Central Bedfordshire Sustainable Drainage Guidance

Adopted April 2014, Updated May 2015

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Image courtesy of Land Use Consultants Ltd

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INTRODUCTION

Image courtesy of Land Use Consultants Ltd

With ever-increasing urbanisation, the ability for precipitation to penetrate the hard paved surfaces to the groundwater below is inhibited. This results in increased flood risk, overstressed combined sewer infrastructure, and reduced ability to replenish aquifers. Sustainable Drainage Systems (SuDS) mitigate these issues by replicating natural processes to manage rainfall.

There are many benefits to using SuDS to manage surface water runoff. Primarily, SuDS filter and attenuate surface water, reduce pressure on infrastructure, have low construction cost, provide ease of maintenance and where geological conditions permit, replenish groundwater supplies through infiltration. For SuDS which incorporate vegetation, however, there are ancillary benefits, which contribute in other ways to the community. These include:

- Sequestered carbon in plants and trees as they grow
- Improved thermal comfort resulting from evapotranspiration
- Increased biodiversity through ecological enhancement
- Opportunities for recreation and relaxation, particularly in larger green spaces
- Increased property values
- Improved air quality

Well designed SuDS are now the preferred surface water management strategy and as described in further detail in this document are expected as part of all new developments in Central Bedfordshire. Incorporating SuDS in developments, however, should also be viewed as an opportunity to realise many of the benefits listed above, and are an easy way to obtain the support of the local community and local authority.

THE VISION

Through the reintroduction of more natural drainage systems, the management of water can move from the realms of a hidden necessity to becoming part of everyday life and an asset to be celebrated. Thinking of water management in this way allows for innovation and creativity to aid design and maximise the benefits that SuDS can bring to Central Bedfordshire.

While well designed SuDS can provide effective water management and drainage, it is their ability to offer attractive solutions that sets them apart. SuDS can enhance urban form and the public realm, and also complement rural landscapes and their open spaces. Central Bedfordshire's rich and varied landscape provides the opportunity to create an equally eclectic mix of SuDS schemes.

Within the unitary authority are the Chilterns Area of Outstanding Natural Beauty, National Nature Reserves and Sites of Special Scientific interest. Sustainable drainage systems can help enhance biodiversity and landscape character. Working with the landscape to improve the surrounding area can also help developers create desirable, affordable, and profitable properties.

This guidance aims to convey how SuDS can deliver multiple benefits beyond just managing flood risk – from improved health and wellbeing of the communities they serve to increased biodiversity, habitat creation and recreation to cleaner water resources and more valuable developments. The incorporation of SuDS also has the ability to improve access to local natural green spaces, which in turn has a positive impact on recreation, and ultimately health and wellbeing. It is a resource for any developer or SuDS designer looking to capitalise on all the opportunities SuDS can offer in Central Bedfordshire.

We will update this Supplementary Planning Document (SPD) periodically in light of any amendments or policy changes at the Local or National Level. This Guidance was adopted in April 2014 and updated in May 2015 to reflect the changes relating to SuDS and how they are considered as part of the planning process.

Image courtesy of Land Use Consultants Ltd

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SuDS in Central Bedfordshire will:

Provide multiple benefits

Providing multiple benefits to the site, local area, and unitary authority through the consideration and inclusion of multi-functioning solutions that are of the highest standards of design.

Be attractive and locally sensitive solutions

Providing attractive and locally sensitive solutions, which enhance local character and biodiversity.

Be designed for access and recreation

Creating accessible, attractive spaces that can be used for recreation and relaxation, promoting health and wellbeing.

Be designed for longevity and ease of maintenance

Creating well designed SuDS with longevity and ease of maintenance built in from the beginning; ensuring functional and cost effective systems throughout their operational lifetime.

HOW TO USE THIS DOCUMENT

This Supplementary Planning Document provides technical guidance on the application of SuDS within Central Bedfordshire. It has been created to be a comprehensive resource for SuDS reference and policy development for decision makers and designers, developers and partner organisations to support the application of SUDS in a range of contexts across Central Bedfordshire. This document should be read in conjunction with information signposted throughout the Document, including national policy and guidance as well as industry best practice.

A wide range of people will need to access the information included in this document. Information required, however, will not be generic across the board. As such, the document has been split, indicated in the illustration to the right, to allow users to "hop into" the document at relevant points and easily find the information that they require.

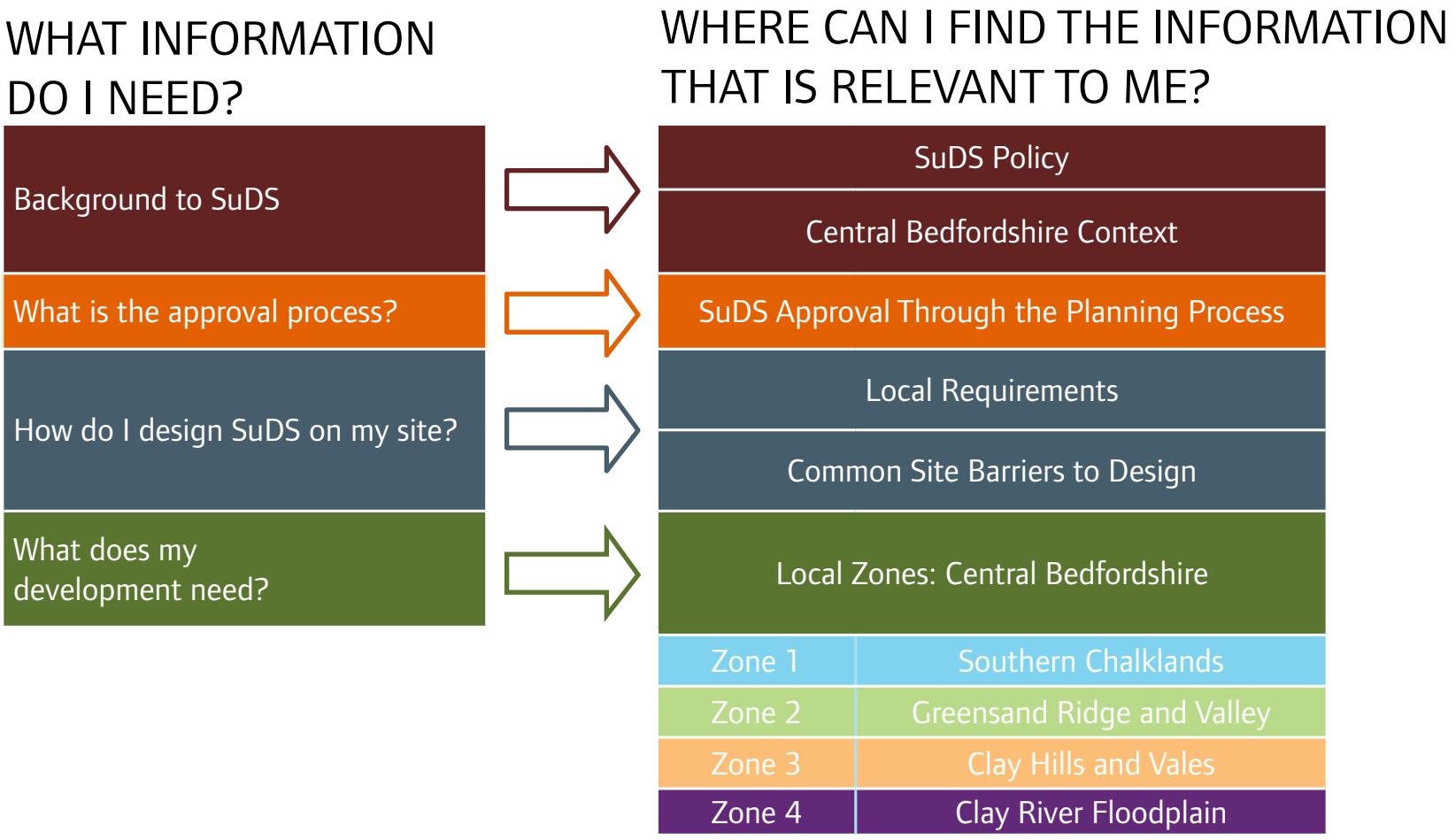


Image courtesy of Land Use Consultants Ltd

1 BACKGROUND

Image courtesy of Land Use Consultants Ltd

POLICY CONTEXT

1.1 EU Water Framework Directive (WFD)

The EU Water Framework Directive (WFD) was put in place in 2003, and looks to bring together standards and objectives for water quality improvement across Europe. Member countries implement the WFD into their own legislation, in the UK this includes (among others) the Flood and Water Management Act 2010 and River Basin Management Plans.

The WFD aims for water bodies to achieve 'good status' by 2015 and SuDS are likely to play a significant role in reducing pollution and achieving this objective.

The WFD acknowledges that surface water quality is critical to the overall quality of water in our streams, rivers and groundwater, and favours naturally occurring and sustainable processes such as filtration and attenuation to control run off and the effects of 'diffuse pollution.' It also requires management of discharges of surface run off, which SuDS will play a vital part in.

1.2 Pitt Review 2007

"The Pitt Review: Lessons Learned from the 2007 Floods" was commissioned in response to the extreme flooding experienced across the UK. The review recognised that the frequency of such events is likely to increase and concluded that a major rethink was required as to how the UK manages rainfall and surface water. In the wake of the review, proposals to increase the uptake of sustainable drainage systems in new developments were made.

The report made a series of recommendations:

- Wider brief for Environment Agency (EA) and Local Planning Authorities (LPA) to strengthen technical capabilities. Protect communities through robust building and planning controls;
- Presumption against building in high flood risk areas, with consideration for all sources of flooding. Developers should make a full contribution toward the construction and maintenance of required flood defences; SuDS are considered part of this;
- Restrict developers and house owners ability to use impermeable surfaces;
- Remove the automatic right to connect to sewerage systems as a point of course for new developments; and
- Learn from good experience.

In recognition of the recommendations made in the Pitt Review, the Flood and Water Management Bill became an Act in 2010, providing better and more comprehensive management of flood risk for people, homes and businesses.

Signpost:

EU Water Framework Directive
http://ec.europa.eu/environment/water/water-framework/index_en.html

The Pitt Review, 2007
http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%2520pdf.pdf

1.3 Flood and Water Management Act 2010 (amended 2012)

The Flood and Water Management Act (FWMA) came into effect in 2010 with the goal to reduce flood risk and strengthen the role that building control and planning can play in surface water management.

Under the Act Unitary/county councils took on new responsibilities as 'Lead Local Flood Authorities' for their areas with new powers to manage flood risk from ordinary watercourses, surface water and groundwater. As such they are required to produce a Local Flood Risk Management Strategy to assess flood risk and propose measures to mitigate these, including the application of SuDS. The strategy for Central Bedfordshire was adopted in 2014 and sets out objectives to ensure flood risk is mitigated. Objective 2 of the strategy states that new development should look to reduce the causes and impacts of flooding and that all development uses SuDS as normal practice, and where appropriate safeguard land which is needed for current and future flood management.

The amendments to the FWMA also amend the Land Drainage Act; permission is still required from the drainage authority for any works affecting the flow of water in a watercourse regardless of need for planning permission.

Schedule 3 of the Act set out the requirement for a Unitary Authority/County Council to establish a SuDS Approval Body to determine drainage applications submitted for new developments, this has now been superseded by new planning laws on SuDS introduced in a written statement by the Secretary of State for Communities and Local Government in December 2014. However, section 27 of the Act still gives "Lead Local Flood Authorities, District Councils... a duty to aim to make a contribution towards the achievement of sustainable development when discharging their flood or coastal erosion risk management functions". The FWMA also stipulates that in designing and implementing SuDS, consideration should be given to ensuring that they: reduce damage from flooding, improve water quality, protect and improve the environment, protect health and safety and ensure stability and durability of drainage.

Signpost:

Flood and Water Management Act
http://www.legislation.gov.uk/ukpga/2010/29/contents

1.4 Written Ministerial Statement 2014

The written statement made on 18 December 2014 by the Secretary of State for Communities and Local Government, made clear the Government's expectation that "sustainable drainage systems will be provided in new developments wherever this is appropriate". The statement made changes to the National Planning Policy Framework (NPPF) which in turn made SuDS a material consideration while determining planning applications for major development. These changes came into effect on 6 April 2015. The statement goes on to say that "all new developments in areas at risk of flooding should give priority to the use of sustainable drainage systems".

The LPA is now responsible for the enforcement of the legislation, ensuring that new developments meet the Defra prepared National Standards (Non-statutory technical standards for sustainable drainage standards, March 2015) and local requirements for SuDS. This role will require the LPA to approve SuDS before construction can commence.

1.5 National Planning Policy Framework

The National Planning Policy Framework (NPPF) focuses on localism and presents a shift to a "presumption in favour of sustainable development." The NPPF aims to tackle a multitude of issues, a key area being flood risk and how development can improve resilience and reduce vulnerability within its boundaries and to the wider area. The NPPF recognises the opportunity for open spaces, including SuDS, to perform multiple functions which will bring a multitude of benefits including health, social and cultural wellbeing to local residents. Through the use of visually attractive and appropriate landscaping SuDS can help contribute to the green infrastructure to create a clear sense of place, reflecting the local character of the area.

The NPPF was amended following the ministerial statement on SuDS and states that "when determining planning applications... development [must be] appropriately flood resilient and resistant" (para. 103), and not increase flood risk elsewhere offsite, regardless of size or type, with a priority given to sustainable urban drainage systems (SuDS). Alongside the changes to NPPF the Development Management Procedure Order was amended, making Central Bedfordshire Council as LLFA a statutory consultee to the planning process on the management of surface water, starting from 15 April 2015.

Consequently, developers need to provide SuDS on major development where appropriate (the NPPF acknowledges that not all new developments can practicably include SuDS), while paying due regard to the following:

- Planning practice guidance, which has been updated to reflect these changes.
- Non-statutory technical standards for the design, maintenance and operation of SuDS which have been published by Defra.

Determining whether SuDS are inappropriate is left to the discretion of the LPA to determine in consultation with all relevant parties. The operational and maintenance plans and funding to run SuDS will be agreed and secured through the use of conditions and obligations enforced by the LPA.

1.6 Planning Practice Guidance (PPG)

Supporting guidance to the NPPF is provided in Planning Practice Guidance (PPG) under 'Flood Risk and Coastal Change', which requires the LPA to be satisfied that there are clear arrangements in place for the ongoing maintenance of the SuDS, once completed. The LPA may also impose conditions in planning consents or planning obligations in section 106 agreements to secure the delivery of such arrangements, of which the developer has a high degree of flexibility over. The suitability of the proposals will be dictated by a range of factors, including the nature of the development undertaken, the identity of the occupiers, the structure and features of the SuDS and the financial and technical resources required and available for long-term maintenance.

PPG provides further support to building in flexibility with regard to climate change into new developments. Table 5 of the Technical Guidance indicates that surface water management on new development allows for an increase in peak rainfall intensity, which means adding an extra amount to peak rainfall (20% for commercial development, 30% for residential). Under water supply, wastewater and water quality, the PPG reinforces the need to consider the implications of new development on water quality, water cycle management as well as biological elements.

Signpost:

Ministerial Statement, December 2014.
http://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

National Planning Policy Framework, 2012.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Planning Practice Guidance
http://planningguidance.planningportal.gov.uk/

1.7 Non-Statutory Technical Guidance. Sustainable Drainage Systems, Defra. March 2015

Technical guidance has been developed by Defra to sit alongside PPG to provide non-statutory standards as to the expected design and performance for SuDS. In March 2015, the latest guidance was released, providing amendments as to what is expected by the LPA to meet the national standards.

The guidance provides a valuable resource for developers and designers outlining peak flow control, volume control, structural integrity of the SuDS, and flood considerations both within and outside the development as well as maintenance and construction considerations. The LPA will make reference to these standards when determining whether proposed SuDS are considered reasonably practicable.

1.8 CIRIA SuDS Manual

The CIRIA (Construction Industry Research and Information Association) SuDS manual provides comprehensive direction on the planning, design, construction and maintenance of SuDS in developments. It also provides additional information including landscaping, waste management, costs/benefits, and promoting community engagement.

The manual outlines the ways in which SuDS provide more sustainable solutions than conventional drainage methods and stresses the importance of utilising a "management train" - connecting several SuDS elements together - to reduce flow rates, runoff volumes and pollution in a sequential manner.

The importance of evaluating the needs of stakeholders is outlined in order to influence decisions on options available in SuDS.

The manual also outlines the ability to maintain SuDS through standard practice, due to their visibility and ease of comprehension.

Signpost:

Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

CIRIA SuDS Manual
http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

1.9 Local policy context

Development Strategy for Central Bedfordshire, Submitted 2014

The submitted Development Strategy has been prepared to be in line with the NPPF and the Flood and Water Management Act, as such the framework is developed with the assumption in favour of sustainable development built into its core values and aspirations.

In Central Bedfordshire the requirement for the inclusion of SuDS is extended beyond the requirement for major developments as set out in the NPPF, but also includes minor developments; permitted development is also encouraged to integrate SuDS measures.

SuDS have been incorporated into the general adaptation policy which aims to ensure that all new development, not just major development, integrates SuDS to manage onsite surface water and is resilient to a changing climate. A focus on resilience and adaptation is recognised in Central Bedfordshire's Local Flood Risk Management Strategy, which was impacted by the 2007 flooding events affecting many parts of the unitary authority.

With respect to SuDS, the emerging development strategy for Central Bedfordshire has two main focuses. As per Policy 48: Adaptation, it is important to first focus on using SuDS as a means to prevent surface water flooding. Second, the potential to use SuDS to deliver multiple benefits, which extend beyond flood risk. The importance of delivering high quality design with multiple benefits is also supported by the unitary authority's revised draft design guide, Design in Central Bedfordshire: A guide for development. Policy 49: Mitigating Flood Risk, also supports the need for SuDS to improve the quality of water bodies and positively impact on the water environment.

SuDS can also satisfy other local policies within the emerging Development Strategy, such as: protect and enhance existing open space (Policies 39 – 41); contribute to the requirement for all developments to be designed to a high quality (Policy 43); improve water quality and protect health (Policy 44); sequester carbon and mitigate climate change impacts (Policy 47); and maintain Central Bedfordshire's rural character (Policy 50).

