Flood and Water Management

Supplementary Planning Document

Tewkesbury Borough Council

Consultation Draft

September 2017

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CHAPTER 1 – INTRODUCTION AND OBJECTIVES

1.1 Flood events have had a detrimental effect on the social, economic and environmental wellbeing of the country. Parts of Tewkesbury Borough in particular have suffered from the effects of flooding in recent times, largely due to its proximity to the Severn and Avon Rivers.

1.2 All forms of flooding and their impact on the natural and built environment are material planning considerations that are taken into account when determining planning applications. Tewkesbury Borough Council expects an integrated approach to flood risk and water cycle management (including rainwater, storm water, sewage, ground water, surface water and recycled water) to secure a range of social, economic and environmental benefits. Consequently, there is a need for a comprehensive approach to dealing with flood risk and the aim of Tewkesbury Borough Council is to ensure that this matter is properly considered at the very earliest, and all subsequent, stages of the planning process.

1.3 This document is a material consideration when considering planning applications. It should be read in conjunction with national and local planning policies and guidance (see Chapter 3 below). In accordance with these; Tewkesbury Borough Council will always seek opportunities to reduce the overall level of flood risk in the area and beyond. It will also seek to maximise amenity, biodiversity and water quality benefits, as well as those opportunities and benefits which can be obtained from effective flood and water management.

1.4 The aim of this SPD is to provide guidance on the approach that should be taken to manage flood risk and the water environment as part of new development proposals. The SPD highlights the documents which will be required to accompany planning applications, including:

- Sequential Test, and where appropriate Exception Test, reports
- Site Specific Flood Risk Assessments (FRA's) and Drainage Strategies (incorporating the approach to surface water drainage and suitability evidence)

1.5 The key flood and water management objectives of Tewkesbury Borough Council are summarised as follows:-

Key Objectives

1. **To steer new development to areas with the lowest probability of flooding.**
2. **To ensure that new development does not increase the risk of flooding either on a site or cumulatively elsewhere; and to always seek betterment over the bare minimum requirements, wherever possible.**
3. **To require the inclusion of effectively designed Sustainable Drainage Systems (SuDS) within new developments which mimic natural drainage as closely as possible, with the provision for their long-term maintenance, in order to sustainably mitigate the risk of flooding.**
4. **To ensure that development incorporates appropriate water management techniques which improves the existing hydrological conditions and maximises the opportunities and benefits of betterment of water quantity, water quality, biodiversity and amenity.**
5. **To ensure on-site storage capacity for surface water attenuation for storm events up to the 1% probability event (1 in 100 years) including allowance for climate change.**
6. **Encourage the use of water efficient and recycling devices within new developments.**

1.7 There is an emerging policy framework within the Joint Core Strategy (JCS) and Tewkesbury Borough Plan, which will include policies relating to flood risk and water management. Policy INF3 of the emerging JCS specifically relates to flood and water management issues. This SPD provides additional information to supplement this emerging policy, as well as those in the emerging Tewkesbury Borough Plan and the existing 'saved'

policies contained within the Tewkesbury Borough Local Plan to 2011. Early use of this document by applicants in the design process is therefore essential.

How to Use This Supplementary Planning Document.

1.8 To ensure that Tewkesbury Borough has a consistent and appropriate approach to flood risk and water management, this SPD should be used by:-

- Developers and applicants when considering sites for development.
- Developers and applicants when preparing the brief for their design team to ensure drainage and water management systems are sustainably designed.
- Consultants when carrying out site-specific flood risk assessments.
- Design teams preparing master plans, landscape and surface water drainage schemes and assessments.
- Development management officers and their specialist consultees when determining delegated planning applications, selecting appropriate planning conditions, making recommendations to committees and drawing up section 106 obligations that include contributions for suds.
- Other interested parties (e.g. local members) who wish to better understand the interaction between development, flooding and drainage issues.
- Developers and applicants in designing future maintenance regimen for the life time of the development

1.9 This SPD is set within the context of a water flood risk management hierarchy to help developers and decision-makers understand flood and water management and to embed it in decision-making at all levels of the planning process.

1.10 The flood risk management hierarchy.

Assess		Avoid		Substitute		Control		Mitigate
Appropriate flood risk assessment	▶	Apply the sequential test to the site location	▶	Apply the sequential approach at site level	▶	E.g. suds design, flood defences, etc	▶	E.g. flood resilient construction

1.11 This SPD addresses the flood and water management issues associated with development within the Tewkesbury Borough context. It should however be understood that the design of drainage systems and water features is dependent on a number of constraints such as existing ground conditions, including site contamination levels. This SPD does not provide detailed information in relation to groundwater contamination or remediation measures.

1.12 Neither does this SPD provide a comprehensive guide on all other development related issues. There is a wide range of other guidance available as part of the national planning policy, and from various sources, for other matters.

CHAPTER 2 – SETTING THE LOCAL CONTEXT

2.1 Tewkesbury Borough is heavily influenced by the Severn and Avon Rivers, which run through the district. These rivers pose the greatest flood risk particularly during periods of high flows at the place where the two watercourses meet at Tewkesbury town. A considerable amount of land to the western side of the Borough comprises the functional flood plain and the majority of the borough area drains into the Severn. Flooding from surface water is also a problem as drainage is closely linked to main river levels, with the largely impermeable geology and generally gentle topography of the Borough contributing to increased likelihood of surface water flooding.

2.2 Tewkesbury Borough has suffered from numerous severe flooding events in its history, one of the most notable of which was in the summer of 2007.

Case Study

The summer of 2007 was one of the wettest on record.

Following a very dry April, Gloucestershire experienced heavy rainfall in June. This overloaded the county's drainage systems through a combination of the influx of surface water and very high water levels in main rivers and brooks and lead to some localised flooding across the county.

During July however the rains were even heavier. On 20th July, two months' worth of rain fell in just 14 hours. This ultimately resulted in two emergencies; widespread flooding and water shortages. The water shortage occurred due to the Severn Trent Water Treatment Works in Tewkesbury being contaminated with flood water.

With flood water reaching depths of over two metres in some places, across Gloucestershire over half of all homes and 7,500 businesses were without any mains water for up to 12 days and without drinking water for 17 days. Electricity was lost to 48,000 homes for two days. Within Tewkesbury borough over 1800 homes were directly affected by the floods.

The effects of global climate change are likely to result in more occurrences of extreme weather events and resultant flooding in the future.

With the need for significant levels of new housing and employment development within the Borough, which is emerging through the Joint Core Strategy, it is imperative that issues associated with water management are identified and subsequently tackled if

existing problems are not to be exacerbated, along with the associated negative social, environmental and economic impacts. Key issues to be tackled include: the location and design of existing and future development; flood risk management; design and maintenance of flood risk management infrastructure; future water resource needs; water supply and sewerage.

2.3 Tewkesbury Borough Council will always seek to manage, and reduce flood risk through the development management process.

2.4 As flood risk is determined by activity within the wider hydrological catchment, the consideration of flood risk should not be limited to the Local Authority area alone. Risks to and from neighbouring local authority areas should also be considered where appropriate.

CHAPTER 3 - LEGISLATIVE AND POLICY BACKGROUND

3.1 There are a number of legislative and policy considerations that have been taken into account in the preparation of this SPD, and which must also be taken into account when submitting a planning application. These considerations are summarised as:

LEGISLATION

3.2 European Legislation

The Floods Directive

3.2.1 **The EU Floods Directive - 2007/60/EC** came into force due to a need for European Union countries (member states) to better understand and gather accurate data about the risks from surface water flooding. In the UK the Directive came into force via the Flood Risk Regulations 2009 which in turn sets the requirement for Preliminary Flood Risk Assessments (PFRA) to be produced by all unitary and county councils.

The Water Framework Directive

3.2.2 **The Water Framework Directive - 2000/60/EC (WFD)** was enacted into UK law in December 2003. This legislation requires member states to make plans to protect and improve the water environment. In summary, the Directive aims to protect and prevent the deterioration of aquatic ecosystems; conserve habitats and species that depend directly on water; reduce the release of individual pollutants that present a significant threat to the aquatic environment; reduce the pollution of groundwater and prevent or limit the entry of pollutants; and help reduce the effects of floods and droughts.

3.3 National legislation

The Flood and Water Management Act (FWMA) 2010

3.3.1 **The Flood and Water Management Act 2010** (FWMA) has brought about significant legislative changes to the management of flood risk and water. Gloucestershire County Council (GCC) has been established as a Lead Local Flood Authority (LLFA) with responsibility for managing local flood risk from surface runoff, ordinary watercourses and groundwater in the area. GCC has a responsibility to produce a Local Flood Risk

Management Strategy, and they also have powers and duties to issue consents for works on ordinary watercourses and undertake enforcement activities.

3.3.2 The FWMA also seeks to encourage the uptake of Sustainable Drainage Systems (SuDS) by agreeing new approaches to the management of drainage systems. This new approach seeks to deliver sustainable drainage systems by strengthening of current planning policy.

PLANNING POLICY

3.4 National Planning Policy Framework (NPPF)

3.4.1 In March 2012 Government published the **National Planning Policy Framework (NPPF)** which sets out Government planning policy in England. The framework replaced many of the previous Planning Policy Guidance (PPG) or Planning Policy Statements (PPS), including PPS25: Development and Flood Risk. However, the accompanying planning practice guidance to the NPPF retains key elements of PPS25 and its associated Practice Guide.

3.4.2 At the heart of the NPPF is the presumption in favour of sustainable development, which is described as 'a golden thread running through both plan-making and decision-taking.' Sustainable development comprises three dimensions; economic, social and environmental and these should not be treated in isolation as they are mutually dependent. To achieve sustainable development, economic, social and environmental gains should be sought simultaneously through the planning system.

3.4.3 Flood risk and water management falls within Section 10: 'Meeting the challenge of climate change, flooding and coastal change' and one of the core planning principles of the framework is that planning should take full account of flood risk. Furthermore, the framework sets out the government's intention that planning authorities should adopt proactive strategies to mitigate and adapt to climate change.

3.4.4 Solely as a starting point, the flood risk assessment climate change allowance guidance on the gov.uk website can be reviewed. Extracts from which are included below:

Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%
Severn	Upper end	25%	40%	70%
	Higher central	15%	25%	35%
	Central	10%	20%	25%

Using peak river flow allowances for flood risk assessments

Consider the appropriate flood risk vulnerability classification to decide which allowances apply to your development or plan. This will help you understand the range of impact. The higher central, central, and upper end allowances are in table 1. Whilst the majority of the Borough is within the Severn River Basin District there is a small area to the east of the Borough within the Thames District. Please refer to the EA's River Basin District Map to identify the relevant district for your site.

Table 2 shows anticipated changes in extreme rainfall intensity in small and urban catchments. For flood risk assessments and strategic flood risk assessments, assess both the central and upper end allowances to understand the range of impact.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Central	5%	10%	20%

Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

Area of England	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115	Cumulative rise 1990 to 2115 / metres (m)
South West	3.5 (122.5 mm)	8 (240 mm)	11.5 (345 mm)	14.5 (435 mm)	1.14 m

For further guidance on the application of climate changes allowances please refer to the EA's local area advice on Climate Change Allowances for Planning at Appendix V of this document.

Whilst the majority of Tewkesbury Borough Council area is not directly affected by Tidal flooding, the increase in sea level may have an impact on parts of the Borough and will therefore need to be taken into account.

The NPPF and its associated **Planning Practice Guidance** is an important consideration in the decision making process.

3.4.5 The framework indicates that local plans and planning applications should both ensure that flood risk, including surface water flooding, is not increased as a result of development and that development proposals should only be permitted in areas at risk of flooding, where it can be demonstrated that:

- a site specific flood risk assessment has been undertaken which follows the Sequential Test, and if required, passes the Exception Test;
- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;
- development is appropriately flood resilient and resistant, including safe access and escape routes where required;
- that any residual risk can be safely managed, including by emergency planning; and
- the site gives priority to the use of sustainable drainage systems.
- The framework also indicates that local plans should use opportunities offered by new developments to reduce flood risk elsewhere.

3.4.6 Sustainable Drainage Systems: Written Ministerial Statement

On 18th December 2014, a ministerial statement was made by the Secretary of State for Communities and Local Government (Mr Eric Pickles). The statement has placed an expectation on local planning policies and decisions on planning applications relating to major development to ensure that SuDS are put in place for management of runoff, unless demonstrated to be inappropriate. The statement made reference to revised planning guidance to support local planning authorities in implementing the changes and on 23rd March 2015, the Department for Environment Food and Rural Affairs (Defra) published the "Non Statutory Technical Standards for Sustainable Drainage Systems"

3.5 Local Planning Policy

The Tewkesbury Borough Local Plan to 2011 – March 2006

3.5.1 **The Tewkesbury Borough Local Plan to 2011** was adopted in March 2006. In accordance with paragraph 215 of the NPPF, due weight should be given to relevant 'saved' policies in the local plan according to their degree of consistency with this framework (the closer the policies in the plan to the policies in the framework, the greater the weight that may be given). Planning law makes it clear that planning applications should be determined in accordance with the development plan, unless material considerations indicate otherwise. The local plan therefore remains the starting point for decision making.

3.5.2 The following local plan policies are relevant to flood risk and water management and should be taken into account when you are thinking of submitting a planning application:-

3.5.3 **Policy EVT5** states that within areas with a high flood risk, and low to medium flood risk and outside these areas if required by the environment agency, proposals for development must be accompanied by a Flood Risk Assessment. Development will only be permitted provided that the proposed development has been demonstrated to meet a number of criteria in respect of flood protection.

3.5.4 **Policy EVT9** relates to Sustainable Urban Drainage Systems (SUDS) and states that development proposals must demonstrate that appropriate provision has been made for the on-site attenuation and treatment of surface water run-off. Further comprehensive guidance on the design, maintenance and adoption of SuDS is available within the SuDS Manual (CIRIA, C753)

3.5.5 Tewkesbury Borough Council considers that these policies are consistent with the NPPF and therefore should be afforded significant weight in the consideration of planning applications in accordance with paragraph 215 of the NPPF.

The emerging Joint Core Strategy

3.5.6 **The Joint Core Strategy (JCS)** is a strategic development plan document that is being prepared through a partnership between Gloucester City Council, Cheltenham Borough Council and Tewkesbury Borough Council. The JCS will provide a co-ordinated strategic plan for this joint administrative area during the period up to 2031. Whilst not yet adopted, the JCS has an extensive and up to date evidence base, including Strategic Flood Risk Assessments which provide a detailed assessment of multiple flood sources for specific broad locations within the JCS area.

The emerging Tewkesbury Borough Plan

3.5.7 Whilst the JCS will provide the strategic level policies for development in the area, this will be supplemented at individual district level by locally specific plans. In Tewkesbury Borough, the council has begun preparation of the **Tewkesbury Borough Plan**, which is at a relatively early stage of preparation at the time of the publication of this SPD.

CHAPTER 4 - THE IMPORTANCE OF PRE-APPLICATION ADVICE

4.1 The Council encourages early discussions in relation to development proposals. Developers are strongly advised to use the Council's **pre-planning application advice service** to discuss any potential issues that may arise from development proposals. There is also an expectation that developers seek early engagement with local communities and relevant organisations on their development proposals.

4.2 Seeking pre-application advice may help applicants to address issues such as:

- Whether the proposed development is acceptable in principle and thus warranting further investigations in respect of flooding and drainage
- Whether a Flood Risk Assessment (FRA) needs to be submitted and, if so, what is the required scope of the assessment?;
- Confirmation of whether the Sequential and/or Exceptions Tests need to be applied, and advice on how to undertake the tests appropriately;
- Advice on the most appropriate form of sustainable drainage measures for a site;
- Whether there are any known contamination issues on the site which could affect site design and layout and the types of SuDS used?
- Agreeing the discharge points for site drainage with the LPA and relevant RMA;
- Obtain any relevant data needed in order to prepare the site specific FRA and drainage strategy.

4.3 The Council will, if necessary, seek the technical advice and views of the following Flood Risk Management Authorities (FRMA) when providing pre-application advice to applicants and determining subsequent planning applications:-

Environment Agency

4.4 **The Environment Agency** (EA) is a public body that has responsibilities for protecting and enhancing the environment as a whole and contributing to the government's aim of achieving sustainable development. The EA are a statutory consultee and provide bespoke advice on certain planning applications in Flood Zones 2 and 3 and on sites in Flood Zone 1 which have critical drainage problems (as notified to the local planning authority by the Environment Agency). The EA do however apply standing advice to a wide range of development proposals. For the EA's local level consultation filter, flood risk matrix and

standing advice please refer to APPENDIX V. The consultation filter should be used to identify when the EA should be consulted and the flood risk matrix to identify when standing advice applies and which standing advice note to refer to. In providing pre-application advice the Council will refer to the EA's standing advice where applicable. **It should be noted however that the EA operate charges for providing bespoke pre-application advice (i.e. in situations where standing advice does not apply) and in such circumstances the Council is unable to consult the EA as part of its own pre-application advice service. Applicants are therefore expected to obtain pre-application advice from the EA on a separate basis.**

Severn Trent Water

4.5 **Severn Trent Water** (STW) has the responsibility to maintain foul, surface and combined public sewers in Tewkesbury Borough so that they can effectively drain the area. STW ensures that the public sewer system has the capacity to accept flows from new developments. To provide the necessary capacity STW may require planning conditions to be imposed on planning permissions requiring the delay of any connection to the sewerage system until the additional capacity to accommodate the development is provided. STW will be a statutory consultee on future developments.

Lead Local Flood Authority (Gloucestershire County Council)

4.6 The 2010 FWMA establishes **Gloucestershire County Council** as Lead Local Flood Authority (LLFA). As Lead Local Flood Authority, it has responsibility for managing local flood risk from surface runoff, ordinary watercourses and groundwater in the area and is a statutory consultee. Gloucestershire County Council is also the Local Highway Authority, and in this regard it is responsible for road construction and highway drainage consents.

