CENTRAL BEDFORDSHIRE

SUSTAINABLE DRAINAGE GUIDANCE

March 2014

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INTRODUCTION

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) mitigates 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, and where geological conditions permit, replenish groundwater supplies through infiltration. For SuDS which incorporate vegetation, however, there are ancillary benefits, which are 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

As described below, SuDS will soon be legislated in new developments. Incorporating SuDS in developments, however, should also be viewed as 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.

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.

Attractive and locally sensitive solutions

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

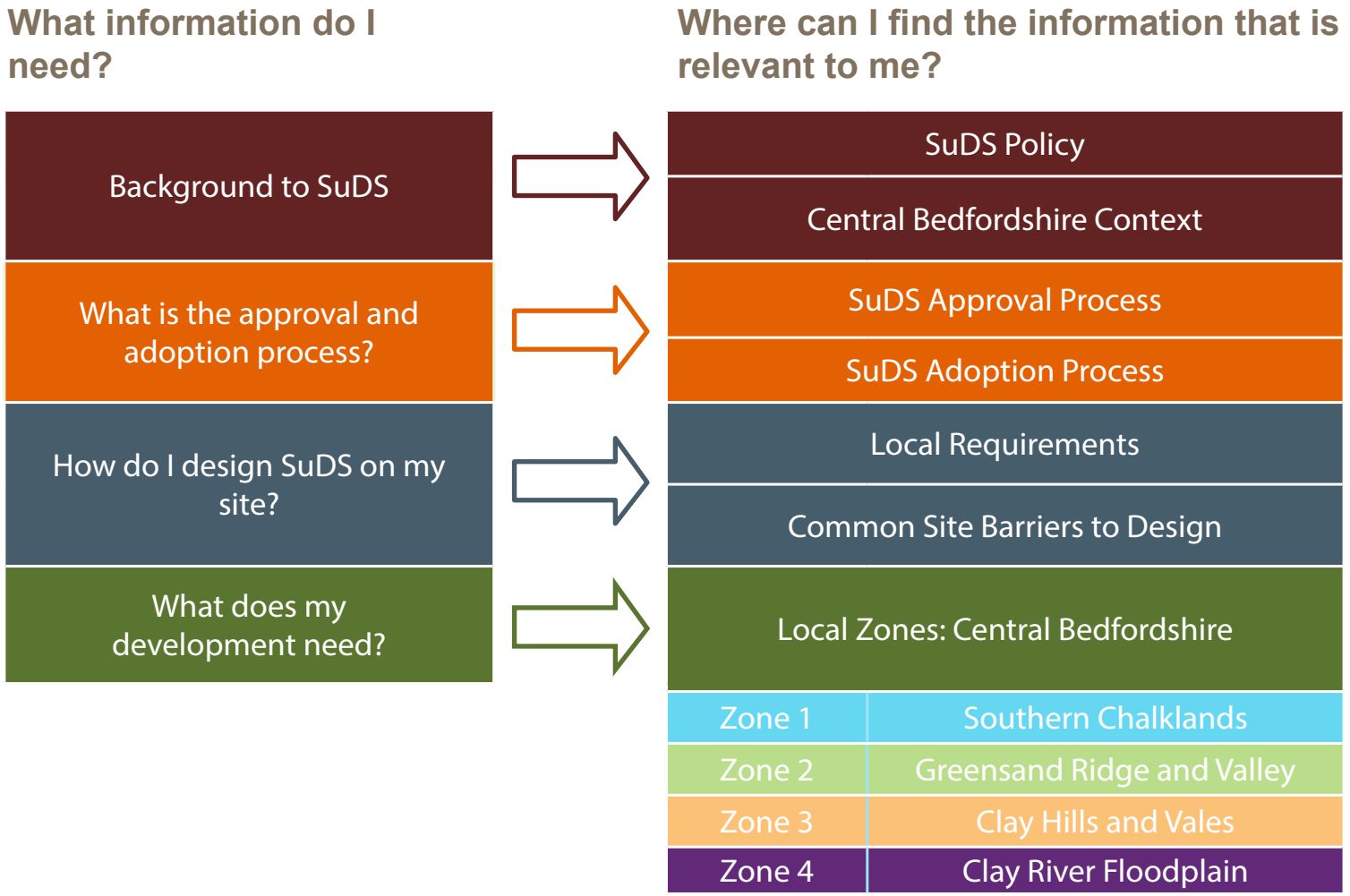
Designed for access and recreation

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

HOW TO USE THIS DOCUMENT

This Supplementary Planning Document provides Technical Guidance on sustainable drainage, and has been created to be a comprehensive resource for SuDS reference and policy development and has been developed with the intention for it to be reviewed periodically, and updated to account for new Central Bedfordshire Council as well as national policy. This will be particularly important as Central Bedfordshire's SuDS Approval Body gains experience approving and adopting SuDS.

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.



1 BACKGROUND

POLICY CONTEXT

1.1 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 improve water management. As part of the Act, Schedule 3 requires new developments to implement Sustainable Drainage Systems (SuDS) on all new developments. SuDS aim to use natural features in place of conventional drainage to reduce surface water runoff, mitigate flood risk, and improve water quality.

To enforce the legislation, the government has introduced the SuDS Approval Body (SAB) to be responsible for ensuring that new developments meet the National Standards and local requirements for SuDS. This role will require the SAB to approve SuDS before construction can commence. Once approved, the SAB will also be responsible for adopting and maintaining the SuDS scheme.

The FWMA 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:

National Standards for sustainable drainage systems Designing, constructing, operating and maintaining drainage for surface runoff, 2011.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82421/suds-consult-annexa-national-standards-111221.pdf

Consultation on the Implementation of the Sustainable Drainage Systems provisions in Schedule 3 Flood and Water Management Act 2010, 2011.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82423/suds-consult-doc-111120.pdf

1.2 National policy context

The FWMA was released under the purview of the National Planning Policy Framework (NPPF), which 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 states that "when determining planning applications…development [must be] appropriately flood resilient and resistant", with a priority given to sustainable urban drainage systems (SuDS) as a means of achieving this. There is a duty for the Local Planning Authority (LPA) to develop proactive strategies that tackle issues surrounding water management, flood risk, water supply and demand.

The framework recognises the opportunity for land and open spaces 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 and green infrastructure a clear sense of place can be achieved, reflecting the local character of the area.

SIGNPOST:

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

1.3 Local policy context

Development Strategy for Central Bedfordshire, Pre-submission Jan 2013

The emerging 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.

SuDS have been incorporated into the general adaptation policy which aims to ensure that development is resilient to the 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, and 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).

1.4 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.

Within Central Bedfordshire there are two drainage districts, 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

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

Design Guide for Central Bedfordshire:
http://www.centralbedfordshire.gov.uk/Images/Design%20Guide%20for%20Central%20Bedfordshire_tcm6-8531.pdf

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

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

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

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

1.5 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:

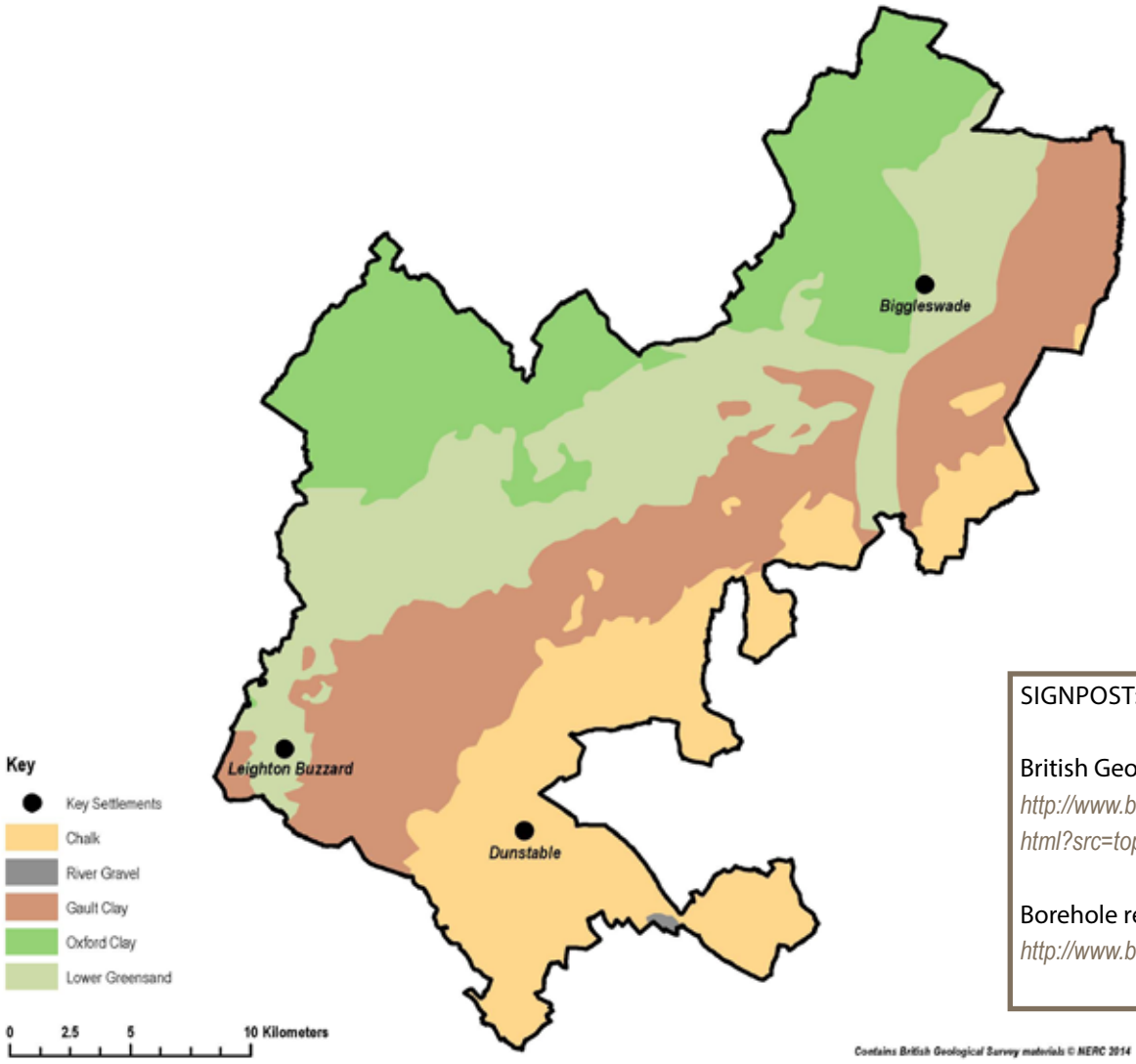
Rebuilding Biodiversity in Bedfordshire and Luton
http://www.bedscape.org.uk/BRMC/newsite/index.php?c=bedslife_rebuild

