainage pipes and connection components are designed to optimise rainwater drainage and transport, whatever the volume or flow, to meet the toughest regulatory obligations.

Attenuation and infiltration

Our underground attenuation/infiltration tanks collect all the surface water from your roof guttering, downpipes, surface water gullies and channel drains, storing it until it can naturally soak into the surrounding ground.

Managing pollution

Our silt traps help you meet regulatory requirements to remove pollutants from collected rainwater before discharge. We offer both the expert advice and the solutions you need to meet all compliance obligations.

If you would like to find out more, or request a consultation to discuss the possibilities for your next project, visit: wavin.com/en-gb/stormwater



solving the
puzzle of
stormwater



Appendix

The susdrain organisation holds the most comprehensive list of [policies and documents](#) relating to sustainable drainage systems. With thanks to susdrain, we summarise them here:

European

Floods Directive 2007
The Floods Directive aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and the economy.
[Click here for more information](#)

Water Pollution by Discharges of Certain Dangerous Substances 2006
This Directive introduced the concepts of list I & II substances whilst the purpose of the Directive is to advise on how to eliminate pollution from list I substances and to reduce pollution from list II substances.
[Click here for more information](#)

Groundwater Directive 2006
The Groundwater Directive establishes a regime which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. Water Framework Directive 2000 The Water Framework Directive helps to protect and enhance the quality of all water bodies within the European Union.
[Click here for more information](#)

Habitats Directive 1992
The Habitats Directive forms part of a cornerstone of Europe’s nature conservation policy.
[Click here for more information](#)

Urban Waste Water Directive 1991
The Urban Waste Water Directive concerns urban wastewater particularly the collection, treatment and discharge of domestic waste water, mixtures of waste water and waste water from certain industrial sectors.
[Click here for more information](#)

Bathing Water Directive 1976
The Bathing Water Directive concerns the quality of bathing water in the Member States of the European Union.
[Click here for more information](#)

United Kingdom
Neighbourhood planning 2012
Neighbourhood planning is a new right for communities introduced through the Localism Act 2011.
[Click here for more information](#)

Localism Act 2011
The Localism Act was enforced to shift power from central government back into the hands of individuals, communities and councils.
[Click here for more information](#)

Natural Environment White Paper 2011
The Natural Environment White Paper outlines the Government’s vision for the natural environment until 2051, backed up with practical actions.
[Click here for more information](#)

Water White Paper 2011
Effectively called Water for Life, the Water White Paper outlines a vision for future water management.
[Click here for more information](#)

Code for Sustainable Homes – Setting the Standard in Sustainability for New Homes 2008
Code for Sustainable Homes is the National Standard for the sustainable design and construction of new homes and sets out the assessment process and the performance standards required for the Code.
[Click here for more information](#)

England and Wales

Silts and SuDS 2011
Silts and SuDS is a regulatory position statement on the deposit and dewatering of non-hazardous silts from SuDS on land.
[Click here for more information](#)

Environmental Permitting Regulations 2010
The EP Regulations have combined both the Pollution Prevention and Control (PPC) and Waste Management Licensing (WML) regulations.
[Click here for more information](#)

Flood and Water Management Act 2010
The Flood and Water Management Act provides comprehensive management of flood risk for people, homes and businesses.
[Click here for more information](#)

Flood Risk Regulations 2009
The Flood Risk Regulations place a duty on the EA and LLFA to prepare a number of documents including Preliminary Flood Risk Assessments, Flood hazard and risk maps, and Flood Risk Management Plans in relation to provisions set by the European Floods Directive.
[Click here for more information](#)

Model agreement #1 - Planning obligation incorporating SuDS provisions 2008
Model agreement based on 2008 legislation for the implementation and maintenance of SuDS either as a planning obligation under Section 106 of the Town and Country Planning Act, 1990 or as a condition attached to planning permission.
[Click here for more information](#)

Model agreement #2 – SuDS maintenance framework agreement 2008
Model agreement based on 2008 legislation for a legal framework that defines which body takes over and maintains the SuDS.
[Click here for more information](#)

Model agreement #3 – Model discharge agreement 2008
Model agreement based on 2008 legislation for owners of SuDS facilities granting sewerage undertakers rights in perpetuity to discharge, flood and maintain in default.
[Click here for more information](#)