Lower Severn Internal Drainage Board (IDB)

4.7 IDBs are local public authorities that manage water levels. They are an integral part of managing flood risk and land drainage within areas of special drainage need in England and Wales. IDBs have permissive powers to undertake work to provide water level management within their Internal Drainage District. They undertake works to reduce flood risk to people and property and manage water levels for local needs. Much of their work involves the maintenance of rivers, drainage channels, outfalls and pumping stations, facilitating drainage of new developments and advising on planning applications. They also have statutory duties with regard to the environment and recreation when exercising their permissive powers. IDBs input into the planning system by facilitating the drainage of new

and existing developments within their districts and advising on planning applications; however they are not a statutory consultee to the planning process.

Planning Application Requirements

4.8 Pre-application advice will help applicants to understand the issues relating to their proposal by the time a planning application is submitted. However, it is also important that all the correct information is submitted to ensure applications can be validated and determined efficiently. The Council's **validation checklists** set out the requirements.

CHAPTER 5 - FLOOD RISK AND SITE SELECTION

5.1 Introduction

5.1.1 Development in areas at risk of flooding should be avoided. Flood risk includes risk from all sources of flooding, including from:

- rivers (fluvial)
- tidal and coastal flooding;
- rainfall surface water (pluvial);
- overwhelmed sewers and drainage systems;
- groundwater; and
- from reservoirs, canals and lakes.

Where development is necessary, it should be safe and should not increase flood risk elsewhere.

5.1.2 Flood risk is an expression of the combination of the flood probability (how likely the event will happen) and the magnitude of the potential consequences (the impact such as economic, social or environmental damage) of the flood event.

5.1.3 The likelihood or risk of flooding can be expressed in two ways:

Chance of flooding: As a percentage chance of flooding each year. For example, for Flood Zone 3a there may be a 5% annual probability of this area flooding

Return period: This term is used to express the frequency of flood events. It refers to the estimated average time interval between events of a given magnitude. For example, for Flood Zone 3a the return period could be expressed as 1 in 20 year

5.1.4 There is however a move away from using return periods as an expression of flood risk as this approach does not accurately express the risk of flooding. For example, it is misleading to say that a 1 in 100 year flood will only occur once in every hundred years. This suggests that if it occurs in one year then it should not be expected to reoccur again for another 100 years; however this is not the case. The percentage chance of flooding each year, often referred to as **annual probability**, is now the preferred method of expressing flood risk.

5.1.5 Fluvial flooding is divided into flood zones based on the risk of flooding:

Figure 5.1: Fluvial Flood Risk Zones

Flood Zone	Definition
Zone 1 - Low Probability	Land having a less than a 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 - Medium Probability	Land having between a 1% and a 0.1% annual probability of river flooding; or Land having between a 0.5% and a 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a - High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b - The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. LPAs should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map)

5.1.6 Maps showing Flood Zones are available on the gov.uk website. Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. Table 4.1 details the Flood Zones and their definitions taken from the PPG. It should be noted that the EA's flood map is indicative only and doesn't cover the entire Borough. For example, flood risk associated with smaller watercourses with a catchment of less than 3 km^2 does not necessarily feature on the EA flood map. This does not however mean that there is not a risk of flooding associated with these watercourses. Other sources of flood mapping are available which may provide more robust and extensive information. These may include

the Level 2 SFRA for the JCS area and GCC's SFRA mapping. Individual site specific hydraulic modelling may also be required in some instances to establish the flood risk on a site.

5.1.7 To cope with the potential risks and forecasts of climate change (predicted 1.14m rise in sea levels in the South West of England, warmer summers, wetter winters and increased river flows by 2115) and to ensure that new development is safe for its lifetime, the Government has emphasised that development in areas at risk of flooding should be avoided by directing development away from the highest risk areas. Where development is necessary it should be made safe without increasing flood risk elsewhere. Please see the DEFRA/ EA publication 'Flood Risks to People' for further information on what is considered 'safe'.

5.1.8 All proposals should therefore follow a Sequential Approach to flood risk. This means relevant development will be directed to the areas at the lowest risk of flooding at a strategic, local and site-scale level. It will be necessary to consider flooding from all sources: the sea (tidal), rivers (fluvial), surface water (pluvial) and ground water, and a possible combination of all of these. Further detail on the Sequential Test is provided below.

5.1.9 The design flood with annual probability of 1% flood level fluvial, or 0.5% tidal, plus climate change allowance should be used to inform the sequential approach , including appropriate location of built development; consideration of flood risk impacts, mitigation/enhancement and ensure 'safe' development.

5.2 Site Vulnerability

The general approach to flood risk and planning is to ensure that where possible, development is located in the areas of lowest flood risk and this approach can be applied at various levels i.e. strategic scale, individual site scale and building scale to ensure the most vulnerable uses are located in the area of lowest flood risk

5.2.1 Therefore it is necessary to identify how 'vulnerable' the proposed development is using the vulnerability classification set out in Table 2 of the **Planning Practice Guidance**. This is important because different types of development are acceptable in different flood risk situations. In simple terms, the more vulnerable the development type is, the more important it is to locate it in areas of the lowest possible flood risk. The table in the

Planning Practice Guidance sets out in more detail what types of development can be located in which flood zone and categorises the developments into the following areas.

- Essential Infrastructure
- Highly Vulnerable
- More Vulnerable
- Less Vulnerable
- Water Compatible Development.

5.3 The Sequential Test

5.3.1 The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding with the Environment Agency's 'flood zone' maps normally being the starting point for any assessment. As set out in section 5.5, the local Strategic Flood Risk Assessment Level 2 mapping **(SFRA L2)** for the area can also be used in conjunction with the Environment Agency's maps to establish flood risk. Development should not be permitted if there are reasonably available sites in areas with a lower probability of flooding. The sequential approach is to be used in areas known to be at risk from flooding.

5.3.2 The overall aim is to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, Tewkesbury Borough Council will take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 where flood risk is minimal, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

In applying the sequential test to major developments Tewkesbury Borough Council will require the developer to provide information and if deemed necessary, request additional up to date modelling to demonstrate that the application takes account of changes both in climate change requirements and any actual recorded flooding events since the original Environment Agency modelling was carried out.

5.3.3 The sequential approach should also be applied within the application site itself by locating the most vulnerable elements of the development in the lowest flood risk areas in the first instance. The use of flood risk areas (i.e. Flood Zones 2, 3a and 3b) for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and

environmental benefits. Sequential test guidance can be found at **https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants.**

5.3.4 The Sequential Test does not need to be applied for:

- Individual developments on sites which have been allocated in development plans, as the Sequential Test process has already been undertaken (unless the Flood Zones for the site have changed);
- Minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site); or
- Sites located wholly in Flood Zone 1

5.3.5 The definition of minor development for the purposes of the Sequential Test is:

- Minor non-residential extensions: industrial/commercial/leisure etc. extensions with a footprint less than 250 square metres;
- Alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
- Householder development: for example sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

5.3.6 All sources of flood risk should be considered when assessing the need for the Sequential Test as well as undertaking the test.

5.3.7 The PPG requires a pragmatic approach to the Sequential Test and site availability and suggests that it might be impractical to suggest there are more suitable alternative sites in some circumstances. For example, it may be that proposals are submitted which involve the redevelopment of heritage assets where the benefits that would arise from bringing the buildings back into use cannot be provided by development on an alternative site.

5.3.8 The following sets out how applicants should undertake the Sequential Test for assessment by the LPA. This would normally take the form of the submission of a report commensurate in size to the scale of development proposed.

- The Applicant should agree with the LPA the geographical area over which the test is to be applied. This will normally be based on the circumstances and requirements of the proposed development in question. For example, where a large scale strategic

housing development is proposed it will normally be appropriate to consider the Borough as a whole, however where a small scale housing development meeting local needs is proposed the geographical area may be more refined and based on that local area. Furthermore, there may be situations where the functional requirements and objectives of the proposed development justify a refined catchment area (e.g. the catchment area for a school, community facilities and development within a regeneration zone).

- The relevant policies of the local plan should be the starting point to understand areas of local need. For uses that have a sub-regional, regional or national impact it may be appropriate to expand the area beyond the LPA boundary.

- The developer should identify and list reasonably available sites that meet the functional requirements of the application in question and are considered reasonably available and would be given planning permission for the proposed use. The Council's Strategic Assessment of Land Availability (SALA) provides a source of information on sites in the Borough that are available for development. It must however be noted that the identification of a potential site within the SALA does not imply that it is deliverable and developable and the council would grant planning permission for development. All alternative sites must still be in conformity with the Adopted Development Plan, the National Planning Policy Framework and its associated National Planning Practice Guidance. Other sources of alternative sites may include unimplemented site allocations within an adopted Development Plan Document and unimplemented planning pemissions (although permissions that are likely to be implemented are not considered to be reasonably available).

- The Developer should obtain the necessary flood risk information for all the sites. This should be from all available sources including the SFRA, the EA's Flood Zones maps, the EA's Areas Susceptible to Surface Water Flooding Maps, the British Geological Society Areas Susceptible to Groundwater Flooding Maps together with any other local flood risk knowledge.

- The Developer should apply the Sequential Test and compare the flood risk from all sources for the reasonably available sites to the original sites flood risk as set out in the site specific FRA to demonstrate if there are any reasonably available sites that have a lower flood risk, state how they compare regarding flood risk and any reasons why they are unsuitable or not available within the report.

- If the site is not within Flood Zone 1 are there any reasonably available sites in the area with a lower probability of flooding that would be appropriate to the type of development or land use proposed. If no, this does not mean that the proposed development is acceptable in flood risk terms as it may be necessary to apply the exception test as part of the site specific flood risk assessment.

- Reasonably available does not mean that the sites must be in the same ownership. Instead the Council will view reasonably available sites as those that are both 'deliverable' and 'developable' as defined by the NPPF (Para.47, footnotes 11-12). The Council does not necessarily accept however that to be 'deliverable' for the purposes of the Sequential Test an alternative site must have a realistic prospect of housing being delivered on it within the first five years. Instead, determining whether an alternative site is deliverable should be based on the likely delivery trajectory of the proposed development in question (for example where a very large, complex development is proposed and it is unlikely that the site would deliver within the first five years, it is inappropriate to only consider alternative sites that can deliver within five years). Furthermore, for non-residential developments delivery timeframes may not be as important a consideration. The deliverability of alternative sites will therefore be considered on a case by case basis. In addition, reasonably available sites should:

  1. Lie within the agreed area of search; *and*

  2. Can accommodate the general requirements of the development; *and*

  3. Are, in principle, in conformity with the Adopted Development Plan, the National Planning Policy Framework and its associated National Planning Practice Guidance.

5.3.9 In considering whether an alternative site can accommodate the general requirements of the development the Council will expect a flexible approach to be employed. For example, where appropriate, applicants will be required to consider disaggregating proposals where two or more alternative sites with a similar combined capacity have been identified.

5.4 The Exception Test

5.4.1 If, following application of the Sequential Test, it is not possible for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if required (see Table 3 Flood Risk Vulnerability and flood zone compatibility PPG). For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits (including social, economic and environmental benefits) to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

5.4.2 The Exception Test applies to planning applications and the allocation of land through the development plan process. Both elements of the exceptions test must be satisfied.

5.5 The Joint Core Strategy Strategic Flood Risk Assessment

5.5.1 To complement the Environment Agency's flood zone maps, Gloucestershire County Council prepared a **Strategic Flood Risk Assessment (SFRA) Level 1** for the County in September 2008. This assessed all forms of flood risk: fluvial (rivers), tidal (sea), surface water, groundwater, sewers, reservoirs and canals.

5.5.2 To provide more site specific information, two **SFRA Level 2** reports were published in October 2011 and April 2013. These involved a more detailed review of flood risk at identified broad locations based on the risk identified in the Level 1 SFRA. Areas with the lowest flood risk (Flood Zone 1) were not subject to the Level 2 SFRA. Along with the Environment Agency's flood maps, the SFRA L1 and L2 and the site specific FRA provide the information necessary to apply the Sequential Test and Exception Test in the development management process by helping to identify sites that may or may not be suitable for development. An additional SFRA Level 2 report will also be published as part of the emerging Tewkesbury Borough Plan to cover any housing and employment allocations.

5.6 Site Suitability and Flood Risk Considerations for Planning Applications and Site Specific Flood Risk Assessments (FRA)

5.6.1 Developers proposing development or a change of use to a more vulnerable class in areas of flood risk from any source or with critical drainage problems (as notified to the local planning authority by the Environment Agency) or which could create flood risk for others or are more than 1 hectare in size are responsible for:

- Demonstrating that the proposed development is consistent with national and local planning policy.
- Undertaking appropriate consultation with the flood risk management authorities (Section4)
- Providing a site-specific flood risk assessment (FRA), as part of the planning process, which meets the requirements of this Section, and those set out by the relevant flood risk management authority.
- Integrating measures into the proposals design that reduce flood risk to the development and elsewhere, by incorporating appropriate flood risk management measures (Chapter 9) including the use of Sustainable Drainage Systems (SuDS) (Chapter 6)
- Ensuring that any necessary flood risk management measures are sufficiently funded to ensure that the site can be developed, occupied and maintained safely throughout its proposed lifetime. (Section 6.15)

5.6.2 The Council will refuse to validate applications for sites in Flood Zones 2 and 3 where no FRA is submitted.

5.6.3 The following section sets out the points that need to be taken into consideration when determining a site's suitability for development due to flood risk. All requirements are consistent with the NPPF and PPG with local requirements explained further.

Assessment

5.6.4 Applicants must consider allocations within the local Development Plan. If the site has been allocated in the Development Plan for the same land use type/vulnerability classification that is now being proposed, then an assessment of flood risk, at a strategic level, has already been undertaken. This will have included assessing the site, against other alternative sites, as part of the sequential approach to flood risk. A site's allocation in the Development Plan for the same land use/vulnerability does not however preclude it from requiring a site specific FRA, only from the application of the Sequential Test.

5.6.5 Can it be demonstrated that the flood risk information contained within the SFRA and associated sequential test assessment accompanying the local plan/development plan (where applicable) is still appropriate for use? If not, has the flood zoning of a site changed after adoption of the relevant part of the local plan or is there any updated climate change allowances or a recorded flood. In this case Tewkesbury Borough Council will require the developer to provide evidence that the changes have been taken into account and, for a Major Development, the Developer will need to provide an updated Flood Risk Assessment using updated modelling to redefine the flood zones.

5.6.6 Where the site has not been allocated in the local plan or the flood zone classification has changed since adoption of the plan (i.e. it is a windfall or non-allocated site), a detailed flood risk assessment including the sequential test and, where appropriate, the exception test will need to be undertaken following the overarching principles of the sequential approach. Details of the sequential and exception test are specified above at 5.3 and 5.4.

5.6.7 Applicants should indicate their site boundary on a plan and, if applicable, the boundary of any allocated site and provide evidence of any checks to see if there is any updated Flood Risk information after the preparation of the relevant SFRA.

5.6.8 For 'major' development (as defined within The Town and Country Planning Development Management Procedure (England) Order 2015) a detailed FRA is to provide an appropriate assessment (hydraulic model) of the 1% annual probability flood event, with **70%** allowance added to 'peak river flows' to account for climate change.

5.6.9 For non-major development; the preference is to undertake the same approach as for major development. However in the absence of modelled climate change information, it may be reasonable to utilise an alternative approach (see APPENDIX V).

5.6.10 Have other sources of significant flood risk from sources other than fluvial or tidal, such as pluvial (surface water, as demonstrated either by the LLFA surface water management plan or physical photographic evidence of previous events), groundwater, reservoirs, sewers, etc. been considered (see Sequential Test details at 5.3)?

5.7 What an FRA Should Contain

5.7.1 A brief FRA is all that is normally required for small-scale proposals such as householder development and other minor extensions (<250sqm) in Flood Zones 2 and 3. The FRA (which must be submitted along with supporting evidence, as part of a planning application) for such developments must, as a minimum, be based on the most up to date EA guidance for Minor Development in Flood Zone 2 and 3. In addition, it needs to take into account the most up to date advice on climate change (see APPENDIX V for local Environment Agency Guidance on both these points). However, for other types of development a more detailed FRA will be required. Obtaining pre-application advice from the Council will assist in determining the level of detail required for a FRA.

5.7.2 For more complex development schemes, an FRA will be required to include a detailed sustainable drainage scheme to mitigate the site. Any suggestion that preferred SuDS techniques for a particular site are unviable or unduly onerous, by virtue of factors such as extraordinarily high development costs or significant harm to heritage assets must be robustly evidenced. The **Environment Agency** has published further guidance setting out what an FRA should contain and **English Heritage** has published guidance on the consideration of heritage assets within flood mitigation schemes.

5.7.3 FRAs should be proportionate to the risk and appropriate to the scale, nature and location of the development. A FRA should always be undertaken **as early as possible** in the planning process to avoid abortive work raising landowner expectations where land is unsuitable for development.

5.7.4 **FRAs should**, where appropriate:

a) Consider and quantify the **different types of flooding** whether from natural or human sources (i.e. canals, dam breaches and reservoir breaches) and including joint and cumulative effects. The LPA will expect links to be made to the management of surface water as described in Chapters 6 and 7. Information to assist with the identification of surface water and groundwater flood risk is available from the LLFA, the EA and the LPA. Applicants should also assess the risk of foul sewage flooding as part of the FRA. Severn Trent Water as sewerage undertaker can provide relevant information to the applicant to inform preparation of FRAs.

b) Consider the effects of a range of flooding events including the **impacts of extreme events** on people, property, the natural and historic environments and river processes.

c) Consider the **vulnerability of occupiers and users** of the development, taking account of the Sequential and Exception Tests and the vulnerability classification, and include arrangements for safe access (Please see the Defra/EA publication 'Flood Risks to People' for further information on what is considered 'safe').

d) Identify relevant **flood risk reduction measures** for all sources of flood risk not just for the site but elsewhere i.e. downstream existing flooding problems.

e) Consider both the potential adverse and beneficial **effects of flood risk management infrastructure** including raised defences, flow channels, flood storage areas and other artificial features together with the consequences of their failure.

f) Include assessment of the remaining **residual risk** after risk reduction measures have been taken into account and demonstrate that this risk is acceptable for the particular development or land use. Further guidance on this is given in Chapter 9.

g) Be supported by appropriate **evidence data** and information, including historical information on previous events. All topographical survey data submitted with applications must be presented as an accurate height Above Ordnance Datum, Newlyn (mAOD)

h) Consider the risk of **flooding arising from the proposed development** in addition to the **risk of flooding to development on the site**. This includes considering how the ability of water to soak into the ground may change after development. This would mean the preparation of surface water drainage proposals. This includes all flow routes including flood flow paths or ordinary watercourses flowing onto the development site and therefore needing to be taken account of.

i) Take a **'whole system'** holistic approach to drainage to ensure site discharge does not cause problems further along in the drainage sub-catchment and can be safely catered for downstream and upstream of the site.

j) Take the appropriate **impacts of climate change** into account for the lifetime of the development including the proposed vulnerability classification.

k) The FRA must clearly demonstrate that the **Sequential Test and Exception Test** have been passed.

l) A surface water drainage strategy contains the proposals for the surface water drainage of the development. Such a strategy should include initial proposals that are sufficient to demonstrate a scheme can be delivered that will adequately drain the proposed development whilst not increasing flood risk elsewhere as part of the FRA.

m) If an outline application is to be submitted for a major development, then an outline surface water drainage strategy must be submitted as part of the FRA, outlining initial proposals and quantifying the conceptual surface water management for the site as a whole. This should detail any strategic features, including their size and location. A

detailed surface water drainage strategy must subsequently be submitted and approved for the whole site and, with each reserved matters application that comes forward, it must be demonstrated that the surface water drainage strategy is still appropriate and how the reserved matters application complies with the outline and detailed whole site surface water drainage strategy's.