1.6 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/boreholes.htm

1.7 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.

1.8 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.

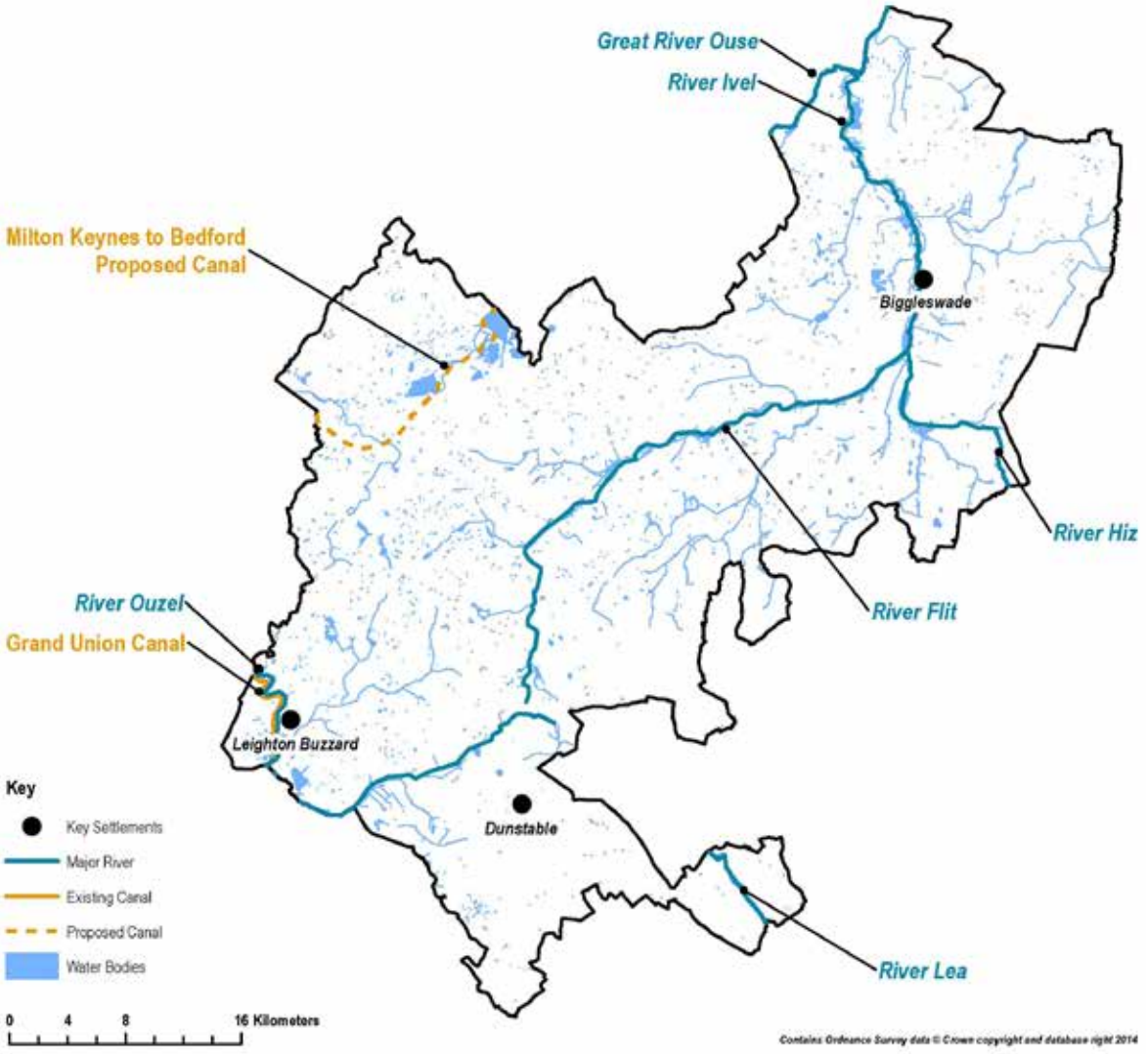
Central Bedfordshire Climate Change Risk Assessment, 2012:
http://www.centralbedfordshire.gov.uk/Images/Central%20Beds%20Climate%20Change%20Risk%20Assessment%20Apr%2012_tcm6-31868.pdf#False

1.9 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



1.10 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.

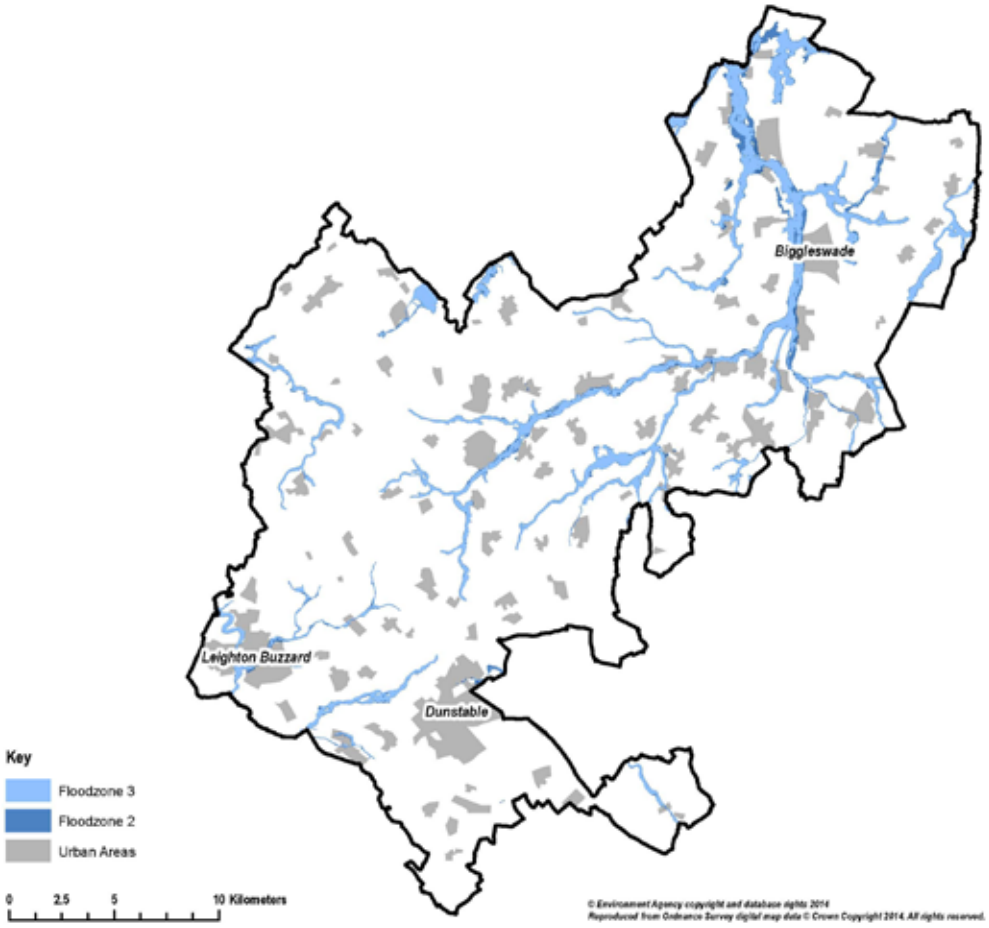
Generally rivers, watercourses and floodplain areas are considered to be floodzone 3, which falls under a 1 in 1000 risk. However, there are some areas which under floodzone 2, 1 in 100 risk, particularly along the River Ivel to the north and south of Biggleswade.

