

South Staffordshire District Council

Strategic Flood Risk Assessment for

Local Development Framework

Level 1

Volume 1

October 2007

Halcrow Group Limited



South Staffordshire District Council

Strategic Flood Risk Assessment for Local Development Framework Level 1 Volume 1

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	A	Draft Report	Aug 07	RD
1	B	Draft Report	Sept 07	RD
2		Final Report	Oct 07	RD

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Executive Summary

In June 2007 the South Staffordshire District Council commissioned Halcrow to produce a Level 1 Strategic Flood Risk Assessment (SFRA) in accordance with Planning Policy Statement 25 (PPS 25). The objective of this assessment is to inform the plan-making process of the South Staffordshire Local Development Framework (LDF). It should be used as a tool by the Local Planning Authority (LPA) to assess flood risk for spatial planning, producing development briefs, setting constraints, informing sustainability appraisals, identifying locations of emergency planning measures and requirements for flood risk assessments.

South Staffordshire District is some 407km² in size and lies to the north and west of Wolverhampton, also bordering Shropshire to the west and Worcestershire to the south. The District is covered by two river catchments: The River Penk, which drains north through the village of Penkridge to the River Sow (part of the River Trent catchment) and Smestow Brook, which drains south into the River Severn catchment. Many additional tributaries flow into the main rivers contributing to the flood risk within the District.

In accordance with the recently published document: Development and Flood Risk, a Practice Guide Companion to PPS 25 (February 2007), a Level 1 SFRA has been carried out and is contained herein. The study takes full account of the effect of climate change predictions as set out in PPS 25. The assessment also complies with the content of the accepted proposal dated May 2007.

This report provides general guidance and an overview of assumptions, uncertainties, approach, tasks undertaken and understanding of flood risk within the District. It provides the information required for the application of the Sequential Test of PPS 25. The LPA should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

Policy ideas are provided together with comprehensive guidance for the preparation of flood risk assessments. Flood risk assessments will be required in most cases and the level of detail will depend on the proposed development footprint, its spatial distribution and the type and magnitude of existing and future flood risk.

The Environment Agency agrees fully with the content of this SFRA and a letter of acceptance of the assessment can be found in Appendix C.

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1 Introduction

1.1 Terms of Reference

In June 2007 the South Staffordshire District Council commissioned Halcrow to produce a Level 1 Strategic Flood Risk Assessment (SFRA) in accordance with Planning Policy Statement 25 (PPS 25). This report presents the findings of the SFRA.

1.2 Project Objectives

The objective of the SFRA is to inform the plan-making process of the South Staffordshire District Council LDF. This SFRA has been undertaken to provide a detailed and robust assessment of the nature and extent of all types of flooding in the District and the implications that this may have for land use planning.

The SFRA will allow the LPA to:

- Prepare appropriate policies for the management of flood risk within the Local Development Documents (LDDs)
- Meet the needs of the LDF
- Identify the level of detail required for site specific Flood Risk Assessments (FRAs) in key locations
- Determine the acceptability of flood risk in relation to emergency planning capability
- Allocate appropriate sites for development
- Identify opportunities for reducing flood risk
- Ensure South Staffordshire District Council meets its obligations under the latest planning guidance PPS 25

The best available data (within the study timescale) has been collected for use in this study. The SFRA is a living document and it will require updating as additional data becomes available.

1.3 Methodology

Halcrow has carried out this project in accordance with the methodology outlined in the South Staffordshire District Council Strategic Flood Risk Assessment Project Proposal, dated May 2007. The assessment also follows the guidance contained in "Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft'" for a Level 1 SFRA. The SFRA has also followed advice from the Environment Agency, and a letter detailing the Environment Agency's acceptance of this assessment can be found in Appendix C.

1.4 Project Deliverables

The deliverables of this assessment are as follows:

- A technical report including analysis of missing/incomplete data required for a Level 2 SFRA
- A non-technical summary

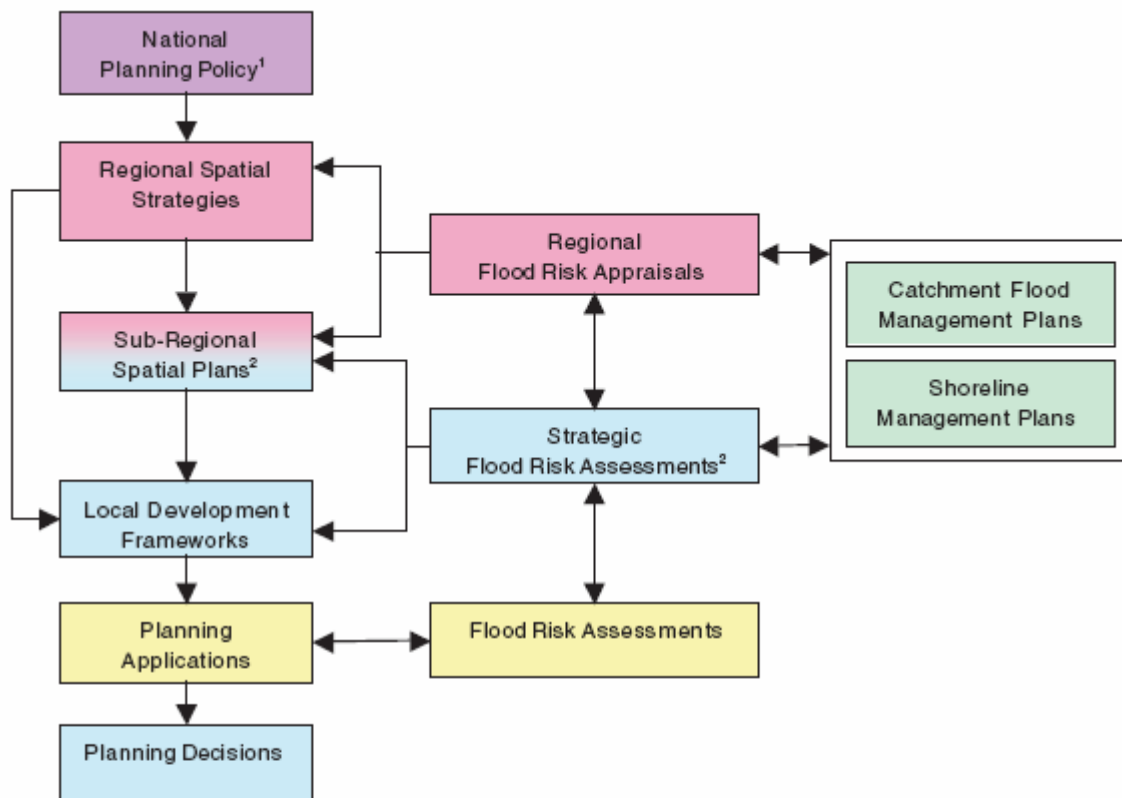
- Strategic Flood Risk Maps, showing:
 - Flooding from all sources
 - Climate Change Scenarios

- GIS maps of collated data, including:
 - Main Rivers
 - Ordinary Watercourses
 - Existing Flood Zone Maps
 - Hydrometric data coverage
 - NFCDD data
 - Flood Warning Areas
 - Geological maps
 - Artificial drainage information

1.5 SFRA Context

An SFRA is a strategic document which refines information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. An SFRA provides the basis for applying the Sequential Test, a process which seeks to locate new development in appropriate flood zones, based on the development's vulnerability classification. An SFRA is also a living document and should be updated as new data becomes available, such as quarterly updates from the Environment Agency, who continuously refine and improve their Flood Zone Maps.

The figure overleaf, taken from the PPS 25 Practice Guide, illustrates the responsibilities for the production of key documents required to effectively manage flood risk through each stage of the spatial planning process, and, importantly, shows the link between other strategic documents.



Legend: Responsibilities are indicated using colour-coding, as follows

National Government	Regional Government	Local Authority	Environment Agency/ Maritime Local Authorities	Developer
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Notes

- 1 Including Planning Policy Statement 25 'Development and Flood Risk' and the other flooding-related national planning policy listed in Appendix B of this Practice Guide.
- 2 SFRAs may cover more than one local planning authority region, and the adoption of a catchment-based approach by a number of LPAs working in partnership could be highly beneficial.
- 3 This diagram has been developed from the original within the Defra/EA 2005 report FD2320.

1.6 South Staffordshire District Council

South Staffordshire is a non-metropolitan District, covering an area of some 407km². The District lies to the north and west of Wolverhampton, also bordering Shropshire to the west and Worcestershire to the south. It does not contain any towns and can be described as a community of communities, often dormitory villages for Wolverhampton, Birmingham and Telford. The total estimated population in 2005 was 105,300.

Over 80% of South Staffordshire falls in the Midlands Green Belt, and forests and woodlands contribute to much of the attractiveness of the countryside. Agriculture is also an important industry and there are extensive areas of high quality land. The proximity to the nearby West Midlands conurbation and excellent road and rail links means the area provides an attractive settlement for commuters.

The area is covered by two river catchments: The River Penk, which drains north to the River Sow (part of the River Trent catchment) and Smestow Brook, which drains south into the River Severn catchment.

The District contains a number of designated main rivers:

- **River Penk:** This watercourse rises at Perton and flows northwards through the District, receiving flows from Whiston Brook, Watershead Brook, Moat Brook, Saredon Brook, Otherton Brook and Bell Brook as it does so. At the northern end of the District the River Penk forms a short section of the District's boundary with Stafford, before flowing out of the study area between Wildwood and Rickerscote.
- **Whiston Brook:** This watercourse rises in the north-west of the District, briefly flowing through Stafford before re-entering the study area as it passes beneath the Shropshire Union Canal. Mottymeadows Brook enters on the right bank, and here the watercourse is called Wheaton Aston Brook. The watercourse flows east, becoming Longnor Brook and then Whiston Brook. The Brook eventually drains into the River Penk just west of Penkridge.
- **Watershed Brook:** This watercourse rises in the north-western side of the West Midlands conurbation, just outside the District, and flows north to join the River Penk, south-west of Coven.
- **Moat Brook:** Moat Brook rises south-west of Codsall and flows north-eastwards around the settlement before taking a more easterly orientation, eventually joining the River Penk.
- **Saredon Brook:** This watercourse rises just outside the south-east of the District near Little Wyrley. It flows northwards towards Great Wyrley, where it is entitled Wash Brook. It then flows eastwards, passing Bridgtown to the north and becoming Wyrley Brook. Over this distance, the watercourse tends to form the boundary with Cannock Chase Council. However, north of Wedge's Mills, the watercourse turns west, directly into the District, becoming Saredon Brook. The brook is bordered by the Staffordshire and Worcestershire Canal to the north. As it approaches Four Ashes the watercourse subtly changes name to Saredon Brook. Just north of Coven the Brook enters the river Penk on the left bank.
- **Otherton Brook:** The main river section of this brook begins just south of Penkridge, south of Lynehill Lane. The brook flows northwards directly through Penkridge, before meeting the River Penk.
- **Bell Brook:** The main river section of Bell Brook begins south-east of Penkridge, west of a small village called Pillaton. The Brook flows north-west through some fields before flowing beneath the M6 and into Penkridge. The Brook meets the River Penk just downstream of the Penk's confluence with Otherton Brook.
- **Black Brook:** The headwaters are located west of Perton and flows south through Great Moor, where it is called Nurton Brook, before joining with a small tributary and becoming Black Brook. The watercourse then continues southwards, west of Trescott, before meeting a drain which enters on the left bank and becoming Smestow Brook.
- **Smestow Brook:** Smestow Brook continues southwards from Black Brook, towards Seisdon. It then turns to flow east towards Trysull, then again turning south towards Smestow. As it

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continues south the Brook receives flows from Wom Brook, Spittle Brook and Dawley Brook, eventually meeting the River Stour just north of Stourton.

- Warstones Brook: This brook enters South Staffordshire just north of Lower Penn and flows westwards towards the South Staffordshire railway walk, before turning southwards to flow alongside the Staffordshire and Worcester Canal. The watercourse eventually meets the Wom Brook, in Wombourne.
- Wom Brook: The watercourse begins outside the District, north of Sedgley, where it is called Penn Brook. It flows south-westwards, through Wombourne, where it becomes Wom Brook. The Brook then enters Smestow Brook on the left bank.
- Dawley Brook: This brook enters the District at the south-eastern end, meeting Smestow Brook near Ashwood.
- Spittle Brook: This watercourse rises in the south-west of the District, where it is entitled Philley Brook. As it flows eastwards, the watercourse changes name to Spittle Brook. The Brook then meets Smestow Brook, where the two watercourses merge to continue in a southward direction, running parallel with the Staffordshire and Worcester Canal.
- River Stour: This watercourse enters the District at the south-eastern end, from Halesowen. It flows in a predominantly western direction, parallel with the Stourbridge Canal in some places, before turning southwards where it meets Smestow Brook. The river passes Stourton before turning east towards Kinver, continuing to run parallel with the Staffordshire and Worcestershire Canal. The River Stour then flows out of the District at the southern end.

A number of minor watercourses, non-main rivers, exist and have been analysed where data exists. Please refer to Volume 2, Tiles A1-A7, for watercourse maps.