Surface Water Drainage Strategy

5.7.5 Developers should prepare the surface water drainage strategy as part of the FRA, ensuring consistency between the surface water flood risk and any initial drainage proposals. It is recommended that a surface water drainage strategy is based on the following principles:

a) Work up your drainage strategy in tandem with your site layout and highway designs. This will help avoid abortive work in any one area. Use Chapters 6, 7 and 9 to ensure that the following have been considered:

a.1. The submission requirements, including any supporting investigations

a.2. Sustainable drainage design principles

a.3. Interception, infiltration, flow rate runoff control, volumetric runoff control, and exceedance flow management

a.4. Site discharge location and attenuation provision

a.5. Water quality treatment, habitat provision and biodiversity

a.6. Health and safety, access and amenity

a.7. Use the correct climate change allowances for the development based on its lifetime.

a.8. Ensure that the required management and maintenance of all site features has been clearly set out as part of the drainage strategy. Get initial agreements in place to cover management funding for the lifetime of the development.

b) Check that the quality of the water environment and therefore the Water Framework Directive (WFD) impacts have been specifically considered as part of all of the flood and drainage measures proposed. Is development of the site likely to cause detriment to the WFD status of a water body? Have opportunities been taken to enhance the water environment?

5.7.6 Where there are proposals which include changing the discharge of surface water flows between catchments, planning permission will be refused unless copies of Legal Easements from the new point of discharge to the original point of discharge to the main watercourse

are provided to the Planning Authority as part of any planning submission. The detailed drainage design will need to comply with the Local Authority Suds Officers Practice Guidance along with this document. The design will need to ensure that any attenuation facility has a Flood Hazard Rating of less than **0.75**, with normally a maximum depth of storage of **1.2m**, and banks no steeper than a **1 in 6** slope). The design shall ensure that the attenuation storage requirement is assessed against a **1%** (1 in 100) annual probability flood event plus **70%** allowance for climate change on the receiving watercourse. The greenfield run off rate to be used for the design of Attenuation Storage for all storms up to a **1%** (1 in 100) annual probability plus 70% allowance for climate change, shall be the **1 in 1 year** greenfield run off rate calculated by using ReFH2 for the whole catchment.

5.7.7 For Development Sites where either there is recent photographic evidence, or if the Surface Water Management Plan shows the presence of pluvial flooding, the Development will need to compensate for the pluvial flood volume lost by providing additional flow and storage capacity within the developments surface water drainage system and attenuation storage. In a large-scale development or an allocation, the compensatory storage would need to be comprehensive, contiguous and protected from development.

5.7.8 The detailed design of development should seek to reduce the risks of flooding for any existing development and land in or around the application site as part of the new development and deal with flooding in a comprehensive manner for the whole of the site.

5.7.9 Within an application site, where there is reason to believe that overland flow could occur into the site, then provision shall be made to accommodate those flows within the site layout. The design of the site must also ensure that flows resulting from these overland flows are managed in exceedance routes that minimise the risks to people and property and avoids creating hazards to access and egress routes.

5.7.10 The critical duration event for watercourses and rivers can typically range from around 4 hours for small catchments, up to 3 days for the large rivers such as the River Severn. Therefore, there is the real possibility the critical duration event for the development site could coincide with major flows in rivers, with subsequent hydraulic consequences. Where there is this 'dependency' then the relevant return period needs to be applied to both the site drainage system and the relevant watercourse, to ascertain what the implications are for the site system. Where the impact is considered to be

significant, more detailed examination of the interconnection needs to be undertaken, using joint probability analysis, in order to refine the site design.

CHAPTER 6 - SUSTAINABLE DRAINAGE SYSTEMS (SuDS)

6.1 SuDS are surface water drainage systems which manage water runoff in a more sustainable way than conventional drainage, through managing flow rates and protecting water quality. All developments regardless of scale and constraints should seek to incorporate Sustainable Drainage and in virtually all cases it will be a requirement. It is incorrect to assume that ground conditions preclude their use, as there are a variety of solutions available depending on the location and needs of a development. SuDS are intended to replicate, as closely as possible, the natural drainage from a site before development takes place.

6.2 SuDS offer significant advantages over conventional piped drainage systems in reducing flood risk, by reducing the quantity of surface water run-off from a site and the speed at which it reaches water courses, promoting groundwater recharge and improving water quality and amenity. The range of SuDS techniques available means that a SuDS approach in some form will be applicable to almost any development, to maximise the opportunities and benefits obtainable from surface water management.

6.3 Please note that reference is made to 'SuDS' throughout this chapter, rather than 'surface water drainage' as the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), Non-Statutory Technical Standards for Sustainable Drainage and adopted and emerging Local Planning policies require a SuDS solution to surface water management for new development. Many of the general principles within this chapter can also be applied to traditional surface water drainage and so this chapter needs to be complied with on all development sites and the provision of SuDS maximised. Even on very constrained sites SuDS can be implemented in one form or another.

6.4 WHAT IS REQUIRED?

6.4.1 For all Greenfield sites, developers must attenuate runoff so as to not exceed the **1 in 1 year** greenfield rates for all storms up to a 1 in 100 year event. An allowance of **+70%** peak rainfall must be made to take account of future climate change and urban creep. The climate change allowance must be added to the post-development run-off rate and volume calculations only.

6.4.2 For brownfield sites, SuDS techniques should reduce the proven current instantaneous runoff rate to the **1 in 1 year** greenfield run off rate wherever possible for all storms up to a 1 in 100 year event. An allowance of **+70%** peak rainfall must be made to take account of future climate change and urban creep. In all instances, opportunities to improve runoff rates and reduce flood risk will be sought, with a minimum discharge reduction of **40%**. Innovative SuDS design solutions will be supported in principle.

6.4.3 The preferred hydrological methods are those utilising ReFH2 with FEH 2013 rainfall data. If other models give a more conservative estimate of flow rate and volumes, these may be acceptable to the LPA.

6.5 There are a variety of SuDS techniques and further guidance should be sought via the SuDS Manual (CIRIA C753). The use of 'open to surface' SuDS management train techniques is preferred, as opposed to piped or tanked solutions which offer nothing in terms of water quality, biodiversity, amenity, have increased future maintenance requirements and are typically more expensive to implement. In addition, any innovative solutions will be welcomed and supported in principle.

6.5.1 One or more of the following 'open to surface' options should be considered first. This list is not exhaustive and further guidance can be found in the SuDS Manual (CIRIA C735). If these methods are discounted, robust evidence as to why this is the case should be demonstrated as part of any submission.

Surface SuDS Elements

Permeable surfaces: Surfaces that allow inflow of rainwater into the underlying construction or soil; such as gravel, permeable hard surfacing, permeable block paving, porous tarmac and porous concrete. The storage can be created within the sub-base of these surfaces given careful selection of the stone fill or use of plastic box systems. They are also very effective at removing a wide range of pollutants and may also permit infiltration.

Green roofs: A vegetated roof which provides retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.

Brown roofs: Similar to green roofs, but the permeable layer is made from crushed material which provides a good void ratio and does not contain any contaminates.

Rainwater harvesting: A system that collects rainwater from where it falls rather than allowing it to drain away. It includes water that is collected within the boundaries of a property, from roofs and surrounding surfaces and can reduce the risk of flash flooding. Rainwater harvesting systems are not included in the calculation of attenuation storage provision due the fact that they may be full at the start of a storm event.

Filter trenches/ drains: Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water. They may also permit infiltration.

Filter strips: Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.

Sand Filters: Structural controls designed to treat surface water by passing runoff through a filter bed of sand. Temporary storage can be provided by ponding above the filter layer and they can be used where high pollutant removal is required.

Swales: Shallow vegetated channels that conduct and can retain water in larger storm events. The vegetation filters out particulate matter in the flow thus providing treatment and improving water quality. They may also permit infiltration.

Basins: Ponds and wetland areas that may be utilised for surface runoff storage.

Bio-retention areas: Vegetated areas designed to collect and retain runoff and permit settlement of suspended solids and biological removal of pollutants before discharge via a piped system or infiltration to the ground.

6.5.2 The following below ground techniques are recognised, but the developer must demonstrate how the siltation risk is to be reduced and how silt can be removed from the drainage element safely and economically. Design life data, maintenance and replacement information must also be provided. In general; priority is given to the use of 'open to surface' SuDS management train techniques, as opposed to piped or tanked solutions which offer nothing in terms of water quality, biodiversity, amenity, have increased future maintenance requirements and are typically more expensive to implement.

Sub-Surface SuDS Elements

The most commonly found sub-surface elements of a sustainable drainage system are set out below. It should be noted that these solutions should only be considered when all other surface/open to air techniques have been robustly demonstrated not to be suitable.

Geocellular/Modular Storage: Sub-surface storage structure that has a very high void ratio and thus occupies a reduced space compared to other options, e.g. stone filled trenches. They can also be used as a very effective infiltration technique where ground conditions are suitable.

Pipes and accessories: A series of conduits and their accessories, normally laid underground, that convey surface water to a suitable location for treatment or disposal.

Pre-treatment devices: These remove silt, sediment and debris to prevent downstream clogging and provide pollutant capture from runoff. These devices require regular maintenance to work efficiently. e.g. sediment sumps and catch basin inserts.

Large diameter pipes, culverts or tanks: Provide a volume of below ground storage which should be large enough to allow for unrestricted future maintenance and cleaning.

6.6 Prior to submitting a planning application an applicant should discuss with the Council's Development Management team what SuDS techniques would be most appropriate and how they should be applied on a site. Some SuDS techniques are not appropriate on sites with particular ground conditions. The Local Highways Authority should be contacted to discuss suitable/adoptable SuDS solutions for the surfacing of estate roads.

6.7 SuDS DESIGN PRINCIPLES

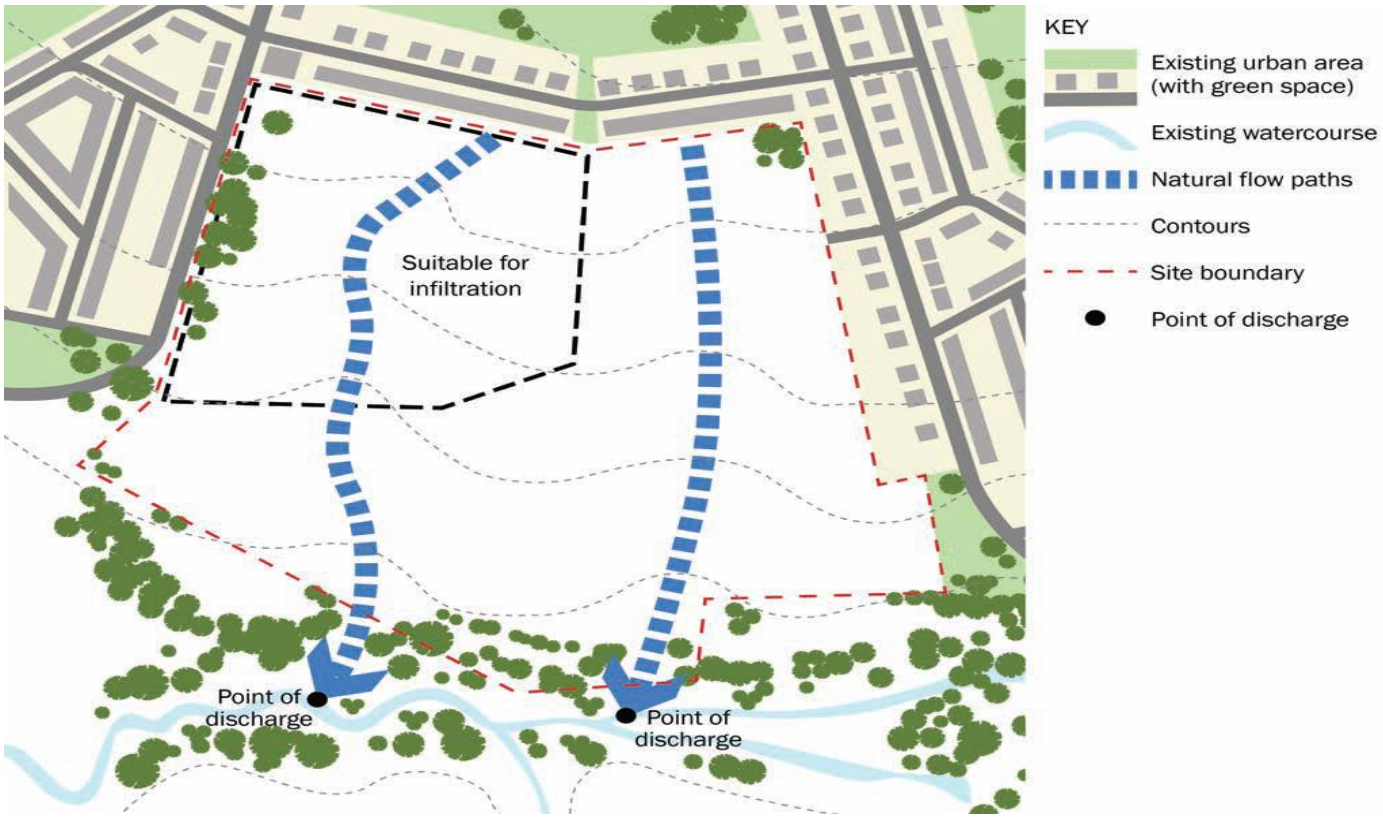
Design in SuDS from the start.

6.7.1 Considering SuDS during the preliminary stages of site design provides the opportunity to incorporate features that are appropriate to the local context and character of an area. Integrated design to achieve multi-functional benefits is inherent to the site master planning and layout process; therefore it is most efficient and cost effective to design SuDS schemes into a site as early as possible. When drainage is accounted for from the beginning of the design process, it provides opportunity for the built up areas to be designed in-line with the topography, rather than to fit the drainage around the site at a later stage which is much less effective.

6.7.2 Land uses that have different pollution potential can also be clustered and phased so that management trains can be designed most effectively. The result of early inclusion of SuDS is a more effective and efficient layout which will avoid the need for abortive work and changes at a later stage which can escalate costs.

6.7.3 The better the SuDS design the more options for adoption that might be available to a development. The stages described in Figure 6.1 to Figure 6.5 show how a design can integrate SuDS spatially through the evolution of a masterplanning exercise.

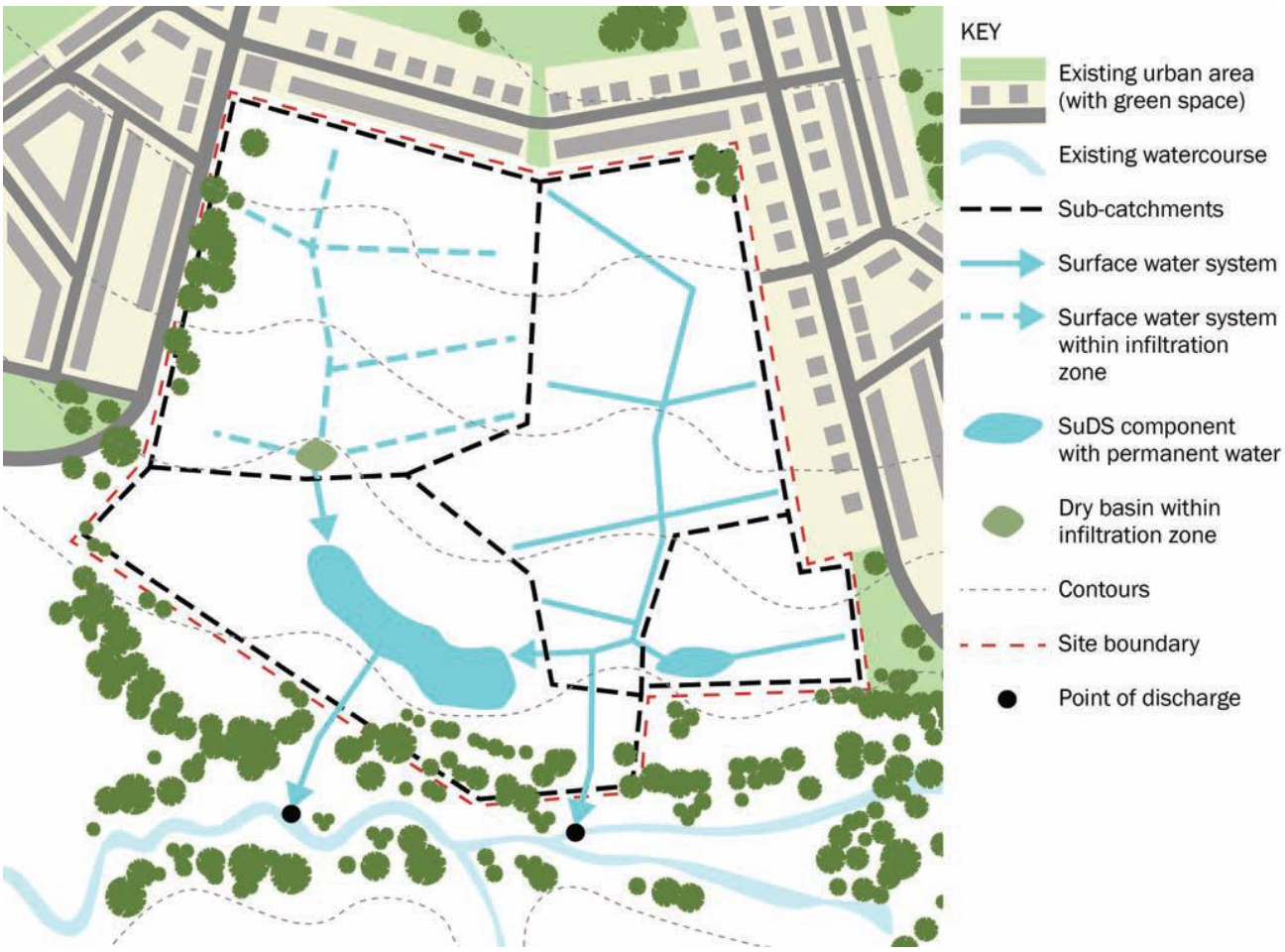
Figure 6.1: Stage One



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Examine site typography and geology: Aim to mimic the natural drainage systems and processes as far as possible. Identify key natural flow paths, existing water bodies and potential infiltration areas to understand opportunities and constraints.