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

C Fluvial Flood risk in Central Bedfordshire



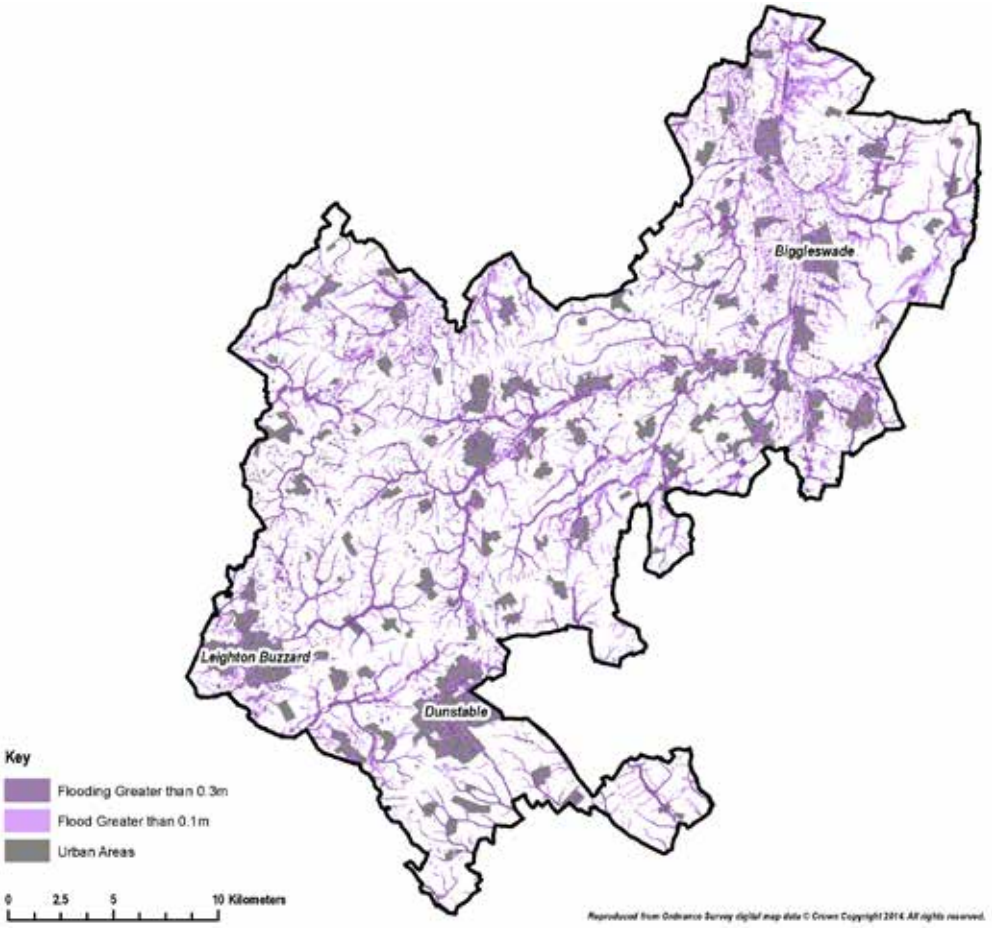
d Risk of Surface Water Flooding in Central Bedfordshire

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.



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

SIGNPOST:

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

Groundwater Flood risk

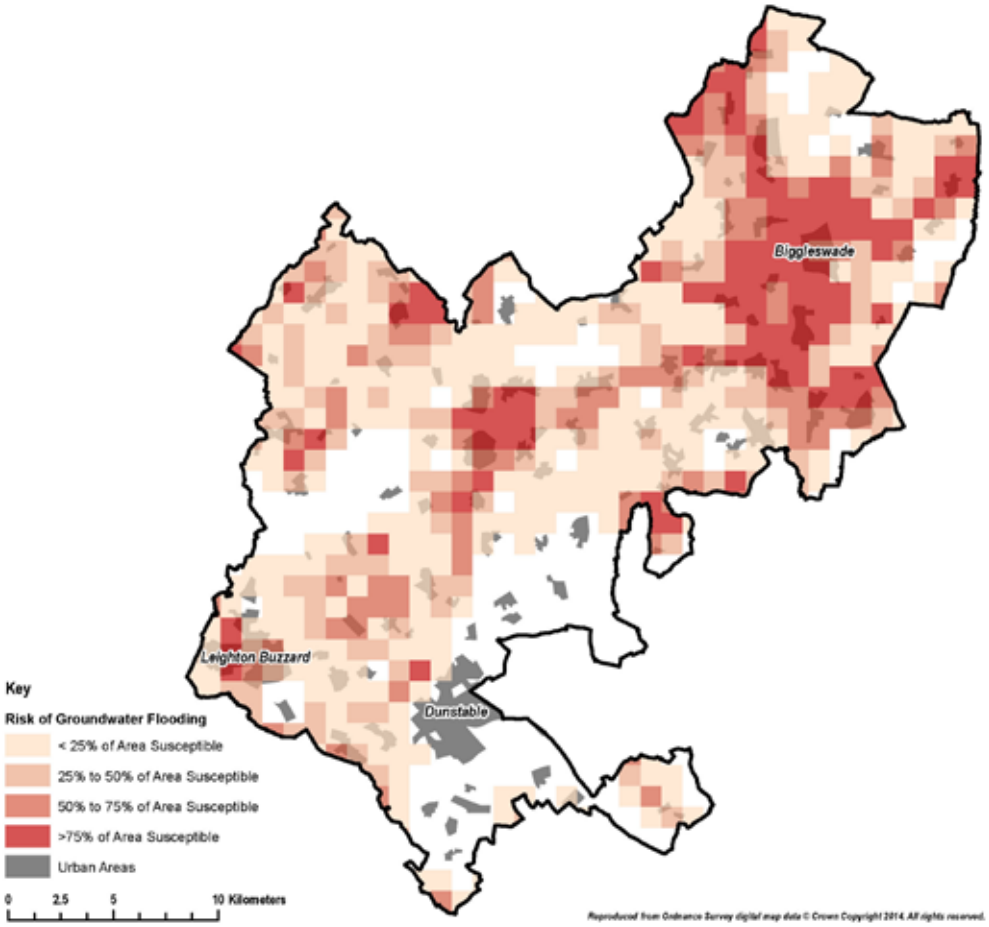
Flooding of this kind occurs when precipitation overwhelms the water table below ground causing it to rise above the surface. It is most common in areas where there are aquifers (permeable rock that water can soak into or pass through).

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

e 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

1.11 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.

1.14 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

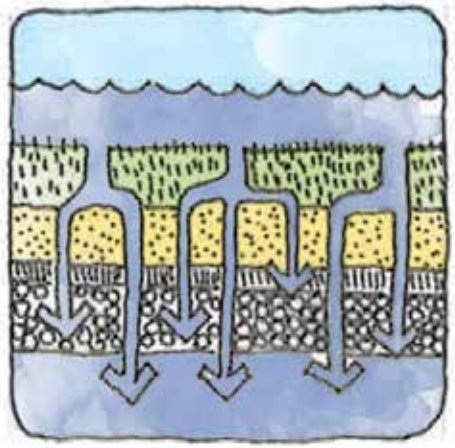
Sustainable Drainage Systems are now recognised as the preferred method for managing rainfall runoff. This is partly due to their versatility and ability to be designed for numerous landscapes and in response to a host of constraints. SuDS can be designed to include natural vegetation – wetlands, green 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.

1.15 SuDS have a number of benefits:

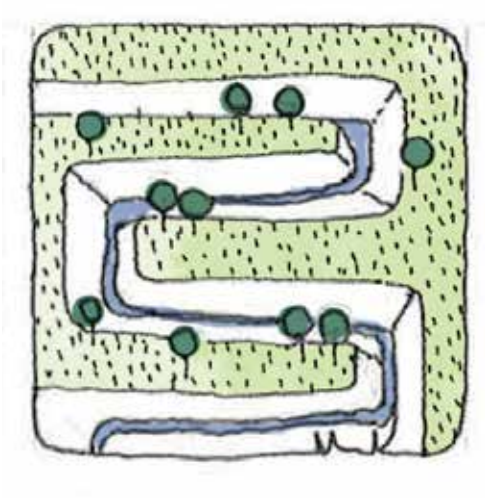


A) Infiltration

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

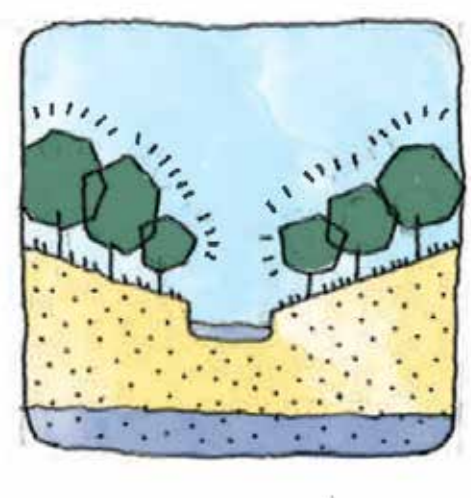
B) Filtration

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

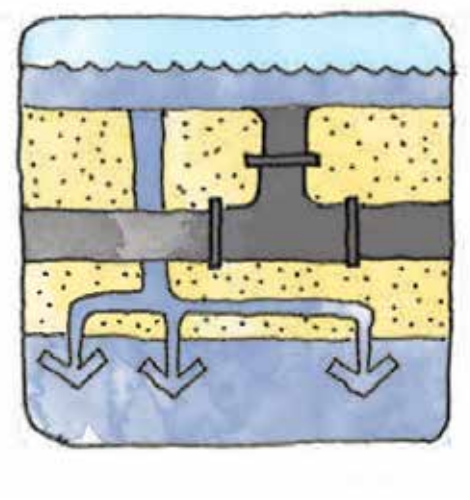


D) Carbon sequestration

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.