Code for Sustainable Homes – Technical Guidance 2008
This technical guidance sets out the requirements for the Code for Sustainable Homes. It sets out the process by which a Code assessment is reached.
[Click here for more information](#)

Permitted Development Rights 2008
Household owners have the right to implement permeable paving for their front gardens without the need to apply for permission. As a result the Environment Agency provided guidance on permeable surfacing of front gardens.
[Click here for more information](#)

Sewers for Adoption – 6th Edition 2006
Sewer for Adoption contains detailed requirements for lateral drains and SuDS so they can be offered for adoption.
[Click here for more information](#)

Sustainable and Secure Building Act 2004
The Sustainable and Secure Building Act amends and improves previous legislation by introducing objectives related to sustainable development, conservation of energy and management of water in buildings.
[Click here for more information](#)

Building Regulations Part H 2002
Building Regulations apply in England & Wales and promote standards for most aspects of a building’s construction.
[Click here for more information](#)

The Groundwater Regulations 1998
The Groundwater Regulations complete the implementation of the Groundwater Directive for England, Wales and Scotland. It supplements regulation 15 of the Waste Management Licensing Regulations 1994 and existing water pollution legislation.
[Click here for more information](#)

Environment Act 1995
The Environment Act set up the Environment Agency (EA) in England and Wales and the Scottish Environment Protection Agency (SEPA) in Scotland, to protect the environment and manage resources.
[Click here for more information](#)

Land Drainage Act 1994
The Land Drainage Act consolidates previous enactments relating to internal drainage boards, and to the functions of such boards and of local authorities in relation to land drainage.
[Click here for more information](#)

Water Industry Act 1991
The Water Industry Act consolidates previous enactments relating to the water supply and the provision of wastewater services in England and Wales.
[Click here for more information](#)

Water Resources Act 1991
The Water Resources Act provides regulations related to water resources, water quality & pollution, and flood defence.
[Click here for more information](#)

New Roads and Street Works Act 1991
The New Roads and Street Works Act provides a legislative framework for street works by undertakers (including utility companies) and works for road purposes.
[Click here for more information](#)

Town and Country Planning Act 1990
The Town and Country Planning Act provides a local planning authority (LPA) with the power, in certain circumstances, to take steps requiring land to be cleaned up when its condition adversely affects the amenity of the area.
[Click here for more information](#)

Environment Protection Act 1990
The Environment Protection Act brings in a system of integrated pollution control for the disposal of wastes to land, water and air.
[Click here for more information](#)

Water Act 1989
The Water Act effectively privatised ten water authorities in England and Wales, and with it the transfer of river functions to the National River Authority, which was eventually subsumed within the Environment Agency.
[Click here for more information](#)

Highways Act 1980
The Highways Act details the management and operation of the road networks in England and Wales.
[Click here for more information](#)

England

English SuDS policy 2015
[ADCLG Written Ministerial Statement](#) altering the [National Planning Policy Framework \(NPPF\)](#) expecting SuDS to be considered where appropriate for major developments.

The NPPF Practice Guide has been updated to provide further clarification on [managing flood risk](#) and [securing SuDS](#).

Non-statutory technical standards for the design, maintenance and operation of SuDS have been produced by Defra. Specific guidance around these non-statutory technical standards is being produced.

Defra Statement of Obligations 2012
The document describes the Government’s understanding of the main environmental statutory obligations that apply in particular to water and sewerage undertakers over the Price Review period 2015-2020.
[Click here for more information](#)

National Planning Policy Framework (NPPF) 2012
The National Planning Policy Framework set out the Government’s planning policies for England.
[Click here for more information](#)

Technical Guidance to the National Planning Policy Framework 2012
The Technical Guidance to the National Planning Policy Framework ensures local planning authorities can effectively implement the planning policy.
[Click here for more information](#)

National Standards for Sustainable Drainage 2011
The National Standards for Sustainable Drainage presents Defra’s proposals and sought views on implementation requirements for sustainable drainage systems (SuDS) in new and redeveloped sites in England.
[Click here for more information](#)

