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South Staffordshire, Cannock Chase, Lichfield & Stafford

Strategic Flood Risk Assessment

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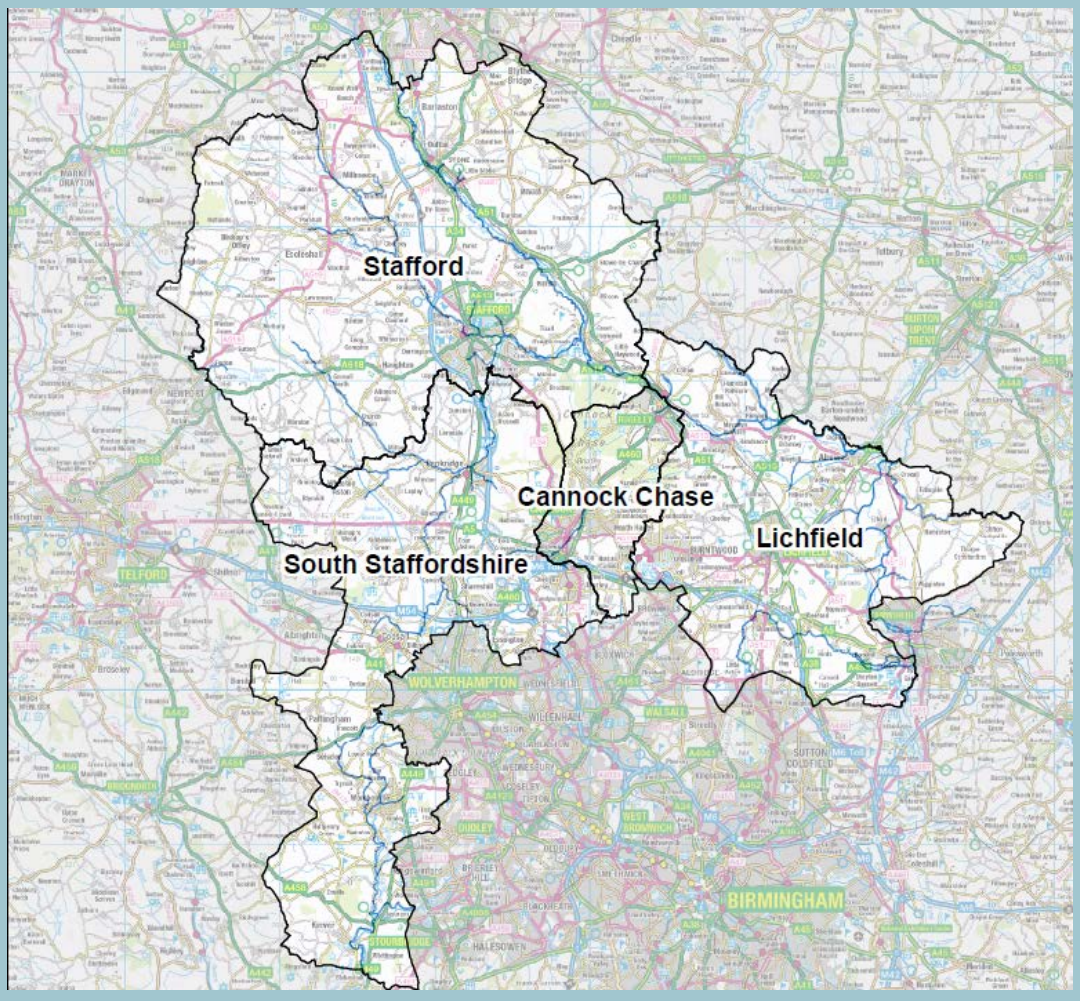

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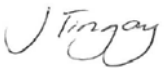
Prepared by	Jane Tingay	Signature (for file)	
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Contents

Figures

Tables

Appendices

Glossary

Term	Definition
CIRIA	Construction Industry Research and Information Association
Civil Contingencies Act 2004	The Civil Contingencies Act 2004, the bulk of which was enacted in 2005, imposed duties on local bodies to assess the risk of an emergency occurring and to maintain plans for the purposes of responding to emergencies. Emergency includes acts that would have engaged previous civil defence legislation, terrorism and events which threaten serious damage to human welfare or to the environment.
CLG	Communities and Local Government: The Government department responsible for the National Planning Policy Framework (NPPF)3 and the Technical Guidance to the National Planning Policy Framework4
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Consequence	Impact that the flood event would cause if it occurred
De facto flood defence	A structure, such as a road embankment, rail embankment or wall that was not designed to provide a flood risk management function but which provides a level of protection to a vulnerable receptor
DEFRA	Department for Environment, Food and Rural Affairs: The Government department responsible for environmental protection, agriculture, food production and food standards as well as fisheries and rural communities.
DG5 Register	A water-company held register of properties that have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DPD	Development Plan Document
Drift Geology	The name for all material of glacial origin found anywhere on land or at sea. Typically refers to deposits of Quaternary age (up to 2.6M years).
EA	EA: A non-departmental Agency reporting to DEFRA charged with protecting or enhancing the Environment and managing flood risk and pollution in England.
Exception Test	The Exception Test should be applied following the application of the Sequential Test. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, the development is safe and will not increase flood risk elsewhere.
Flood defence	Natural or man-made infrastructure used to prevent flooding
Flood Map for Surface Water (FMfSW)	National scale surface water flood modelling published in 2009. Two bandings are provided, 'Surface Water Flooding' and 'Deeper Surface Water Flooding', which indicate surface water flooding greater than 0.1m and greater than 0.3m respectively. There are outputs available for events with a 1 in 30 and 1 in 200 chance of occurring in any given year. These maps have now been superseded.
Updated Flood Map for Surface Water (UFMfSW)	National scale surface water flood modelling published in 2012. Three bandings are provided, 'High', 'Medium' and 'Low', which are the 1 in 30, 1 in 100 and 1 in 1000 probabilities, respectively. These maps are more detailed than the previous maps.
Flood risk	Flood risk is a combination of two components: the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred.

Term	Definition
Flood risk 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.
Flood Risk Vulnerability	Classifications presented within the Technical Guidance to the National Planning Policy Framework, which indicates the vulnerability of a specific land-use to flood risk.
Flood Zones	This refers to the Flood Zones in accordance with Table 1 of the Technical Guidance to the National Planning Policy Framework. For the purpose of the SFRA, where the 'actual risk' is referred to this reflects the vulnerability of land to flooding taking into account the presence of flood defences.
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist.
Flood and Water Management Act (FWMA)	An Act of Parliament which forms part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods. The Act takes forward some of the proposals in three previous strategy documents published by the UK Government – Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt's Review of the Summer 2007 floods. The Act also takes forward parts of the draft Flood and Water Management Bill and takes into account pre-legislative scrutiny of the draft Bill by the Environment, Food and Rural Affairs Committee. The Act was passed in 2010 and is currently being enacted.
Fluvial	Relating to a watercourse (rivers or streams)
FRA	Flood Risk Assessment
Freeboard	The height of the top of a bank, floodwall or other flood defence structure, above the design water level (normally the water level that would occur disregarding any effects from wave action).
FRR	Flood Risk Regulations: Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
FRSA	Flood Risk Standing Advice. The EA's website providing development and flood risk advice for Local Planning Authorities, applicants and agents.
FZM	Flood Zone Map. The term used to refer to the EA's maps that present the currently defined Flood Zones.
Groundwater	Groundwater is the term used to describe the water stored underground in areas of permeable rocks, known as aquifers. Consistently high levels of groundwater can lead to groundwater flooding.
LDD	Local Development Documents: Documents describing a Local Planning Authority's strategy for development and use of land within their area of authority. These include Local Plans, Supplementary Planning documents, and Neighbourhood Plans
LFRMS	Local Flood Risk Management Strategy. Under the Flood & Water Management Act 20105, a Lead Local Flood Authority (LLFA) must produce a strategy for managing local flood risk from surface run off, ordinary water courses and ground water.

Term	Definition
LiDAR	Light Detection and Ranging, a technique to measure ground and building levels remotely from the air, LiDAR data is used to develop DTMs and DEMs (see definitions above).
LLFA	Lead Local Flood Authority: Local Authority responsible for taking the lead on local flood risk management. The duties of LLFAs are set out in the Floods and Water Management Act5.
Local Plan	The plan for the future development of the local area drawn up by the local planning authority in consultation with the community.
Local Sources of Flooding	The flood risk posed from ordinary watercourses, surface water, groundwater, canals and small reservoirs. Any source of flooding other than main rivers, the sea and large reservoirs.
LPA	Local Planning Authority
MAFP	Multi-Agency Flood Plan. An emergency plan focussed specifically on the complex issues associated with flooding that can be prepared by a Local Resilience Forum and/or a Local Planning Authority.
Main River	Main rivers are a statutory type of watercourse in England and Wales and are usually larger streams and rivers, but may also include some smaller watercourses. A main river is defined as a watercourse marked as such on a main river map. It can include any structure or appliance for controlling or regulating the flow of water in, into or out of a main river. The EA's powers to carry out flood defence works apply to main rivers only.
NFCDD	National Flood and Coastal Defence Database. The data held in NFCDD consists of mapping data showing the areas at risk of flooding and data about the defences themselves (their type, location and condition) and the areas that benefit from those defences.
NGR	National Grid Reference
NPPF	National Planning Policy Framework (March 2012) is the document sets out the Government's planning policies for England and how these are expected to be applied, providing a framework within which local and neighbourhood plans can be produced to reflect local needs and priorities.
NPPG	National Planning Policy Guidance (March 2014) is the supporting guidance document to NPPF (as detailed above).
Ordinary Watercourse	All watercourses that are not designated main river, and which are the responsibility of Local Authorities or, where they exist, IDBs are termed Ordinary Watercourses.
PAR	Preliminary Appraisal Report. The reporting element of the Preliminary Flood Risk Assessment (PFRA) process
PFRA	Preliminary Flood Risk Assessment: A statutory requirement of the Flood Risk Regulations, which implement the requirements of the European Floods Directive. The Floods Directive required PFRAs to be published by 22 December 2011.
Policy Unit	A defined area in which the EA's CFMP policies are applied. .
Probability of Consequence	The probability of a flood event being met or exceeded in any one year. For example, a probability of 1 in 100 corresponds to a 1 per cent or 100:1 chance of an event occurring in any one year.

Term	Definition
RBMP	River Basin Management Plan. A strategic document that sets out measures to protect and improve the water environment. They have been developed in consultation with organisations and individuals and they identify the main issues for the water environment and the actions that are needed to deal with them.
Receptor	A property, business or land-use that is at risk from flooding.
Residual risk	Flood risks resulting from an event more severe than for which particular flood defences have been designed to provide protection.
RPB	Regional Planning Body
SAB	SuDS Approval Body. A body that will be set up on the commencement of the National Standards for Sustainable Drainage (likely to be the lead local flood authority) that will be responsible for approving, adopting and maintaining drainage plans and SuDS schemes that meet the National Standards for sustainable drainage systems serving two or more properties.
Sequential risk-based assessment	Priority in allocating or permitting sites for development, in descending order to the Flood Zones set out in Table 1 of the Technical Guidance to the National Planning Policy Framework, including the sub divisions in Zone 3. Those responsible for land development plans or deciding applications for development would be expected to demonstrate that there are no reasonable options available in a lower- risk category.
Sequential Test	Test to determine if there are other reasonable available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
Sewer flooding	Sewer flooding occurs when surface water or foul sewage escapes from the sewerage system due to either hydraulic inadequacy or other causes (blockage, collapse or equipment failure).
SFRA	Strategic Flood Risk Assessment
Solid Geology	The bedrock geology underlying soil or drift geology.
SoP	Standard of Protection. The actual or design standard of protection afforded by a flood defence, whether formal or informal.
SuDS	Sustainable Drainage Systems
Surface water	Any body of water that is not groundwater (for example rivers, estuaries, ponds etc) as well as temporary waters resulting from flooding, run-off etc.
SWMP	Surface Water Management Plan
WFD	The Water Framework Directive came into force in 2000. It was transposed into UK law in 2003 and it establishes a strategic framework for the management of the water environment with the aim of enhancing aquatic ecosystems, promoting the sustainable use of water and reducing water pollution.
Windfall Sites	Sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan
WIRS	Water Incident Reporting System. A database of incidents associated with United Utilities sewer network. Replaced the Sewer incident Reporting System (SIRS) in 2008.

1. Introduction

1.1 Background

A Level 1 Strategic Flood Risk Assessment (SFRA) was carried out in 2008, for each individual council, Cannock Chase, Lichfield, South Staffordshire and Stafford Borough Councils. The SFRA was produce in accordance with the now superseded Planning Policy Statement 25 (PPS 25). The objective of the assessments was to inform the plan-making process for each of the council's Local Plan.

Capita were commissioned in December 2013 to update the Level 1 SFRA documents and combined the four council Local Planning Authorities (LPA), Cannock Chase, Lichfield District, South Staffordshire and Stafford Borough (the councils appear in alphabetic order through out this document). The 2008 SFRAs were largely retained however several updates and reviews were carried out. The following summarises the scope of works for this updated document:-

- Identify and review policy updates since 2008, including the introduction of National Planning Policy Framework (NPPF) and its Technical Guidance and the National Planning Practice Guidance (NPPG).
- Identify and review new information available, including the Southern Staffordshire Surface Water Management Plan (SWMP), Phase 1 and 2.

NPPF and the supporting guidance NPPG emphasises the responsibility of the Local Planning Authority to ensure that flood risk in their areas is understood and manage using a risk-based approach as an integral part of the strategic planning process. NPPF and NPPG encourage LPAs to undertake SFRAs and to use their findings and those of other studies to inform strategic land use planning. NPPF states:

> *"A Strategic Flood Risk Assessment is a study carried out by one or more planning authorities to assess the risk to an area from flooding from all sources, now and in the future, taking account of climate change, and to assess the impact that changes or development in the area will have on flood risk".*

The NPPF and the NPPG maintain the requirement to apply a risk-based, sequential approach to the location of development in order to avoid flood risk to people and property. The key difference for flood risk policy compared to PPS25 is that the NPPF gives local authorities a wider remit to interpret and implement local policies. This makes the SFRA process all the more important in establishing suitable, reasonable and practical local development policies to manage local flood risk. Refer to Section 2 of this document for further discussion on the introduction of NPPF and NPPG, and the implications for the management of flood risk. The key differences between NPPF and the previous guidance contained in Planning Policy Statement 25 for flood risk are shown in Appendix F.

1.2 SFRA Aims

The aim of this Level 1 SFRA is to present sufficient information to enable the LPAs to apply the Sequential Test (explained further in Section 5.2) to site allocations and to assist in identifying if application of the Exception Test will be necessary. In addition the SFRA will form a reference document for use by development control officers for advising and determining decisions on windfall and allocated sites.

Where development must be located in areas of flood risk the LPA, with technical input from the developers, will be required to justify the development through application of the Exception Test. To assist the LPA in understanding the flood risk posed to developments in the floodplain, a Level 2 SFRA will be required and should present sufficient information to assist in determining if proposed developments in flood risk areas will be safe from the risks of flooding for their lifetime.

The SFRA will inform the site selection process for future development sites and provide recommendations for policies to deal with non allocated sites. The SFRA will feed into the respective

Local Authority's Local Plans and will enable informed decisions to be made relating to land use and development allocation within the respective Development Plan Documents (DPDs).

1.3 SFRA Objectives

The objective of the SFRA is to inform the plan-making process of the Cannock Chase Council, Lichfield District Council, Stafford Borough Council, and South Staffordshire Council. This SFRA has been undertaken to provide a detailed and robust assessment of the nature and extent of all types of flooding within the study area and the implications that this may have for land use planning.

The SFRA will allow the LPA to:

1. Prepare appropriate policies for the management of flood risk within the Local Plans;
2. Meet the needs of the Local Plan;
3. Identify the level of detail required for site specific Flood Risk Assessments (FRAs) in key locations;
4. Determine the acceptability of flood risk in relation to emergency planning capability;
5. Allocate appropriate sites for development;
6. Identify opportunities for reducing flood risk; and
7. Ensure the Councils meet their obligations under NPPF and NPPG.

Note that the above objectives have not changed and remain the same (updated to account for policy changes) as the 2008 SFRAs. The potential impact of growth on future flood risk is a key driver for development of the SFRA and to provide a consistent and robust evidence base for assessment of new development.

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.

1.4 SFRA Deliverables

The deliverables of this assessment are as follows:

- A technical report
- A summary document
- A series of maps

In keeping with guidance presented in the NPPF and its accompanying Technical Guide, the key outputs for the Level 1 SFRA are:

1. Plans showing the administrative boundaries of the study area, watercourse centreline, modelled watercourses, canals, defences, and Areas Benefiting from Defences (ABDs).
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.
3. An assessment of the implications of climate change for flood risk in the study area over an appropriate time period.
4. Details of any flood risk management measures, including both infrastructure and details of the flood warning areas and warnings.
5. Guidance on the application of the Sequential Test.
6. Guidance on the preparation of FRAs for development sites.
7. Guidance on the likely applicability of different Sustainable Drainage Systems (SuDS) techniques for managing surface water runoff at key development sites.

1.5 SFRA Structure

This report presents the information generated during Level 1 of the SFRA.

Section 2 of the report provides an overview the planning policy framework relevant to the study area.

Section 3 of the report describes the data collection process, presents the available data and illustrates how the available data has been used in the production of mapping and GIS (Geographical Information Systems) deliverables to meet the requirements of NPPF. Section 4 provides a summary of the flood risk within each of the council areas (more detailed has been provided in Appendix A, B, C, & D, which are referenced in the report).

Section 5 should be used by the LPA and developers seeking to understand and apply the Sequential Test. Section 6 should be employed by developers, development control and strategic planning officers where application of the Exception Test is required.

Section 7 identifies the flood risk management measures proposed or suitable for the study area in the future, with Section 8 summarising where and how SuDS can be utilised. Section 9 provides catchment wide and specific area policy recommendations and a review of the current development sites provided by the individual councils.

Section 9 and 10 provides the conclusions of this Level 1 SFRA and recommendations for further work and management of the SFRA.

2. Planning Context

This section provides an overview of the planning policy framework relevant to Cannock Chase, Lichfield District, South Staffordshire and Stafford Borough Council. The SFRA conforms to National Planning Policy. Information contained in the SFRA will provide evidence to facilitate the preparation of robust policies for flood risk management.

The SFRA 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 Local Plans, to provide robust evidence to support the Local Plans at examination and to help formulate appropriate flood risk policies. The SFRA should be used to inform the SA of Local Plans and will enable informed decisions to be made relating to land use and development allocation within the respective Development Plan Documents (DPDs).

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 each Council to establish robust policies that will ensure future sustainability with respect to flood risk.

2.1 Planning Policy framework

The UK planning system has a comprehensive hierarchy of policies and plans, beginning with national guidance which provides a broad framework through to local plans. The local plans are intended to provide clear guidance for prospective developers. They are prepared following public and stakeholder involvement and are intended to reconcile conflicts between the need for development and the need to protect the wider built and natural environment.

There have been a number of reforms in the planning system, with the National Planning Policy Framework (NPPF) brought into force in March 2012 and the National Planning Practice Guidance (NPPG) in March 2014. Regional Spatial Strategies (RSS) have been abolished (as discussed below) and Councils are currently adopting new local plans.

In May 2010 the new Government announced the abolition of Regional Spatial Strategies (RSS), which was enabled by the Localism Act 2011. The West Midlands Regional Spatial Strategy has been formally revoked, this was laid in Parliament on 24th April 2013 and came into effect on 20th May 2013. Therefore the West Midlands Regional Spatial Strategy no longer forms part of the statutory development plan for Cannock Chase, Lichfield, South Staffordshire and Stafford Borough. Local planning authorities are now responsible for establishing the right level of local housing provision in the area, and identifying a long term supply of housing land-without regional housing targets.

The following paragraphs provide an overview of the relevant policy documents and a brief explanation of their significance for the SFRA.

2.2 European (EU) policies

2.2.1 Water Framework Directive

The EU WFD was developed following a review of EU water policy. The WFD aims to help protect and enhance the quality of surface freshwater (including lakes, streams and rivers), groundwater, groundwater dependant ecosystems, estuaries and coastal water out to one mile from low water. It seeks to restore and improve water quality in rivers, coastal waters and groundwater in an integrated way. It seeks to achieve 'good ecological status' of water bodies through integrated river basin management. This is a method of ensuring all requirements and pressures on the water environment are taken into account within a river basin. The implications of the WFD on flood risk are likely to include controls on the type of flood alleviation schemes that can be implemented and that any flood alleviation schemes should also contribute to achieving 'good ecological status' through methods such as restoration of floodplains to their natural state and purpose.

2.2.2 Flood Directives

The European Directive on the Assessment and Management of Flood Risks (European Union, 2007) came into force on the 26th November 2007. The Directive was transposed into English and Welsh law as the Flood Risk Regulations in December 2009. The Directive requires member states to consider the potential impacts that domestic policies might have on flood risks and the management of flood risks to neighbouring member states. It recognises that objectives regarding the management of flood risk should be determined by the Member States themselves and should be based on local and regional circumstances.

The directive requires Member States to designate competent authorities to implement the Directive; for England, this will be the EA. The directive requires the following elements to be undertaken:

- Preliminary Flood Risk Assessments to identify areas that are at potentially significant flood risk, to be completed by 20 December 2011;
- Flood hazard maps (showing the likelihood and flow of the potential flooding) and flood risk maps (showing the impact), to be completed by 20 December 2013;
- Flood risk management plans (showing measures to decrease the likelihood or impact of flooding), to be completed by 22 December 2015; and
- Updates every 6 years thereafter that take into account the impact of climate change.

Refer to the comments made in section 3.8 for further information on the outcomes from the PFRA.

2.2.3 The Humber& Severn River Basin Management Plans (RBMP)

The RMBP are about the pressures that are facing the water environment along the Severn and Humber River, and the actions that will address them. The plans have been prepared under the WFD and are the first of a series of six-year planning cycles.

The Humber River Basin District is one of the most diverse regions in England, the two catchments that cover the council areas of interest are Staffordshire Trent Valley (including Cannock Chase, Lichfield, South Staffordshire and Stafford) and Tame, Anker & Mease (including Lichfield). A brief description of the pressure on each of these catchments is given below, which has been extracted from Challenges and Choices consultation run by the Environment Agency in 2013.

Staffordshire Trent Valley

- Changes have been made to river channels to support urban development, flood defence and water supply, all of which can impact on river wildlife and habitat. For example, throughout its length the River Sow has little natural gradient and many man-made modifications can reduce oxygen levels in the water. Wildlife habitat in the catchment needs to be improved and schemes, such as building wetlands and reedbeds, can have multiple benefits as they can also reduce flooding.

- Polluted water running off from urban areas is a particular issue around Stoke-on-Trent and Newcastle under Lyme.

- In the rural parts of the catchment agriculture is a significant land use. It comprises a mixture of arable and livestock, some intensive pig and poultry units, and horticulture. These activities are causing excessive sediment, pesticide and nutrients in the rivers.

- Groundwater is important for drinking water supply, with abstractions at Slade Heath, Seedy Mill and in the upper Blithe and Moddershall area.

- The priorities in the catchment to get to healthy waters are to: improve land management activities and reduce soil, pesticide and nutrient loss to watercourses; work with Severn Trent Water to improve the quality of sewage works discharges; reduce the impact of urban runoff from the Stoke-on-Trent and Newcastle under Lyme conurbations; and improve wildlife habitats.

Tame, Anker and Mease

- Large quantities of treated sewage are discharged into the catchment at a range of locations. As a result, large stretches of water are at risk from nutrients and ammonia, affecting the quality of protected habitats. Severn Trent Water has made improvements at a number of its works in the catchment but further investment, together with new technologies, coordinated with action on other phosphate sources is needed to reduce phosphate to the required river standards.

- In both the rural and urban areas man has modified the water environment for housing, industry and drainage reasons, which has damaged the physical habitat for wildlife.

- Improvements to habitats will be costly but there are opportunities to combine this work with other planned development.

- Within the urban areas of Birmingham and the Black Country the rivers are subject to a range of pressures, including polluted urban runoff, discharges from industrial areas and Severn Trent Water sites, and wrong connections. Historical industrial activity has also left a significant legacy of contaminated land, such as localised pollution of the groundwater in Birmingham with solvents. Local authorities need to promote sustainable and green development, for example where possible new development should install sustainable drainage systems (SuDS). These can create wildlife habitat, prevent flooding, and trap silt and pollutants.

- Polluted runoff from rural land is also a problem and further action is needed to improve land and soil management. Several drinking water sources, including Whitacre on the Blythe and Shustoke on the Bourne need protecting further to reduce the impact of pesticides and nutrients from agriculture.

At present, because of these pressures, and the higher environmental standards required by the Water Framework Directive, only 18 per cent of surface waters are currently classified as good or better ecological status/potential. 27 per cent of assessed surface water bodies are at good or better biological status now, however the plan details that this may decrease to 24 per cent when the EA we have assessed all water bodies.

The plans indicate that the aim by 2015 is 14% surface waters (rivers, lakes and estuaries) in this river basin district area is going to improve for at least on biological, chemical element or physical element, measured as part of the an assessment of status according to the WFD. This includes an improvement of 2,258 km of the river network in relation to fish, phosphate, specific pollutants and other elements.

The plan has the following aims by 2015:

- 19% of surface waters will be at good or better ecological status/potential.
- 32% of groundwater bodies will be at good status.
- 19% of all water bodies will be at good or better status. The Environment Agency wants to go further and achieve an additional two per cent improvement to surface waters across England and Wales by 2015.
- At least 29% of assessed surface waters will be at good or better biological status.

The Severn River Basin District has a very special environment. The two catchments within the basin that cover the council areas of interest are Severn Middle Shropshire (including Stafford) and Severn Middle Worcestershire (various including South Staffordshire). A brief description of the pressure on each of these catchments is given below, which has been extracted from Challenges and Choices consultation run by the Environment Agency in 2013.

Worcestershire Middle Severn

- Pollution from land management activities, particularly phosphate, pesticides and sediment is a challenging issue that can harm river life and risk drinking water sources. Nitrates are a particular issue in underground water in parts of the catchment.
- The Environment Agency is working with a number of partners, such as Wildlife Trusts, Natural England and farmers to reduce the amount of sediment being washed off the land.
- Nutrients, particularly phosphate, from sewage treatment works entering the water is a widespread issue across the catchment and affects plants and wildlife. A number of the larger works such as Barnhurst in Wolverhampton have already been improved. However, Severn Trent Water needs to do more to reduce phosphate from other treatment works in the catchment. Nutrient planning is also required to make sure that when farmers use sewage sludge as a fertiliser it does not run into rivers.
- Another issue in the catchment is caused by the significant modifications that have been made to the rivers, for example culverting of brooks. This has resulted in habitat loss and barriers that prevent fish moving freely. Removing weirs, particularly on the downstream sections, including on the River Stour, is a priority.
- There are historical issues in parts of the catchment, with low flows being caused by too much water being taken from underground water to provide drinking water supplies. Some of the impacts have been temporarily addressed through flow augmentation. The Environment Agency is considering options for a long term solution, which may include tighter restrictions on water users.
- The priorities in the catchment to achieve healthy waters are to improve land management, work with Severn Trent Water and land managers to reduce of the amount of phosphate entering the water; tackle the effect of man made changes by improving river flow and allowing fish to move more freely; and coordinate action in urban areas to improve river habitat and water quality.

Shropshire Middle Severn

- The priorities in this catchment to achieve healthy waters are to improve land management in order to reduce pesticide and nutrient loss to rivers and the Meres; reduce the amount of phosphate entering waters; reduce the effect of man made changes by removing obstacles to allow fish to move freely; and to deal with the historic contamination legacy around Telford.

At present, because of these pressures, and the higher environmental standards required by the Water Framework Directive, only 29 per cent of surface waters are currently classified as good or better ecological status. 37 per cent of assessed surface water bodies are at good biological status now, although we expect this to change to 32 per cent when we have assessed all water bodies.

For the River Severn, the plan indicates that the aim is by 2015, 17% surface waters (rivers, lakes and estuaries) in this river basin district area going to improve for at least on biological, chemical element, measured as part of the an assessment of status according to the WFD. This includes an improvement of over 1860 km of river, in relation to fish, phosphate, specific pollutants and other elements.

The plan has the following aims 2015:

- 34 per cent of surface waters will be at good or better ecological status/potential.
- 65 per cent of groundwater bodies will be at good status
- 35 per cent of all water bodies will be at good or better status by 2015. The Environment Agency wants to go further and achieve an additional two per cent improvement to surface waters across England and Wales by 2015.
- At least 38 per cent of assessed surface waters will be at good or better biological status.

2.3 National Planning Policies

2.3.1 Flood and Water Management Act, 2010

The Flood and Water Management Act 2010 places significantly greater responsibility on LA to manage and lead on local flooding issues. The Act and Regulations together set out the requirements and targets Local Authorities need to meet, including:

- Taking an active role leading flood risk management as Lead Local Flood Authorities (LLFAs).
- Cooperating with other relevant authorities to manage local flood risk.
- Duty to investigate flood incidents and report upon them.
- Maintain an 'Asset Register' of assets that have a significant influence on local flood risk.
- Designate 'features' that have a significant influence on local flood risk.
- Regulation of works on 'ordinary watercourses'.
- Development and implementation of Local Flood Risk Management Strategies (LFRMS).
- Responsibility for first approval, then adoption, management and maintenance of Sustainable Drainage System (SuDS) where they service more than one property (not currently enacted – expected to be enacted in 2014).

The Flood and Water Management Act also clarifies three key areas that influence development:

- Sustainable drainage (SuDS) - the Act makes provision for a national standard to be prepared on SuDS. Developers will be required to obtain Local Authority approval for the SuDS in accordance with the standards, likely with conditions. When they are designed and constructed robustly, local authorities will be required to adopt and maintain the SuDS that serve more than one property.
- Flood risk management structures - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.
- Permitted flooding of third party land - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

2.3.2 National Planning Policy Framework (NPPF)

The National Planning Policy Framework was issued in March 2012 and outlines the national policy including on development and flood risk assessment. This replaced with immediate effect national policy including Planning Policy Statement 25 – Development and Flood Risk. A table summarising the key differences between PPS25 and NPPF is provided in Appendix F. The table includes impacts on existing local policy.

The NPPF requires Local Plans to be supported by a SFRA and develop policies to manage flood risk from all sources. Advice should be sought from the EA and other relevant flood risk management bodies, such as LLFAs and IDBs. In developing policies, Local Plans should apply a sequential, risk-based approach to the location of development in order to avoid flood risk to people and property, to manage any residual risk, and to take account of the impacts of climate change.

In general, these requirements will be met by:

- Applying the Sequential Test and where appropriate and necessary, the Exception Test.
- Safeguarding land from development that is required for current and future flood risk management.

- Using opportunities offered by new development to reduce the causes and impacts of flooding.
- Seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations where climate change is expected to increase flood risk to existing development.
- Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The SFRA will be the basis for applying this test and a sequential approach should be used in areas known to be at risk from any form of flooding.
- Following application of the Sequential Test, if it is not possible for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied. It should only be applied if appropriate to the type of development and flood zone and if consistent with wider sustainability objectives.
- For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA. It must also be demonstrated within a site specific FRA that the development will be safe for its lifetime without increasing flood risk elsewhere and where possible reducing flood risk.
- When determining planning application, LPA should ensure that flood risk is not increased elsewhere and should only consider development in areas at risk from flooding where it can be demonstrated that a sequential approach has been taken, that the development is appropriately flood resilient, that residual risks can be managed and that priority is given to the use of sustainable drainage systems.