2 APPROVAL AND ADOPTION PROCESS

THE APPROVAL PROCESS

This section details the approval and adoption process that Central Bedfordshire Council (in its role as a SuDS Approval Body, and Local Planning Authority) will follow. Information about Central Bedfordshire Council's approach to approval and adoption of SuDS in the interim period before taking on the SuDS Approval Body role is detailed in section 2.1.

With the passage of the FWMA (2010), any development which could have an impact on the existing drainage infrastructure will require SAB approval. The SuDS approval process will differ depending on whether planning permission is also required, or if it is permitted development. The two different processes are outlined in Figures 1 & 2.

The aim of this section is to detail the steps developers and designers will need to undertake meet the National Standards in the Central Bedfordshire context, enabling their schemes to be approved and adopted. When considered along with the local requirements outlined in section 3, this document should be a valuable resource in simplifying the design process.

2.1 Interim Period

There will be an interim period between the adoption of this guidance and the time when Central Bedfordshire Council takes on the SuDS Approval Body role. In this period, we will expect the design of SuDS to comply with the local requirements set out in Chapter 3 of this guidance, and design SuDS to consider local nuance, as described on Chapter 4, as these requirements and principles relate to adopted local planning policies. This will be assessed as part of the planning application process.

There may also be instances where Central Bedfordshire Council will be able to adopt the SuDS. For developments where the Council is intended to adopt the green spaces that are part of the development, and where the SuDS are designed to be an integral part of the greenspace network, the Council would consider adopting the SuDS as part of the greenspace adoption. In these instances, the SuDS should be designed to demonstrably meet the drainage performance requirements described by Defra in their National Standards for Sustainable Drainage, and the design and drainage requirements explained in the SuDS Manual (CIRIA c697, 2007, or as updated), as well as the local requirements and design considerations detailed in this guidance. Funding for the maintenance and management of the SuDS would need to be negotiated and agreed as part of the package of funding for the greenspaces, and agreed through the planning application process.

2.2 Planning Application and Drainage Application

All construction and development requiring planning permission will need collaboration between planners and the SAB to ensure both planning application and drainage application are managed in an efficient and timely manner. As a unitary authority, Central Bedfordshire benefits from having planners and the forthcoming SAB operating within the same authority – this should make communication and collaboration more efficient than for two-tier authorities.

At the Full or Reserved Matters planning application stage, the developer will submit both the planning application and the drainage application to the planning department. The planning department will then submit the drainage application the SAB with any relevant documents and context-relevant information. Should the SAB require additional information, this request should be made of the developer in parallel with any clarifications the planning department needs.

The drainage application should not delay the process – as such, the SAB is given 12 weeks to determine the drainage application for all major developments, and 7 weeks for all other applications. The SAB is then to submit their determination and any drainage-related conditions to the planning department to be included in the planning permission. In the case where planning permission is granted, but drainage application is rejected, the drainage application will need to be re-submitted to a satisfactory level (as determined by the SAB) before full planning permission can be granted.

The relationship between the two parties, the developer and the statutory consultees is outlined in the Figure 3. If the development seeks outline planning permission, SuDS approval is not required at this stage; however, ensuring the developer provides the planning department with a concept SuDS strategy for the site to be passed to the SAB to make any necessary representations.

2.3 Drainage Application: Planning Permission Required

Designing and implementing the most effective SuDS schemes requires involving a variety of relevant professionals from the beginning of the masterplanning process. Consulting with the SAB, statutory and non-statutory consultees during pre-application stage will make the process more efficient at the Full and Reserved Matters Application stage. Figure 1 outlines the process diagrammatically. Each stage of the application process is detailed below.

Stage 1: Masterplanning

For larger developments a masterplan is often necessary. At this stage, the developer or landowner should consult with the SAB to understand drainage requirements their development needs to consider. The SAB will provide high level design considerations, and notify them of any relevant by-laws and consultees which should be included in the design process. It is at this stage that SuDS layout should be determined – the design team should design the site around natural flow routes, considering topography, geology, and greenspace to ensure the design is safer, mitigating flood risk in the process. Seeking advice from the SAB and relevant experts from the earliest stages of the masterplanning process will create a better functioning drainage scheme, and reduce the need for costly alterations to the masterplan at later stages. Considering SuDS at this stage also provides an opportunity for SuDS to be inform and enhance the site design, enabling developers to maximise the financial benefits that SuDS can provide in the process.

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.

Stage 2: Pre-application

Consultations undertaken at this stage will reduce the time and cost of doing so in later stages. During the pre-application stage, it is advisable for the developer to share the drainage scheme's conceptual design with the SAB, planning department, and any relevant statutory consultees.

INFORMATION REQUIRED AT MASTERPLANNING AND PRE-APPLICATION

During the pre-application and masterplanning stage, the SAB will provide general guidance and may respond to any specific questions. While there is no submission at this stage, the developer should consult with relevant consultees and review pertinent documents such as Flood Risk Assessments and underlying geology maps. Doing so at this stage could avoid costly masterplan changes later.

Stage 3: Outline Planning Application

When an outline planning application is to be submitted, the developer should include a concept SuDS strategy with the planning application. The concept SuDS strategy should include basic design information which demonstrates that SuDS design has been intelligently considered and incorporated into the overall masterplan.

The planning department will need to forward the Drainage Application to the SAB who will need to make representations to the planning department before planning permission can be granted. If the developer has not yet consulted the relevant statutory consultees, this is the time for the SAB to recommend which ones the developer should contact. If statutory consultees are not also planning application consultees, they should provide comments through the SAB.

INFORMATION REQUIRED AT OUTLINE APPLICATION STAGE

At outline application stage, the developer will need to describe how SuDS have been accommodated in the site's concept design.
The documentation should be considered under three different headings: site assessment, SuDS design, and processes and timings.

SITE ASSESSMENT

- Site drainage patterns – An examination of the current and previous drainage patterns on the site and surrounding sites needs to demonstrate that drainage proposals do not impair the existing drainage system, and mitigates any existing flood risk.
- Infiltration assessment – Following an initial site investigation, soil types and geology should be assessed for infiltration potential. Infiltration tests should be conducted on site, and test for: constraints to be considered prior to planning infiltration SuDS; drainage rate of the ground; ground stability, particularly after water has been absorbed; and groundwater quality after infiltration. Seasonal variations in groundwater levels should also be examined. One of the best resources to consult for assessing infiltration is the British Geological Survey (bgs.ac.uk).

SUDS DESIGN

- Concept surface water runoff management strategy, including; rationale for the SuDS selected and their layout and indicative sizing within the site.
- Feasibility of SuDS should be considered: Indicative runoff rates and attenuation volumes over the development's lifetime
- Consideration for how the SuDS scheme integrates with the existing landscape design
- Expected source control measures

PROCESS AND TIMING

- Development phasing: For larger sites, the development's phasing plan and its impact on delivery of the SuDS scheme
- Explanation of how land use decisions will impact drainage
- Any records of relevant consultations with statutory and non-statutory consultees

Stage 4: Full or Reserved Matters Planning Application

Assuming the previous stages have been completed as recommended above, this stage should be streamlined. The developer submits the Drainage Application with the Full/Reserved Matters Application to the planning department. The submission should address how the Drainage Application complies with the National Standards as well as the Local Requirements. As with the outline planning application, the planning department will receive the Drainage Application and pass it to the SAB. The SAB will be responsible for passing the Drainage Application to any relevant statutory consultees. The SAB will have 12 weeks to determine the Application for all major developments (10 or more dwellings), and 7 weeks for all other applications. Within the SAB's timeline, the statutory consultees will be given 3 weeks to respond to matters concerning the Application. The SAB can review the Drainage Application at the same time as the statutory consultees' own review process to streamline the process.

INFORMATION REQUIRED AT FULL PLANNING APPLICATION/ RESERVED MATTERS APPLICATION

As outlined in the CIRIA SuDS Manual (2007), the following information will be required as part of the Drainage Application submission to the SAB:

- Drainage layout: the types of SuDS to be incorporated, as well as their layout, and land take
- Landscape integration strategy: How the SuDS scheme will integrate with the existing landscape. This should also detail if there is any publicly accessible open space, and if the SuDS will provide habitat or other social enhancement. The planting scheme around SuDS features should work to improve the integrity of the storage design.
- Details of how surface water will be managed during the development's construction phase
- SuDS design statement, including which SuDS will be incorporated and any relevant discharge points. This should also consider how the drainage design will manage water quality, attenuation, and discharge quantity in-line with SuDS best practices.
- Runoff calculations: A comparison of the runoff rate before and after construction. The comparison should demonstrate that the development results in no increase in flood risk and where possible should reduce the risk of flooding. As well as any Central Bedfordshire by-laws, or discharge rates specified by the Environment Agency or IDBs should be demonstrated.
- Overland flow paths: Indication of natural overland flow routes and protection plan for properties at risk of flooding.
- Flow control: If runoff is being discharged off-site, flow control should be given and design detailed.
- Maintenance: Outline which body is responsible for testing and maintaining the drainage proposals
- Soil porosity tests: To be completed at the location of any SuDS with consideration given to proximity of winter water table
- Wet weather flows: Provisions made for drainage during large storm events, including protection for SuDS
- Confirmation of land ownership: of all land required for drainage
- Foul drainage proposals: with relevant routes and interaction with SuDS
- Any records of relevant consultations with statutory and non-statutory consultees.