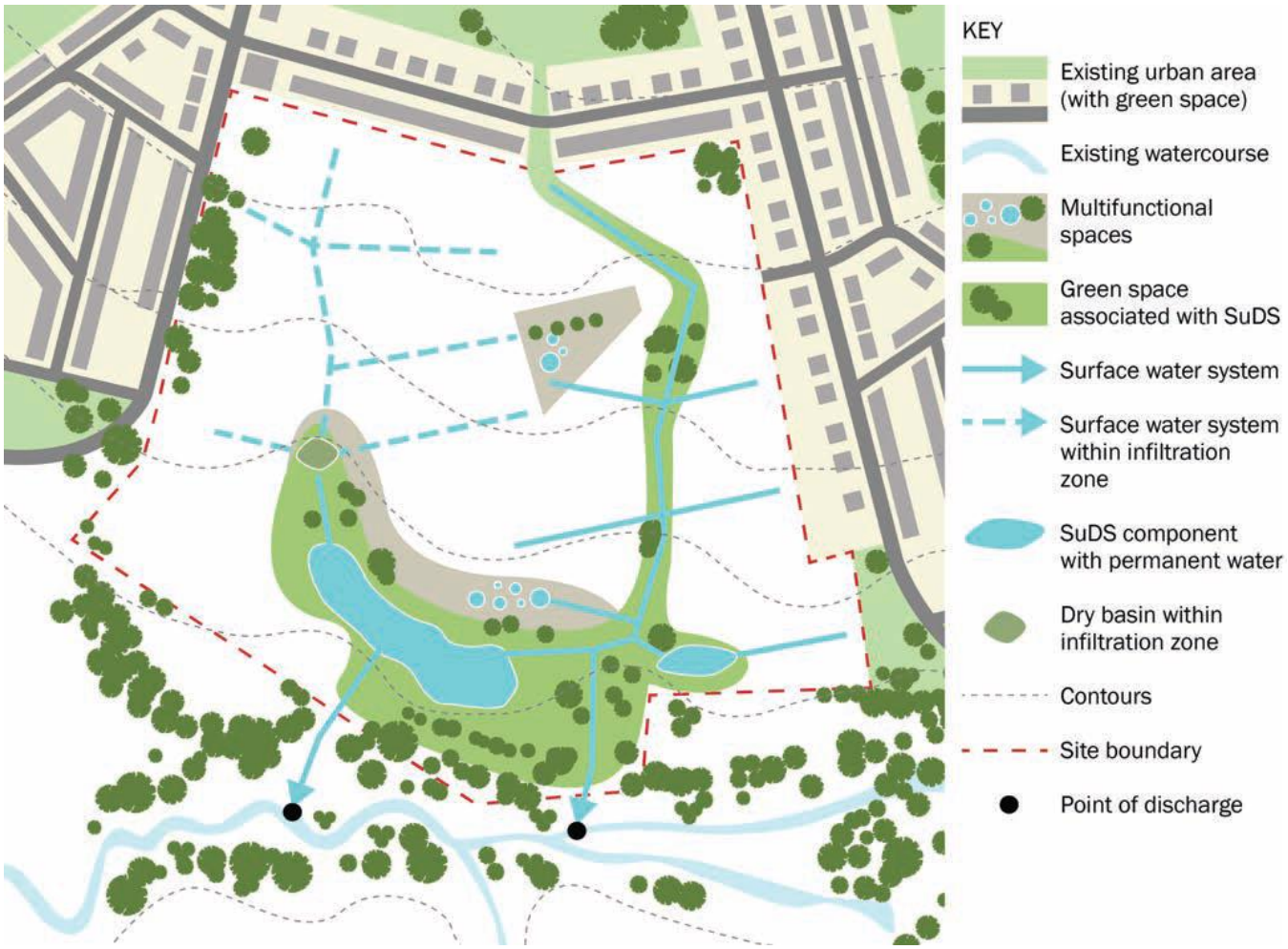
Figure 6.2: Stage Two



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Create a spatial framework for SuDS: Minimise runoff by rationalising large paved areas and maximising permeable surfaces. Consider likely space needs for site control SuDS based on character of development and the proposed degree of source control. Use flow paths and possible infiltration or storage areas to inform development layout.

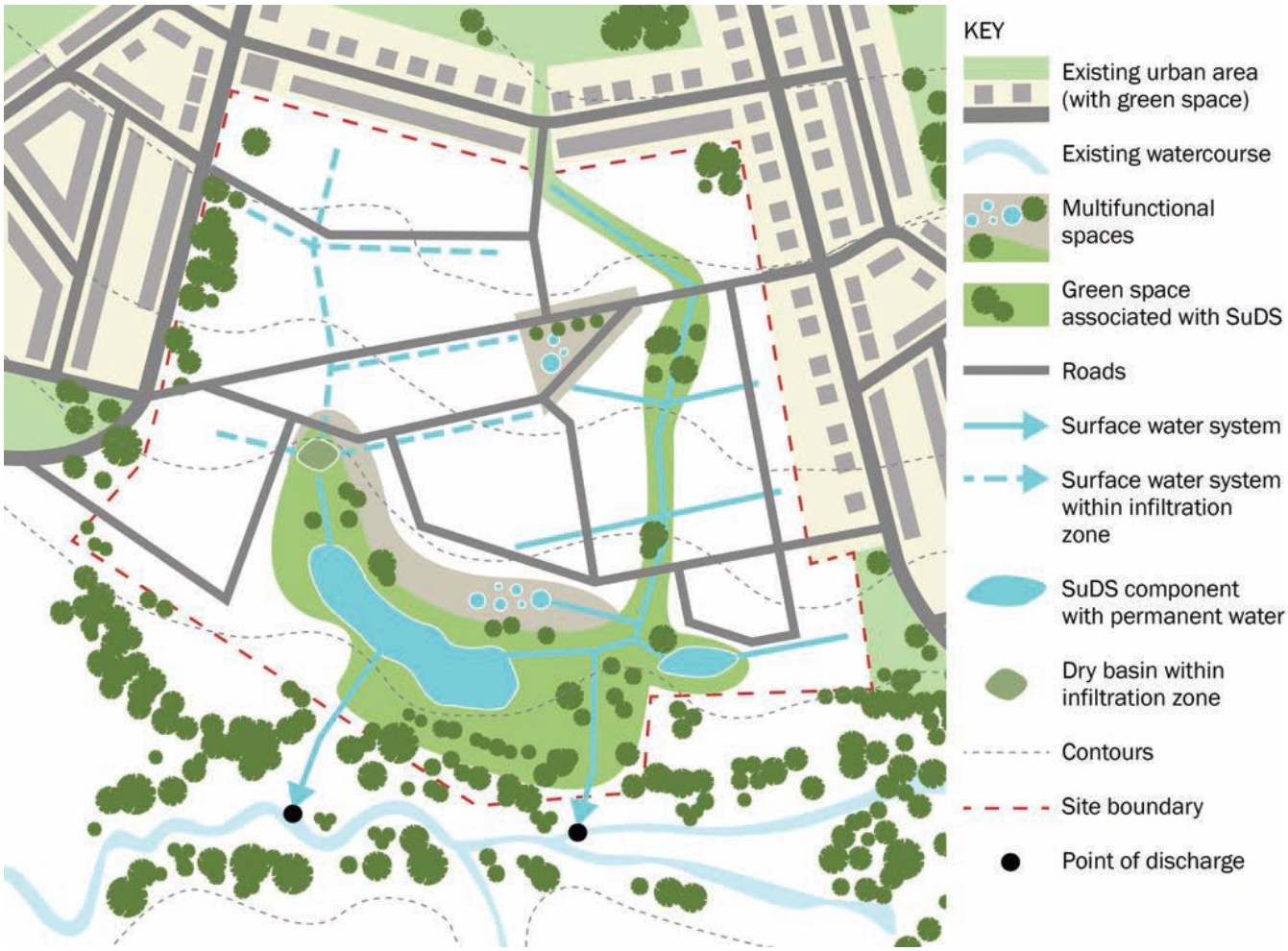
Figure 6.3: Stage Three



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Look for multi-functional spaces: Consider how SuDS features can be co-located with green infrastructure, open space and public realm areas to create multi-functional spaces. SuDS can be designed to be valuable amenity and ecological features.

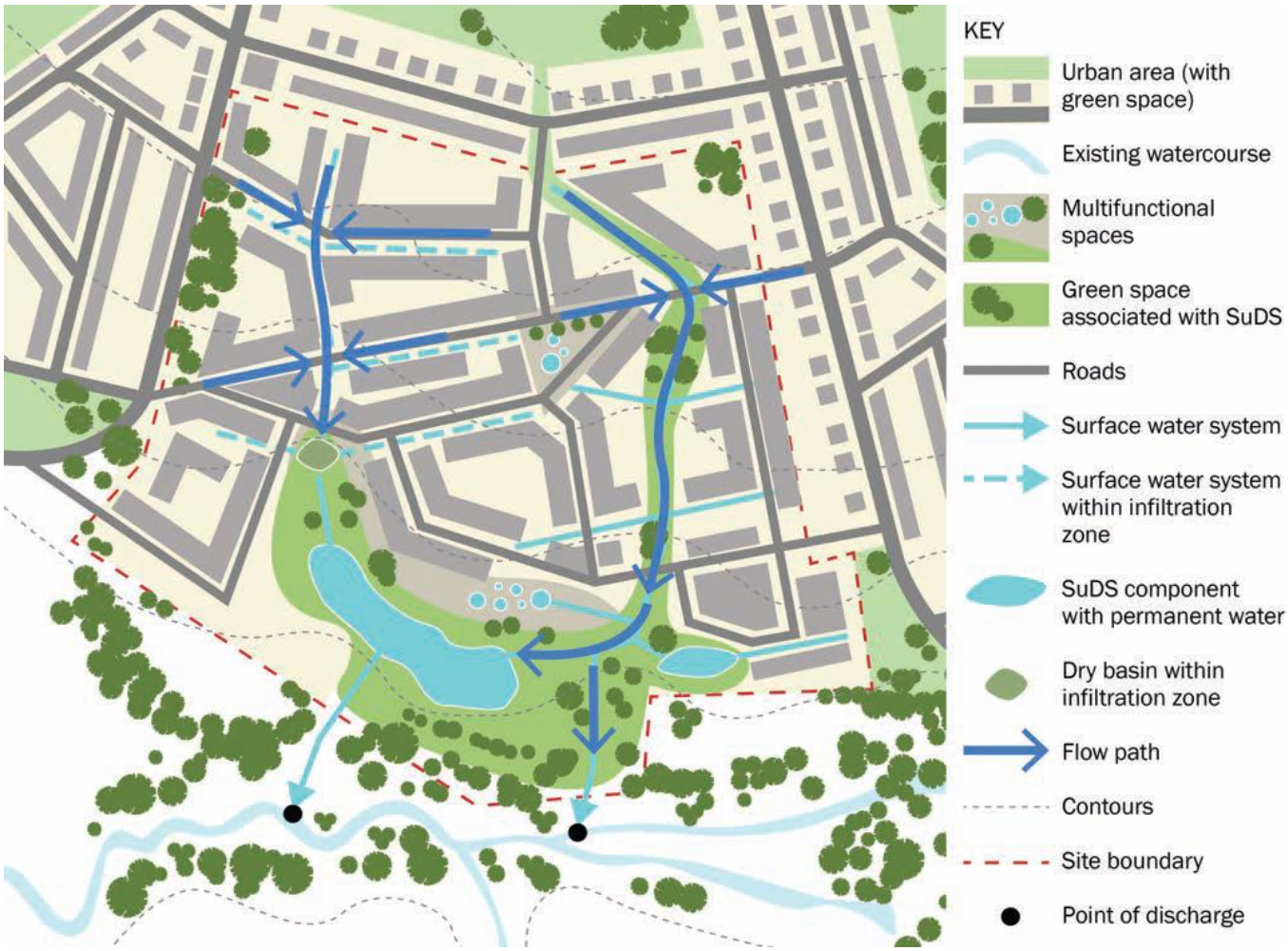
Figure 6.4: Stage Four



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Integrate the street network with SuDS: Structure the street network to complement and manage flow pathways. Integrate SuDS features into street cross-sections, ensuring street widths are adequate. SuDS should be used to enhance the streetscape providing amenity and multi-functionality by integrating with other street features including tree planting, traffic calming, parking bays, verges and central reservations.

Figure 6.5: Stage Five



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C7537

Cluster land uses to manage pollution: The number, size and type of SuDS selected will be affected by land uses and the corresponding pollution risk. Potential polluters, e.g. industrial development should have their own isolated SuDS network. Integrate a series of SuDS features that will provide water treatment throughout the networks, responding to the level of pollution risk. Clustering should be considered alongside other mixed use ambitions.

Mimic natural drainage

6.8.1 The topography of an undeveloped site provides a good indication of natural flow routes and can therefore assist in defining appropriate and efficient flow routes through a developed site without relying on additional infrastructure. The most effective and cost efficient designs make use of the local topography, increase landscape permeability, and reduce the amount of surface water flowing off site as much as possible. Allowing surface water runoff to follow the natural physical geography requires less soil movement and can eliminate the need for additional underground piping and pumping of water. Where the site is suitable for infiltration, opportunities to discharge water to the ground should be taken to mimic natural infiltration and recharge groundwater aquifers.

6.8.2 All new developments on greenfield land are required to discharge the runoff from the impermeable areas at the 1 in 1 year greenfield runoff rate, or less than. The IDB may stipulate its rates of discharge for developments within its area and the Lead Local Flood Authority (LLFA) or LPA agree an acceptable discharge rate outside of these areas. Note that in the IDB area, consent will be required for any discharge into an IDB watercourse. Similarly a developer will be required to provide evidence confirming their right to discharge surface water to any watercourse particularly where a change of catchment could occur.

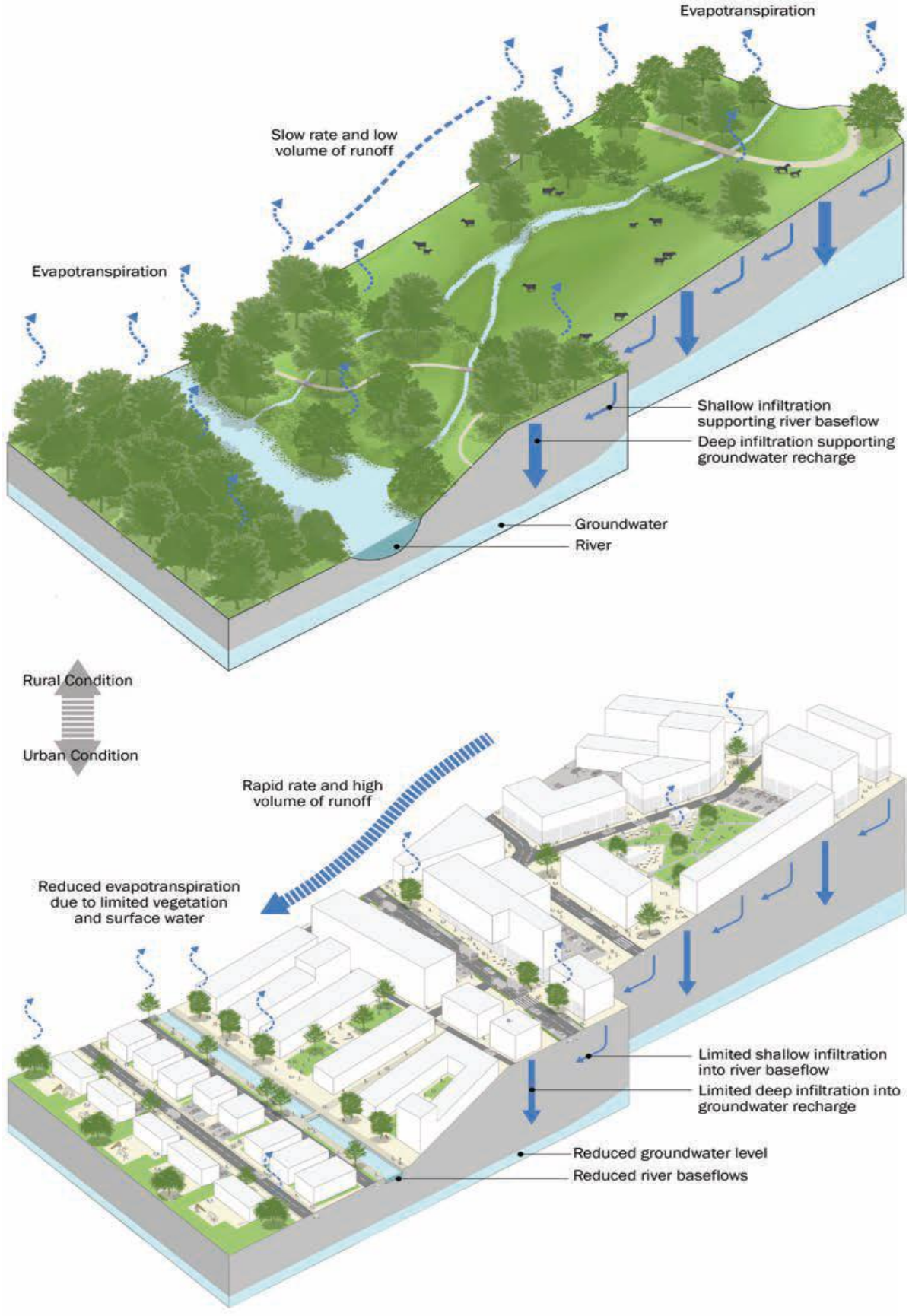
6.8.3 All major development proposals will need to demonstrate which watercourse catchments they fall within.