Signpost:

Development Strategy for Central Bedfordshire: submitted 2014.
http://www.centralbedfordshire.gov.uk/planning/strategic-planning/development-strategy.aspx

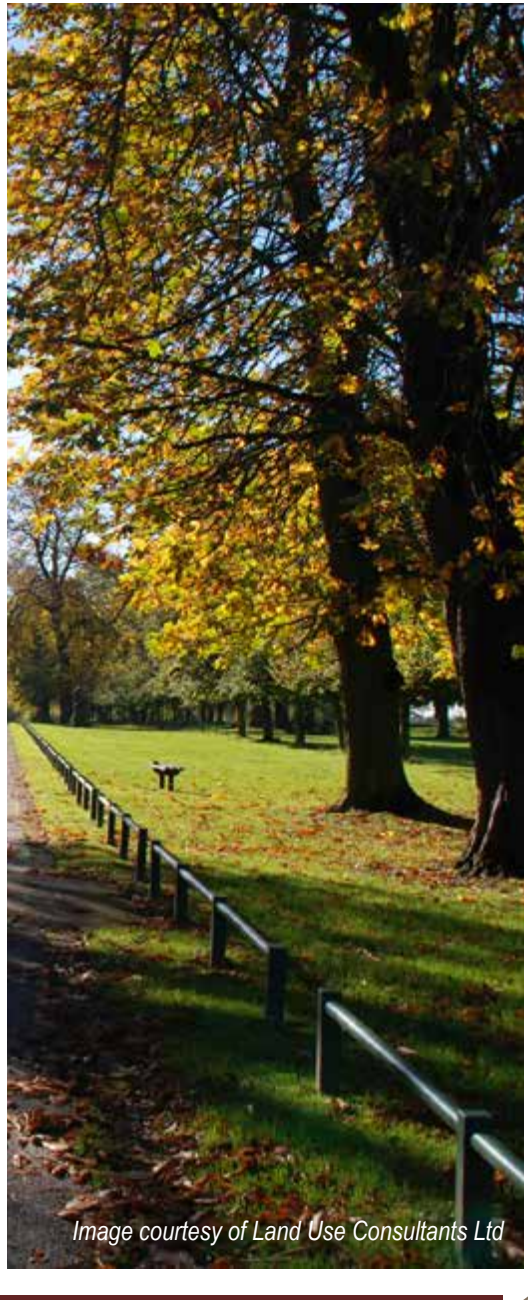


Image courtesy of Land Use Consultants Ltd

1.10 The Central Bedfordshire Context

Central Bedfordshire's Joint Strategic Needs Assessment (November 2013) noted that climate change represents one of this century's largest health threats. Research suggests that increased incidents of extreme flooding, heat-waves and drought have will become more prevalent.

Vulnerable citizens, such as children and the elderly, are more likely to bear the consequences of more severe weather. With climate change already contributing to a widening chasm in health inequality, it will be important to ensure health and social wellbeing for all citizens is the cornerstone in all climate resilient solutions adopted.

Delivering well designed sustainable drainage not only mitigates the impacts of climate change, it also improves access to greenspace. Through attenuating surface water runoff, and infiltrating it into the groundwater below, SuDS reduce flood risk. Despite Central Bedfordshire's predominantly rural nature not everyone is able to access natural open spaces. When also designed to be multi-functional, SuDS can provide the greenspace needed to promote higher levels of physical activity. For these reasons SuDS provide an opportunity to address a number of Central Bedfordshire's health issues.

To aid in the delivery of contextually appropriate SuDS, the Landscape Character Assessment (LCA) provides an overview of Central Bedfordshire's landscape, and details the landscape types, their formation and how they may change in the future. The LCA serves to ensure development considers the existing context and does not undermine the character or value of the area. The LCA is critical to ensuring that SuDS are delivered with consideration to the context of the various landscape character areas across the unitary authority. The Design Guide for Central Bedfordshire details how development should consider the various landscape character areas including elements, such as: settlement form, building typology, and building materials. Understanding the importance of the unitary authority's various landscapes, this guidance has tailored its approach based on 'SuDS Zones', which incorporate landscape character.

Internal Drainage Board

Under the Land Drainage Act 1991 (as amended by the 1994 Act), Drainage Boards were given powers to undertake works on any watercourse under their jurisdiction other than the "Main River." Drainage Boards may also undertake works on watercourses outside their drainage district in order to benefit the district.

Within Central Bedfordshire there are two drainage districts, (Beds and Ivel Board and Bucks and Ouzel) which fall under the jurisdiction of Bedford Group of Drainage Boards (IDBs). Any development which will impact on waterways within the IDBs' jurisdiction will need to consult with them. The main rivers, however, fall under the jurisdiction of the Environment Agency.

Importantly, this guidance will also complement existing work already completed in the Marston Vale Surface Waters Plan, which outlines policies for the sustainable development of growth in the area.

Signpost:

Joint Strategic Needs Assessment for Central Bedfordshire
http://www.centralbedfordshire.gov.uk/health-and-social-care/jsna/joint-strategic-needs-assessment-jsna.aspx

Central Bedfordshire Landscape Character Assessment:
http://www.centralbedfordshire.gov.uk/environment/natural-environment/natural-environment-landscape-character-assessment.aspx

Design Guide for Central Bedfordshire:
http://www.centralbedfordshire.gov.uk/Images/Item%203%20-%20Design%20Guide_tcm6-56206.pdf

Bedford Group of Internal Drainage Boards website.
http://www.idbs.org.uk/legal-financial/byelaws/

Marston Vale Surface Waters Plan (2002)
http://www.centralbedfordshire.gov.uk/Images/The%20Surface%20Waters%20Plan_tcm6-13659.pdf

1.11 Biodiversity, Ecology, and Habitats

Consideration for landscape and biodiversity is critical to delivering contextually appropriate SuDS schemes.

The ecological needs vary across Central Bedfordshire, and SuDS will need to be tailored to conserve, restore, and enhance local biodiversity and priority habitats. While there is a concentration of sensitive landscape in the Chilterns, there are multiple Sites of Special Scientific Interest (SSSIs) and habitats of principal importance throughout the unitary authority.

In Central Bedfordshire the biodiversity needs vary from grasslands, to watercourses water bodies, as well as associated wetlands. One of the most important needs in Central Bedfordshire is reconnecting fragmented habitats resulting from a long history of farming. In fact, farmland - including hedgerows, ponds, ditches, improved grassland and road verges - is the most common land use and habitat in Central Bedfordshire.

There are also a range of woodland habitats across the unitary authority. In the south, beech woodland is prominent. Through the middle of the unitary authority, underlain by clay, a variety of oak species are present. Wet woodland habitat is a scarce habitat, an example would be the willow woods in the Tiddenfoot Waterside Park. In the clay hills and vales plantation woodland, new broad leaved woodland, ancient semi-natural woodland and wet woodland can be found. In the clay valley, woodland is less prominent – the largest being the Stanford Plantation.

Various grasslands feature prominently throughout Central Bedfordshire, including a significant amount of improved and semi-improved neutral floodplain grassland, as well as low land calcareous grassland, which is considered to be a national priority habitat.

Signpost:

Rebuilding Biodiversity in Bedfordshire and Luton
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=bedslife_rebuild

Biodiversity Opportunity Mapping
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=bedslife_rebuild

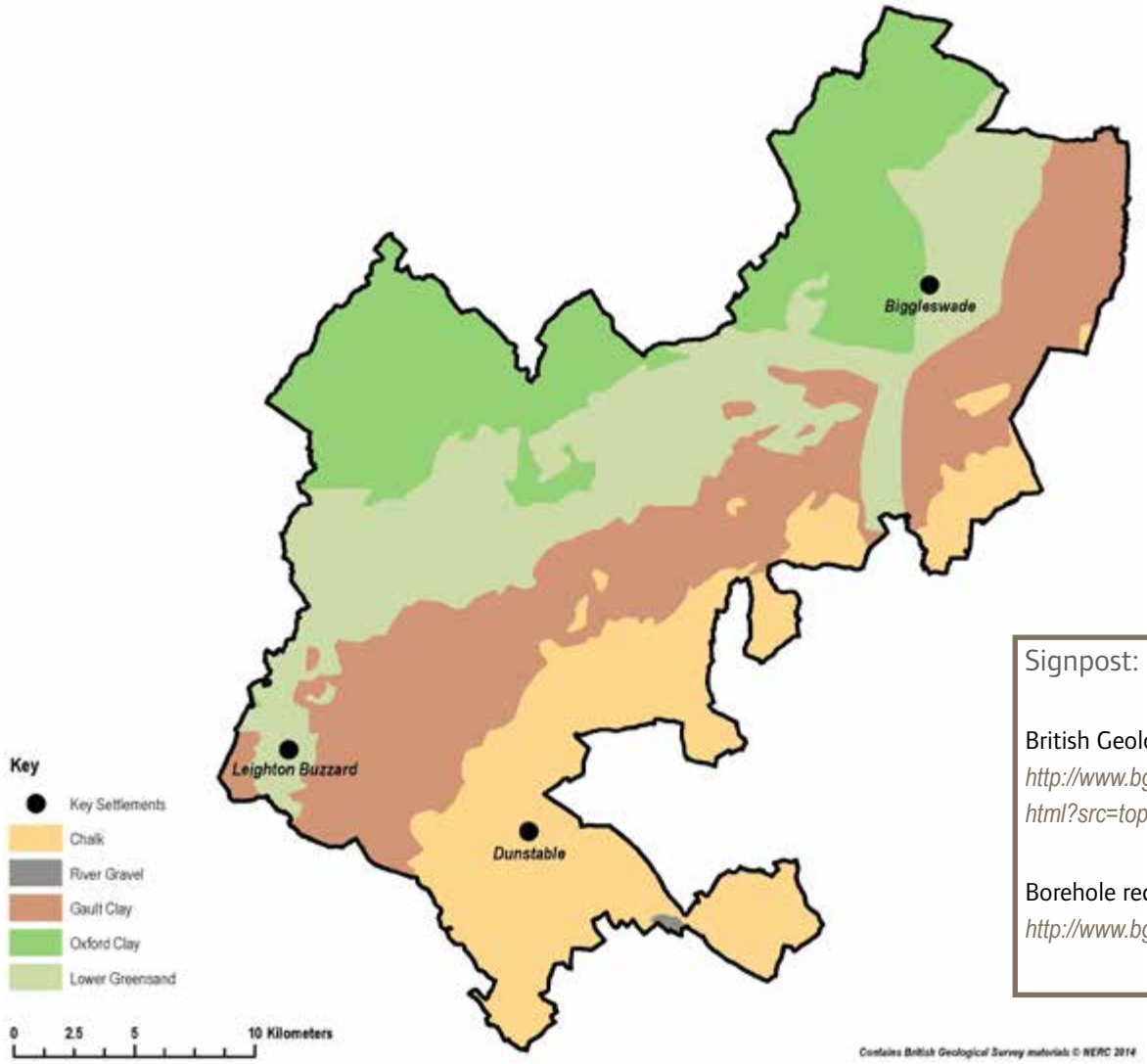
Image courtesy of Land Use Consultants Ltd

1.12 Geology

The Geology of the area is broken into lateral strata stretching from west to east. The southern areas largely consist of chalk, in line with the areas of higher elevation which make up part of the Chilterns; however, small pockets of river gravel are also found here. A ridge of gault clay stretches across the entire width of the area and makes up part of the West Anglian Plain, separating the chalk area from the strata of lower greensand found to the north. The northern border is for the most part made up of Oxford Clay. Following the course of the River Ivel and River Ivel Navigation are deposits of river gravel and alluvium stretching from the northern tip of the area down south and also to the west.

In areas underlain by chalk and greensand infiltration to the water table below is possible and should be a priority. Where possible in these areas, SuDS should be designed for recharging groundwater. Unlike chalk, clay is poor for allowing water to infiltrate to the groundwater below – SuDS in these areas will need to manage water on the surface, focusing on attenuating and filtering water before returning it to a receiving body of water downstream.

a Geology in Central Bedfordshire



Signpost:

British Geological Survey maps
http://www.bgs.ac.uk/products/onshore/home.html?src=topNav

Borehole records can be found here:
http://www.bgs.ac.uk/GeoIndex/wms.htm

1.13 Topography

Central Bedfordshire as an area has a varied topography, but it can be broken down into two main topographical areas. To the south are the chalk Chilterns which at 260-metres above sea level they are the highest points in Central Bedfordshire.

Along the greensand ridge, to the north of the Chilterns land falls down to 89-118 metres, which is largely maintained along the ridge stretching from the west to the east.

The areas to the east and north of the Unitary Authority, Oxford and Gault clays, are generally flatter and low-lying with elevations between 21 and 60 metres, with even lower lying land found in the most northern areas.

1.14 Water Resources and Rainfall

Similar to many parts of the UK, water resources in parts of Central Bedfordshire are already under pressure (Central Bedfordshire Climate Change Risk Assessment, 2012). Projections suggest that water supply will continue to be constrained, with the potential for a 30% reduced output by the 2080s.

With an average annual rainfall of approximately 600mm, Central Bedfordshire is also one of the driest parts of the UK. By comparison, the annual average rainfall for the UK is approximately 1,200mm. While month-to-month precipitation is relatively similar in the unitary authority, there are more rainy days in autumn and winter, and fewer but heavier rainfall events during the spring and summer.

Water quality is also an issue. The majority of Central Bedfordshire falls within the Anglian River Catchment, which has been designated a nitrate vulnerable zone. This means the level of nitrates in the waters either exceed or at risk of exceeding safe levels of nitrates. The high nitrate levels can result in algal blooms, which can devastate aquatic ecosystems. For this reason, there is a greater need for SuDS near waterways to focus on removing pollutants.

The southern tip falls under the Lea sub-catchment of the Thames catchment area. The Upper Lea Valley is targeted as an area for practical conservation to enhance the setting and quality of the river. The river corridor provides the opportunity for educational and as well as recreational uses. The location of the sewage works on the river may be an opportunity to improve water discharge from the facility through the use of SuDS.

Signpost:

Central Bedfordshire Climate Change Risk Assessment, 2012:
http://www.centralbedfordshire.gov.uk/Images/Central%20Beds%20Climate%20Change%20Risk%20Assessment%20Apr%2012_tcm6-31868.pdf#False

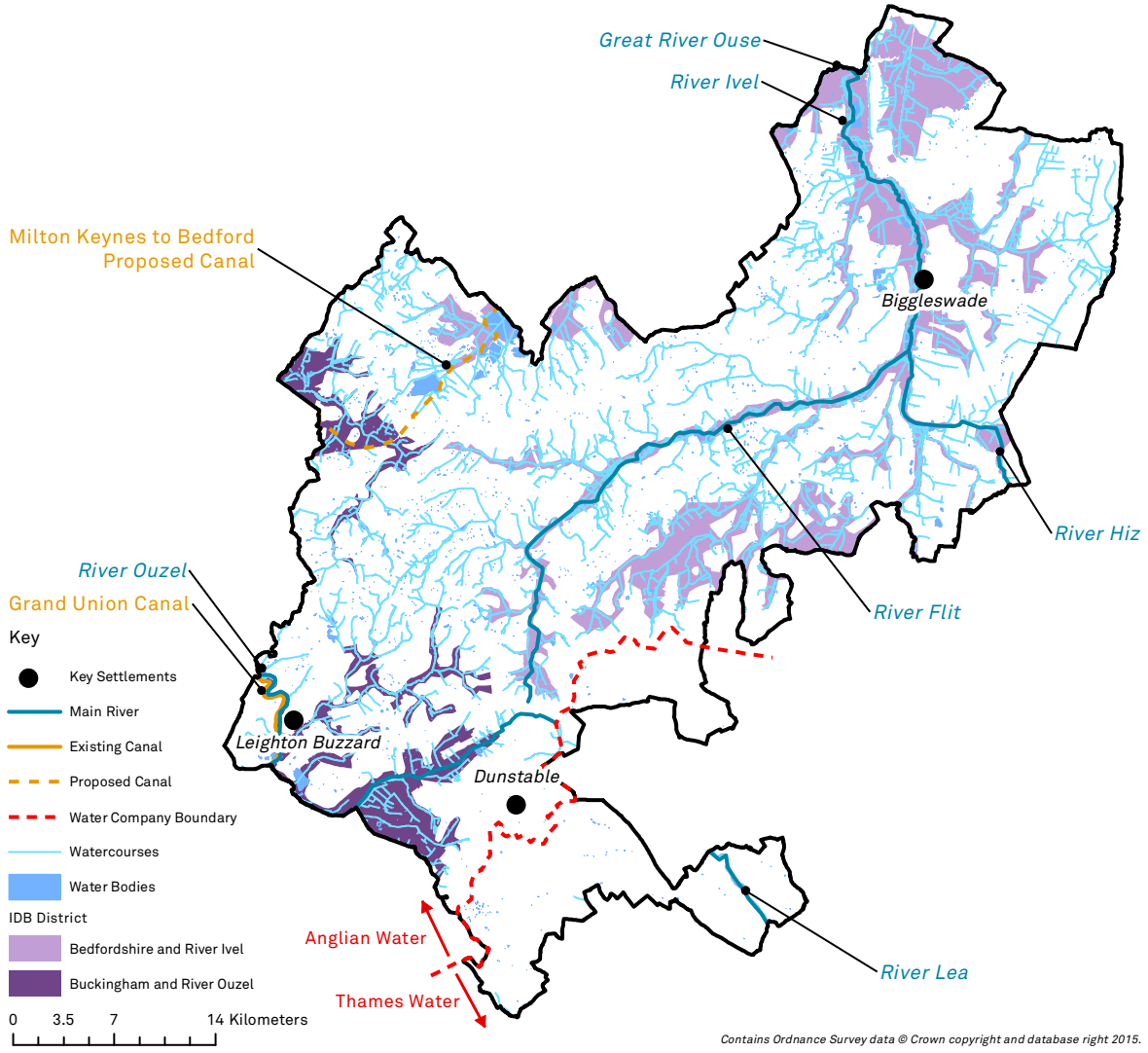
Image courtesy of Land Use Consultants Ltd

1.15 Presence of water features

Central Bedfordshire is rich with watercourses and water features. Multiple rivers flow through the Unitary Authority, including the River Great Ouse, River Flit, River Ivel, River Hiz, River Lea and the River Ouzel. To the South, in the Luton area is the River Lea, which is partly culverted through the city. Several lakes, such as Stewartby Lake as well as other areas of open water such as reservoirs are located within the area.