2.3.3 Planning Practice Guidance

The Planning Practice Guidance was launch in March 2014 by the Department for Communities and Local Government (DCLG). The guidance provides additional guidance to the Local Planning Authorities to ensure effective implementation of the planning policy set out in the National Planning Policy Framework on development in areas at risk of flooding. The guidance is now provided as a web-based resource, and is linked to the National Planning Policy Framework and other relevant planning practice guidance.

The Planning Practice Guidance provides supporting information on:

- The definition of Flood Zones.
- Flood risk vulnerability of different land uses.
- The application of the sequential approach and Sequential and Exception Tests.
- FRA at the strategic and site level.

The Practical Planning Guidance clarifies that the SFRA refines information on the probability of flooding by taking into account information on other sources of flooding and, where information is available, the effect of climate change. The document indicates that LPAs should undertake a Strategic Flood Risk Assessment to fully understand that flood risk in the area to inform and support Local Plan. The SFRA should be prepared in consultation with the EA, lead local authorities, local planning authorities' own functions of emergency response and drainage authorities and where appropriate internal drainage bodies. The SFRA should also inform appropriate flood risk management policies, the sustainability appraisal of the development plan documents and will form the basis of applying the Sequential and Exception Test in the development allocation and development control process.

2.4 Local Planning Policies

2.4.1 New Local Plans

Local plans should be prepared by each Local Planning Authority (LPA) in accordance to national policy, section 20 of the Planning and Compulsory Purchase Act 2004 and the NPPF. The Town and Country Planning (Local Planning) (England) Regulations 2012 now establishes that the Local Plan is any document which compromises the Core Strategy, Site Allocations or Development Control Policies.

South Staffordshire currently have an adopted Local Plan in the form of the Core Strategy (which includes development control policies), but do not have an adopted Site Allocations Document.

Cannock Chase, Lichfield and Stafford are preparing new Local Plans which are close to adoption.

2.4.2 Cannock Chase 1997 Local Plan

The adopted Development Plan for the District is the Cannock Chase 1997 Local Plan which forms the principle basis for which development is promoted and controlled within the area. This plan will soon be replaced with the Cannock Chase Local Plan.

The most up to date document provided by the Council is the Cannock Chase Local Plan (Part 1) Proposed Submission 2013. This plan sets out the strategic and development management policy for the District up to 2028 to help shape the way in which its physical, economic, social and environmental characteristics will change. The plan combines the Core Strategy and Rugeley Town Centre Area Action Plan into one document.

In the previous plan Policy PEP3 was the relevant policy to the SFRA. This policy has been replaced by two policies CP16 and RTC11, within the updated plan. The policies are detailed below:

Policy CP16 – Climate Change and Sustainable Resource Use (Core Strategy, Section 1)

1. The Council, working with partners, will tackle climate change and ensure sustainable resource use via the promotion and positive consideration of initiatives and development proposals that:

> *g. appropriately account for both current and future potential levels of flood risk. Via the strategic approach (Policy CP1) developments are guided away from areas of flood risk. However where there are no alternative options available and development is required within the highest risk zone 3b, flood risk shall be managed through upstream alleviation in order to bring development in line with national planning policy. Land for key infrastructure requirements, namely for the formal flood alleviation scheme for the Rising Brook at Rugeley, will be safeguarded via the strategic approach. The need for alleviation of surface water flood risk in the higher risk areas of Rugeley and Cannock is also identified and will be promoted via partnership working with the Lead Local Flood Authority.*

2. All residential and non-residential development proposals should contribute to tackling climate change and promoting sustainable resource use by:

> *c. Avoiding developments in high risk flood areas as per the Strategic Flood Risk Assessment. The sequential and exceptions tests will be applied and flood risk alleviation may be required, taking into account cumulative impacts upon risk in the catchment. Assessments should also consider flood risk from other sources as appropriate, particularly surface water, by having regard to the Surface Water Management Plan. Surface water run-off rates should be limited to the Greenfield equivalent in areas upstream of flood risk problem areas wherever possible, such as the Rising Brook in Rugeley and Ridings/Saredon Brook in Cannock;*
>
> *d. Protection of the water environment. This can be achieved by assessing options for (and implementing where viable) incorporating Sustainable Drainage to improve water quality, including consideration of green roofs; de-culverting watercourses; attenuating surface water discharges to combined foul/surface water systems and reducing overflows. Developments should ensure there is adequate on and off-site drainage infrastructure in place to serve their needs without posing a risk to the environment, including foul drainage and waste water treatment capacity.*

Policy RTC11 – Flood Alleviation Measures (Rugeley Town Centre Area Action Plan, Section 2)

To reduce existing flood risk affecting the town centre, a formal flood alleviation scheme will need to be constructed within the open land west of Western Springs Road, A460 (formerly A51). As a minimum, the scheme shall hold back functional flood plain flows and ensure that all site allocations, currently in flood zone 3B within the AAP are outside the functional flood plain, and will enable vehicular access. This scheme will be delivered in partnership through financial contributions from the EA and appropriate town centre developers and shall be undertaken to the satisfaction of the EA. Implementation of the scheme will be required prior to regeneration of the Rugeley Market Hall/Bus Station site (Policy RTC6) and also the Market Street Garages Site (Policy RTC5) unless flood risk assessment indicates otherwise in accordance with policy RTC5.

2.4.3 Lichfield Local Plan 1998

Lichfield's Local Plan was adopted in June 1998, this plan covered the period from 1998-2001. This plan was later updated and adopted until 27th September 2007. A comprehensive schedule of saved policies now contained within the Local Plan was approved by the Government Office in September 2007. Saved policies will remain until replaced by policies in the emerging Local Plan.

A new unadopted Local Plan Strategy has been produced for Lichfield. , which sets out the strategic and development management policy for Lichfield District for a 15 year period to help shape the way in which its physical, economic, social and environmental characteristics will change. The following policies relating to flooding have been taken from the Local Plan: Strategy (Proposed Submission) July 2012.

Core Policy 1: The Spatial Strategy

Development proposals will be expected to make efficient use of land and prioritise the use of previously developed land (PDL). Proposals will promote sustainability by minimising and/or mitigating pressure on the natural, built and historic environment, natural resources, utilities and infrastructure and areas at risk of flooding, whilst also mitigating and adapting to climate change and reducing the need to travel.

Core Policy 3: Delivering Sustainable Development

- *Give priority to utilising ground infiltration drainage techniques and including sustainable drainage techniques and incorporate other sustainable techniques for managing surface water run-off such as green roofs in new development and in retro-fitting where historic flooding events have been identified;*
- *Guide development away from known areas of flood risk as identified in the Strategic Flood Risk Assessment (Level 1) and Surface Water Management Plan. Where development is proposed in flood risk areas a site-specific flood risk assessment*
- *Minimise levels of pollution or contamination to air, land, soil or water, including noise and light pollution and avoid unacceptable uses within source protection zone 1 areas to safeguard water resources and ensure water quality.*

Detailed Policies for the main settlements within Lichfield Council are provided. A need for 'The provision and maintenance of sustainable drainage systems and flood mitigation measures' is recognised within the majority of the settlement specific policies.

2.4.4 South Staffordshire Local Plan

The South Staffordshire Core Strategy (Local Plan) Development Plan Document was adopted in December 2012. This document replaces the South Staffordshire Local Plan 1996. The Local Plan will help shape a sustainable future for the South Staffordshire. The Local Plan sets out the spatial planning strategy for the District up to 2028.

As part of the Local Plan a planning strategy known as a 'Core Strategy' has been prepared for South Staffordshire and adopted. The Core Strategy is at the heart of the Local Plan and sets out the long-term vision, objectives and planning policies to deliver the vision and secure a sustainable future. It has been informed by and draws upon other strategies produced by the Council and other

organisations, particularly the Sustainable Community Strategy. The Core Strategy is the first major component of the Local Plan to be adopted.

The Core Strategy presents the 'Strategic Objectives' and then identify a series of 'Core Policies'. The strategic objectives are the higher level or 'strategic' policies to guide the growth and development of South Staffordshire and they are then followed and supported by more detailed 'Development Policies' which are intended to manage the types of land uses and development that will take place in South Staffordshire over the lifetime of the plan. Strategic Objective 7, to reduce the effect of society on the environment, and adapt to the impacts of climate change, presents the policy that is important to flood risk, Core Policy 3, elements of which are clarified in greater detail in Policy EQ7.

Core Policy 3: Sustainable Development and Climate Change

The Council will require development to be designed to cater for the effects of climate change, making prudent use of natural resources, enabling opportunities for renewable energy and energy efficiency and helping to minimise any environmental impacts. This will be achieved by:

j) guiding development away from known areas of flood risk as identified in the Strategic Flood Risk Assessment, Surface Water Management Plan and consistent with NPPF;

k) ensuring the use of sustainable drainage (Sustainable Drainage Systems) in all new development and promoting the retrofitting of SuDS where possible;

l) ensuring that all development includes pollution prevention measures where appropriate to prevent risk of pollution to controlled waters.

Policy EQ7: Water Quality

All planning applications must include a suitable Sustainable Drainage (SuDS) scheme, and greater detail will be considered in a Sustainable Development Supplementary Planning Document. Developers are advised to refer to the guidance on SuDS contained in section 4.3 of the Southern Staffordshire Outline Water Cycle Study.

2.4.5 Stafford Borough Local Plan 2001

Stafford Borough is centrally placed within Staffordshire. The Stafford Borough Local Plan (2001) was adopted on 18th October 1998. The plan contains policies directing development proposals and promoting appropriate land use. The Local Plan, as part of the Planning and Compulsory Purchase Act 2004, was saved in its entirety until 27th September 2007. Following this, The Secretary of State has now made a decision on the policies that should be saved beyond this date.

Similar to the other councils (except for South Staffordshire) Stafford Borough New Local Plan is close to adoption, anticipated in Summer 2014. The following policies are relevant to flood risk management Policy N1 and Policy N2, which have been extract from the new Local Plan:

Policy N1

Design

To secure enhancements in design quality, development must, at a minimum, meet the following principles:

Use

a. Ensure that, where relevant the scale, nature and surroundings, major applications are comprehensively master planned or, where appropriate, are accompanied by a development brief;

b. Be designed, sited and grouped in order to provide access for all;

c. New development of ten dwellings or more should demonstrate compliance with the Building for Life 12 assessment and any successor documents, unless it makes the development unviable or it has been sufficiently demonstrated, through a Design & Access Statement, that each of the twelve Building for Life questions has been optimally addressed, or conversely why it is not practical or appropriate to do so;

Form

d. Incorporate sustainable construction and energy conservation techniques into the design in accordance with Policy N2;

e. Require the design and layout to take account of noise and light implications, together with the amenity of adjacent residential areas or operations of existing activities;

f. Retention of significant biodiversity, landscaping features, and creation of new biodiversity areas that take into account relevant local information and evidence;

g. Include high design standards that make efficient use of land, promote activity and takes into account the local character, context, density and landscape, as well as complementing the biodiversity of the surrounding area;

h. Designs must have regard to the local context, including historic views and sightlines, and should preserve and enhance the character of the area with locally distinctive materials;

Space

i. Strengthen the continuity of street frontages and enclosure of space;

j. Development should clearly distinguish between public and private space, and provide space for storage, including for recycling materials;

k. Streets and public open spaces are designed to be usable, easy to maintain and productive for the amenity of residents by being overlooked to create a safe environment;

l. Require the design and layout of new development to be safe, secure and crime resistant, by the inclusion of measures to address crime and disorder through environmental design and meet "Secured by Design" Standards;

n. Where appropriate, development should ensure that there is space for water within the development layout to facilitate the implementation of Sustainable Drainage Systems (SuDS).

Movement

o. Ensure that places inter-connect using important routes and linkages, including Rights of Way, which are pedestrian, vehicle and cycle friendly, whilst allowing for ease of movement, legibility and permeability through a clearly defined and well structured public realm;

p. Ensure car parking is well integrated and discreetly located.

Policy N2

Climate Change

All development must incorporate sustainable design features to facilitate a reduction in the consumption of natural resources, improve the environmental quality and mitigate against the impact of climate change. Proposals must take particular account of the need to ensure protection from, and not worsen the potential for, flooding.

Sustainable Drainage

All new development will be expected to incorporate Sustainable Drainage Systems (SuDS). Each system should:

1. Discharge clean roof water to ground via infiltration techniques such as soakaways, unless demonstrated by an infiltration test that due to ground conditions or underlying contamination, this is not possible;

2. Limit surface water discharge to the Greenfield run-off rate or, where this is demonstrated to not be viable, a minimum of 20% reduction from the existing situation;

3. Improve the water quality of run-off by ensuring that foul and surface water run-off are separated;

4. Protect and enhance wildlife habitats, existing open spaces / playing fields, heritage assets, amenity and landscape value of the site, as well as being sympathetically designed to meet the needs of the local community, based on the scale and location of the new development. All new development must provide adequate arrangements for the disposal of foul sewage, trade effluent and surface water to prevent a risk of pollution. Groundwater resources and surface water bodies will be safeguarded, and any development leading to pollution or degradation will not be permitted, unless adequate mitigation measures can implemented that avoid adverse impacts. Development will not be permitted in locations where adequate water resources do not exist, or where the provision of water would be detrimental to the natural environment. Any development that could lead to the degradation of the Water Framework Directive (WFD) status of the waterbody should not be permitted.

2.4.6 Southern Staffordshire Outline Water Cycle Study (July 2010)

The study area for the Water Cycle Study (WCS) covers the administrative areas of Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire and Cannock Chase, with a combined area of 1,450km^2. The WCS has been produce in consultation with the five Local Authorities, as well as Staffordshire County Council, the EA, Severn Trent Water Limited (STWL), South Staffordshire Water (SSW) and British Waterways.

The WCS considers the following issues (detailed below), and addresses the constraints that may impact future development and discusses the improvements necessary to achieve the required level of development through the planning period, until 2026:

- Flood Risk.
- Water Resources.
- Water Supply.
- Wastewater Collection.
- Wastewater Treatment.
- Water Quality and Environmental Issues.
- Demand Management.

The WCS provides Local Authority specific policy recommendations (Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District respectively) and general study area policy recommendations are provided at the end of the WCS. Lastly the WCS provides a constraints table to assist the Councils in their comparison of the viability and potential cost and time implications of the development of various sites.

2.5 Surface Water Management Plan Phase 1 & 2

The Surface Water Management Plan (SWMP) Phase 1 & 2 was commissioned by Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire and Cannock Chase Council.

The Phase 1 SWMP identified five settlements as being at high risk of surface water flooding (based upon historic flood occurrences, future flooding potential and severity of flooding) and also identified locations for a relatively high number of potential development sites. These settlements were recommended to be subject to the Phase 2 SWMP.

- Stafford town.
- Lichfield City.
- Cannock Town (including Norton Canes).
- Tamworth.
- Penkridge (South Staffordshire).

For all the proposed development sites outside these five listed settlements the developer should, through the precautionary principle, ensure that water issues are sufficiently addressed and agreed with the EA, as part of a site specific FRA.

Phase 1 SWMP recommended that the following councils should review the settlements detailed below:

- ***Cannock Chase:*** Cannock, Rugeley and Norton Canes.
- ***Stafford:*** Stafford, Eccleshall and Copmere End, Salt and Weston, Stone, Walton and Norton Bridge and Yarnfield.
- ***Lichfield:*** Lichfield City, Armitage and the Longdons, Burntwood, Elford, Little Aston, Millie Oak and Fazeley and Whittington.
- ***South Staffordshire:*** Codsall, Great Wyrlery and Cheslyn Hay, Penkridge, Perton and Wombourne.

These areas have been highlight as having a high overall risk of surface water flooding. All the areas that have been highlight in the SWMP should be reviewed by the Council. If there are proposed developments at these locations the SWMP should be reviewed by developers and the Lead Local Flood Authorities (LLFAs) should be liaised with, as part of the site specific FRAs.

For the settlements that are not included in more detail (in the SWMP Phase 2) the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.

The Phase 1 SWMP indicates that the Councils and developers should ensure appropriate SuDS techniques are implemented into all new developments (as per the Floods and Water Management Act) and, as far as possible retrofitted into existing settlements, especially where historic flood events have been identified.

Phase 2 SWMP was carried out on the five settlements detailed above. Phase 2 identified a number of key strategies, those relevant to the SFRA are detailed below:

- All information contained within the SWMP should be considered when site specific FRAs are undertaken for developments within the area.
- Installation of SuDS in all new developments, with the aim to reduce runoff below Greenfield rate in the key drainage areas upstream of the town (the EA advise this is set to an annual rate of all return periods. We recommend the Council discuss the most appropriate rate with the EA).
- Retrofitting of SuDS in existing developments where feasible.
- Investigation into dual use of residential roads as flow pathways, and reduction in private gardens / driveway paving where possible.

2.6 Preliminary Flood Risk Assessment

The Preliminary Flood Risk Assessment (PFRA) for Staffordshire was completed in March 2011. The PFRA is aimed at providing high level overview of flood risk from all sources of flooding within the local area, included consideration of surface water, groundwater, ordinary watercourses and canals for both historical and future.

The study area for the PFRA is the County of Staffordshire located in the West Midlands region of England. Staffordshire County has two tier of Local Government which, in addition to the County Council also comprises with District/Borough Councils; Newcastle under Lyme Borough; Tamworth Borough; South Staffordshire; Cannock Chase; Lichfield District; Stafford Borough; Staffordshire Moorland District and East Staffordshire Borough.

Data collection process for the PFRA indicated that there are a lot of gaps in the available data. The PFRA indicated that there was limited or missing information in the past flood records for Staffordshire, and the majority of information is from anecdotal sources. Therefore there should be a degree of caution when interpreting the data.

The national assessment carried out by the EA and DEFRA identified the West Midlands as one of the ten Indicative Flood Risk Areas (IFRA) across England. The southern edge of South Staffordshire District and Lichfield District are included in the West Midlands Indicative Flood Risk Area. Historical incidences of flooding within the Staffordshire area of the IFRA have been identified (although the only significant flood event which provides overlap in these marginal areas of Staffordshire is the summer 2007 event). Although there are no significant urban areas within the boundary of the IFRA in Staffordshire, the catchments within the IFRA are linked to settlements downstream within the County boundary, therefore the southern edge of Staffordshire is to remain within the IFRA. As part of the PFRA there were no additional Indicative Flood Risk Areas identified in Staffordshire.

The PFRA provided structured actions for the each of the Council to implement, support and progress as a part of local flood risk management in the future.

2.7 Environment Agency Planning Policy

2.7.1 Catchment Flood Management Plans (CFMP)

Catchment Flood Management Plans (CFMPs) are the EA's high level strategic plans for the sustainable management of flood risk at a river catchment scale. 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 documents seek to identify those factors that influence flooding in an area, and through liaison with key decision makers identify broad policies for the long term management of flood risk in a sustainable manner. Flood risk management can reduce the probability of occurrence, through the management of land, river systems and flood defences, and reduce the impact though influencing development in flood risk areas, flood warning and emergency response.

This Level 1 SFRA study area is covered by two CFMPs, the River Trent and Severn CFMPs. The River Trent CFMP covers all four Councils, whereas South Staffordshire is the only Council included in both the River Trent and Severn CFMPs.

2.7.1.1 River Severn CFMP

The River Severn catchment area is approximately 11,000km^2. The River Severn CFMP details that the River Severn catchment has a long history of flooding with the most recent significant event occurring during the Summer of 2007 due to a period of exceptional rainfall.

The main sources of flood risk for people, property, infrastructure and the land are:

- River flooding from the River Severn and its tributaries.
- Surface water drainage and sewer flooding which has occurred in numerous locations throughout the catchment.

For the River Severn CFMP the Severn catchment area was divided into 20 sub-sections called policy units. The Summary Severn CFMP combines with adjacent policy units that are similar in physical characteristics, sources of flooding and level of risk. The Sub Area relevant to South Staffordshire is, Sub Area 5 Telford, Black Country, Bromsgrove, Kidderminster & Coventry Cluster.

The preferred policy selected for this Sub Area 5 is Policy Option 5, which is *'Area of moderate to high flood risk where we can generally take further action to reduce flood risk'*. It should be noted that South Staffordshire District Council is only a small portion of sub area 5. The CFMP indicates that within the South Staffordshire area there is under 100 properties at risk of flooding for the 1% annual probability flood event.

2.7.1.2 River Trent CFMP

The River Trent catchment area is approximately 10,000 km^2. The major tributaries in the catchment that join the River Trent are located in the following areas:

- The Peak District (Dove, Derwent, and Erewash).
- Central Midlands (Sow, Tame and Soar).

- Lower Catchment (Torne and Idle).

The River Trent CFMP has been broken up into 10 distinctive sub areas, The Level 1 SFRA study area is located in two of the ten sub areas. Sub Area 6 Mid Staffordshire and Lower Tame which covers Lichfield, South Staffordshire and east Stafford, and Sub Area 7 West Staffordshire which covers Cannock Chase, South Staffordshire and west Stafford.

The preferred policy selected for Sub Area 6 is Policy Option 6 *'Areas of low to moderate flood risk where required action will be taken to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits'*. The EA long term solution for this area is to develop a framework to deliver a sustainable approach to flood risk management that considers the natural function of the river and reduces long term dependence on raised flood defences. This will also include identifying opportunities to better utilise areas of natural floodplain to store floodwaters and to attenuate rainwater that will reduce flood risk within this sub area and downstream.

The preferred policy selected for Sub Area 7 West Staffordshire is Policy Option 4 *'Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change'*. The risks in the long term are expected to rise and will required appropriate management in the future.

2.7.2 Flood Risk Management Strategies

The EA advocates a strategic approach to flood risk management on a 'whole catchment' basis. In line with this thinking, a number of Flood Risk Management Strategies have been undertaken by the EA within the Midlands region, the Fluvial Trent Strategy and the River Tame Flood Risk Management Strategy.

2.7.2.1 The Fluvial River Trent Strategy

In 2005, the EA produced a Flood Risk Management Strategy for the River Trent. The study spanned from Stoke-on-Trent, where the River Trent's head of Main River is located, to the tidal limit at Cromwell Weir downstream of Newark, a distance of some 200km. The principal aim of the Fluvial Trent Strategy is to identify the preferred high level approaches for sustainable management of flood risk along the River Trent corridor over the next 50 years.

The strategy is limited to the Trent corridor only, and while local catchment wide solutions (i.e. of the tributaries) are appraised in some instances, flood risk along the Trent corridor is mainly considered. The Trent flows through the length of Stafford Borough, directly through Stone. Here, the floodplain has been left relatively undeveloped and as such, flood risk posed by the River Trent is relatively low. In fact, Stone does not feature on the table which shows flood risk hotspots along the Trent corridor.

The Trent was split into 99 independent flood cells and flood risk management options which were appraised for each. The flood cells from the south of Stoke-on-Trent to just upstream of Rugeley (flood cells 1.10 to 2.7) are not described as key flood risk hotspots, and for this reason, flood risk management options and subsequent appraisals are not considered in the strategy. However, at the south-eastern end of Stafford Borough, a flood cell begins just downstream of the Trent / Sow confluence to the Borough's boundary with Lichfield District (flood cell 2.8). This comes under the 'Rugeley' Flood Risk Location, and the option includes creating online storage by reducing aqueduct pass through flow at the northern end of Rugeley. This would require a dam to encompass flow and the storage would alleviate flood flows downstream. This option was not recommended because it was felt that the aqueduct might have historic significance and might increase flood risk upstream, which would affect Stafford Borough.

Nonetheless, the strategy identifies a number of options which are considered best practice and are recommended. These include:

- SuDS: either retrofitted or on new developments.
- Development Control: appropriate measures to restrict inappropriate developments.
- Land Management: Appropriate land management techniques that could reduce surface runoff.

- Floodplain Obstructions: the removal of such obstructions, where appropriate, to improve local conveyance.

2.7.2.2 The River Tame Flood Risk Management Strategy

The River Tame Flood Risk Management Strategy (2011) includes Birmingham, the Black Country and Tamworth. This Strategy examines the options available for managing flood risk from the River Tame. The objectives of the Strategy are:

- Understanding and raising awareness of the risk of flooding on the River Tame, both now and in the future.
- Developing a plan for the management of flood risk on the River Tame that is sustainable, taking into account future changes in the environment (human, built or natural) and the climate.
- Ensuring all proposals are technically feasible, economically viable, socially acceptable and environmentally appropriate (by meeting the strategic environmental objectives).
- Seeking opportunities for environmental improvements wherever possible through the recommendation of integrated flood risk management measures.
- Working in partnership with and encouraging co-operation between stakeholders.

This document summarises the management of flood risk in the area for the next 100 years (from 2009 to 2109).

The River Tame is the largest tributary of the River Trent. The total catchment is approximately, 1,500 square kilometres and the river is 100 kilometres long. Over 1.7 million people live within the catchment area. The River Tame starts as two distinct watercourses: the Oldbury Arm and the Willenhall Arm, in the Black Country. These combine at Bescot and continue eastwards through Birmingham before changing direction at Water Orton. The river then flows north through Tamworth to the confluence with the River Trent.

There is an existing flood risk management scheme in place in the upper catchment of the River Tame, which provides a varied level of flood risk management. This is a combination of channel maintenance, earth embankments, flood walls and flood water storage areas. This system was designed in the 1970s to reduce risk of flooding to an event which at that time had a 2% annual probability of occurring. Other localised flood defences exist downstream at Water Orton, Minworth, Whitacre Heath, Fazeley and Tamworth. Through Fazeley and Tamworth the surrounding area is protected by flood walls and earth embankments.

The strategy has split the River Tame up into reach, options have been applied to each of these reaches. Reach 8 Fazeley and Tamworth is the reach located in the Level 1 SFRA study area, located in the Lichfield District Council area. This reach tends to be protected by flood walls and earth embankments.

The flood risks to this reach are:

- Without defences there would be 3,030 properties at risk.
- There are currently 304 properties at risk.
- The current flood defences therefore manage the risk of flooding to 2,726 properties.
- There will be 5 properties at risk with the Strategy in place.
- The Strategy will therefore manage the risk of flooding to an additional 299 properties.
- By 2025 an additional 3 properties will be at risk of flooding as a result of climate change.

The Strategy proposes a combination of Option 3 (Maintain) and Option 6 (Improve conveyance and new flood defences). From these options the following new defences are proposed at the following locations:

- On the left bank around the Mayfair Drive area of Fazeley. This will consist of a flood embankment built to a height of approximately 1.5 metres that will reduce the risk of flooding to this part of Fazeley to a 0.5% probability of flooding in any given year.

- Increasing the height of the existing embankment defences to approximately 2 metres to reduce the risk of flooding in the Brook End vicinity of Fazeley on the left bank, by. These measures will reduce the risk of flooding to properties in this location to a 0.5% annual probability of flooding.
- New embankments will be constructed to a height of approximately 1 metre in the Coton Lane area (in the north of Tamworth) to ensure that the residual flood risk is managed.
- South of Coton Lane area additional embankments are proposed to a similar height to provide a 0.5% probability of flooding in Lichfield Road in the vicinity of Chatsworth Road and The Fox Public House.

None of the existing defences in this reach require replacement within the next five years, however sections of defence will reach the end of their useful life within the next 20 years and will require replacement.

3. SFRA Methodology

NPPF recommends that SFRAs are completed in two consecutive stages. This provides the LPA with tools throughout the Local Plan and SFRA process sufficient to inform decisions regarding development sites. The two stages are: -

- Level 1 SFRA – Study Area Flood Source Review & Sequential Test.
- Level 2 SFRA – Development Site Assessments for Exception Testing.

The results of the Level 1 SFRA should enable the Councils to clearly identify where development is appropriate according to NPPF, and where development is necessary and requires justification through application of the Exception Test. The Level 1 SFRA should therefore enable a prompt start to the commencement of Level 2 (where required). As part of this SFRA the proposed development areas (provided by the individual councils) have been assessed to determine the requirement of a Level 2 SFRA (Section 9). The data review element of Level 1 also enables a robust specification and programme to be developed for a Level 2 SFRA.

3.1 Level 1 – Area Flood Source Review and Sequential Test

A Level 1 SFRA presents sufficient information to enable the LPA to apply the Sequential Test to potential development sites and assists in identifying if application of the Exception Test will be necessary. The Level 1 SFRA also provides background information, a review of local policies, and guidance for site specific flood risk assessment and the potential for application of Sustainable Drainage Systems (SuDS). The review of policies is allied to guidance on the requirements for site-specific Flood Risk Assessments (FRAs) throughout the study area.

The outcomes from the Level 1 SFRA should be used by the LPA to identify the most suitable locations for development in line with NPPF and other planning drivers. Where sites cannot be located in line with the principles of NPPF further investigation may be required through a Level 2 SFRA. This report presents the information generated during Level 1 of the SFRA.

3.2 Level 2 – Development Site Assessments for Exception Testing

The objective of a Level 2 SFRA is to use information obtained in the Level 1 SFRA where suitable and additional works where necessary to reduce uncertainty regarding flood risk to those developments / development sites that cannot be located in low risk flood zones (therefore requiring application of the Exception Test). The information presented for each development site should be sufficient to:

> *"demonstrate the development will be safe for its lifetime, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall" (paragraph 102 of NPPF).*

Information provided in the Level 2 SFRA should be used to supplement information presented in the Level 1 SFRA and where possible assist the LPA in developing justification for development in flood risk areas through application of the NPPF Exception Test.

Level 2 SFRA outputs should 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.

3.3 Data Collection

Throughout the data collection and review process it has been critical to make best use of the information which already exists with respect to all types of flood risk (held by public and private organisations). All data collected has been reviewed, assessment of its significance and quality, and advice on which part of the collected data needed to be used for the SFRA. The main approach to the SFRA update has been to build on previous/existing studies and further information gathered. This information has been used to update the existing dataset and it is detailed in Appendix E.

Consultation has formed a key part of the data gathering stage of the SFRA. A number of stakeholders were consulted during the SFRA and as part of the consultation process. The benefits of adopting a partnering approach (as advocated by NPPF) are significant and have helped to ensure that the findings and recommendations of the SFRA are relevant and workable for the Councils.

For the purpose of this assessment, sources of flooding are divided into five categories; fluvial flooding, pluvial flooding (surface water), flooding from sewers, groundwater flooding and other sources of flooding. The data collected from each of the stakeholders is presented in Appendix E.

3.4 SFRA Maps

This section describes the data used in the production of mapping for the project. To facilitate production of the maps, some of the data received from the stakeholders has been standardised and / or combined. As part of this update, data sources used in the 2008 SFRA were reviewed and included where appropriate. Where updated information was available this was incorporated into the SFRA the following provides a summary of new and updated data sets:-

- Reservoir inundation mapping.
- Updated Flood Map for Surface Water (UFMfSW) provided by the EA.
- Outputs from the SWMPs Phase 2.
- Updated historic flooding records for all sources of flooding.
- Updated DG5 records.
- Latest National Flood and Coastal Defence Database (NFCDD) download

The Level 1 SFRA assessment methodology is based on using available existing information and data where it this is suitable. There have been no new investigations carried out for this updated SFRA. The information presented is sufficient to enable application of the Sequential Test and to identify where further investigation is required through either a Level 2 SFRA or those elements requiring consideration in a site specific Flood Risk Assessment.