6.8.4 It must be demonstrated by the applicant that the site can continue to drain when receiving water bodies are in flood conditions. Irrespective of any agreed runoff rates, source control methods must be implemented across sites to provide effective pre-treatment of surface water. This must be demonstrated as part of the proposal.

6.8.5 Brownfield (previously developed land) sites must reduce the existing runoff from the site as part of the redevelopment. In order to provide betterment, redevelopments should look to reinstate 1 in 1 year greenfield runoff rates unless otherwise agreed by the LPA.

6.8.6 Figure 6.6 shows the differences in drainage patterns between natural landscapes and built-up areas. Mimicking the natural landscapes in urban areas is the best strategy to mitigate flood risk and improve downstream water quality.

Figure 6.6: Difference between natural and urban drainage

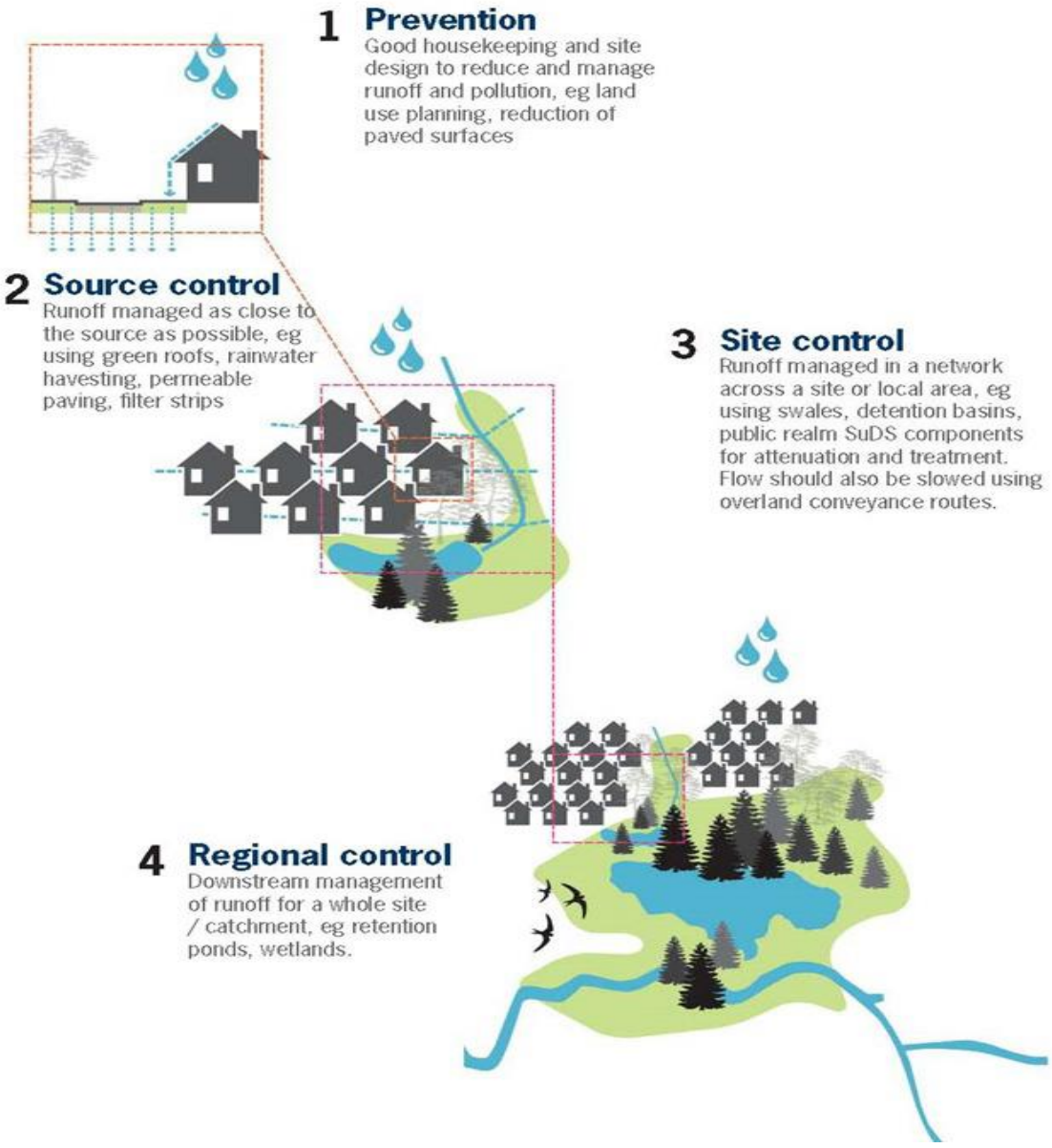


Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

The Surface Water Management Train

6.8.7 The Surface Water Management Train (sometimes called the treatment train) is fundamental to designing a successful SuDS scheme and provides a hierarchy of drainage techniques for improving quality and quantity. If water cannot be dealt with at one level in the management train, it should sequentially be taken down the hierarchy. Techniques closer to source are preferable to those lower down the hierarchy. Therefore prevention and source control should always be considered before site or regional control and discharging runoff to surface water sewers should only be considered as a last resort. Further information on applying the principles of the Surface Water Management Train is included below.

Figure 6.7: SuDS Management Train (CIRIA C697 2007)



Water reuse first

6.8.8 Reusing water whenever possible is important to improving the country's water resilience, and reducing pressures on precious water supplies. Recycled rainwater and surface water runoff can be used for non-potable purposes, such as toilet flushing and irrigation. Water can be collected for reuse from both roofs and/ or paved surfaces and can be stored for reuse using a water butt or rainwater recycling system. Surface water runoff from streets or public areas can also be collected and treated using SuDS features, such as a rain garden, before storing it for surrounding buildings to reuse.

Follow the drainage Hierarchy

6.8.9 It is a Building Regulations and PPG requirement that the discharge hierarchy in Figure 6.8 is used when considering proposals.

Figure 6.8: Surface water drainage hierarchy

Rainwater shall discharge to the following, listed in order of priority

To ground in an adequate soakaway or some other adequate infiltration system; where that is not reasonably practicable		**A watercourse; or where that is not reasonably practicable**		**A surface water sewer, highway drain or other drainage or where that is not reasonably practicable**		**A combined sewer**

Note: in all instances adequate stormwater storage will need to be provided in order to meet the relevant infiltration or discharge rates and volumes (see Section 6.4).

Use infiltration where suitable.

6.8.10 The potential for infiltration measures on a site should be considered at the outset. Careful consideration of the acceptability of infiltration drainage should be given particularly in relation to potable water sources (e.g. drinking water) or land contamination issues.

6.8.11 The British Geological Survey can provide maps and reports to support decisions with regards to the suitability of the subsurface for the installation of infiltration type SuDS type systems. The suitability for infiltration across an area should be based on:

- Existing constraints prior to planning infiltration SuDS;
- Drainage capacity and rate of infiltration into the ground;
- Potential for ground instability when water is infiltrated;
- Impact on groundwater quality as a result of infiltration;
- Development on contaminated land or Source Protection Zones (SPZ) (vulnerable aquifers).

6.8.12 Infiltration should be assessed on-site using infiltration tests that follow the detailed SuDS design principles covered in BRE365/CIRIA 156 procedure. SPZ's should be taken into account when considering infiltration and guidance provided by the EA who should be consulted to determine infiltration constraints and requirements in these areas. Where infiltration drainage is proposed on previously developed land, contamination risk needs to be considered. This may not rule out the use of infiltrating SuDS but will require site investigations and information on remediation prospects which are outside the scope of this Supplementary Planning Document (SPD).

6.8.13 The maximum acceptable depth for an infiltration device is usually 2.0m below ground level if there is any risk of groundwater contamination, with a minimum of 1.2m clearance between the base of the feature and peak seasonal groundwater levels. In areas with a high groundwater table, the possibility of incorporating shallow infiltration features such as trenches should be investigated. Deeper ('deep bore') soakaways pose a serious pollution risk and are not acceptable and it is expected they will become contrary to the European Union (EU) WFD.

Keep surface water on the surface

6.8.14 In some areas the presence of low permeability clay soils means that infiltration systems are not viable. Whilst low permeability soils are often cited as a reason for not including SuDS however, this is not acceptable as other SuDS solutions do exist. Although soakaways and other infiltration methods may not be suitable, many other methods such as swales, ponds and wetlands should be prioritised, selected and designed accordingly. It is also possible to allow some water to soak into the ground (for example out of the bottom of an unlined swale), even if drainage design calculations do not allow for it.

6.8.15 Design and layout should seek to manage and convey surface water above-ground, avoiding the use of underground piping as far as possible. This is particularly pertinent in the flatter landscape areas or areas of high groundwater. Managing surface water runoff at the surface has the benefit of:

- Avoiding concentration and acceleration of surface water into waterways which causes downstream erosion;
- Integrating removal of pollutants by filtering water during conveyance;
- Reducing construction and maintenance requirements and costs;
- Creating habitats;
- Contributing to public amenity by better quality urban and landscape design;
- Increasing residents' awareness of water management; and
- Detecting blockages and obstructions more easily.

Place-making through SuDS design

6.8.16 When using conventional surface water management systems, water is hidden in pipes underground. By bringing water management to the surface using SuDS, there is an opportunity to enliven public spaces and streetscapes. The presence of water features within the urban environment can promote a strong sense of place, bring an urban space to life and create unique spaces that can be enjoyed by all. SuDS features such as ponds, wetlands, pools, fountains and planted rills which can be purely aesthetic or interactive in nature, can be integrated into the public realm and open spaces to enrich the area with green infrastructure. Note that interactive SuDS should include an appropriate level of natural pre-treatment upstream before coming into human contact, such as in the case of water play areas. Designing for water quality is discussed further in Section 7.

Landscape-led approach

6.8.17 The selection of SuDS types and the creation of the SuDS network should both respond to and contribute to the surrounding built and natural landscape. A landscape-led approach uses SuDS as a mechanism to create strong green infrastructure networks and is important to increase connectivity to the wider ecosystem and landscape. Effective integration will also require carefully researched and selected plants, which work to improve the local green infrastructure and enhance biodiversity. Also selection of hardscape materials used in SuDS construction, such as concrete, brickwork, wood, aggregate and paving, should consider the surrounding landscape and urban character and be developed alongside the

overall urban design vision. Using a landscape led approach will improve the amenity value of SuDS for local residents, and provide water management and design benefits.

Minimise embodied carbon in SuDS

6.8.18 One of the advantages of SuDS is their ability to improve the natural environment. It is important that environment improvements from SuDS are not reduced by incorporating high carbon solutions. The excessive use of concrete and other aggregates with high levels of embodied energy is discouraged. Eliminating energy consuming water pumps whenever possible is also encouraged. Vegetated SuDS components can have a positive impact by storing carbon as they grow, through a process known as carbon sequestration.

Minimise waste in SuDS

6.8.19 When undertaking the maintenance of SuDS, waste will be generated. This will be predominantly grass and other vegetation, and may be managed on site in wildlife piles. There is still a requirement to comply with all relevant waste management legislation and ensure waste is taken to an appropriately licensed site. This is even more pertinent when waste is disposed off-site. Management of SuDS on industrial sites will need to ensure hazardous waste is disposed of separately.

Design for wildlife and biodiversity

6.8.20 SuDS can provide the ideal opportunity to bring urban wetlands and other wildlife-friendly green spaces into towns and cities. They can be linked with existing habitats to create blue and green corridors whilst providing an amenity and education resource for the community.

6.8.21 Where possible, existing habitats should be retained and incorporated into the landscape design. SuDS features are likely to have greater species diversity if existing habitats are within dispersal distance for plants, invertebrates and amphibians. It should however be noted that existing wetlands should not be incorporated into SuDS unless there is a guaranteed supply of clean water.

6.8.22 An aim should be to create new habitats based on the ecological context and conditions of the site. Habitats and species objectives that contribute to local, regional and national biodiversity targets should be prioritised. Further information on local objectives can be found in local (BAPs). Guidance on maximising the biodiversity potential of SuDS can be found in the Royal Society for the Protection of Birds (RSPB) publication, Maximising the Potential for People and Wildlife.

Design for easy maintenance and access

6.8.23 When designing SuDS it is crucial to consider throughout the process how features will be maintained and accessed, who is ultimately responsible for the lifetime of the development, and the likely costs involved. Embedding foresight into every stage of the design process will produce a more effective, better maintained SuDS scheme upon completion. Design should also consider Construction Design and Management (CDM) Regulations from the outset to ensure that access is provided for maintenance and that health and safety measures are adhered to. Those responsible for SuDS across a development must be provided with an operation and maintenance manual by the designer and this could be part of the documentation provided under CDM. Aspects that should be included within the operation and maintenance manual are shown in Table 6.1:

Table 6.1: What to Include in the Operation and Maintenance Manual

- Location of all SuDS components on site
- Brief summary of the design intent, how the SuDS components work, their purpose and potential performance risks
- Depth of silt that will trigger maintenance
- Visual indicators that will trigger maintenance
- Depth of oil in separators etc. that will trigger maintenance
- Maintenance requirements (i.e. maintenance plan) and a maintenance record pro-forma
- Explanation of the objectives of the maintenance proposed and potential implications of not meeting those objectives
- Identification of areas where certain activities are prohibited (e.g. stockpiling materials on pervious surfaces)
- An action plan for dealing with accidental spillages of pollutants
- Advice on what to do if alterations are to be made to a development or if service companies need to undertake excavations or similar works that could affects SuDS
- Details of whom to contact in the event that pollution is seen in the system or if it is not working properly

Source: CIRIA 753 (Chapter 32)

Design SuDS for brownfield sites

6.8.24 Previously developed land (brownfield sites) should not be seen as a barrier to using SuDS. When developing on brownfield sites, existing drainage infrastructure should be documented and mapped to determine what can be reused as part of the SuDS scheme.

6.8.25 The use of shallow surface features can often be a benefit in brownfield sites as they limit excavations into contaminated soils. The impact of the proposed SuDS features on any contamination and vice versa needs to be carefully assessed by an experienced professional. The presence of contamination in the ground may limit the use of certain features (e.g. soakaways) or require liners below ponds, basins and permeable pavements. However, it will never prevent the use of all SuDS features and a suitable system can be designed. The separation of surface water drainage and foul drainage should be a priority in these areas.

Consider flood extents in SuDS design

6.8.26 The natural floodplain must be protected and considered in the design of SuDS. Where SuDS are proposed in a fluvial or tidal floodplain (Flood Zones 3a or 3b) the features may fill during a flood event and would therefore not have capacity to hold the rainfall runoff from the site as originally intended. Large areas of Tewkesbury Borough, where land is low lying, are in the floodplain, and a pragmatic approach to SuDS design needs to be taken where flood risk is carefully considered. However, the presence of a floodplain should not explicitly exclude the integration of SuDS features for day-to-day water management provided the SuDS do not contribute towards stormwater storage requirements. Above ground SuDS should not be included in areas where water regularly flows or is stored

Design open spaces to incorporate SuDS

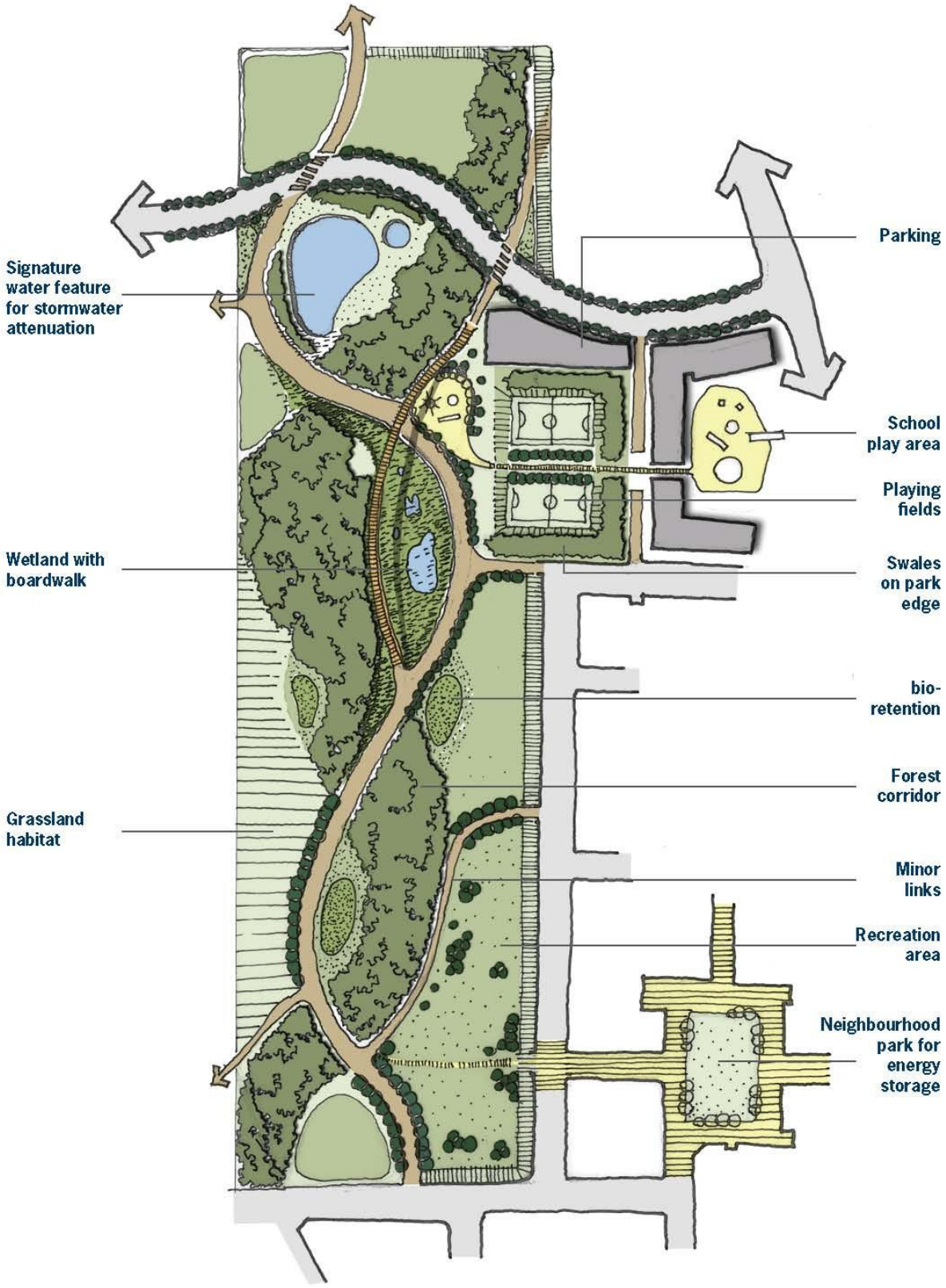
6.8.27 Open spaces are an asset to the community and to the environment and form an important component of a wider green infrastructure network. A network of woodland, recreational and open spaces, whether green or paved, will be essential for well-designed developments. Open spaces can provide space for SuDS features to provide attenuation and treatment of surface water runoff. Good design will seek ways to integrate SuDS with the rest of the open space and to make SuDS features multifunctional. In these areas, there is a need to concentrate on design and amenity value, recreational use, and fit with surrounding landscape (see Figure 6.9). Examples of multi-functional uses in open spaces include temporary storage areas doubling as playing fields or recreation areas, hardscape attenuation doubling as water features and public art, bio-retention areas doubling as

landscaped garden areas, wetlands and ponds doubling as amenity and habitat areas, and bio-retention planters linking with open space divisions or seating areas. Within open spaces, SuDS design will also need to consider:

