

SUSTAINABLE DRAINAGE



Cambridge Design and Adoption Guide

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SUDS management train diagram based on original design
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Key of benefits arising from specific SUDS measures



Water storage

Providing long and short term storage of water during a storm event



Silt removal

Removing suspended sediments in water



Pollutant treatment

Effective treatment of polluted water



Infiltration

Allowing water to soak into the ground



Biodiversity

Increasing the variety of plants and wildlife



Visual amenity

Providing attractive, useable and pleasing features



Play

Open space available for physical activities



Education

Learning opportunities with wildlife and water management



Embodied Energy

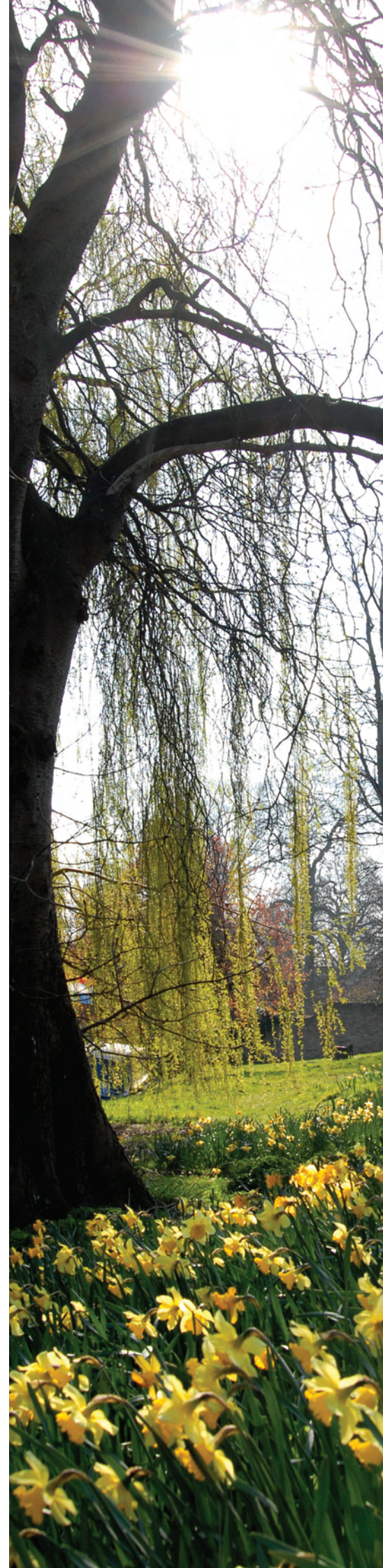
Reduction in construction energy



Adaptability

Easily changed for additional future capacity

Each sustainable drainage component throughout this document has been rated for all of the above benefits that they can provide. By comparison a traditional drainage scheme will only score high on storage.



Foreword

Water is an essential part of the Cambridge landscape, from the world renowned Backs, to the historic wetlands of Coe Fen and Sheep's Green through to the man-made watercourse of Hobson's Conduit and the unique Runnels along Trumpington Street. In the 21st Century, strains on historic drainage systems and the challenges of climate change mean innovative new solutions to water management are needed. It is widely recognised that sustainable drainage systems (SUDS) provide this solution and they offer an excellent opportunity to introduce water in the landscape throughout the new communities that are planned for the City.

SUDS can play a large part in shaping these high quality neighbourhoods, enhancing the opportunities for leisure, play and education within the open spaces. Wildlife thrives in well-designed SUDS. They will be especially significant in dealing with landscape and drainage issues in those areas of Cambridge that are due to see considerable expansion over the next few years.

This Design and Adoption Guide provides developers with all the information needed to meet our adoption standards. In the words of our Quality Charter, this guide should ultimately ensure that we treat 'water as a friend and not an enemy'.

*Executive Councillor for Climate Change & Growth,
Sian Reid*

Executive Councillor for Arts & Recreation, Julie Smith

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Readers of this guide are reminded that they are responsible for observing the technical and regulatory standards relevant to their project and for the appropriate application of this document to such projects.