The Sow and Penk Internal Drainage Board (SPDB) operate within the South Staffordshire District. The SPDB extends firstly from the River Penk immediately downstream of the A5 (SJ 8957 1075) and secondly from Whiston Brook (SJ 8956 1467) to the northern extent of the District. The River Penk itself is the responsibility of the Environment Agency, however, the SPDB are responsible for a number of minor watercourses and ditches within the District. These include: Deepmore Drain South, Deepmore Lock Drain, Pothook Inn Brook and Acton Brook. The SPDB area is shown Volume 2, Tiles A1-A7.

The SPDB (Policy Statement on Flood Protection and Water Level Management, 2005) states that the Board operates under the Land Drainage Act 1991 and manages adopted outfalls, pumping stations and watercourses to maintain water levels in its District to serve the community in general. The policy aim is:

“To reduce the risk to people and the developed and natural environment from flooding and coastal erosion by encouraging the provision of technically, environmentally and economically sound and sustainable defence measures.” (Sow & Penk Internal Drainage Board – Policy Statement on Flood Protection and Water Level Management, 2005).

Objectives of the SPDB are to discourage inappropriate development in areas at risk from flooding. The IDB recognises the potential impact on flood risk through development in the Drainage District, or

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in the wider catchment to the District and will take an active role in the assessment of structure planning, local plans and individual planning applications to ensure that flood risk is not increased.

2 Planning Context

2.1 Introduction

This report conforms with National and Regional Planning Policy. It is a living document that provides the necessary information and guidance to allow the Council to make informed decisions relating to the use and allocation of land within the LDDs, to provide robust evidence to support the LDF at examination and to help formulate appropriate flood risk policies. An SFRA should be used as a tool by the LPA to assess flood risk for spatial planning, produce development briefs, set constraints, inform sustainability appraisals, and identify locations of emergency planning measures and requirements for flood risk assessments.

The success of the SFRA is heavily dependent upon the Council's ability to implement the recommendations put forward for future sustainable flood risk management. It is ultimately the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk.

2.2 National Planning Policy

The Government has updated its planning advice contained within Planning Policy Guidance Notes (PPGs) with the publication of new Planning Policy Statements (PPSs).

In December 2006 the Government published PPS 25: Development and Flood Risk (a restatement of PPG 25). It reflected the general direction set out in 'Making Space for Water' (Defra, 2004), the evolving new strategy to shape flood and coastal erosion risk over the next 10 to 20 years.



2.3 Regional Planning Policy

Regional planning policies provide the overarching framework for the preparation of the LDF. Regional Planning Guidance for the West Midlands (RPG11) was published in June 2004 but under the Planning and Compulsory Purchase Act 2004, RPG11 was automatically replaced by a new Regional Spatial Strategy for the West Midlands. The purpose of the West Midlands Regional Spatial Strategy (WMRSS) is to provide a long term land-use and transport planning framework for the West Midlands region. The WMRSS framework guides the preparation of local authority development plans and local transport plans. It determines (amongst other things) the scale and distribution of housing and economic development for each District or Borough within the region, investment priorities for transport and sets out policies for enhancing the environment. The WMRSS has been prepared by the West Midlands Regional Assembly has been guided by the national policy framework provided by Planning Policy Guidance, particularly PPG11, and other key policy documents and plans including the National Sustainable Development Strategy.

The WMRSS was published in June 2004. In approving the document the Secretary of State identified a number of issues where further work was required. The revision is being carried out in three stages. Phases One and Two of the Spatial Strategy Revision are underway, and Phase Three is due to launch in 2007.

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The WMRSS identifies the 'North Black Country and South Staffordshire (Future Foundations)' as an Urban Regeneration Zone, identified by the Regional Economic Strategy to provide a focus for action in areas of need and provide substantial opportunities for change. WMRSS also states that more rural areas of the West Midlands will be regenerated. This includes areas of southern Staffordshire, through the improvement of choice in housing; diversification of the rural economy; better transport links both within rural areas and between rural and urban areas; improving health, education, skills training, social, shopping, community facilities and other services; the sustainable use of environmental assets and the prudent use of natural resources.

The "Development and Flood Risk" section of the WMRSS identifies the following policies in relation to Flood Risk Management:

8.42 *The implications of climate change for the severity of floods is uncertain but the most realistic approach is to accept that flooding is an inevitable process. PPG25 [now PPS25] Development and Flood Risk sets out detailed guidance on how flood risk should be considered at all stages of the planning and development process, including a sequential approach to locating development. Local authorities should also consider local Environment Agency plans, Catchment Flood Management Plans and indicative floodplains (Quality of the Environment – Assets Diagram).*

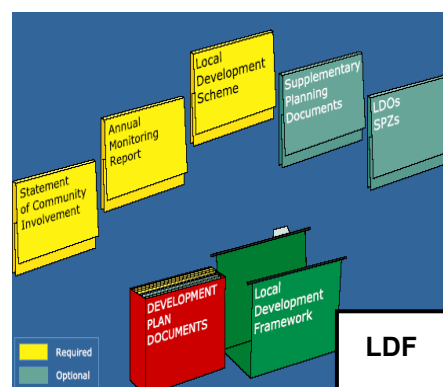
8.43 *For the review of this RPG the RPB with the Environment Agency and other partners should identify where flooding issues are likely to be of Regional significance, assess their implications for the distribution of development and where appropriate, set out appropriate policies and measures to address them. This could include defining areas where sustainable drainage systems would best contribute to reducing flood risk, and improving water quality where the need to improve the performance of the floodplain, attenuate flows and provide local treatment of polluted run-off is greatest. However it should be borne in mind that sustainable drainage systems are unlikely to provide the complete answer to problems associated with large-scale river flooding episodes; in the longer term they can help attenuate flows and reduce the risk of flooding in urban areas downstream.*

8.44 *When considering the possible risks, implications and steps needed to prevent general flooding affecting new development, the potential for sewer flooding should also be considered by developers and planning authorities. Large new developments may require some new or updated infrastructure in the existing sewer network and treatment works in order to cope with the additional load. Sustainable drainage systems can, in the correct conditions, help alleviate sewer flooding problems by preventing surface water from entering the sewerage system."*

2.4 Local Planning Policy

2.4.1 Local Development Framework

The current Local Plan for South Staffordshire was adopted in December 1996 and was prepared to conform to the Staffordshire Structure Plan, which was approved in 1991 and covered the period up to 2001. The Local Plan set out detailed policies and proposals to meet the provisions of the Structure Plan and identifies land for housing and employment uses.



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A review of the Local Plan started in 2001 and an initial period of public consultation was carried out in April and May 2001. A Deposit Local Plan was approved for public consultation by the Council on the 16th September 2003 and was placed 'on deposit' for public inspection from 17th November 2003 to 9th January 2004. A report on the response to the public consultation on the Deposit Local Plan Review was considered at a meeting of the Executive of the Council in February 2005. The report also considered the changes to the development planning system introduced under Planning and Compulsory Purchases Act 2004, requiring the Local Planning Authority to produce a Local Development Framework rather than a Local Plan.

On the 1st March 2005, the Council decided to cease work on the Local Plan and prepare an LDF, containing Development Plan Documents, which will replace the Local Plan and cover the period up until 2026.

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3 Flood Zone Maps

3.1 Introduction

A good understanding of the PPS25 Flood Zones, the Environment Agency Flood Zones and SFRA Flood Maps is of fundamental importance for SFRAs.

3.2 PPS 25 Flood Zones

PPS 25 Flood Zones are adjacent areas that subdivide the spatial variation of flood probability from rivers and the sea. These are the functional floodplain and the high, medium and low probability flood zones.

It is important that within each flood zone there is a spatial variation of flood probability (a range of flood probabilities) and these are well defined. The functional floodplain, for example, comprises land where water has to flow or be stored in times of flood. The functional floodplain can be drawn, therefore, on a map by combining

the flood extents of many frequent floods, with high probability of occurrence. The range of frequency of these floods (or statistically, their average probability of occurrence in a given year) is the combination of floods that have an average probability of occurrence of 20%, or more, in a given year. Other flood probabilities apply when the functional floodplain is designed to store water (see below).

There are many methods that estimate the probability of occurrence of a flood, based on historical events, measurements of flows, etc. The term average means, for example, that a flood that has a 100% (or 1:1 chance) probability of occurrence in a given year will flood almost every year; however it may not flood all years.

PPS 25 defines the flood zones as follows:

Zone 1: Low Probability

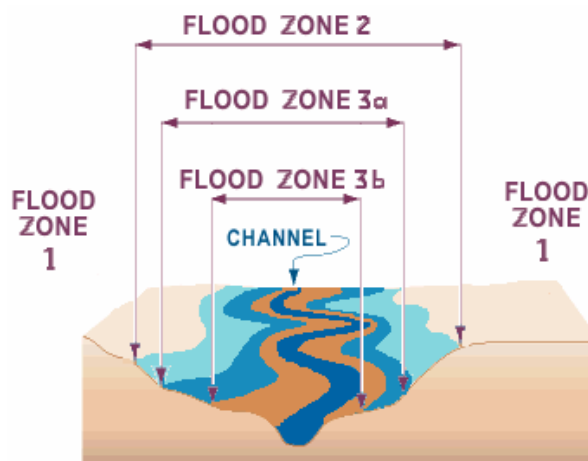
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Zone 2: Medium Probability

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Zone 3a: High Probability

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.



Zone 3b: The Functional Floodplain

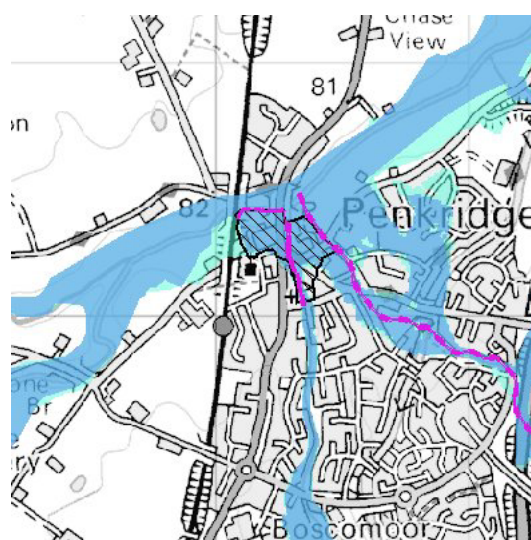
This zone comprises land where water has to flow or be stored in times of flood. SFRA should identify this Flood Zone where possible (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

3.3 Environment Agency Flood Zones

The Environment Agency flood zones are published and updated quarterly in their website at:

<http://www.environment-agency.gov.uk/subjects/flood/?lang=e>.

Historically the Environment Agency and its predecessors have kept formal maps of tidal and fluvial flooding to the standards required by legislation. Originally this mapping recorded flood events, however in 1991, PPG 25 (the predecessor of PPS 25 – see *Section 2.2*) imposed a duty on the Environment Agency to produce flood zone maps. These maps needed to show the predicted extent of tidal and fluvial flooding for the high, medium and low flood zones (see Appendix A for more details). The Environment Agency flood maps do not show the functional floodplain, which is a recent PPS 25 requirement.



3.4 SFRA Flood Maps

SFRA flood maps in general reproduce the Environment Agency high, medium and low probability flood zones where no other more up to date information is available. They also include assessments of the functional floodplain and the effect of climate change on the flood zones, where appropriate.

SFRA flood maps do not only show updated flood zones, they also show 'localised' flooding areas from other sources/forms of flooding (see Volume 2, Tiles B1-B6).

3.5 SFRA Climate Change Maps

PPS 25 sets out guidance for changes to flood risk as a result of climate change and this is shown overleaf. These climate change scenarios are now included in most Environment Agency river models and flood outlines are produced; for older river studies this is less likely.

The main Climate Change table from PPS 25 is shown below:

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

In its November 2006 publication of the predicted effects of climate change on the United Kingdom, DEFRA described how short duration rainfall could increase by 30% and flows by 20%, and suggests winters will become generally wetter. These effects will tend to increase both the size of flood zones associated with the sea and rivers, and the amount of flooding experienced from “other sources”.

Where climate change outlines have been produced from existing models these outlines have been used on the SFRA climate change maps. If these do not exist, analysis of other modelled scenarios has been undertaken to assess their suitability for use as a climate change proxy. In general our past experience has shown that the 1 in 1000 or 1 in 200 year outlines often show similar extents to the climate change scenarios of the 100 year event.

For watercourses where models do not exist, the most up-to-date Environment Agency flood zone maps have been used. A 1 in 100 year climate change scenario has been produced by assuming that Flood Zone 2 (1 in 1000 year return period) will become Flood Zone 3 (1 in 100 year return period). We have also assumed that the functional flood plain (3b - 1 in 20 year return period) will become Flood Zone 3a (1 in 100 year return period). This is a precautionary approach but one which is consistent with our past modelling experience, which has shown that the 1 in 1000 year flood outline is often similar to the climate change scenario for the 100 year event. The LPA might wish to use the climate change maps to carry out the sequential test, in order to give a particularly long-term risk-based approach to planning.