Wetlands are another prominent water feature in Central Bedfordshire. The Grand Union Canal is a significant area of open water with associated wetland habitats. The presence of water features in Central Bedfordshire requires that they are considered in the design of SuDS - it is important that runoff entering these features does not contaminate them. The features also offer the opportunity to, where sufficient research and testing has been carried out, make use of them as part of the wider SuDS systems.

b Water features in Central Bedfordshire



1.16 Flood risk

From the two SFRAs there are flood events recorded from as far back as 1875 with more recent flood events in 2002, 2003, 2005 and 2006 - causes of these events range from blocked culverts to main river flooding. Current day flood risk has been mapped on the pages to follow.

Fluvial Flood Risk

Fluvial flooding occurs when a watercourse is overwhelmed by the amount of water draining into it causing the watercourse to overtop its banks.

Generally rivers, watercourses and the functional floodplain, together with land having a 1 in 100 or greater annual probability of river flooding is in flood zone 3. In Central Bedfordshire, particularly along the River Ivel to the north and south of Biggleswade, there are some areas in flood zone 2, where the annual probability of river flooding is between 1:100 and 1:1000.

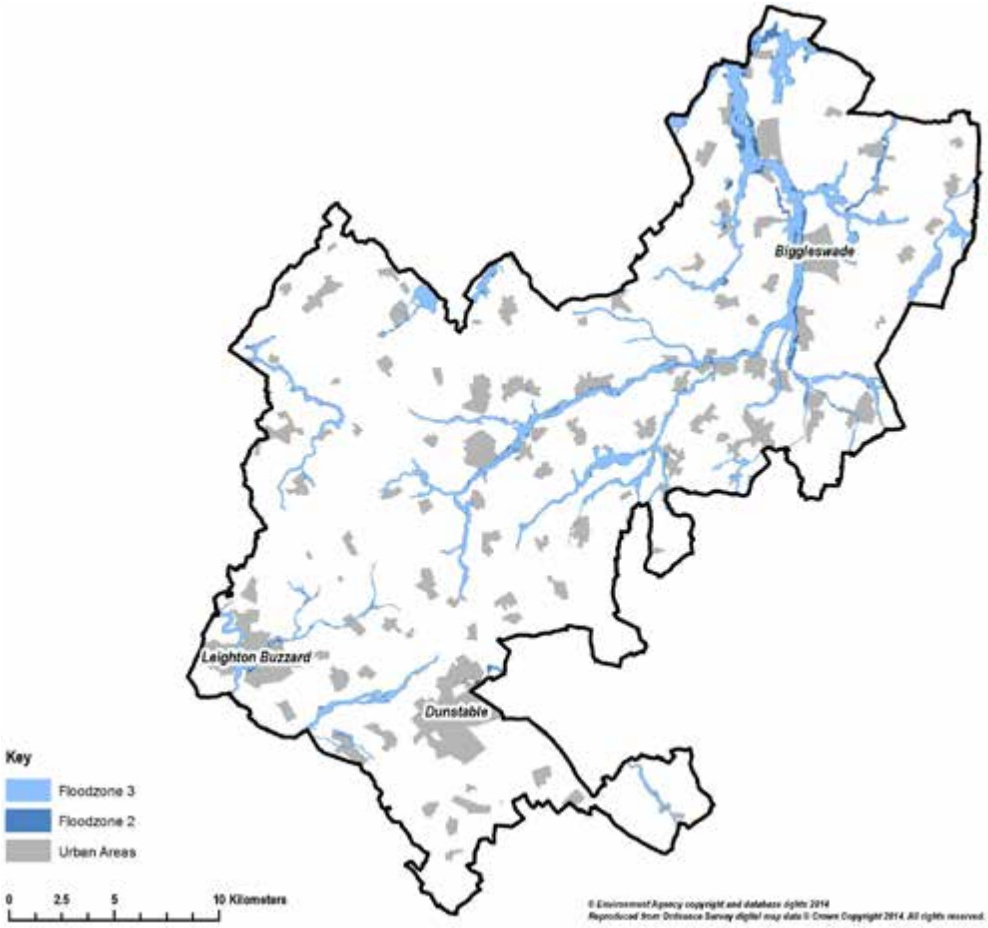
Signpost:

Central Bedfordshire Local Flood Risk Management Strategy
http://www.centralbedfordshire.gov.uk/environment/natural-environment/flood-risk/

Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment
http://www.bedford.gov.uk/pdf/PFRA.pdf

Flood Map for Planning, Environment Agency
http://apps.environment-agency.gov.uk/wiyby/37837.aspx

C Fluvial Flood risk in Central Bedfordshire



Surface Water Flood risk

Surface water flooding occurs when normal drainage systems fail to drain away rainwater, or it fails to soak into the ground. As a result, the rainwater lies on the ground or flows over it. Predicting flooding of this type can be difficult.

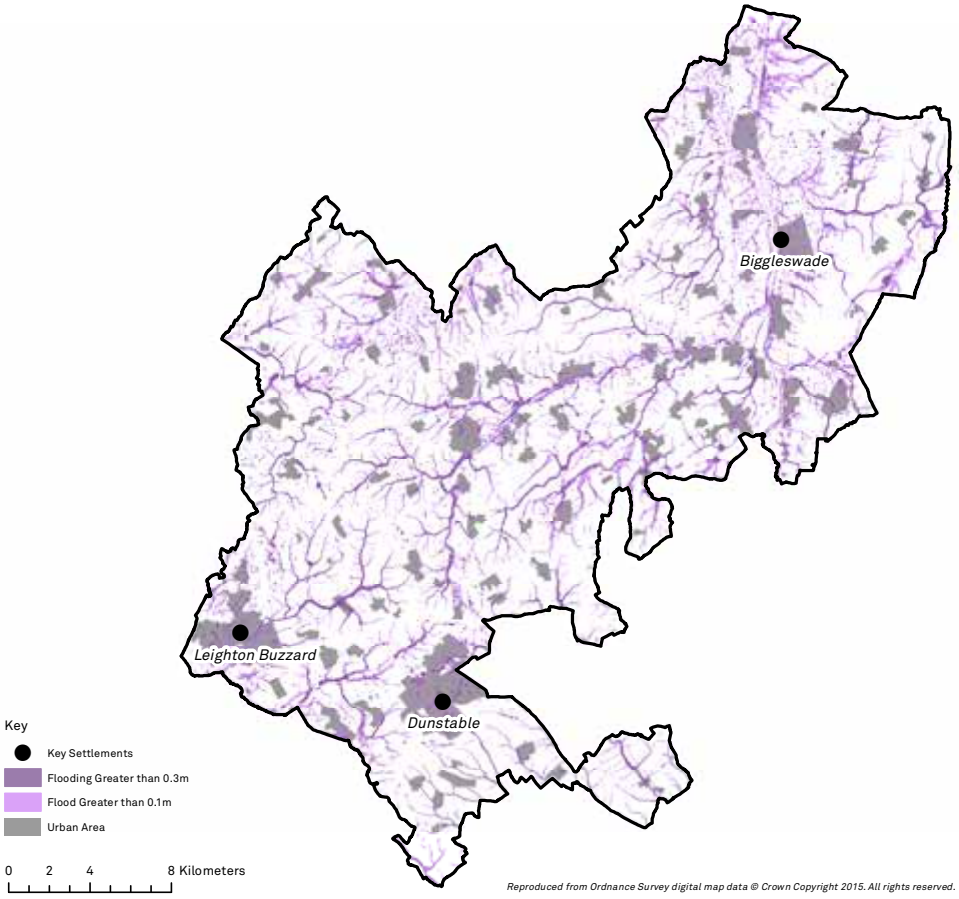
Surface water flood risk areas are spread across Central Bedfordshire and largely follow water courses, or channels linked to them, across all geologies.

Based on national surface water modelling, approximately10,000 properties in CBC are estimated to be at risk from flooding during a 1 in 200 year rainfall event.

Signpost:

Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment
http://www.bedford.gov.uk/pdf/PFRA.pdf

Risk of Surface Water Flooding in Central Bedfordshire



Source: Upper River Great Ouse Tri LLFA's Preliminary Flood Risk Assessment using data from the Environment Agency

Groundwater Flood risk

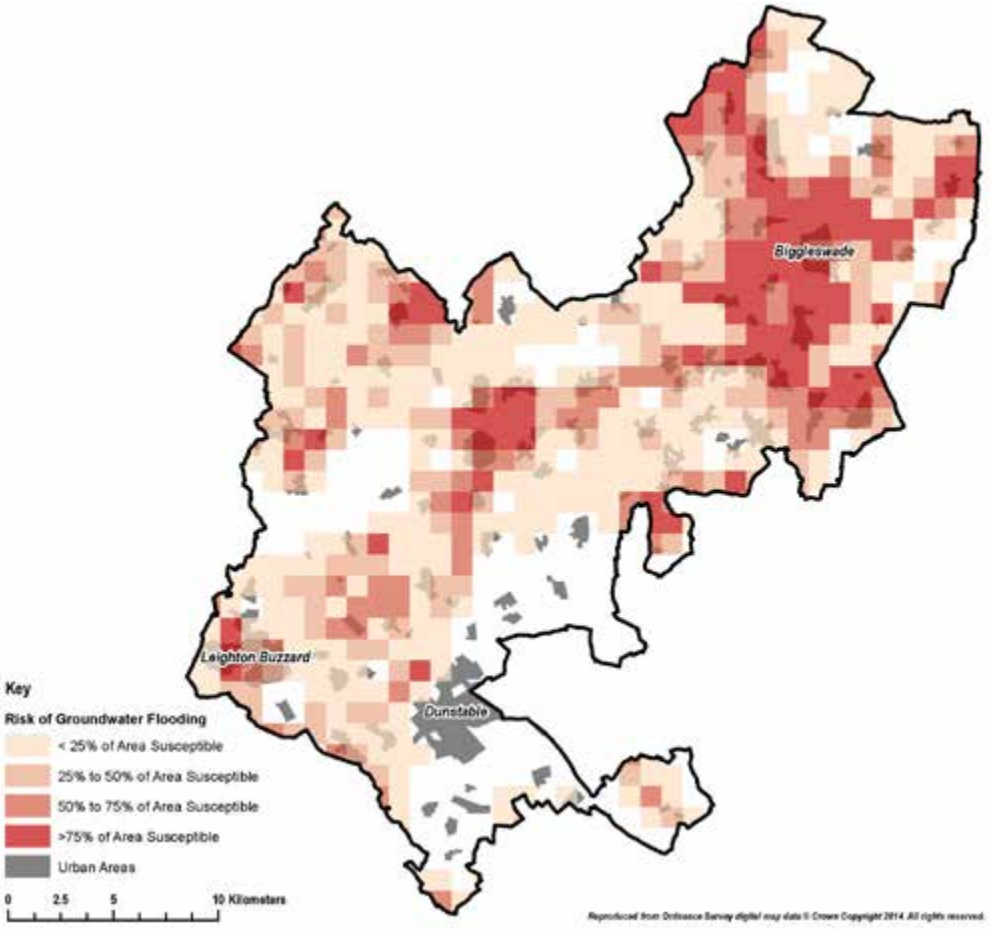
Flooding of this kind occurs when precipitation overwhelms the water table below ground causing it to rise above the surface. It is most common in areas where there are aquifers (permeable rock that water can soak into or pass through).

Groundwater flood risk is largely concentrated in the north and east, within areas underlain by clay geology. This flood risk also extends west along watercourses. There are also some isolated flood risk areas identified in the western and southern parts of Central Bedfordshire.

Signpost:

Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment *http://www.bedford.gov.uk/pdf/PFRA.pdf*

Risk of Groundwater Flooding in Central Bedfordshire



Source: Upper River Great Ouse Tri LLFA's Preliminary Flood Risk Assessment using data from the Environment Agency

Parish Flood Risk

A combination of national data and detailed local knowledge, from drainage engineers, has been used to allocate a flood risk to each parish within Central Bedfordshire.

The flood risk allocated here is based upon:

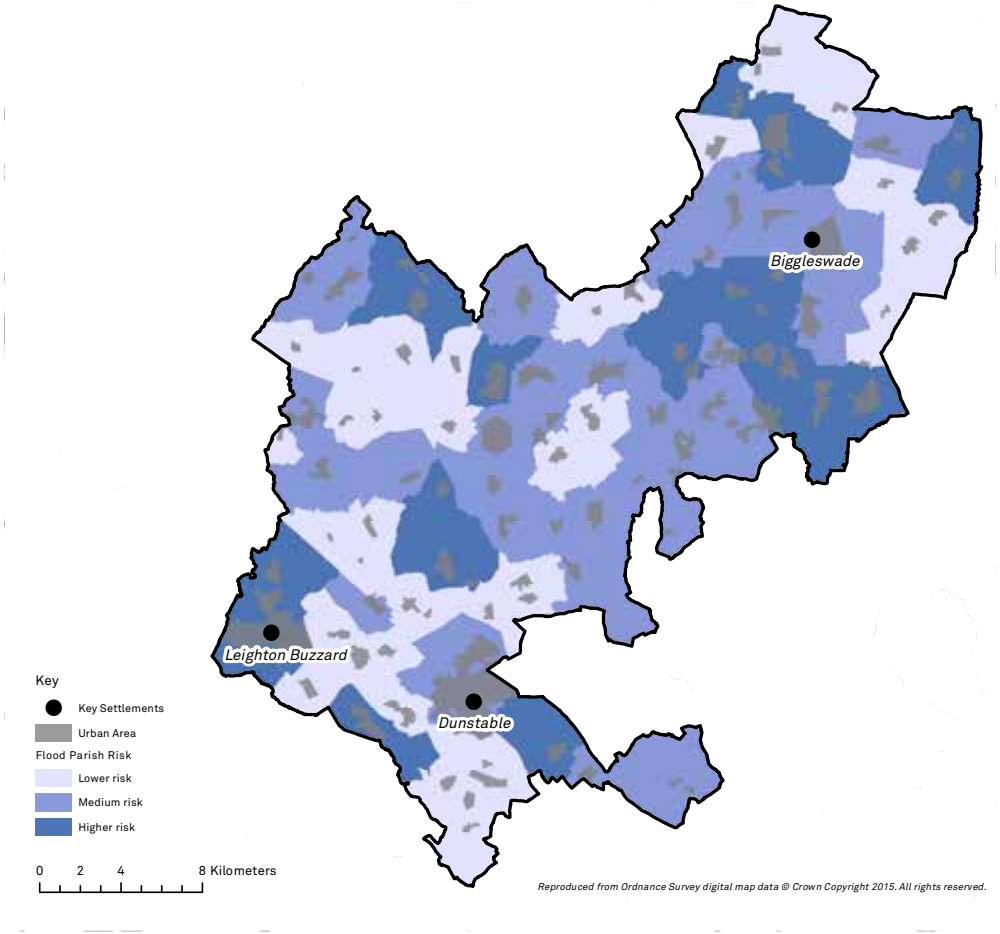
- Assessment of surface water flood risk;
- Assessment of flood risk from ordinary watercourses;
- Assessment of historic risk; and
- Local knowledge.

CBC will use this information to focus attention on planning applications in higher risk areas.

Signpost:

Local Flood Risk Management Strategy for Central Bedfordshire, 2014. *http://www.centralbedfordshire.gov.uk/Images/CBC%20Draft%20LFRMS%20%28v8%20170314%29_tcm6-55819.pdf*

Parish Flood Risk in Central Bedfordshire



Source: Parish Flood Risk from the Local Flood Risk Management Strategy.

1.17 Growth and New Development

Central Bedfordshire's population is expected to grow over the next two decades. To accommodate the expected population and household growth, a substantial number of new homes are expected to be delivered by the end of the planning period, 2031. Strategic sites near urban areas such as Houghton Regis, Luton, and Leighton Buzzard are where the majority of these new homes will be delivered. New development provides the best opportunities to design SuDS in from the beginning of the masterplanning process to maximise the multiple benefits.

1.18 Why SuDS

Conventional drainage relies on underground sewers to manage surface water runoff. This has the unfortunate consequence of overwhelming the existing sewer system, which sometimes results in untreated water being discharged into receiving waterways during heavy rainfall events. Focusing on managing water runoff through conventional drainage does nothing to address the negative impacts from increased urbanisation, including:

- Increased runoff rates, which result in soil erosion and flood risk
- Reduced water table recharge
- More polluted water discharged into environmentally sensitive waterways
- Missed opportunities to improve the landscape character

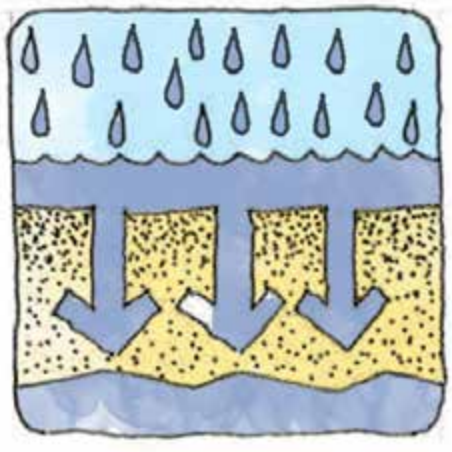
Sustainable Drainage Systems are now recognised as the preferred method for managing rainfall runoff. This is partly due to their versatility and ability to be designed for numerous landscapes and in response to a host of constraints. SuDS can be designed to include natural vegetation – wetlands, green roofs, ponds, wetlands, and swales. However, they can also be designed to respond to more urban character, such as permeable paving, canals, and rills. When infiltration is not possible SuDS can also be designed to include underground storage.

While individual SuDS features can improve water management, they are most effective when considered on a site-wide basis. When individual SuDS features are combined in sequence together, they are known as a treatment train. The purpose of a treatment train is to drain the site as closely as possible to pre-development runoff rates.

In order for these benefits to be realised in the most effective and efficient manner, both in terms of cost and time, it is important that SuDS are considered from the outset and designed strategically to be integrated in new developments. Consideration for easy access and maintenance will ensure a high level of design can be maintained throughout the scheme's lifetime.

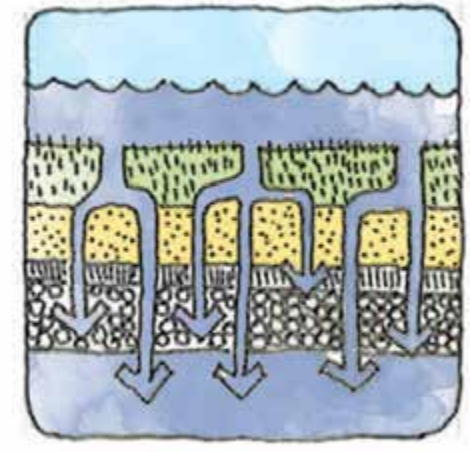
This image of a sewer overflow is the result of overstressed water infrastructure. One advantage of SuDS is their ability to remove surface water runoff from the sewer system, improving its capacity for managing wastewater.