Introduction

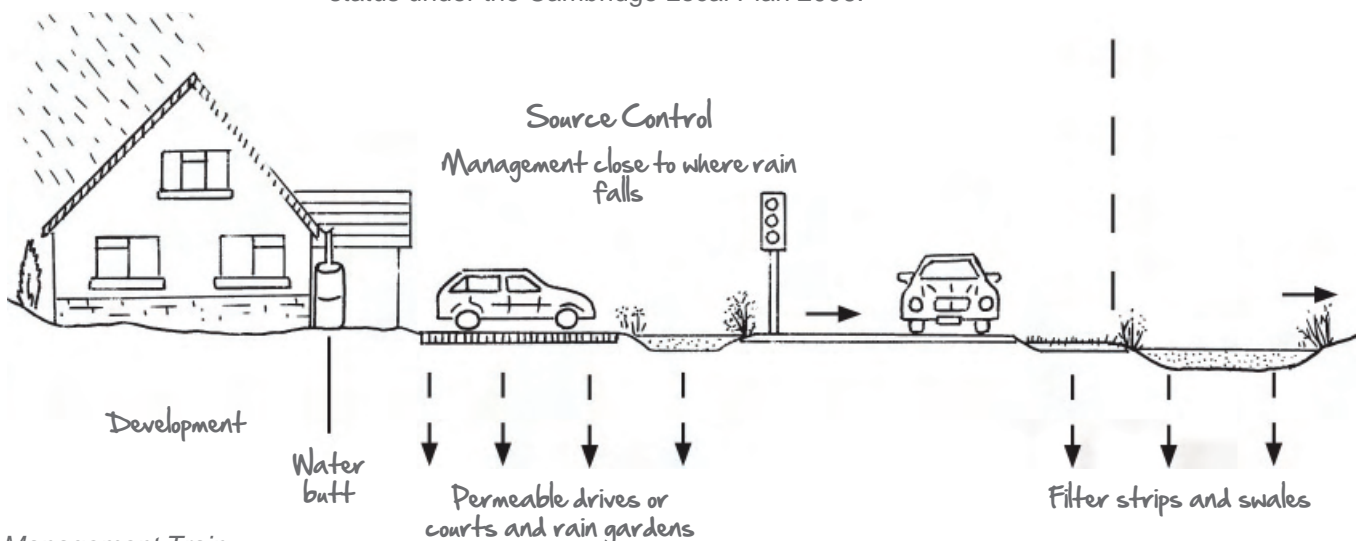
A successful SUDS scheme will deliver many **community** benefits, enhancing the **quality of life** of people living there, **increasing biodiversity** whilst reducing the risk to residents and their homes from **flooding** and providing greater resistance to the impacts of **climate change**.

The SUDS will ensure that local watercourses and rivers, such as Hobson's Brook and The Cam, will not suffer any detrimental **water quality** effects or increased flood risk due to the new developments discharging into them. The City Council will also be taking a lead role in ensuring that these systems are maintained and remain effective throughout the life of the development, a move in line with increasing responsibility for flood risk management being passed to local authorities.

Purpose of this Guide

This guide is primarily intended for use by **developers** and their **consultants** where they are seeking adoption of SUDS by Cambridge City Council within the public open space of new developments. It sets out the **design** and **adoption** requirements that the City Council will be looking for, in order to ensure a smooth and satisfactory adoption process.

This guide does not form part of the Cambridge Local Development Framework or have any formal planning status under the Cambridge Local Plan 2006.



What are sustainable drainage systems or SUDS?

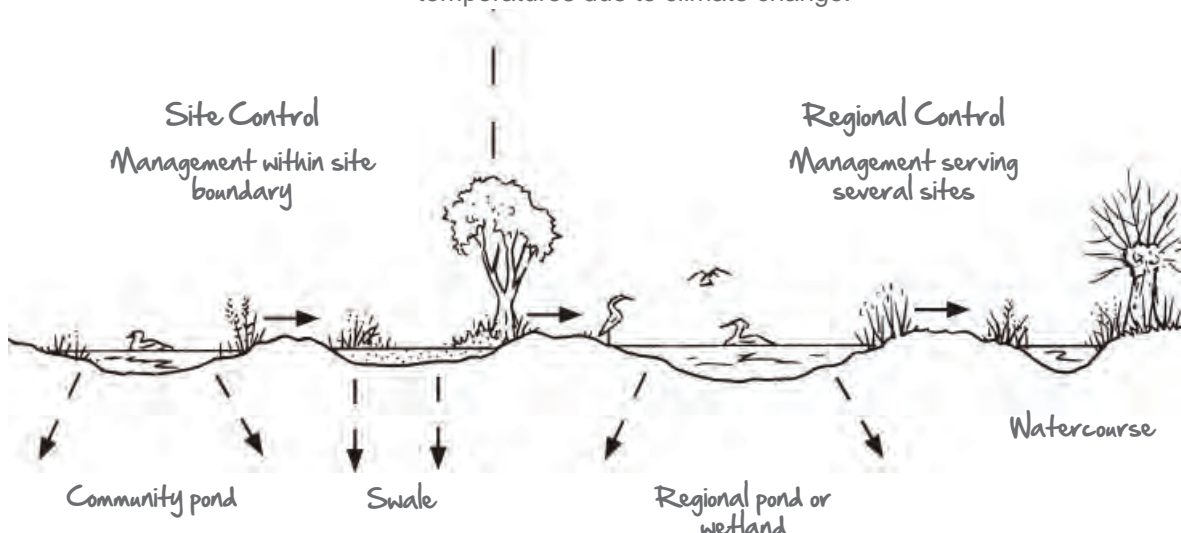
Sustainable drainage systems are now the preferred approach to managing rainfall from hard surfaces and can be used on any site. There are many different SUDS features available to suit the constraints of a site. These features include green roofs, and more natural features such as ponds, wetlands and shallow ditches called swales. Hard engineered elements are often used in high density, commercial and industrial developments. These include permeable paving, canals, treatment channels, attenuation storage and soakaways.