Tackling Diffuse Water Pollution in England 2010
The Tackling Diffuse Water Pollution in England report examined the Environment Agency’s progression in tackling diffuse pollution.
[Click here for more information](#)

Flood Risk Management in England 2010
The Flood Risk Management in England report examined the progress made since 2007 in strengthening flood risk management in England.
[Click here for more information](#)

Future Water 2008
Future Water sets out the Government’s plans for water in the future as well as the practical steps that need to be taken to ensure that good clean water is available for people, businesses and nature.
[Click here for more information](#)

Pitt Review 2007
The Pitt Review is an independent review of the flooding emergency that took place in June and July 2007.
[Click here for more information](#)

Wales

Recommended non-statutory standards for sustainable drainage in Wales 2016
The Welsh government has published standards and guidance for SuDS serving new developments in Wales.
[Click here for more information](#)

Planning Policy Wales – 4th Edition 2011
Planning Policy Wales provides a framework for the effective preparation of the local planning authorities’ development plans and sets out land use planning.
[Click here for more information](#)

The Wales Spatial Plan 2008
The Wales Spatial Plan is the overarching framework and integration tool for Wales.
[Click here for more information](#)

Tan 15: Development and Flood Risk 2004
Technical Advice Note (TAN) 15 provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding.
[Click here for more information](#)

Tan5: Nature conservation and planning 2004
Technical Advice Note (TAN) 5 provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to nature conservation and planning.
[Click here for more information](#)

Scotland

Water resilient places - surface water management and blue-green infrastructure policy framework 2021

This paper outlines how surface water is currently managed in Scotland, sets out a vision for the future and describes the components that should be brought together to form a coherent framework that will support delivery of water resilient places.

[Click here for more information](#)

SEPA Regulatory Method 2019

The SEPA Regulatory Method (WAT-RM-08) for Sustainable Urban Drainage Systems provides guidance on the regulation of surface water discharges from built developments including construction sites, buildings, roads and yards.

[Click here for more information](#)

Sewers for Scotland – 4th edition 2018

Sewers for Scotland is a design and construction guide aimed at all developers and consultants who plan to undertake developments of any size in Scotland.

[Click here for more information](#)

Water assessment and drainage assessment guide 2016

Document produced by the Sustainable Urban Drainage Scottish Working Part (SUDSWP) to provide advice on water supply and SuDS infrastructure for new developments.

[Click here for more information](#)

Building a Hydro Nation 2010

This consultation document sets the initial scene for proposed legislation with regard to Scotland building a hydro nation, by exploring ideas and opportunities.

[Click here for more information](#)

Scottish Planning Policy 2010

The Scottish Planning Policy is a statement of the Scottish Government’s strategy on nationally important land use planning matters.

[Click here for more information](#)

Designing Places 2010

Designing Places sets out the policy context for important areas of planning policy, design guidance, professional practice, and education and training.

[Click here for more information](#)

Designing Streets 2010

Designing Streets sits alongside Designing Places and is a policy statement for street design emphasising that guidance on street design should move toward place-making and away from a system focused upon the dominance of motor vehicles.

[Click here for more information](#)

National Planning Framework 2009

The National Planning Framework plays a key role in co-ordinating policies with a spatial dimension whilst aligning strategic investment priorities.

[Click here for more information](#)

Flood Risk Management Act 2009

The Flood Risk Management Act develops a sustainable and modern approach to flood risk management, suited to the needs of the 21st century and to the impact of climate change.

[Click here for more information](#)

Planning Advice Note 69: Planning and Building Standards Advice on Flooding 2004

PAN 69 provides good practice advice on planning and building standards in areas where there is a risk of flooding.

[Click here for more information](#)

Water Environment & Water Services Act 2003

The Water Environment and Water Services (Scotland) Act 2003 is the enabling act for the European Water Framework Directive.

[Click here for more information](#)

Building Act 2003

The Building Act provides for approved designers and approved persons or bodies involved in the construction process to certify that elements of a building do or will comply with building regulations.

[Click here for more information](#)

Town and Country Planning 1997

The Town and Country Planning (Scotland) Act 1997 is the principal piece of legislation governing the use and development of land within Scotland

[Click here for more information](#)