3.4.1 Requirements of NPPF

NPPF and its accompanying Technical Guidance requires SFRA to present sufficient information on all flood sources to enable local planning authorities to apply the Sequential Test in their administrative areas. In order to apply the Sequential Test information is required on the probability (High, Medium and Low) associated with flooding from the different flood sources. This information should be presented graphically where possible as a series of figures and/or maps.

In addition, the assessment of probability should also account for the effects of climate change on a flood source for the lifetime of any development that would be approved through the emerging Local Plan. The following sections explain how the available data has been used to develop strategic flood risk mapping for use in undertaking the Sequential Test. Table 3-1 summarises NPPFs flood zone definitions.

Table 3-1 National Planning Practice Guidance - Flood Zone definitions

Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map)

All areas within Flood Zone 3 should be considered as Flood Zone 3b unless, or until, appropriate assessment shows to the satisfaction of the EA that the area falls within Flood Zone 3a. Therefore in areas where the functional floodplain has not been defined and no suitable surrogate data is available the functional floodplain (Flood Zone 3b) has been defined as the extent of Flood Zone 3a.

The functional floodplain should be determined considering the effects of defences and other flood risk management infrastructure. The functional floodplain relates only to river and coastal flooding, it does not include areas at risk of flooding solely from other sources of flooding (e.g. surface water, sewers).

3.4.2 Fluvial Flooding

3.4.2.1 Data Sources

A number of hydraulic modelling studies have been carried out in the study area. Details of these studies are provided below:

- Sandyford Brook model was produced as part of the Strategic Flood Risk Mapping Study (SFRM) in 2007.
- Ridings Brook model was originally constructed in 2009 as part of the Flood Risk Mapping Study. The most recent model extends from Wryley Brook Park, through Bridgtown up to Hednesford. The model was used facilitate the design and construction of the Cannock Flood Alleviation Scheme, and to update the Environment Flood Zone maps.
- Rising Brook model was originally constructed as part of a Strategic Flood Risk Mapping study. The model was then later updated for the Rugeley Level 2 SFRA, and this has been used to produce the current EA flood zone outlines. The model covers the Rising Brook from the A51 to its confluence with the River Trent. In 2008 it was identified that the Wash Brook flood extents needed updating in response to changes in fluvial flooding due to the construction of the M6 toll road. We have not found any further details about this study and no updated information has been provided by the EA.
- River Tame model was produced as part of the SFRM in 2009. The model extends from Oldbury and Willenhall to the confluence with the Trent.
- River Trent model was constructed as part of the River Trent CFMP in 2009. The River Trent flood outlines have not been included or checked against the updated EA flood zone maps as the EA were unable to provided the model outlines.
- River Mease and it tributaries Hooborough Brook and Gilwiskaw Brook were modelled as part of the Measham and Packington Scenario Modelling, Model and Mapping Report (2012).

- River Sow and Penk hydraulic models were originally built in 2006 and then were updated in July 2008 as part of the Model Calibration Study. The River Penk model covers the whole of the main River Penk channel within extending from the head of the main river at Codsall to the northern boundary of South Staffordshire close to Wildwood and Rickerscote.
- Smestow Brook hydraulic model was developed as part of the Wolverhampton, Womborune and Kingswinford Flood Mapping Study (2012).

Maps have been created to show the model extents and area located in Volume 2 of this report, a separate figure has been provided for each area. These models have been included in the EA flood zones, except for the River Mease model.

- Cannock Chase Council – Figure M-CC.
- Lichfield District Council – Figure M-LD.
- Stafford Borough Council – Figure M-SB.
- South Staffordshire Council – Figure M-SS.

Detailed models, mapping studies and river flow and level data are continuously used to improve the EA's knowledge of the floodplain. Therefore, as part of the SFRA, model updates and changes to the EA flood zones should be considered and continually updated within this document.

3.4.2.2 Mapping

SFRA maps have been generated showing EA Flood Zones 2 and 3. The EA's Flood Map shows the natural floodplain without the presence of defences, showing areas potentially at risk of fluvial flooding. The flood zone maps show Flood Zone 3, areas at high risk; susceptible to flooding from a 1 in 100 year (1 % AEP) event, Flood Zone 3 with climate change and Flood Zone 2, the areas at medium risk; susceptible to a 1 in 1000 year (0.1% AEP) event.

The EA flood zone maps are shown in Volume 2 of the Level 1 SFRA. A separate figure has been provided for each council, detailed below:

- Cannock Chase Council – Figure FZ-CC.
- Lichfield District Council – Figure FZ-LD.
- Stafford Borough Council – Figure FZ-SB.
- South Staffordshire Council – Figure FZ-SS.

The hydraulic models identified above have been used to update the EA Flood Zone maps.

In addition, the Flood Zones should also be defined considering the effects of climate change. For fluvial systems NPPF requires an increase of 20% in peak flows to be used when mapping climate change Flood zones up to 2115. The models detailed above have been used to determine the Flood Zone 3 with climate change flood extent.

3.4.3 Sewer Flooding

3.4.3.1 Data Source

Areas at risk from sewer flooding have been determined through a review of records from the DG5 registers provided by Severn Trent. The data shows postcodes where properties are known to have experienced sewer flooding prior to January 2014. The data provides an overview of flood incidents at specific locations. The SFRA has presented this data in a mapping format (shown in the individual flood risk sections). The data has been presented in postcode sectors (a four digit postcode) so that the data is not property specific.

3.4.3.2 Climate Change

Climate change is estimated to result in milder wetter winters and increased summer rainfall intensity. This combination will increase the pressure on existing sewer systems effectively reducing their design standard, leading to more frequent flooding.

The current data does not show the effects of climate change on sewer flooding to be undertaken. Therefore in the absence of accurate data the effects of climate change should be taken to result in an increase in the flooding probability of each post code area by one category. For example where a post code area is currently identified to have a medium probability, accounting for the effects of climate change the area has been defined as high probability.

3.4.3.3 Mapping

Historic records of flooding attributed to the sewerage network in the Study Area have been mapped. The centroid of the postcode area has been plotted; this does not reflect the exact location of the incidents. A separate figure has been provided for each council and is provided in Volume 2 of the Level 1 SFRA, detailed below:

- Cannock Chase Council – Figure SF-CC.
- Lichfield District Council – Figure SF-LD.
- Stafford Borough Council – Figure SF-SB.
- South Staffordshire Council – Figure SF-SS.

3.4.4 Groundwater Flooding

3.4.4.1 Data Sources

The British Geological Survey (BGS) produced the Susceptibility to Groundwater Flood layer which is the first national hazard dataset for groundwater flooding. The dataset is based on geological and hydrogeological information, the data identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. It is important to note that the data shows susceptibility to groundwater flooding, it does not indicate hazard or risk, i.e. it does not provide any information on the depth to which groundwater flooding occurs or the likelihood of the occurrence of an event of a particular magnitude.

Groundwater flooding is the emergence of groundwater at the ground surface. It can occur in a variety of geological settings including valleys in areas underlain by Chalk, and in river valleys with thick deposits of alluvium and river gravels. Groundwater flooding happens in response to a combination of already high groundwater levels (usually during mid- or late-winter) and intense or unusually lengthy storm events. Groundwater flooding often lasts much longer than flooding caused by a river over-flowing its banks. It may last many months and can cause significant social and economic disruption to the affected areas.

The dataset shows three classes of susceptibility to groundwater flood classes. Outside of these areas and onshore, the rock types are not considered to be prone to groundwater flooding.

Table 3-2 Ground Water Susceptibility Classifications

Classification	Description
A	**Limited potential for groundwater flooding to occur:** based on rock type and estimated groundwater level during periods of extended intense rainfall.
B	**Potential for groundwater flooding of property situated below ground level:** based on rock type and estimated groundwater level during periods of extended intense rainfall. Where this may have an impact, you are advised to check that this has not been a problem in the past at this location and/or that measures are in place to sufficiently reduce the impact of the flooding.
C	**Potential for groundwater flooding to occur at surface:** based on rock type and estimated groundwater level during periods of extended intense rainfall. You are advised to check that this has not been a problem in the past at this location and/or that measures are in place to sufficiently reduce the impact of the flooding.
Elsewhere (onshore)	**Not considered to be prone to groundwater flooding**: based on rock type.

3.4.4.2 Climate Change

As the available information only allows an assessment of susceptibility, no allowance for climate change can be made.

3.4.4.3 Mapping

Mapping of the Groundwater Flood Susceptibility datasets for each council area is shown in separate figures. The type of groundwater flooding and percentage of area susceptible to groundwater flood emergence have both been mapped for each of the study areas, provided in Volume 2:

- Cannock Chase Council – Figure GW-CC
- Lichfield District Council – Figure GW-LD
- Stafford Borough Council – Figure GW-SB
- South Staffordshire Council – Figure GW-SS

3.4.5 Overland Flow / Pluvial Flooding

3.4.5.1 Data Sources

The Updated Flood Maps for Surface Water (UFMfSW) have been provided by the EA. The map shows areas that are at risk of surface water flooding for the following flood extents 1 in 30, 1 in 100 and 1 in 1,000 probabilities. These maps are more detailed than the FMfSW maps, they have been generated based on JFLOW model using a 5m grid size and detailed hydrology. The updated model includes representation of building, structures and the road network.

More detailed modelling was carried out as part of the Phase 2 Surface Water Management Plans (SWMP). Maps produced for this study included depth and hazard mapping, these maps are held by each council and have not been reproduced in the SFRA.

3.4.5.2 Mapping

The UFMfSW have been provide by the EA and are shown in Volume 2. A separate figure has been provided for each council area, detailed below:

- Cannock Chase Council – Figure SW-CC.
- Lichfield District Council – Figure SW-LD.

- Stafford Borough Council – Figure SW-SB.
- South Staffordshire Council – Figure SW-SS.

3.4.6 Reservoir Flooding

3.4.6.1 Data Sources

In 2009 the EA produced a series of reservoir inundation flood maps. The assessment included large reservoirs that hold over 25,000 cubic meters of water. The predicted flood extents have been provided by the EA for use within this updated SFRA to determine the potential risk within each Council area. The maps only show the maximum extent of flooding should the reservoir breach and all of the water is released, information on depth and hazard was not made available for the SFRA.

3.4.6.2 Mapping

Reservoir inundation maps are based on the data set provided by the EA and are shown in Volume 2. A separate figure has been provided for each council area:

- Cannock Chase Council – Figure RIM-CC.
- Lichfield District Council – Figure RIM-LD.
- Stafford Borough Council – Figure RIM-SB.
- South Staffordshire Council – Figure RIM-SS.

3.4.7 Residual Risk

3.4.7.1 Data Sources

There are a number of flood defences in the study area. The flood defence information has been taken from NFCDD (provided by the EA). There are only two locations that are classified as Area Benefiting from Defences (ABDs) within the study area, provided by the EA. These ABDs are located in Penkridge along the River Penk, located adjacent to the Stone Cross, and Stafford town along the River Sow, located adjacent to the A516.

3.4.7.2 Mapping

The flood defences and the Areas Benefitting from Defences (ABDs) have been mapped for each of the council areas provided in Volume 2:

- Cannock Chase Council – Figure FD-CC.
- Lichfield District Council – Figure FD-LD.
- Stafford Borough Council – Figure FD-SB.
- South Staffordshire Council – Figure FD-SS.

4. Flood Risk

4.1 Introduction

The study area for this updated Level 1 SFRA includes four councils. The full extent of the study area is shown in Figure A (located in Volume 2, SFRA), showing the individual council boundary areas.

In order to address the requirements of each individual council this section of the document provides a summary of the flood risks to each of the individual council. Further details on flood risk as well as discussions on the hydrology, geology, topography, historical flooding, and other sources of flood risk, are provided in Appendix A for Cannock Chase, Appendix B for Lichfield District, Appendix C for South Staffordshire and lastly Appendix D for Stafford Borough.

4.2 Summary of Flood Risk in Cannock Chase

4.2.1 Fluvial Risk

The main rivers located in the Cannock Chase Council area are:

- River Trent.
- Rising Brook.
- Ridings Brook.
- Saredon Brook.

The following watercourses have had separate studies undertaken which included a hydraulic assessment:

- Rising Brook – Rising Brook Flood Risk Mapping (2006), this was recently updated as part of the Rugeley Level 2 SFRA (2009).
- Riding Brook – Riding Brook Flood Risk Study (2008).

The EA flood maps are shown in Figure FZ-CC. The results of the models have been included in the EA flood zones, which have been updated since 2008. There has been no significant increase/decrease in the flood extents since 2008.

The Water Cycle Study indicates that Cannock Chase Council area is classified as having a medium probability of fluvial flood risk, with high consequences. The study classified the Council area as having a medium probability of residual flooding from the overtopping or breaching of flood defences (Southern Staffordshire Water Cycle Study Report, April 2011).

Further information and details of fluvial flood risk to the Cannock Chase area is detailed in Appendix A.

4.2.2 Pluvial Risk

Details of pluvial flood risk to Cannock Chase Council area is provided from the UFMfSW, shown in Figure SW-CC. Further information has been provided as part of the WCS and SWMP Phase 2. Pluvial flood risk has been identified as the most significant risk of flooding to the Cannock Chase area, which occurs due to the exceedance of the drainage capacity in urban areas. The SWMP indicated that there is risk of significant pluvial flood events within Cannock and Rugeley Town Areas.

Further information and details of pluvial flood risk to the Cannock Chase area is detailed in Appendix A.

4.2.3 Flood Risk from Sewers

The DG5 Records provided by Severn Trent Water indicate within Cannock Chase Council area there are 12 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below and Figure SF-CC shows these location of the properties postcode areas.

Table 4-1 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Properties at risk of flooding
WS11 0	1
WS11 2	1
WS11 5	4
WS11 6	4
WS11 9	3
WS12 0	9
WS12 1	2
WS12 2	3
WS12 4	14
WS15 1	2
WS15 2	8
WS15 4	2

The EA recommends 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.

4.2.4 Groundwater Flooding

Figures GW-CC shows the areas susceptible to groundwater flooding. Areas along the main watercourses are most susceptible to groundwater flooding, there is limited potential for groundwater flooding in the higher areas.

There is limited evidence available concerning ground water flood in the Cannock Chase council area. Historical data provided do the SFRA indicated that there has been an incident of groundwater flooding East of Ridings Brook.

Further information and details of risk of groundwater flooding to the Cannock Chase area is detailed in Appendix A.

4.2.5 Other Sources of Flood Risk

The EA Reservoir Maps show the risk of flooding from reservoirs, Figure RIM-CC. The Belvide reservoir and Mill Green balancing pond, in Cannock Chase pose a risk of flooding from reservoirs. These maps show that areas at risk should the dam fail. Although the consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

There are a number of canals located in Cannock Chase Council area, consultation with the Canal and Rivers Trust indicate that there were no records of canal breaches, therefore currently it is considered that the risk of flooding from canals is extremely low. However development proposals adjacent to a canal should be considered on an individual case-by-case as part of any FRA.

4.3 Summary of Flood Risk in Lichfield District Council

4.3.1 Fluvial Risk

The main rivers located in the Lichfield District Council area are:

- River Tame.

- River Trent.
- River Mease.
- Moreton Brook.
- River Blithe.

The following watercourses have had separate studies undertaken which included a hydraulic assessment:

- The River Mease and it tributaries Hooborough Brook and Gilwiskaw Brook were modelled as part of the Measham and Packington Scenario Modelling, Model and Mapping Report (2012).
- The River Tame has had separate studies undertaken which is included a hydraulic assessment. The study was the River Tame Flood Risk Mapping Study (2009).

The EA flood maps are shown in Figure FZ-LD. The new EA Flood Maps have been updated since 2008 and included only the River Tame model. The Measham and Packington results have not been included. There has been no large increase/decrease in the flood extents since 2008.

The River Tame and River Trent are the main rivers that flow through the Lichfield District Council area. These rivers carry large volumes of water and have wide floodplains. The EA Flood Zone maps for the River Trent and River Tame indicates fluvial risk occurs predominantly into rural agricultural land where there is currently little proposed development.

Further information and details of fluvial flood risk to the Lichfield District Council area is detailed in Appendix B.

4.3.2 Pluvial Risk

Details of pluvial flood risk to Lichfield District Council area is provided from the UFMfSW, shown in Figure SW-LD. Further information has been provided as part of the WCS and SWMP Phase 2.

Pluvial flooding poses a risk to the Council area, due to the lack of drainage capacity during high flows. Blockages of drains and watercourses in urban areas have been attributed to the pluvial flooding incidents in the Lichfield Council area. This was the case during the 2007 storm events, when extreme flows resulted in backing up of surface water drains as water levels in the watercourses rose above outfall height.

Through the Lichfield District council areas there are a large number of pluvial flooding occurrences that have been identified as highways flooding. Fazeley is the area most at risk of pluvial flooding as detailed in the SWMP Phase 2. Historic records indicate that Fazeley suffers from recurring fluvial and pluvial flood events.

Further information and details of pluvial flood risk to the Lichfield District Council area is detailed in Appendix B.

4.3.3 Flood Risk from Sewers

The DG5 Records provided by Severn Trent Water indicate within Lichfield Council area there are 15 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below and Figure SF-LD shows the location of the properties postcode areas.

Table 4-2 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Properties at Risk of Flooding
B74 3	6
DE13 7	3
ST15 8	1
WS13 6	2
WS13 7	4
WS13 8	2
WS14 0	7
WS14 9	3
WS15 1	3
WS15 3	1
WS15 4	8
WS7 1	1
WS7 4	1
WS7 9	4
WS9 0	1

The EA recommends 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.

4.3.4 Groundwater Flooding

Figure GW-LD show the areas susceptible to groundwater flooding. Areas along the main watercourses are most susceptible to groundwater flooding; largely surrounding the River Trent and River Tame. A large area in between the Tame and the Trent along the northern boundary of the Council area has large areas susceptible to groundwater flooding.

Existing studies (WCS Report, 2010) indicate that there are no known problems with groundwater flooding within the Lichfield District Council area. It should be noted however that the underlying geology is fluvial sand and gravel deposits, which hold extensive groundwater resources. These resources in the sands and gravels are generally not heavily exploited, but locally abstraction for agriculture has been developed. There is significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems, although secondary controls include drawdown generation from abstractions for localised water resource use and dewatering related to mineral extraction.

Further information and details of groundwater flood risk to the Lichfield District Council area is detailed in Appendix B.

4.3.5 Other Sources of Flood Risk

Figure RIM-LD shows the risk of flooding from reservoirs map, provided by the EA. In the south of the council area, the Little Aston Pool, Chasewater, Stowe Pool and Shustoke Lower reservoirs pose a risk of flooding from reservoirs. In the north, the Blithfield and Chasewater reservoirs pose a risk. These maps indicate the areas that would be inundated should the reservoir fail and release all of the

water it holds. Although the consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

There are a number of canals located within Lichfield Council area: the Trent and Mersey Canal, cutting across the north of the area, and the Coventry Canal and the Birmingham and Fazeley Canal running from north to south, and part of the Wyrley and Essington Canal Anglesey Branch to the south of Chasewater. Liaison with British Waterways indicated that there are no recorded incidents of breaches or any other flood risk instances associated with these canals. However development proposed adjacent to a canal should be investigated on an individual basis, as part of any FRA.

4.4 Summary of Flood Risk in South Staffordshire

4.4.1 Fluvial Risk

The main rivers located in the South Staffordshire Council area are:

- River Penk
- Smestow Brook
- River Stour.

A separate study has been undertaken on the Smestow Brook, which included a hydraulic model. This study was the Wolverhampton, Womborune and Kingswinford Flood Mapping Study (2012). The EA flood maps are shown in Figure FZ-SS. The results of the model have been included, which have been updated since 2008. There has been no increase/decrease in the flood extents since 2008.

South Staffordshire is a predominantly rural district, where flood risk to urban areas and properties is generally low. Further information and details of fluvial flood risk to the South Staffordshire Council area is detailed in Appendix C.

4.4.2 Pluvial Risk

Details of pluvial flood risk to South Staffordshire Council area is provided from the UFMfSW Maps, shown in Figure SW-SS. Further information was information has been provided as part of the WCS and SWMP Phase 2. Pluvial flooding is accountable for a high proportion of the flood incidents in the district. Penkridge, Wombourne, Codsall and Perton are the areas identified as being at greatest risk of pluvial flooding.

Further information and details of pluvial flood risk to the South Staffordshire area is detailed in Appendix C.

4.4.3 Flood Risk from Sewers

The DG5 Records provided by Severn Trent Water indicate within South Staffordshire Council area there are 14 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below and in Figure SF-SS shows the location of properties postcode areas.

The EA recommends 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.

Table 4-3 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Recorded Incident Locations
DY7 6	2
ST19 5	3
ST19 9	2
WS6 6	7
WS6 7	6
WV10 7	5
WV4 4	2
WV5 0	1
WV5 8	1
WV5 9	2
WV6 7	7
WV8 1	8
WV8 2	3
WV9 6	1

4.4.4 Groundwater Flooding

Figure GW-SS show the areas susceptible to groundwater flooding in the South Staffordshire Council. The figure indicate that the area susceptible to groundwater flooding are more erratic than in any of the other Council areas. A lot of the area has limited potential for ground water flooding to occur specifically in the south.

Existing reports indicate that there are no known problems with groundwater flooding within the South Staffordshire Council area (WCS Study, 2010). Similarly to Lichfield Council area, the northwest of the area has underlying Mercia Mudstone Group Deposits, sand and gravelly deposits, which hold extensive groundwater resources. There can be significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems.

Further information and details of groundwater flood risk to the South Staffordshire Council area is detailed in Appendix C.

4.4.5 Other Sources of Flood Risk

Figure RIM-SS shows the risk of flooding from reservoirs, provided by the EA. In the Council area there are a large number of reservoirs that pose a flood risk compared to the other Council areas, however the extent of the potential inundation is much smaller. The reservoir inundation maps indicate the areas that would be inundated should the reservoir fail and release all of the water it holds. Although the consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

There are three canals are located within the South Staffordshire Council area. At present canals do not pose a risk of flooding to the surrounding Council area. However, 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.

4.5 Summary of Flood Risk in Stafford Borough Council

4.5.1 Fluvial Risk

The main rivers located in the Stafford Borough Council area are:

- River Trent.
- Scotch Brook.
- River Sow.
- Sandyford Brook.
- Kingston Brook.
- Meece Brook.
- Doley Brook.

The Sandyford Brook has had separate studies undertaken which is included a hydraulic assessment. The study was the Sandyford Brook Flood Risk Mapping Study (2007). The River Sow and Penk hydraulic models were originally built in 2006 and then were updated in July 2008 as part of the Model Calibration Study.

The EA flood maps are shown in Figure FZ-SB. The new EA Flood Maps have been updated since 2008 and included this model. There has been no significant change in the flood extents since 2008.

The EA flood maps indicate, in comparison to the other council, fluvial flood risk is of most significance to Stafford Borough. The locations that are a risk of fluvial flooding are the confluence of the Sandyford Brook and River Penk with the River Sow in Stafford town. The EA flood maps indicate that the town of Stone and rural area upstream and downstream are at risk of flooding from the River Trent. The risk of fluvial flooding has been reduced in the Borough due to well planned and managed flood storage areas, such as the Tillington SSSI nature reserve, and undeveloped floodplains.

Further information and details of fluvial flood risk to the Stafford area is detailed in Appendix D.

4.5.2 Pluvial Risk

Details of pluvial flood risk to Stafford Borough Council area is provided from the UFMfSW Maps, shown in Figure SW-SB. Further information was information has been provided as part of the WCS and SWMP Phase 2.

The following locations are known to have experienced a significant number of historic pluvial flood occurrences:

- Stafford.
- Eccleshall.
- Copmere End.
- Salt.
- Weston.
- Stone.
- Walton.
- Norton Bridge.
- Yarnfield.

Pluvial flooding across Stafford town originates from overland runoff, from rural and urban areas upstream of the town (SWMP Phase 2, Stafford Town, 2011). Pluvial flooding rarely originates from blockages or failure of the sewer network within Stafford town. Flooding in the Borough often occurs due to the interaction between pluvial and fluvial flooding.

Further information and details of pluvial flood risk to the Stafford area is detailed in Appendix D.

4.5.3 Flood Risk from Sewers

The DG5 Records provided by Severn Trent Water indicate within Stafford Borough there are 15 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below and Figure SF-SB shows the location of the properties postcode areas.

Table 4-4 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Properties at Risk
ST12 9	10
ST15 0	2
ST15 8	19
ST16 1	9
ST16 2	1
ST16 3	7
ST17 0	11
ST17 4	8
ST17 9	4
ST17 0	1
ST18 0	5
ST18 9	6
ST20 0	3
ST21 6	5
ST3 7	1

The EA recommends 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.

4.5.4 Groundwater Flooding

Figure GW-SB show the areas susceptible to groundwater flooding. Areas more susceptible to groundwater flooding generally follow the main river networks, specifically along the River Trent and the area where the River Sow and River Penk converge. The higher areas to the north are less susceptible to groundwater flood are located in the north.

Existing reports state that there are no known problems with groundwater flooding within the Stafford Borough (WCS Study, 2010). Similarly to Lichfield and South Staffordshire, the majority of the area has underlying Mercia Mudstone Group Deposits, sand and gravelly deposits, which hold extensive groundwater resources. There can be significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems.

Further information and details of groundwater flood risk to the Stafford Borough Council area is detailed in Appendix D.

4.5.5 Other Sources of Flood Risk

Figure RIM-SB shows the risk of flooding from reservoirs, provided by the EA. In the council area there are five reservoirs:

- Black Lake.
- Knowle Wall Farm.
- Bromley Mill Pool.
- Gap Pool.
- Tixall Park Pool.
- Trentham Gardens Lake.

The maps indicate the areas that would be inundated should the reservoir fail and release all of the water it holds. Although the consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

There are three canals located within the Stafford Borough; the Staffordshire and Worcestershire Canal south of Stafford Town, the Trent and Mersey Canal, and the Shropshire Union Canal. There has been one occurrences of canal overtopping reported (Phase 1 SWMP, 2011); a breach at Church Eaton in 1957 and a breach at High Offley in 1991 due to a culvert failure. A Flood Risk Assessment should be carried out for sites in close proximity to canals.

5. How to use the SFRA in Local Planning

5.1 Introduction

5.2 Sequential Test

The NPPF Sequential Test is a risk based approach to determine the suitability of development according to flood risk from fluvial and tidal flood sources. The NPPF requires LPAs to apply the Sequential Test at all stages of the planning process to ensure that where possible developments are removed from areas with a high probability of flooding. Through application of the Sequential Test LPAs are encouraged to guide new development towards areas of the lowest flood probability.

Allied to the Sequential Test, the NPPF (through the NPPG) also assigns different vulnerabilities to different types of development (Table 5-1). If when applying the Sequential Test development in the floodplain is necessary the LPA should also bear in mind the vulnerability classification of their proposed development to assess if it is appropriate in an area of flood risk. In exceptional circumstances the LPA may be required to undertake the Exception Test to justify development in the floodplain (discussed further in Section 5.3).

Table 5-1 (Table 2 of the NPPG) presents types of development according to their flood vulnerability. By using this information in tandem with the Sequential Test planners should guide developments to those areas where the development vulnerability is appropriate to the flooding probability.

Table 5-1 Flood Risk Vulnerability Classification (from NPPG)

ESSENTIAL INFRASTRUCTURE	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
HIGHLY VULNERABLE	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substance consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

MORE VULNERABLE	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
LESS VULNERABLE	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
WATER-COMPATIBLE DEVELOPMENT	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

NPPF acknowledges that some areas could also be at risk of flooding from flood sources other than fluvial and tidal systems. Consequently all sources of flooding must be considered when looking to

locate development. Other sources of flooding requiring consideration when situating new development allocations in the administrative area include:

- Pluvial;
- Groundwater;
- Sewers; and
- Artificial Sources.

5.2.1 How should the SFRA be used to apply the Sequential Test?

The LPA should use the information presented and mapped (Figures FZ-CC, FZ-LD, FZ-SS & FZ-SB) in this Level 1 SFRA to undertake the Sequential Test. The Sequential Test should be accurately documented to ensure that the decision processes followed for the locating of a development are consistent and transparent.

The Sequential Test should be carried out on all development sites and seek to guide development to the lowest flood risk areas (i.e. Flood Zone 1). Where there are no reasonably available alternative sites in Flood Zone 1 to accommodate development, sites in Flood Zones 2 or 3 may be considered but must balance the flood probability and development vulnerability of sites. This should be based on the Flood Zone and Flood Risk Vulnerability Compatibility which is summarised

The Level 1 SFRA mapping provides the tools by which the councils can undertake the Sequential Test. This is achieved by presenting information to identify the variation in flood risk across a local authority administrative area, allowing an area-wide comparison of future development sites with respect to flood risk considerations.

Figure 5-1 has been extract from NPPG. The Flood Risk Matrix illustrates how the Sequential Test should be undertaken and is taken from Table 3 of the NPPF Technical Guidance document.

Additional guidance to assist the Councils to strategically undertake the Sequential Test is detailed in Section 5.2.2.

Table 5-2 Flood Risk Vulnerability and Flood Zone 'Compatibility' from NPPG

Flood Risk Vulnerability Classification		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	Exception Test Required	✓	✓	✓
	3A	Exception Test Required[1]	✘	Exception Test Required	✓	✓
	3B	Exception Test Required[2]	✘	✘	✘	✘

✓ Development is appropriate.

✘ Development is not appropriate.