This is the level of detail which PPS25 requires for a Level 1 SFRA, and has recently been successfully implemented on Halcrow’s SFRA projects, giving an indication of how flood zones and flood probabilities are likely to change over time. The climate change scenarios are provided in a series of maps covering the study area (Volume 2, Tiles C1-C7).

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4 Overview of PPS 25

4.1 Key Aims

The key aims of PPS 25 are reproduced below:

“The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.”

Regional planning bodies and LPAs should prepare and implement planning strategies that help to deliver sustainable development by:

Appraising risk:

- Identifying land at risk and the degree of risk of flooding from rivers, the sea and other sources in their areas
- Preparing Regional Flood Risk Appraisals (RFRAs) or SFRAs as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans

Managing risk:

- Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change
- Only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding

Reducing risk:

- Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water, and flood defences
- Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS)
- Using opportunities offered by new development to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; re-creating functional floodplain; and setting back defences

A partnership approach:

- Working effectively with the Environment Agency, other operating authorities and other stakeholders to ensure that best use is made of their expertise and information so that plans are effective and decisions on planning applications can be delivered expeditiously
- Ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning”

These broad planning objectives effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning and development control decisions that ensure the objectives set out above can be achieved.

4.2 Outcomes of the SFRA Process

A Level 1 SFRA provides sufficient data and information to enable a planning authority to apply the Sequential Test to land use allocations (see Section 4.3).

PPS 25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area. Under the Town and Country Planning (Local Development - England) Regulations 2004, a Sustainability Appraisal (SA) is required for all LDFs. The purpose is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The Regulations stipulate that SAs for LDFs should meet the requirements of the Strategic Environmental Assessment (SEA) Directive. An SFRA is also used as a tool by an LPA for the production of development briefs, setting constraints, identifying locations of emergency planning measures and requirements for FRAs.

It is important to reiterate that PPS 25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for future development must also meet the requirements of other planning policy. Clearly a careful balance must be sought in these instances, and the SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

4.3 The Sequential Test

A planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

Preference should be given to locating new development in Flood Zone 1 (see Section 3.2). If there is no reasonably available site in Flood Zone 1, the flood vulnerability (or level of resilience to damages from flooding of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3 (Appendix B).

Within each Flood Zone new development should be directed to sites with lower flood risk (towards the adjacent zone of lower probability of flooding) from all sources as indicated by the SFRA.

4.4 The Exception Test

If, following application of the Sequential Test, it is not possible or consistent with wider sustainability objectives for the development to be located in zones of lower probability of flooding, the Exception Test can be applied. This test provides a method of managing flood risk while still allowing necessary development to occur.

The Exception Test is only appropriate for use when there are large areas in Flood Zones 2 and 3, where the Sequential Test alone cannot deliver acceptable sites, but where some continuing development is necessary for wider sustainable development reasons, taking into account the need to avoid social or economic blight and the need for essential civil infrastructure to remain operational during floods. It may also be appropriate to use it where restrictive national designations such as

landscape, heritage and nature conservation designations, e.g. Areas of Outstanding Natural Beauty (AONBs), Sites of Special Scientific Interest (SSSIs) and World Heritage Sites (WHS), prevent the availability of unconstrained sites in lower risk areas.

For the Exception Test to be passed:

- a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the Development Plan Document has reached the 'submission' stage (see Figure 4 of PPS 12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal
- b) The development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land
- c) A flood risk assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall

The Exception Test will be possible following completion of the Level 2 SFRA.

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5 Study Methodology

5.1 The Practice Guide Companion to PPS 25

The practice guide companion to PPS 25 (February 2007) is a 'living draft' web-based consultation paper (see <http://www.communities.gov.uk/index.asp?id=1504639>), incorporating many recommendations from previous Guidance documents.

The document reaffirms the adoption of a risk-based approach to flooding by following stepped hierarchical measures at all stages in the planning process. Avoidance/prevention is always the first measure, followed by substitution, control and then mitigation. This is summarised in Table 1.2 of the Practice Guide Companion to PPS 25 (as reproduced below).

Flood Risk Management Measure	Description	Example tools and measures	Key responsible parties
Avoidance/Prevention	Allocate developments to areas of least flood risk and apportion development types vulnerable to the impact of flooding to areas of least risk	Regional Flood Risk Appraisals (RFRAs), Strategic Flood Risk Assessments (SFRAs), Flood Risk Assessments (FRAs) and application of the sequential approach	Planning bodies
Substitution	Substitute less vulnerable development types for those incompatible with the degree of flood risk		Planning bodies and developers
Control	Implement measures to reduce flood frequency to existing developments Appropriate design of new developments	River Basin Management Plans (RBMPs), Catchment Flood Management Plans (CFMPs), Shoreline Management Plans (SMPs), Flood Risk Management Strategies, appraisal, design and implementation of flood defences	Environment Agency and other flood and coastal defence operating authorities, developers and sewerage undertakers
Mitigation	Implement measures to mitigate residual risks	Flood risk assessments. Incorporating flood resistance and resilience measures. Emergency Planning Documents. Implementation of flood warning and evacuation procedures	Planning bodies, developers, the Environment Agency, other flood and coastal defence operating authorities and sewerage undertakers

The Sequential Test of PPS 25 is the most important flood risk management tool for spatial planning, as it implements the high level measures of avoidance/prevention and substitution (see Section 4.3).

5.2 Level 1 SFRA

A Level 1 SFRA is defined in the Practice Guide Companion to PPS 25, as the level that provides the necessary information for undertaking the Sequential Test. The scope of this study is a Level 1 SFRA.

Where the need to apply the Exception Test is identified, due to there being an insufficient number of suitably available sites for development within zones of lower flood risk, the scope of the SFRA is widened to a more detailed Level 2 study.

5.2.1 Project Outputs for a Level 1 SFRA

The project outputs for Level 1 SFRA have been adopted for this study.

Following the advice from Section 2.34 of the Practice Guide Companion to PPS 25, the key project outputs are as follows:

- 1) Plans showing the administrative boundaries of the study area, main rivers, ordinary watercourses and defences (Volume 2, Tiles A1-A7)
- 2) Strategic flood risk maps showing flooding from all sources, including fluvial flood zones (including the functional floodplain where possible), and areas at risk of flooding from sources other than rivers (Volume 2, Tiles B1-B6)
- 3) An assessment of the implications of climate change for flood risk in the study area over an appropriate time period (Volume 2, Tiles C1-C7)
- 4) The location of any flood risk management measures, including both infrastructure (Volume 2, Tiles A1-A7) and the coverage of flood warning systems (Volume 2, Tile E1)
- 5) Locations where additional development may significantly increase flood risk elsewhere (see Section 6).
- 6) Guidance on the application of the Sequential Test (see Chapter 9)
- 7) Guidance on the preparation of Flood Risk Assessments for development sites (see Chapter 10).
- 8) Guidance on the likely applicability of different SUDS techniques for managing surface water run-off at key development sites (see Chapter 11)

5.3 Approach to Data Gathering

The main source of data for this study has been the Environment Agency, IDBs, web based information, British Waterways, South Staffordshire District Council and Severn Trent Water.

Priority has been given to the collection of geo-referenced information in electronic format, to ensure the effective management of the data within a GIS environment. All incoming data has been recorded on a project data register.

The quality review of the information has been carried out by an experienced core team. The team has been able to review the collected data, assess its significance and quality, and advise on which part of the collected data needed to be used for the SFRA. The main approach to the SFRA has been to build on previous studies and gathered information.

5.4 Production of Flood Maps

The Environment Agency Flood Zone Maps and river models have been collected and used for the production of the SFRA flood maps (Volume 2, Tiles B1-B6).

5.4.1 Hydraulic (River) Models

Within the District of South Staffordshire, two Environment Agency hydraulic models are known to exist: the River Sow and Penk, and the River Stour and Smestow Brook.

The River Penk model covers the whole of the main River Penk channel within the District, extending from the head of main river at Codsall (NGR SJ 890 037) to the northern boundary of South Staffordshire close to Wildwood and Rickerscote.

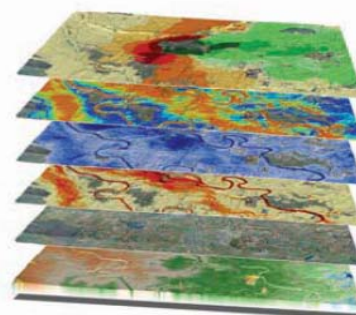
The River Stour and Smestow Brook hydraulic model covers the whole of the main River Stour channel from the point at which it enters the District in the south-east from Halesowen and exits at the southern extent of the District. The Smestow Brook section of the model also covers the whole main channel within the South Staffordshire District.

Modelled flood outlines for the River Sow and River Penk were provided by the Environment Agency for the 1% AEP (1 in 100 Year) and 0.1% (1 in 1000 Year). These have been used in preference to the current Environment Agency Flood Zones for Flood Zones 2 and 3. In addition, mapped outlines for the 5% AEP (1 in 20 year) event have been used to produce the Flood Zone 3b outline for the River Sow and Penk watercourses. This is in line with the current guidelines outlined in PPS 25.

No modelled flood outlines were available for the River Stour and Smestow Brook Models, therefore no new information was available to improve the present day Environment Agency Flood Zone Maps.

5.4.2 Strategic Flood Risk Maps

The main GIS delivery is the production of strategic flood risk maps, showing flooding from all sources and incorporating the subdivision of Zone 3 into Zones 3a and 3b of PPS 25. The strategic flood risk maps are presented as GIS layers (with associated descriptive information) together with OS base maps and layers of watercourses.



In the absence of more detailed information, a precautionary assumption has been adopted where Flood Zone 3b does not exist. When carrying out the Sequential Test the LPA should assume that where Flood Zone 3b does not exist, its extent would be equal to Flood Zone 3a.

This approach is suitable at the Level 1 SFRA stage when carrying out the Sequential Test, a process whereby development should be placed in the lowest risk zone, Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers should take into account the flood risk vulnerability of the development and consider reasonably available sites in Flood Zone 2. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3.

In the absence of a Flood Zone 3b outline, the implications of assuming Flood Zone 3b is equal to Flood Zone 3a can be summarised in the following example. PPS 25 says that 'more vulnerable' developments, such as a housing development, can be placed in Flood Zone 3a provided it passes the Exception Test, but cannot be placed in Flood Zone 3b. If such a development was placed in Flood Zone 3a following the Sequential Test, further modelling work would have to be carried out as part of a Level 2 SFRA to define the extent of Flood Zone 3b, thereby defining the area where the

development could not be placed. In the event that detailed modelling work is not possible, the LPA should assume that Flood Zone 3b extends to the 3a extent, and should therefore remove the development from this area. Should a developer wish to prove otherwise, it is at this stage that developer contributions can be given in order to carry out further modelling work. Such a scenario would be expected in an area where the development pressures are significant and there is little other developable land in lower risk areas.

Should sites be placed in Flood Zones 2 or 3, they should always be assessed through a more detailed Level 2 SFRA, which will refine flood zone information and allow the development to be located on parts of the site at lowest probability of flooding.

5.5 Forms of Flooding and Data Limitations

For the purpose of this assessment, forms of flooding (also defined as sources of flooding) are divided into four categories, the first covering fluvial flooding, the second flooding from artificial drainage systems and surface water runoff, the third covering flooding from impounded water bodies and the fourth from groundwater flooding. The reason for adopting this classification is to provide an understanding of data limitations and assumptions as there are different standards for the collection of each of these types of data.

5.5.1 Fluvial Flooding

This form of flooding (flood zones) is described in Chapter 3. See also Appendix A for further details, including assumptions and limitations.

5.5.2 Records of Flooding Artificial Drainage Systems and Surface Water Runoff

Methodologies for recording flooding from sources other than fluvial or tidal were not standardised until 2006. Therefore records held of such flooding can be incomplete, and not to a uniform standard. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register tends to show, to a greater or lesser extent, the following: the date of the most recent incident, the post town, locality, street, post code (four or six figures), a sewer problem description, sewer type description, if internal flooding occurred, details of curtilage flooding, and the eastings and northings of the flood incident. The recording of flood events by the authorities has often led to improvements intended to prevent reoccurrence, so historical flooding is not necessarily evidence of propensity for future flooding.

Information on flooding caused by surface water runoff can also be obtained from local government, highway authorities, the Environment Agency and libraries.

5.5.3 Records of Flooding from Impounded Water Bodies

Records of flooding from reservoirs and canals are erratic as there is no requirement for the Environment Agency to show historic flooding from canals and raised reservoirs on plans. In particular, PPS 25 does not require flood risk from canals and raised reservoirs to be shown on the flood map. This is surprising, as overflows from canals are common due to flows from land drainage

and their frequent lack of overflows. Occasionally major bank breaches also occur, leading to rapid and deep flooding of adjacent land.

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act and are listed on a register held by the Environment Agency. Due to high standards of inspection and maintenance required by legislation, normally flood risk from registered reservoirs is moderately low.

5.5.4 Records of Groundwater Flooding

Both the Environment Agency and planning authorities can keep records of individual groundwater flooding events.

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6 Flood Risk in the Study Area

6.1 Hydrology

The District is covered by two main river catchments: The River Penk, which drains north to the River Sow (part of the River Trent catchment) and the Smestow Brook, which drains south into the River Severn.