- The interaction with the public – safety, education, and controlled access via boardwalks or similar structures;
- Areas of the ground that are likely to be seasonally wet should not be used for formal or informal recreation and play space such as sports pitches;
- An appropriate balance between visual amenity and water treatment needs to be achieved – while amenity value is of increased importance, it should not impinge on SuDS treatment and water management;
- Situating SuDS away from floodplains that might impact on SuDS treatment and floodplain storage and conveyance;
- Ecological needs – existing vegetation of biodiversity value should be retained whenever possible, and land stability taken into account.
- Opportunities to reuse recycled surface water for irrigation or other purposes.
- Consideration should be given to safety issues with regard to water ponding/ storage in or near play areas.

6.8.28 Where Tewkesbury Borough Council will adopt SuDS in public open spaces, they must still be able to function and be accessible as useable open space for the majority of the time for them to be included within the open space calculations.

Figure 6.9: Integration of SuDS features into open space design



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

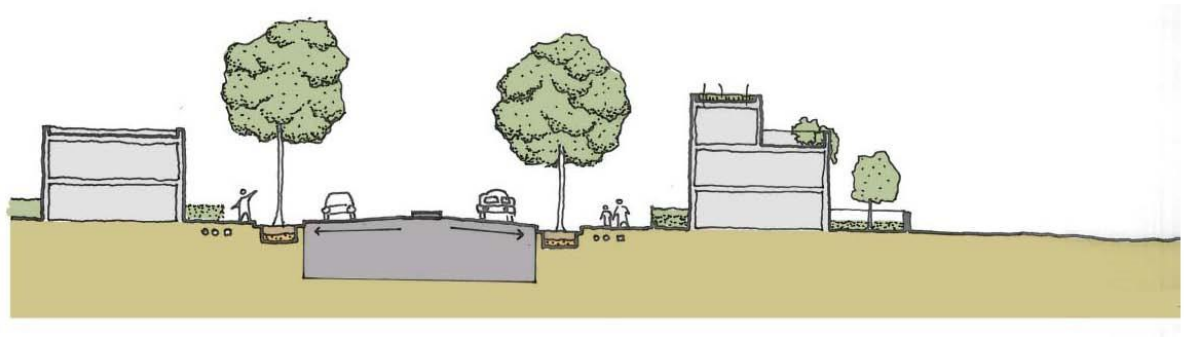
Design streets to incorporate SuDS

6.8.29 Within a catchment, streets and roads are a significant source of surface water runoff and pollutants. Streets are often used as a conveyance of surface water drainage from adjoining sites via underground pipes, and in a SuDS network they are likely to also be key conveyance routes for example through the use of roadside swales. Therefore there is a prime opportunity in streetscapes to integrate SuDS features that capture, treat and attenuate surface runoff. Improving upon traditional drainage, streetscapes can include bioretention technology (rain gardens) with appropriate conveyance such as swales or under-drained SuDS features to minimise the need for conventional piping. A number of standard streetscape features can include SuDS and become multifunctional, including verges, tree pits, traffic calming islands, and parking dividers. To implement SuDS effectively either along or within streets, there is a need to consider:

- Easy and safe access for all highway users, irrespective of mode of travel;
- Easy access to utilities for maintenance workers;
- Improvement to the urban design of streetscapes and contribution to sense of place; and
- Robust design to reduce maintenance and replacement requirements

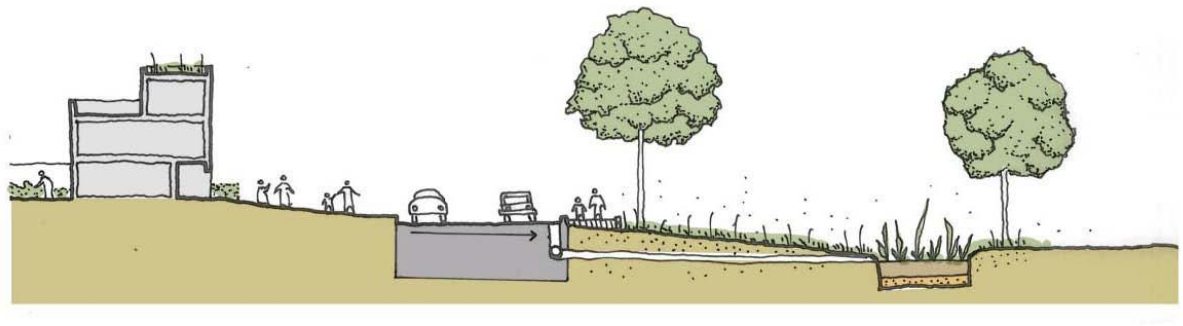
6.8.30 Figure 6.10 to Figure 6.12 demonstrate how SuDS can be incorporated into street design.

Figure 6.10: Street design to drain SuDS features to either side



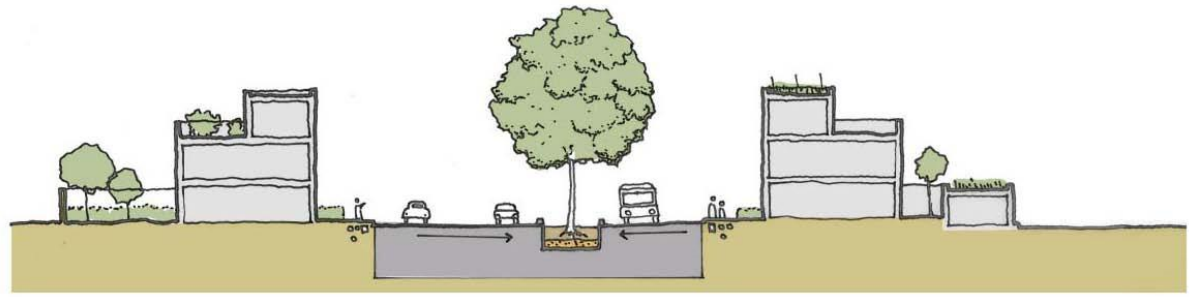
Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.11: Street design to drain to adjoining lower ground SuDS feature



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.12 : Street design to drain to central SuDS feature

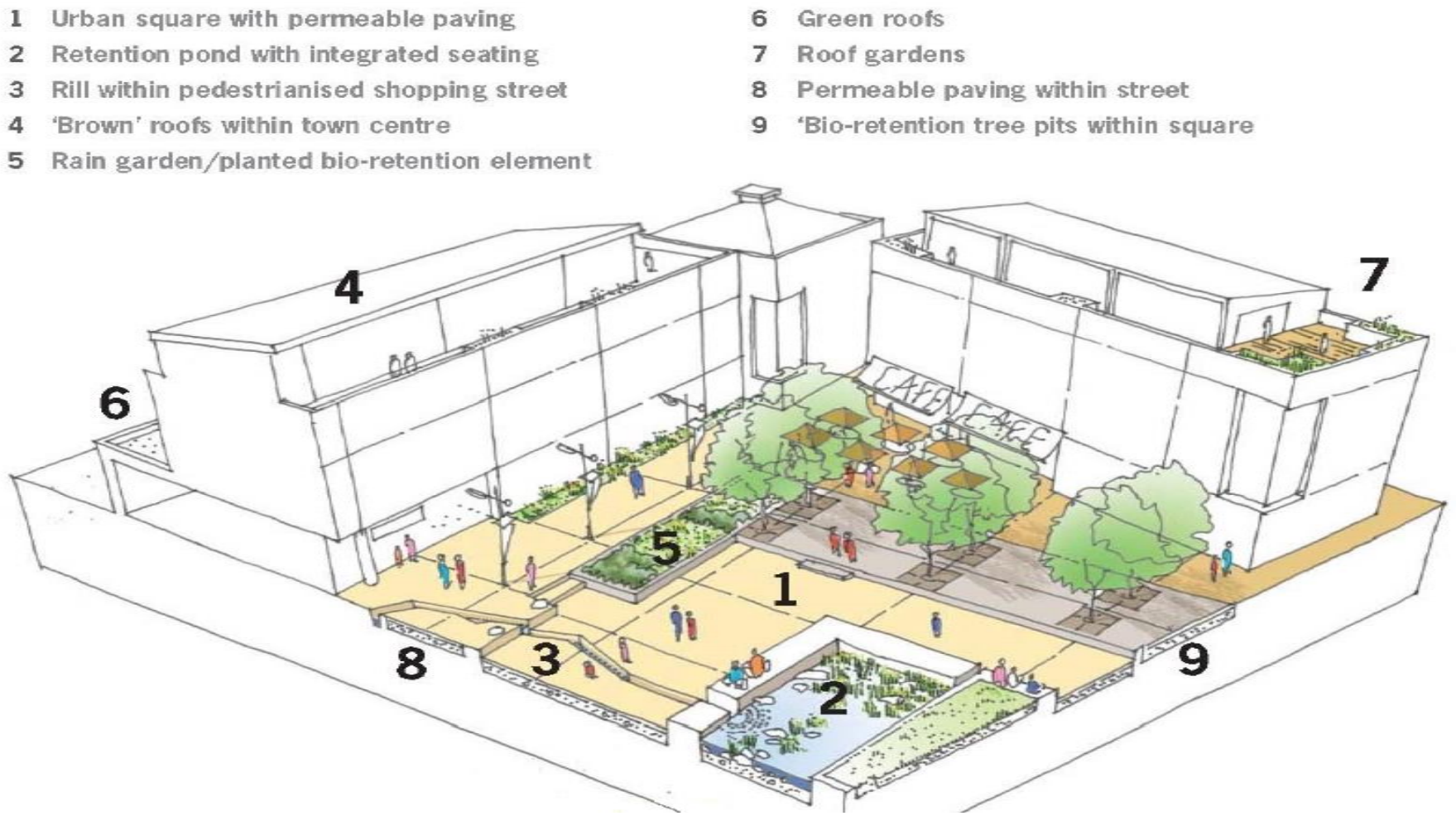


Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design SuDS to match the density of developments

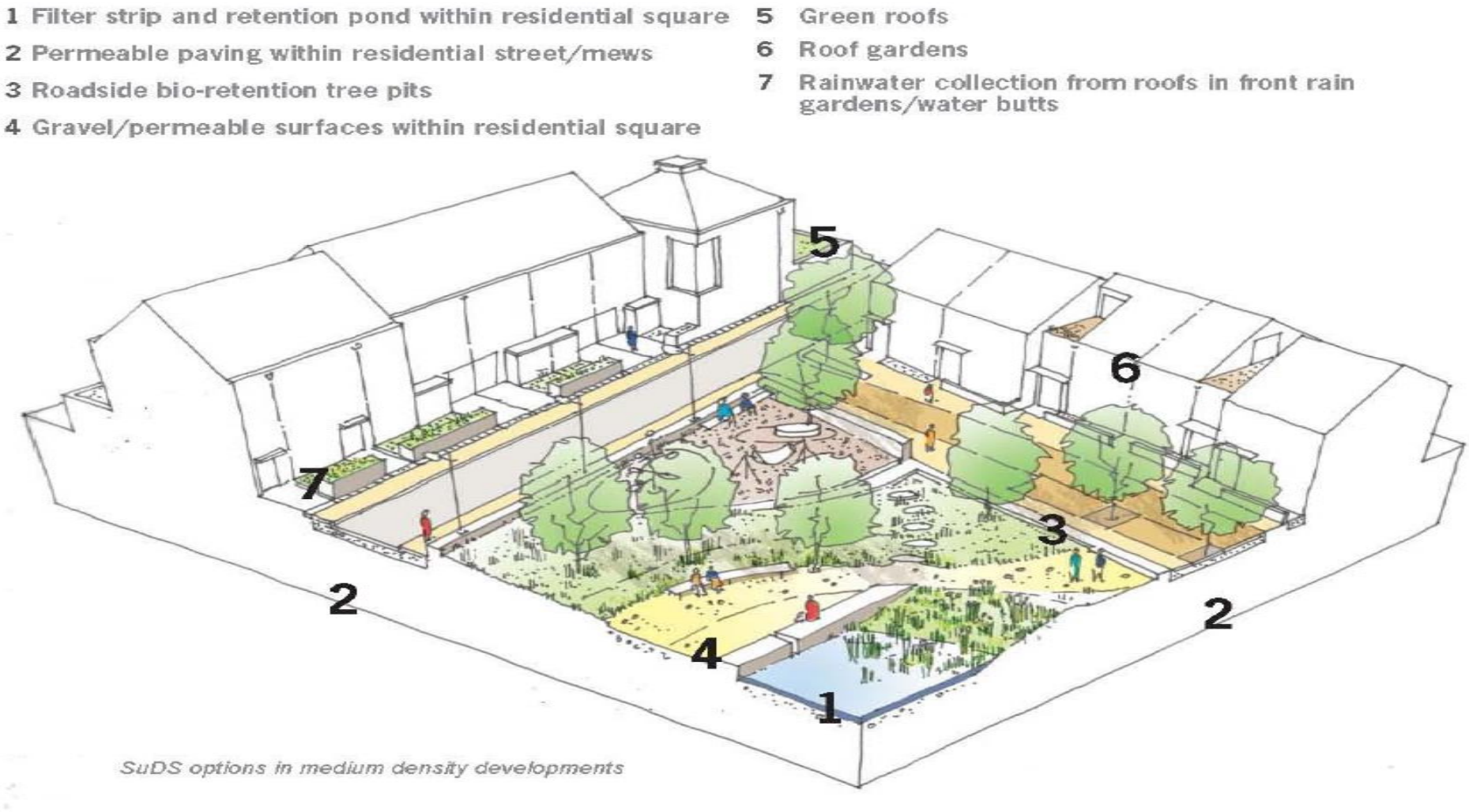
6.8.31 Limited space is often cited as a reason for not including SuDS, which is not acceptable as solutions do exist. Ideally, initial layout should consider how source control and localised SuDS features can be sized and located to provide adequate attenuation and treatment of runoff from high density areas. It is still possible to use SuDS in high density developments, but design needs to be suitable. Source control measures like green roofs and rainwater harvesting are strategies to reduce runoff. Additionally, building downpipes can be altered or disconnected to feed into gardens, soakaways or permeable paving. In high density courtyards and streets there is also potential to incorporate bio-retention features and planted rills. Figure 6.13 to Figure 6.15 demonstrate how SuDS can be incorporated into developments of varying densities.

Figure 6.13: SuDS options in high density developments.