Notes to table 3:

This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;

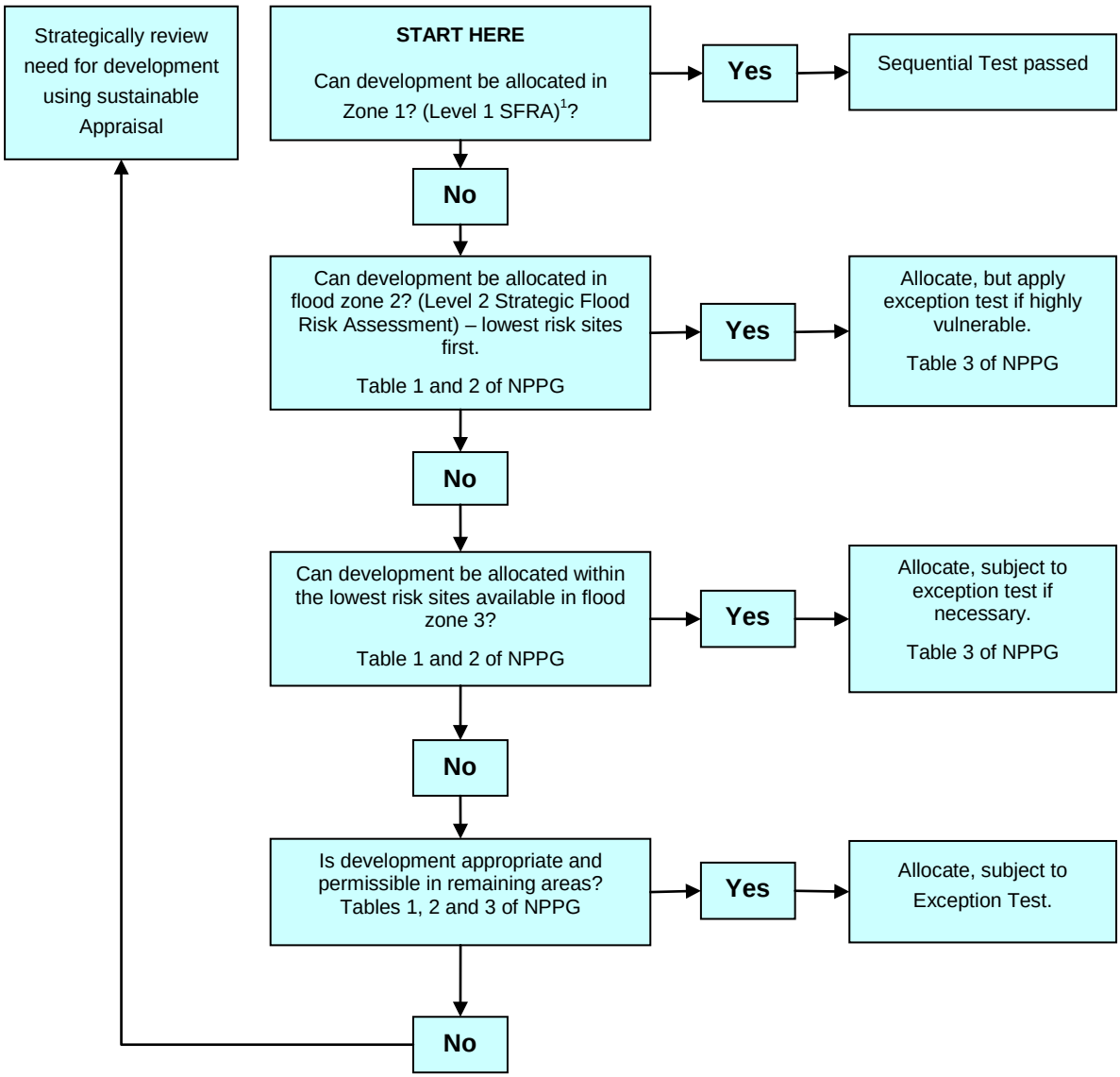
The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;

Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

1. In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood

2. In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.



Note 1. Other sources of flooding need to be considered

Figure 5-1: Application of the Sequential Test adapted from NPPG

5.2.2 Additional Guidance

The sequence of steps presented below in tandem with Figure 5-1 is designed to provide the Councils and developers with additional guidance on how to apply the Sequential Test strategically. The steps are designed to ensure land allocations are allocated in line with the principles of the Sequential Test or, failing this, that the requirement for application of the Exception Test is clearly identified.

1. The strategic developments (i.e. housing, hospitals, industrial etc) that need to be accommodated in the Council's administrative area within the lifetime of its Local Plan should be assigned a vulnerability classification in accordance with Table 5-2 "Flood Risk Vulnerability Classification" in NPPF;
2. The Flood Zone classification of all development sites identified by the Council's should be determined based on a review of the Sequential Test Maps (Figure 14). This should consider the effects of climate change on flood zone definition for the design life of any development that the site may be suitable for, i.e.:
    - 60- year design life for commercial / industrial developments (however this should be reviewed on a site by site basis and agreed with the EA; and
    - 100 year design life for residential developments.
3. In the first instance the 'highly vulnerable' developments the LPA is required to accommodate should be located in those sites it has identified as being within Flood Zone 1. If the 'highly vulnerable developments' cannot be located in Flood Zone 1, because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1 then sites in Flood Zone 2 can be considered. If sites in Flood Zones 1 and 2 are inadequate, then to accommodate the development the LPA may have to identify additional sites in Flood Zones 1 or 2 or seek opportunities to locate the development outside their administrative area.
4. Once all 'highly vulnerable' developments have been allocated to a development site, the LPA can consider those development types defined as 'more vulnerable'. In the first instance 'more vulnerable' development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate the 'more vulnerable' development types, sites in Flood Zone 3a can be considered. However, any 'more vulnerable' developments in Flood Zone 3a will require application of the Exception Test (described in Section 5.3).
5. Once all 'more vulnerable' developments have been allocated to a development site, the LPA can consider those development types defined as 'less vulnerable'. In the first instance 'less vulnerable' development should be located in any remaining unallocated sites in Flood Zone 1, 2 or 3a (in that order). Less vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
6. 'Essential infrastructure' developments should also be preferentially located in the lowest flood risk zone. However this type of development can be located in Flood Zones 3a and 3b, where necessary, through application of the Exception Test.
7. Finally, it is recommended that water compatible development is located last. Water compatible developments typically have the least flood risk constraints and therefore it is considered appropriate to consider them last when allocating development sites.
8. For decisions made through steps 4 to 7 it will also be necessary to consider the risks posed to the site from other flood sources and where comparable development sites in the same flood zone may be more suitable due to:
    - flood risk management measures,
    - the rate of flooding,
    - flood water depth, or,
    - flood water velocity.

Table 1 in Appendix G is provided as a suggested pro-forma for Council's to follow when undertaking the Sequential Test. The table has been prepared to assist the LPA in providing a transparent and structured reporting system and to assist in identifying where developments / development sites may require application of the Exception Test.

5.3 Exception Test

5.3.1 What is the Exception Test?

After application of the Sequential Test, if it is has not been possible for a development to be located in a low risk flood zone, or a flood zone where the development vulnerability is appropriate then it may be necessary and appropriate to apply the Exception Test to the allocation, providing the development is consistent with the wider sustainability objectives of the area. Table 5-1 provides guidance on the vulnerability of types of development in conjunction with Table 5-2, where various types of development are appropriate with regards to flood risk and where it may be appropriate for the Exception Test to be applied.

5.3.2 Why is there an Exception Test?

The Exception Test is essential in cases where the Sequential Test is unable to deliver acceptable sites for allocations. In some areas of flood risk development may be required to ensure social or economic blight does not occur, thus ensuring continued sustainable development or constraints on land elsewhere (i.e. areas protected by nature conservation designations preclude the identification of additional lower risk areas).

5.3.3 What is required to pass the Exception Test?

The Exception Test can be applied, when appropriate and following the application of the Sequential Test, where it is not possible to locate development within flood zones that have a lower probability of flooding (NPPF, Section 102).

Figure 5-1 in Section 5.2 highlights the stages in the Sequential Test at which the Exception Test may need to be applied. The Test provides a method of managing flood risk whilst still allowing necessary development to occur. It may not always be appropriate to apply the Exception Test, however if applied, both of the following elements must be passed.

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA; and
- a site-specific FRA must demonstrate that the development will be safe taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Figure 5-2 presents the process that should be followed by the Council in its application of the Exception Test under the NPPF.

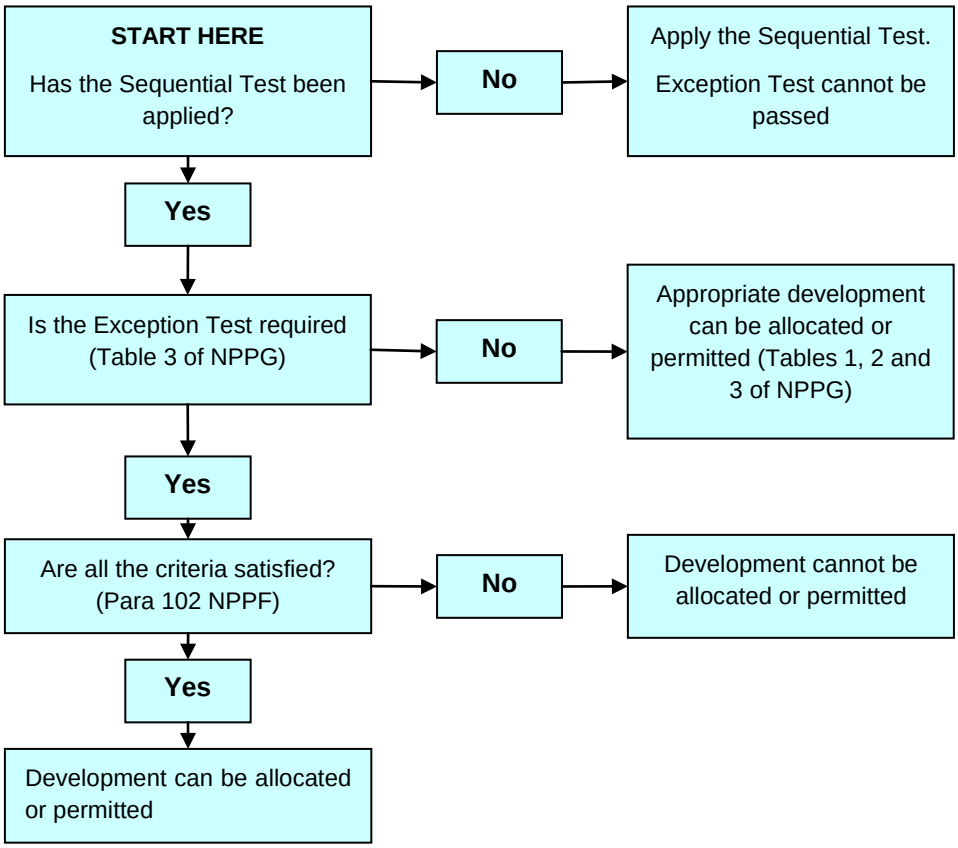


Figure 5-2: Application of the Exception Test

The first part of the test reflects on the wider sustainability benefits of the development, which should be tested against the aims and objectives of the Sustainability Appraisal and other Local Plan policy. As indicated above, other spatial planning issues such as transport, housing, economic growth, natural resources, regeneration, biodiversity, the historic environment and other hazards can influence the overall suitability and sustainability of development at a site and these issues should be considered in relation to whether the site meets the first criteria of the Exception Test.

The second part of the Exception Test relates to the safety of the development and the need to not increase flood risk elsewhere. There are no fixed criteria for what constitutes 'safe' development, as it will depend upon not only the nature of the development but also the source and mechanism of flood risk. Appropriate application of the flood risk management hierarchy of 'Avoid – Substitute – Control – Mitigate' can increase the safety of a development, however, it is the responsibility of the developer to show that the measures proposed are sufficient.

It is important that the individual Councils retain a record of all its assumptions and decisions with regard to both the Sequential and Exception Tests, in order to demonstrate that they have performed the process appropriately.

Figure 5-3 identifies the key concepts to consider when assessing whether a site will be safe over the lifetime of the development.

Flood events, more than many other emergencies, can affect a wide number of homes and properties and the time to recover from a flood emergency can be prolonged. Accordingly it should be remembered that the level of "safety" will vary depending on the vulnerability of the community and land use affected. More vulnerable residents will potentially be more severely affected by the consequences of flooding and levels of safety should be commensurate with the risk.

Because of the variability in the definition of safety there can be no fixed specification of what is safe. Figure 5-3 should therefore be used when considering the risks to a site to assist in making a judgment on whether a site can be considered safe given its proposed use and users. Where possible, however, the following should be considered for new development that is within the floodplain and justification should be provided where this cannot be achieved:

- Development ground floor levels and access should be dry, particularly for More or Highly Vulnerable uses; and
- The Flood Hazard should be less than Significant (Dangerous for Most People), as defined within DEFRA/EA FD2321/TR1 Report Flood Risks to People[1]. This implies a Hazard rating of less than 1.25, which correlates to fast flowing shallow water and/or slow flowing deep water. The EA recommends that this rating is less that 0.75 (Danger for Some – Elderly and Infirm).

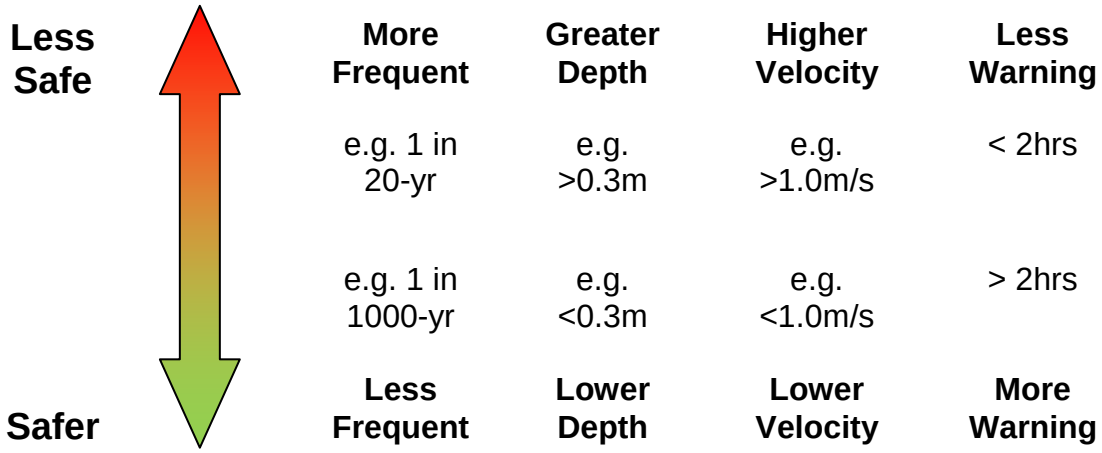


Figure 5-3: Site-specific aspects to consider with respect to what is 'safe?'

5.4 Climate Change

Guidance that is of relevance within the Level 1 SFRA study area on the anticipated effects of climate change on flood risk indicates that rainfall will become more intense and river flows will increase in relation to the severity and frequency of the event. Guidance is provided by Defra in its *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts* document from October 2006, which has been incorporated into the guidance provided in the Technical Guidance to the National Planning Policy Framework.

More intense rainfall will result in an increase in surface water and sewer flooding incidents as the infiltration capacity of land is exceeded and sewer systems are overwhelmed more frequently. Fluvial flows will increase as a consequence, resulting in more frequent fluvial flooding and a greater risk to areas already at risk and an increase in the extent of areas at risk.

Climate change impacts used within this assessment are those that have been agreed with the EA. These show a gradual increase in the intensity of rainfall by up to 30% by 2115 and an increase in fluvial flows by up to 20% by 2115. The effect of climate change on offshore wind speed and wave heights is not relevant within the SFRA. Table 5-4, below, summarises the relevant effects of climate change as agreed with the EA.

[1] DEFRA/EA FD2321/TR1 Report Flood Risks to People, March 2006.

Table 5-3: Climate change impacts (from Table 5 of NPPF technical Guidance)

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%		

The effect of climate change on the 1% AEP fluvial flood risk is explicitly indicated in Figures FZ-CC, FZ-LD, FZ-SB & FZ-SS in Volume 2 and should be taken into account of the lifetime of the development when considering flood risk at a site and in applying the exception test. However, the effects of climate change are not available for datasets presenting the risk of flooding from surface water or from reservoirs and canals. Climate change information for surface water flooding is presented in the Phase 2 SWMPs for specific areas. A flood risk assessment should consider the effect of climate change on these sources of flooding if they affect a proposed development site.

6. Guidance for Developers

An SFRA is a strategic document that provides an overview of flood risk throughout the study area. Site-specific FRAs will be required for most proposed developments and the level of detail will depend on the level of flood risk at the site. The onus is on the developer to provide this information in support of a planning application. The developer should apply the sequential approach to any flood risk within the site itself and demonstrate compliance with the NPPF when determining the location of appropriate land uses. The aim of the sequential approach is to minimise flood risk by considering the probability of flooding in conjunction with the vulnerability of receptors.

Where developers promote development outside of the allocated areas identified in the DPD and within flood risk areas defined in Level 1 SFRA Volume 2 (Figure FZ-CC, FZ-LD, FZ-SS & FZ-SB), they are responsible for demonstrating compliance with the NPPF, notably by obtaining confirmation from the relevant council that the proposed application site satisfies the outcome of the Sequential Test and if necessary the Exception Test. The evidence required for the Sequential and Exception Tests to be applied is likely to include:

- Information on the flood risk on the site.
- Information on the availability of 'reasonably available' sites in areas of lower flood risk.
- Information on the vulnerability classification of the development.
- Information on the wider sustainability benefits of the site (if the Exception Test will need to be applied).
- Information to show that the development is safe.

In areas where flood risk has been identified as an issue, developers should liaise with the relevant council to agree on who should be consulted. Pre-application discussions between the relevant council, the EA and other relevant stakeholders should be used to scope out the availability of other sites that may meet the requirements of the application and also to scope out what evidence will be required to show that other sites have been considered. The scope of any site-specific FRA should also be agreed with the relevant council, which will be informed by the outputs from the Level 1 and Level 2 SFRA and in consultation with the EA where necessary.

Following the implementation of the Flood and Water Management Act 2010, Local Authorities are now responsible for the management of flood risk from local sources and are therefore responsible for, and should be consulted about, all sources of flooding other than from main rivers, the sea and large reservoirs, which remain the responsibility of the EA.

Developers may want to consult with insurers to discuss the suitability of flood risk management measures and how this affects the overall insurability.

6.1 Flood Risk Assessments (FRAs)

The NPPF states that FRAs should be carried out to the appropriate degree at all levels of the planning process, to assess the risks of all forms of flooding to and from development taking climate change into account and to inform the application of the sequential approach. It is the responsibility of developers to consider the flood risk to a site as early as possible.

Planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 will require a FRA. A FRA will need to demonstrate that flood risk to the development can be managed now and in the future over the lifetime of the development, that the development will not increase the risk of flooding elsewhere and that the proposals are compliant with local planning policy. The scope of a FRA should include the following key points directed by the policy guidance and recommendations, which are detailed in NPPG.

Development description and location:

- What type of development is proposed (e.g., new development, an extension to existing development, a change of use etc.) and where will it be located?
- What is its flood risk vulnerability classification?
- Is the proposed development consistent with the Local Plan for the area? (Seek advice from the local planning authority if you are unsure about this).
- What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type?
- Will your proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? (Particularly relevant to minor developments (alterations & extensions) & changes of use).

Definition of the flood hazard

- What sources of flooding could affect the site?
- For each identified source in box 2a above, can you describe how flooding would occur, with reference to any historic records where these are available?
- What are the existing surface water drainage arrangements for the site?

Probability of flooding

- Which flood zone is the site within? (As a first step, check the Flood Map for Planning (Rivers and Sea) on the EA's web site)
- If there is a Strategic Flood Risk Assessment covering this site (check with the local planning authority). Does this show the same or a different flood zone compared with the EA's flood map? (If different you should seek advice from the local planning authority and, if necessary, the EA).
- What is the probability of the site flooding, taking account of the maps of flood risk from rivers and the sea and from surface water, on the EA's web site, and the Strategic Flood Risk Assessment, and of any further flood risk information for the site?
- If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?

Climate change

- How is flood risk at the site likely to be affected by climate change? (The local planning authority's Strategic Flood Risk Assessment should have taken this into account. Further information on climate change and development and flood risk is available on the EA's web site.

Detailed development proposals

- Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (including providing details of the development layout)?

Flood risk management measures

- How will the site/building be protected from flooding, including the potential impacts of climate

change, over the development's lifetime?

Off site impacts

- How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?
- How will you prevent run-off from the completed development causing an impact elsewhere?
- Are there any opportunities offered by the development to reduce flood risk elsewhere?

Residual risks

- What flood-related risks will remain after you have implemented the measures to protect the site from flooding?
- How, and by whom, will these risks be managed over the lifetime of the development? (E.g., flood warning and evacuation procedures).

6.2 Consultation with the Environment Agency

The EA has developed a consultation matrix, which identifies when the EA should be consulted, and what level of information needs to accompany the FRA if one is required. The council within the Level 1 SFRA study area support this process by identifying the extent of flood risk from different sources within their administrative boundary and, with respect to fluvial flood risk, the extent, depth, velocity and hazard.

The EA consultation matrix is part of the EA's Flood Risk Standing Advice (FRSA), which is provided to LPAs for more straightforward planning applications. The FRSA also allows LPAs to identify those higher risk development situations where consultation with the Agency is essential. This information is available on the Agency website at *www.environment-agency.gov.uk/planning*.

As of January 2014 the EA will no longer respond in details to individual planning applications that are considered to be 'low risk'. The EA will provide standard comments in response to these applications, in line with flood risks and NPPF. This type of response will mainly be given to development in Flood Zone 1 greater than 1 hectare. Please note at present these procedures are not detailed in the FRSA package, however eventually it will be included.

6.3 Consultation with the Lead Local Authorities

The Lead Planning Authority and the developer should consult with the Lead Local Flood Authority, Staffordshire County Council specifically in regards to site specific surface water drainage, etc. This will be until the SuDS Approval Bodies (SABs) are introduced later in 2014.

6.4 Consultation with Severn Trent Water

The study area is serviced by surface water, foul and combined sewers. Unless new development is to be located directly adjacent to a watercourse it is likely that development runoff will discharge to the local sewer network, which is known to have limited capacity in some locations. Developers should consult with Severn Trent Water as early as possible in the formulation of development proposals in order to determine the capacity of the local drainage network to accept surface water runoff as well as potential connection points. Severn Trent Water is the starting point for all developments. Severn Trent Water specify that surface water should not be connected to the public sewerage system unless it can be proved that this is the most sustainable option.

The Floods and Water Management Act 2010 is set to remove the automatic right to connect to public surface water sewers, which may require developers to provide more justification than is currently required in order to connect to the Severn Trent Water sewer network. It may in future be necessary

to provide evidence that surface water runoff cannot be appropriately managed within the site through the use of soakaways or direct discharge to surface water in order to gain approval for connection to the public surface water sewer. Developers should seek opportunities to reduce the existing discharge from the site to below the existing rates and volumes.

6.5 Consultation with Canal & River Trust

British Waterways ceased to exist in England and Wales and was replace by Canal & River Trust. The canals within the Level 1 study area are owned and managed by Canal & River Trust and must be consulted in relation to any development adjacent to its assets. The *Code of Practice for Works Affecting British Waterways* (August 2007), gives guidance and procedures to Developers, Local Authorities, Statutory Undertakers and their consultants when undertaking work that may affect the waterways.

The Canal & River Trust can advise of the risk to a particular property with respect to flood risk from the canal and can provide guidance on the need to conduct more detailed analysis of the potential risk from failure of a Canal and River Trust assets on flood risk at a particular site, including on the need for and details of breach modelling. It should be noted that because of the managed nature of the waterway network and the unlikely and unpredictable nature of flooding from the waterway, flooding from the canal should be considered a residual risk and therefore not a source of flooding that should determine whether development takes place but instead should be considered a potential source of flooding that should be considered within the flood risk management and design of the site.

6.6 Suggested Flood Resilient Construction

6.6.1 Raised Flood Levels and basements

The raising of floor levels above the 1 in 100 year 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.

6.6.2 Development behind defences

Areas behind defences are at particular risk due to breach or overtopping, resulting in the rapid on-set of fast-flowing, deep water flooding with little or no warning. Risks will therefore be highest closest to these defences and as such it is recommended that the LPAs should set back developments and ensure that those proposing developments develop robust evacuation plans as part of their FRA in consultation with the EA.

Consideration of flood risk behind defences should be made as part of detailed FRAs. Developers should review Volume 2, Figure FZ-CC, FZ-LD, FZ-SS & FZ-SB, to determine the location of

structures and defences in proximity to the site and therefore identify the possibility of localised residual flood risk. The FRA should take into account:

- The potential mechanisms of failure of flood defence infrastructure
- The standard of protection and design freeboard
- The asset condition of the flood defence
- The height of the flood defence infrastructure and retained water levels compared to ground levels
- The potential location, width and invert level of breach(es) in the flood defences
- The duration of water levels during a flood event or tidal cycle
- The period it would take the operating authority to close the breach
- The period it would take for water to drain from the flooded area following a breach or overtopping event

In addition to it is recommended that should any development be proposed in a defended flood area, the potential cumulative impact of loss of storage on flood risk elsewhere should be considered.

6.6.3 Car parks

Car parking may be appropriate in areas subject to shallow, low velocity flooding (in High Probability Zone 3a) provided sufficient flood warning is available, and appropriately located and worded signs are in place. However, this would need to be discussed and agreed with the LPA and EA. As part of a FRA, the developer should consider the likelihood of people being able to move their cars within the flood warning time.

7. Flood Warning Systems and Flood Management Measures

Current flood risk management practices within the Level 1 SFRA study area have been discussed in Section 2. This section describes the practices that are planned for the area or can be incorporated into new developments.

7.1 Flood Defences, Storage Areas & Residual Risk

Flood defences are structures which affect flow in times of flooding and therefore prevent water from entering property. They generally fall into one of two categories: 'formal' or 'informal'. A 'formal' defence is a structure which has been specifically built to control floodwater. It is maintained by its owner (this is not necessarily the EA) so that it remains in the necessary condition to function. An 'informal' defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

A study of informal defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study, it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal defences should be identified as part of site-specific detailed FRAs and the residual risk of their failure assessed.

In accordance with the scope of a Level 1 SFRA, a high level review of formal flood defences has been carried out using data from the NFCDD. This is a good starting point for identifying significant flood defences and potential areas benefiting from defence, but the quantity and quality of information provided differs considerably between structures. The NFCDD is intended to give a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA where the need arises).

In producing Flood Zone maps the EA takes the presence of defences into account by showing the area that benefit from the defence (ABD). This area can also be deemed an area which is at risk of defence overtopping or failure. It can therefore also be described as a residual risk zone. Residual flood risks can arise due to:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system
- A severe flood event that exceeds a flood management design standard and results in, for example, overtopping.

The presence of Areas Benefiting from Defences (ABDs) are discussed for each Council in the sections below.

In the study area there are a number of storage areas. 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. It is imperative that any natural storage areas and purpose-built water bodies 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. It is imperative that these areas are not infilled to allow development. The presence of these storage areas are discussed in the sections below.

7.1.1 Cannock Chase District

Within the study area a number of structural flood risk management measures (defence walls, attenuation reservoirs, etc) have been constructed in recent years within the Ridings Brook Catchment. Historically, flooding has been experienced at a number of locations along the Ridings Brook. In 1977 Mill Green Balancing Pond was constructed to attenuate storm flows and help relive downstream flooding. However, despite the construction of the balancing pond, flooding continued to occur in times of severe storm. Following a review of the catchment by Cannock Chase Council (Ridings Brook – Catchment Plan, 1998), Halcrow Group Ltd was commissioned to undertake a Project Appraisal Report (PAR) for the Ridings Brook, Cannock and in December 2006 the Cannock Chase Flood Alleviation Scheme (FAS) was completed.

The Flood Alleviation Scheme has been designed to provide protection to 151 residential and business properties from a 2% (1 in 50 year) event and an additional 94 properties from an event with a 1.3% chance (1 in 75 year) of occurring in any year. The following work has been undertaken as part of the scheme:

- **Mill Green Dam –** The existing dam was raised by 2m to increase flood storage capacity to 198,000m^3. Outlet penstocks were installed to regulate flows through Cannock. The penstocks are automatically controlled via water level monitors at Rumer Hill and the A5.
- **Rumer Hill –** An 80m long flood wall of height 1-1.5m was constructed behind properties on the north side of Rumer Hill Road. New walls constructed on the watercourse upstream of Rumer Hill Road protect properties on both sides from flooding. Further walls approximately 100m in length protect additional properties in the allotments and between the residential and commercial properties. The channel capacity of the watercourse was also increased.
- **A5 and Sewage Treatment Works Area –** New enlarged culverts were constructed beneath the A5 trunk road and the river channel was realigned to improve flow capacity. The sewage works storm overflow discharge channels were re-routed and a number of environmental enhancements were undertaken.

Sections of culverted watercourse as identified within NFCDD have been demonstrated in Volume 2, Figure FD-CC.

In some areas, particularly for existing properties and proposed developments behind defences, it may be necessary to extend the scope to a more detailed SFRA. The outputs from detailed overtopping and breach analysis of the key defences will provide refined hazard information on flood depths, velocities and flow paths, which could be used by the LPA emergency planning teams to define new or refine existing emergency plans for these areas.

Within the Cannock Chase district administrative boundary there is one ABD. This ABD is due to the Cannock Flood alleviation Scheme. The flood defence includes flood walls which provide protection to local residents. With this, and local culverts, there is a residual risk of overtopping, breach or blockage, which could result in significant damage to buildings and highway infrastructure as well as posing danger to life.

Actual levels of residual risk will vary spatially depending on flow routes, velocities, flood depths and proximity to the breach or overtopping location. In the event that the Exception Test needs to be applied to specific site allocations, the scope of the SFRA should be extended to a more detailed assessment to refine information on the flood hazard in defended areas.

All culverts and defences are also shown in Volume 2, Figure FD-CC. These should be referenced by those proposing development to identify the possibility of localised residual risks as well as opportunities for de-culverting and restoring the natural channel.

7.1.2 Lichfield District

There are permanent formal defences located within Lichfield District along the River Tame in Fazeley (Volume 2, Tile A1). The defence runs along the River Tame/Bourne Brook confluence. When constructed in the early 1960's, the defence was designed to protect to a 1 in 100 year standard plus freeboard. At one location, this freeboard had been eroded by cattle, and during the June 2007 event,

overtopping occurred at this location. Following this event, the EA undertook repairs to the freeboard where it had eroded.

There are two sets of new defences located along the New Trent outside of King's Bromley and on the River Trent both the right and left bank.

All culverts and defences are also shown in Volume 2, Figure FD-LD. These should be referenced by those proposing development to identify the possibility of localised residual risks as well as opportunities for de-culverting and restoring the natural channel.

There are a number of areas of floodplain acting as natural storage within the Lichfield District study area. Located upstream of Tamworth (in the south-eastern section of the study area) the River Tame flows towards Fazeley. There is wide natural floodplain on the left bank (between Drayton Bassett and Tamworth) which conveys and stores significant volumes in times of flood. Downstream of Tamworth, the River Tame flows through large predominately rural agricultural land, with wide flat floodplains, before joining the River Trent at Croxall.

The River Blythe, a right bank tributary of the River Trent, flows through wide open rural agricultural land with large areas of natural storage. The River Tent also has natural wide floodplain for the majority of the length through the study area, but also flows into the Saddlesall lake system, at Kings Bromley, which will provide additional storage in times of flood.

Within the Lichfield District there are no Areas Benefiting from Defences (ABDs) contained within the EA's ABD database. There are however several major formal flood defences. With each defence there is a residual risk of overtopping, breach or blockage, which could result in significant damage to buildings and highway infrastructure as well as posing danger to life. It is possible that future modelling work undertaken by the EA may lead to the availability of such information and therefore the flood maps should be updated if this information becomes available. Areas of residual risk are treated uniformly and are represented in the GIS as a simple outline of the expected affected area. Actual levels of residual risk will vary spatially depending on flow routes, velocities, flood depths and proximity to the breach or overtopping location. In the event that the Exception Test needs to be applied to specific site allocations, the scope of the SFRA should be extended to a Level 2 assessment to refine information on the flood hazard in these locations.

7.1.3 South Staffordshire District

Only a few locations at risk of flooding are currently protected by permanent defences within South Staffordshire, and can be viewed in Volume 2, Figure FD-SS. 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 Book 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 and the River Penk.

A number of council maintained defences have been identified as part of this study. Figure FD-SS 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.