- SuDS Management Plan: This should be prepared in conjunction with any required landscape and ecology management plans. It should provide:
  - Statement outlining management goals and required maintenance
  - Maintenance schedule and tools required
  - Site plan, including access points and outfalls
  - Phasing plan: A plan will be required for developments which will be delivered in phases. For smaller developments a plan for each development plot, which shows the allocated storage volume and discharge rate given to that plot as part of the wider SuDS strategy.

ADDITIONAL REQUIREMENTS TO BE INCLUDED IF RELEVANT, OR AT THE SAB'S REQUEST:

- Consideration of future development
- Consideration for safety and how it has been incorporated in SuDS design
- Treatment volume calculation and demonstration of its adequacy
- Impact of development on groundwater, including pollution and contamination risks
- Additional treatment for SuDS schemes discharging to sensitive receiving bodies of water
- Ecological assessments to determine impact on biodiversity. Reference should be made to designated sites, protected species, priority species & habitats, and local Biodiversity Action Plans
- Demonstration of best practice with respect to ecology, including protecting and enhancing habitats, and de-culverting waterways.
- Consideration for site relationship to surrounding water sources, including groundwater
- Details of site's previous uses and environmental impacts

Process of Planning Application

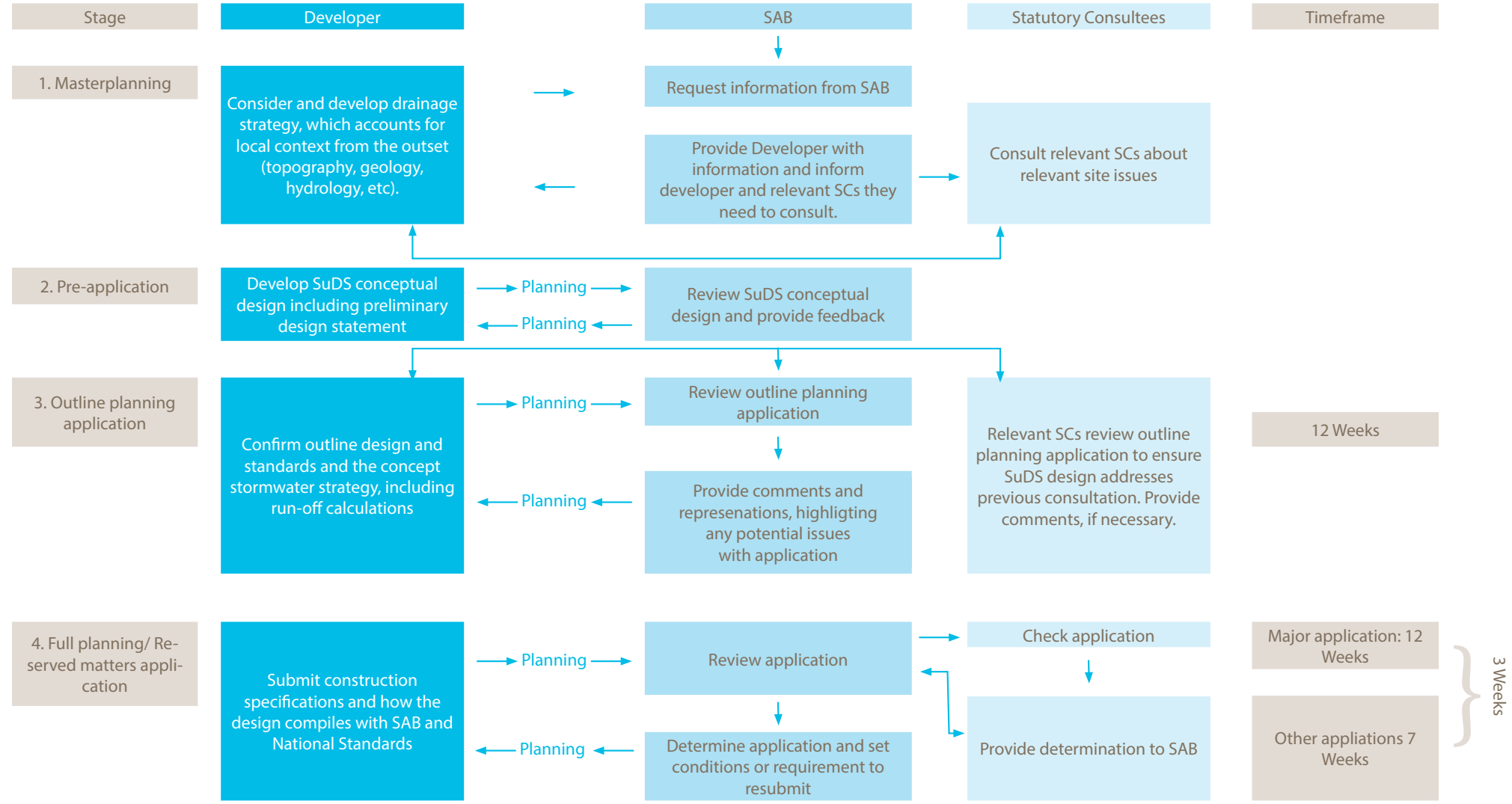


Fig. 1. SAB Approval Process when planning permission is required

2.4 Permitted Developments with Impact on Drainage

For developments which will have an impact on surface water drainage, but do not require planning permission (permitted developments) a Drainage Application must be submitted to the SAB. Without a planning application, there is a simpler process, which has been outlined in Figure 2.

In this simplified process, there is only a pre-application and an application phase. The planning department is not involved, and the developer or land owner communicates directly with the SAB. In pre-application, the developer or land owner will consult with the SAB and any relevant statutory consultees. During application phase, the developer or land owner will submit the Drainage Application to the SAB, and the SAB will forward the application on to relevant statutory consultees. The application will be determined based on satisfying the National Standards, Local Requirements, and any relevant statutory consultees' requirements.

Information required to be submitted with a free-standing drainage application is the same as information required at full/reserved matters applications. See the previous section for details.

Approval Process with Permitted Development

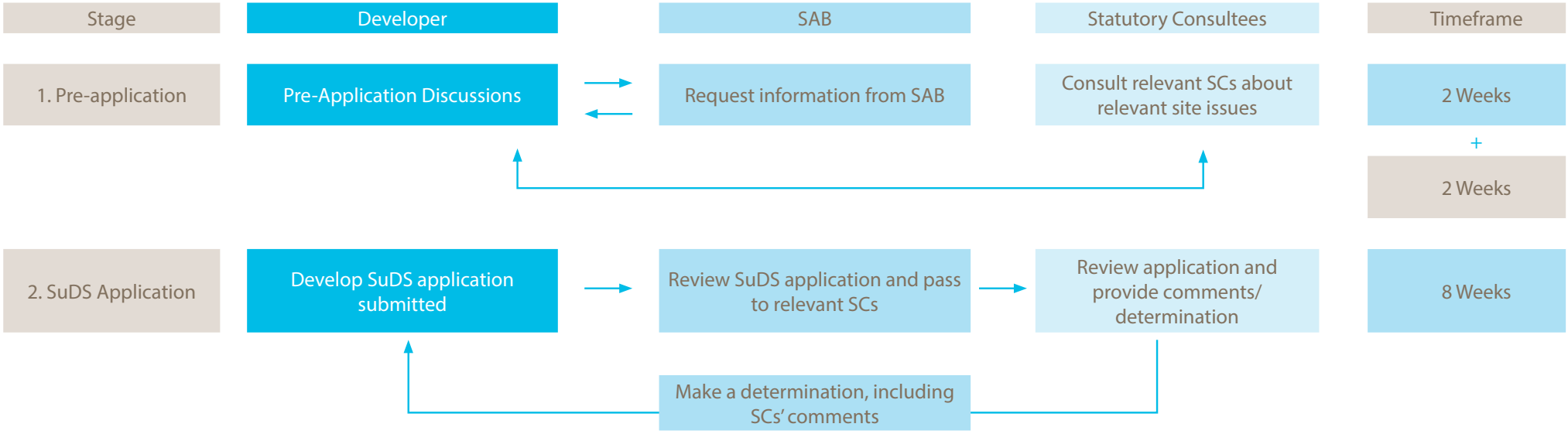


Fig. 2. SAB Approval process with permitted development

2.5 Statutory Consultees

The Flood and Water Management Act (2010) and the SuDS National Standards detail when various statutory consultees should be consulted. Figure 3, found to the right, outlines this.

For any Drainage Application believed to impact on these bodies, it is incumbent on the SAB to consult with the relevant statutory consultees. The SAB should also consider the proposed drainage scheme's impact on adjacent sites. This may require consulting with the planning department or other statutory or non-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.

2.6 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. Similarly, while permission from the planning department is not necessary for permitted development, consulting them may still be appropriate.