The River Penk rises at Perton and flows northwards through the District fringing the villages of Codsall and Coven, before flowing through Penkridge where the catchment area is approximately 272km². The floodplain is predominantly rural with a relatively low to moderate relief catchment. As the watercourse flows through the District it receives flows from the adjoining tributaries of the Saredon Brook, Moat Brook, Watershed Brook and Whiston Brook. The catchment areas of the adjoining tributaries are 71km², 49km², 15.53km² and 33km² respectively at their confluences with the River Penk.

The Smestow Brook forms a continuation of the Black Brook. The watercourse initially flows in a southerly direction through the District before turning to flow east towards Trysull, then south towards Smestow where the Brook commands a catchment area of approximately 51km². As the watercourse continues to flow in a southerly direction, it receives flows from the Wom Brook (catchment area approximately 25km²) and Spittle Brook (catchment area approximately 20km²), both of which have a significant number of tributaries themselves. Downstream of Swindon, the Smestow flows due south before eventually meeting the River Stour just north of Stourton where the catchment area is approximately 137km². As the Smestow Brook flows through the District it interacts with the Staffordshire and Worcestershire Canal at numerous locations. The largest of these is located at Compton, near Tettenhall, where a large side spill weir enables high flows in the canal to discharge to Smestow Brook via Graiseley Brook. Although this is outside of the District boundary, this will have an impact on flows within the Smestow Brook further downstream as it flows through the District. It is also thought that the Staffordshire and Worcestershire Canal collects surface water directly from the catchment via local surface run-off and small surface water sewer connections (Floodplain Mapping – River Stour and Smestow Brook, 1993). This water is considered to enter Smestow Brook via side spill weirs or via other smaller canal / Brook interactions.

The River Stour enters the District in the south-eastern extent from Halesowen, flowing in a predominantly western direction, parallel with the Stourbridge Canal, before turning southwards where it meets Smestow Brook. Here, the catchment area of the River Stour is approximately 90km² and the catchment is predominantly rural. Below the confluence with Smestow Brook the River Stour then passes Stourton before turning east towards Kinver. At Kinver, the catchment area is approximately 230km². The River Stour then meanders its way through mainly rural floodplain before eventually flowing out of the District at the southern extent by Whittington towards the River Severn.

6.2 Geology and Topography

The geology of the South Staffordshire District consists predominantly of sedimentary rock of the Triassic period in a more or less continuous sequence of ancient desert deposits (Volume 2, Tiles D1 (solid) and D2 (drift)). The underlying rock strata are divided into Sherwood Sandstone and Mercia Mudstone.

Glacial sands and gravels are found in the District particularly in the south around Wombourne and Seisdon. There are also deposits of boulder clay in the central and north-eastern parts of the District.

To the eastern fringes of the District there is carboniferous coal bearing measures of the Cannock and South Staffordshire Coalfields where extensive coal reserves have been exploited in the past.

The topography of the District is generally very undulating and the geology does not give rise to many prominent physical features. The northern part of the District, north of the A5, has a generally undulating landform with a flat lower lying central corridor based on the floodplain of the River Penk and Otherton Brook. The area to the east of Penkridge lies on the lower slopes of Cannock Chase.

The north-eastern area has been affected by past mining activity and mineral workings. The area is generally flat with an undulating central corridor and some higher ground around at Saredon Hill, near Great Saredon.

In the central part of the District the landform is undulating with the flatter low lying areas based on the floodplain of the River Penk. There are four prominent ridgelines, Chillington-Pendeford Ridge, Pittingham Ridge, Perton Ridge and Abbots Castle which forms the eastern barrier to the Shropshire Plain and is an extremely strong feature.

The south of the District is characterised by a more strikingly undulating and elevated landform with strong features in the Kinver area such as Kinver Edge and The Sheepwalks. In contrast, the Smestow Valley containing the drainage areas of the River Stour and Smestow Brook form incised valleys through the area. Within Smestow valley area there are a series of sandstone escarpments including Abbot's Castle Hill and Orton Hill around Wombourne.

6.3 Historical Flooding

Recent years have seen a number of large scale flood events throughout the UK including October 1998, Autumn 2000, February 2002, New Year 2003, February 2004 and more recently summer 2007.

Both the Seven and Trent catchments have a long history of flooding on their main rivers and adjoining tributaries. However, the size of the catchments means that different areas can be affected during different flood events. There is very little historic data to suggest that large areas of the South Staffordshire District have been affected by persistent large scale flood events. The exception is perhaps the River Penk where anecdotal evidence indicates that flooding to large areas of agricultural land and the village centre has been experienced on a number of occasions in recent years. In addition, the River Stour and its major tributary Smestow Brook are both subject to flooding of residential, commercial and agricultural land. Other flooding within the District tends to be at specific locations, particularly in areas where drainage systems are unable to cope with the volume of water. This has been reflected in the historical flood records received as part of this SFRA.

Notable flood events that have occurred within the South Staffordshire District are detailed below:

1958

In 1958 the centre of Penkridge was flooded by the combination of flows from the River Penk and the Bell and Otherton Brooks.

Autumn 2000

Flash flooding to large areas of agricultural land in the River Penk catchment was experienced in Autumn 2000.

October 2004

The village of Penkridge experienced significant flooding at a number of locations within the village. This included Crown Bridge area, the site of the then proposed medical centre off Pinfold Lane, Penkridge Market, Crown Bridge, and, floodplain to the north and south of Cuttlestone Bridge.

Summer 2007

England experienced the wettest three months to the end of July since records began, with at least twice the average rainfall falling across parts of the country. The extreme conditions led to large scale urban and rural flooding across south-west England, north-east England and the Midlands. A lot of the flooding was from a combination of surface water and fluvial flooding. Records received from South Staffordshire District Council indicate that flooding was experienced at numerous locations within the District, from a variety of sources including both fluvial and surface water. In particular, the village of Penkridge was one of the worst affected areas experiencing flooding during both the June 2007 and July 2007 events. Flood Meadows adjacent to the River Penk were inundated on numerous occasions with water levels reaching as far as the Riverside Care Home and the boundary of the newly opened Health Centre. According to historic evidence, past flood events have seen even higher water levels than this in previous years (Penkridge Parish Council). Reports have also been received that Pinfold Lane was completely submerged between the new Penkridge Medical Practice and Monckton Recreation Centre, and the River Penk rose to the height of the arches at Cuttlestone Bridge resulting in flooding to the adjacent fields. Playing fields opposite Marshbrook School were also inundated during the June 2007 event.

6.3.1 Events Specific to South Staffordshire

As discussed in section 6.3 there is very little historic data suggesting that large areas of the South Staffordshire District have been affected by persistent large scale flood events, rather smaller more specific events have affected locations within the District.

Anecdotal evidence received as part of this study has indicated that various locations within Penkridge have been affected by flooding in recent years from both fluvial flooding and surface water flooding. A number of reports have been received detailing fluvial flooding in both October 2004 and June and July 2007. The flood meadows adjacent to Cuttlestone Bridge have been inundated by flood waters in both 2004 and more recently in summer 2007. Flooding to Penkridge Market adjacent to Crown Bridge has also been recorded in 2004 and in 2007 where flood waters came up to the boundary fence of the newly opened Health Centre and the boundary walls of the Riverside Care Home. Records of flooding to gardens north of the River Penk on Stafford Road and Teddesley Road have also been reported. Surface water flooding in Penkridge has also been recorded on a number of occasions particularly to locations around Hailing road, Littleton Crescent, and Kempson Road. Historically this part of Penkridge was very wet marsh land containing a number of ponds and ditches.

South Staffordshire District Council

Historically, the village of Kinver has experienced flooding problems from the River Stour as a result of runoff from the adjacent Sandstone Hills flowing into the watercourse. During the July 2007 flood event several streets and roads were closed (including Mill Lane) due to flooding from the River Stour.

Other locations affected by the Summer 2007 event within South Staffordshire District include large areas surrounding the Whiston Brook, Hinksford, Perton, Brewood Pools located on either side of the River Penk east of Brewood and Wombourne. During the recent June 2007 events, much of the area bordering the Wom Brook was flooded resulting in most of the pathways being flooded. In addition, a number of gardens of residential properties along Rookery Road were flooded.

The Moat Brook located to the south-west of Codsall has not been affected by any one major flood event; rather there are specific areas in Codsall and Bilbrook which appear to have been affected by flooding at different times in the past. Similarly, the reported flood events do not appear to have caused significant damage, and actual inundation of homes is rare. Areas which have been affected by flooding in the past include Bilbrook Road, Pendeford Mill Lane, Barnhurst Lane, Manor House Park, the corner of Joey's Lane, and Moatbrook Lane's junction with Wood Road, which often results in this section of the road being closed to vehicles. Some reports suggest that flooding at the junction is a yearly occurrence and can also occur to a lesser extent when there is heavy rain. Additionally, the section from Watery Lane to the Shropshire Union Canal commonly experiences flooding on the left and right banks. This area tends to flood every winter and is likely to be the area affected by the mean annual flood as recognised by Mott MacDonald's report, produced in 1994. There are no reports that any of the houses on the new housing estate to the east of Watery Lane and have been affected by flooding.

6.3.2 Flooding from Fluvial Sources

Within the District of South Staffordshire there aren't any towns, however a number of smaller villages including Penkridge, Wombourne and Kinver that are at least partially contained within Flood Zone 2. The Environment Agency Flood Zone Maps provide an indication of the locations at risk from fluvial sources within the District.

The Environment Agency Flood Zone Maps for the River Penk extend predominantly into undeveloped agricultural land at the upstream extent of the catchment apart from a small number of properties on the northern edge of Perton. As the watercourse continues to flow in a north easterly direction through the District, a small business park (Balliol Business Park and Works) is located within Flood Zone 2. Modelled flood outlines from the River Sow and Penk model have been used to update the Environment Agency Flood Zone Maps for the remainder of the River Penk between Wobaston Road and the District boundary. A small number of isolated buildings and farms lie within Flood Zone 2 between Wobaston Road and the village of Penkridge. As the River Penk flows towards Penkridge the watercourse receives flows from a number of smaller watercourses including Whiston Brook and Otherton Brook. Through Penkridge, Flood Zone 2 extends for up to 300m on the right bank affecting a significant number of properties around Market Place. As the watercourse continues to flow in a northerly direction, Flood Zone 2 extends onto the left and right banks, again encompassing predominantly agricultural land and a small number of isolated properties. Reports of flooding from the River Penk received as part of this study are generally consistent with the modelled Flood Zone Maps.

A number of properties are at risk from flooding from the River Stour. As the watercourse enters the District in the south-east, it flows in a westerly direction mainly through agricultural land. A small cluster of properties and a pumping Station are located within Flood Zone 2 at Prestwood and Stourton where Flood Zone 2 extends for approximately 150m on the left bank and 180m on the right bank. The main urban area at risk from flooding from the River Stour within South Staffordshire District is at Kinver with Flood Zone 2 extending for approximately 150m on the right bank onto the High Street. The left bank the floodplain is restricted by the Staffordshire and Worcestershire Canal, however a pumping station is located within the floodplain at Kinver Lock. Further properties are located within Flood Zone 2 at Mill Lane and Redwood Road, along with a sewage works downstream of Windsor Holloway.

Environment Agency Flood Zone maps for the Smestow Brook demonstrate that a number of residential and commercial properties (including Wombourne Enterprise Park) lie within Flood Zone 2 at Seisdon, Trysull and Swindon. As the Smestow Brook flows towards the River Stour the floodplain widens and incorporates predominantly agricultural land.

The Saredon Brook flows into the north-eastern extent of the District where South Staffordshire borders Cannock Chase District. Wash Brook flows along the boundary of South Staffordshire District with Cannock Chase District Council. Flood Zone 2 extends from the left bank into the District with a number of properties affected in the Churchbridge area. Consultation with the Environment Agency has indicated that the Flood Zone outlines for the Wash Brook require updating following the construction of the M6 Toll Road. It is not known when this work will be undertaken but the flood maps used within the SFRA should be updated once completed to ensure the full extent of flood risk within the area is assessed. As the watercourse flows along the District boundary, it becomes known as the Wyrley Brook, and then the Saredon Brook. A small number of properties and reclamation works and pumping station are located within Flood Zone 2 around Wedges Mills, and a number of properties at Saredon.

A number of properties are shown to lie within Flood Zone 2 at Codsall and Bilbrook. The Flood Zone Maps for the Moat Brook are generally consistent with the reported locations and extent of flooding. It should be noted however that areas to the north of Bilbrook, including Bilbrook Road, Manor House Park and Joeys Lane have all been affected by flood events in the past, by events that are likely to be less than the 1%AEP event. However, the current flood maps do not recognise these areas as being at risk from the 1%AEP event. Additionally, Barnhurst Lane and Pendeford Mill Lane are also known to have been affected in the past, but again the current flood maps do not recognise these areas as being at risk from the 1%AEP event.