In a well designed SUDS a number of different features are provided in sequence, which is known as the **management train**.

The primary purpose of SUDS is to mimic the **natural drainage** of the site prior to development. This is achieved by capturing rainfall, allowing as much as possible to evaporate or soak into the ground close to where it fell, then conveying the rest to the nearest watercourse to be released at the same rate and volumes as prior to development. Along the way any pollutants, such as metals and hydrocarbons from roads and car parks, are reduced. Water entering a local watercourse is therefore cleaner and does not harm wildlife habitats.

SUDS generally replace traditional underground, piped systems that use grates or storm water drains at street level. If the water is kept on the surface as much as possible the SUDS can provide valuable amenity asset for local residents and create new habitats for wildlife. This also means that any problems with the system are quicker and easier to identify than with a conventional system and are generally cheaper and more straightforward to rectify.

SUDS will become increasingly important to control surface water as rainfall increases because of **climate change**. They can also provide other benefits in developments such as passive cooling, which will again help mitigate any increase in temperatures due to climate change.



However, it is also intended to act as a **design guide**, to assist developers when designing SUDS systems, irrespective of who the adoption body will be as it provides locally specific information on how to integrate SUDS successfully into the **Cambridge landscape**. It sets out a broad landscape vision that should help shape the approach to SUDS in the City, alongside the engineering design.

The guide will be reviewed regularly and updated, as the Council's experience of adopting SUDS grows and as information such as costs needs refreshing. It is possible that in future it could be adapted to become a Supplementary Planning Document (SPD), but this will require going through the formal process and would be set out in the Council's Local Development Scheme, if this was proposed.

Policy 9/3 of the Cambridge Local Plan 2006 requires the implementation of SUDS on the major growth sites. Further guidance on submission requirements is provided in the Sustainable Design & Construction Supplementary Planning Document (both are available at www.cambridge.gov.uk).

Included within the guide are design considerations and essential principles that developers and their consultants will need to take into account when designing and constructing SUDS for adoption by the Council. The aim is to ensure that high quality SUDS are delivered that reduce flood risk. They will also be easy to maintain and maximise the landscape, amenity and biodiversity potential of the scheme. Good quality SUDS should also help developments to adapt to the predicted effects of climate change.

All of the essential requirements for adoption are based on current best practice design guidance and practical experience from schemes implemented around the country. This guide does not seek to replicate or replace the existing body of technical design guidance for the creation of SUDS. Organisations such as British Standards, CIRIA and Interpave provide the information that should form the basis of any SUDS design.

Responsibility will rest with the designers for ensuring that the scheme is designed to the requirements of the Environment Agency and the City Council as local planning authority.



High quality SUDS for a high density development were achieved by early consideration in the design process – Stamford

Who is this Guide for?

This guide is primarily for **developers**, to provide them with the information they need if they would like the City Council to adopt SUDS features within their developments. It is also intended for use by all those involved in the design, construction and future maintenance of any adoptable SUDS. These include:

- Developers
- Engineers
- Landscape designers
- Architects & urban designers
- Development control and other City Council officers
- City Council maintenance team



SUDS can help adaptation of developments for increased future rainfall - Cambridge

A SUDS design team should be multi disciplinary and have:

- a strong **landscape** and **urban design** influence to guide the form and shape of the SUDS, especially in the early stages of the development design.
- **drainage engineers** with the expertise to ensure the proposed design will provide effective drainage.
- **ecologists** providing advice on how to maximise the biodiversity.

An effective SUDS team will work through these issues from early in the scheme development to find the most appropriate way to deal with any conflicting design aims.