1.19 SuDS have a number of benefits:



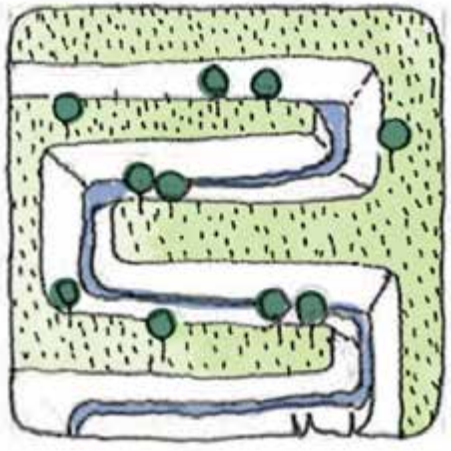
A) Infiltration

Enables groundwater recharge where possible, and slows conveyance to the nearest watercourse at a "greenfield" runoff rate – the pre-development rate and volume of surface water runoff.



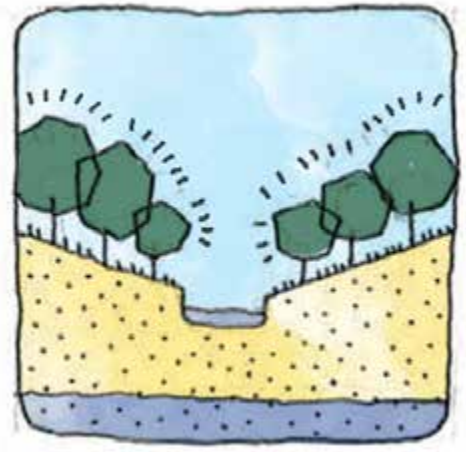
B) Filtration

Removes pollutants such as metals, hydrocarbons, and nutrients from roads, car parks, and agricultural land.



C) Attenuation

Naturally vegetated SuDS also help to attenuate and convey water slowly, reducing soil erosion and mitigating flood risk.

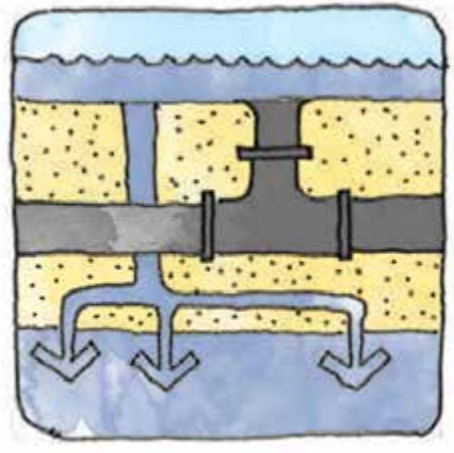


D) Carbon sequestration

Naturally vegetated SuDS can also sequester carbon in the atmosphere as they grow.

E) Thermal control

Green infrastructure is known to reduce the temperature of the immediately surrounding environment by increasing evapotranspiration. The changing climate will mean this becomes increasingly important.



F) Reduced pressure on infrastructure

Reducing the amount of surface water runoff sewer infrastructure handles provides headroom for the sewer system to manage wastewater, reducing the potential for combined sewer overflows.

G) Cost savings; ease of maintenance

SuDS provide long term solutions to surface water drainage, as they are above ground blockages and issues can be easily identified and remedied. If integrated from the early stages of the design process SuDS provide cost savings for design, installation and maintenance when compared to more traditional surface drainage systems.

2 APPROVAL PROCESS

Image courtesy of Land Use Consultants Ltd

THE APPROVAL PROCESS

This section details how Central Bedfordshire Council (CBC), as Local Planning Authority (LPA), will consider how proposed development meets the requirements set out in section 1 as part of the planning application process. For major developments, or those located in high risk areas (see map on page 24), CBC requires a 'Surface Water Drainage Strategy' as part of the planning application. The use of SuDS should also be prioritised in minor applications, and CBC also encourages permitted developments to incorporate SuDS.

The aim of this section is to set out the steps developers and designers will need to undertake in order to meet national and local policy requirements for SuDS and to make best use of industry guidance within the context of Central Bedfordshire. When considered along with the local requirements and design considerations, this document should be a valuable resource in simplifying the design process.

2.1 Development Requiring Planning Permission

Major Applications

As defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015, major applications are considered to be where:

- The number of dwelling houses to be provided is 10 or more; or
- The development is to be carried out on a site having an area of 0.5 hectares or more and the number of dwelling houses to be constructed is not known;
- The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
- Development carried out on a site having an area of 1 hectare or more.

Minor Applications

Minor applications are defined to be:

- Up to a maximum of 9 dwelling houses; or
- Under 0.5ha; or
- 999m^2 of non-residential property.

Signpost:

National Planning Policy Framework
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Sustainable Drainage Systems: Non-technical standards for sustainable drainage systems
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

2.2 Planning Application Process

Overview

15th April 2015, all planning applications for major developments, and those in flood risk areas (see map on p24) must include a 'Surface Water Drainage Strategy' or they will not be made valid. Minor developments should provide sufficient detail on how surface water will be managed, and the use of SuDS should be prioritised. It is also encouraged that permitted development also include SuDS measures onsite.

The Surface Water Drainage Strategy is expected to demonstrate that the SuDS to be included are appropriate and sufficient to meet the run off rates of the development.

The systems should also be suitable for future changes, for example climate change and urban creep. Successfully designed SuDS are expected to not only serve as water management systems, but they should also provide additional environmental benefits in line with policy requirements as outlined on pg.47 of this document. This document also provides valuable information as to how to achieve these expectations in the context of Central Bedfordshire.

Designing and implementing the most effective SuDS schemes requires the involvement of a variety of relevant professionals from the beginning of the design process. Consulting with the LPA, statutory and non-statutory consultees during pre-application stage will make the process more efficient at the Full and Reserved Matters Application stage and when discharging conditions.
Figure 1 (page 36) outlines the process diagrammatically. A checklist of submission materials is provided on pages 32-33. Any enquiries should be directed to the duty planning officer.

The 2015 updates to the NPPF require CBC, as LPA, to consult with the Lead Local Flood Authority (LLFA) for all major planning applications. CBC will also consult the LLFA for minor applications where appropriate.

The funding for construction as well as longer term maintenance and operational arrangements will need to be negotiated and agreed with the relevant parties through the planning application process, further details are outlined in the following section.

As provision of the Surface Water Drainage Strategy is part of the planning application process, it will not cause any delays to the process with no changes to the planning application decision time frame.

Any conditions made relating to the Surface Water Drainage Strategy will form part of the planning permission. These conditions will be subject to existing planning condition protocols.

Should the LPA require further information regarding surface water drainage on site than that given in this section, the request will be made of the developer in parallel with any planning related clarifications.

Stage 1: Masterplanning and Pre-application

At this stage, the developer or landowner should consult with the LPA to understand the drainage requirements their development needs to consider. The LPA will provide high level design advice, and notify of any relevant by-laws and consultees which should be included in the design process. The developer / landowner should consider the geology and infiltration potential of the site, and the topography and flow routes to ensure that the masterplanning process includes consideration of strategic scale SuDS design principles.

Pre-application advice would confirm site constraints, flood risk and suitable SuDS approaches.

Seeking advice from the LPA and relevant experts from the earliest stages of the design process will create a better functioning drainage scheme, and reduce the need for costly alterations to the design at later stages. Considering SuDS at this stage also provides an opportunity for SuDS to inform and enhance the site design, enabling developers to maximise the functional and financial benefits that SuDS can provide in the process.

During the pre-application stage, it is advisable for the developer to share the drainage scheme's conceptual design with the duty LPA and any relevant statutory consultees.

Stage 2: Outline Planning Application

When an outline planning application is to be submitted, the developer should include a concept SuDS scheme within the Surface Water Drainage Strategy. The concept SuDS scheme should include basic design information which demonstrates that SuDS design has been intelligently considered and incorporated into the scheme.

It is at this stage that the SuDS layout should be confirmed – the design team should design the site around natural flow routes, considering topography, geology, and greenspace to ensure the design is appropriate to the site, mitigates flood risk, has the potential to improve water quality and deliver wider environmental benefits through the demonstration of an effective water management and treatment train, and integration of the SuDs design with landscape, ecology and open space design to maximise environmental and amenity benefits.

The provision of evidence to support the Surface Water Drainage Strategy, including plans, calculations and reports is recommended at this stage, allowing the LPA to cross check and evaluate the submitted plans. Ensuring that the drainage system is designed to meet the above requirements early in the design process is essential in the development of efficient, effective and cost effective drainage solutions.

The LPA will consider the Surface Water Drainage Strategy in the context of the planning application before planning permission can be granted. If the developer has not yet consulted the relevant statutory consultees, this is the time for the LPA to recommend which ones the developer should contact. Statutory consultees will provide their comments relating to the Surface Water Drainage Strategy to the LPA.

As part of the outline permission, conditions may be issued to ensure that the developer provides a complete and detailed Surface Water Drainage Strategy and all necessary evidence and supporting materials as part of the Full or Reserved Matter Planning Application.

Stage 3: Full or Reserved Matters Planning Application

If the planning application is for full planning permission and has not been preceded by an outline permission, the requirements for the outline stage should be met.

Assuming the previous stages have been completed as recommended, this stage should be streamlined. The developer submits the Surface Water Drainage Strategy in full with all evidence and supporting materials as part of the Full/Reserved Matters Application to the planning department.

The strategy should demonstrate that it complies with the National Standards as well as the Local Requirements. The LPA will be responsible for inviting relevant statutory consultees to comment on all aspects of the planning application.

The strategy should demonstrate exceedance pathways, and how the scheme will be constructed and maintained, including a phasing plan where appropriate.

Stage 4: Discharging Conditions

Protocols for discharging surface water management related conditions are the same as with all conditions applied as part of a planning permission.

In order for the condition to be discharged the developer will need to demonstrate to the LPA that all requirements have been met through the submission of evidence and any required supporting materials.

Where required the LPA will be responsible for the invitation of relevant statutory consultees to comment on evidence submitted to support the discharging of conditions.

Checklists for Major Planning Applications

The following checklists demonstrate the required Surface Water Drainage Strategy specific materials to be submitted at each stage of the planning application process. The level of detail in the strategy that will be required by the LPA will vary depending on the relative risk and scale of the development.

Pre-application

The developer should:

- Consult with CBC, relevant consultees and designers;
- Review pertinent documents such as Flood Risk Assessments and underlying geology maps; and
- Begin to consider how to structure the overall design of the development to integrate SuDS.

Outline Application

At the outline planning stage, the submission to the LPA should include, but is not limited to (additional evidence and supporting material may be required by the LPA:

The developer should:

- Confirm the site specific conditions such as topography, hydrological and hydro-geological context, flow routes and permeable and impermeable areas;
- Indicate existing and proposed runoff destinations and discharge points;
- Indicate existing and proposed peak flow and discharge rates;
- Indicate existing and proposed discharge volumes;
- Indicate existing and proposed attenuation requirements;
- Demonstrate how the SuDS design is integrated with landscape, ecology and open space plans to maximise environmental and amenity benefits;
- Give an overview of the likely water quality hazard caused by the development and how water quality will be improved through demonstration of a water treatment train; and
- Submit SuDS designs demonstrating the systems to be included and concept designs for appearance as well as initial operation and maintenance proposals.

Full Planning Application/ Reserved Matters Application

As part of the full/reserved matters application the developer will need to submit a full and detailed Surface Water Drainage Strategy with all evidence and supporting material:

The developer should:

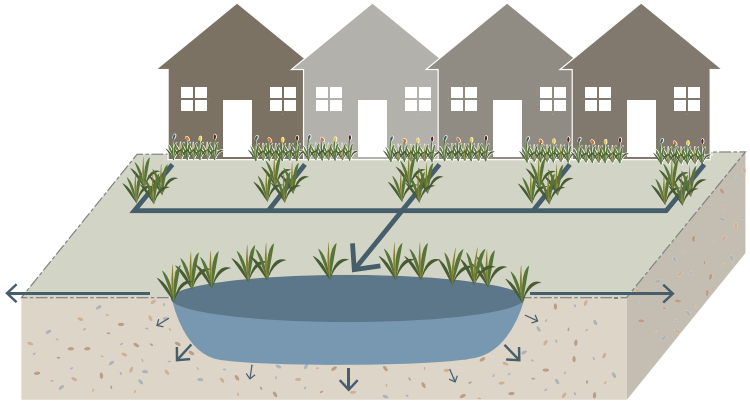
- Provide detailed information demonstrating site investigation outcomes;
- Confirm runoff, peak flow, discharge volumes and attenuation requirements submitted at outline stage;
- Confirm the systems to be implemented as part of the development;
- Provide detailed design principles, product details, and flow controls;
- Demonstrate the designed SuDS are sufficient for the likely impacts of climate change;
- Demonstrate exceedance pathways;
- Provide a detailed plan highlighting SuDS and how they are fully integrated within the development and existing landscape;
- Provide detailed construction and phasing plans for the SuDS; and
- Provide a detailed management and maintenance plan, including who is to be responsible for the continued management and maintenance including details of the construction and any phasing.

Discharging Conditions

A complete Surface Water Drainage Strategy should have been submitted to the LPA as part of the full/reserved matters application. The LPA may wish to set conditions as part of the planning permission to ensure that the Surface Water Drainage Strategy is executed and any uncertainty adequately resolved before completion and the development becomes operational.

The developer should:

- Confirm with evidence and supporting materials that the SuDS installed are both as per the detailed plans submitted as part of the full/reserved matters application and that they are functioning to the minimum level as agreed in developments permission; and
- Provide evidence and supporting evidence to demonstrate that the requirements of conditions as per the permission have been met.



Operational Development

2.3 Minor Planning Applications

It is important that all developments with drainage implications are able to demonstrate that they positively contribute to the management of surface water runoff and attenuation. Minor applications will need to demonstrate compliance with planning policy in relation to sustainable drainage, including with this document.

The developer may be asked to provide evidence and supporting materials to demonstrate suitability of SuDS proposals depending on the scale and risk of the development.

Checklist for Minor Planning Applications

Minor Planning Applications

As part of the planning application, the developer should include the information below, although it is possible that more information will be required on a specific site.

☑ The developer should:

- Confirm the site specific conditions and constraints, identifying the existing means of drainage and how surface water will be managed, with clear descriptions of changes to permeable and impermeable areas;
- Estimate surface water runoff before and after development, and identify attenuation requirements;
- Demonstrate how the site layout and topography has been considered to reduce both the volume and speed of surface water run-off, and demonstrate how the design of the SuDS will improve biodiversity, amenity and water quality;
- Provide detail on the function, operation and management of the SuDS systems, and provide plans and drawings showing the location of the SuDS; and
- Provide information on any consultation taken with regulators (e.g. the IDB, Water Company, Environment Agency).

Operational Development

2.4 Determination

The NPPF (Paragraph 103) requires that LPAs prioritise SuDS in the determination of planning applications for all major applications. In Central Bedfordshire the expectation for the inclusion of SuDS has been extended to include all developments requiring planning permission.

Once the LPA has received the Planning Application, they will check to ensure that all required documentation has been included and have been completed sufficiently, the developer will be notified. At this point, the review process will begin.

At the beginning of the review process the LPA will contact the relevant statutory consultees. Maintaining an open dialogue between interested parties – developer, LPA, and numerous statutory and non-statutory consultees – is of primary importance.

The surface water drainage aspect of the planning application will be determined based on the National Standards, up-to-date local and neighbourhood plans relevant to the development, the National Flood and Coastal Erosion Risk Management Strategy, the Local Flood Risk Management Strategy, the local requirements outlined in this document, and any relevant by-laws from the Environment Agency, IDBs, or Central Bedfordshire Council. The LPA has the ability to refuse a planning application should the applicant not supply sufficient materials and evidence regarding SuDS, or if the LPA deems the SuDS in question to not satisfactorily manage surface water from the development in-line with National Standards and requirements outlined in this document.

2.5 Conditions

The LPA, as part of the planning permission can impose conditions (in-line with planning policy) to ensure the success of sustainable drainage solutions. Conditions can ensure:

- The SuDS systems proposed meet the minimum standards of operation and maintenance as dictated by site specific context.
- Detailed design will be submitted and approved by the LPA as part of the planning application before construction can begin.
- That the developer confirms that the SuDS functions as per the designs submitted to planning before the development can be occupied.
- That post-construction the SuDS are maintained and managed as per the submitted and approved plans.

Any conditions that have been imposed on granting planning permission (including any relating to SuDS) run with the land and continue to apply, so future landowners would be required to adhere to them.

The LPA should respond to requests to discharge conditions without delay, within 21 days. Where the views of a third party such as a statutory consultee are required to discharge a condition, every effort should be made to ensure that the 21 day requirement can still be met.

A condition will be attached where its implementation is viable. Drainage related conditions will be enforced under existing planning enforcement regimes.

2.6 Post-Construction

Following construction, CBC expects developers to provide detailed, as built drawings and location information, and a maintenance plan including a schedule of maintenance, if it hasn't been submitted as part of the planning application to allow CBC to preserve a record of SuDS.

Engaging with the community is an important component of SuDS maintenance. When designed effectively, residents should be able to notice if the scheme is not working as it should. A well designed SuDS scheme should include information and sign posting to notify residents how a SuDS feature should operate and can help to mitigate health and safety concerns, and serve to educate them in the process.