The EA NFCDD layer also identifies a number of privately owned defences within the South Staffordshire District. These include a control floodbank at Warstones balancing area, and a series of floodbanks and retaining walls at the waterworks in Dunsley, Kinver.

The defence and culverted watercourse as identified within NFCDD are shown in Figure FD-SS, Volume 2.

7.1.4 Stafford Borough

The NFCDD identifies the following flood defence structure in the Stafford Borough:

- In the village of Millmeece, approx 287m of the railway embankment and an archway through the embankment are classified as flood defence structures and are maintained by the EA.
- In Yarnfield there is a weir on a small watercourse running through the village over a weir which is maintained by the EA to provide flood defence.
- In Stafford Town there are a few places where flood defences have been installed. These include a pond and reed bed on the Marston Brook adjacent to the Astonfields industrial park which is maintained by the EA. Also a few sections of floodwall and bridge abutment at Meadow Bridge in the town centre which are listed as being under private ownership.
- A scheme to protect Stafford town was undertaken in the 1970's, giving the majority of the town protection to a 1 in 100 year standard. In 1994 an asset survey identified that problems were developing at the river edge in Victoria Park, caused by the poor ground conditions in Stafford. In November 2000, Stafford experienced serious flooding, with properties in the Newport Road and Bridge Street areas being worst affected. A flood alleviation scheme was developed and completed in 2004 to replace existing piling which was in need of repair. Flood risk through the centre of Stafford has been reduced, and the construction of a new flood defence wall near Green Bridge has improved flood protection for the Newport Road and Bridge Street area of Stafford.

There are no Areas Benefiting from Defences (ABDs) contained within the EA's ABD database within Stafford Borough administrative area. This is because modelling work has not been carried out to define the ABD area. With each defence there is a residual risk of overtopping, breach or blockage, which could result in significant damage to buildings and highway infrastructure as well as posing danger to life. It is possible that future modelling work undertaken by the EA may lead to the availability of such information, and therefore the flood maps should be updated if this information becomes available. Areas of residual risk are treated uniformly and are represented in the GIS as a simple outline of the expected affected area. Actual levels of residual risk will vary spatially depending on flow routes, velocities, flood depths and proximity to the breach or overtopping location. In the event that the Exception Test needs to be applied to specific site allocations, the scope of the SFRA should be extended to a Level 2 assessment to refine information on the flood hazard in these locations.

Scotch Brook through Stone is prone to soil and bank erosion, made worse by aggregate being removed upstream. It transports and deposits significant amounts of loose material, including fine material, gravel, boulders and fallen trees. This can block the channel or any structures along the watercourse, reducing their capacity, and therefore presenting residual risk. Additionally, poorly maintained trash screens and rubbish inappropriately dumped in watercourses in urban areas can cause a residual risk if structures become blocked.

All structures and defences are mapped in Volume 2, Figure FD-SB. These should be referenced by those proposing development to identify the possibility of localised residual risks as well as opportunities for deculverting and restoring the natural channel.

West of Stafford the Doxey Tillington SSSI nature reserve is an area of extensive floodplain storage, creating an area of wet marshland. The marshes provide an area of extensive floodplain through the town of Stafford. The area is classified a nature reserve and a SSSI, and provides 300 acres of wet grassland. The River Sow and a number of arterial drains pass through the reserve and periodically breach, subjecting the marshes to flooding. The area was created due to subsidence as a result of local brine pumping. This formed a distinct area of open water locally known as flashes. There has been little change in the management of the marshes from the middle ages to the mid twentieth century. In 1979, the Severn Trent Water Authority carried out flood alleviation work which involved the re grading and deepening of the Sow throughout the site, resulting in a 25% increase in capacity and a fall in water levels of around 1m.

Natural storage areas, i.e. undeveloped floodplain, are in abundance in Stafford Borough. It is imperative that these are protected and continue to be used as a means of attenuation of flood

waters. They should also 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.

7.1.5 Proposed and Future Flood Alleviation Schemes

The EA have provided details of proposed and future flood alleviation schemes that will be managed by the EA or by Staffordshire County Council.

The following schemes have been proposed by the EA within their Medium Term Plan:

- Sandyford Brook (NGR: SJ 9312 2302): The EA have indicated that part of the money can be funded through Flood Defence Grant in Aid and the remainder will have to be met through developer contributions at Land North of Stafford. The scheme is due for completion in 2021 (dependent entirely on developer). This scheme will provide a benefit to 77 properties.
- Rising Brook, Stafford (NGR: SJ9247021555): The proposed scheme will cost approximately £1.6m. The scheme will provide benefit to 100 properties. The scheme is to be completed 2020/21 (subject to the programme). There is a requirement of an upstream storage option, however it is unknown where the contribution for this scheme will come from.
- Rising Brook, Rugeley (NGR: SK04311799): The proposed scheme will cost approximately £1.5m and provide benefit to 70 properties. The scheme is to be completed by 2018/19. The scheme requires funding input of approximately £700k from Local Enterprise Partnership (LEP). This scheme is essential for the delivery of regeneration of Rugeley Town Centre under Area Action Plan Policy 7.
- Scotch Brook, Stone (SJ9010133596): The proposed scheme will cost approximately £2m and will provide benefit to 21 properties. The proposed scheme involves replacement of Syphon under canal with some an aqueduct/box culvert. Approximately 4% of the cost will be funded through Flood Defence Grant in Aid. The remaining fund will need to be made up from Developer contributions, LEP, and the Canal & Rivers Trust. The scheme is to commence in 2022/24 and to be completed in 2025/28

The following schemes are within Staffordshire County Council pipeline, these schemes were provided by the EA but the have not yet been confirmed by the Staffordshire County Council.

Project	Type	Location NGR	Houses to be protected	Anticipated Year of Completion
Kinver, River Stour, PLP Scheme	PLP	SO47103310	1	2016/17
Pooley Lane, Moreton, Surface Water FAS	PLP	SJ79471716	1	2016/17
Perton, Surface Water FAS	DEF	SO86319977	220	2016/17
Huntingdon, Cannock, Surface Water FAS	DEF	SJ74992602	29	2017/18
Lower Tean, River Tean, FAS	DEF	SK19998632	9	2017/18
Knoll Brook, Barton under Needwood, Flood Alleviation Scheme	DEF	SK83228770	14	2017/18
Rolleston on Dove, Surface Water FAS	DEF	SK40237716	16	2017/18
Dunston, River Penk, PLP Scheme	PLP	SJ22757779	3	2018/19

PLP – Property Level Protection

DEF – Defence

7.2 Flood Warning

The EA 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 EA, local authorities and the emergency serves to work together to protect people and properties. Cannock Chase District, Lichfield, South Staffordshire and Stafford Borough falls within the Central area of the Midlands Region of the EA, and the Flood Incident Management Team here is responsible for issuing flood warnings in the study area.

When conditions suggest that flood are likely, it is also the responsibility of the EA 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.

Sir Michael Pitt's review[i] of the summer 2007 floods stresses the importance of developing a flood warning system for surface water flooding. One of the reports interim conclusions (IC3) was *"the EA further develops tools and techniques for predicting and modelling river flooding, especially to take account of extreme multiple events; and takes forward work to develop similar tools and techniques to model surface water flooding."*

The flood warning system is in operations for the main rivers within the Level 1 SFRA Study areas and is outlined below in four stages.

Flood Watch Alert

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.
- Consult the EA's website: http://environment-agency.gov.uk/subjects/flood/?version=1&lang=_e

Flood Watch Areas 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 for the Council are shown in Table 7-1.

Table 7-1 Council Flood Watches

Lichfield District	Midlands, Upper Trent 2 (covering the Trent corridor and River Blithe)
	Midlands, Upper Trent 3 (including Lichfield, the Bourne Brook, the River Tame and the River Mease)
Stafford Borough	Midlands, Upper Severn 2 (covering the western segment of the Borough)
	Midlands, Upper Trent 3 (covering Stafford)
	Midlands, Upper Trent 4 (covering the Trent corridor)
South Staffordshire District:	River Stour
	Smestow Brook & Tributaries,
	River Sow
	River Penk
Cannock Chase	Stafford and Burton including Cannock, Rugeley & Uttoexter.
	Tamworth and Nuneaton including Lichfield, Hinckley and Ashby
	Birmingham including Solihull, Walsall and Sandwell

Flood Warning Areas

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

Flood warning areas service is currently set up to warn properties within the Flood Zones 2 and 3. The following locations are currently covered by the EA Flood Warning System:

Lichfield District	• River Trent at Handsacre, Nethertown and Kings Bromley. • River Tame at Elford including Elford Mill and Stubby Lea Farm. • River Trent in the Alrewas and Wychnor including Coton Close and Church Road in Alrewas, Wychnor Bridges and Sewage Works. • The Risings Brook, on the Ridings Brook and on the Saredon Brook.
South Staffordshire	• River Penk at Penkridge • Saredon Brook at Standeford near Coven • River Stour at Kinver • River Stour and Smestow Brook in the Black Country and South Staffordshire
Stafford Borough	• River Sow at Stafford from Tillington to Kingston. • Sandyford Brook in Stafford at Sandon Road and the Queensway area. • River Penk at Acton Bridge. • River Trent at Great Haywood Little Haywood Colwich and Wolsey Bridge area. • River Trent at Enson Sandon Salt and Weston areas. • River Trent at Stone including Trent Close and Stafford Street. • River Trent at Hanford and Trentham including Church Lane area of Hanford, Park Drive in Trentham and Trentham Gardens.
Cannock Chase	• Ridings Brook at Bridgtown, Cannock, including parts of Walsall Road and Longford Industrial Estate. • Ridings Brook at Rumer Hill, Cannock including parts of Rumer Hill Road, Walsall and St Johns Road. • Saredon Brook at Wedges Mills, Cannock. • River Trent at Rugeley including Mast Trading Estate, Power Station Road area, Boston Industrial Estate, Bishops Grange and Vicars Croft. • River Trent at Great Haywood Colwich and Wolsley Bridge area.

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

Within the following Council administrative areas there are the following Severe Flood Warning areas are in operation:

Lichfield District	• River Tame from Drayton Manor to Hopwas
Stafford Borough	• River Penk from Coven to Stafford. • River Trent from Knypersley to Darlaston. • River Trent from Darlaston to Great Haywood.
South Staffordshire District:	• River Penk from Coven to Stafford. • River Stour at Kinver. • River Stour at Kidderminster.

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

7.3 Flood & Emergency Response Plan

Each Local Authority (County, District and Borough) have the following responsibilities under the under the Civil Contingencies Act 2004:

- Assess the risk of emergencies occurring and use this to inform contingency planning.
- Put in place emergency plans.
- Put in place business continuity management arrangements.
- Put in place arrangements to make information available to the public about civil protection matters and maintain arrangements to warn, inform and advise the public in the event of an emergency.
- Share information with other local responders to enhance co-ordination.
- Co-operate with other local responders to enhance co-ordination and efficiency.
- Provide advice and assistance to businesses and voluntary organisations about business continuity management.

South Staffordshire, Lichfield District and Staffordshire County Council employ the Staffordshire Civil Contingency Unit to manage their responsibilities under the Act. Whereas, Stafford Borough and Cannock Chase District Council manage their responsibilities internally through an Emergency Planner.

As part of these duties, all Local Authorities form part of the Staffordshire Resilience Forum (SRF), which consists of more than 20 Category 1 responders, who work together to ensure Staffordshire is resilient, and a safe place to live and work.

Each Local Authority has its own emergency plans – either a Major Incident Plan or Incident Response Guide, which outlines the Council's own response to an incident in their area, as well as Business Continuity Plans, which outline how the Council will continue to operate its Critical Services during an incident. In addition, most of the Councils also have their own Local Flood Plans, which sit underneath the Staffordshire Emergency Flood Plan, which highlight the specific flood risk areas in that local area, the response mechanisms in place for flooding in that area, and how to escalate to a major flooding event, which would then be managed by the Staffordshire Emergency Flood Plan.

It is recommended that the Council's Emergency Response Plan and Staffordshire Emergency Plan is reviewed and updated in light of the updates of the SFRA to ensure that safe evacuation and access for emergency services is possible during times of flood both for existing developments and those

being promoted as proposed development areas. It is further recommended that the Council works with the EA to promote the awareness of flood risk to maximise the number of people signed up to the FWD service (previously this has involved targeted mail shots to those identified as living within Flood Zone 3a).

With respect to new developments, developers should take advice from the Council and/or the Staffordshire Civil Contingency Unit (depending on the location of the Council area), for large-scale developments when producing an evacuation plan as part of a FRA. As a minimum these plans should include information on:

How flood warning is to be provided:

- Availability of existing warning systems;
- Rate of onset of flooding and available warning time; and
- Method of dissemination of flood warning

What will be done to protect the infrastructure and contents:

- How more easily damaged items could be relocated
- The potential time taken to respond to a flood warning
- Ensuring safe occupancy and access to and from the development
- Occupant awareness of the potential frequency and duration of flood events
- Provision of safe (i.e. dry) access to and from the development
- Ability to maintain key services during an event
- Vulnerability of occupants and whether rescue by emergency services may be necessary and feasible
- Expected time taken to re-establish normal practices following a flood event

7.3.1 Staffordshire Emergency Flood Plan

The following information is provided with the Staffordshire Emergency Plan which covers all four council areas. The plan contains the following details, and should be referred to where deemed appropriate:

- Detail of the trigger warnings that are set up in the county council area and who is responsible for these warnings.
- Details of where sandbags are available within the council areas.
- Detail on how to deal with hazardous and vulnerable sites
- Templates available in the plan for the following SAM Agenda, SCG Agenda, TCG Agenda and Public Information Leaflet.
- Details of other key related plans which included EA Staffordshire Local Flood Warning Plan and Staffordshire Prepared Generic Offsite Reservoir Plan.

7.3.2 Staffordshire Reservoir information:

A Large Raised Reservoir is defined as “of capacity greater than 25,000m^3 above surrounding land” (Reservoirs Act 1975). This capacity has changed to 10,000m^3 when regulations come into force following the publication of the Flood and Water Management Act 2010.

In Staffordshire County Council there is 45 Large Raised Reservoirs. Staffordshire does not have any of the highest risk reservoirs in the country and therefore does not require any site-specific offsite emergency plans for individual reservoirs. None of Staffordshire’s Large Raised Reservoirs are in Stoke-on-Trent, but is affected if Knypersley or Serpentine Reservoirs breach.

The reservoir owners should have should all have onsite emergency plans. There should also be a Generic Offsite Reservoir Plan which contains two response sections

- Standby – Potential problem with a reservoir – may instigate a Strategic Assessment Meeting
- Implementation – Trigger level for Alarm, Imminent Failure or Failed is activated by the Reservoir’s onsite plan.

At the end of 2009/early 2010 Reservoir Flood Maps (RFMs) and summary sheets for all 45 reservoirs were provided by the EA. These maps are provided on the EA website (and have been produced as part of this Level 1 SFRA, Figure RIM-CC, RIM-LD, RIM-SB and RIM-SS) and are also held by CCU in the Members Area of the Staffordshire Prepared website under 'Reservoirs'.

The maps that are available in this report and on both websites, are outlines of the extent of the inundation areas. In addition detailed maps were created showing velocity, depth, time to impact etc. These maps are Restricted and are only available on the National Resilience Extranet (NRE) or from the EA. It is important to note that all maps are based on worst case scenario.

8. Guidance for Application of SuDS

8.1 What are SuDS?

SuDS are a varied collection of techniques designed to manage surface water in a sustainable manner. SuDS achieve this by seeking to manage surface water from new developments as close to its source as possible and by mimicking the surface water flow regime present on a site prior to development. Typically this approach involves a move away from conventional piped systems to softer engineering solutions inspired by natural drainage processes.

For SuDS to be fully sustainable they should seek to contribute to each of the three goals of sustainability (identified below), with the favoured system contributing equally to each goal. The three goals of sustainable drainage systems are:

1. Reduce flood risk (to the site and neighbouring areas),
2. Reduce pollution, and,
3. Provide landscape and wildlife benefits.

In addition, SuDS should also be designed to ensure they remain effective for storm events up to and including the 1% annual probability storm event including an increase in peak rainfall intensities to account for the predicted effects of climate change.

8.2 SuDS Policies

Section 2 outlines the policies that govern development and flood risk management in the Level 1 SFRA area. It is widely recognised that SuDS are a useful tool in the management of flood risk and water quality. As a result, the use of SuDS in individual planning applications should be promoted. Whilst NPPF does not contain the detailed specific guidance of PPS 25, the essence of PPS 25 is still applicable to any development site. However NPPF does indicate that developers should not increase flood risk and should seek opportunities to reduce the overall level of flood risk to the area and beyond.

The following general principal should be followed:-

"The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect."

This is to alleviate the pressure on sewer systems that may be old or serving a catchment area greater than their original design or designed to a standard less than the 1% annual probability event now required.

If a proposed development results in an increase in surface water runoff, the EA (and Local Authority following the introduction of SuDS Approval Bodies) will expect to see SuDS forming part of the proposed mitigation. With their powers of direction, developments that do not incorporate SuDS without sound reasons can expect them to be required through Section 106 conditions to their planning permissions. Where the consented discharge rates are low, retrofitting of SuDS can significantly impact development proposals.

8.2.1 SuDS Approval body (SAB)

The Flood and Water Management Act 2010 set out in Schedule 3 details for the establishment of a SuDS Approval Body (SAB) which will be the responsibility of SCC as the Lead Local Flood Authority (LLFA). The SAB will be a statutory consultee of the planning process.

Schedule 3 of the Act, which is yet to be commenced, will require new drainage systems to be assessed and approved prior to construction. It requires that the drainage system meet new national standards (currently being consulted upon) for the design, construction, operation and maintenance of

SuDS. If these National Standards are met then the SAB will be required to adopt and maintain the SuDS where they serve more than one property.

The Act also amends Section 106 of Water Industry Act (1991)[2] to make the right to connect surface water to public sewers conditional on the SAB approving the drainage system as meeting the National Standards. The SuDS provisions in Schedule 3 of the Act make no changes to the right to connect foul water to the public sewer system.

8.2.2 Building Regulations 2008 H3 Rainwater Drainage

The Building Regulations 2008 (Approved UK Building Regulations 2008) enable the principles of the NPPF to be enforced during construction by stipulating that:

1. Adequate provision shall be made for rainwater to be carried from the roof of the building;
2. Paved areas around the building shall be so constructed as to be adequately drained;
3. Rainwater from a system provided pursuant to sub-paragraphs (1) or (2) shall discharge to one of the following, listed in order of priority:
    - an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,
    - a watercourse; or, where that is not reasonably practicable,
    - a sewer.

As the EA are the consenting authority for discharges to controlled waters (i.e. groundwater or watercourses), SuDS will be favoured for the removal of pollutants and attenuation of discharge rates.

8.2.3 Code for Sustainable Homes Technical Guide 2010

The Code for Sustainable Homes (CLG, November 2010) sets out the requirements of the latest version of the Code for Sustainable Homes and the process by which a Code assessment is reached. It replaces the May 2009 Version 2 of the Code Technical Guidance.

Proposed developments are assessed against a number of sustainability criteria that include 'water use' and 'surface water run-off'. For each category points are awarded depending on the sustainability of the management technique proposed (i.e. the more sustainable the more points are awarded). The points for each category are collated and the development is given an overall code level from 1 – 6. Under the Code 'internal water use' and 'management of surface water runoff from developments' will be assessed as mandatory elements, requiring developments to demonstrate their sustainability against these criteria.

Table 8-1 and Table 8-2 summarises the measurement criteria used for both potable water consumption and surface water runoff in the Code for Sustainable Homes.

[2] Water Industry Act, July 1991.

Wat 1 Aim: *To reduce the consumption of potable water in the home from all sources, including borehole well water, through the use of water efficient fittings, appliances and water recycling systems.*

Table 8-1 Summary of the measurement criteria for water use

Category 2 Water		
Criteria	**Water Consumption**	**Credits Available**
Indoor Water Use (Mandatory element)	Where predicted water consumption (calculated using the Code water calculator) accords with the following levels:	**One** of the following point scores
	≤ 120 l/p/d	1
	≤ 110 l/p/d	2
	≤ 105 l/p/d	3
	≤ 90 l/p/d	4
	≤ 80 l/p/d	5
External water use	For providing a system to collect rain water for use in irrigation e.g. water butts.	1

Sur 1 Aim: *To design surface water drainage for housing developments which avoid, reduce and delay the discharge of rainfall runoff to watercourses and public sewers using SuDS techniques. This will protect receiving waters from pollution and minimise the risk of flooding and other environmental damage in watercourse.*

Table 8-2 Summary of the measurement criteria for surface water runoff

Category 4 Surface Water Runoff		
Issue	**Measurement Criteria**	**Credits Available**
Management of surface water runoff from developments (Mandatory element)	Where rainwater holding facilities/sustainable drainage (SuDS) is used to provide attenuation of water run-off to either natural watercourses or municipal systems. Points for attenuation covering hard surfaces	0
	Water Quality Criteria 1. One credit can be awarded by ensuring there is no discharge from the developed site for rainfall depths up to 5mm 2. One credit can be awarded by ensuring that: • The run off from all hard surfaces shall receive an appropriate level of treatment in accordance with The SuDS Manual to minimise the risk of pollution.	2

8.3 Achieving SuDS in Developments

The application of SuDS techniques is not limited to one technique per site. Often a successful SuDS solution will utilise a number of techniques in combination, providing flood risk, pollution and landscape/wildlife benefits to the site and surrounding area.

A common issue with incorporating SuDS in developments is the belief that all SuDS are 'land hungry' and significantly impact on the developable area of sites. However, SuDS can be designed to achieve the above goals without significantly impacting on development. In addition, SuDS can be employed on a strategic scale, for example with a number of sites contributing to large scale jointly funded and managed SuDS, however, each development site must offset its own increase in runoff; attenuation cannot be "traded" between developments.

Such an approach is advocated by the 'Management Train', which recommends incorporating a chain of techniques throughout a development, (as outlined in CIRIA C697 (Woods Ballard *et al*, 2007), where each component adds to the performance of the whole system, the total SuDS system can be spread throughout a site and more readily incorporated into the sites infrastructure. The Management Train approach consists of four stages:

- **Prevention** — good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping)
- **Source control** — runoff control at/near to source (e.g. rainwater harvesting, green roofs, pervious pavements)
- **Site control** — water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site)
- **Regional control** — integrate runoff management from a number of sites (e.g. into a wetland).

8.4 SuDS Techniques

There are a wide range of SuDS techniques available for use throughout the four stages of the Management Train. Techniques available to manage the quantity of surface water typically operate in combination or solely on the basis of the following two main principles:

- Infiltration
- Attenuation

The effectiveness of techniques in achieving the goals of attenuating discharges, reducing pollution and providing amenity benefit will depend on a number of other factors such as filtration, settlement and oxidation.

The SuDS Manual (C697)[3] provides a summary of SuDS techniques and their suitability to meet the three goals of sustainable drainage systems and their suitability within the stages of the Management Train. Table 8-3 presents a summary of a variety of SuDS techniques along with their suitability in achieving the goals of sustainability and their place within the Management Train.

[3] CIRIA, The SUDS Manual (C697), March 2007

Table 8-3 Summary of SuDS Techniques and their Suitability to meet the three goals of sustainable drainage systems

Management Train			SuDS Technique	Description	SuDS Principle	Water Quantity	Water Quality	Amenity Biodiversity
Regional	Site	Source – Prevention	Green roofs	Layer of vegetation or gravel on roof areas providing absorption and storage.	Attenuation	●	●	●
			Rainwater harvesting	Capturing and reusing rainwater for domestic or irrigation uses.	Attenuation	●	○	○
			Permeable pavements	Infiltration through the surface into underlying layer.	Infiltration	●	●	○
		Source	Filter drains	Drain filled with permeable material with a perforated pipe along the base.	Infiltration	●	●	X
			Infiltration trenches	Similar to filter drains but allows infiltration through sides and base.	Infiltration	●	●	X
			Soakaway	Underground structure used for store and infiltration.	Attenuation	●	●	X
			Bio-retention areas	Vegetated areas used for treating runoff prior to discharge into receiving water or infiltration	Attenuation	●	●	●
			Swales	Grassed depressions, provides temporary storage, conveyance, treatment and possibly infiltration.	Attenuation	●	●	○
			Sand filters	Provides treatment by filtering runoff through a filter media consisting of sand.	Infiltration	●	●	X
			Basins	Dry depressions outside of storm periods, provides temporary attenuation, treatment and possibly infiltration.	Attenuation	●	●	○
			Ponds	Designed to accommodate water at all times, provides attenuation, treatment and enhances site amenity	Attenuation	●	●	●

		value.				
	Wetland	Similar to ponds, but are designed to provide continuous flow through vegetation.	Attenuation	●	●	●

Key: ● – highly suitable, ○ - suitable depending on design, X – unsuitable

8.5 SuDS Design

Detailed guidance for the design of SuDS is available in the CIRIA SuDS Manual C697, and the associated document 'Site Handbook for the Construction of SuDS, C698 (Woods Ballard *et al*, 2007a). These publications provide best practice guidance on the planning, design, construction, operation and maintenance of SuDS, to ensure effective implementation within developments.

The design of SuDS measures should be undertaken as part of a drainage strategy and design for a development site. A ground investigation should form part of the SuDS assessment to determine ground conditions and the most appropriate SuDS technique(s). Hydrological analysis should be undertaken using industry approved procedures, to ensure an appropriate design is developed. This should account for the effects of climate change over the lifetime of the proposed system/development and based on an agreed permitted rate of discharge from the site.

During the design process, liaison should take place with the authority responsible for the receiving water body and any organisations involved in the long term maintenance of the system. This may include liaison with the councils, the EA), Severn Trent Water. Liaison with these organisations should focus on establishing a suitable design methodology, any restrictions and provision for the long-term maintenance of the SuDS system.

8.6 Where can SuDS be utilised

The underlying ground conditions of a development site will often influence the type of SuDS technique suitable at an individual site. While this will need to be determined through ground investigations carried out on-site, an initial assessment of a sites suitability to the use of SuDS can be obtained from a review of the available soils/geological survey of the area.

Tables presented in Section 8.4 are provided as a guide alone and should not be used to accept or refuse SuDS techniques. Overall the suitability and design of a SuDS system should be determined on a site by site basis through consultation with the authority responsible for the receiving water body.

It is recommended that the councils completes Appendix Table 3 (Appendix G) to assist in identifying suitable SuDS for development sites in the area. Completion of the table in Appendix C will assist in identifying where various types of SuDS are most suitable and enable developers to account for SuDS when developing master plans for development sites.

8.6.1 Methodology for assessing the suitability of SuDS

Overlaying GIS datasets can provide overview of appropriate SuDS techniques within the study area. An analysis of physical, hydrological and environmental spatial data sets within a Geographical Information System (GIS) platform was undertaken and allowed areas that would benefit from different types of SuDS techniques to be identified, these techniques have been split into attenuation and infiltration, as detailed in Section 8.4.

The first stage of the spatial analysis was to identify the main factors affecting the suitability of SuDS techniques. On a strategic scale, the main factors were identified as drift geology and susceptibility to groundwater flooding (BGS data), topography and available space.

Across the study area each factor was assigned a value from 0-50 appropriate to its suitability for either infiltration or attenuation based SuDS. Ground slope was calculated from LiDAR data and divided into three categories <2%, 2-8%, >8%, and again assigned a suitability value from 0-50 for both SuDS types.

Each category was then weighted based on its relative importance in defining SuDS suitability. Table 8-4 shows the scores and Table 8-5 shows the weightings applied in the assessment.

Table 8-4 Score used for each dataset analysed

Drift Geology	Infiltration Score	Attenuation Score
Sand and/or gravel	50	10
Diamiticon/unclassified	25	25
Layers containing clay and silt	10	40
Clay or Peat	0	50
Groundwater Susceptibility	**Infiltration Score**	**Attenuation Score**
A	10	50
B	30	30
C	50	10
Area Slope	**Infiltration Score**	**Attenuation Score**
<2%	30	30
2-8%	50	50
>8%	10	30

Table 8-5 Weighting factor for the datasets used

Variable	Infiltration Weighting	Attenuation Weighting
Drift Geology	3	2
Groundwater Susceptibility	5	3
Area Slope	4	2

The datasets were then interrogated for a 50m grid cell and the weighting factors applied to calculate a total value indicating the suitability of a particular SuDS technique to each grid cell. The higher the value in each grid cell the higher the suitability of that particular SuDS technique. The results are presented in Figure SS1-CC, SS1-LD, SS1-SB & SS1-SS for the infiltration techniques and Figure SS2-CC, SS21-LD, SS1-SB & SS1-SS for the attenuation techniques, all the figure can be found in Volume 2.

It must be understood that this is a broad scale assessment intended to give an indication of general suitability of SuDS techniques. There are many factors affecting the optimum SuDS design for a site which require a site-specific assessment. The use of both infiltration and attenuation techniques may be constrained in urban areas, as a result of space restrictions. The use of attenuation solutions will also be constrained by unstable ground conditions. For areas which are not suitable for either infiltration

techniques or storage techniques, should consider the use of source control methods such as rainwater harvesting and green roofs.

8.7 SuDS Constraints

During the design process, in addition to considering the properties of the underlying soils and strata it is necessary to also consider the sensitivity of the receiving water body and any previous uses of the site.

The use of SuDS can be limited based on a number of issues, which include:

- Groundwater vulnerability and potential contamination of an aquifer.
- Current or target water quality of a receiving watercourse.
- The presence of groundwater Source Protection Zones and potential contamination of a potable water source.
- Restrictions on infiltration on contaminated land to prevent the spread of contamination.
- Restricted area on development sites where housing densities are high.

8.8 Groundwater Vulnerability

Groundwater resources can be vulnerable to contamination from both direct sources (e.g. into groundwater) or indirect sources (e.g. infiltration of discharges onto land). The Areas Susceptible to Groundwater Flooding are shown in Figure GW-LD, GW-CC, GW-SS and GW-SB for the study area, which is based on the BGS data.

The vulnerability of the groundwater is important when advising on the suitability of SuDS. The EA is the responsible drainage authority for any discharges to groundwater and should be consulted on proposals to discharge to ground.

8.8.1 Nitrate Vulnerable Zones & Groundwater Source Protection Zones

The entire area of Lichfield District and Stafford Borough, and the majority of South Staffordshire has been highlighted by DEFRA as a Nitrate Vulnerable Zone (NVZ) and there are significant areas in the west, south and north of the area 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.

GSPZs are defined based on the time it takes for pollutants to reach an abstraction point. Depending on the nature of the proposed development and the location of the development site with regards to the SPZs, restrictions may be placed on the types of SuDS appropriate to certain areas.

The GSPZ is situated over the local aquifers 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 0.6 to 4.2 Kilometres. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination.

Lichfield District (Seven GSPZ Inner Zones)	North west area: Longdon Central area: Lichfield and Fradley South Southern area: Shenstone South west area: Hammerwich Western area: Chasetown and Gentleshaw
South Staffordshire (Fourteen GSPZ Inner Zones)	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.
Stafford Borough (Nineteen GSPZ Inner Zones)	North east area: Cresswell, Meir, Meir Heath, Moddershall and three in Fulford Northern area: Cranberry, Millneece and three in Swynnerton Coles North west area: Croxton Western area: Knighton, Weston Jones and Gnosall Central area: Haughton South east area: Millford and Brocton
Cannock Chase (Six Inner Zones)	East of Acton Trussell East of Weeping Cross where Holdiford Road crosses the railway line. Intersection of the A460 with the Marquis's Drive at Cannock Chase Country Park. Slitting Mill, Rugeley. Northern end of Rugeley between the A460 and the A51 (two inner zones at this location).