Other smaller watercourses within the District indicate a degree of flood risk to properties. A small number of properties adjacent to the Horse Brook are shown to lie within Flood Zone 2 with the floodplain extending for approximately 30-60m on the left and right banks. A number of properties along the Chillington Brook are situated within Flood Zone 2 at Stonebridge Road and Brewood Hall Farm. However, the majority of the land within Flood Zone 2 remains undeveloped. It should be noted that the flood outlines appear to be misaligned in places and therefore caution should be taken when interpreting the information.

A significant number of properties fall within the Environment Agency's Flood Zone 2 along the Wom Brook catchment through the village of Wombourne. This appears to be consistent with reports of flooding received as part of this study.

6.3.3 Flooding from Artificial Drainage Systems and Surface Water Runoff

Information on flooding from surface water and artificial drainage sources has been provided by Severn Trent Water (STW) in the form of four digit postcode locations as recorded within their DG5 Flood Register. This information has been digitised and represented as postcode area within Volume 2, Tiles B1-B6.

The aim of the DG5 levels of service indicators is to measure the frequency of actual flooding of properties and external areas from the public sewerage system by foul water, surface water or combined sewage. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

When a flood incident is reported to STW, a decision chart is used to assess whether the properties / areas are 'at risk' and then the record is added to the appropriate register. The following registers are currently maintained:

- Properties / areas at risk of flooding twice in ten years or more are added to the 2 in 10 year (2:10) register (FLOODS2 acronyms I05 / E05– Internal / External)
- Properties / areas at risk of flooding once in ten years but less than twice in ten years are added to the 1 in 10 year (1:10) register (FLOODS2 acronyms I10 / E10 – Internal/ External)
- Properties / areas at risk of flooding more once in twenty years but less than once in ten years are added to the 1 in 20 year (1:20) register (FLOODS2 acronyms I20 / E20 Internal / External)
- Properties / areas at risk of flooding on a greater than 20 year return period are added to the 1:>20yr register (FLOODS2 acronyms IXX / EXX Internal / External)

Within the South Staffordshire District there are fifteen postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. Due to the implications of the Data Protection Act on the data held on the DG5 flood register, this report cannot pin-point the exact locations of properties at risk; however, the numbers of properties affected within each post code area, type of register and date of flooding (where available) has been identified and detailed in Table 6.1 overleaf. The Environment Agency has asked that, should development take place in these areas, further work should be carried out to investigate the nature and scale of the risk posed, so that mitigation can be put in place and the areas can be targeted through appropriate policies for reducing flood risk.

It is clear that surface water drainage is an issue in some parts of the study area, and back-up of water during heavy rainfall events can cause roads to become flooded. Anecdotal evidence has indicated that in June 2005, in excess of 100 calls were received by Staffordshire Fire and Rescue Service after bad weather caused flooding problems (BBC News, 2005). Reports received were mainly a result of drain systems not being able to take the capacity of water and as a result manhole covers were pushed out of their seatings in the road and numerous homes were flooded.

Table 6.1: Flooding From Artificial Sources as Recorded in Severn Trent DG5 Register

Postcode Area	No. Properties Affected	Date(s) of Reported Incident	Current DG5 Register Classifications
DY7 6	2	07/03/2006	E20 – Garden I20 - Domestic
ST19 5	1	26/10/2001	I05 - Domestic
ST19 9	1	18/04/2005	I05 – Domestic
WS6 6	7	24/07/1994, 03/07/1999, 19/06/2005	I05 – Domestic E20 –Garden E05 - Garden
WS6	8	19/06/2005	E10 – Garden I10 – Domestic I20 – Domestic
WV10	4	03/07/1999, 22/12/2002, 19/06/2005	E05 – Garden E05 – Non-Domestic E05 - Highway I05 – Domestic I20 - Domestic
WV11 2	3	-	E05 - Highway
WV4 4	2	09/08/2002	IXX – Domestic EXX - Garden
WV5 0	2	01/08/1999, 23/08/2007	I20 – Domestic IXX - Domestic
WV5 8	5	02/07/1999, 03/07/1999, 05/07/1999, 22/09/1999, 01/08/1999, 19/06/2005, 30/10/2005	E05 – Garden E05 – Highway E20 – Garden I20 - Domestic
WV5 9	2	02/02/1999, 03/02/1999	I20 – Domestic E20 - Garden
WV6 7	7	11/07/1995, 09/08/1999, 07/08/2002, 09/08/2002, 23/08/2006	E05 – Garden E10 – Public OS E20 – Garden EXX – Garden EXX – Highway RTU – R5 Domestic
WV6 8	1	-	E05 - Highway
WV8 1	9	11/06/1997, 03/07/1997, 05/07/1997, 19/06/2005, 28/06/2006, 04/07/2006, 22/07/2006, 23/08/2006, 04/09/2006 14/09/2006	E05 – Highway E05 – Garden E20 – Garden EXX - Garden
WV8 2	5	02/07/1999, 03/07/1999, 05/07/1999, 01/08/1999, 08/08/1999/	E20 – Garden E05 – Garden I05 - Domestic

It is evident from Table 6.1 that flooding from artificial sources occurs at a number of locations within the northern and central post code areas within the South Staffordshire District, and towards the south of the District around the Kinver area (post code area DY7 6). Post code area WV8 1 had nine reported incidents, WS6 eight reported incidents, WS6 6 seven reported incidents and WV6 7 seven reported incidents.

Severn Trent Water has stressed that Local Planning Authorities should adopt a planning policy requiring the use of Sustainable Drainage Systems (SUDS) as proposed in PPS25 and that PPS25 should be used to allocate land for development within Flood Zones so that the risk of fluvial flooding is minimised. This reduces the risk of fluvial flood waters entering public foul and surface water sewers and resultant widespread flooding and pollution. Individual developments should be designed so that natural flood pathways are left free of buildings. Further guidance on the application of SUDS can be found in Section 11, and in the CIRIA Report C635, Designing for Exceedance in Urban Drainage (2006).

6.3.4 Flooding from Impounded Water Bodies

Three canals are located within the South Staffordshire District: the Shropshire Union Canal, the Staffordshire and Worcestershire Canal and the Stourbridge Canal. Consultation with British Waterways (BW) has indicated that there are no available records of canal breaches within the South Staffordshire District.

It is however important that canals are included in any Strategic Flood Risk Assessment as they form a vital land drainage function. Any Flood Risk Assessment (FRA) should therefore take account of canals. Not only do canals occasionally overtop in places due to high inflows from natural catchments (i.e. where inflows are higher than the capacity of the flood control structures), but they are also vulnerable where overtopping occurs from adjacent water courses. Additional water from adjacent watercourses must be routed/conveyed by the canal which may cause issues elsewhere, not only within the catchment of interest but also in neighbouring catchments, as the canal crosses catchment boundaries. Additionally, the canal itself can reduce flood risk where BW control flood flows within the canal, or accept flood waters either for temporary storage or transfer.

At present canals do not have a level of service for flood recurrence, although BW, as part of its function, will endeavour to maintain water levels to control the risk of flooding from canals to adjacent properties. It is important, however, that any development proposed adjacent to a canal be investigated on an individual basis regarding flooding issues and should be considered as part of any FRA.

It should be noted that Proposals are currently under investigation for the restoration of the Hatherton Canal. The Hatherton Canal was originally constructed in opened in 1841 from Calf Heath on the Staffordshire and Worcestershire Canal to Churchbridge. It was then further extended in 1860 to join the Cannock Extension Canal and was in use until abandoned in 1955. In its current state, the canal is only in water for the first two miles from Calf Heath, with the remainder of the canal having been in-filled and redeveloped. Restoration of the canal is proposed to re-join the canal to the Cannock Extension Canal.

The proposed route of the Hatherton Canal runs into South Staffordshire District on the eastern edge of the District where the District borders Cannock Chase District Council to the West of Bridgetown

(SJ 965 089). There are three significant watercourses in close proximity to the proposed route of the restored canal which also form the boundary of South Staffordshire District with Cannock Chase District; these are the Saredon Brook, Wyrley Brook and Wash Brook. Details of the proposed canal route are contained within the Hatherton Canal Restoration Feasibility Report (ref. 17). Historically, there is a long history of fluvial flooding from the watercourses located adjacent to the proposed canal route. Environment Agency flood maps indicate that there may be some interaction between the watercourses and provide an indication as to the extent of flooding. In addition, the Environment Agency Scoping Report for the Cannock Flood Alleviation Scheme (ref. 2) refers to issues relating to the flow of water from Ridings Brook and Saredon Brook into Hatherton Branch Canal. It may be possible for water to overtop the branch canal banks if inflows exceed its capacity. Therefore, the interaction between the watercourse and the proposed new canal should be considered as any developments constructed along the watercourse may increase flows within the canal and increase the potential for breaches or overtopping to occur.

Three reservoirs are identified in South Staffordshire, these being Belvide, located at SJ 86494 10165, Calf Heath, located at SJ 92839 10109 and Gailey, located at SJ 93723 10291. Investigation into the history of these reservoirs did not uncover any records of breach or overtopping.

6.3.5 Flooding from Groundwater

Consultation with the Environment Agency has suggested that there are no known problems with flooding from groundwater within South Staffordshire District.

6.4 Areas Where Development May Increase Flood Risk Elsewhere

A number of storage areas are present within South Staffordshire District. It is imperative that any storage areas used as a means of attenuation of flood waters should be maintained to ensure their efficient operation during a flood event. If the storage areas are not maintained this may lead to an increased risk of flooding at locations downstream of the storage areas.

Two proposed highways developments have been identified within South Staffordshire District: The M6 Junction 11a – 19 and the M6 / M6 (Toll) Link Road. The exact routes of the schemes have not yet been finalised. Consultation with the Highways Agency regarding the M6 / M6 (Toll) link Road has indicated that proposed routes for the scheme are currently under review and that as part of the process an Environmental Report will be produced examining the risk of flooding. The outcome of the review should be incorporated within the SFRA when available to ensure development will not increase flood risk within the District elsewhere.

The Flood Zone Maps indicate that large areas of the floodplain of the River Penk are at risk from flooding. A new Defra initiative (Innovation Project SLD2314 - Farming Floodplains for the future – South Staffordshire Washlands) has recently been launched. Recent problems with flash flooding of large areas of land, such as those experienced in 2000, have shown that new approaches to flood risk management are needed. In the past, farmers were encouraged to drain their land and rivers were deepened to help take water away faster. This can lead to exacerbated flooding problems downstream. The Defra initiative is aiming to work in collaboration with farmers and others to encourage management of important rivers and streams flowing into them and surrounding land in lowland Staffordshire. This includes the River Penk flowing through north Penkridge. The scheme will concentrate on farmland along the whole of the river, but especially where large areas of

countryside can be allowed to flood more easily, preventing floodwater from moving into rivers too fast.

7 Flood Warning Systems and Flood Management Measures

7.1 Flood Management

Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences, and reduce the impact through influencing development in flood risk areas, flood warning and emergency response.

A Catchment Flood Management Plan (CFMP) is a high-level strategic plan through which the Environment Agency seeks to work with other key-decision makers within a river catchment to identify and agree long-term policies for sustainable flood risk management. A CFMP for the Fluvial Severn was issued during 2005. The document assesses the size, nature and distribution of the current flood risk whilst providing an indication of future flood risk in the catchments. It then provides a complementary set of long-term flood risk management policies and an indication of the types of response that could be implemented to meet them. The key policies relating to the study area are outlined in the next chapter.

The River Severn Fluvial Strategy follows on from the CFMP study and identifies preferred flood risk management measures that would deliver the CFMP policies in a specific area or river reach. Flood risk areas were defined to cover communities at risk options for flood management were then considered and technical, environmental and economic appraisals were carried out. The results of the three appraisals were used to identify a preferred option for each of the flood risk areas.

A CFMP is currently being undertaken for the River Trent catchment. At the time of this SFRA the document was still in production. It is thought that the final document will be issued shortly and following its issue should be reviewed and incorporated into the South Staffordshire SFRA.

7.2 Flood Defences

Only a few locations at risk of flooding are currently protected by permanent defences within South Staffordshire, and can be viewed in Volume 2, Tiles A1-A6. Within Penkridge, a floodbank is located along the right bank at Cattlebank extending to the confluence of the River Penk with Otherton Brook. The floodbank continues to extend along the left bank of the Otherton Brook for approximately 60m before becoming Bridge Terrace Floodwall and extending to the B5012, Mill Street. The modelling report states that the floodwalls and embankments prevent flooding up to the 1% AEP (1 in 100 year) event. Flood walls are also present along the right banks of the Otherton Brook between Mill Street (SJ 9229 1423) and the river Penk (SJ 9228 1441).

A number of council maintained defences have been identified as part of this study. Tiles A1-A7 in Volume 2 demonstrate the locations of council maintained defences. The defences include culvert inlet screens on the River Penk at Gainsborough and The Parkway in Perton (for fluvial debris to prevent blockages); balancing ponds for Perton Village on the Upper and Lower Lakes on River Penk; Brown Shore Lane Balancing Area in Essington (balancing pond with flow regulating apparatus); Bumblehole Meadows flood meadow, Wombourne (basin shaped artificial meadow to accommodate storm volumes); Waterstones Brook balancing pond (balancing pond with flow control sluice gates); Smith's Rough Catchpit Chamber (Catchpit chamber on a culverted watercourse), Wrottersley Park Road, Perton; and, Sparrow's End Lane Open Channel (Storm water storage channel running parallel to the Brook), Brewood.