Process of Planning Application

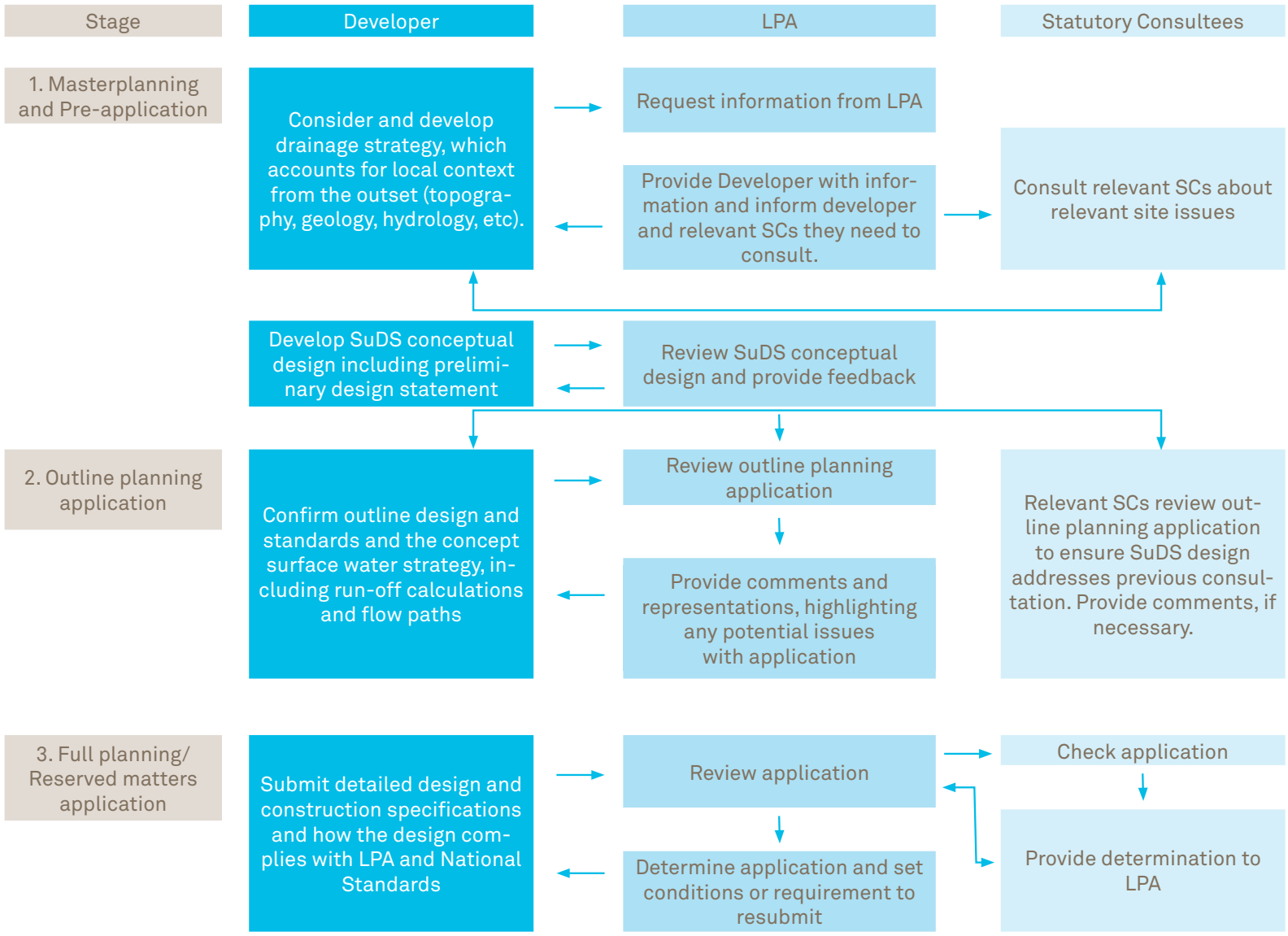


Fig. 1. Approval Process when planning permission is required

2.7 Statutory Consultees

Statutory consultees are only required to be consulted during the formal application stage. However, by involving them from the earliest stages of the planning process, developers can avoid delays and unnecessary charges. The result is likely to be a better functioning, more aesthetically pleasing design.

For any surface water drainage systems believed to impact on these bodies, it is incumbent on the LPA to consult with the relevant statutory consultees. The LPA will also consider the proposed drainage scheme's impact on adjacent sites. This may require consulting with other statutory or non-statutory consultees.

Statutory Consultees	When to consult
Lead Local Flood Authority	If the development will have a potential negative impact on surface water drainage.
Canal and Rivers Trust	If the drainage system may affect the discharge of water into or under a waterway managed by them.
Environment Agency	If the proposed SuDS scheme will affect fluvial flood risk or discharge into a main river.
Highways England	If the proposed SuDS scheme will impact on any adopted public highways or discharge surface water into highway authority drainage systems.
Sewerage Undertaker	If the proposed SuDS scheme is connected to their network.

Fig. 2. When to consult Statutory consultees

Signpost:

Guidance on Statutory Consultees (DMPO)
http://www.legislation.gov.uk/uksi/2015/595/schedule/4/made

2.8 Non-Statutory Consultees

Non-statutory consultees are those organisations not included in the National Standards, but whom the SuDS scheme is likely to impact on, or who may want to adopt and maintain the SuDS features. For example:

- The Wildlife Trust might need to be consulted if there are habitat, or other significant ecological implications.
- Any relevant Internal Drainage Board should be consulted if the drainage system will discharge directly or indirectly into a watercourse within the Board's district.
- While permission from the planning department is not necessary for permitted development, consulting them in all instances may still be appropriate.

As they are not required to be consulted, it is up to the LPA to recommend relevant consultees to the developer/ landowner. It will be up to the LPA to include non-statutory consultees' comments in their own representations/ determinations.

2.9 Adoption of SuDS by Third Parties

There are a variety of maintenance options open to developers that allow an element of flexibility. The developer can maintain the SuDS themselves or they may negotiate with a third party to maintain the SuDS.

Management Companies

- As part of the establishment of a maintenance to manage and maintain the public open spaces in a development, it is possible incorporate the maintenance of SuDS within their scope of work.
- Costs can be covered as part of an annual service charge paid by householders and premises occupiers.
- Costs can also be covered by a commuted sum paid by the developer to the management company.
- Charitable trusts can act as a management providers.

Water Company: Anglian Water or Thames Water

- The water company may construct, maintain and operate drainage systems which relieve the public sewer (as per s114A of the Water Industry Act 1991, as amended by Water Act 2014). SuDS would fall under this category.
- A developer and the water company may agree that the developer builds or contributes towards the construction of a sustainable drainage system which the water company would then own. Costs would be covered through the normal charges, spreading the costs to all bill payers within the water company's area; charges would be monitored by OfWAT.
- The water company may offer to operate as the management company. As its charges are not spread to all bill payers within water company's area OfWAT would not monitor the charges.

Central Bedfordshire Council (CBC Leisure/open space)

- In some instances Central Bedfordshire Council may adopt the SuDS and maintain them as part of their wider public open space and amenity management function.
- In this instance the Council would need to charge for this work, which would be agreed through S106 agreement negotiations.

CBC Highways

- CBC Highways may adopt SuDS within close proximity of a highway managed by them. They will then maintain the SuDS as part of their highways management function.
- In this instance the Council would need to charge for this work, which would be agreed through S106 agreement negotiations.

Town and Parish Councils

- Town and Parish Councils may adopt open and green spaces within developments, and, as part of this, may be willing to adopt SuDS features that are part of the open space network.
- Town and Parish Councils would need to be approached on a site by site basis, and would need to be aware of how the SuDS fitted with the overall open spaces, and the ongoing liabilities of adopting them.

IDB (Bedford Group of IDBs)

- In instances where the SuDS will be discharging into a IDB managed waterway or it is in close proximity to an IDB managed waterway, the IDB may adopt the SuDS and maintain it as part of their waterways management role.
- A developer and the IDB may agree that the developer builds or contributes towards the construction of a SuDS which the IDB would then own.
- The IDB may offer to operate as the management company.

Private Individuals

- In instances where the drainage system only drains their properties and no others, the community or volunteers from the community may maintain their own SuDS.
- If the systems are simple and involve minimal or no proprietary products, are easy to maintain and serve a small number of properties they could collectively agree to maintain the system.
- A complete maintenance plan would need to be provided by the developer to the owner or owners in this instance, including repair and replacement requirements.

Signpost:

Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment
http://www.bedford.gov.uk/pdf/PFRA.pdf

Anglian Water SuDS Adoption Manual
http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf

Sewers for Adoption (7th Edition)
http://sfa.wrcplc.co.uk/ceswi-7th-edition.aspx

Thames Water Adoption Addendum
https://www.thameswater.co.uk/tw/common/downloads/your-business-developer-services/tw-addendum-to-sewers-for-adoption-7th-edition.pdf

Open space swale.

Public road with permeable paving.

Public realm bio retention.

Open space wetland.

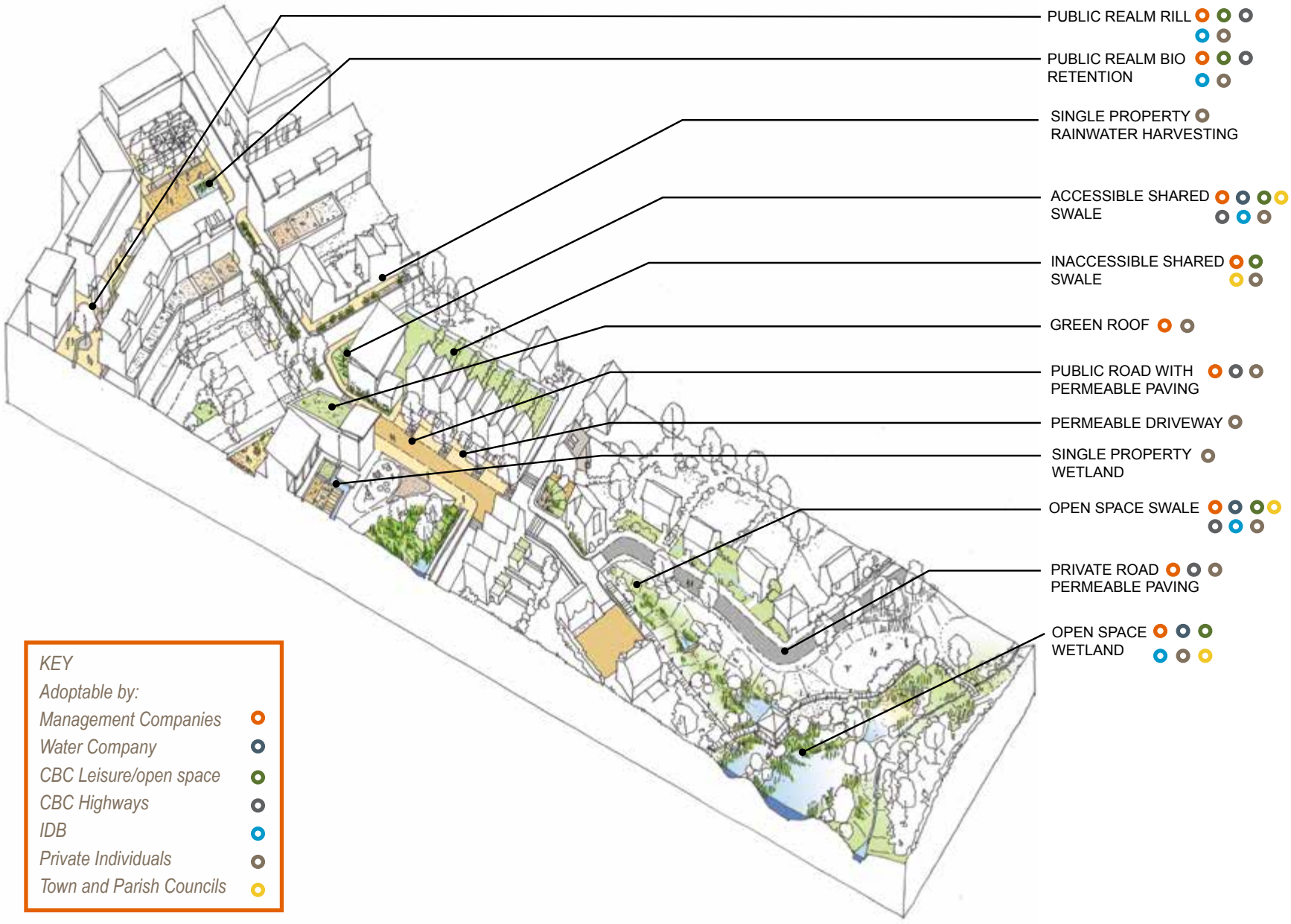


Fig.3: SuDS Features third parties may adopt

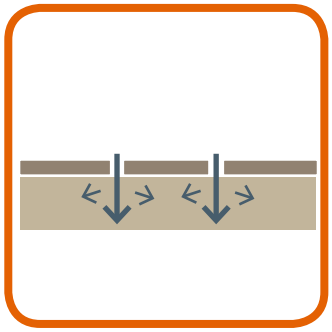
2.10 Permitted Developments with Impacts on Drainage

For developments which will have an impact on surface water drainage, but do not require planning permission (permitted developments) the inclusion of SuDS is preferred. However, as with development that does requires planning permission including SuDS is still highly beneficial. Small changes can realise big results for not only the individual householder, but the wider community.

The developer or land owner can still consult with the LPA and statutory consultees to seek advice on the types of SuDS that are appropriate. Some suggestions have been given here:

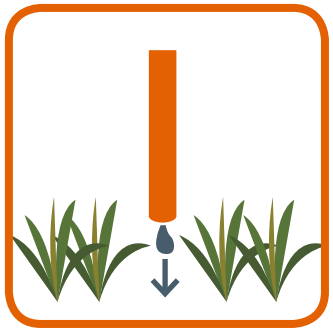
Vegetated front gardens

Permeable paving

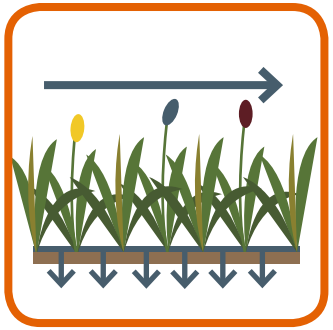


Water butts

Disconnected downpipes



Rain gardens



Onsite water recycling

Green roofs

Permeable driveways

Image courtesy of Land Use Consultants Ltd

3 DESIGN CONSIDERATIONS AND LOCAL REQUIREMENTS

Image courtesy of Land Use Consultants Ltd

DESIGN CONSIDERATIONS

Information on national level standards, practice and guidance is provided in section 1 of this document. This section sets forth local requirements for SuDS design in all developments in Central Bedfordshire, to ensure that development responds to the local context. It also includes information on how to overcome common site challenges for SuDS. The next section, Considering Local Nuance: Development of Local SuDS Zones, outlines guidance for SuDS design based on the geographic location of the development.

In general, intelligent SuDS design will apply the following elements:

- Designs should be inspiring, engaging and educational, aid people's well being and quality of life, while improving the aesthetic appeal and value of an area.
- All flow control structures should be simple and easily maintained
- Minimal use of sub-surface linking features. Where necessary, they should be simple uncomplicated and easily maintainable structures

The importance of designing SuDS with ease of access and maintenance in mind cannot be understated. This image to the right presents thoughtfully designed access, which facilitates ease of maintenance.

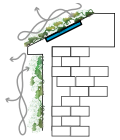
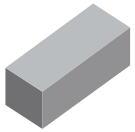
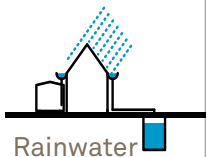
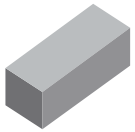
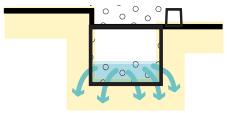
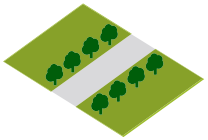
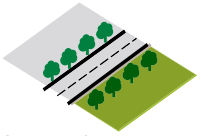
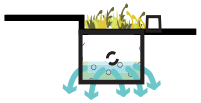
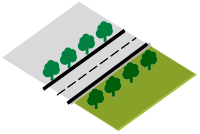
For more information on detailed SuDS design guidelines, SuDS designers should reference The SuDS Manual (CIRIA C697).

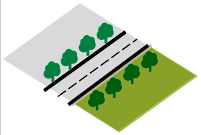
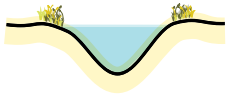
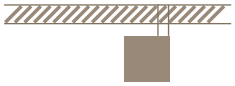
Signpost:

CIRIA SuDS Manual
http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

This image shows adequate access to effectively maintain SuDS features.

There are a number of SuDS features which can be incorporated in any drainage scheme. Features should be selected based on local context, and how the features fit into the wider management train. As runoff should first be managed at source, features such as green roofs and rainwater harvesting can be implemented on individual buildings. Bio retention areas and wetlands, on the other hand, are better suited to managing communal surface water runoff, while SuDS such as swales and permeable paving may be used to convey water between the two different scales. The table below outlines the various SuDS features with a description, and the associated area required.

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bio retention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bio retention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

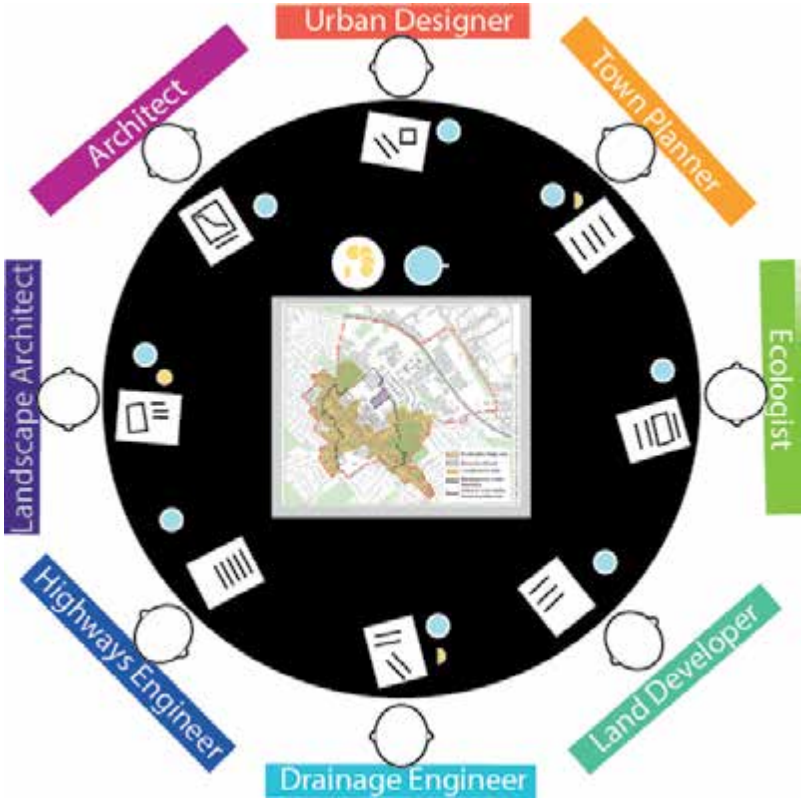
	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenance typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation. This feature, however, does not provide the wider benefits that other green SuDS do, and should be viewed as a secondary option.	 Open space	Dependant on runoff volumes and soils.