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

Statutory Consultees	When to consult
Internal Drainage Board	If the drainage system will discharge directly or indirectly into a watercourse within the board's district
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 discharge any water into a watercourse
Highways Authority	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. 3. When to consult Statutory consultees

2.7 SAB Determination

Once the SAB has received the Drainage Application, they will check to ensure that all required documentation has been included. Once they have determined that all documents have been completed sufficiently, the SAB will notify the planning department, who will then notify the developer. At this point, the review process will begin.

At the beginning of the review process the SAB will contact the relevant statutory consultees. Given the number of bodies involved in the process – developer, SAB, planning department, and numerous statutory and non-statutory consultees – communication is of primary importance.

The Drainage Application will be determined based on the National Standards, the local requirements outlined in this document, and any relevant by-laws from the Environment Agency, IDBs, or Central Bedfordshire Council. As part of the determination, the SAB will make a site visit to ensure the SuDS scheme considers the site character and drainage. Once the SAB has made its determination, it will notify the planning department, who will then notify the developer.

The Flood and Water Management Act (2010) grants the SAB with the power to approve applications subject to conditions, such as modification of proposed drainage, payment of non-performance bond, inspections during and after construction, and any required fees paid to the unitary authority to determine the application.

2.8 What SuDS will the SAB Adopt?

The SAB is required to adopt all SuDS schemes that meet the National Standards, as well as any relevant local requirements outlined in this guidance. The SAB will adopt all SuDS serving more than one property. However, the SAB may still adopt SuDS that the National Standards do not require them to adopt, such as 'orphan' SuDS or SuDS that only serve individual properties at their discretion.

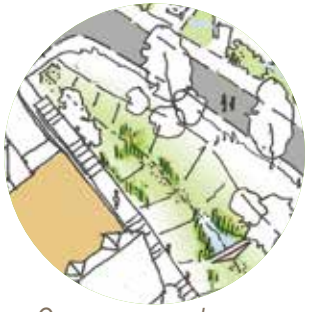
The SAB is the organisation responsible for adopting SuDS in Central Bedfordshire; however, in some instances, other organisations will be responsible for adoption. For developments incorporating SuDS that the SAB does not adopt, a third party will need to be secured to adopt and maintain them (see Figure 4). The SAB may provide guidance to developers looking to source an appropriate body for SuDS adoption and maintenance. If a third party wishes to adopt a SuDS scheme, a legal agreement tied to the title of the property will need to be agreed to with the SAB and the SAB should be informed of the third party during the pre-application stage of the Drainage Application.

The SAB will not adopt SuDS on single properties and public roads. In compliance with the National Standards, the Highways Authority will adopt all SuDS within the adopted public highway, including all above ground SuDS. Developers will need to secure a third party adoption body to operate and maintain SuDS on single property developments, such as school campuses, hospitals, and commercial or office buildings.

With respect to mineral extraction and landfill developments, they would not normally require SAB approval and adoption if they do not involve construction work in connection with or in preparation for the creation of a building or other structure. The SAB is not required to adopt any SuDS serving minerals and waste development which is designed only to provide drainage for a single property.

SIGNPOST:

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



Open space swale.

Public road with permeable paving.

Public realm bio retention.

Open space wetland.

Fig.4: SuDS Features the SAB may adopt

2.9 Requirements for SAB Adoptions

Before the SAB will adopt a SuDS scheme, it will need to confirm that its design and construction has been completed in line with SAB-approved scheme. Therefore, the developer will need to allow the SAB to conduct site visits throughout the construction process. Once the Drainage Application is approved, the developer will be required to submit a detailed programme of construction to the SAB. After construction is complete, a verification report, which includes detailed evidence of the construction phase being completed to the approved design is required. In case the SuDS do not meet the design specification, a non-performance bond must be provided. Details regarding what is required pre and post construction are outlined below.

Prior to commencing construction the developer will be required to submit a programme of construction to the SAB. This will detail the following items:

- Construction time, and expected completion date
- Temporary drainage measure during construction
- The site manage during site construction
- Access points for SAB inspections
- Consideration and assessment of health and safety

Once construction of the SuDS scheme has been completed a verification report, which details the construction process, will be needed. The report will need to include:

- Photographs of excavations, confirmation of soil conditions and levels, profiles and general earthworks
- Photographs and manufacturers' details of inlets, outlets and any control structures associated with any feature to be adopted
- Sources of topsoil (with appropriate certificates)
- List of plants and confirmation of sources, planting method statement, and initial maintenance requirements
- Confirmation of subsoil and topsoil respective depths
- Confirmation of gravel fill specification and sources, installation method statement of filter drains
- Test certificates of membrane liners used. Membranes are required to have welded joints and be inspected after installation.
- Photographs of the SuDS features both before and after planting
- 'As constructed' drawings including flow control structures and any associated chambers and outfalls. A topographical survey of the 'as constructed' feature should also be included
- The initial maintenance schedule

Verifying that the SuDS operate as designed will require a maintenance period of one year after completion of the entire development. As per the National Standards, within this year, the non-performance bond may be used to cover any adjustments based on the performance of the SuDS scheme. At the end of the year there will be a final inspection. The non-performance bond may also be used to cover any repairs required as a result of the final inspection.

If the SuDS system does not function as designed, or does not meet adoption requirements, the SAB reserves the right to decline adoption.

2.10 Request for Adoption

Following the initial year, the developer may submit a request to the SAB to adopt the scheme. The SAB must then determine whether it will adopt the scheme within 8 weeks. A formal request for adoption will require the developer to provide the SAB with:

- Location, type of SuDS, and design specifications
- Roles and responsibilities for each organisation related to the SuDS scheme
- Previous and future maintenance records
- Manufacturer's guides

2.11 Post-Adoption

As per the National Standards, the SAB is required to register all adopted SuDS as flood risk structure and feature within 28 days of adoption. Designating SuDS as such means they cannot be altered, replaced, or moved without consent from the relevant authority. SuDS along public roads will need to be designated as having "special engineering difficulties" as per the New Roads and Street Works Act.

Following registration, the scheme should be included in a SuDS asset management system. Central Bedfordshire should maintain a database of local SuDS scheme they have adopted, including GIS layers, and maintenance regimes. The SAB will also need to organise maintenance responsibilities, which they may undertake in-house, or outsource the responsibility to a private third party. Should the SAB elect to outsource maintenance, it is important to note they are still ultimately responsible for SuDS it adopts.

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. Sign posting to notify residents how a SuDS feature should operate can help mitigate health and safety concerns, and serve to educate them in the process.

3 DESIGN CONSIDERATIONS AND LOCAL REQUIREMENTS

DESIGN CONSIDERATIONS

The National Standards outline national requirements for SuDS designs, and provide top tier authorities with the ability to apply more stringent local SuDS requirements to ensure developments respond to the local context. This section sets forth local requirements for SuDS design in all developments in Central Bedfordshire and addresses 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.

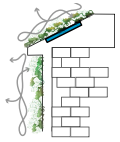
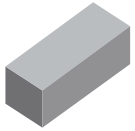
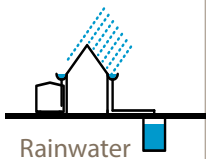
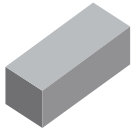
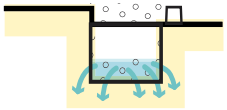
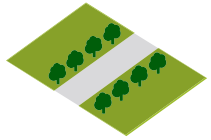
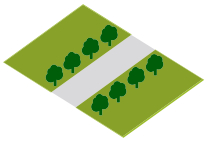
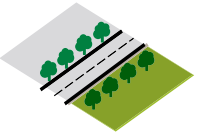
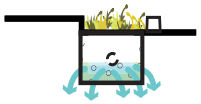
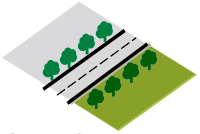
For more information on detailed SuDS design guidelines, SuDS designers should reference The SuDS Manual (CIRIA C697).

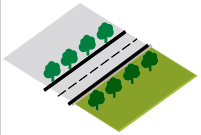
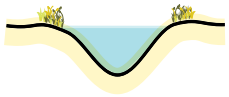
SIGNPOST:

CIRIA SuDS Manual
http://www.ciria.org/SERVICE/Home/core/orders/product.aspx?catid=2&prodid=155.