8.8.2 Water Quality

Under the River Basin Management Plans (RBMPs) all member states are required to take steps to achieve good ecological status of water bodies by 2015. To achieve this, discharges to watercourses draining development areas will require pre-treatment to remove oils and contaminants. Appropriately designed SuDS can assist developments improve water quality discharges through passive treatment, whilst additionally providing ecological benefit to a development or local area.

8.8.3 Contaminated Land

Previous site uses can leave a legacy of contamination that if inappropriately managed can cause damage to local water bodies. During the design of SuDS it is essential to have regard to the nature of potential ground contamination.

Particular restrictions may be placed on infiltration based SuDS, forcing consideration of attenuation based systems. Early discussion with the authority responsible for the receiving water body should be undertaken to establish the requirements of SuDS on contaminated sites.

8.8.4 High Development Densities

Where developments are required to achieve high development densities it is essential that the requirement for SuDS and their constraints are identified early in the site master planning process. High development densities can restrict the land area available for SuDS, which if mandatory can affect the ability of a site to gain planning permission.

Early consideration of SuDS enables the drainage requirements to be integrated with the design, limiting the impact they have on developable area and development densities.

9. Policy Guidance and Recommendations

This chapter provides recommendations for what should be included in the Council's policy for flood risk management. Council policy is considered essential to ensure that the recommended development control/management conditions can be imposed consistently at the planning application stage.

The policies have been extracted from the existing SFRAs produced for each council area in 2008. These policies have been modified and updated following a review of new policies and new flood risk information that has been made available. This data has been reviewed as part of the updated Level 1 SFRA. The policies have been designed to address the entire Level 1 study area.

In parallel with the specific recommendations presented in this SFRA, it is further recommended that the Councils refer to the following key flood risk management documents in order to fully inform their own flood risk management policy positions:

- **National Planning Policy Framework** – sets out national policy for development and flood risk assessment and supports the Government's objectives for sustainable communities. This framework replaced with immediate effect national policy including Planning Policy Statement 25 – Development and Flood Risk.
- **National Planning Practice Guidance** – provided guidance on the policies contained within the National Planning Policy Framework.
- **River Trent Catchment & River Severn Catchment Flood Management Plan** - strategic planning document through which the EA will work with other stakeholders to identify and agree policies for long-term flood risk management over the next 50 to 100 years.
- **Staffordshire Preliminary Flood Risk Assessment** – The PFRA was completed in March 2011. The PFRA is aimed at providing a high level overview of flood risk from all source of flooding within the local area, included consideration of surface water, groundwater, ordinary watercourses and canals for both historical and future. The assessment of this information enables the identification of Flood Risk Areas.
- **Surface Water Management Plan Phase 1 & 2** –The Phase 1 SWMP was completed in July 2010. Following this a Phase 2 study was completed in specific areas for each of the council areas, in the critical areas identified in Phase 1. The Phase 2 study has identified a number of key strategies that should be applied as part of development in the area.
- **Making Space for Water** - outlines the Government's proposals for forward planning of flood management over the next 20 years advocating a holistic approach to achieve sustainable development. The protection of the functional floodplain is central to the strategy.
- **Water Framework Directive** - European Community (EC) water legislation which requires all inland and coastal waters to reach good ecological status by 2015.

Integration of these suggested policy recommendations into the emerging Local Plan should ensure that the objectives of national policy are embedded within the local planning system. The policy recommendations ensure national policy is met, whilst strengthening the position of the Local Planning with regard to flood risk. These will also provide consistent guidance for Councils to apply to developments in those growth areas that span its administrative boundary.

9.1 Flood Risk Objective 1: To Seek Flood Risk Reduction through Spatial Planning and Site Design

The following policies have been extracted from the existing Level 1 SFRA, and have been updated in review of recent policies and documentation. These policies apply to all four Councils.

- Use the Sequential Test to locate new development in least risky areas, giving highest priority to Flood Zone 1
- Use the Sequential Test within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits
- Build resilience into a site's design (e.g. flood resistant of resilient design, raised floor levels)
- 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 EA 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 applying mitigating actions, during the 1 in 1000 year event, should also be 'safe'.
- Determine decisions for windfall development through application of the Sequential Test. Where this is not practical, in the shorter term a proactive approach could be taken by the Council, directing developers away from areas at risk of fluvial flooding (within Flood Zone 2 and 3, defined in Figures FZ-SS, FZ-LD, FZ-SB & FZ-CC) and surface water flooding (Figures SW-SS, SW-LD, SW-SB & SW-CC). In the long term it would be beneficial and more efficient for the council to define areas where windfall development may not be appropriate and further specify the types of development that would not be appropriate in each area, based on the sequential approach. Where the area of a windfall site has not been sequentially tested, this should be assessed for the flood risk at an individual site against the type of development proposed. In addition emergency planning arrangements and the contribution the development would make to the wider sustainability of the area should be considered before determining a decision. The developer should provide evidence to Council that they have considered other reasonably available sites (this should not only include the sites owned by the developers), through comparing windfall sites against allocated sites in the Local Plans.

9.2 Flood Risk Objective 2: Reduce Surface Water Runoff

The following policies have been extracted from the existing Level 1 SFRA and have been updated in review of recent policies and documentation. These policies apply to all four Councils. The policies have been split between new development and agricultural land.

9.2.1 Reduce Surface Water Runoff from New Development

The following policies have been extracted from the existing Level 1 SFRA, and have been updated in review of recent policies and documentation. Additional policies have been added in light of the Surface Water Management Plans Phase 1 & 2 that have been undertaken in the Council areas.

- SuDS required on all new development. The previous SFRA outlined appropriate SUD techniques, these have been updated as part of this SFRA and are provided in Section 8.4. The infiltration systems should be the preferred means of surface water disposal, provided ground conditions are appropriate. Above ground attenuation should be considered in preference to below ground attenuation, due to the amenity value, water quality, biodiversity benefits and resource value of development and/or surrounding areas.
- All sites that are greater than 1 hectare require the following: SuDS, and both Greenfield and Brownfield sites should aspire to attenuate to Greenfield run-off rates. However where this is demonstrated to not be viable, a minimum of 20% reduction from the existing situation.
- Space should be specifically set aside for SuDS and used to inform the overall site layout
- Surface water flooding should be investigated in detail as part of FRAs for developments located in moderate to extreme hazard areas, and comprehensive surface water runoff calculations undertaken. Planning applications for developments in these areas should submit a FRA that considers flooding from the sewer system and the consequences of a failure of the drainage system through blockage.
- Require sustainable drainage design to take account of the impacts of climate change for the lifetime of the development at the site and downstream.
- Consider the vulnerability and importance of local water resources and key infrastructure when determining the suitability of drainage strategies/SuDS.
- On sites which are less that 1 hectare, SuDS should be incorporated. A reduction in runoff rates during the 1 in 100 year storm event plus climate change to Greenfield rates is the ideal. However, where space does not allow for attenuation to Greenfield rates, the development must prove that mitigation has been achieved in the reduction of run-off rates, with SuDS being utilised where possible.
- Seek opportunities to utilise SuDS in areas shown to be potentially at risk of overland flow flooding.
- All information contained within this SWMP should be considered when site specific FRAs are undertaken for developments within the area.
- Installation of SuDS in all new developments, with the aim to reduce runoff below Greenfield rate in the key drainage areas upstream of the town (the EA advise that this is set to an annual rate for all return periods. We recommend that the Council agrees the most appropriate rate with the EA).

- Investigation into dual use of residential roads as flow pathways, and reduction in private gardens/driveway paving where possible.

9.2.2 Reduce Surface Water Runoff from Agricultural Land.

There has been no change to the flood risk from the agricultural land, no additional policies have been added. However, the Phase 2 SWMP highlighted the need for the promotion of Codes of Good Agricultural Practice and recognition of NVZ status to reduce pollution from direct runoff in rural areas.

- Promote environmental stewardship schemes to reduce water and soil runoff from agricultural land.

9.3 Flood Risk Objective 3: To Support River Basin Management Planning and Water Framework Delivery

The following policies have been extracted from the existing Level 1 SFRA, and have been updated in review of recent policies and documentation, specifically the Severn and Humber River Basin Management Plans. These policies apply to all four Councils.

- An assessment of the condition of existing assets (e.g. bridges, culverts, river walls) should be made. Refurbishment and / or renewal should be made to ensure the lifetime is commensurate with lifetime of the development. Developer contributions should be sought for this purpose.
- New developments should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water and the EU WFD. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bioengineered river walls, raising bridge soffits to take into account climate change).
- All new developments should provide opportunities for de-culverting and removal of structures from existing channel, river renaturalisation or other mechanisms to increase capacity of the channel. This will promote habitat improvement, fish migration, water quality improvement, improvement of the river corridor, and will have positive impact on flood events and surface runoff. In turn, meeting the requirements of EU WFD.
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip.

9.4 Flood Risk Objective 4: To Protect and Promote Areas for Future Flood Alleviation Schemes

The following policies have been extracted from the existing Level 1 SFRA, and have been updated in review of recent policies and documentation. These policies apply to all four Councils. These policies are detailed below:

- Protect Greenfield functional floodplain from future development (our greatest flood risk management asset) and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones)
- Develop appropriate flood risk management policies for the Brownfield functional floodplain, focusing on risk reduction
- It would be of significant benefit for each council to identify any proposed developments that have the potential to contribute to EA and Staffordshire County Council proposed and future flood alleviation schemes (detailed in Section 7.1.5). Proposed developments should offer financial

contributions through a partnership funding approach or CIL / S106 route which would provide protection to any new properties proposed whilst providing wider contributions thereby ensuring local community schemes receive full funding. Work to identify the need for flood risk infrastructure generated by new developments should be undertaken to inform the respective Council's Infrastructure Delivery Plans.

- Seek opportunities to make space for water to accommodate climate change

There have been no flood alleviation schemes built since 2008 and review of recent policy and update flood risk information does not indicate that there should be any changes or updates to the policy.

9.5 Flood Risk Objective 5: To Improve Flood Awareness and Emergency Planning

The following policies have been extracted from the existing Level 1 SFRA, and have been updated and review recent policies and documentation. The main update of importance for this objective is the introduction of the Reservoir Inundation Maps, by the EA, in 2008. These maps indicate that there is risk of flooding if the dams of the reservoir were to breach. The probability of a dam breaching are low however the consequences are high.

The policies detailed below are applicable to all four council areas:

- Seek to improve the emergency planning process using the outputs from 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 EA.
- Ensure robust emergency (evacuation) plans are implemented for new developments greater than 1 hectare in size.
- Ensure appropriate flood risk warnings are applied to new development in respect to the breach of the upstream reservoirs. Ensure that the EA and all relevant authorities are included when defining the warning.

9.6 Flood Risk Objective 6: To prevent new development within sensitive development locations

The following policies have been extracted from the existing Level 1 SFRA, and have been updated in review of recent policies and documentation. These policies are specific to each council area.

- **Cannock Chase Council:** The Level 1 Cannock Chase SFRA addressed policies for development within Rugeley Town centre. There are a high number of culverts through the town centre which poses an additional risk of flooding if they become blocked. Therefore there is a need to ensure that new developments do not increase the flood risk. However since 2008 the Level 2 SFRA was produced for Rugeley Town Centre which superseded the policies in the Level 1 SFRA 2008. The policies for Rugeley Town Centre are detailed in Section 6 Policy Recommendation of the Level 2 SFRA (January 2009).
- **Lichfield District Council:** Proposed development should be guided away from the extended floodplain (outside the functional flood) for both the Rivers Tame and Trent. These floodplains are important features in terms of flood risk management. Any development in these areas would

have detrimental effect on flood risk in Lichfield, and would increase flood risk downstream. There are development pressures on the land surrounding the villages of Fradley.

- **Stafford Borough:**
  - Proposed development should be guided away from areas that would significantly increase flooding risk elsewhere. Any development in the recognised storage areas and functional floodplain would have a detrimental effect, and would increase flood risk downstream of these locations. In Stafford Borough the locations that are particularly sensitive to the issues mentioned above are the Scotch Brook in Stone and the Sandyford Brook in Stafford.
  - The issues mentioned above are the Scotch Brook in Stone and the Sandyford Brook in Stafford. There are a large number of environmentally valuable sites within the Borough of Stafford, including nature reserves, Sites of Specific Scientific Interest (SSSIs) and Conservation Areas including the Trent and Mersey canal. An increase in water levels on any of the Main Rivers in the catchment would not only have the potential to affect properties in Flood Zones 2 and 3, but the impact on these areas must also be considered.
  - It is important to consider cross border issues, where development upstream could impact on areas within the Stafford Borough. The Flood Zones of the River Penk through Stafford are already very close to the developed areas and an increase in flood volumes in this location would pose a significant threat to existing development.

9.7 Recommendations

9.7.1 Requirements for Level 2 SFRA

In some cases this may require application of the Exception Test. Should this be the case a Level 2 SFRA will be required which should improve the quantity / quality of data available in those areas requiring the Exception Test such that decisions regarding the safety and impact of the proposed developments can be made on robust data.

Such situations will include any development allocations in areas of Flood Zone 3 and some locations in Flood Zone 2 where the development vulnerability dictates. Any proposed development allocations that extend across the indicative floodplains will also require assessment through a Level 2 SFRA.

The proposed development areas have been provided by each of the Council areas, and are discussed in Section 9.8. The assessment of the sites shows that there is no need for a Level 2 SFRA, however this will need to be reassessed once South Staffordshire Council have identified their proposed allocation sites.

9.7.2 Development Control

Development Control/Management Officers within the Councils should familiarise themselves with the SFRA and ensure that site specific Flood Risk Assessments are provided where necessary.

9.7.3 Emergency Planning

It is recommended that each of the Council's Emergency Response Plans are reviewed and updated in light of the findings of this SFRA, to ensure that safe evacuation and access for emergency services is possible during times of flood, both for existing developments and those being promoted as possible sites within the Local Plan process.

It is further recommended that the four Council's work with the EA to promote the awareness of flood risk and encourage communities at risk to sign-up to the EA Flood Warning Direct service.

9.8 Site Allocation Consideration

9.8.1 Cannock Chase Council

Cannock Chase Council has provided their proposed allocation/development sites (it is important to note that even though these sites have been considered not all of these site will be allocated). The proposed allocation/development sites have been split into two layers, development in the next 0 to 5 years and development planned for the next 6 to 15 years.

The proposed allocation/development sites are concentrated within the areas of Cannock Town, Norton Canes and Rugeley Town Centre. All new development with Rugeley Town Centre will be considered through the Level 2 SFRA for Rugeley Town Centre (July, 2009).

The proposed allocation/development sites, outside Rugeley Town Centre, mainly fall in Flood Zone 1 (Refer to Figure FZ_CC), with no known local fluvial flood risk issues. For some of the proposed allocation sites there are small parts of the proposed allocations that fall within Flood Zone 2 and 3, two of the proposed allocation sites are located outside Churchbridge north of the M6 Toll and in Bridgtown along Riding Brook. For these development the requirements of NPPF may need to be addressed in the FRA as part of the Sequential Test process.

For the proposed allocation/development site within Flood Zone 1, the FRA for the developments would need to consider vulnerability of the development from all sources of flooding, which is detailed below. The FRA will need to consider the potential increase in flood risk to surrounding areas due to modification of the permeability of the surface at the sites. A Drainage Impact Assessment (DIA) will also be required following the requirements of the policy, Flood Risk Objective 2. This will require the inclusion of appropriate SuDS techniques, discussed in Section 8.

Other sources of flooding have been used to asses the flood risk to the proposed allocation sites:

- *Pluvial Flooding:* Review of the UFMfSW and the SWMP Phase 2 (refer to Figure SW_CC & Figure UFMfSW_CC) show that the proposed allocation sites are located within areas at risk of pluvial flooding, especially those located adjacent to the major transport network.
- *Reservoir Inundation:* There are a number of proposed allocation sites at risk of flooding if the reservoir dam were to breach (Figure RIM_CC), located within Cannock Town.
- *Sewer Flooding:* The areas at risk of sewer flooding are mainly located within Cannock Town (Figure SF_CC). This would mean any new development would need to consider the risk of flooding from the sewer.
- *Groundwater Flooding:* Review of the Susceptibility to Groundwater Flooding Maps (refer to Figure GW-CC) shows that parts of a number of the proposed allocation sites are located in the area classified as Class B and C (refer to Table 3-2). Further investigations would be required as part of the FRA, including gathering of any historical evidence, and appropriate measure should be implemented to reduce the impact of flooding.
- *Historical Flooding:* The historical flood incidents are spread across the Council area and are mainly due to fluvial flooding. There has not been a large increase in the number of historical flood incidents since 2008.

9.8.2 Lichfield District Council

Lichfield District Council has provided their proposed allocation sites. The majority of these locations are concentrated around Lichfield City. These sites have been reviewed against the existing flood risk information.

All the proposed allocation sites fall entirely in Flood Zone 1 (Refer to Figure FZ_LD), with no known local fluvial flood risk issues. The FRA for the sites would need to consider vulnerability of the development from all sources of flooding, which is detailed below. The FRA will need to consider the potential increase in flood risk to surrounding areas due to modification of the permeability of the surface at the sites. A Drainage Impact Assessment (DIA) will also be required following the requirements of the policy, Flood Risk Objective 2. This will require the inclusion of appropriate SuDS techniques, discussed in Section 8.

Other sources of flooding have been used to asses the flood risk to the proposed allocation sites:

- *Pluvial Flooding:* Review of the UFMfSW and the SWMP Phase 2 (Figure UFMfSW_LD & Figure SW_LD) show that the proposed allocation site are not located in areas with high flood risk, however appropriate SuDS technique will need to be applied to the new developments.
- *Reservoir Inundation:* Most of the proposed allocation sites are not a risk of flooding if the reservoir dam was to breach (Figure RIM_LD). Part of the proposed allocation site outside Rugeley, at the Rugeley Amenity lake are located within the extent of inundation however the area at risk is a body of water.
- *Sewer Flooding:* Within the Council area there are only a few records of sewer flooding (Figure SF_LD). Consequently there is minimal risk of sewer flooding within the proposed allocation sites.
- *Groundwater Flooding:* Review of the Susceptibility to Groundwater Flooding Maps (refer to Figure GW-CC) shows that the proposed allocation sites are located in the area classified as Class B and C (refer to Table 3-2). Further investigations would be required as part of the FRA, including gathering of any historical evidence, and appropriate measure should be implemented to reduce the impact of flooding.
- *Historical Flooding:* Historical flood incident show that outside Lichfield City along the A51 there are incidents of highway and surface water flooding (Figure HF_LD).

9.8.3 Stafford Borough Council

Stafford Borough Council has provided their proposed allocation sites within the Plan for Stafford Borough as two separate layers, housing and employment sites. These developments are concentrated around Stafford Town and Stone. These sites have been reviewed against the existing flood risk information.

The proposed allocation sites in Stone and north of Stafford fall entirely in Flood Zone 1, with no known local fluvial flood risk issues. The FRA for the sites would need to consider the vulnerability of the development from other sources of flooding, which is detailed below. In addition the potential increase in flood risk to surrounding areas through the modification of permeability of the surface at the sites should be addressed. A Drainage Impact Assessment (DIA) will also be required following the requirements of the policy, Flood Risk Objective 2. This will require the inclusion of appropriate SuDS techniques, discussed in Section 8.

Part of the proposed allocation site west of Stafford, to the south of the railway line in Stafford, is located within Flood Zone 2 and 3. Only part of the west of Stafford's proposed allocation site is affected by Flood Zone 2. It is recommended that in the first instance, alternative sites in lower risk areas are considered. Land use with Flood Zone 3 should be restricted to the 'less vulnerable' and 'water compatible' uses to satisfy the requirements of the Sequential Test, whereas 'More vulnerable; uses will have to pass the Exception test. The FRA for the new developments may require additional hydraulic modelling, using the existing River Penk model. The requirements of NPPF may need to be addressed in the FRA as part of the Sequential Test process.

Development within Flood Zone 2 should be restricted to 'essential infrastructure', 'water compatible', 'less vulnerable' and 'more vulnerable' categories. Only if the Sequential Test process has been carried out and passed should such development occur in Flood Zone 2. 'Highly vulnerable' uses in Flood Zone 2 will have to pass the Exception Test.

For the new developments in Flood Zone 2 and 3 the requirements of NPPF will need to be addressed in the FRA. Guidance for the Council is provided in Section 5 and guidance for developments in Section 6.

Other sources of flooding have been considered in assessing the flood risk to the proposed allocation sites:

- *Pluvial Flooding:* Review of the UFMfSW and the SWMP Phase 2 (Figure UFMfSW_SB & Figure SW_SB) show that the proposed allocation sites are located in areas with high flood risk, especially those located south of the railway line in Stafford.
- *Reservoir Inundation:* None of the proposed allocation sites are at risk of flooding if the reservoir dam was to breach (Figure RIM_SB).
- *Sewer Flooding:* Within the Council area there are records of sewer flooding within Stafford and Stone, mainly within Stafford. However these incidents are not located near the proposed allocation sites (Figure SF_SB).
- *Groundwater Flooding:* Review of the Susceptibility to Groundwater Flooding Maps (refer to Figure GW-CC) shows that a number of the proposed allocation sites are located within the area classified as Class C (Potential for groundwater flooding to occur at surface, refer to Table 3-2). Further investigations would be required as part of the FRA, gathering of any historical evidence, and appropriate measure should be implemented to reduce the impact of flooding.
- *Historical Flooding:* There are recent recorded flood incidents through Stafford Borough Council's area. In Stafford Town and Stone they are fluvial and pluvial (highway) flooding (Figure HF_SB).

9.8.4 South Staffordshire Council

South Staffordshire Council has provided a full list of their proposed site allocations however the council are yet to decide upon their final list. Therefore no assessment has been provided for the Council.

The review of the flood risk information from the previous Level 1 SFRA and this updated Level 1 SFRA indicates that the main rivers within South Staffordshire have quite narrow floodplains. The EA flood zone maps (Figure FZ_SS) indicate that parts of Penkridge are located with Flood Zone 2 & 3. In respect to development, all new development would need to meet the requirements of NPPF and NPPG.

- Flood Zone 1: For proposed allocation sites that fall entirely in Flood Zone 1, with no known local fluvial flood risk issues. The FRA for the sites would need to consider the vulnerability of the development from other sources of flooding. In addition the potential increase in flood risk to surrounding areas through the modification of permeability of the surface at the site. A Drainage Impact Assessment (DIA) will also be required following the requirements of the policy, Flood Risk Objective 2. This will require the inclusion of appropriate SuDS techniques, discussed in Section 8.
- Flood Zone 2: For the proposed allocation sites that are only partial affected by Flood Zone 2, the requirements of NPPF and NPPG would need to be addressed in the FRA. Where sites are substantially affected by Flood Zone 2, alternative sites in Flood Zone 1 should be considered in preference as part of the Sequential Test process. Development within Flood Zone 2 should be restricted to the 'essential infrastructure', 'water compatible', 'less vulnerable' and 'more vulnerable' categories. Only if the Sequential Test process has been carried out and passed

should such development occur in Flood Zone 2. 'Highly vulnerable' uses in Flood Zone 2 will have to pass the Exception Test.

- Flood Zone 3: For proposed allocation sites located within Flood Zone 3, it is recommended that in the first instance, alternative sites in lower risk areas are considered. Land use with Flood Zone 3 should be restricted to the 'less vulnerable' and 'water compatible' uses to satisfy the requirements of the Sequential Test. Whereas 'More vulnerable; uses will have to pass the Exception Test.

For new developments in Flood Zone 2 and 3 the requirements of NPPF and NPPG will need to be addressed in the FRA. Guidance for the Council is provided in Section 5 and guidance for developments in Section 6.

10. SFRA Maintenance and Management

This chapter provides an introduction to the maintenance and management procedures that are recommended and which will ensure that the Cannock Chase, Lichfield District, South Staffordshire and Stafford Borough Level 1 SFRA remains up-to-date and continues to make use of the best available information. Implementing a maintenance and management procedure for the Level 1 SFRA will assist the councils to regularly review the technical data available and to commission technical updates where necessary.

Details of the data gathering and creation of maps are provided in Section 3.

10.1 Data ownership

The datasets obtained for use in the Level 1 SFRA have come from a number of sources, under licence agreement. These datasets cannot be passed to external parties without permission from the owner and that those requiring the data ensure that they possess the appropriate copyrights and access.

The Councils should be aware of the IPR they possess so that they only issue data that is contractually appropriate. Datasets produced during the Level 1 SFRA are owned by Councils and can be passed to external parties at their discretion. The key datasets are summarised in detailed in Section 3.3.

It is recommended that information on all sources of flooding continues to be collected and that where appropriate more resources are invested in determining the source and pathways of flooding. When more detailed or updated hydraulic modelling becomes available from the EA or other sources this information should be incorporated into the Level 1 SFRA. More detailed information may also be collected for FRAs carried out by developers and land owners at the local site scale. Information from site level FRAs will be submitted to the councils and the EA as part of the development management process and this information should be used to inform the Level 1 SFRA in the future.

Table 10-1: Key Datasets

Data	Ownership	Licence Required	Contact
LiDAR	Environment Agency	Yes	Environment Agency (Geomatics Group)
Flood Zones	Environment Agency	Yes	Flood Mapping and Data Environment Agency
Flood Defence Asset data (NFCDD)	Environment Agency	Yes	Flood Mapping and Data Environment Agency
Areas Benefitting from defences	Environment Agency	Yes	Flood Mapping and Data Environment Agency
Areas susceptible to groundwater flooding	Environment Agency	Yes	Flood Mapping and Data Environment Agency
Historic Flood data/Maps	Staffordshire County Council / Environment Agency	No but may be confidential	Staffordshire County Council / Environment Agency
Existing Defences and Structures	Environment Agency	Yes	System Asset Management, Environment Agency
OS Mapping	Ordnance Survey	Yes	Councils
Level 2 SFRA reports and Maps	Cannock Chase, Lichfield District, South Staffordshire, & Stafford Borough.	No	Councils
DG 5 Records	Severn Trent Water	No but may be confidential	Severn Trent Water
Reservoir Inundation Mapping	Environment Agency	Yes	Flood Mapping and Data Environment Agency
Updated Flood Maps for Surface Water	Environment Agency	Yes	Flood Mapping and Data Environment Agency

10.2 SFRA data management system

The data management strategy developed for the Level 1 SFRA is designed to account for likelihood that external parties will seek to make use of the information within the Level 1 SFRA in preparing flood risk assessments and assessing sites. The Level 1 SFRA is also a “live” document, and as such it is necessary to ensure at regular intervals in the future that the information within it remains valid.

To ensure that the Level 1 SFRA remains ‘live’ it is important to nominate a Management Group with responsibility for monitoring, managing and maintaining the SFRA. Maintaining the SFRA will ensure that

there is a consistent and up to date supply of strategic flood risk information to all levels of planning process.

10.3 Future Updates to the SFRA

NPPF and the EA intend for SFRAs to be living documents, updated as new data is available. New sources of data become available all the time and as such Cannock Chase, Lichfield District, South Staffordshire and Stafford Borough should liaise with the EA to determine a suitable period for review and update of the SFRA that is acceptable to all parties. This may include consideration of:

- New climate change updates;
- Modelling result updates;
- Development of new flood alleviation measures;
- New model data;
- Issue of new guidance documentation; and/or,
- Development of all allocations; or
- Developments through the EU Flooding Directive.

11. References

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Stafford Borough (October 1998). Stafford Borough Local Plan 2001.

Appendix A – Cannock Chase Council

1.1 Cannock Chase Council Flood Risk

Figure A shows the Cannock Chase Council administrative boundary within the Level 1 SFRA Study Area. The council area is a small area covering approximately 78 km^2, extending from the fringes of the West Midland conurbation in the south, through the Cannock Chase Area of Outstanding Natural Beauty, to the River Trent floodplain in the north.

1.2 Hydrology

Figure H-CC shows the key hydrological features of the Cannock Chase Council area. There are three main watercourses within Cannock Chase Council area, The River Trent, Ridings Brook and Saredon Brook. The Environment Agency's Midlands Region, Central Area is responsible for the operation and maintenance of the Main Rivers within the Council area.

The responsibility for minor watercourses and flood defence assets lies with different organisations, e.g. landowners, Parish Councils, County Council, Severn Trent Water and the Environment Agency.

There is no separate Internal Drainage Board (IDB) within the Cannock Chase Council area and Severn Trent Water is responsible for the operation and maintenance of the artificial drainage systems i.e. sewers.

The **River Trent** forms the northern boundary of Cannock Chase Council with Lichfield District Council. The river flows in a south-eastern direction and is 2.8km long within Cannock Chase. At the upstream extent, within the Council administrative boundary, the watercourse emerges from beneath the Trent and Mersey Canal aqueduct before heading in a fairly straight south-eastern direction passing industrial units to the south-west before flowing out of the administrative boundary, adjacent to the power station.

The **Trent and Mersey Canal** mainly runs parallel to the River Trent for approximately 900m before the canal takes a south-south-east orientation, running through the outskirts of Rugeley and Brereton.

The **Ridings Brook** and **Saredon Brook,** lie in the south of the County Council. Ridings Brook rises in the Hednesford Hills to the north east of Cannock where the watercourse falls steeply, flowing in a south-westerly direction towards Hednesford and Cannock town centres. The watercourse flows in a predominantly south-westerly direction, flowing adjacent to an off-line pool before converging with open channel where the Pye Brook and Chadsmoor Brook join the Ridings Brook. The watercourse then flows in a southerly direction bounded to the west by the railway line before flowing beneath Old Hednesford Road. Immediately downstream of Old Hednesford Road, the County Brook joins the Ridings Brook before the watercourse crosses Eastern Way adjacent to Ridings Park Industrial Estate. The watercourse continues to flow in a south-westerly direction adjacent to Eastern way before flowing under Hawks Green Lane and into Mill Green. Hawkes Brook joins the Ridings Brook approximately 242 m downstream.

Mill Green Balancing Pond was constructed in 1977 with storage achieved by means of an earth dam with a concrete core. The storage capacity of the dam has been increased as part of the Cannock Flood Alleviation Scheme, with a penstock installed to regulate flows through Cannock. The controlled discharge from the reservoir enters a short section of open channel, then crosses under Lichfield Road before passing under the railway line, and into Girton Road Allotments. Approximately 150 m downstream of the allotments, Ridings Brook crosses Rumer Hill Road before entering a culverted section between 'Shorades' off Walsall Road and Laburnum Close. The brook then continues to flow in a south-westerly direction through some playing fields before it is joined by the Golly Brook 330 m downstream. The watercourse then continues in a south-westerly direction flowing through a series of culverted sections beneath Delta Way, Longford Road and Fairway, before reaching Severn Trent Sewage Treatment Works (STW) on the A5, Watling Street. As the Ridings Brook approaches the STW there is a bifurcation of the watercourse. Historically, the watercourse continued through the STW with flow split travelling south crossing under the A5 before joining the Golly Brook (South). As part of the FAS, a new culvert was installed connecting the Ridings Brook to the Golly Brook beneath the A5 trunk road.