3.1 The SuDS Design Team

Before the SuDS design process can begin, it is critical that the correct experts are part of the design. Not only will including the right experts result in a more intelligent design, it will also save costs in the long-run by integrating SuDS from the beginning. In Central Bedfordshire, the relevant experts who should be included as part of the developer's design team are:

- Drainage engineers
- Land developers
- Ecologists
- Town planners
- Urban designers
- Architects
- Landscape architects
- Highways engineers

Co-ordinating all of these people will require collaboration and effective communication. Ensuring team members remain engaged throughout the process is key to an effective SuDS scheme.



3.2 SuDS Local Requirements

SuDS design can define a community. Delivering SuDS effectively in Central Bedfordshire will need to adhere to the local requirements outlined here. These local requirements have been tailored to Central Bedfordshire, and aim to ensure that SuDS are designed to function optimally and improve the character of the surrounding landscape.

Importantly, the local requirements have been developed with a keen eye on the local planning policies, which support the wider benefits SuDS can deliver. The draft Development Strategy for Central Bedfordshire Council has been through public consultation. Previously adopted Core Strategies for Central Bedfordshire – formerly known as Mid and South Bedfordshire – contain the existing policies.

The local requirements within this section will help to ensure new developments meet these wider policies requirements.
The policies overleaf support the list of local requirements, which have been created to help ensure developments have an easier time meeting local expectations. It should be noted that each local requirement is considered equally important to the delivery of effective SuDS schemes in Central Bedfordshire. Additional surface water management information relating to development can be found in the Marston Vale Surface Waters Plan.

The policies in the table, "Relevant SuDS Policies", on the following page have been labelled 'a' through 'e'. These labels are included in all ten local requirements to indicate the most relevant policy areas for each.

Signpost:

Marston Vale Surface Waters Plan (2002)
http://www.centralbedfordshire.gov.uk/Images/The%20Surface%20Waters%20Plan_tcm6-13659.pdf

1 Plan in SuDs from the start

2 Replicate natural drainage

3 Water re-use first

4 Enhance biodiversity

5 Focus on multi-functional uses

6 Minimise carbon and waste in SuDS

7 Design for easy access and maintenance

8 Linked design through every scale

9 Place making through SuDS design

10 Surface conveyance over pipes

RELEVANT SUDS PLANNING POLICIES

Policy	Subject	Explanation	Policy Requirements
a	Climate Change mitigation and adaptation	Focusing on increasing carbon sequestration, improving water efficiency and drainage. It also focuses on incorporating vegetated SuDS to prevent surface water flooding, and on water recycling measures where appropriate.	CBC draft development strategy Policy 48; Mid-Bedfordshire policy CS13; South Bedfordshire policy CS12.
b	Green infrastructure and ecological enhancements	Restore and repair fragmented habitats to created functional green corridors.	CBC draft development policies 56 and 57; Mid Bedfordshire CS18, CS17; South Bedfordshire policy CS10.
c	Managing water quality and flood risk	Improve the ecological quality of water bodies and produce an overall positive impact on the water environment	CBC draft development strategy policy 49; South Bedfordshire policy CS12;
d	Landscape character	There is a focus on conserving and enhancing existing landscape character and local distinctiveness as per Central Bedfordshire's landscape character assessment	CBC draft development strategy policy 58; Mid Bedfordshire policy CS16
e	Open space for healthy and sustainable communities	Policies targeted at improving the quantity, quality and access to open space will enhance opportunities for recreation and general well-being.	CBC draft development strategy policies 22 and 41; Mid Bedfordshire policy CS3; South Bedfordshire policy CS7

Signpost:

Development Strategy for Central Bedfordshire (pre submission) January 2013.
http://www.centralbedfordshire.gov.uk/planning/strategic-planning/development-strategy.aspx

Mid Bedfordshire Core Strategy and Development Management Policies, November 2009
http://www.centralbedfordshire.gov.uk/Images/CSDM%20Policies%20Adopted%20Nov%202009%20tagged_tcm6-21001.pdf#False

Luton and Southern Central Bedfordshire Core Strategy (pre-submission), November 2010
http://www.centralbedfordshire.gov.uk/Images/JCS1LutonandsouthernCentralBedsCoreStratPre-SubNov2010_000_tcm6-48032.pdf#False

Image courtesy of Land Use Consultants Ltd

1. Plan in SuDS from the start

Ensuring that SuDS are considered and incorporated early in site design will avoid costs associated with attempting to shoehorn drainage plans in at a later stage in the masterplanning process. This is also essential if the potential benefits are to be maximized. Considering SuDS and drainage from the outset ensures that built up areas are designed to be outside of potential flood risk zones and natural flow routes, and open spaces can be designed to accommodate exceedance flow routes during extreme weather events. By including SuDS from the beginning the drainage system can perform more effectively and will remove the risk of having to retrofit post-construction which is less effective, less efficient and more expensive.

One of the additional benefits of planning SuDS from the beginning of the process is the opportunity to engage the community and garner their support. Including the community from the outset ensures citizens can learn about how SuDS operate, their potential for flood risk mitigation, and also addresses the community's priorities and concerns. Ultimately, this increases the likelihood of achieving the community's buy-in and designing SuDS which maximises benefits for all parties involved.

Most Relevant Policy areas:

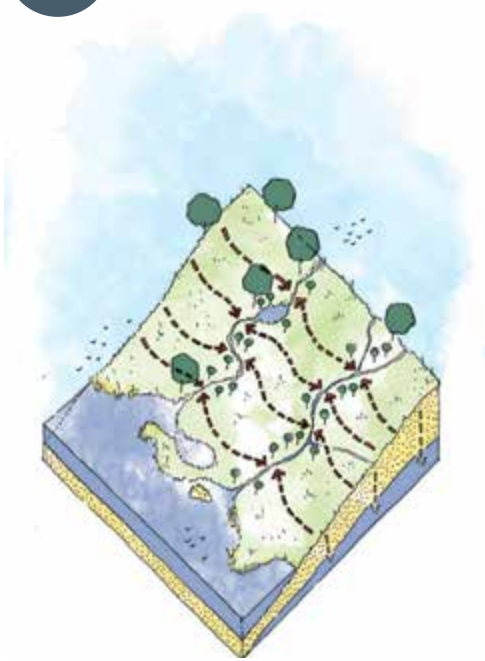
C

I

Examine site typography and geology

The goal is to replicate natural drainage and processes. The first step is to identify key natural flow paths, existing water bodies and potential infiltration areas to understand where opportunities and constraints exist.

II



Create a spatial framework for SuDS

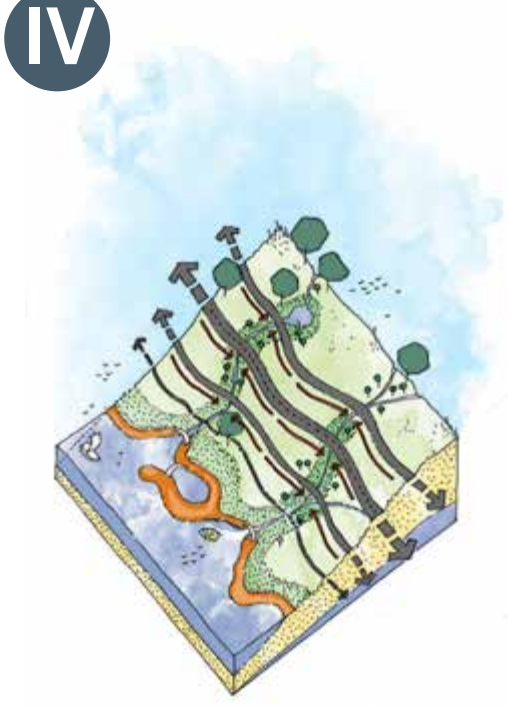
Minimise runoff by maximising permeable surfaces. Consider likely spatial requirements for SuDS on-site based on the character of the development and proposed degree of source control. Natural flow paths and opportunities for infiltration or storage areas should inform the development's layout.

III

Look for multi-functional spaces

Consider how SuDS features can incorporate green infrastructure, open space and public realm areas to create multi-functional spaces. SuDS can be designed to be assets with valuable amenity and ecological features.

IV



Integrate the street network with SuDS

Structure the street network to complement and manage flow pathways, with SuDS features integrated into street cross-sections. SuDS should be used to enhance the streetscape providing amenity as well as multi-functional benefits, integrating SuDS with other street features such as tree plantings, traffic calming, parking bays, verges and central reservations.

V

Cluster land uses to manage pollution

Land uses and the corresponding pollution risk will affect the number, size and type of SuDS selected. Potential polluters, such as industrial developments, should have their own isolated SuDS network. A series of SuDS features that will provide water treatment throughout the networks should be integrated, and respond to the level of pollution risk. Clustering should be considered alongside other mixed-use ambitions.

2. Replicate natural drainage

By mimicking natural drainage patterns, SuDS can be designed to work with the landscape rather than against it. By assessing the natural patterns that exist on the site, far more effective and cost-efficient designs can be developed. Controlling the surface water runoff at source through groundwater infiltration where appropriate and rainwater recycling measures will help to reduce the amount of surface water running off-site.

Runoff rates should always aim to match greenfield runoff rates to mitigate flood risk and maintain or improve the health of downstream waterways. Designing with natural drainage patterns in mind, where natural systems have been lost, is the best opportunity to restore natural drainage.

Signpost:

Groundwater Protection Policy and Practice
http://www.environment-agency.gov.uk/research/library/publications/144346.aspx

Most Relevant Policy areas:

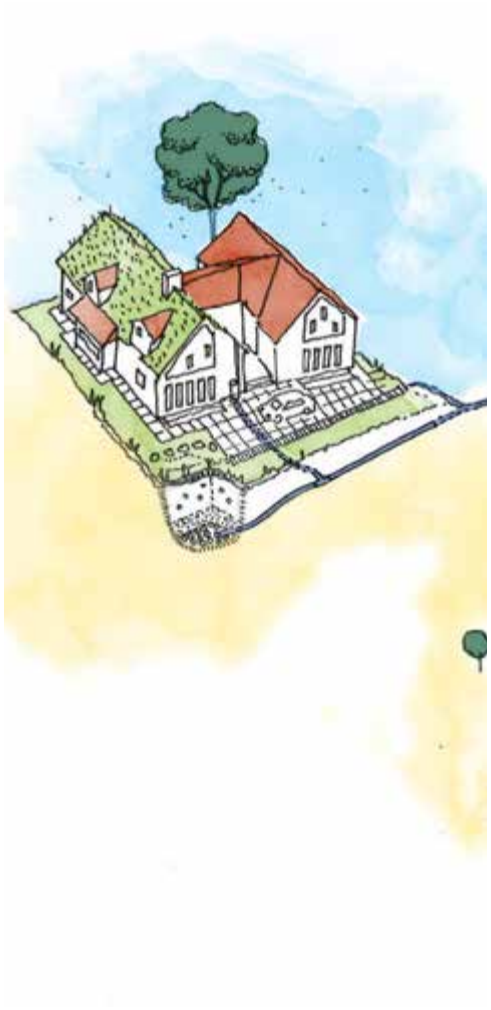
a c

3. Water reuse first

Central Bedfordshire's 600mm of annual rainfall is half the UK average. Therefore, finding ways to increase supply is crucial, especially as water demand increases with population growth. Collecting and recycling rainwater and surface water runoff are both options which can be used for non-potable purposes, such as irrigation and toilet flushing. Rainwater can be collected from roofs and stored in water butts, or rainwater recycling systems. Surface water runoff can be collected from impermeable surfaces and treated using SuDS features before being used for non-potable purposes such as on site irrigation or to replace toilet flushing water.

Most Relevant Policy areas:

a c



4. Enhance biodiversity

Part of the application of SuDS is the potential to promote local biodiversity through considered planting and habitat creation. Due to the vast variety of SuDS designs, the varieties of potential habitats that can be developed are equally vast, including larger wetland habitats as well as small vegetated areas.
Assessments to determine local native species will ensure that the correct species are introduced to an area. It is important that SuDS measures do not negatively impact on the existing biodiversity needs of an area, but instead they should enhance and strengthen it.

If biodiversity is determined to be a priority on site SuDS should be designed to function with little intrusive maintenance.

Most Relevant Policy areas:

b d

Signpost:

Rebuilding biodiversity Vol. 1 and Vol. 2
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=bedslife_rebuild

Bedfordshire and Luton Biodiversity Recording and Monitoring Centre
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=sites_bedscape

RSPB and WWT Sustainable Drainage Systems, Maximising the Potential for People and Wildlife: A Guide for Local Authorities and Developers, 2012.
http://www.rspb.org.uk/Images/SuDS_report_final_tcm9-338064.pdf

5. Focus on multi-functional uses

One of the main benefits of SuDS is their ability to deliver multiple benefits. Open spaces are a prime example, as they offer a place for ecology, recreation, and incorporation of sustainable drainage. When designed intelligently, SuDS can optimise all of these in a way which fits with the surrounding landscape. Examples include park areas which can be used as temporary flood storage during heavy rainfall events, and wetlands being used to deliver amenity value and habitat as well as water treatment.

While large open spaces are optimal, small spaces should also be sought to maximise benefits. Permeable paving in town squares can be used to improve the design quality of the space while increasing land permeability, and tree pits can improve amenity value while delivering flood mitigation opportunities.

Most Relevant Policy areas:

b e

6. Minimise carbon and waste in SuDS

Minimising the carbon consumption associated with SuDS building and operation – the embodied carbon – ties in with the need to design in a natural, environmentally sensitive manner. The construction of SuDS using large amounts of concrete or other materials, which inherently have high levels of carbon, is strongly discouraged. Reducing the need for water pumps, which use large amounts of energy, should also be avoided. Rather, SuDS should be constructed using vegetation, as its ability to sequester carbon as it grows makes it carbon positive.

The design of SuDS should consider the waste that will be produced through their maintenance, and maintenance schedules should be designed to prevent excess waste from accumulating. As much of the waste generated will be organic, it can be managed on-site. However, extra care should be taken on industrial sites as waste may be hazardous and will need to be disposed of off-site.

Most Relevant Policy areas:

a

7. Design for easy access and maintenance

It is important that post-construction access and maintenance are considered when designing SuDS. Ideally, this should be considered from the outset of the masterplanning process to reduce costs, improve maintenance access, and ensure a more intelligently designed SuDS scheme. In this respect, the Construction Design Management regulations should be followed for health and safety purposes. Understanding the individual responsible for maintenance can also improve design and access.

Easy maintenance also requires using hardy species, which take hold quickly. In amenity spaces it is important to design SuDS that also look pleasing. This can be achieved using a species mix tolerant of higher nutrient soils, including selection of acidic, neutral or calcareous grasses.

Image courtesy of Bedford Group of IDBs

Most Relevant Policy areas:

c

8. Linked design through every scale

Individual SuDS features should not be considered in isolation, but instead as part of a wider network of drainage solutions. SuDS should be interconnected and should be designed with the wider context in mind. Minimising site runoff through source control measures such as permeable paving, green roofs, and water butts should be the first step. The relationship between neighbouring properties to manage water on a site-wide basis should be considered next. These features may include swales, wetlands, or large rain gardens which attenuate and treat surface water runoff. At the largest scale, regional measures such as retention ponds and larger wetlands can be considered.

Most Relevant Policy areas:

c d e

9. Place making through SuDS design.

One of the biggest advantages of SuDS over conventional drainage is its ability to improve the character of the surrounding area – using water to celebrate and animate the landscape rather than hide it in underground pipes. When considered in this way, SuDS can be used to enhance the public realm, create unique spaces, use water as public art, and deliver recreational spaces, all while providing all the functional benefits SuDS offer. This is especially the case when SuDS have been integrated into the designs from the beginning as part of a 'water sensitive urban design' approach. Considering SuDS from the outset also allows for an effective approach to construction design and management (CDM), which creates a safe environment while minimising the need for unsightly handrails and fences.

When designing an interactive water feature where there is potential for human contact, the upstream SuDS treatment train should be designed for adequate treatment. The design of SuDS should enhance and contribute to the surrounding landscape and built environment within which it operates. A landscape-led approach, which considers the wider ecosystem, will be important to creating functional ecological corridors, ensuring permeability for wildlife through new developments. Plant selections can contribute to establishing more resilient ecosystem.

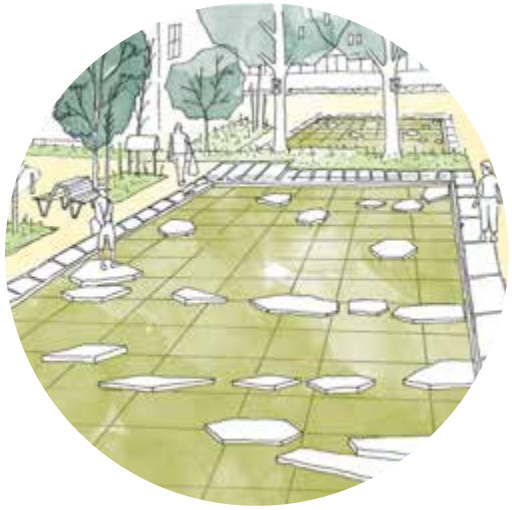
While ecology and the natural environment are important considerations, it is equally important to consider the built environment when designing SuDS for the urban context. A selection of hardscape materials, including concrete, brickwork, and paving may be more suitable in this context, and help to incorporate greenery in an urban-appropriate manner.

Most Relevant Policy areas:

d e

Sign posting:

Central Bedfordshire Landscape Character Assessment – Mid and South Beds
http://www.centralbedfordshire.gov.uk/environment/natural-environment/natural-environment-landscape-character-assessment.aspx



Public square: dry conditions

Public square: wet conditions

Open space: dry conditions

Open space: wet conditions

10. Surface conveyance over pipes

SuDS should be designed to retain and convey water on the surface as much as possible. This avoids unnecessary underground piping for conveyance or tanks for storage, whilst maximising opportunities for biodiversity, amenity and reducing maintenance costs. In the clay areas of Central Bedfordshire which do not lend themselves to effective infiltration, avoiding the use of underground pipes and pumps and managing runoff on the surface has a number of benefits, such as: attenuating water, which reduces erosion and flash flood risk; improved filtration; fewer construction and maintenance costs; increased habitats; community engagement and awareness; and easier detection of blockages.