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. Bioretention 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.
 Bioretention 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. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

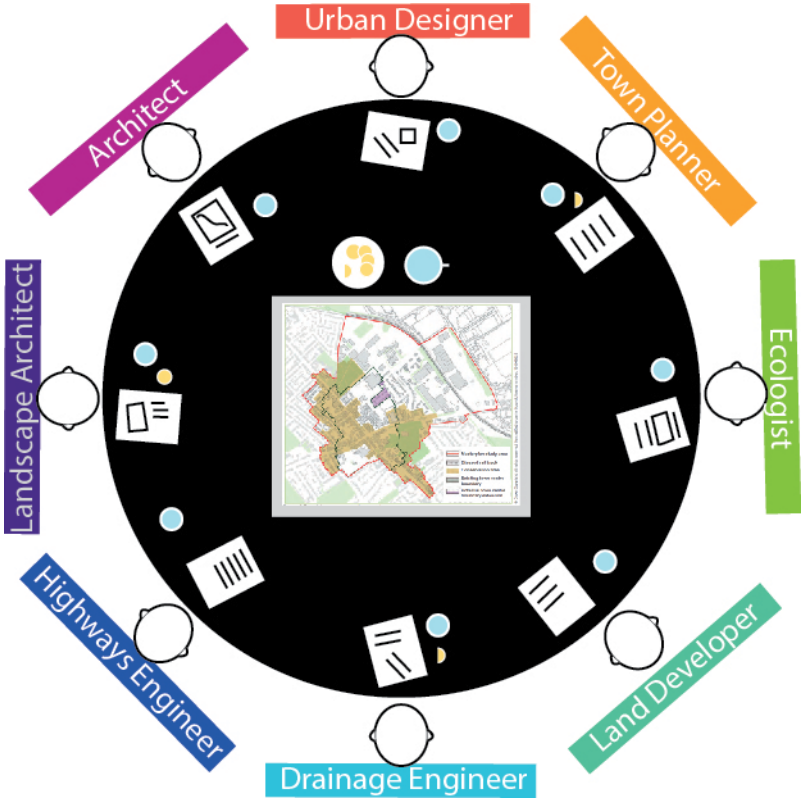
	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account 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 Reduce reliance on pipes and pumps

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/Images/Development%20Strategy%20publication%20January%202013%20070113_tcm6-39267.pdf#False

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

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

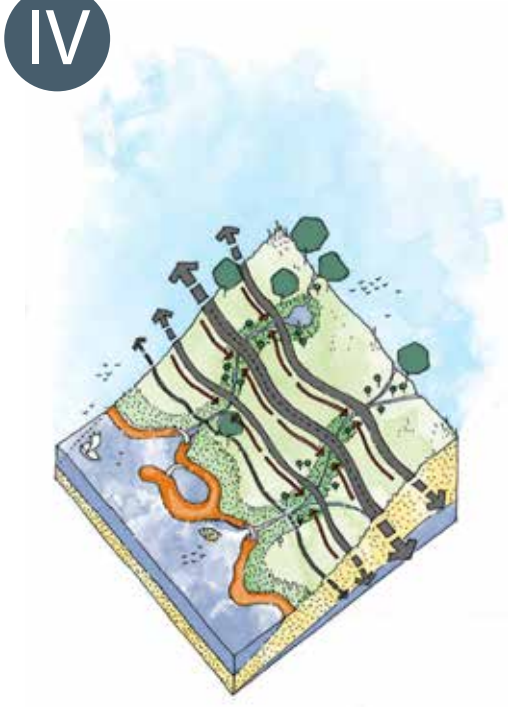
Minimise runoff by maximising permeable surfaces. Consider likely spatial requirements for SuDS on-site based on the character of the development and proposed degree of source control. Natural flow paths and opportunities for infiltration or storage areas should inform the development's layout.

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:

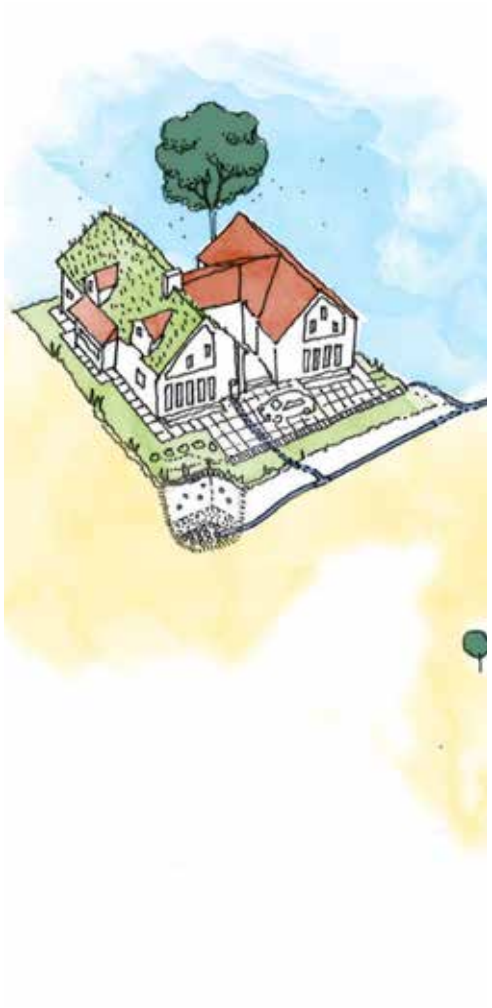
a c

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.

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. Reduce reliance on pipes and pumps

SuDS should be designed to retain and convey water on the surface as much as possible. This avoids unnecessary underground piping. In the clay, for 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 habits; community engagement and awareness; and easier detection of and 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.

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.

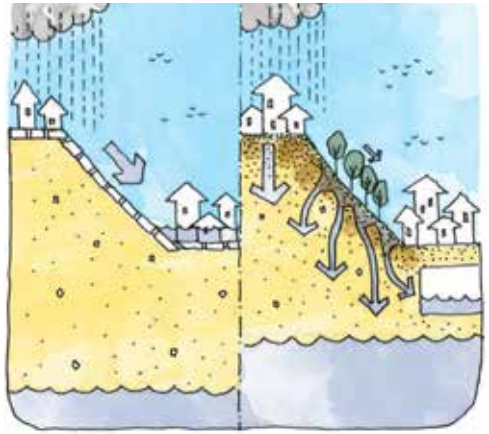
Approach - The presence of a floodplain should not preclude the site from including SuDS as they could still be effective in managing routine rainfall. Design should limit grading and the creation of surface features (such as berms and non-reinforced channels) that could be washed out in a flood. Surface 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.

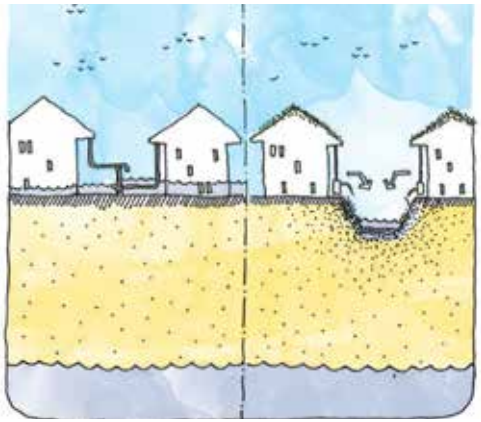
Approach - It is important to investigate at the initial design stage if your site is in, or upstream of, local surface water flood risk areas. Early discussions with the SAB will help define attenuation requirements and may influence the placement or design criteria for SuDS features. See the SuDS Approval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

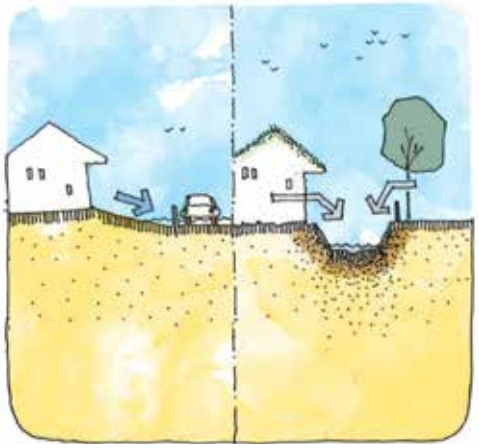


Considering Groundwater

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/SERVICE/Home/core/orders/product.aspx?catid=2&prodid=155.

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.

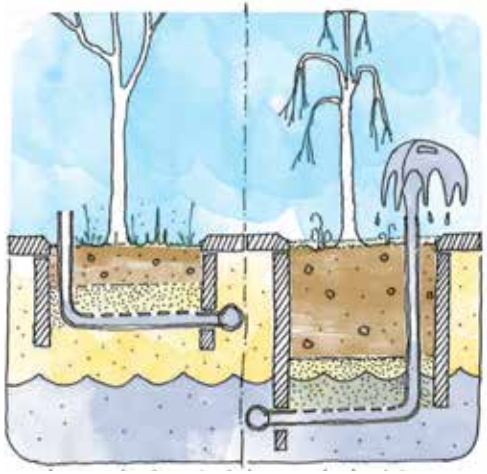
Approach – If a high groundwater table has been determined then SuDS selection will focus on surface and shallow features that avoid infiltration. Some SuDS features that usually allow infiltration may possibly still be suitable if used in conjunction with an impermeable liner (such as a water proof 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.

Environment Agency Groundwater Protection: Principles and Practice (GP3) document Position Statements G1 - G13.
http://www.environment-agency.gov.uk/research/library/publications/144346.aspx

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.

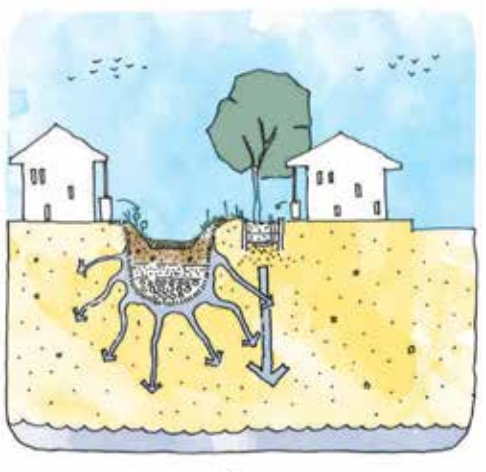


Topography

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 bioretention and wetland features staggered in a terraced arrangement. Infiltration is not recommended near steep slopes as it can cause instability.