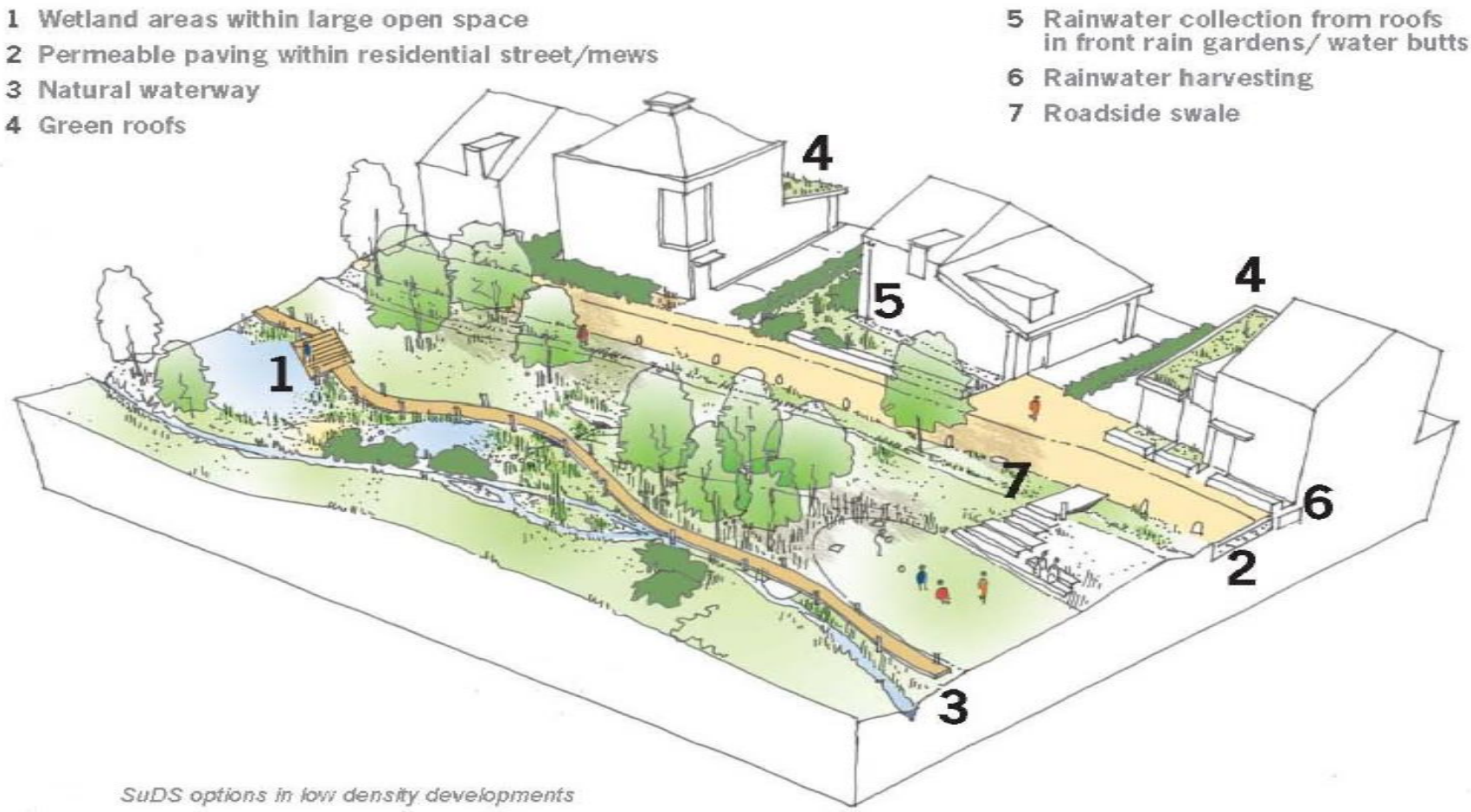
Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.14: SuDS options in medium density developments



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.15: SuDS options in low density developments

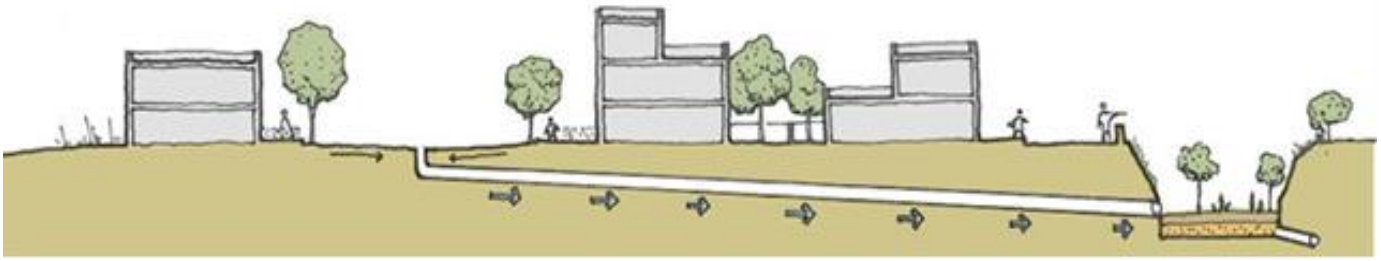


Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design SuDS for flat sites

6.8.32 Drainage is particularly important on flat sites that do not have the opportunity to take advantage of gravity. Hydraulically efficient kerbs should be designed to channel water directly onto above ground SuDS, before draining to underground storage, or a piped network. Alternatively, roadside swales located within the road verge with flush kerbs can enable surface water to discharge directly into the swale, where it is pre-treated before discharging to a SuDS feature downstream, such as a retention pond, rain garden, or wetland. By keeping water on the surface as much as possible, deep downstream management features can be avoided. Deep features are undesirable due to increased excavation, the potential need for unnecessary pumping and the requirement for mitigation measures. Figure 6.16 demonstrates the negative impact a piped system can have on flat sites.

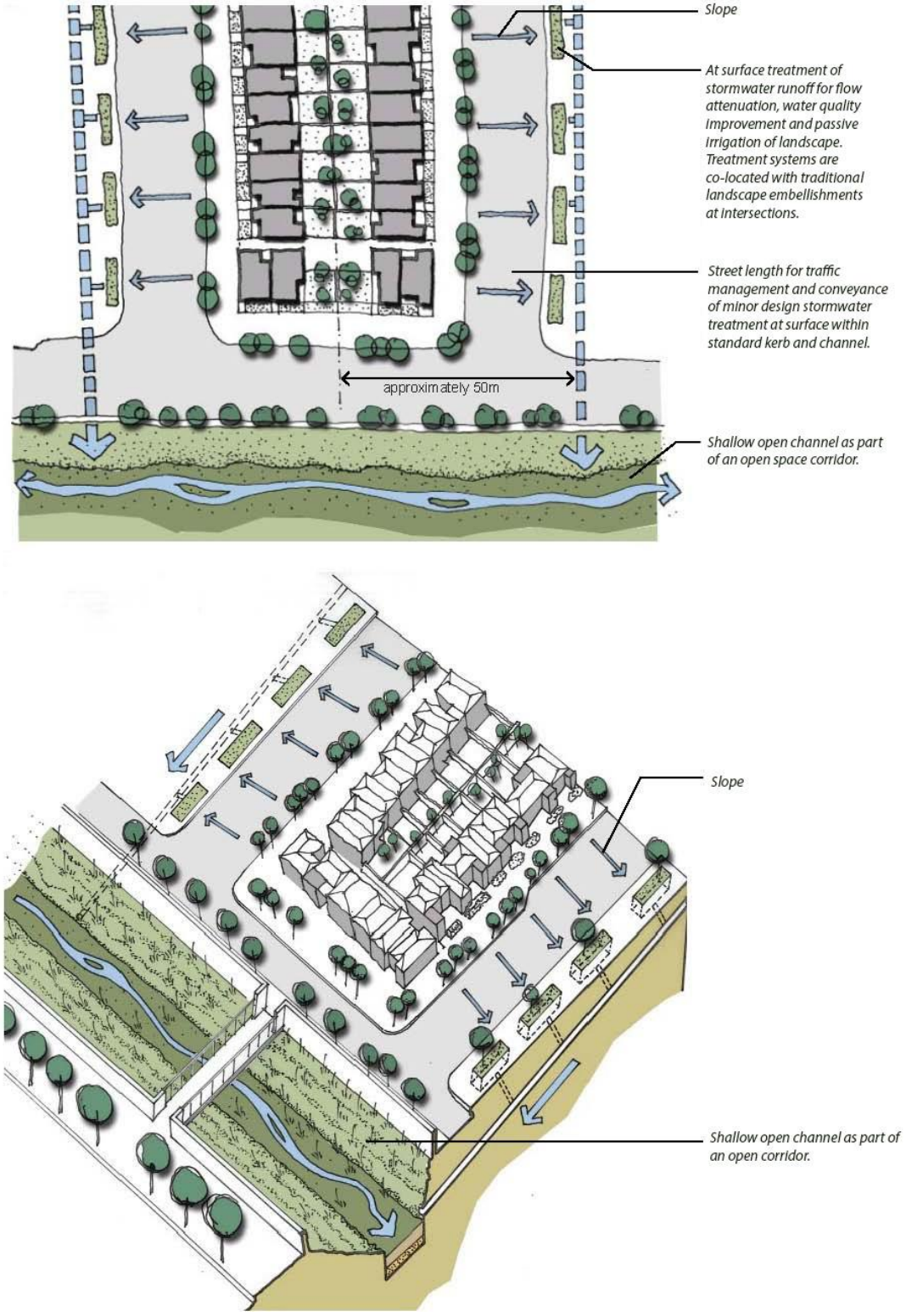
Figure 6.16: Negative impact of piped drainage on a flat site



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

6.8.33 Figure 6.17 shows how SuDS could possibly be incorporated into a flat, urban site.

Figure 6.17: Possible urban layout for a flat site



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design industrial and agricultural sites to incorporate SuDS

6.8.34 Industrial and agricultural sites often have larger volumes of water discharge with higher levels of pollutants, and as such they require special attention. The best strategy is to separate water discharging from work areas, car parks and roofs. Water runoff from high-risk work areas should be separated into interceptor tanks and treated as industrial waste. This separation is vital to ensuring the surface water from non-work areas of the site that do not have the same contaminants, can be treated similarly to surface water runoff from residential and commercial properties. Additional treatment stages are required where runoff is being drained from higher contamination risk area, such as car parks. Each site should be designed based on the risk posed. Figure 6.18 demonstrates how SuDS can be incorporated in an industrial setting.

Figure 6.18: Incorporating SuDS on industrial sites

Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design standards and designing for exceedance

6.9.1 In a new development there should be no flooding of any properties for a 1 in 100 annual probability (critical) rainfall event plus an appropriate allowance for climate change (refer to Chapter 3 for details of climate change allowances). In line with Sewers for Adoption, there should also be no water outside of the designed system for a 1 in 30 annual probability (critical) rainfall event.

6.9.2 Consideration should also be given as to how the system performs for events that exceed the design capacity of the system or if a part of the system blocks or fails. The design of the site must also ensure that flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property and avoids creating hazards to access and egress routes. Guidance on how to apply this can be found in Designing for Exceedance in Urban Drainage: Good Practice (C635).

Designing for water quality

6.10.1 SuDS have a considerable advantage over traditional drainage as a well-designed system will provide a level of treatment to surface water runoff before it is discharged into the receiving water body. It does this through a number of processes including filtration, settlement, and uptake by plants. For example; permeable paving is very effective at removing a wide range of pollutants from runoff, so improving water quality. The pollutants may either remain on the surface or be flushed into the underlying pavement layers, where many are filtered and trapped and degrade over time.

6.10.2 To protect the water quality of receiving waters, runoff from a site should be of an acceptable water quality to help ensure current and/or future water quality objectives are not compromised. As there can be a wide range and level of contaminants contained within surface water runoff, water quality needs to be managed using a risk-based approach, facilitated by the SuDS management train. The SuDS management train refers to a variety of SuDS components in a series that provide treatment processes to deliver a gradual improvement in water quality as water moves through the system.

6.10.3 The size and number of treatment stages required is based on the level of pollution entering into the system. For example, industrial sites will contain a higher level of pollutants within surface water runoff than from a small residential road. Please refer to Chapter 4 of the SuDS Manual (CIRIA, C753) for further detail on designing SuDS for water quality.

Designing a safe environment

6.11.1 All SuDS schemes should be designed as a safe environment that can be accessed and enjoyed by residents and visitors. The use of fencing and barriers should not be the approach to making SuDS features safe, particularly in residential developments. It is however recognised that there may be cases in less sensitive environments (such as industrial areas) where steeper earthworks and safety measures are appropriate. The SuDS features themselves should be designed to be safe through measures such as:

- Following the topography of the site - this will minimise the depth of the features throughout the development.
- Ensuring gently sloping sides and that they are planted with vegetation to act as a barrier to unintended entry into the water.
- Ensure open areas of water are obvious to residents and visitors and any vertical drops are easily identified. The use of safety rings are generally not appropriate for SuDS as they are designed to be dropped vertically and not thrown any distance as they are heavy and awkward to handle. Their use should be limited to areas where they will be effective.
- Use of appropriate signage in the right locations. These should not be used as a replacement for appropriate design.

6.11.2 Further information can be found in the CIRIA publication, The SuDS Manual (C753) and the RoSPA publication Safety at Inland Water Sites.

Developing a surface water drainage strategy

Masterplanning

6.12.1 For larger developments a masterplan will be necessary. It is at this stage the SuDS layout (taking into account flow routes, topography, geology and green space) and proposed maintenance of the system should be determined whilst ensuring a safe design and mitigation of flood risk (see Figure 6.1). Seeking advice at the earliest opportunity from the relevant FRMAs will help avoid any costly issues or redesigns at a later stage. Effective master planning should ensure a robust, viable and cost-effective scheme from the outset, where objectives of the development are informed by the SuDS scheme and vice versa.

Outline planning application

6.13.1 When an outline planning application is required the applicant should include an outline drainage strategy with the planning application. It should include enough design information that demonstrates the conceptual surface water drainage design across the site. The assessment submitted should outline the existing surface water run-off rates from the site and an indication of post development run-off rates with associated storm water storage requirements. SuDS should have been appropriately considered, taking into account site specific drainage requirements and constraints, and incorporated effectively into the overall masterplan. APPENDIX VIII includes a drainage pro-forma to be followed to ensure the correct information is included within the drainage strategy.

Full planning application or reserved matters application

6.13.2 Many developments move straight to a full planning application following pre-application discussions with the relevant FRMAs. At this stage applicants will also be expected to submit a detailed surface water drainage strategy with the planning application. Whilst most topics will have been covered to some degree in the outline drainage strategy (if applicable) the applicant will be expected to provide more detail at this stage. The strategy should demonstrate that opportunities to integrate SuDS have been maximised and where obstacles to their use do persist this should be fully justified within the report. Where proposing to discharge into a third party asset (such as a watercourse or public sewer), appropriate permissions and required consents should have been discussed with the asset owner and legal easements may need to be provided.

6.13.3 The key information a surface water drainage strategy must contain includes:

- How the proposed surface water scheme has been determined following the drainage hierarchy;
- Pre-development runoff rates;
- Post development runoff rates with associated storm water storage calculations
- Discharge location(s);
- Drainage calculations to support the design of the system;
- Drawings of the proposed surface water drainage scheme including sub catchment breakdown where applicable;
- Surface water and sustainable drainage systems
- Maintenance and management plan of surface water drainage system (for the lifetime of the development) including details of future adoption;

- Completed drainage pro-forma – the applicant must ensure that the surface water strategy contains the appropriate level of information in relation to the points covered in the pro-forma.

6.13.4 Note that the size and complexity of the site will determine how much information is included within the surface water drainage strategy. However using the pre-application design checklist and drainage pro-forma in APPENDIX VIII will ensure the right matters are covered with the appropriate level of detail.

Approval of SuDS

6.14.1 SuDS are approved as part of the planning application for a development. It is the LPAs responsibility to ensure that the design submitted as part of either an outline or full planning application is robust and contains adequate detail to ensure that the SuDS are appropriate for the development and will be adequately maintained throughout their lifetime. The LPA may also seek expert advice from the LLFA as part of this process. For major developments national guidance for SuDS can be found in the PPG, additionally the Non-Statutory Technical Standards for Sustainable Drainage Systems provides the high level principles all SuDS designs must follow.

Adoption and maintenance of SuDS

6.15.1 It is recommended that a statutory organisation takes on the role of maintaining the SuDS as this will guarantee maintenance of the drainage system in perpetuity. However where this is not possible, alternative bodies such as private management companies may also be considered able to maintain SuDS, provided that a suitable maintenance plan has been submitted to and agreed with the LPA. Statutory organisations may include organisations such as the local authority, Severn Trent Water, the Lower Severn IDB and Parish Councils. For SuDS serving the highway these should be discussed with the Highways Authority at Gloucestershire County Council (GCC) to ensure suitability for adoption.

6.15.2 Open space provision within development sites is a normal planning requirement and offers suitable landscaped areas for the inclusion of a wide range of SuDS features (e.g. ponds, basins and swales). These features can enhance the nature conservation and amenity value of the site, although a primary consideration should be the effectiveness and maintenance of the SuDS.

6.15.3 Where the Council is adopting the open space provision, this could include adoption of the SuDS features within the open space (seek clarification from local authority). In adopting these features, a range of issues will need to be addressed:

- The primary purpose of the SuDS features relate to drainage. If the open space is to be used for other purposes, such as nature conservation or as a play area, this must not conflict with the effective working and maintenance of the SuDS.
- Safety issues will come into play if a body of water is involved.
- There is a need to ensure that a long-term, effective maintenance regime is in place along with a long term habitat management plan where appropriate. Details of these ongoing commitments will normally be agreed as part of the planning application process.

6.15.4 If the applicant is minded to choose Severn Trent Water as the appropriate body for SuDS adoption they should ensure the proposed design meets their adoption criteria, referencing relevant guidance and advice where appropriate and that Severn Trent Water have confirmed that they will adopt the SuDS for the whole site.

6.15.5 Section 106 of the Town and Country Planning Act 1990 provides a suitable mechanism by which properly designed SuDS features can be transferred into the management and maintenance responsibilities of a local authority or other statutory organisation. The local authority should secure a financial mechanism through commuted sums, identified in the adoption agreement, to facilitate maintenance and management requirements. This would allow adoption of the areas within an acceptable timeframe without placing additional burdens on the local authority's resources. Clarification will also need to be sought from the Council on whether SuDS are delivered through the Community Infrastructure Levy or Section 106.

6.15.6 In certain circumstances where a management company is required to maintain the SuDS, a legal agreement tied to the title of the property will need to be agreed with the LPA (usually via a Section 106 agreement). If this is the case then discussions will need to take place during the pre-application stage of the development so that assurances can be made that this is the correct option for the development.

6.15.7 Evidence should be provided by the applicant on the suitability and experience of the management company during this process and how the Council can be assured that the maintenance will be carried and who is responsible for any failure to maintain, repair or replace. Such evidence will be expected as part of a SuDS Maintenance Plan either

forming part of a planning application submission or submitted to discharge associated conditions.

6.15.8 The Developer will need to demonstrate that sufficient funding will be provided to maintain and replace the SuDS systems in perpetuity which, for this case, is taken as the design life of any structures which must be 120 years.

CHAPTER 7 – WATER MANAGEMENT, RECYCLING, SUPPLY AND POLUTION CONTROL

7.1 WATER SUPPLY AND INFRASTRUCTURE

Water Supply

7.1.1 Groundwater resources are a vital component of potable water supplies; once polluted, the damage can be irrevocable. They can also have an impact on sites of wildlife significance. Development proposals that significantly threaten this resource will not be permitted. Development proposals will, where appropriate, need to demonstrate that they can be implemented without detriment to the quality or quantity of existing water and the wider environment. Tewkesbury Borough Council will have regard to current Environment Agency guidance on the protection of groundwater.