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The Environment Agency NFCDD layer also identifies a number of privately owned defences within the South Staffordshire District. These include a control floodbank at Warstones balancing area (SO 8735 9655), and a series of floodbanks and retaining walls at the waterworks in Dunsley, Kinver (SJ 8482 8334).

Sections of culverted watercourse as identified within NFCDD have been demonstrated on Tiles A1-A7, Volume 2.

A study of informal defences has not been made as part of this assessment.

7.3 Flood Warning

The Environment Agency is the lead organisation on flood warning and its key responsibilities include direct remedial action to prevent and mitigate the effects of an incident, to provide specialist advice, to give warnings those likely to be affected, to monitor the effects of an incident and to investigate its causes. This requires the Agency, local authorities and the emergency services to work together to protect people and properties. South Staffordshire falls within the Central area of the Midlands Region of the Environment Agency. Prior to the Environment Agency's boundary re-organisation of the Midlands Region which occurred in April 2007, most of South Staffordshire fell in Upper Trent Area, with a small proportion to the west of the District falling in Upper Severn Area.

When conditions suggest that flood are likely, it is the responsibility of the Environment Agency to issue flood warnings to the Police, Fire and Rescue Service, to the relevant local authorities, to the public and to the flood wardens. It is the responsibility of individuals in the community to receive flood warnings via Flood warnings Direct (FWD) which passes messages over the telephone network.

A flood warning system is in operations for the main rivers within South Staffordshire and is outlined below in four stages.

- **Flood Watch:** Flooding of low lying land and roads is expected. Be aware, be prepared, watch out! The following actions are recommended:
 - Watch water levels
 - Stay tuned to local radio or TV
 - Ring Floodline on 0845 988 1188
 - Make sure you have what you need to put your flood plan into action
 - Alert your neighbours, particularly the elderly
 - Check pets and livestock
 - Reconsider travel plans



Flood Watch Areas cover the entire Upper Trent area, as can be seen in Tile E1, Volume 2. Flood Watches are issued for expected flooding, which could occur anywhere within the Flood Watch Area

but with low or minor impact. The trigger for Flood Watch is a forecast that flooding of low impact land is expected.

Flood watches are in operation within the South Staffordshire District for the River Stour & Smestow Brook & Tributaries, and the River Sow and River Penk.

- **Flood Warning:** Flooding of homes and businesses is expected. Act now! The following actions, in addition to those associated with Flood Watch, are recommended:
 - Move pets, vehicles, food, valuables and other items to safety
 - Put sandbags or floodboards in place
 - Prepare to turn off gas and electricity
 - Be prepared to evacuate your home
 - Protect yourself, your family and others that need your help

The flood warning areas in South Staffordshire area illustrated in Tile E1, Volume 2. The service is currently set up to warn properties within the 1% Annual Exceedance Probability (1 in 100 year event) and the 0.1% Annual Exceedance Probability (1 in 1000 year event). The following locations are currently covered by the Environment Agency Flood Warning System:

- River Penk from Coven to Stafford Flood Warning
 - Saredon Brook from Deepmore Farm to Coven
 - River Stour at Kinver Warning
 - River Stour from Caunsall to Wolverley
 - River Stour at Kidderminster Warning
 - River Stour from Hoobrook to Stourport
- **Severe Flood Warning:** Severe flooding is expected. There is extreme danger to life and property. Act now! The following actions, in addition to those associated with Flood Warning, are recommended:
 - Be prepared to lose power supplies - gas, electricity, water, telephone
 - Try to keep calm, and to reassure others, especially children
 - Co-operate with emergency services and local authorities
 - You may be evacuated
 - **All Clear:** Flood Watches or Warnings are no longer in force. The following is recommended:
 - Flood water levels receding
 - Check all is safe to return

- Seek advice

Within South Staffordshire District the following Severe Flood Warning areas are in operation:

- River Penk from Coven to Stafford Severe
- River Stour at Kinver Severe
- River Stour at Kidderminster Severe

7.4 Flood Response Plan

The South Staffordshire Integrated Emergency Management Plan Supporting Document 4C aims to describe the response to serious flooding in South Staffordshire and to detail to measures to be taken by the various agencies involved.

South Staffordshire Council does not provide an out-of-hours response to flooding and advises householders in distress due to property flooding to contact the Staffordshire Fire and Rescue Service for help in this situation.

South Staffordshire Council provides the following service within the District in respect to flooding and land drainage:

- Providing advice or information to help deal with a variety of flooding problems
- Investigating land drainage complaints where there is a serious risk of multiple property flooding
- Providing practical assistance where possible in a flooding situation. A limited supply of sandbags is stored at the Council's depot in Bilbrook and these can either be collected or delivered on a first come, first served basis

8 Flood Risk Management Policies

8.1 Severn CFMP

Catchment Flood Management Plans (CFMPs) are documents which aim to identify flood risk management policies for river catchments. CFMPs are high-level documents which do not stipulate how policy should be achieved, but indicate the types of response that could be implemented to deliver a policy. Two CFMPs cover the South Staffordshire District: The River Trent CFMP and the Severn CFMP. The Trent CFMP is currently in production and could therefore not be incorporated into this document. The Trent CFMP is due to be completed shortly and should be incorporated into this SFRA when available.

The generic flood risk management policies which have been considered for the Severn CFMP are:

- Do nothing – no active intervention, including flood warning and maintenance
- Do minimum – continue with maintenance of river channel and existing flood defences, including asset surveys and inspections, and continue with the existing flood warning service; it is accepted that flood risk may change over time. Activities such as promotion of local self help types of response and individual property protection would also continue
- Maintain the current level of flood risk in the face of future changes. This is likely to require intervention during the life of the Plan, such as improving existing flood defence infrastructure or introducing upstream storage
- Intervene to reduce the current level of flood risk and to maintain this level in the face of future changes
- Intervene to increase the level of flood risk in specified areas in order to gain benefits locally or elsewhere, for example flooding farmland upstream of a community to provide storage for floodwater.

For the purposes of the CFMP, the Severn catchment has been considered as 20 sub-catchments. The sub-catchment(s) relevant to South Staffordshire District Council's area are the River Worfe, River Tern and River Stour (Worcs). It should be noted that for some of the sub-catchments only very small portions of the catchments detailed in the Severn CFMP fall within the South Staffordshire District (Figure 8.1). Details of the relevant policies for these sub-catchments have been included below for completeness.

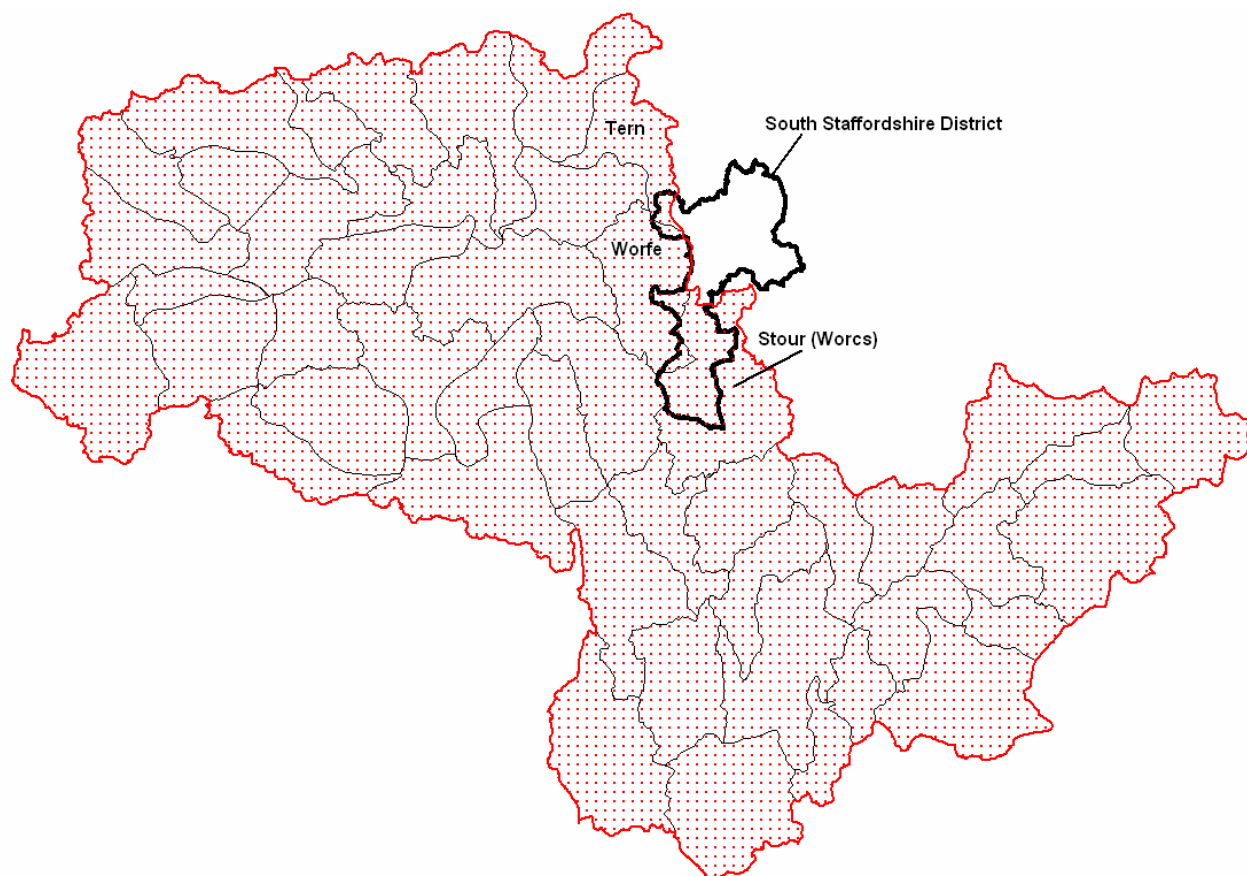


Figure 8.1: Severn CFMP sub-catchments with reference to South Staffordshire District

Given the 50-year timescale of the Plan, and the potential effects of future change scenarios, policies for short and long term for each sub-catchment have been identified. Short term policies cover the first 10 years of the Plan period, while long term policies take into account future change scenarios and cover the remaining 40 years of the Plan.

The policies identified for these catchments are as follows:

River Worfe Catchment

- **Short Term Policy (0-10 years)**

- Do minimum

- **Long Term Policy (11 - 50 years)**

- Reduce level of flood risk for larger settlements
- Maintain current levels of flood risk for smaller communities
- Recognise that the level of flood risk will increase for agricultural and undeveloped land and isolated properties

Worcestershire Stour Catchment – remainder of catchment

- **Short Term Policy (0-10 years)**
 - Do minimum
- **Long Term Policy (11 - 50 years)**
 - Reduce level of flood risk for larger settlements
 - Maintain current level of flood risk for smaller communities
 - Recognise the level of flood risk will increase for agricultural and undeveloped land and isolated properties

River Tern - remainder of catchment

- **Short Term Policy (0-10 years)**
 - Do minimum
- **Long Term Policy (11 - 50 years)**
 - Reduce level of flood risk for larger settlements
 - Maintain current level of flood risk for smaller communities
 - Recognise that the level of flood risk will increase for agricultural land and undeveloped land and isolated properties.

8.2 Policy Considerations

Given the broad nature of these policies, more specific policy considerations are put forward below to drive the Council's flood risk management policies.

To Seek Risk Reduction through Spatial Planning and Site Design:

- Use the Sequential Test to locate new development in least risky areas, giving highest priority to Flood Zone 1
- If a Sequential Test is undertaken and a site in a floodplain is identified as the only site for development, after application of Exception Test, use the sequential approach to inform the site design and seek opportunities to reduce risk
- Ensure that any redevelopment within the floodplain that is justified on wider sustainability grounds is resilient to flooding
- Identify long-term opportunities to remove development from the floodplain through land swapping
- Ensure development is 'safe'. For residential developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. The Environment Agency states that dry pedestrian access/egress should be possible for the 1 in 100 year return period event, and residual risk, i.e. the risks remaining after taking the sequential approach and taking mitigating actions, during the 1 in 1000 year event, should also be 'safe'.