The scale with which systems of this type can be incorporated safely into urban areas include: roadside kerbs, swales and rills. These are effective features for collecting and conveying water to areas with better permeability, and they avoid the need to convey water in underground pipes.

Piped conveyance ✗

Surface conveyance ✓

Most Relevant Policy areas:

a c

Site Challenges for Designing SuDS

Many sites have issues which can make SuDS schemes difficult to design and construct. However, SuDS can almost always be incorporated to respond to local site conditions if considered intelligently from early in the design process. The following are common site challenges, and the best practices to address them.

Flood Prone Areas

Designing in a Floodplain

Challenge – Floodplains mitigate flood risk. During storms and heavy rainfall these areas will naturally flood with river or coastal water, making them ineffective for storing surface water runoff and are potentially vulnerable to erosion.

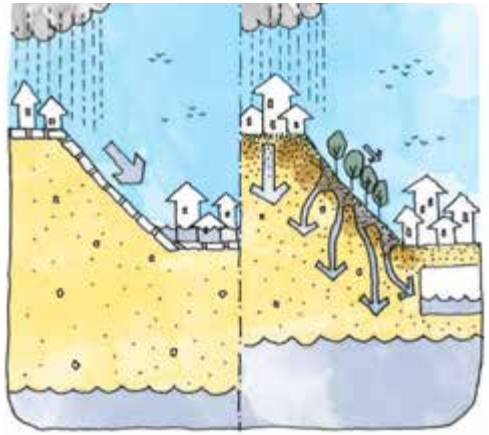
Approach - The presence of a floodplain should not preclude the site from including SuDS as they could still be effective in managing routine rainfall. Design should limit grading and the creation of surface features (such as berms and non-reinforced channels) that could be washed out in a flood. Surface discharge from SuDS should be dispersed (allowed to shed off as sheet flow), and point discharges minimised or eliminated. Attenuation periods for SuDS should be designed so that SuDS empty within 48 hours of any rainfall.

Managing Runoff

Lying within or upstream of local surface water issues

Challenge – Sites that are in or upstream of local surface water issues may be subject to additional restrictions, such as a lower run-off rate, in order to manage problems.

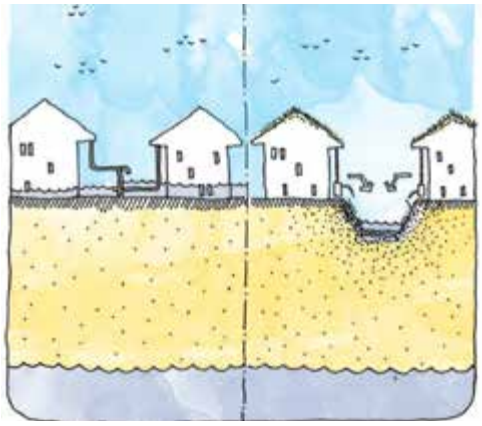
Approach - It is important to investigate at the initial design stage if your site is in, or upstream of, local surface water flood risk areas. Early discussions with the LPA will help define attenuation requirements and may influence the placement or design criteria for SuDS features. See the SuDS Approval section for further details.



Preventing runoff from neighbouring sites flooding the development site

Challenge – Some sites will lie downstream of surface water flows and as such can be liable to flood.

Approach – Ideally, runoff should be managed at a catchment scale rather than on individual properties. As such, the LPA actively supports effective communication and collaboration from all stakeholders. However, where this is not possible an understanding of flows from elsewhere will ensure that buildings are located outside existing surface water conveyance routes. Furthermore, SuDS such as a swale could be used along the boundary to intercept and divert flows and increase land permeability.

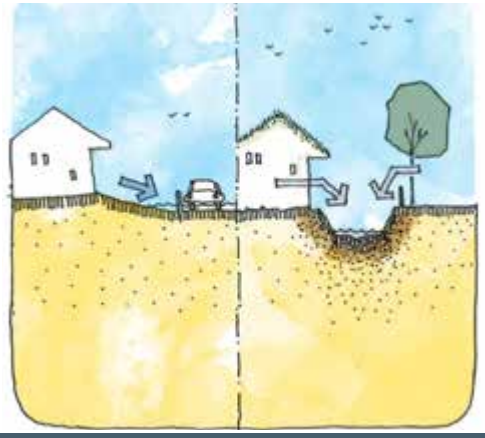


Considering Groundwater

Managing runoff to and from Adopted Highway

Challenge – Large areas of hard, impermeable surfaces, roads and highways can generate large amounts of runoff. As such, development sites cannot usually discharge to road drainage and conversely, there may be instances where some sites will be expected manage runoff from neighbouring roads.

Approach – The local highways authority representative should be engaged early in the development process, as there may be potential for an efficient solution which benefits both private property owners and the highways authority. Adoption of SuDS in the roadway should also be discussed at this point.



Protecting the quality of a receiving body of water

Challenge – As surface water flows over the surface it can pick up pollutants that will reduce the quality of the receiving body of water, damaging the ecological systems. This can be particularly acute for runoff from industrial sites. Any runoff at high risk of contamination from chemicals or other serious waterborne pollution should be contained and treated as industrial waste. Any water being discharged into a water body should be well treated to remove nutrients and sediments and a greater number of treatment stages are likely to be required when the receiving body quality is high.

Approach – Particularly hazardous sites should be divided into sub-catchments that isolate areas where there is an identified risk so that they can drain into separate systems whilst less risky areas such as roof and car parking spaces can still be managed by SuDS. There are, however, a range of SuDS that can provide useful treatment for less hazardous pollution. As different SuDS provide different levels of treatment, a treatment train of at least two or three SuDS features should be introduced to ensure water is exposed to a variety of filtration mechanisms and attenuated to allow pollutants to settle out.

Infiltration SuDS such as soakaways, unsealed porous pavement systems or infiltration basins can only be used where it can be demonstrated that they will not pose a risk to controlled waters (i.e. groundwater, inland freshwaters, coastal waters and relevant territorial waters).

For additional guidance see CIRIA SuDS Manual
http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

Sites with a high groundwater level

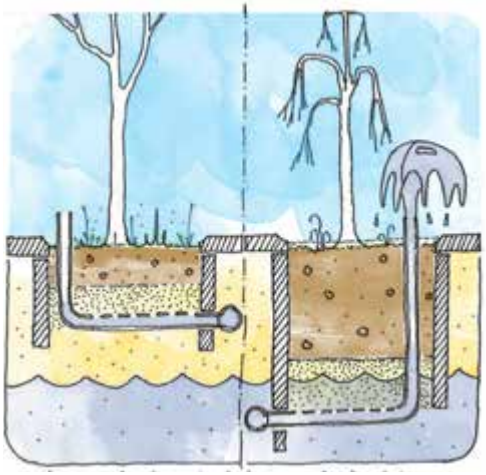
Challenge – Sites with a high water table are susceptible to flooding and may also damage deep SuDS features. If the surface of an infiltration system is too close to the water table, a rise in water levels during particularly wet periods could cause groundwater to enter the infiltration system, reducing the amount of storage available. Groundwater must also be protected from contamination and pollutants.

Approach – If a high groundwater table has been determined then SuDS selection will focus on surface and shallow features that avoid infiltration. Some SuDS features that usually allow infiltration may possibly still be suitable if used in conjunction with an impermeable liner (such as a water proof membrane or compacted native clay) to prevent infiltration. Infiltration SuDS should ensure that a minimum clearance between the base of infiltration SuDS and peak seasonal groundwater.

Ground Water Protection Zones

Challenge – Some areas are designated as a groundwater protection zone to protect drinking water supply and as such are sensitive to contamination. In these areas there might be additional restrictions, particularly on infiltration.

Approach – Some SuDS, such as permeable paving and some rain gardens can provide treatment of surface water before infiltration and potentially avoiding contamination. However, it is important that the proposed drainage strategy is discussed with the EA and if infiltration is not permitted then SuDS can be lined as discussed above.

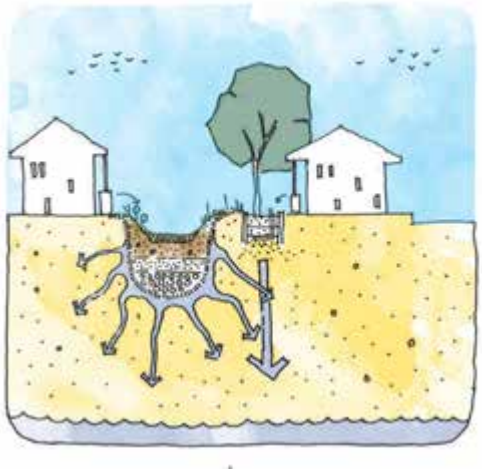


Topography

Incorporating SuDS on a flat site

Challenge – Conveying water using gravity ideally requires a gradient. Flat sites can, therefore, be a challenge. If a piped system is being used to convey surface water on a flat site, downstream SuDS can become deep and unattractive due to the drop required for pipe cover and gradient.

Approach – Manage surface water runoff at the surface and as close to its source as possible. If conveyance is required, surface approaches could include roadside kerbs with shallow rills and swales. Pumping should only be used as a last resort.



Incorporating SuDS on a steep site

Challenge – Steep slopes increase the velocity of surface water, which can in turn increase erosion.

Approach – Check dams and staged storage can be used to slow runoff as it travels down steeper slopes. Similarly, runoff can be controlled by conveying it on platforms in a similar manner to switchback roads on or using bio retention and wetland features staggered in a terraced arrangement. Infiltration is not recommended near steep slopes as it can cause instability.

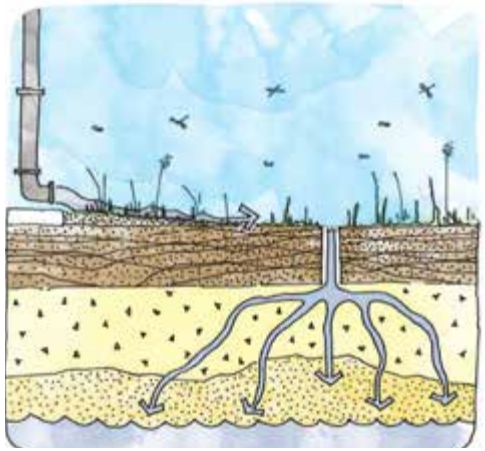
Ground Conditions

Poor Permeability

Challenge – Impermeable soils restrict infiltration and can lead to surface water flooding.

Approach – Where infiltration is not possible the required treatment and attenuation will need to be delivered on the ground or near to the surface. As areas with poor permeability are likely to have naturally high greenfield runoff rates, these requirements should be relatively manageable. It might be, however, that a more permeable layer occurs beneath shallow layers of impermeable geology. As such, it is worth understanding the vertical geology to see if infiltration could occur at a greater depth.

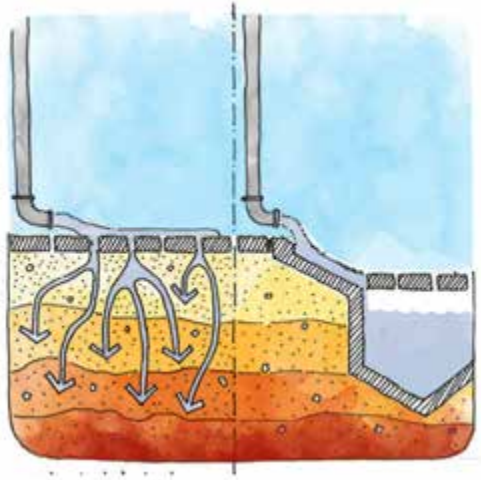
It should be noted that deep bore and other deep soakaway systems are not appropriate in areas where groundwater constitutes a significant resource. The requirements for deep bore soakaways should be discussed with the Environment Agency.



Contaminated Land

Challenge – Some site may have contaminated soils. This restricts infiltration as concentrated ground flow could lead to water-borne contaminants being transferred to deeper soils or sensitive aquifers.

Approach – As with areas that are impermeable, water will need to be treated and attenuated on the ground or near to the surface. SuDS features may need to be lined to restrict any infiltration as SuDS of this type have the potential to provide a pathway for pollutants. They would only be acceptable if a phased site investigation showed the presence of no significant contamination.



Constrained Space

Limited Space

Challenge – As SuDS are often associated with large open areas, space constraints are often cited as a reason for not incorporating them into drainage strategies.

Approach – Considering SuDS early in the masterplanning process is key to ensuring that spatial requirements of features are planned for appropriately. There are also a range of SuDS features which can be easily designed into tight urban settings. Space efficient SuDS include green roofs, bio retention gardens, permeable paving, rills, rainwater harvesting, hardscape storage, micro-wetlands, and bio retention tree pits.

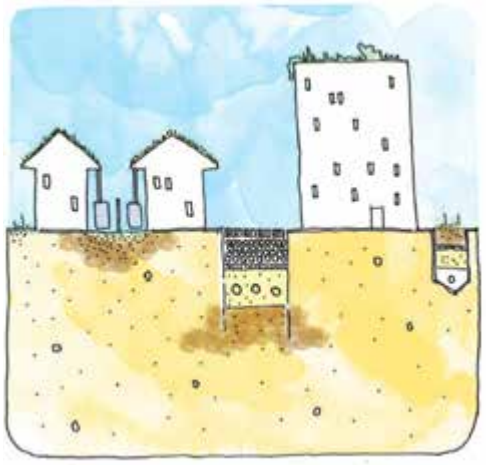


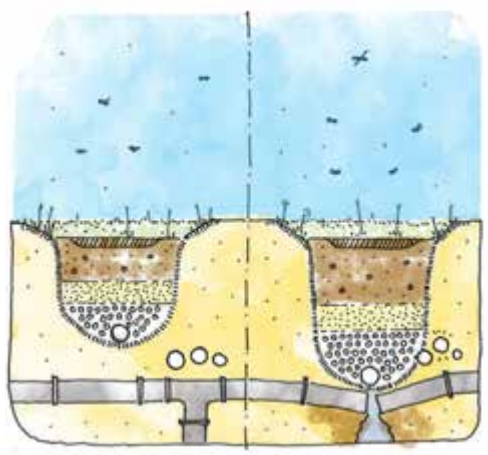
Image courtesy of Land Use Consultants Ltd

Compatibility with existing infrastructure

Challenge – The subterranean environment beneath previously developed sites can become constrained with existing infrastructure. Buried infrastructure, such as utilities, will need to be located and considered in SuDS design and construction. Access to these utilities is likely to restrict SuDS selection.

Approach – Existing drainage infrastructure could be usefully reused as part of a cost-effective drainage strategy. As such it will be important to understand the location and capacity of existing drainage to determine it is potential.

Using SuDS such as permeable paving and bio retention should be avoided in major service strips, as access will require disturbance and rebuilding of the SuDS system, but compatibility can be achieved by constructing dedicated and well-marked service strips that are designed with access in mind.



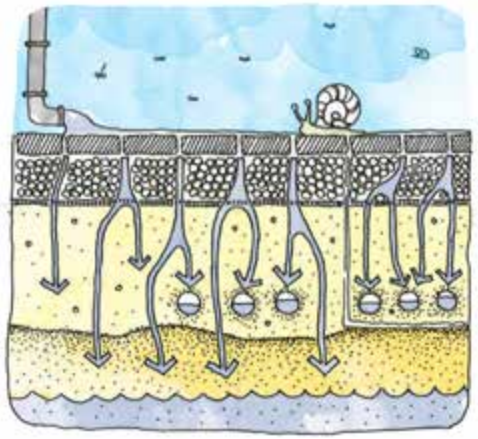
Signpost:

Additional Guidance can be found in 'Use of SuDS in High Density Developments,' HR Wallingford Report SR 640

Incorporating SuDS on a site that is mainly paved

Challenge – hard surfacing, such as paved areas, prevents infiltration and increases runoff.

Approach - Permeable paving can be used for part of the paved area to drain a larger area. The areas of permeable paving should be selected to be the least trafficked (e.g. parking and footpaths) and outside of service strips where possible. Hardscape depressions and rills can be used to provide aboveground storage and double as a water feature in courtyard and paved public realm areas. Underground storage is also an option, but one which won't deliver amenity benefits.



Addressing cost and time needed for maintenance

Challenge – perception that SuDS are expensive and time consuming to design, build and manage.

Approach - It is a common misconception the design, construction and maintenance of SuDS is more expensive and time consuming and less effective than conventional drainage methods. However, as stated by Defra "all evidence is that sustainable drainage systems are generally cheaper to build; and maintaining them will be cheaper...than the same cost to maintain conventional drainage at present". It is important to build in SuDS from the beginning to maximise on the functional and financial benefits.