Foul Drainage

7.1.2 When preparing sewerage proposals for any development, the first presumption will be to provide a system of foul drainage discharging into a public sewer. This should be achieved in consultation with the statutory sewerage undertaker for the area. Only if, taking into account the cost and/or practicability, it can be shown to the satisfaction of the local planning authority that connection to a public sewer is not feasible, a package sewage treatment plant incorporating a combination of treatment processes will be considered. The plant should offer full treatment (including secondary and if necessary tertiary treatment) with the final effluent discharge from it meeting the standard and conditions set by the Environment Agency where applicable. Proposals for package treatment plants should also set out clearly the responsibility and means of operation and maintenance to ensure that the discharge consent is not likely to be infringed in the life of the plant. Such provision may be adopted by the statutory sewerage undertaker under section 104 of the Water Industry Act 1991, subject to certain criteria being met. Severn Trent Water are likely to be issuing guidance on adoption of treatment plants in the near future.

7.1.3 Only if it can be clearly demonstrated that the sewerage and sewage disposal methods referred to above are not feasible, will a system incorporating septic tank(s) be considered. Applications for planning permission should be supported by an assessment of the proposed use of septic tanks, to confirm that there will be no adverse effects. This assessment should focus on the likely effects on the environment, amenity and public health. It should include a thorough examination of the impact of disposal of the final

effluent, whether discharged to a watercourse or disposed of by soakage into the ground. An Environmental Permit maybe required from the Environment Agency for certain types of non-mains drainage. Further guidance on this is available from the Environment Agency advice document **'Guidance for the registration of small sewage effluent discharges'**.

Development adjacent to watercourses

7.1.4 Any riverside developments should leave a minimum **8 metre** wide undeveloped buffer strip, to preserve the river and its floodplain as an enhancement feature and to allow for routine maintenance. Such developments should also have a maintenance strategy for clearing and maintaining the channel, and any structures such as trash screens and bridges. Development proposals should also consider opportunities to undertake river restoration and enhancement to make space for water.

Maintenance of existing structures and flood storage areas

7.1.5 Existing flood water storage areas should be maintained and safeguarded from development. New development should also be designed not to prohibit the maintenance and functioning of structures required for flood risk management purposes.

7.2 WATER RECYCLING

7.2.1 Water recycling is a key component of integrated water cycle management. The safe implementation of water recycling can help to reduce inputs of nutrients and other contaminants to surface waters, conserve drinking water and provide economic and social benefits to communities. It can also reduce demand for water provided by water companies during periods of drought. SuDS need to take into account the possibilities of re-using and recycling surface water in as many ways as feasible.

7.2.2 The aim in Tewkesbury Borough is to encourage and support water recycling that is safe, environmentally sustainable and cost-effective by encouraging the use of rainwater harvesting and grey water recycling methods in new development, where practical and feasible. These methods are only effective outside floodplains. Applicants should give consideration to the following measures.

7.2.3 **Rainwater Harvesting** is described as being water collected from roofs via traditional guttering, through down pipes to an underground tank. This water is then delivered on demand by an in-tank submersible pump direct to toilets, washing machines and outside tap use. More than 50% of mains water can be substituted by rainwater in this way.

Rainwater harvesting can be incorporated on development sites for uses such as car washing, watering gardens and topping up ponds or wetland habitats.

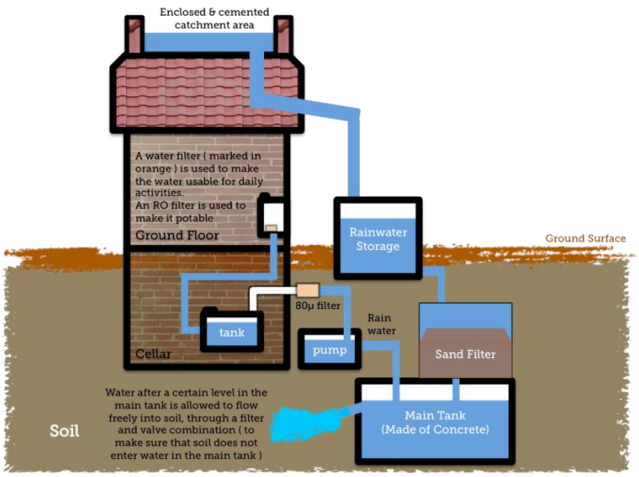


Fig 2: Rainwater Harvesting System

7.2.4 **Greywater Recycling** is typically defined as being water from the bath, shower and wash hand basin. The ideal situation for grey water is in living accommodation where sufficient amounts are generated daily for reuse in toilets, the washing machine and any outside tap. Greywater recycling systems can be incorporated on development sites for non-potable uses such as for flushing toilets.

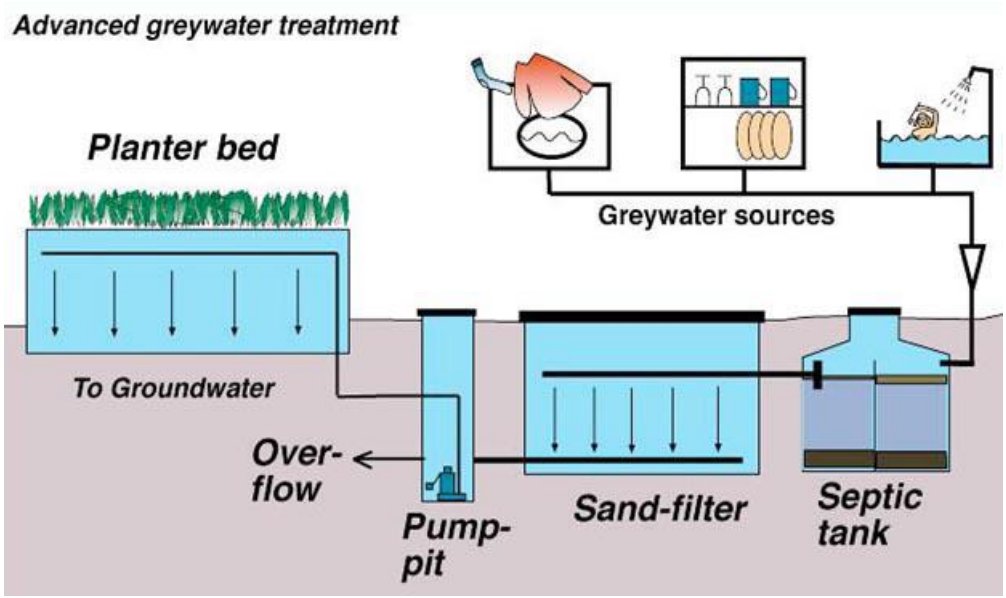


Fig 3: Advanced Greywater Treatment System

Methods and Maintenance of Rainwater Harvesting and Greywater Recycling Systems

7.2.5 Consideration should be given to the use of more efficient domestic and non-domestic appliances, such as low flush or compost toilets, waterless urinals, reduced flow rates for showers, low-flow or spray taps and water meters with pulsed output (levels of water use should be consistent with 'very good' standards for BREEAM and Eco-Homes on new build wherever possible).

7.2.6 In addition, water recycling measures should be considered when designing any landscaping scheme for residential or non-residential development. Such measures could include working with existing natural vegetation, selecting drought-resistant plants or low water use landscaping / gardens and using automatic drip irrigation systems.

7.2.7 Applicants should also consider the installation of water meters to link water habits to a charging structure, thus encouraging occupants to consider their individual wastage. Further information and illustrations on water conservation methods and techniques can be found at **APPENDIX IV**.

7.2.8 The facilities for both rainwater harvesting and grey water re-use require maintenance to ensure their effectiveness and to prevent deterioration of water quality. Future maintenance arrangements should be addressed in the earliest project planning stages.

7.3 WATER QUALITY AND POLLUTION CONTROL

7.3.1 Paragraph 109 of the National Planning Policy Framework states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of water pollution. The Council will seek to ensure that new developments achieve this objective.

Causes of water pollution

7.3.2 Some traditional methods of building can cause poor water quality as surface water run-off can contain a variety of pollutants. The poor water quality associated with new developments may also have direct negative impacts on biodiversity.

7.3.3 Large areas of hard landscaping can result in surplus run-off, exacerbating flooding, causing pollution and erosion problems and reducing natural infiltration. This can directly lead to water quality problems, by accumulating pollutants as water runs over land.

Runoff from roads will also contain heavy metals and hydrocarbons and run-off from farmland is more likely to contain nitrates and sediment. These can have serious implications for water quality and amenity.

Possible solutions for minimising pollution

7.3.4 Although some pollution arising from surface water runoff may be unavoidable and water treatment at every outfall may be impractical, moderating flows and filtering runoff through SuDS can deliver significant reductions in the impact on the water resource by means of ground infiltration, sub base storage and filtration.

7.3.5 Applicants may be required to use mitigation measures to minimise resultant pollution within new development. Supporting documentation accompany planning applications for major developments should explain how contaminated water arising during the construction process will be addressed.

Pollution reduction methods

7.3.6 Methods that can help to reduce pollution include infiltration trenches, basins, ponds, wetlands, filter drains and permeable surfacing.

7.3.7 Infiltration trenches comprise stone filled reservoirs to which storm water runoff is diverted, and from which the water gradually infiltrates the ground. Infiltration is unlikely to be successful in the clay soils of Gloucestershire, and a soil analysis will therefore be required for any major development proposal to demonstrate whether this approach would be effective.

7.3.8 Ponds and wetlands remove pollution by a range of chemical, physical and biological processes. Pollutant removal is by absorption, filtering and microbial decomposition in the surrounding soil. Systems can be designed which successfully incorporate both infiltration and filter systems.

7.3.9 Permeable paving can maximize opportunities for using space in a multi-functional way requiring no additional land take. They are not solely infiltration systems, do not have onerous maintenance requirements and can accommodate heavier traffic (including construction traffic). In addition, there is also evidence to show whole life costs can be significantly lower than a conventional ‘pipe’ system, as the future maintenance requirement is low and they negate the need for grates, gullies, expensive flow control structures, extensive lengths of pipework, oil separators etc.

CHAPTER 8 – WATER MANAGEMENT STATEMENTS

8.1 National planning policy only requires planning applications of a certain scale and nature to be accompanied by Flood Risk Assessments. However, given the severity of river and surface water flooding in Tewkesbury Borough and the potential impact of cumulative development, it is considered necessary to require all applications except those proposing minor development[1] to be accompanied by detailed information in relation to the flooding. This information shall be submitted in the form of a Water Management Statement (WMS), which will be a validation requirement for such schemes.

8.2 The WMS is as a crucial element in managing flood risk and it is advised that appropriate details should be submitted to and agreed with the Council's Development Management team prior to the submission of a planning application. The WMS should involve several stages:

1. Prior to land acquisition, the developer should undertake an assessment of the site in terms of the requirements set out in this SPD in order to assist appraisal of site development constraints and land acquisition costs.

2. The level of detail required within the WMS will depend on the scale and type of development and individual site conditions. The level of information should be agreed with the Council's Development Management team at an early stage.

3. Evaluation of the submitted WMS will be undertaken by the Council in conjunction with the other regulatory bodies, including the Environment Agency and the LLFA.

[1] The term 'minor development' is the same as that defined within the Planning Practice Guidance and means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metres.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.
- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

Water Management Statement Requirements

All outline and detailed planning applications (including reserved matters) which fall outside of FRA requirements, except those proposing minor development, shall, as a minimum, be accompanied by a Water Management Statement.

The Water Management Statement (WMS) shall comprise a report, being proportionate to the scale and nature of development proposed, outlining the water cycle issues relevant to a development proposal and suitable means of providing for the sustainable drainage of the site in the long term. The WMS shall also explain how both foul and storm water sewage from a development will be addressed. The WMS should include details of existing drainage systems and problems, infiltration, groundwater, surface water flow, foul and storm water disposal and any other drainage related flooding issues that may relate to the development.

A feasibility study evaluating the means of incorporating SuDS as part of the proposed development should also be included, as will a study of local soils and geology supported by site investigation results. This information will assist in developing a proposal for SuDS to be incorporated within the proposed layout of the development. The developer must be able to demonstrate that the technique is suitable for the development and provide supporting evidence to back up their calculations. The WMS should also assess the feasibility of incorporating rainwater harvesting and grey water recycling, and the appropriate measures for collecting and reusing water should be incorporated into a development.

CHAPTER 9 – MANAGING AND MITIGATING FLOOD RISK

9.1 Residual risks are those remaining after applying the sequential approach and mitigating measures. Applicants will be required to assess flood risk for their development, propose measures to mitigate it and show that any residual risks can be safely managed. However, resilience measures should not be used to justify development in inappropriate locations.

9.2 The following measures can help mitigate flood risk and will be expected to be taken into account in new development where appropriate (also see APPENDIX V):-

Flood Mitigation Measures

Floor levels in new residential and non-residential development

Floor levels for habitable rooms in new development must be set at 600 mm or more above the flood level predicted for the 1:100 year flood event (plus climate change) in order to reduce the potential risk to life and damage to property. All levels should be presented as an accurate height Above Ordnance Datum, Newlyn (mAOD)

Protection of flood flow routes and culvert policy

Development should ensure it does not inhibit the function of flood flow routes to convey floodwater as efficiently as possible across floodplains. Culverting of watercourses will be strongly resisted and existing culverts opened up where possible.

Use of flood resilient construction in new development

Where appropriate, new development should be built with flood resilient materials and construction methods, demonstrating that as a minimum, the mandatory elements of the Code for Sustainable Homes are met. Flood resilient construction allows buildings to recover quicker than conventional buildings following a flooding event.

Flood-resistant construction can prevent entry of water or minimise the amount that may enter a building. This form of construction should be used with caution and accompanied by other resilience measures as effective flood exclusion may be reliant on elements, such as barriers to doorways, being maintained in a good state. Buildings may also be damaged by water pressure or debris being transported by flood water. This may breach flood-excluding elements of the building and permit rapid inundation.

Provision of safe access and egress routes in new development

For residential developments to be classed as 'safe', as a minimum dry pedestrian access should be provided to and from the development without crossing through the 1 in 100 year plus climate change floodplain. Vehicular access to a site should also be achievable, taking into account extreme events. The production of flood plans are also recommended to aid evacuation and rescue during flood events, which should satisfy the concerns of the local authority emergency planner and the emergency services. Access should also be considered for other types of development.

Site layout

9.3 The site layout of any proposed development should take into consideration areas of flood risk present on the site and this should influence the choice of where to locate elements of the proposed development including Sustainable Drainage Systems (SuDS) (see Chapter 7). This is in line with the Sequential Approach to flood risk as outlined in Chapter 5. If, following the application of the sequential test, areas of flood risk cannot be avoided then the least vulnerable elements of the proposed development should be located to coincide with the highest level of flood risk.

9.4 The inclusion of good quality green infrastructure (including trees and other vegetation) within a development master plan has the potential to significantly increase the profile and profitability of developments. Low lying ground can be designed to maximise benefits by providing flood conveyance and storage as well as recreation, amenity and environmental purposes. Where public areas are subject to flooding easy access to higher ground should be provided. Structures, such as street furniture and play equipment, provided within the low lying areas should be flood resistant in design and firmly attached to the ground.

9.5 Site layout does not only have to cater for the flood risk on the site but can also accommodate flood water that may contribute to a problem downstream. For example, where a proposal has a watercourse flowing through which contributes to flooding downstream in the existing community or further downstream within an adjacent community, the proposed development should offer flood risk betterment by holding back flood flow peaks within the site in a green corridor and by making space for this water. This is a proactive approach to flood risk management where new developments offer enhancements to the surrounding area. All developments with watercourses identified within their site must consider this approach.

9.6 The site layout should also respond to the characteristics of the location and the nature of the risk. In some areas it is more appropriate to make space for water and allow controlled flood water onto areas of the development site. This is particularly relevant to riverside developments where extreme events can be catered for in multi-function open space areas (likely to form part of the green infrastructure provision) that would normally be used for recreation but infrequently can flood. The use of such features in these areas

should be appropriate and compatible with the frequency, depth and duration of any flooding. However, signage clearly explaining the use of such areas for flood control and recreation should be fully visible so that infrequent flood inundation does not cause alarm.

CHAPTER 10 – BIODIVERSITY

10.1 The 2006 Natural Environment and Rural Communities Act (NERC) places a duty on all public authorities in England and Wales to have regard, in the exercise of their functions, to the purpose of conserving biodiversity. A key purpose of this duty is to embed consideration of biodiversity as an integral part of policy and decision making.

10.2 Paragraph 109 of the NPPF also states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.

10.3 Those proposing development should therefore seek opportunities to use multi-purpose open space for amenity; incorporate wildlife habitat and flood storage uses and need to consider how flooding and biodiversity can be jointly managed. Opportunities should always be explored to recreate more natural conditions along watercourses. For example, de-culverting, restoring or re-profiling rivers to promote ecological improvements and integration with wider green/blue infrastructure networks.

10.4 Further guidance on biodiversity and green Infrastructure can be found in the natural conservation policies within the **Tewkesbury Borough Local Plan to 2011** and policies SD10 and INF4 of the **emerging Joint Core Strategy.**

10.5 In accordance with the NPPF and the 2006 Act, developers will be required to demonstrate that where practicable, SuDS schemes will benefit water habitats and biodiversity. The council therefore expects features such as ponds and wetlands to be planted to enhance biodiversity.

10.6 The planting of native species appropriate to the local conditions will be favoured and where appropriate the mix of planted species should aim to create habitats that contribute to the local Biodiversity Action Plan.

10.7 Some common landscape and ecological design requirements may have to be adapted slightly to ensure that the SuDS can function effectively. It will also be important that the types of planting proposed are considered in line with the design of the SuDS features. For example, the soil moisture profile may be very different at the top of a swale's bank to the bottom and this will need to be taken into consideration to ensure the success of both the plants and the operation of the drainage feature.

10.8 Opportunities should also be explored to recreate more natural conditions along watercourses. Examples of this include: de-culverting; restoring or re-profiling rivers to promote ecological improvements; removal of barriers to fish migration; integration with wider green/blue infrastructure networks; setting back development from watercourses to enable access and enhancement; and protection of sensitive locations.


Tewkesbury
Borough Council