- Raise floor levels above the 1 in 100 year plus climate change water level
- As some areas of the village centre of Penkridge have experienced severe surface water flooding issues (due to underlying marshland), any new development in these areas should be carefully considered, as this could exacerbate the surface water flooding problem

To Reduce Surface Water Runoff from New Developments and Agricultural Land:

- SUDS required on all new development. As outlined in section 11.3 which outlines appropriate SUDS techniques for the District, infiltration systems should be the preferred means of surface water disposal, provided ground conditions are appropriate. Above ground attenuation, such as balancing ponds, should be considered in preference to below ground attenuation, due to the water quality and biodiversity benefits they offer.
- All sites greater than 1 Ha in size require the following:
 - SUDS
 - Greenfield discharge rates
 - 1 in 100 year on-site attenuation taking into account climate change
- Set-aside space for SUDS on all allocated sites
- Promote environmental stewardship schemes to reduce water and soil runoff from agricultural land

To Enhance and Restore the River Corridor:

- Assess condition of existing assets and renew if required to ensure their lifetime is commensurate with lifetime of the development
- Seek opportunities to undertake river restoration/enhancement as part of a development to make space for water
- Avoid further culverting and building over of culverts. All new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip. Making space for water and additional capacity to accommodate climate change

To Protect and Promote Areas for Future Flood Alleviation Schemes

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset)
- Develop appropriate flood risk management policies for the Brownfield functional floodplain, focusing on risk reduction

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- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas
- Seek opportunities to make space for water to accommodate climate change

To Improve Flood Awareness and Emergency Planning

- Seek to improve the emergency planning process following future updates to the SFRA
- Encourage all those within Flood Zone 3a and 3b (residential and commercial occupiers) to sign-up to Flood Warnings Direct service operated by the Environment Agency
- Ensure robust emergency (evacuation) plans are implemented for new developments greater than 1 Ha in size

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9 Guidance on the Application of the Sequential Test

This section provides guidance on how to apply the Sequential Test.

9.1 Step One: Strategic Overview of flood risk across all potential development areas

The recommended initial step is to determine the extents of potential land allocations on large scale maps showing the most up-to-date flood zones, in accordance with PPS 25. Summary tables of flood risk issues should then be prepared for each location, indicating if the potential areas overlap Zones 2, 3, localised flooding areas or if there are records of previous flood incidents shown in the maps. It is then recommended that the summary tables and proposed locations are sent to the Environment Agency for verification. Particular care should be taken by identifying allocations that could increase flood risk elsewhere (flood incident points, localised flooding areas, flood zones) and lack of dry access.

9.2 Step Two: Flood Risk Issues in Zone 1

The next step should be to analyse all potential sites within Zone 1 by identifying those that have any flood risk issues (for example those affected by other sources of flooding or those that do not have dry access routes during flood events).

For the sites with flood risk issues, an assessment of likely significance of flood risk should then be carried out in terms of likely probability of flooding and potential consequences/flood damages (advice from a drainage specialist may be required, such as the SFRA consultant, the Environment Agency, a highways drainage engineer and/or the planning authority drainage specialist). The purpose is to identify sites with significant flood risk - high probability of flooding and significant flood damages with deep flooding and high velocities which could result in loss of property and potentially loss of life.

If a site with significant flood risk is identified within Zone 1, this would be considered as if it was in the High Probability Zone 3a, for further application of the Sequential Test in Zone 3a (see Section 9.3), bearing in mind that if a more vulnerable land use is required for the site, it will have to pass the Exception Test.

For those sites within localised flooding areas or with flood incident records where flood risk issues are not significant (for example shallow flooding and non-frequent blockages, etc), development should still be acceptable provided that adequate policies are in place for mitigating the risk (for example contributions may be required from the developer for the upgrade of the surface water system in the area).

It is important to note that most potential sites that pass the Sequential Test in Zone 1 will still require site-specific flood risk assessments. For development proposals on sites comprising one hectare or greater, the vulnerability to flooding from other sources (as well as from river flooding) and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, should be incorporated in an FRA. This need only be brief unless the factors above or other local considerations require particular attention. It is recommended that FRAs are still produced for Zone 1 sites of less than one hectare, at locations where there are records of previous flood incidents.

9.3 Step Three: Sequential Test in Zones 2 and 3

The third step is to sequentially allocate sites as described in Section 4.3 and as part of a Sustainability Appraisal (SA). It is recommended that prior to incorporating the Sequential Test within the SA, the following actions take place:

- a) Apply the measure of avoidance/prevention (see Section 5.1) by moving the boundaries of the potential sites away from Zones 2, 3a and 3b, for those cases where the loss of site area is acceptable. This is generally the case at locations where the loss in area is of the order of 10%.
- b) Provisionally adopting land uses that are fully compatible with the vulnerability classification of PPS 25, to try to avoid the need to apply the Exception Test where possible.

10 Guidance for Preparation of Flood Risk Assessments

The SFRA should be used as a starting point for flood risk assessments, to understand the level of risk posed to a particular site. General details about FRA requirements can be found in Table D.1: Flood Zones, in PPS 25. For quick reference, this table has been provided on the strategic flood risk maps in Volume 2.

It is imperative that site-based FRAs are discussed early in the planning process and submitted as an integral part of the planning application. It is a government directive that planning applications seeking approval for development within flood affected areas can be regarded as invalid if not supported by a detailed FRA. FRAs should also be incorporated into Environmental Statements, where one is required.

FRAs will be required for most proposed developments, but the level of detail will be dependant upon the existing level of flood risk posed to the site. FRAs should always be proportionate to the degree of flood risk and the scale, nature and location of the proposed development. The scope of FRAs should be agreed with the LPA, in consultation with the Environment Agency and other relevant bodies. The table matrix overleaf has been taken from the Environment Agency's standard advice on Development and Flood Risk (<http://www.pipenetworking.com/floodrisk/>). The consultation matrix sets out when the Environment Agency needs to be consulted by Local Planning Authorities, together with guidance on what that consultation should contain.

Should new developments be permitted in Flood Zones 2 and 3, it is important to consider Flood Resilient Construction. It is also important that vulnerable uses of development have safe dry access, and less vulnerable developments have safe refuges and evacuation plans.

A1 Development category	B1 Development (including boundary walls etc.) within 20 metres of the top of a bank of a Main River	C1 Includes culverting or control of flow of any river or stream	D1 Within Flood Zone 3	E1 Within Flood Zone 2	F1 Within Flood Zone 1
A2 Householder development and alterations	B2 Consult EA Note	C2 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D2 No consultation - see standard comment Note	E2 No consultation - see standard comment Note	F2 No consultation - No EA Advice
A3 Non-residential extensions with a footprint of less than 250m ²	B3 Consult EA Note	C3 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D3 No consultation - see standard comment Note	E3 No consultation - see standard comment Note	F3 No consultation - No EA Advice
A4 Change of use FROM Water Compatible TO 'Less Vulnerable' development	B4 Only consult EA if site also falls within Flood Zone 3. FRA Required	C4 No consultation - no EA advice	D4 Consult EA with FRA	E4 No consultation - no EA advice	F4 No consultation - No EA Advice
A5 Change of use RESULTING IN 'Highly Vulnerable' or 'More Vulnerable' development	B5 Only consult EA if site also falls within Flood Zone 3 or 2. FRA Required	C5 No consultation - no EA advice	D5 Consult EA with FRA	E5 Consult EA with FRA	F5 No consultation - No EA Advice
A6 Operational development less than 1 hectare	B6 Consult EA	C6 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D6 Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	E6 Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	F6 No consultation - No EA Advice
A7 Operational development of 1 hectare or greater	B7 Consult EA	C7 Consult EA with FRA showing design details of any culvert or flow control structure proposed	D7 Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	E7 Consult EA with FRA and Sequential Test Evidence (and where required confirm Exception Test has been applied)	F7 Consult EA with FRA

There are three levels of FRA which can be undertaken by a developer:

- **Level 1: Screening Study:** To identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The SFRA document, as well as the strategic flood risk maps (which reproduce the Environment Agency's Flood Maps and also show flooding from other sources) will allow the LPA to ascertain whether an FRA is required.

The Level 1 FRA should refer to Table D1 of PPS 25, which is provided on the strategic flood risk maps, when cross-referencing proposed development sites with flood risk areas.

- **Level 2 – Scoping Study:** To be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding or that the site may increase flood risk due to increased runoff. This study should confirm the sources of flooding which may affect the site. The study should also include the following:
 - An appraisal of the availability and adequacy of existing information
 - A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere
 - An appraisal of the scope of possible measures to reduce the flood risk to acceptable levels

The scoping study may identify that sufficient quantitative information is already available to complete an FRA appropriate to the scale and nature of the development.

Typical sources of information for this level of study include: Regional/Local policy statements, Regional Flood Risk Appraisals, the SFRA, CFMPs (summarised in this document), Surface Water Management Plans, consultation with the Environment Agency, Historic maps, local information and a walkover survey of the proposed site (to assess potential sources of flooding, likely routes for flood water, site's key features). A site survey to determine ground levels across the site and levels of formal and informal flood defences should also be ascertained.

- **Level 3 – Detailed Study:** To be undertaken if the Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include:
 - Quantitative appraisal of the potential flood risk to the development
 - Quantitative appraisal of the potential impact of the development site on flood risk elsewhere
 - Quantitative demonstration of the effectiveness of any proposed mitigation measures

Typical sources of information for this level of study are as for the Level 2 FRA, as well as a detailed topographical survey, detailed hydrologic survey, site-specific hydrological and hydraulic modelling study, model calibration/verification (where data exists to do so) and continued consultation with the LPA, the Environment Agency and other flood risk consultees.

The following reflects best practice on what should be addressed within a detailed FRA.

10.1 Proposed Developments Within Flood Zone 3a

All FRAs supporting proposed development within High Probability Zone 3a should assess the proposed development against all elements of the Council's flood policy, and include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will involve discussion with the Council and the Environment Agency to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change), i.e. maximum water levels, flow paths and flood extents within the property and surrounding area. The Environment Agency may have carried out detailed flood risk mapping within localised areas that could be used to underpin this assessment. Where available, this will be provided at a cost to the developer. Where detailed modelling is not available, hydraulic modelling by suitably qualified engineers will be required to determine the risk of flooding to the site.
- Whether the development contributes towards reducing flood risk. This is an important test of any new development in the context of PPS 25. The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property should also be assessed. The latter point refers to the impact that the development will have on flood flow routes and flood storage. This will require a detailed assessment to be carried out by a suitably qualified engineer.
- It is highlighted that all forms of flooding need to be considered as localised flooding may also occur, typically associated with local catchment runoff following intense rainfall passing directly over the Borough. This localised risk of flooding must also be considered as an integral part of the detailed Flood Risk Assessment.
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning.
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum.

It is essential that developers thoroughly review the existing and future structural integrity of informal defences, if present, upon which the development will rely (i.e. over the lifetime of the development), and ensure that emergency planning measures are in place to minimise risk to life in the unlikely event of a defence failure.

10.2 Proposed Developments Within Medium Probability Flood Zone 2

For all sites within Medium Probability Zone 2, a high level FRA should be prepared based upon readily available existing flooding information, sourced from the Environment Agency. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed

through, for example, the provision of raised floor levels and the provision of planned evacuation routes.

10.3 Proposed Developments Within Flood Zones 1 and 2

Within all areas of the district, the risk of alternative sources of flooding (e.g. surface water, sewage, and/or groundwater) must be considered, and sustainable urban drainage techniques must be employed to ensure no worsening of existing flooding problems elsewhere within the area.

The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular 'zones' of the area. These recommendations should form the basis for the site-based FRA.

10.4 Raised Floor Levels and Basements (Freeboard)

The raising of floor levels above the 1% probability peak flood level will ensure that the damage to property is minimised. Given the anticipated increase in flood levels due to climate change, the adopted floor level should be raised above the 1% probability flood level assuming a 20% increase in flow over the next 20 to 100 years.

It is highlighted that many of those areas currently situated within Medium Probability Zone 2 could become part of the High Probability Zone 3. This is important as it means that properties that are today at relatively low risk will, in 20 to 100 years, be within High Probability Zone 3a. It is imperative therefore that planning and development control decisions take due consideration of the potential risk of flooding in future years.

Wherever possible, floor levels should be situated a minimum of 600 mm above the 1% probability peak flood level plus climate change flood level (+20% flows), determined as an outcome of the site-based FRA. Additional freeboard may be required because of the risk of blockages to the channel, culvert or bridge. The height that the floor level is raised above the flood level is referred to as the 'freeboard', and is determined as a measure of residual risks.

The use of basements within flood affected areas should be discouraged. Where basements are permitted however, it is necessary to ensure that the basement access points are situated a minimum of 600 mm above the 1% probability flood level plus climate change. The basement must have unimpeded access and waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within Flood Zone 3 should not be permitted, while basement dwellings can be allowed in Flood Zone 2 provided they pass the Exception Test.

10.5 Developer Contributions

If new developments are placed on Flood Zones 2 or 3, it might be necessary for local infrastructure to be increased. With regards to flood risk, it might also be necessary to extend flood warning system coverage, or increase the maintenance of flood defences. The LPA and other authorities might wish to request developer contributions to cover the cost of this, and if so this should be achieved through a Section 106 Legal Agreement.

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11 Guidance for the Application of Sustainable Drainage Systems

11.1 Introduction

PPS1: Delivering sustainable development and PPS25 requires that LPAs should promote SUDS. LPAs should therefore ensure policies encourage sustainable drainage practices in their LDDs. SUDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings. Indeed, reducing the rate of discharge from urban sites to Greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the District.

11.2 Types of SUDS Systems

SUDS may improve the sustainable management of water for a site by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- reducing volumes of water flowing directly to watercourses or sewers from developed sites;
- improving water quality compared with conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open space and wildlife habitat;
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

Any reduction in the amount of water that originates from any given site is likely to be small however if applied across the catchment, the cumulative affect from a number sites could be significant.