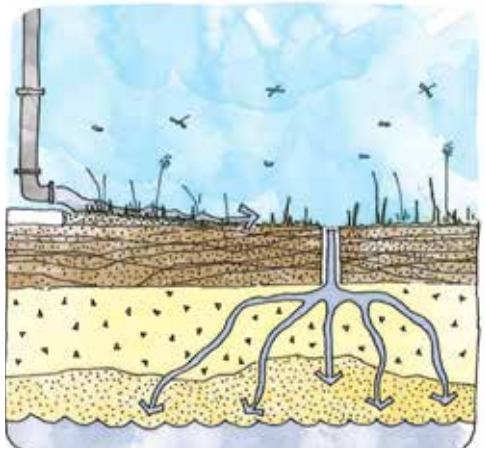
Ground Conditions

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.

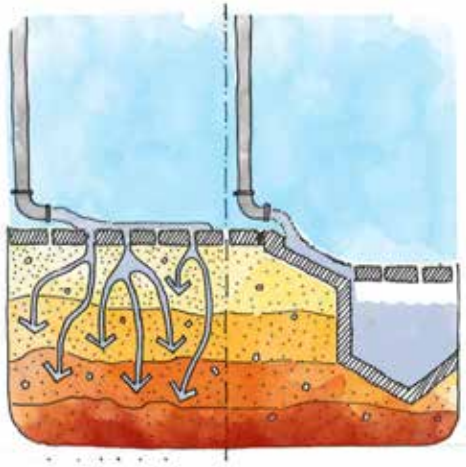
It should be noted that deep bore and other deep soakaway systems are not appropriate in areas where groundwater constitutes a significant resource. The requirements for deep bore soakaways should be discussed with the Environment Agency.



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.

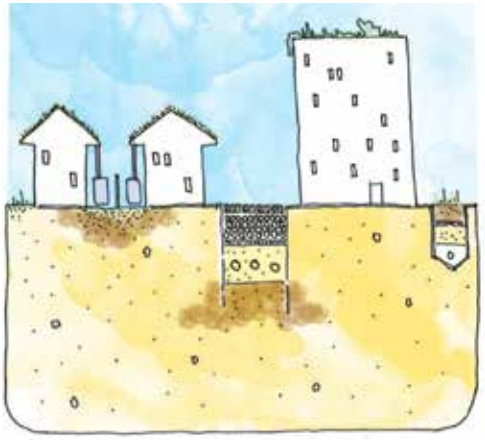


Constrained Space

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, bioretention gardens, permeable paving, rills, rainwater harvesting, hardscape storage, micro-wetlands, and bioretention tree pits.

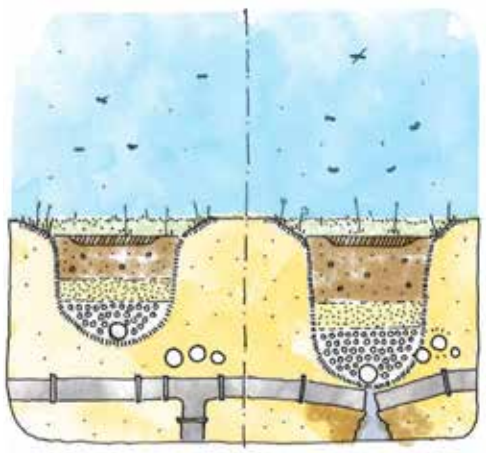


Compatibility with existing infrastructure

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 bioretention 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.



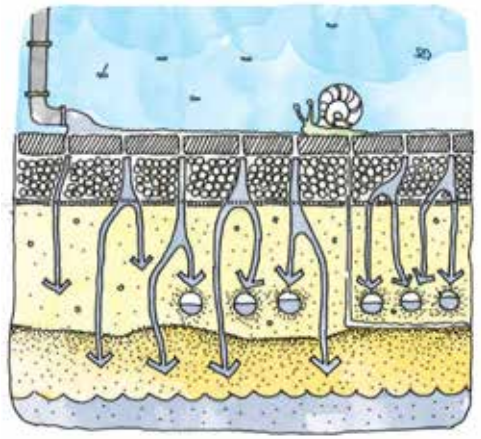
SIGNPOST:

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.



4 CONSIDERING LOCAL NUANCE: DESIGNING LOCAL SUDS ZONES

DESIGN CONSIDERATIONS

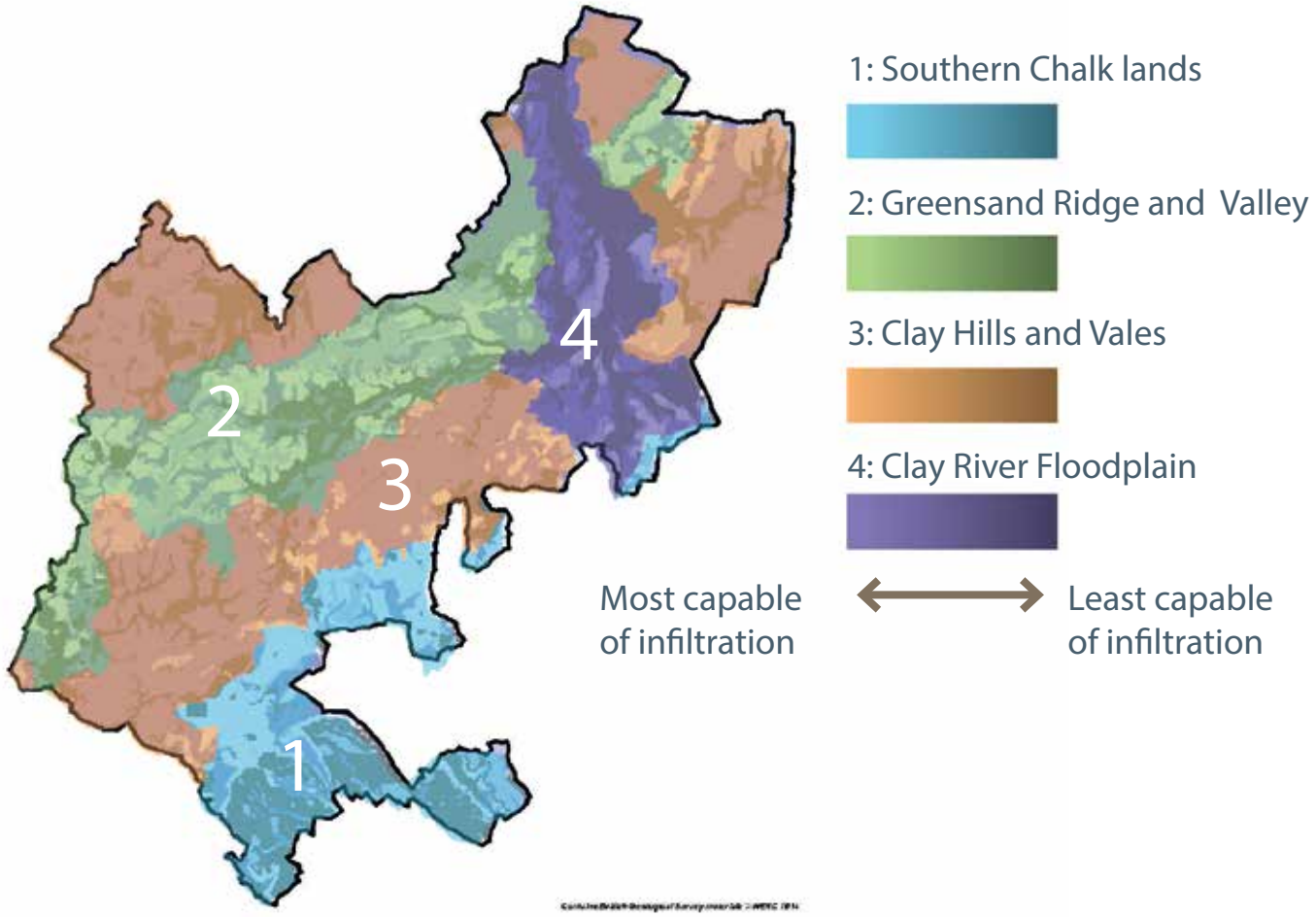
The local requirements outlined in the previous section are important for designing SuDS across Central Bedfordshire. However, Central Bedfordshire has a number of unique landscape characteristics, which will impact the way SuDS are designed. This section outlines how the existing landscape should inform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

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 SAB, 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, SAB, 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

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

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

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, Reduce reliance on pumps and pipes.

Marston Vale Surface Waters Plan
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 SAB, 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, SAB, 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, Reduce reliance on pumps and 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.

ADDITIONAL RESOURCES

This guidance document outlines the SuDS Approval and Adoption 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

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

National Standards for sustainable drainage systems Designing, constructing, operating and maintaining drainage for surface runoff, 2011. *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82421/suds-consult-annexa-national-standards-111221.pdf*

Consultation on the Implementation of the Sustainable Drainage Systems provisions in Schedule 3 Flood and Water Management Act 2010, 2011. *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82423/suds-consult-doc-111120.pdf*

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

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*

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

Flood Risk

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*

Marston Vale Surface Waters Plan
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 in Central Bedfordshire: A Guide for Development
http://www.centralbedfordshire.gov.uk/Images/Design%20Guide%20for%20Central%20Bedfordshire_tcm6-8531.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 The SuDS Manual (C697), 2007.
http://www.ciria.org/SERVICE/Home/core/orders/product.aspx?catid=2&prodid=155

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