A number of minor watercourses also flow through the Council area. The **Bentley Brook** and **Rising Brook** flow through the larger settlement of Rugeley in the north of the area. Bentley Brook flows along the southern edge of Rugeley to the south-east. Further downstream the floodplain to north of the brook is heavily developed, constituting the centre of Rugeley.

Wash Brook is located at the southern end of Cannock Chase Council's area. The upstream area of the watercourse is surrounded primarily of fields and grassland. The brook flows in the north-west direction where it meets the Cannock Chase Council's boundary, where it continues to flow along the boundary.

To the south of the River Trent and the Trent and Mersey Canal, a series of additional minor watercourses flow within the Council area; these are Fallow Stream, Little Stafford Brook, Stony Brook, Redmoor Brook and Red Brook and most flow through rural areas.

1.3 Geology & Topography

The Solid Geology for the Council area is shown in Figure SG-CC and the Drift Geology is shown in Figure DG-CC. The northern half of the Council area is made up of Scythian early Triassic Sandstones forming a major aquifer, whilst the southern half of the area overlies Late Carboniferous Coal Measures (minor aquifer) which have been extensively mined. With regard to drift geology, glacial till covers the southern part of the Council area while alluvium and river terrace deposits underlay and surround the River Trent and Rising Brook to the north of the area.

The topography of the Council area has been represented using EA LiDAR, which is shown in Figure T-CC. The lower parts of the council are to the north and south, where the rivers are located. The central areas of the catchment is higher, and would have limited flood risk issues.

1.4 Historical Flooding

Historic flooding records in the Cannock Chase Council area are shown in Figure HF-CC. The figure shows the Environment Agency Historic Flood Map, and Historic Flood points showing recorded flooding incidents.

There are no records of any flood events since 2008 however the UK has experienced two large flood events in Summer 2012 and Winter 2013.

The following events were experienced in Cannock Chase Council:

- ***September 1994*** – Flooding was experienced in the south-west of the Cannock Chase Council area. The 1994 floods were the result of multiple storms. Mill Green Balancing Pond on the Ridings Brook did not have sufficient time to drain between storms and water overtopped the dam, resulting in flooding downstream. Many areas of Cannock including Rummer Hill Road, Walsall Road (A34) and Watling Street (A5) were all severely affected, with the A5 closed for two days.
- ***July 1999*** – Flooding from the Ridings Brook was experienced to the south of Mill Green Balancing Ponds.
- ***November 2000*** – Heavy rainfall resulted in minor flooding at Eternit and Finnings factories along the A5. On this occasion, severe flooding of many properties was averted due to the presence of contractors manually operating the Mill Green sluice gates.
- ***Summer 2007*** - The significant flood event of Summer 2007 affected many regions across the UK. The entire Cannock Chase Council area is reported to have been affected by the flooding from prolonged rainfall. Multiple exceptional flood events were reported surrounding the Ridings Brook watercourse in the southern half of the area.

The major flood events experienced within the Cannock Council area all occurred prior to the completion of the Cannock Flood Alleviation Scheme (FAS). Following the completion of the Cannock Flood Alleviation Scheme, the capacity of Mill Green Balancing Pond has been increased and most properties

in the floodplain downstream of Mill Green are now protected against a 1 in 100 year event (1% chance of occurring) and even the most vulnerable properties will not begin to flood until a 1 in 50 year event (2% chance of occurring in any year).

Historic flood maps provided by the Environment Agency show flooding documented along the Saredon Brook and Wryley Brook along the southern border of the Council area. The Phase 1 Southern Staffordshire SWMP Study (2010) similarly indicates that Norton Canes, Cannock and Rugeley towns have experienced exceptional flood events (with return periods greater than 1 in 5 years).

1.5 Sources of Flood Risk

1.5.1 Fluvial Flood Risk

The watercourses within the Cannock Chase Council area impose a fluvial flood risk to the urban areas within the Council area, and other settlements downstream.

The most up to date Environment Agency formal flood zone maps have been used for this SFRA and demonstrate that there are a number of areas at risk of flooding due to the River Trent, Bentley Brook, Rising Brook, Riding Brook and Wash Brook. The Environment Agency flood maps are shown in Figure FZ-CC. These maps have also been compared to the flood maps used in the previous SFRAs to examine the changes in fluvial flood risk.

To the north of Cannock Chase Council area, the flood maps show areas at risk of fluvial flooding along the northern boundary of the Council area between the River Trent and, the Trent and Mersey Canal. The flood maps are defined using the modelling results from the Fluvial Trent Strategy (2005) and the Level 2 Rugeley Town Centre (2009).

The extent of flooding through Rugeley Town Centre is not large and is of medium probability. Further development within Rugeley would require a FRA and recommendations in the Rugeley Town Centre Level 2 SFRA would need to be considered.

Further downstream and upstream of the Rugely Town Centre fluvial flood risk is predominantly to natural and recreational areas.

In the south of the Cannock Chase Council area flood zone maps indicate that there is a fluvial flood risk from Ridings Brook, Saredon Brook, Golly Brook and Wyrley Brook. The EA flood maps included the Ridings Brook model results between Market Street and the confluence with the Wyrley Brook, and the Cannock Flood Alleviation Scheme hydraulic model.

Fluvial flood risk along the Wash Brook is high, however the impact is low as the flood zones extend into predominantly rural areas.

The Southern Staffordshire WCS Study (2010) classified the Cannock Chase Council area as having a medium probability of fluvial flood risk, with high consequences. It also classified the Council area as having a medium probability of residual flooding from the overtopping or breaching of flood defences.

1.5.2 Pluvial Flood Risk

The Updated Flood Maps for Surface Water have been mapped for the Cannock Chase Council area, Figure SW-CC.

In the Cannock Chase Council area there are number of areas where pluvial flooding has been highlighted as a risk:

- **Rugeley Town Centre:** The main flood risk in this area is pluvial flooding. This is due to the lack of capacity of culverts and drains during storm surges (Southern Staffordshire Outline Water Cycle Study, 2010). Sitting Mill and Brereton Road areas experience repeated exceptional pluvial flood events (SWMP Phase 1).

- **Cannock Town:** Pluvial flooding occurs through this area due to the capacity of the drainage network during extreme events, which is further exacerbated by blockages. In addition pluvial flooding is from overland runoff from rural areas and watercourses upstream, and surrounding urban areas.

The communications networks within the Council area are susceptible to pluvial flooding, and in some cases can exacerbate or alleviate flooding in other Council areas. The M6 Toll road and railway embankments are reported to act as barriers to flow in some locations, causing backing up and increased hazard upstream, but alleviating pluvial flooding downstream.

1.5.3 Flood Risk from Sewers

Figure SF-CC and Table A- 1 show information on flooding from surface water and artificial drainage sources. The data has been provided by Severn Trent Water (STW) in the form of four digit postcode locations which are recorded within their DG5 Flood Register. The records were obtained from STW in January 2014. The data provided by STW is limited to postcode area, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records 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 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. In addition, the records do not account for the effect of any capital works designed to alleviate flooding.

Within Cannock Chase Council area there are 12 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below.

Table A- 1 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Properties at risk of flooding
WS11 0	1
WS11 2	1
WS11 5	4
WS11 6	4
WS11 9	3
WS12 0	9
WS12 1	2
WS12 2	3
WS12 4	14
WS15 1	2

WS15 2	8
WS15 4	2

1.5.4 Groundwater Flooding

Figure GW-CC shows Groundwater flood susceptibility in the Cannock Chase Council area. Areas along the main watercourses in the north and south of the Council area have potential for groundwater flooding to occur at the surface, based on rock type and estimated groundwater levels during periods of extended intense rainfall. Most of the elevated and central parts of the Council area have limited potential for groundwater flooding to occur.

It is important to recognise that the risk of groundwater flooding is dependent on local and antecedent conditions. Therefore it should be noted that 'groundwater risk' is not mapped as part of this SFRA, however consultation with the Environment Agency has confirmed that the Council area is not considered at risk of groundwater flooding.

The Environment Agency can monitor groundwater levels using boreholes and the records of these are held on the WISKI database. Both the Environment Agency and planning authorities can keep records of instances where a high water table has led to individual groundwater flooding events.

Evidence of historical groundwater flooding in the Council area is limited; only the Phase 1 SWMP (2010) identifies rare groundwater flooding incidents to the East of Ridings Brook.

The Coal Authority control mine water levels at a 'central' pumping station at Mid Cannock. Mine water passes through a series of lagoons and, via discharge consent, to the tributary of the Saredon Brook. Mining has ceased in the area and there have been small increases in the flows in Gains Brook and Wash Brook (WCS, 2010).

1.5.5 Other Sources of Flood Risk

1.5.5.1 Risk of flooding from Canals

Two canals are located within Cannock Chase: the Trent and Mersey Canal to the north-east and the Wyrley and Essington Canal to the south. The Trent and Mersey Canal runs for 3.8 km along the north eastern edge between Rugeley to Brereton. At the northern most point of the Council area, the canal crosses above the River Trent via an aqueduct and is elevated above the floodplain on embankments. It is unlikely that water would spill into the canal from the river due to its high elevation. The Fluvial Trent Strategy (2005) does not refer to any potential flooding problems resulting from interactions between the canal and river at this location.

The Wyrley and Essington Canal (Cannock Extension Canal) is located in the south-eastern corner of the Council area. The canal runs for approximately 2km within the Council between Pelsall Wood and Wattling Street (A5 Road).

There is a derelict canal, The Hatherton Canal, originally constructed and 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. The restoration of the canal did not go ahead for economic reasons. Currently, only a short section near the junction with the Staffordhsire and Worcestershire Canal is navigable.

Consultation with the Canal and River Trust (formerly British Waterways) has indicated that there are no records of canal breaches within the Council area. However, a Flood Risk Assessment (FRA) should be carried out for sites in close proximity to 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 the

responsible authority 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. Any development proposed adjacent to a canal should be investigated on an individual basis regarding flooding issues and should be considered as part of any FRA.

1.5.5.2 Risk of flooding from reservoirs

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act 1975 and the Flood and Water Management Act 2010. A register list is held by the Environment Agency. The Mill Green Balancing Pond is the only reservoir in Cannock Chase. It was constructed in 1977 to attenuate storm flows and help relieve downstream flooding.

Figure RIM-CC shows the risk of flooding from reservoirs, the outlines were provided by the Environment Agency. These maps indicate that some of the northern areas of the Cannock Chase Council are at risk if the Rugeley Ash Lagoon (4LH and 4RH), Rugely Cooling Tower Ponds (6-9), Gailey Upper Pool and Belvide Reservoir became breached, and should the Mill Green Balancing pond fail and release all of the water it holds, some of the southern areas of the Council along the Ridings Brook and surrounding Cannock Chase Town may be at risk of flooding. The consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

Appendix B – Lichfield District Council

1.1 Lichfield District Council Flood Risk

Figure A shows the Lichfield District Council administrative boundary within the Level 1 Study Area. The council is situated in the east of Staffordshire and is a non-metropolitan council, covering an area 331 km². The council area shares its border with East Staffordshire, South Derbyshire, North Warwickshire, Tamworth, Birmingham, Walsall, Cannock Chase and Stafford Council boundaries. The council is made up of a historic cathedral city, Lichfield, a modern urban centre, Burntwood, and a large rural area with pleasant villages.

In recent years the area has seen many new developments, such as Fradley Park on the A38 and the M6 Toll. The Council area has an important and dense transport infrastructure; the West Coast main line and Birmingham Cross City Line both serve the city of Lichfield and there are links to many towns in the surrounding area by major trunk roads. The Council area is also dissected by the M6 Toll which links the area to the national motorway network. The Burntwood Business Park is experiencing major growth, in part because of the direct access to the M6 Toll and A5.

1.2 Hydrology

Figure H-LD shows the key hydrological features in the Lichfield District Council area. There are four main watercourses located in the area, River Blithe, Little Blithe, Moreton Brook, River Trent, River Tame and River Mease.

The **River Blithe** is fed by the discharge from the Blithfield Reservoir, and continues on through the north of the Council area splitting into the **Little Blithe** for some distance, flowing along the council boundary. Both watercourses eventually merge and continue through open pasture past Hamstall Ridware meandering across the farmland before joining the River Trent. There is little development along the course of the river.

Moreton Brook is a short reach of Main River in the north of the council area draining south from the village of Colton to its confluence with the Trent. **The River Trent** enters the council area to the north of Rugeley. The Trent is a mature river here having flowed over 40km from Stoke on Trent and commanding a catchment of around 1000km^2. It cuts across the north of the council area forming the border between Lichfield District Council and East Staffordshire for some of its length before turning north towards Burton upon Trent. There is little development along this section of the Trent corridor and the channel takes a natural path. The only main centres of population which lie adjacent to the river are, Armitage, Kings Bromley and Alrewas. Other tributaries of the Trent include the Curborough Brook and the River Swarbourn.

The River Tame runs through the council area from Tamworth near Hopwas in a northerly direction. Within the Lichfield area, the floodplain is very rural and the channel untrained, a contrast to its journey through the city of Birmingham where the channel is heavily modified and the watercourse receives runoff from the large urban conurbation. The River Anker, a major tributary of the Tame, joins at Tamworth and has a significant impact on the local regime of the river. It is in the north of the Lichfield Council area that the confluence between the Tame and the Trent can be found and only a short distance downstream, the **River Mease** also flows into the Trent having drained the north east part of the catchment. Other tributaries of the River Tame include the Mare Brook, the Leasow Brook, the Comberford Brook, the Bourne Brook and the Curborough Brook, which all drain rural, mainly agricultural areas.

1.3 Geology & Topography

The Solid Geology for the Council area is shown in Figure SG-LD and the Drift Geology is shown in Figure DG-LD. Triassic mudstones and sandstones dominate the geology within the Lichfield Council area. Being relatively soft, these had eroded over thousands of years to form the wide flat valley of the River Trent and its tributaries. Recent glaciation also influences the landscape we see today. Glacial deposits of sands and gravels cover much of the river valley and extraction works are located in much of

the extended floodplain. The landscape is mainly low lying agricultural and pastoral land and it is currently this land use that covers the floodplain of the River Trent.

Although the River Anker does not run thought the study area, it is a major tributary of the River Tame and its behaviour affects the River Tame through Lichfield District Council. The Anker catchment responds rapidly to rainfall. The fast flows over the softer mudstones make the river vulnerable to soil erosion and sediment is transferred down the river. When sediment load reaches the River Tame the change in channel slope and the reduced velocity of the water means that much of the load is deposited and channel capacity is reduced. This description could also be applied to the River Mease flowing into the River Trent.

The topography of the Council area is shown in Figure T-LD. The EA LiDAR information provides good coverage of Lichfield.

1.4 Historical Flooding

Recent years have seen a number of large scale flood events throughout the UK, noticeably in response to storms and prolonged rainfall. The following events were experienced in Lichfield Council:

- ***August 1987*** – Flooding was experienced along the River Blithe (a left bank tributary of the River Trent), as a result of channel capacity exceedance.
- ***December 1992*** – Flooding from the River Tame, upstream and downstream of Tamworth. The left bank was severely flooded, but the defences at Brook End were not overtopped. The River Mease was also affected, but flooding was confined to the floodplain and agricultural land.
- ***Autumn 2000*** – Exceptional flooding events along the River Tame. Elford was severely affected, due to surcharging of the Green Brook Culvert. A number of properties in the Trent Valley area of Colton were flooded by the Moreton Brook
- ***Summer 2007*** - The significant flood event of Summer 2007 affected many regions across the UK. The entire Lichfield Council area is reported to have been affected by the flooding from prolonged rainfall. Multiple exceptional flood events were reported around Elford and Colton, surrounding the River Tame. A second flood event in July again inundated Fazeley, Elford and Colton.
- ***September 2009*** – Pluvial flooding on Tamworth Road, Cappers Lane, Thomas Greenway road flooded due to failure of highways drainage capacity. Roads and footways were closed and flooding to external areas of residential properties was experienced. Flooding occurrence noted as exceptional .
- ***June 2009*** – Pluvial flooding in Shenstone due to damage of the gullies and outlets. Residential properties and highways flooded. Sewer flooding recorded in Lichfield due to exceedance of highways and public sewer drainage networks. External areas of public property flooded.
- ***November 2009*** – Failure of public highways and sewer networks attributed to flooding along the main road in Alrewas and along the A513. Roads and footpaths closed and damaged. External areas of public property flooded.
- ***September 2010*** – Failure of public sewer and highways drains caused flooding along the main street in Campville. External areas of residential properties flooded and closure of road.
- ***October 2010*** – Pluvial flooding along the main road in Alrewas. Flood frequency noted as recurrent – closure of road and footways sue to blockages of highways drains.
- ***July 2013 –*** Sandford Street, Wheel Lane and Birmingham Road flooded in response to intense summer rainfall
- ***Winter 2013/2014 –*** Large storms and extreme rainfall events through Christmas 2013 and January 2014 have caused flooding throughout the UK, and flood warnings and risk have been the highest in decades.

1.5 Sources of Flood Risk

1.5.1 Fluvial Flood Risk

The River Trent and the River Tame are the main watercourses in the Lichfield Council area. The River Trent flows northwest to southeast across the Council, whilst the River Tame flows northwards through the Council area until its confluence with the River Trent. The River Blithe, Mare Brook, Curborough Brook and Bourne Brook also flow through the area, having drained upstream settlements including Stoke on Trent, Stone and Tamworth.

Figure FZ-LD maps the Environment Agency Flood Zones 2 and 3, and show locations at risk from fluvial flooding. Additional modelling has been carried out along the River Tame as part of the River Tame Strategic Flood Risk Mapping Study.

The Environment Agency Flood Zone maps for the River Trent through the Lichfield areas show fluvial flood risk occurs predominantly into rural agricultural land where there is currently little development. This is similar for the main tributaries of the Tame.

In parts the extent of the Flood Zones is up to 2 km in width, between Armitage with Handsacre and Alrewas. The importance of preserving this floodplain must be highlighted as any constrictions introduced in this area would have significant affects downstream. There are also a number of lakes mainly from quarrying practices located within the Flood Zones which would provide attenuation of flood flows and hence reduce the flooding hazard. Villages situated adjacent to the River Trent, River Tame and its tributaries have relatively few properties located in Flood Zone 3. There are areas where Flood Zone 2 is significantly larger than Flood Zone 3, especially along the Tame between The Mare and Leasow Brook, and at the confluence of the River Blithe and Trent.

Where predominantly the zones extend into rural agricultural land where little development has taken place with the exception of Comberford (north of Tamworth) which is fully covered by the 1% AEP outline. The River Tame poses the largest threat to Tamworth, outside the Council area boundary, but significant when considering cross border issues as the River Tame both upstream and downstream of Tamworth runs through Lichfield District Council.

The current Flood Zones suggest that a number of properties around Nether Stowe and part of the Ringway Industrial estate are at risk from the 1% AEP event. The greatest flood risk is in Fazeley from both the Bourne Brook and the River Tame.

1.5.2 Pluvial flood Risk

The Update Flood Maps for Surface Water have been mapped for the Lichfield District Council area, Figure SW-LD.

Seven settle settlements have been identified based on historical and potential future pluvial flood risks, as having high risk of pluvial flooding in Lichfield District Council (Southern Staffordshire SWMP Phase 1, 2010):

- Lichfield City
- Armitage and the
- Longdons,
- Burntwood,
- Walford,
- Little Aston,
- Mile Oak and
- Fazeley and
- Whittington

There are a large number of pluvial flooding occurrences that have been identified as highways flooding (SWMP Phase 1 2010). Highways flooding can occur even when drainage provisions are clean and well

maintained. Pluvial flooding can occur due to exceptional rainfall, a road being in a low lying area, changes in runoff from adjacent fields and rivers overflowing are some situations that can lead to the road flooding or being waterlogged even when drains are in good working order.

Blockages of drains and watercourses in urban areas have been attributed to the pluvial flooding incidents in the Lichfield District Council. This was the case during the 2007 flood event, when extreme flows resulted in backing up of surface water drains as water levels in the watercourses rose above outfall height. (SWMP Phase 1, 2010)

The key issues surrounding pluvial flood risk in Lichfield City is due to overland flow and a lack of drainage capacity from both sewers and watercourses (SWMP Phase 2, 2011). The surface water flood depths are generally low for all return periods; however depths of up to 2 m have been recorded for the 1 in 200 year flood event. Some low lying areas within the city have been classified with 'moderate' hazard and some open spaces face 'significant' hazard from pluvial flooding. Pluvial flood risk in Lichfield City poses a risk to many of the key infrastructure systems and properties within the area, including schools, care home, emergency services stations and waste management sites.

1.5.3 Flood Risk from Sewers

Figure SF-LD and Table B- 1 show information on flooding from surface water and artificial drainage sources. The data has been provided by Severn Trent Water (STW) in the form of four digit postcode locations which are recorded within their DG5 Flood Register. The records were sourced obtained from STW in January 2014. The data provided by STW is limited to postcode area, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records 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 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. In addition, the records do not account for the effect of any capital works designed to alleviate flooding.

Within Lichfield District Council area there are 15 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below.

The Environment Agency recommends 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.

Table B- 1 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Properties at Risk of Flooding
B74 3	6
DE13 7	3
ST15 8	1
WS13 6	2
WS13 7	4
WS13 8	2
WS14 0	7
WS14 9	3
WS15 1	3
WS15 3	1
WS15 4	8
WS7 1	1
WS7 4	1
WS7 9	4
WS9 0	1

1.5.4 Groundwater Flooding

Figure GW-LD shows Groundwater flood susceptibility in the Lichfield District Council area. Low lying areas along the River Trent, Tame and Bourne Brook Council area have potential for groundwater flooding to occur at the surface, based on rock type and estimated groundwater levels during periods of extended intense rainfall. There is limited potential for groundwater flooding to occur in the more elevated areas away from the floodplains.

It is important to recognise that the risk of groundwater flooding is dependent on local and antecedent conditions. Therefore it should be noted that 'groundwater risk' is not mapped as part of this SFRA, however consultation with the Environment Agency has confirmed that the Council area is not considered at risk of groundwater flooding.

The Environment Agency can monitor groundwater levels using boreholes and the records of these are held on the WISKI database. Both the Environment Agency and planning authorities can keep records of instances where a high water table has led to individual groundwater flooding events.

There are no known problems with groundwater flooding within the Lichfield District Council area (WCS, 2010). It should be noted however that the underlying geology is fluvial sand and gravel deposits, which hold extensive groundwater resources. These resources in the sands and gravels are generally not heavily exploited, but locally abstraction for agriculture has been developed. There is significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems, although secondary controls include drawdown generation from abstractions for localised water resource use and dewatering related to mineral extraction.

Consultation with the Environment Agency has suggested that there are no other known problems with flooding from groundwater in Lichfield District Council area.

1.5.5 Other Sources of Flood Risk

1.5.5.1 Risk of flooding from canals

There are two canals located within Lichfield District Council area: the Trent and Mersey Canal, cutting across the north of the area, and the Coventry Canal, running from north to south through Lichfield. Liaison with British Waterways indicated that there are no recorded incidents of breaches or any other flood risk instances associated with these canals.

Consultation with Canal and River Trust (formerly known as the British Waterways) has indicated that there are no records of canal breaches within the Council area. However, a Flood Risk Assessment (FRA) should be carried out for sites in close proximity to 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. 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.

1.5.5.2 Risk of flooding from reservoirs

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act 1975 and are listed on a register held by the Environment Agency. There are eight bodies of water falling under the Reservoir Act; Canwell estate reservoir, Chasewater, Little Aston Pool, Minister Pool, Rugeley Amenity Lake, Rugeley Ash Lagoon, Stowe Pool and Swinfen Lake.

Figure RIM-LD shows the risk of flooding from reservoirs, the outlines were provided by the Environment Agency. These maps indicate that the following areas would be at risk if the reservoirs located upstream breached. Although the consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

From analysis of the Reservoir Maps the following reservoir contribute to the risk of flooding from a reservoir within Lichfield District Council.

- Rugeley Ash Lagoon (4LH)
- Rugeley Cooling Tower Ponds 6-9
- Belvide
- Rugeley Ash Lagoon (4RH)
- Stowe Pool
- Blithfield
- Little Aston Pool
- Barr Beacon No.2
- Chasewater (Cannock Chase)
- Swinfen Lake
- Canwell Estate Reservoir
- Minster Pool
- Gailey Upper Pool
- Rugeley Amenity Lake

Appendix C – South Staffordshire Council

1.1 South Staffordshire Council Flood Risk

Figure A shows the non-metropolitan South Staffordshire Council administrative boundary within the Level 1 SFRA Study Area. The council area covers some 407km² and is situated to the north and west of Wolverhampton, also bordering Shropshire to the west and Worcestershire to the south There is no single dominant settlement and South Staffordshire can be described as a 'community of communities', often dormitory villages for Wolverhampton, Birmingham and Telford.

Over 80% of South Staffordshire falls in the Midlands Green Belt, and forests and woodlands contribute to much of the attractiveness of the countryside. South Staffordshire is made up of 27 parishes with a dispersed and diverse settlement pattern of villages ranging from small hamlets to large villages.

1.2 Hydrology

Figure H-SS shows the key hydrological features of the South Staffordshire Council area. 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.

The **River Penk** rises at Perton and flows northwards through the Council area fringing the villages of Codsall and Coven, before flowing through Penkridge where the catchment area is approximately 272km^2. The floodplain is predominantly rural with a relatively low to moderate relief catchment. As the watercourse flows through the council area it receives flows from the adjoining tributaries of the Saredon Brook, Moat Brook, Watershed Brook and Whiston Brook.

The **Smestow Brook** forms a continuation of the Black Brook. The watercourse initially flows in a southerly direction through the council area before turning to flow east towards Trysull, then south towards Smestow where the Brook commands a catchment area of approximately 51km^2. As the watercourse continues to flow in a southerly direction, it receives flows from the Wom Brook (catchment area approximately 25km^2) and Spittle Brook (catchment area approximately 20km^2), 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 137km^2. As the Smestow Brook flows through the council area 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 council boundary, this will have an impact on flows within the Smestow Brook further downstream as it flows through the Council area. 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 council area 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 90km^2 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 230km^2. The River Stour then meanders its way through mainly rural floodplain before eventually flowing out of the Council area at the southern extent by Whittington towards the River Severn.

1.3 Geology & Topography

The Solid Geology for the Council area is shown in Figure SG-SS and the Drift Geology is shown in Figure DG-SS. To the eastern fringes of the Council area 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 Council area has been represented using EA LiDAR, which is shown in Figure T-SS. The LiDAR for the southern part of the catchment was not provided therefore OS Open Source 50m data has been used to fill in the areas.

The topography of the Council area is generally very undulating and the geology does not give rise to many prominent physical features. The northern part of the Council area, 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 Council area 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, Pattingham 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 Council area 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 Ortin Hill around Wombourne.

1.4 Historical Flooding

Recent years have seen a number of large scale flood events throughout the UK, noticeably in response to storms and prolonged rainfall. The following events were experienced in the South Staffordshire Council:

- ***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 was experienced in the River Penk catchment.
- ***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*** - Fluvial and pluvial flooding incidents recorded at multiple locations. Penkridge village was the most severely affected area. The River Penk rose as hish as the Riverside Care home and Health Centre. Pinfold Lane was completely submerged. Whiston Brook, Hinksford, Perton and Brewood east of Brewood and Wombourne were flooded.
- ***November 2009*** – Intense summer rainfall caused external flooding of the culvert under St Pauls School in Coven. The origin of this flood is noted as 'exceedance of watercourse'.
- ***January 2010*** – Areas of Gilberts Cross and Orton experienced pluvial flooding, closing roads and footways.
- ***Summer 2010*** – Ball Lane, Stafford Road and School Lane Coven experienced pluvial flooding due to blocked highways drains. Overland flow caused flooding of residential properties; highways and footways closed.

- ***June 2012*** – Exceptional rainfall caused pluvial flooding in Huntington, Essington and Great Wyrley from overland flow. Groundwater flooding noted in Essington.
- ***Summer 2012 –*** Fluvial, pluvial and highways flooding reported in the following parishes; Bilbrook, Brewood, Codsall, Essington, Great Wryley, Huntington, Lower Penn, Perton
- ***Winter 2013 / 2014 -*** Huge storms and extreme rainfall events through Christmas 2013 and January 2014 have caused flooding throughout the UK, and flood warnings and risk have been the highest in decades.

The size of the council and sub 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 Council have been affected by persistent large scale flood events.

1.5 Sources of Flood Risk

1.5.1 Fluvial Flood Risk

South Staffordshire is covered by two river catchments, Smestow Brook is within the River Severn catchment; and the River Penk is within the Trent catchment. Many additional tributaries flow into the Main Rivers contributing to the flood risk within the Council area. Penkridge, Wombourne and Kinver are known to be affected by fluvial flooding, with a number of other settlements also being affected by flooding from fluvial sources.

The Environment Agency Flood Zone Maps, shown in Figure FZ-SS. The flood maps have been created using the updated flood zones provided by the Environment Agency.

Fluvial flood risk along the River Penk extends 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 Council area, a small business park (Balliol Business Park and Works) is located within Flood Zone 2.

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.

There are a number of properties are at fluvial risk due to the River Stour. As the watercourse enters the Council area 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 Council area 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 Council area where South Staffordshire borders Cannock Chase Council. Wash Brook flows along the boundary of South Staffordshire Council area with Cannock Chase Council. Flood Zone 2 extends from the left bank into the Council area 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. As the watercourse flows along the Council boundary, it becomes known as the Wyrley Brook, and then the Saredon Brook. A small number of properties and reclamation works and pumping stations are located within Flood Zone 2 around Wedges Mills, and a number of properties at Sarerdon.

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 Council area 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.

1.5.2 Pluvial Flood Risk

The Updated Flood Maps for Surface Water have been mapped for the South Staffordshire Council area, Figure SW-SS.

Surface water flood maps indicate that a high proportion of the flood incidents in the South Staffordshire Council Council are a result of pluvial flooding, particularly highways flooding. There are also many repeat occurrences of pluvial flooding that have multiple or unidentified causes. The main areas within the Council susceptible to these repeated pluvial flood events are Penkridge, Wombourne, Codsall and Perton.

In Penkridge (SWMP Phase 2 for Penkridge 2011) pluvial flooding was reported to mostly originate from overland runoff from extensive rural areas throughout the catchment and particularly the upstream reaches of the watershed. The Penkridge area has limited urban artificial drainage networks, and exceedance capacity of natural watercourses was identified as the main cause of urban pluvial flooding. Major travel embankments, including the M6 Toll and railway embankments act as barriers to flow, which are reported to exacerbate flood depth and hazard upstream and alleviate flooding downstream. Surface water flood depths are generally low in the Penkridge area, but 1 m depths have been recorded for the 1 in 200 year storm event.

1.5.3 Sewer flooding

Figure SF-SS and Table C- 1 show information on flooding from surface water and artificial drainage sources. The data has been provided by Severn Trent Water (STW) in the form of four digit postcode locations which are recorded within their DG5 Flood Register. The records were sourced obtained from STW in January 2014. The data provided by STW is limited to postcode area, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records 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 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. In addition, the records do not account for the effect of any capital works designed to alleviate flooding.