SUDS pond increasing local biodiversity – Elvetham Heath

It must always be remembered that, although SUDS can and should enhance the environment, the primary and overriding function is to provide **effective drainage**. This may mean that some common landscape and ecological design requirements have to be adapted to suit the SUDS (e.g. immediate-effect flower rich vegetation will need to be sacrificed to the need for robust grass surfaces that resist erosion in the first instance. Such treatment will develop a good biodiversity over time).

When should it be used?

The guide should be used:

- by developers when developing the brief for their design team to ensure any SUDS that they wish the City Council to adopt are designed and constructed to the requirements of the City Council;
- by the design team responsible for the development masterplan, landscape and surface water drainage scheme to design adoptable SUDS to the requirements of the City Council;
- by development control officers when drawing up S106 contributions for SUDS;
- by City Council officers when inspecting the construction of adoptable SUDS on site and overseeing the commissioning of the scheme; and
- by the City Council maintenance team in developing their maintenance schedules.

What it is hoping to achieve?

The guide seeks to achieve **high quality SUDS** integrated into the overall design of a development and should:

- be aesthetically pleasing
- effectively manage water (including it's quality)
- accommodate and enhance biodiversity
- provide amenity for local residents (ensuring a safe environment)

SUDS offer a great opportunity to see a net gain in biodiversity within a new development as required under PPS 9, linking up with the wider green infrastructure and introducing corridors of wildlife throughout the new developments.

By **integrating** the design of the SUDS throughout the development it offers designers a creative free hand, utilising water in interesting and exciting ways but yet still providing a functioning sustainable drainage system.

Residents local to the system can benefit from safe access to water that can enrich their environment and developers can also benefit from this environment improvement by constructing highly desirable and saleable residences.

Cambridge has its own **unique** design considerations being one of the most arid parts of the UK, having limited gradients and having a higher than average surface water flood risk.

This guide provides the first stepping-stone for any SUDS designer, providing a landscape background and an achievable approach to a successful system.

adoption process



Adoption process

The adoption process will follow the same general principles that are proposed in The SUDS Manual (CIRIA C697) for the design of SUDS. It will run parallel with the normal development and drainage design and does not require any significant extra work to be carried out. The adoption process is set out in the table below. A key element to successful SUDS is integrating the design into the development master plan at an early stage. Good SUDS design also requires early and effective consultation with all parties that are involved in the approval process.

Planning stage		Development process/ required information (from the SUDS manual)	Drainage design process (from the SUDS manual)	Adoption process
Pre application discussions and submission of FULL application	Pre application discussions and submission of outline application	Submission of FRA and drainage strategy in line with PPS25. Identification of likely SUDS methods to satisfy planning policy	Conceptual drainage design flow routes through the site and storage locations. Outline drainage design and drainage impact assessment. Demonstrate storage areas and volumes, conveyance routes and controls.	Initial consultation with Cambridge City Council on adoption - locations and design requirements
↓	↓	↓	↓	↓
Negotiation of Full submission and Section 106 discussions	Negotiation of Outline submission and Section 106 discussions	Submission of any amendments (if necessary)	Submission of any amendments (if necessary)	Agreement with City Council of outline drainage design and agreement to adopt in principle (or option to adopt in principle)
↓	↓	↓	↓	↓
Outline permission granted and Section 106 agreed				
↓	Design coding	Principles of the detailed design agreed site wide	Principles of the detailed design agreed site wide	Agreement with the City Council that the detailed design is compliant with adoption guide and S106 agreement
	↓	↓	↓	↓
	Reserved matters applications	Detailed plans in line with agreed design code	Final submitted design with location and size, depth, etc. compliant with approved detail above	Submitted design compliant with adoption guide
↓	↓	↓	↓	↓
Full approval/ S106 approval	Reserved matters approval			
Construction of development	Construction of development	Discharge of any outstanding conditions	Construction of drainage system	Verification of construction to agreed design and specification
↓	↓	↓	↓	↓
Formal adoption of SUDS and monies paid to the City Council as per the trigger/amount agreed in the S106				

Adoption model

The City Council will normally adopt SUDS that are located in public open spaces. These will generally be landscape features such as ponds, wetlands and swales. They will not adopt SUDS that are located within private property, although they will require source control features to be provided to any adopted scheme and these are usually located in private areas (e.g. soakaways to individual houses where appropriate, permeable driveways, etc.).

As the City Council does not generally adopt highways, it will not therefore adopt SUDS located within the highway. However, it will work with Cambridgeshire County Council, which is the responsible agency to promote the use of SUDS within the highway, which currently the County Council will not adopt if non-highway drainage is to be accommodated.