There are numerous different ways that SUDS can be incorporated into a development. The appropriate application of a SUDS scheme to a specific development is heavily dependent upon the topography and geology of the site and the surrounding areas. Careful consideration of the site characteristics is necessary to ensure the future sustainability of the adopted drainage system. When designing surface water drainage systems, the Environment Agency states that climate change should be taken into account appropriate to the predicted lifetime of the development, and designed to account for the predicted increases in rainfall intensity, as outlined in the table in section 3.5.

The most commonly found components of a SUDS system are described below:

- Pervious surfaces: Surfaces that allow inflow of rainwater into the underlying construction or soil.
- Green roofs: Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
- Filter 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.

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- Filter strips: Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
- Swales: Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
- Basins: Ponds and wetlands areas that may be utilised for surface runoff storage.
- Infiltration Devices: Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
- Bioretention areas: Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground.
- Pipes and accessories: A series of conduits and their accessories normally laid underground, that convey surface water to a suitable location for treatment and/or disposal (although sustainable, these techniques should be considered where other SUDS techniques are not practicable).

The Environment Agency asks that as a minimum for Brownfield sites, it should be demonstrated that at least a 20% reduction in discharge rates will be achieved compared to the existing situation, to account for the effects of climate change.

For more guidance on SUDS, the following documents and websites are recommended as a starting point:

- PPS 25
- Practice Guide Companion to PPS 25
- The SUDS Manual – CIRIA C697 (2007) provides the best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems and facilitates their effective implementation within developments.
- Interim Code of Practice for Sustainable Drainage Systems, National SUDS Working Group, 2004
- www.ciria.org.uk/suds/

11.3 Application of SUDS for South Staffordshire District Council

This District has a mixture of slowly permeable and freely permeable, slightly acidic, loamy and clayey soil areas (see Section 6.2). The more permeable sites should have priority given to infiltration drainage techniques, as opposed to discharging surface water to watercourses. Where less permeability is found and infiltration techniques that rely on discharge into the existing soils are not viable (also due to a high water table, source protection zones, contamination etc), discharging site runoff to watercourses is preferable to the use of sewers. Integrated urban drainage should also be used throughout the design process.

The majority of the District has been highlighted by DEFRA as a Nitrate Vulnerable Zone (NVZ) and there are significant areas in the centre and south of the District classified as a Groundwater Source Protection Zone (GSPZ) by the EA. Any boreholes, water wells or other extraction points should also be identified and taken into account in the design process.

NVZs are generally indicative of the agricultural nature of the surrounding land and the use of fertilisers. Nitrate levels in many English waters are increasing principally due to surface water runoff from agricultural land entering receiving water bodies. The level of nitrate contamination will have an impact on the choice of SUDS and will have to be assessed for specific sites.

The GSPZ is situated over the Permo-Triassic Sandstone Aquifer and is designated as inner, outer and total catchment areas. The Inner Zones of the GSPZ are the most sensitive areas and vary in diameter from 0.1 to 0.5 Kilometres. The Outer Zones are also sensitive to contamination and vary in diameter from 1.0 to 5.5 Kilometres. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination.

Fourteen GSPZ Inner Zones have been identified by the EA in South Staffordshire and they are situated in the following areas:

- North-west area of the District: Sheriffhales and Crackleybank.
- North-east area of the District: Bednall, Horsebrook and Shareshill.
- Central area of the District: Pattingham, Lower Penn, Wombourne, Halfpenny Green and Himley.
- Southern area of the District: Two in Kingswinford and one in both Stourton and Kinver.

Runoff which is likely to be heavily contaminated must be treated by a proprietary device, which should be carefully considered to ensure the correct system is selected to remove pollutants. PPG 3 (2006) states that source control SUDS must be considered and incorporated where suitable. For example; surface water drained from a car park should implement a filter bed wherever possible before considering an interceptor device to remove contaminants.

If the local soil is contaminated then a lined system is generally required. This may include a drainage design which allows infiltration in the upper layer, but should incorporate an impermeable layer at its base to prevent contamination. In such cases lined underground attenuation storage is used to store a 1 in 100 year +20% (for climate change) storm event and discharges into a nearby watercourse.

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12 Gap Analysis

Data gaps have been assessed throughout the Level 1 SFRA data collection and review exercise. This has flagged the missing or incomplete data. It should be noted that an SFRA is a living document which should be updated as new and more detailed data becomes available.

12.1 Missing or Incomplete Data

The following data was either not received during the Level 1 of the SFRA or does not yet exist.

Data	Description	Source
Flood outlines	20year return period (or similar) flood outlines for all rivers except the Sow and Penk. These would allow production of flood zone 3b	Environment Agency (this data does not yet exist)
Flooding Data	Flooding information for trunk roads within District	Highways Agency (not received)
LiDAR data	Topographical data required for breach scenarios	Environment Agency (not received)
FRA	Developers Flood Risk Assessments	South Staffordshire DC (exist and to be incorporated into Level 2 SFRA if required)
CFMP	River Trent CFMP	Environment Agency (document in production)
CFMP	River Severn CFMP – Second Edition	Environment Agency (document in production)

12.2 Level 2 SFRA

This Level 1 SFRA will allow South Staffordshire District Council to assess their current proposed site allocations using the sequential test. This will act as a 'sieving' process, allocating as many sites as possible to Flood Zone 1. Where it is found that some sites can only be placed in Flood Zones 2 and 3, the exception test will need to be applied. In order for developments to go ahead in such areas a number of criteria should be satisfied:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage (see Figure 4 of PPS12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal
- The development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land

- A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall

A Level 2 SFRA should be viewed as rather more site specific than a Level 1 SFRA, addressing flood risk to potential development sites which have gone through the sequential test and have been located in flood zones 2 or 3.

The data required for a Level 2 SFRA within South Staffordshire will therefore depend upon which, if any, of the council's final list of preferred sites remain in Flood Zones 2 & 3 following application of the Sequential Test and hence where the Exception test needs to be applied.

In instances where Flood Zone 3b does not exist (and therefore for the purposes of the sequential test Flood Zone 3b is deemed to be equal to 3a), and a 'more vulnerable' development has been allocated in Flood Zone 3a, it may be necessary to define Flood Zone 3b using flood mapping techniques. Halcrow is able to advise on further work required if this situation arises.

It is important that a Level 2 SFRA considers the variation of flood risk in a Flood Zone due to flood risk management measures i.e. flood defences. This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding). If development is to be located behind defences, it would be necessary to model constructional failure of the defence (breach) and water levels rising to exceed the level of the defence (overtopping). It is not necessary to carry out such scenarios behind all existing defences, if no new development is to be located behind these structures. In some instances improvements to existing flood defences may be required to manage residual flood risks. Here, the SFRA should include an appraisal of the extent of works to provide or raise the flood defence to appropriate standard. Should sites become allocated behind defences, Halcrow can advise on the cost of such work, and whether existing data is suitable for this purpose.

Level 2 SFRA outputs would include:

- An appraisal of the condition of flood defence infrastructure and likely future policy
- An appraisal of the probability and consequence of breach or overtopping of flood defence infrastructure
- Maps showing distribution of flood risk across zones
- Guidance on appropriate policies for making sites which satisfy parts a) and b) of the Exception Test safe, and the requirements for satisfying part c) of the Exception Test
- Guidance on the preparation of FRAs for sites with varying flood risk across the flood zone

13 References/Glossary

- 1) **AEP** - Annual Exceedance Probability, for example 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years).
- 2) **Cannock Flood Alleviation Scheme Scoping Report – Environment Agency (Date Unknown)** – Report detailing the Ridings Brook catchment and identification of known flood risk prior to the construction of the Cannock Flood Alleviation Scheme
- 3) **Core Strategy** - The Development Plan Document which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
- 4) **DEFRA** - Department of Environment, Food and Rural Affairs Development.
- 5) **DEFRA Innovation Project SLD2314** - Farming Floodplains for the future – South Staffordshire Washlands (Accessed July 2007)
- 6) **Development Plan Document (DPD)** - A spatial planning document within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.
- 7) **Dry pedestrian egress** - Routes to and from buildings that will remain dry and allow pedestrian/wheelchair evacuation to dry land in times of flood.
- 8) **Environment Agency** - The leading public body for protecting and improving the environment in England and Wales.
- 9) **Environment Agency Flood Map** - Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.
- 10) **Environmental Stewardship** - Environmental Stewardship is a new agri-environment scheme which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. The scheme is intended to build on the recognised success of the Environmental Sensitive Areas scheme and the countryside Stewardship Scheme. Flood risk management is among its secondary objectives.
- 11) **Exception Test** - If, following application of the Sequential Test, it is not possible (consistent with wider sustainability objectives) to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed, the Exception Test may apply. PPS 25 sets out strict requirements for the application of the Test.
- 12) **Floodplain Mapping – River Stour and Smestow Brook (July 1993)** – Floodplain mapping report detailing the hydrological analysis and hydraulic modelling undertaken as part of the study.
- 13) **Flood Estimation Handbook** - The latest hydrological approach for the estimate of flood flows in UK.

- 14) **Flood Risk Management Hierarchy** - PPS 25 reaffirms the adoption of a risk-based approach to flooding by following stepped hierarchical measures at all stages in the planning process. Avoidance/prevention is the first measure, followed by substitution, control and then mitigation.
- 15) **Flood Risk Vulnerability** - PPS 25 provides a vulnerability classification to assess which uses of land maybe appropriate in each flood risk zone.
- 16) **Formal Flood Defence** - A structure built and maintained specifically for flood defence purposes.
- 17) **Functional Floodplain Zone 3a** - Defined as areas at risk of flooding in the 5% AEP (20 year) design event.
- 18) **Habitable Room** - A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted.
- 19) **Hatherton Canal Restoration – Feasibility Report (ARUP, September 2006)** - Feasibility Report detailing the proposed route of the canal and flood risk information
- 20) **High probability Zone 3a** - Defined as areas at risk of flooding in the 1% AEP (100 year) design event.
- 21) **IDB** – Internal Drainage Board, responsible for non-main rivers and drainage within their boundary area.
- 22) **Informal Flood Defence** - A structure that provides a flood defence function however has not been built and/or maintained for this purpose (e.g. boundary wall).
- 23) **JFLOW** - A computer river model based on routeing a flood calculated by Flood Estimation Handbook methodology along a river corridor the levels of which are derived from a Side Aperture Radar (SAR) remote sensed Digital Terrain Model.
- 24) **Land Swapping** - looking for long term opportunities to remove development from areas that flood at present and relocate in lower risk locations which is essentially restoration of the floodplain.
- 25) **LiDAR** - Light Detection and Ranging (LiDAR) is an airborne terrain mapping technique which uses a laser to measure the distance between the aircraft and the ground.
- 26) **Local Development Framework** - The Local Development Framework (LDF) consists of a number of documents which together form the spatial strategy for development and the use of land.
- 27) **Low Probability Zone 1** - Defined as areas outside Zone 2.
- 28) **Main River** – A section of watercourse (including the structures and devices on it used to regulate flow) which is maintained by the Environment Agency.
- 29) **‘Making Space for Water’ (Defra 2004)** - The Government’s new evolving strategy to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches, so

as: a) to reduce the threat to people and their property; b) to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles, c) to secure efficient and reliable funding mechanisms that deliver the levels of investment required.

- 30) **Medium probability Zone 2** - Defined as areas at risk of flooding in events that are greater than the 1% AEP (100 year), and less than the 0.1% AEP (1000 year) design event.
- 31) **NFCDD** – National Flood and Coastal Defence Database, owned by the Environment Agency, containing details of the location, standard and condition of all Environment Agency maintained defences
- 32) **Ordinary Watercourse (non-main river)** – Any section of watercourse not designated as a main river.
- 33) **Planning Policy Statements** - The Government has updated its planning advice contained within Planning Policy Guidance Notes (PPGs) with the publication of new style Planning Policy Statements (PPSs).
- 34) **Planning Policy Statement 25 (PPS 25): Development and Flood Risk** - PPS 25 reflects the general direction set out in 'Making Space for Water'.
- 35) **Previously Developed (Brownfield) Land** - Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land.
- 36) **Residual Risk** - The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.
- 37) **Return Period** – The probability of a flood of a given magnitude occurring within any one year e.g. a 1 in 100 year event has a probability of occurring once over 100 years. However, a 1 in 100 year event could occur twice or more within 100 years, or not at all.
- 38) **Sequential Test** - Informed by a SFRA, a planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.
- 39) **Sow & Penk Internal Drainage Board** – Policy Statement on Flood Protection and Water Level Management, 2005
- 40) **Strategic Flood Risk Assessment (SFRA)** - A Strategic Flood Risk Assessment is used as a tool by a planning authority to assess flood risk for spatial planning, producing development briefs, setting constraints, informing sustainability appraisals and identifying locations of emergency planning measures and requirements for flood risk assessments.
- 41) **Supplementary Planning Document (SPD)** - Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.

- 42) **Sustainability Appraisal (SA)** - Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
- 43) **Sustainable Development** - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (The World Commission on Environment and Development, 1987).
- 44) **West Midlands Regional Spatial Strategy** - This is a new Regional Spatial Strategy which identifies the vision for the region. It will set a new housing requirement for each District or borough.