Within South Staffordshire Council area there are 14 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below.

Table C- 1 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Recorded Incident Locations
DY7 6	2
ST19 5	3
ST19 9	2
WS6 6	7
WS6 7	6
WV10 7	5
WV4 4	2
WV5 0	1
WV5 8	1
WV5 9	2
WV6 7	7
WV8 1	8
WV8 2	3
WV9 6	1

1.5.4 Groundwater Flooding

Figure GW-SS shows Groundwater flood susceptibility in the South Staffordshire Council area. Areas in the northern half of the Council along the River Penk and Saredon Brook have potential for groundwater flooding to occur at the surface, based on rock type and estimated groundwater levels during periods of extended intense rainfall. There is limited potential for groundwater flooding to occur in the more elevated areas away from the floodplains.

It is important to recognise that the risk of groundwater flooding is dependent on local and antecedent conditions. Therefore it should be noted that 'groundwater risk' is not mapped as part of this SFRA, however consultation with the Environment Agency has confirmed that the Council area is not considered at risk of groundwater flooding.

The Environment Agency can monitor groundwater levels using boreholes and the records of these are held on the WISKI database. Both the Environment Agency and planning authorities can keep records of instances where a high water table has led to individual groundwater flooding events.

There are no known problems with groundwater flooding within the South Staffordshire Council area (WCS, 2010). Similarly to Lichfield, the northwest of the area has underlying Mercia Mudstone Group Deposits, sand and gravelly deposits, which hold extensive groundwater resources. There can be significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems.

Consultation with the Environment Agency has suggested that there are no other known problems with flooding from groundwater in South Staffordshire Council area.

1.5.5 Other Sources of Flood Risk

1.5.5.1 Flood Risk from Canals

Three canals are located within the South Staffordshire Council area: the Shropshire Union Canal, the Staffordshire and Worcestershire Canal and the Stourbridge Canal. The Southern Staffordshire Phase 1 SWMP (2010) reports a high number of canal overtopping / breach events compared to the rest of the study area.

A Flood Risk Assessment (FRA) should be carried out for sites in close proximity to 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. 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.

1.5.5.2 Flood Risk from Reservoirs

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act 1975 and are listed on a register held by the Environment Agency. There are three reservoirs in the South Staffordshire Council area; Belvide, Calf Heath and Gailey.

Figure RIM-SS shows the risk of flooding from reservoirs, the reservoir maps have been provided by the Environment Agency. These maps show the areas at risk of flooding from the following reservoirs:

- Fens Pools – Uipper Pool
- Patshull Great Pool
- Patshull Church Pool
- Chillington Pool
- Ridings Brook, Cannock (Mill Green)
- Gailey Upper Pool

- Himley Hall Pool
- Pool Hall
- Park Pool, Weston Park
- Chatwell Park Farm Reservoir
- Lodge Farm
- Belvide
- Gailey Lower Pool
- Lodgerail Pool
- Springslade Pool
- Calf Heath

Within South Staffordshire there are more reservoirs that pose a risk of flooding compared to the other Council areas, the extent of the potential inundation is much smaller. The consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

Appendix D – Stafford Borough Council

1.1 Stafford Borough Council Flood Risk

Figure A shows the Stafford Borough Council administrative boundary within the Level 1 SFRA Study Area. The Council covers an area of approximately 600km² and includes the main towns of Stafford and Stone. The Borough borders with Staffordshire Moorlands, Newcastle-under-Lyme, the City of Stoke-on-Trent, East Staffordshire, Shropshire, Telford and Wrekin, South Staffordshire and Cannock Chase. The town of Stafford acts not only as the administrative centre of the Borough but also Staffordshire County as a whole.

Stafford is a thriving Market Town, steeped in heritage from its long history of shoe making to its association with the 'Potteries'. The old businesses have largely gone now but new factories and warehouses have taken their place. The original settlement was on an island in the middle of the marshes of the River Sow, a tributary of the River Trent. There is still a large area of marshland just north of the town, which in 1947, 2000 and 2007 saw floods.

The rest of the Borough is essentially rural with forests and woodlands contributing 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 location to live and work.

1.2 Hydrology

Figure H-SB shows the key hydrological features of the Stafford Borough.

After rising in the Staffordshire Moorlands, the **River Trent** flows south through Stoke-on-Trent where it becomes designated Main River, then into Stafford Borough in the north. It flows through Stone, dissecting the Borough and exiting just north of Rugeley in Cannock Chase Council area. The Trent and Mersey canal runs adjacent to the River Trent for its entire journey through the Borough. The floodplain of the Trent is relatively wide through the Borough, but mostly undeveloped. Stone is dissected by the River Trent floodplain, which is largely undeveloped. The catchment area of the River Trent at Stone is some 230km^2. **Scotch Brook** enters the River Trent on the left bank as it flows through Stone. Further downstream, Aston Lodge Brook enters the Trent on the left bank. Aston Lodge also has a designated main River tributary called Aston Chase Brook, which flows through the south eastern side of Stone.

The main tributary of the Trent within the Borough boundary is the **River Sow**. The Sow rises at Fairoak and flows through Cop Mere and past Eccleshall where it becomes designated Main River, before flowing through Stafford and on to join the River Trent at Shugborough, where it commands a catchment area of 589 km² . This includes the catchment area of the River Penk (336km²) whose catchment area lies mostly south of the border in Cannock Chase Council's area, but meets the Sow in east Stafford. Just upstream of this confluence, the River Sow is met by **Sandyford Brook** and then **Kingston Brook**, both on the left bank. Both these designated Main Rivers flow southwards through the northern part of Stafford.

Downstream of Eccleshall the River Sow is met by **Meece Brook** on the left bank, which enters the Borough in the north-west and is designated Main River throughout. Meece Brook has a designated Main River left bank tributary called Yarnfield Brook, which rises just north of Yarnfield itself.

Doley Brook is located in the south-west of the Borough. It begins just north-west of Gnosall and flows in a south-easterly direction past Church Eaton and towards Mitton. The Brook at Mitton has a catchment area of 46 km². South of the Borough, the Brook continues to join the River Penk at Penkridge. Just south of Doley Brook, Motty Meadows Brook and Marston Brook, both designated Main River, briefly enter the Borough on the southern boundary. Similarly, the River Meese and Lonco Brook briefly border the Borough on the south-western side, around Forton. Here, a number of brooks drain into Aqualate Mere, and the discharge from the Mere forms the headwaters of the River Meese. The watercourse is then joined by Lonco Brook, which also forms 3km of the Borough boundary. Both watercourses drain a predominantly rural landscape made up of farmland and small hamlets.

1.3 Geology & Topography

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface run-off, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

The Solid Geology for the Council area is shown in Figure SG-SB and the Drift Geology is shown in Figure DG-SB. The Stafford Borough Council area consists predominantly of sedimentary rocks and is represented by three major geological periods. The oldest rocks are from the Carboniferous period, followed by rocks from the Permian and finally the younger Triassic rocks. The Carboniferous rock sequences make up approximately 82% of the geology in the Borough, with the River Sow catchment draining a predominantly Carboniferous landscape. The Sow also drains the escarpment of Cannock Chase (to the south-east of the Borough) which is highly permeable in nature. This, coupled with the moderately permeable Carboniferous landscape of the Sow catchment contributes to a slower runoff response to rainfall. The remainder of the underlying geology within the Borough consists of Mercia Mudstones, argillaceous clay-like rocks, sandstones and conglomerates.

The Mercia Mudstones have a high clay content and are less permeable, in comparison to the Carboniferous landscape of the Sow catchment. Drift deposits of Till are found at the south-western and eastern extents of the Borough. Till is sediment that is deposited by glaciers and made up of clay, detritus that is indicative of the underlying argillaceous clay-rich rocks. Alluvium and river terrace deposits of clay, silt and sand are also found within the Borough along the courses of the Meece Brook, River Sow and River Trent.

The topography of the Council area has been represented using EA LiDAR, which is shown in Figure T-SB. The heavy clay soils form an essentially pastoral landscape across most of the Borough with undulating hills. Elevations across the Borough lie mainly below 150m, and many tributaries drain this landscape towards the River Trent.

1.4 Historical Flooding

Recent years have seen a number of large scale flood events throughout the UK, noticeably in response to storms and prolonged rainfall. The following events were experienced in Stafford Borough Council's area:

- ***November 2000*** – Serious flooding was experienced in response to large storms and intense rainfall, affecting properties in the Newport Road and Bridge Street the worst.
- ***Summer 2007*** - The significant flood event of Summer 2007 affected many regions across the UK. The entire Stafford Borough area is reported to have been affected by a combination of pluvial and fluvial flooding from prolonged rainfall.
- ***September 2008*** – Sewer flooding from a failure of the public sewer capacity in Stafford Town. Flooding to external areas of residential properties.
- ***Summer 2009*** –Flooding to residential gardens in Anthony Grove, Meir Heath and Church Lane Oulton due to build up of surface water along the roads. In some areas water ponded to 0.5 m deep across the low points in the road.
- ***November 2009*** – Exceptional surface water flooding in Forton and Barlaston after prolonged rainfall. Multiple cases of flooding to external residential properties.
- ***January 2010*** – Exceptional rainfall caused flooding to residential properties in Northwood Lane, Stoke-on-Trent.
- ***October 2010*** – Surface water flooding closed roads in Ranton. Damage to road and rail infrastructure, but no properties flooded.

- ***Summer 2012*** – Torrential and prolonged rainfall in July 2012 cause widespread flooding across Stafford Borough.

There have been a fairly large number of historic flood occurrences across the Borough, including sewers, highways and surface water, and one isolated incidence of canal overtopping (SWMP Phase 1, 2010). A high proportion of these floods are listed as occasional or repeat. A number of the flood events are scattered across the rural parts of the Borough, but clusters are evident within the main settlements of Stafford town, Stone and Eccleshall. There is also a prominence of sewer flooding with fairly high occurrences across the Borough as a whole.

Historic flooding records also highlight low lying areas in the centre of the Borough, which were historically marshy areas of ground.

1.5 Sources of Flood Risk

1.5.1 Fluvial Flood Risk

The whole Borough and particularly the main urban areas in the Borough face a significant fluvial flood risk from the main watercourses, River Trent, River Sow and River Penk and their tributaries. This risk is affected not only by activities within the Borough but also activities upstream in the neighbouring Local Authority areas. Conversely activities within the Borough also impact on the flood risk of Local Authority areas downstream.

The Flood Zone maps provided as part of this study, shown in Figure FZ-SB, show an indication of the locations at risk from fluvial sources within the Borough. This section summarises the main flood risk areas as defined by the Flood Zone maps and highlights places where there is a significant number of properties within Flood Zones 2 and 3, or where the extent of the Flood Zones is large.

Fluvial flood risk in Stone is known to occur from small streams and the urban drainage network, rather than the main watercourse of the River Trent. This is similar for Stafford, where no risk has been identified from the River Penk however flooding is known to occur from the River Sow and small streams (River Trent CFMP, 2010).

The River Trent enters the Borough near Trentham where is passes by Trentham Estate and Gardens which are currently located in Flood Zone 3. From here the river follows the Borough's border past the sewage works, also shown to be in Flood Zone 3. As the river turns south, it flows through a rural landscape past Tittensor. Here the floodplain is wide but there is little development affected by fluvial flood risk. The River Trent passes through the centre of Stone, where development has been steered away from the river allowing the natural floodplain to remain. However, Flood Zone 2 currently encroaches on the town in a number of places, namely Abbey Street and Saxifrage Drive.

The Scotch Brook also runs through the town and poses more of a risk than the River Trent. A number of properties located around the confluence of the two watercourses lie in Flood Zone 3. This may be due to reverse flow of the Trent up the Brook, rather from the Brook alone. There is currently no Flood Zone data available for Aston Brook at Little Stoke.

South of Stone, the floodplain remains wide and affects only the rural landscape. However, the Flood Zones suggest that there could be some interactions during larger flood events with the canal.

At Burston, the Jolpool Brook joins the River Trent and it appears that the majority of the village is located in Flood Zone 3. Again this could be the influence of the River Trent rather than the Jolpool Brook.

The floodplains of the Gayton and Amerton Brooks, both tributaries of the Trent (around the village of Weston) are extensive but again there is little development affected. There is extensive flood risk around the confluence of the Rivers Trent and the Sow, and many arterial drains.

The M6 north of Stafford services is currently shown to be in Flood Zone 3. However, it is likely that the motorway is raised above the water levels.

The Doxey Brook, flowing across the east of the Borough, has much land in Flood Zone 3 which is undeveloped and the risk is low. In Gnosall, there are a few properties on Station Road where the road crosses the Brook, which are deemed to be at risk. There is relatively little risk to property throughout the length of the watercourse, except for the village of Church Eaton, where a number of properties lie within Flood Zone 3.

West of Stafford, the Doxey Tillington SSSI nature reserve is an area of extensive floodplain storage, creating an area of wet marshland. At Castletown, the river flows through a narrow corridor. The flood risk from the River Sow through Stafford is relatively low. However there are a number of drains present and their associated Flood Zone extents affect large areas of the town. The current Flood Zones defined for the Sandyford Brook show a high level of risk to many properties along its route through the town, linked to Marston Brook.

The floodplain of the River Penk to the south of the town is easily accommodated and poses little risk to the current development.

1.5.2 Pluvial Flood Risk

The Update Flood Maps for Surface Water have been mapped for the Stafford Borough Council area, Figure SW-SB.

A large majority of the flood occurrences within the towns are identified as highways flooding. These may be as a result of blocked highways drains or overflow of ordinary watercourses or drains.

A large majority of the flood occurrences within the settlements are identified as highways flooding. These may be as a result of blocked highways drains or overflow of ordinary watercourses or drains.

There are a large number of historic pluvial flood occurrences in the Borough, predominantly in clusters within the settlements of Stafford, Eccleshall and Copmere End, Salt and Weston, Stone, Walton and Norton Bridge and Yarnfield. These settlements have been identified as being at high risk of pluvial flooding. (Phase 1 SWMP, 2010)

Pluvial flooding across Stafford town originates from overland run-off, originating both from rural areas upstream of the town and from within the urban area (SWMP Phase 2, Stafford Town, 2011). Pluvial flooding rarely originates from blockages or failure of the sewer network within Stafford town. Flooding in the Borough often originates from interaction between pluvial and fluvial flooding. It is recommended that the backing up of fluvial flows along the surface water drainage network should be investigated further.

Similar to the Lichfield and South Staffordshire Council areas, the M6, railway and major road embankments act, in parts, as barriers to flow, exacerbating flood depth and hazard upstream. In some instances this may be reducing the flood risk to Stafford downstream, but once water has accumulated to a significant depth, this results in the flooding of the key access and egress routes.

1.5.3 Sewer flooding

Figure SF-SB and Table C- 1 show information on flooding from surface water and artificial drainage sources. The data has been provided by Severn Trent Water (STW) in the form of four digit postcode locations which are recorded within their DG5 Flood Register. The records were obtained from STW in January 2014. The data provided by STW is limited to postcode area, resulting in the coverage of relatively large areas by comparatively limited and isolated recorded flood events.

All Water Companies have a statutory obligation to maintain a register of properties / areas which have reported records 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 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. In addition, the records do not account for the effect of any capital works designed to alleviate flooding.

Within Stafford Borough there are 15 postcode areas identified as at risk of flooding from artificial drainage systems and surface water runoff. The number of properties at risk of flooding from sewer flooding is shown in the table below.

Table D- 1 Flooding From Artificial Sources as Recorded in the Severn Trent DG5 Register

Postcode Area	Number of Properties at Risk
ST12 9	10
ST15 0	2
ST15 8	19
ST16 1	9
ST16 2	1
ST16 3	7
ST17 0	11
ST17 4	8
ST17 9	4
ST17 0	1
ST18 0	5
ST18 9	6
ST20 0	3
ST21 6	5
ST3 7	1

1.5.4 Groundwater Flooding

Figure GW-SB shows the groundwater flood susceptibility within the Stafford Borough. Areas along the main watercourses, including the Meece Brook, and Sow, Penk and Trent rivers have potential for groundwater flooding to occur at the surface, based on rock type and estimated groundwater levels during periods of extended intense rainfall. Much of the central and elevated areas of the catchments away from the floodplains limited susceptibility or are not considered to be prone to groundwater flooding.

It is important to recognise that the risk of groundwater flooding is dependent on local and antecedent conditions. Therefore it should be noted that 'groundwater risk' is not mapped as part of this SFRA. However consultation with the Environment Agency has confirmed that the Council area is not considered at risk of groundwater flooding.

The Environment Agency can monitor groundwater levels using boreholes and the records of these are held on the WISKI database. Both the Environment Agency and planning authorities can keep records of instances where a high water table has led to individual groundwater flooding events.

There are no known problems with groundwater flooding within Stafford Borough (WCS, 2010). Similarly to Lichfield and South Staffordshire, the majority of the area has underlying Mercia Mudstone Group Deposits, sand and gravelly deposits, which hold extensive groundwater resources. There can be

significant hydraulic interaction between the groundwater in these deposits controlled by the interaction with the river systems.

Consultation with the Environment Agency has suggested that there are no other known problems with flooding from groundwater within Stafford Borough.

1.5.5 Other Sources of Flood Risk

1.5.5.1 Flood Risk from Canals

There are a number of canals located within the Stafford Borough; the Staffordshire and Worcestershire canal south of Stafford town, the Trent and Mersey Canal, runs almost parallel to the River Trent through the Borough, and the Shropshire Union Canal in the south west, runs parallel to the main orientation of the watercourse in the Borough, north west to south east. There has been one occurrences of canal overtopping have been reported (Phase 1 SWMP addendum, 2011); a breach at Church Eaton in 1957 and a breach at High Offley in 1991 due to a culvert failure.

A Flood Risk Assessment (FRA) should be carried out for sites in close proximity to 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.

1.5.5.2 Flood Risk from Reservoirs

Reservoirs with an impounded volume in excess of 25,000 cubic metres (measured above natural ground level) are governed by the Reservoirs Act 1975 and are listed on a register held by the Environment Agency. There are five reservoirs in the Stafford Borough; Black Lake at, Knowle Wall Farm, Bromley Mill Pool, Gap Pool, Tixall Park Pool and Trentham Gardens Lake.

Figure RIM-SB shows the risk of flooding from reservoirs, the reservoir maps have been provided by the Environment Agency. These maps show the areas at risk of flooding from the following reservoirs:

- Bromley Mill Pool
- Ashton Pool
- Chatwell Park Farm Reservoir
- Knighton
- Belvide
- Gap Pool, Ranton
- Serpentine
- Trentham Gardens Lake
- Chillington Pool
- Gailey Upper Pool
- Gailey Lower Pool
- Black Lake, Knowle Wall Farm
- Tixall Park Pool
- Calf Heath

The consequence of reservoir breach and or failure is high, the probability of breach is considered very low.

Appendix E – Data Collection

Data	Date data was obtained / report written	Description	Source
LiDAR	January 2014	Digital topographical data for the catchment with a horizontal resolution of 2m and a vertical accuracy of +/- 0.15m	Environment Agency
Flood Risk Maps	January 2014	GIS layer showing Fluvial flood zones (v4)	Environment Agency
Flood Defence Asset data (NFCDD)	January 2014	GIS layer showing locations of Flood Defences	Environment Agency
Main River, Canal & Detailed River networks.	January 2014	GIS layer showing main river, canal and detailed river networks	Environment Agency
OS Mapping, Mastermap	February 2014	GIS layer identifying open space, water, roads and urban areas	Councils
Historic Flood Map	January 2014	GIS layer showing historic flood outlines	Environment Agency
Areas Benefitting from defences	January 2014	GIS layer showing areas which benefit from flood defences	Environment Agency
Areas susceptible to groundwater flooding	January 2014	GIS layer showing areas susceptible to groundwater flooding by flood type or susceptibility to emergence.	Environment Agency
Updated Flood Maps for Surface Water	January 2014	GIS layers showing areas susceptible to surface water flooding	Environment Agency
DG5 Records	January 2014	Database containing operational information regarding drainage networks relevant to flooding	Severn Trent Water
Reservoir Maps	Not received yet	GIS layer showing locations and outlines of Reservoirs	Environment Agency
Locations of critical infrastructure	January 2014	GIS layer showing locations of key infrastructure	Cannock Chase Council
Historic Flooding Locations	January 2014	GIS layer showing historic flood locations	Cannock Chase Council, Lichfield District Council, South Staffordshire Council & Stafford Borough Council
Historical Flood Records and Drainage Investigation Information	February 2014	Database documenting flood locations and sources	Cannock Chase Council, Lichfield District Council, South Staffordshire Council & Stafford Borough Council
Allocated sites	January 2014	Potential Development Sites/Locations	Cannock Chase Council, Lichfield District Council, South Staffordshire Council & Stafford Borough Council
Geological Information	Not yet received	GIS layers	Environment Agency or British Geological Society
Cannock Chase Council Local Plan	March 1997	Report	Cannock Chase Council

Lichfield County Council Local Plan	1998	Report	Lichfield District Council
Stafford Borough Council Local Plan	October 1998	Report	Stafford Borough council
South Staffordshire County Council Local Development Documents and Core Strategy	2012	Report	South Staffordshire Council
River Trent Strategy Model	April 2004	Report	Environment Agency
Rising Brook Flood Risk Mapping Study	March 2006	Report	Environment Agency
Sandyford Brook Strategic Flood risk Mapping Study	December 2007	Report	Environment Agency
River sow and Penk Model Calibration	July 2008	Report	Environment Agency
Ridings Brook Flood Risk Mapping Study	July 2009	Report	Environment Agency
River Tame Strategic Flood Risk Mapping Study	April 2009	Report	Environment Agency
River Trent Strategic Flood Risk Mapping Study	June 2009	Report	Environment Agency
Measham and Packington Scenario Modelling and Mapping	April 2012	Report	Environment Agency
Wolverhampton, Wombourne and Kingswinford Flood Mapping Study	September 2012	Report and Modelling Output	Environment Agency
South Staffordshire Level 1 SFRA and supporting data	October 2007	Strategic Flood Risk Assessment	South Staffordshire Council
Lichfield Level 1 SFRA and supporting data	January 2008	Strategic Flood Risk Assessment	Lichfield District Council
Stafford Level 1 SFRA and supporting data	January 2008	Strategic Flood Risk Assessment	Stafford Borough council
Cannock Chase Level 1 SFRA	April 2008	Strategic Flood Risk Assessment	Cannock Chase Council
Rugeley Town Centre Level 2 SFRA	January 2009	Level 2 Strategic Flood Risk Assessment	Cannock Chase Council
River Severn Catchment Flood Management Plan, Summary Report	December 2009	Report	Environment Agency
River Trent Catchment Flood Management Plan, Summary Report	December 2010	Report	Environment Agency
Southern Staffordshire Water Cycle Study Report	July 2010	Water Cycle Study Report	South Staffordshire Council

Southern Staffordshire Surface Water Management Plan, Phase 1	July 2010	Surface Water Management Plan	Cannock Chase Council, Lichfield District Council, South Staffordshire Council & Stafford Borough Council
Southern Staffordshire Surface Water Management Plan, Phase 2 – Cannock Town	July 2011	Surface Water Management Plan	Cannock Chase Council
Southern Staffordshire Surface Water Management Plan, Phase 2 – Lichfield City	January 2011	Surface Water Management Plan	Lichfield District Council
Southern Staffordshire Surface Water Management Plan, Phase 2 – Penkridge Village	March 2011	Surface Water Management Plan	South Staffordshire Council
Southern Staffordshire Surface Water Management Plan, Phase 2 – Stafford Town	May 2011	Surface Water Management Plan	South Staffordshire Council
Staffordshire Preliminary Flood Risk Assessment	March 2011	Preliminary Flood Risk Assessment Report and Annexes	South Staffordshire Council

Appendix F – Transition from PPS25 to NPPF

Table 2-1-1: Differences between PPS25 and NPPF

PPS25	NPPF and Technical Guidance	Difference	Impact on Local Policy
Risk based approach using the source-pathway-receptor model for planning of development (PPS25 – Main Text / Practice Guide – Section 3)	Local Plans should apply a **sequential, risk-based approach** to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change (Paragraph 99)	The NPPF simplifies the PPS25 approach by omitting clear definitions for the 'risk based approach' and not providing a specified 'model' for risk assessment.	The Councils will need to make their own decisions on how to apply the 'risk based approach' to assessment of flood risk. *It is recommended that Councils apply the definitions used in the Flood and Water Management Act 2010. The definitions in the Practice Guide should also still be referred to alongside the slightly less detailed ones in the NPPF.*
Exception Test – Requires the site to be Brownfield 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 (PPS25 – Paragraph 19)	**Exception Test** – No longer requires the site to be Brownfield to pass the test For the Exception Test to be passed it must be *demonstrated that the development provides wider sustainability benefits to the community* that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. Both elements of the test will have to be passed for development to be allocated or permitted (Main Text Paragraph 102)	A site does not need to be Brownfield to pass the Exception Test.	A wider range of sites may pass the exception test. *It is recommended that COUNCILS carefully apply the knowledge gained through the local SFRA document and the SWMP investigations to ensure flood risk on individual sites is fully understood and that only fundamentally safe developments are approved.*

PPS25	NPPF and Technical Guidance	Difference	Impact on Local Policy
Flood Resilient Construction– PPS25 treats this as one of many mitigation solutions available for managing residual flood risk (PPS25 - Annex G)	**Resilient** (compared to resistant) construction is favoured because it can be achieved more consistently and is less likely to encourage occupiers to remain in buildings that could be inundated by rapidly rising water levels (Technical Guidance – Paragraph 17)	The NPPF main text does not specifically described what flood mitigation should be used. The Technical Guidance highlights use of resilience and does not specifically describe any other measures.	This change emphasises the use of effective measures as a practical solution for management of residual risk. *Policy guidance and recommendations on use of flood resilience measures are already included in SFRA documents. Flood resistance and resilience measures should not be used to justify development in inappropriate locations.*

PPS25	NPPF and Technical Guidance	Difference	Impact on Local Policy
Assessment of Flood Defence Breach and Overtopping / Safe Access (Residual Risk) - The Flood Zones refer to the probability of flooding from rivers, the sea and tidal sources and ignore the presence of existing defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development (PPS25 – Paragraph 17) Section S3.2 of *FD2320 Flood Risk Assessment Guidance for New Development Phase 2, Defra/Environment Agency R & D Project 2004*, provides guidance on the assessment of the risk to people behind flood defences. Assessment of flood defence breaching should generally be undertaken on the basis of a design event of the appropriate design standard (1 per cent for river flooding, 0.5 per cent for flooding from the sea), including an allowance for climate change (Practice Guide – Paragraph 3.36) LPAs should in determining planning applications … ensure that all new development in flood risk areas is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed (Practice Guide Annex G)	When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that: within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems (Main Text – Paragraph 103) Residual risks are those remaining after applying the sequential approach and taking mitigating actions. It is the responsibility of those planning development to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed. Flood resistance and resilience measures should not be used to justify development in inappropriate locations (Technical Guidance – Paragraph 16)	No explicit reference is made to the best practice Defra Guidance document (*FD2320 Flood Risk Assessment Guidance for New Development Phase 2, Defra/Environment Agency R & D Project 2004)* for assessment and management of residual risk	The COUNCILS will need to develop their own policy on the standards required for assessment and management of residual risk. *It is recommended that COUNCILS review residual risk guidance in the SFRA and ensure that this is combined with the best practice guidance available from Defra to form a high standard evidence base for assessing development applications.*

PPS25	NPPF and Technical Guidance	Difference	Impact on Local Policy
Sustainable flood plain development – PPS25 and the Practice Guide refer to PPS1 (Delivering Sustainable Development – now superseded by NPPF) for general sustainability principles of development. Sustainable urban drainage systems (SUDS) are the main focus of both PPS25 and the Practice Guide	The NPPF specifically states that Local Plans should use opportunities offered by new development to reduce the causes and impacts of flooding (Main Text – Paragraph 100)	PPS25 focuses on sustainability within individual developments in isolation, while the NPPF encourages local authorities to look at combinations of development sites holistically to identify opportunities.	COUNCILS should be aware of potential cumulative impacts of sites and should identify opportunities to develop catchment wide approach to development planning.
Sustainable Urban Drainage Systems – The Practice Guide has detailed guidance on how SUDS should be implemented within development	NPPF specifies SUDS must be prioritised (Main Text – Paragraph 103), but refers to the Flood and Water Management Act for further detail	Less detail on SUDS is provided in planning guidance – but this will be balanced by new responsibilities of COUNCILS as the Lead Local Flood Authorities to become SUDS Approval Bodies (SABs) under the Flood and Water Management Act	Following commencement of Section 32 of the Flood and Water Management Act, Luton Borough Council will have the responsibility for review, approval and adoption of SUDS systems serving more than one property.
Roles and Responsibilities of Parties – Comprehensive definition of the responsibilities and roles of various entities involved with flood risk managements (PPS25 – Paragraphs 21 to 34 and Annex H)	No equivalent content	Definitions of roles and responsibilities are not covered.	Roles and responsibilities of flood 'risk management authorities' are now defined in the Flood and Water Management Act 2010. Responsibilities of owners / developers with regard to flood risk are now only defined in the SFRA documents.

PPS25	NPPF and Technical Guidance	Difference	Impact on Local Policy
Regional Flood Risk Appraisals (RFRAs) - Regional Planning Bodies should prepare RFRAs in consultation with the Environment Agency to inform their Regional Spatial Strategies (RSSs) on flood risk issues.	No equivalent content	RFRAs and RSSs are no longer required	COUNCILS will need to rely on SFRA documents for flood risk information evidence base.

Appendix G – Example Table

Appendix Table 1: Sequential Test Table

Site	Easting	Northing	Fluvial Flood Zone				Tidal Flood Zone				Groundwater	Drainage	Pluvial	Development Vulnerability	Exception Test Candidate (Y/N)
			1	2	3a	3b	1	2	3a	3b	(Y/N)	(Y/N)	(Y/N)	Essential Infrastructure / Water Compatible / Highly / More / Less	Compare Flood Zone and Development Vulnerability within NPPF
Example	######	######			✓									Residential - More Vulnerable	Exception Test

Those sites considered necessary for application of the Exception Test should be presented in Appendix Table 2. The table should be completed to include the LPAs justification under parts 'a' and 'b' of the Exception Test for discussion and review with the Environment Agency before commencing with the Level 2 SFRA.

Appendix Table 2: Sites for Application of the Exception Test (copy as necessary)

SITE	FLOOD ZONE	DEVELOPMENT VULNERABILITY	EXCEPTION TEST		
			PART A	PART B	PART C
		Essential Infrastructure / Water Compatible / Highly / More / Less	Wider Sustainability	Brownfield Land (Y/N)	To be addressed in the Level 2 SFRA
Example	Flood Zone 3a	More Vulnerable	• Close proximity to transport infrastructure • Gentrification • Intensification to reduce pressure for Greenbelt review	Development of brownfield site assists LPA to satisfy government targets	

Appendix Table 3 : Sustainable Drainage Systems Summary for Allocation Sites

Site Name	Notes	General Geology	General Drainage Assessment	Aquifer Type	Groundwater Vulnerability	Appropriate SuDS	Site Area	FRA Requirements