Where sites span the city boundary into the neighboring authority of South Cambridgeshire, Cambridge City Council would consider adopting any SUDS within the public open space if the majority of the public open space falls within the City boundary (subject to agreement with SCDC).

The adoption model for Cambridge is shown in the plan and table on the following page.

Type	Features	Typical locations	Adoption/ ownership
SUDS in open space	<ul style="list-style-type: none"> Ponds and wetland Infiltration and retention basins Filter strips Swales Rain gardens (bioretention)Filter drains Canals and rills 	Public open space	<p>Will be adopted by Cambridge City Council if located in public open space, where this is being adopted by the Council.</p> <p>This is unlikely to include large commercial or industrial sites, as the Council is unlikely to be adopting public open space within these types of development.</p> <p>Where the City Council adopt any feature, it will also adopt all control structures that are located in the open space (providing they meet adoption criteria).</p>
SUDS in roads	<ul style="list-style-type: none"> Filter strips Swales Rain gardens (bioretention) Filter drains Canals and Rills 	Roads	<p>Will be adopted by the City Council if located in public open space and not provided solely for the purpose of highway drainage.</p> <p>May be adopted by the County Council where SUDS takes only highway drainage.</p> <p>Adoption route must be identified if incorporated into management train above SUDS adopted by City Council</p>
Private SUDS	<ul style="list-style-type: none"> Green roofs Permeable driveways and parking Soakaways Proprietary treatment systems Geocellular storage (preferably combined with rainwater harvesting) 	Within the boundaries of private properties	<p>Located in privately owned land and therefore not adopted by the City Council.</p> <p>Management responsibility must be identified and agreed if discharging into SUDS adopted by the City Council.</p>

Permeable surfaces may also be used in roads subject to the agreement of the County Council.

How to use the Guide

The introductory sections cover the broader issues involved in designing a comprehensive and successful SUDS system, before focussing on individual SUDS features in subsequent sections. There is particular focus in these early sections on Cambridge specific design opportunities and constraints.

The landscape section aims to provide a starting point for developers and their design team to understand the context in which they will be designing a SUDS system.

Detailed information on the adoption requirements for each type of SUDS feature that the City Council will consider for adoption is provided in the subsequent individual sections. Each individual section relates to a particular type of SUDS feature and contains:

- a description of the feature, what it is for and how it works;
- Cambridge specific design requirements;
- practical issues and solutions;
- maintenance requirements

A separate section contains all the essential design and construction requirements if the SUDS are to be adopted by the City Council.

Within the appendices are costs for the purposes of S106 negotiation.

The final sections are of a more general nature and may apply to any or all of the SUDS features. A checklist of the adoption requirements for easy reference is provided in Appendix D.

“Oxfordshire, like most of the country suffered flooding in July 2007. We also had further flooding this year in January, February and June 2008.

None of the developments that have permeable surfaces or other SUDS flooded.

This makes real sense for the County officers, councillors and the people who live on these developments.”

Barry West, Highways Adoption Officer,
Oxfordshire County Council speaking at Landform

FAQs about SUDS

I am unable to utilise infiltration because of clayey soils, how can SUDS be used?

Soakaways and other infiltration methods may not be suitable but there are many other methods that can be used in clayey soils, e.g. swales, ponds, wetlands. Ground conditions should not prevent the use of SUDS but may affect the choice of system. See Section 2.

Are SUDS a health and safety risk?

No, SUDS that are well designed to be shallow and with gentle slopes should not pose a significant health and safety risk. See health and safety section (Section 13).

Can SUDS be used in high density developments?

Yes; however, the nature of a development will affect the type of SUDS that are used (See Section 2). There are many examples of SUDS in high density developments in the UK. Permeable surfaces (see Section 10) and multi functional spaces (using public open space to store water) are usually an important aspect of the SUDS in these types of development.



SUDS in Sheffield during the 2007 floods – there was no flooding from this system and it effectively managed runoff in rainfall that far exceeded the design storm, because it had a management train.

Can SUDS be used on brownfield sites?

Yes, but the type of SUDS that can be used may be constrained by the nature of any contamination. Infiltration may not be possible. See Section 2.

Can SUDS be used in high flood risk areas?

Yes, but the design must ensure that storage for development runoff is available during river or other flooding events. SUDS must be located outside the floodplain. See Section 2.

Can SUDS be located in private areas?

Yes. some methods are appropriate (e.g. permeable driveways) but responsibility for management of the systems must be identified. Normally responsibility should rest with a management company rather than individual house owners.

SUDS techniques that are more strategic (e.g. swales serving more than one or two properties) should not be located in private gardens.



Low flow channel through public park in Malmö.