Signpost:

For supporting evidence and guidance see the documents highlighted here: *http://www.susdrain.org/delivering-suds/using-suds/the-costs-and-benefits-of-suds/guidance-on-cost-benefit-analysis.html*

Image courtesy of Land Use Consultants Ltd

4

CONSIDERING LOCAL NUANCE: DESIGNING LOCAL SUDS ZONES

Image courtesy of Land Use Consultants Ltd

DESIGN CONSIDERATIONS

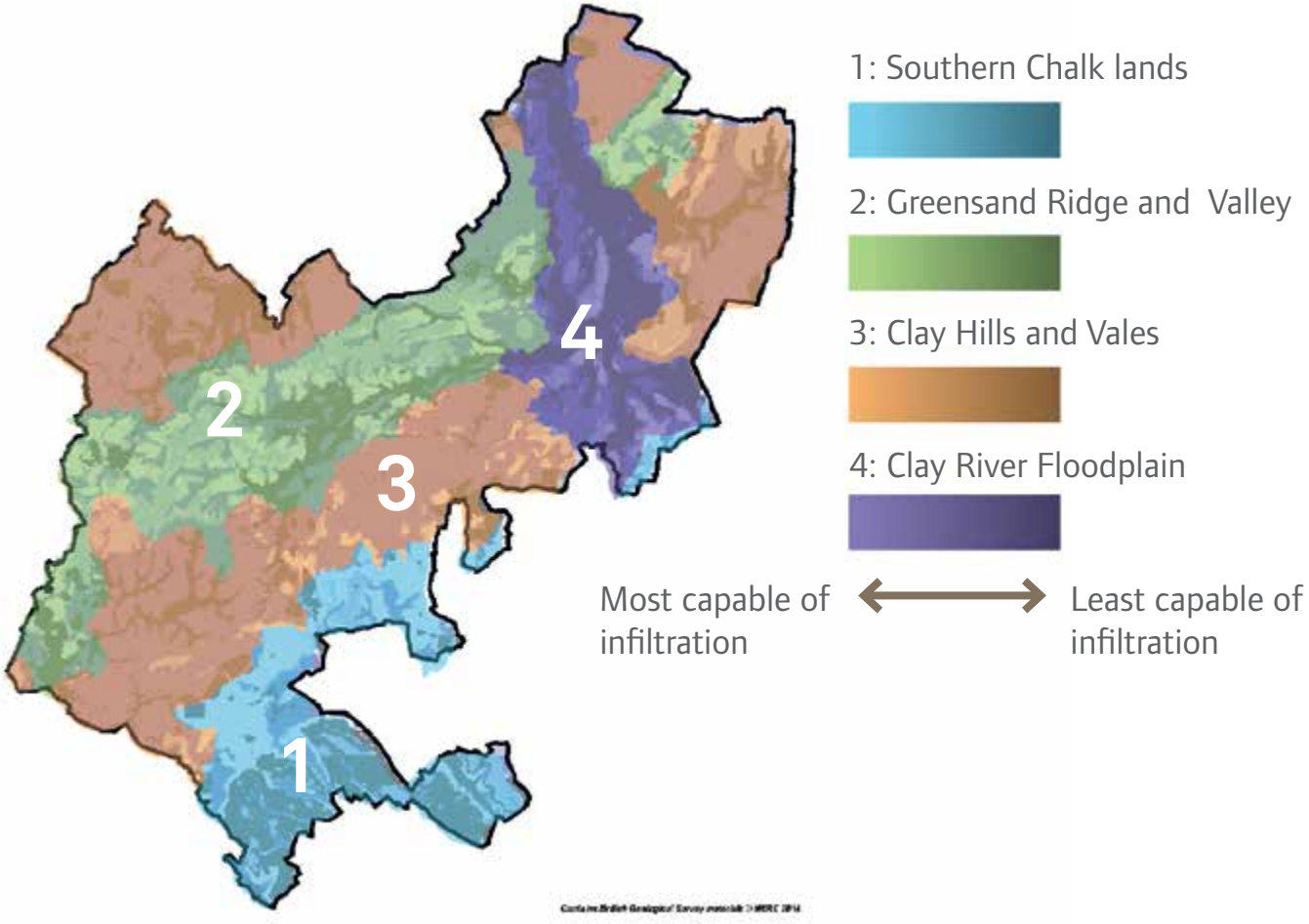
The local requirements outlined in the previous section are important for designing SuDS across Central Bedfordshire. However, Central Bedfordshire has a number of unique landscape characteristics, which will impact the way SuDS are designed. This section outlines how the existing landscape should inform the design of SuDS in four unique zones.

These are:

1. Southern Chalk Lands (Blue on map)
2. Greensand Ridge and Valley (Green on map)
3. Clay Hills and Vales (Orange on map)
4. Clay River Floodplain (Purple on map)

The map opposite outlines the four different zones and the ability of their respective underlying geologies to accept infiltration.

a Indicative map of the Central Bedfordshire Local Zones



1. SOUTHERN CHALK LANDS

Image courtesy of Land Use Consultants Ltd

Arterial Chalk River Valleys, Chalk Dipslope, Chalk Escarpments and Rolling Chalk Farmland.

Characteristic features:

- Mixture of steep sided chalk valleys, with watercourses, as well as dry valleys
- Rivers Lea, Ivel, and Gade are the most prominent rivers flowing through the area
- Arable farming is the predominant land use outside of urban areas with some pasture land found around settlements
- It contains the Chiltern Hills AONB, Lea Valley, and various Sites of Special Scientific Interest (SSSIs)
- The River Lea has been dammed to create two lakes south of Luton

SuDS Standards in the Southern Chalk Lands

1. Consideration should be given to the requirements of the Chilterns Area of Outstanding Natural Beauty

It is important to consider the broader context of where the SuDS are being implemented and the extent to which they can have a positive impact. Water management will have particular implications on landscapes designated as environmentally sensitive, such as Areas of Outstanding Natural Beauty – water and soil quality will need to be monitored more closely to ensure with pollutants or agricultural chemicals from surface water runoff do not harm these landscapes. As such, considerations should be given to the filtration methods used as well as the direction of flow routes so as to ensure that SuDS features focus on filtration. This is particularly important if located near arable or pasture farmland, which often have surface water runoff with higher concentration of nutrient pollution, such as nitrate and phosphorous.

2. Tailor SuDS to suit the permeable nature of the underlying chalk geology of this area.

In areas, such as the Southern Chalk Lands, where the underlying geology is permeable, groundwater recharge via infiltration should be the priority for surface water runoff. Considering the underlying chalk aquifer is a major potable water resource, filtration will be an important consideration. This is particularly important where abstraction occurs.

Much of the area around Dunstable and Houghton Regis is located in a Groundwater Source Protection Zone. These areas are at risk for any activity that might cause pollution, and SuDS will need to be designed with special attention placed on filtering of pollutants, and protecting and improving the quality of the groundwater.

3. Collaboration between Highways Authority, the LPA, and developers

There are a number of large road infrastructure works in the area. The development of these road works will have an impact of surface water runoff from and onto roads. Communication and collaboration between the Highways Authority, LPA, developers, and any statutory and non-statutory consultees will be needed to ensure water quality entering receiving bodies of water is not compromised.

2. GREENSAND RIDGE AND VALLEY

Image courtesy of Land Use Consultants Ltd

Wooded Greensand Ridge and Greensand River Valleys.

Characteristic features:

- Elevated, heavily wooded landscape with a number of small valleys
- Many of the wooded areas are managed for commercial forestry
- There are many SSSIs within the area
- River valleys are largely comprised of low-lying riverside farmland
- Arable farming is the main land use, with some pasture farming
- River Ouzel and River Flit floodplains are important to the area – agricultural pollution is an issue in the River Flit
- Groundwater has filled a number of disused quarries

Signpost:

Central Bedfordshire Development Strategy: Ecosystem Services Appendices January 2013
http://www.centralbedfordshire.gov.uk/Images/Ecosystem%20services%20Apps%20June%2012_tcm6-55528.pdf

SuDS Standards in the Greensand Ridge and Valley

1. Consideration should be given to the underlying geology - clay and the layer of greensand further below. While clay is impermeable, greensand has a high level of permeability.

The underlying green sand aquifers are known to suffer from over abstraction and extended dry seasons with low flows during the spring season. Wherever possible, preference will be placed on SuDS which allow for infiltration. In this zone, however, an impermeable layer of clay covers many parts of the permeable layer of greensand geology preventing infiltration to the aquifer below. It is possible for SuDS to be designed to filter directly to the greensand below, but the thickness of the clay will need to be tested. As the thickness of the clay layer will vary across the zone, infiltration will only be reasonably practicable in areas of shallower depths.

2. Focus on reconnecting fragmented wetlands

The wetland habitat is a key feature to this SuDS zone; however, they are currently fragmented. It will be important that when opportunities arise, reconnecting them should be a priority. Species which inhabit wetlands in this zone should be used in constructed wetlands. These species include: royal fern, mudwort, bog pimpernel, common cotton grass, greater dodder, marsh violet, star sedge, bulbous rush, and heath rush.

3. Contribute to improving River Flit water quality

Agricultural runoff has polluted the River Flit and resulted in poor river water quality. With increased development pressure, there is a risk of even higher pollution levels entering into the river. As per the National Standards, the number of SuDS features in the treatment train will need to consider the poor quality of the Flit. Properties which runoff directly into the River Flit should ensure that surface water runoff is of a higher quality than the river's existing water quality.

3. CLAY HILLS AND VALES

Image courtesy of Land Use Consultants Ltd

Characteristic features:

- Rolling hills and farmland, with some woodland
- Both seasonal and permanent watercourses and wet ditches
- Includes significant parts of the Chiltern Hills Area of Outstanding Natural Beauty
- Arable and pasture farming are the predominant land use – orchards in the area are a distinct feature
- The Clipstone Brook is the main watercourse which feeds into the River Ouzel. Battlesden Lake, disused quarries, and village ponds make up some of the water bodies in the area
- The Marston Vale Surface Waters Plan gives specific details for water management in the area.

SuDS Standards in the Clay Hills and Vales

1. Consideration should be given to the requirements of the Chilterns Area of Outstanding Natural Beauty.

It is important to consider the broader context of where the SuDS are being implemented and the extent to which they can have a positive impact. Water management will have particular implications on landscapes designated as environmentally sensitive, such as Areas of Outstanding Natural Beauty – water and soil quality will need to be monitored more closely to ensure with pollutants or agricultural chemicals from surface water runoff do not harm these landscapes. As such, considerations should be given to the filtration methods used as well as the direction of flow routes so as to ensure that SuDS features focus on filtration. This is particularly important if located near arable or pasture farmland, which often have surface water runoff with higher concentration of nutrient pollution, such as nitrate and phosphorous.

2. The permeability of clay is poor and would not lend itself to infiltration measures; therefore, SuDS should be managed on the surface

The geology in this zone is not favourable for infiltration. As a result, it is important that surface water runoff is kept above ground.

When designing SuDS in this area, the Marston Vale Surface Waters Plan should be consulted.

This is detailed in Local Requirement 10, Surface Conveyance over pipes.

Marston Vale Surface Waters Plan (2002)
http://www.centralbedfordshire.gov.uk/Images/The%20Surface%20Waters%20Plan_tcm6-13659.pdf

3. Consider the quality of the water courses in the design of SuDS

The main water course, The Clipstone Brook, flows into the River Ouzel. Consideration, therefore, for the quality of water should be a high priority. Water quality also has an impact on the health of wetland habitats such as marshes, which are prominent in the zone and are sensitive.

Reducing the risk of agricultural chemicals and other pollutants reaching water courses and water bodies will be important, as quality of surface water runoff will need to be higher than that of the receiving water bodies.

4. Establish habitat-friendly SuDS

This zone is unique in the richness of wildlife, which inhabit it. To achieve this, SuDS should be proximally located, but not connected to existing wetlands. Planted wetlands should be well vegetated, and constructed to have shallow bays and areas of marsh. Only native plants should be used, and "rough" or uneven surfaces are encouraged to increase habitat diversity.

5. Collaboration between Highways Authority, the LPA, and developers

There are several road infrastructure projects planned in the area, such as dualling of the A421 between junction 13 and the Central Bedfordshire boundary. The development of road works will have an impact of surface water runoff from and onto roads. Communication and collaboration between the Highways Authority, LPA, developers, and any statutory and non-statutory consultees will be needed to ensure water quality entering receiving bodies of water is not compromised.

4. CLAY RIVER FLOODPLAIN

This image is taken of the River Ivel Navigation which intersects the River Ivel.

Characteristic features:

- The zone is characterised by low-lying flat floodplains, with watercourses which support willow and poplars
- Arable farming is the predominant land use
- Fertile soils exist in the Ivel Valley
- Disused gravel pits often contain water and are used for conservation and recreation
- The Rivers Ivel and Great Ouse are the main hydrological features, and are generally natural meandering watercourses with some stretches of hard engineering
- Disused gravel pits have resulted in water bodies forming due to the exposure of the water table, features that range from small ponds to larger lakes

SuDS Standards in the Clay River Floodplain

1. The permeability of clay is poor and would not lend itself to infiltration measures; therefore, SuDS should be managed on the surface

The geology in this zone is not favourable for infiltration. As a result, it is important that surface water runoff is kept above ground.

This is detailed in Local Requirement 10, Surface Conveyance over pipes.

2. Encourage uptake of raingardens and allotments as SuDS.

The land surrounding the River Ivel is considered to be fertile, resulting in increased levels of market gardening in the area. It is a practice that is unique to this area in Central Bedfordshire. Given the natural enthusiasm for gardening in the area, gardens should be promoted as an additional benefit. Allotments and gardens should be considered in the design process to appeal to local residents.

3. Place emphasis on the protection of habitats

There are many wet habitats associated with multiple water courses and water bodies in the area. Therefore, it is important that the water entering these is not contaminated with pollutants and agricultural chemicals. Doing so will require that surface water runoff is of a higher quality than that of the receiving waterways and water bodies. There is a high level of biodiversity found within the waterways and waterbodies, some of which are protected, such as Great Crested Newts protected by both EU and UK law. If SuDS features are to support protected species, the design process should consider how best to protect these habitats during maintenance and operation without compromising the function of the assets' to perform as designed.

4. The floodplain is generally low lying and flat, how water is transported should be carefully considered to take this into consideration.

In areas where there is no gradient, or such a low gradient that the movement of water between SuDS measures would require pumping, SuDS should be designed such that water is stored and treated with minimal movement required. It may be the case that water collected and filtered is simply reused on-site. Additional information on designing SuDS in flat landscapes can be found in the Topography section of Design Considerations and Local Requirements.

Image courtesy of Land Use Consultants Ltd

ADDITIONAL RESOURCES

This guidance document outlines the SuDS Approval process in Central Bedfordshire, and how SuDS should be designed given the Central Bedfordshire context. Through considering SuDS from the beginning of the masterplanning process, consulting the appropriate professionals throughout, and creating SuDS schemes which respond to their immediate and wider context, developments can help create a Central Bedfordshire which contributes positively to the community. This guidance, however, should be viewed as a starting point, both for how to design and construct SuDS, and for the Central Bedfordshire context. Additional sources of information have been listed below. These sources will be updated regularly to account for the changing SuDS landscape.

National Policy and Guidance

Flood and Water Management Act
http://www.legislation.gov.uk/ukpga/2010/29/contents

National Planning Policy Framework, 2012.
http://planningguidance.planningportal.gov.uk/blog/policy/

Planning Practice Guidance.
http://planningguidance.planningportal.gov.uk/blog/guidance/

Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems. March 2015
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

Environment Agency Groundwater Protection Policy and Practice.
http://www.environment-agency.gov.uk/research/library/publications/144346.aspx

The CIRIA publications Designing for exceedance in urban drainage - good practice (C635) / 'Planning for SuDS – making it happen' (CIRIA C687)
Available via registration at:
http://www.ciria.org/default.aspx

Environment Agency Rainfall Runoff Management for Developments: Report - SC030219
http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/Rainfall_Runoff_Management_for_Developments_-_Revision_E.sflb.ashx

RSPB and WWT Sustainable Drainage Systems, Maximising the Potential for People and Wildlife: A Guide for Local Authorities and Developers, 2012.
http://www.rspb.org.uk/Images/SuDS_report_final_tcm9-338064.pdf

Environment Agency - A Climate Change Allowances for Planners
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296964/LIT_8496_5306da.pdf

The Building Regulations (Part H)
http://www.planningportal.gov.uk/buildingregulations/approveddocuments/parth/approved#Download

Environment Agency Maps for Planning
http://apps.environment-agency.gov.uk/wiyby/37837.aspx

Local Policy

Joint Strategic Needs Assessment for Central Bedfordshire
http://www.centralbedfordshire.gov.uk/health-and-social-care/jsna/joint-strategic-needs-assessment-jsna.aspx

Development Strategy for Central Bedfordshire: pre-submission, 2013.
http://www.centralbedfordshire.gov.uk/planning/strategic-planning/development-strategy.aspx

Mid Bedfordshire Core Strategy and Development Management Policies, November 2009
http://www.centralbedfordshire.gov.uk/Images/CSDM%20Policies%20Adopted%20Nov%202009%20tagged_tcm6-21001.pdf#False

Luton and Southern Central Bedfordshire Core Strategy (pre-submission), November 2010
http://www.centralbedfordshire.gov.uk/Images/JCS1LutonandsouthernCentralBedsCoreStratPre-SubNov2010_000_tcm6-48032.pdf#False

South Bedfordshire Local Plan Review 2004
http://www.centralbedfordshire.gov.uk/_sbdc-localplan/start.html

Bedford Borough, Central Bedfordshire and Luton Borough Councils Minerals and Waste Local Plan: Strategic Sites and Policies. January 2014
http://www.centralbedfordshire.gov.uk/planning/minerals-and-waste/development-framework.aspx

Advice for the provision of surface water drainage systems for new developments. April 2015
http://www.centralbedfordshire.gov.uk/Images/Requirements%20for%20SuDS%20on%20developments%20with%20surface%20water%20implications_tcm6-65271.pdf

Flood Risk

Local Flood Risk Management Strategy for Central Bedfordshire, 2014.
http://www.centralbedfordshire.gov.uk/Images/CBC%20Draft%20LFRMS%20%28v8%20170314%29_tcm6-55819.pdf

Upper River Great Ouse Tri Lead Local Flood Authority Preliminary Flood Risk Assessment
http://www.bedford.gov.uk/pdf/PFRA.pdf

Marston Vale Surface Waters Plan (2002)
http://www.centralbedfordshire.gov.uk/Images/The%20Surface%20Waters%20Plan_tcm6-13659.pdf

Bedford Group of Drainage Boards
http://www.idbs.org.uk/contact-us/

Local Character and SuDS Design

Central Bedfordshire Landscape Character Assessment – Mid and South Bedfordshire
http://www.centralbedfordshire.gov.uk/environment/natural-environment/natural-environment-landscape-character-assessment.aspx

Design Guide for Central Bedfordshire:
http://www.centralbedfordshire.gov.uk/Images/Item%203%20-%20Design%20Guide_tcm6-56206.pdf

Rebuilding biodiversity in Bedfordshire & Luton, 2007 (Vol. 1 and Vol. 2)
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=bedslife_rebuild

Bedfordshire and Luton Biodiversity Recording and Monitoring Centre
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=sites_bedscape

British Geological Survey
http://bgs.ac.uk/

CIRIA SuDS Manual
http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

HR Wallingford Report SR 640 'Use of SuDS in High Density Developments,' 2005 (Book)

Central Bedfordshire Climate Change Risk Assessment, 2012:
http://www.centralbedfordshire.gov.uk/Images/Central%20Beds%20Climate%20Change%20Risk%20Assessment%20Apr%2012_tcm6-31868.pdf#False

Anglian Water SuDS Adoption Manual
http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf

CIWEM Planning Advice for Integrated Water Management
http://www.ciwem.org/media/1282495/Natural_Capital_Leaders_Platform_Water_Planning_Advice_Note_June_2014%20%282%29.pdf

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