AECOM has prepared this SFRA in such a way that it will provide relevant and easily accessible information for applicants preparing site-specific flood risk assessments (FRAs), as well as provide guidance on the suitability of different types of Sustainable Drainage Systems (SuDS) throughout the District (see Figure 1-1).

1.3 User Guide

It is anticipated that the SFRA will have a number of end users, each with different requirements. This Section describes how to use the SFRA and how to navigate the report and mapping deliverables.

The SMDC SFRA report is set out as follows:

- Section 2: Study Area Overview
- Section 3: Legislative and Planning Policy Context
- Section 4: Flood Risk Sources within Staffordshire Moorlands
- Section 5: Flood Risk Management Policy Recommendations
- Section 6: Guidance on the Application of the Sequential and Exception Tests
- Section 7: Guidance for Preparing Site Specific FRAs
- Section 8: Guidance on the Application of Sustainable Drainage Systems (SuDS)
- Appendix A: Data Register
- Appendix B: Level 1 SFRA Flood Risk Mapping Figures

Section 4 provides a strategic assessment of flood risk from all sources within Staffordshire Moorlands. The suite of figures included within Appendix B should be consulted for further information.

Section 5 outlines a number of flood risk management objectives and policy considerations which may be adopted by SMDC as formal policies within the Local Plan.

SMDC is required to carry out the Sequential Test when allocating future development sites as part of the Local Plan process. Section 6 provides detailed guidance on the application of the Sequential Test, including how it should be carried out by developers promoting development on Windfall Sites. The strategic assessment of flood risk presented in Section 4 will inform the Sequential Test carried out by SMDC.

It should be noted that this document is strategic in nature and only provides an overview of flood risk within the Staffordshire Moorlands District. The document should be used as a starting point for developers and SMDC's Development Management Officers to gain an understanding of flood risk within the District. SMDC should ensure that an appropriate site-specific assessment of flood risk is provided within a Flood Risk Assessment (FRA) accompanying all planning applications, where required by the NPPF, PPG and this Level 1 SFRA. Section 7 provides guidance for prospective developers and SMDC on the contents of a site-specific FRA.

As discussed in Section 2, SMDC will be required to oversee the use of SuDS for new development through enforcement of the planning process. Section 8 provides SMDC, as well as developers, with an overview of the potential use of SuDS within Staffordshire Moorlands District.

1.4 Level 1 SFRA Methodology

This Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable SMDC to apply the Sequential Test to the sites identified in the Core Strategy as potentially suitable for development and to identify whether the Exception Test may be required for specific sites (leading to the need for a Level 2 SFRA). The main tasks in preparing the Level 1 SFRA are described below.

1.4.1 Establishing Key Stakeholders

A project Inception Meeting was held to establish relationships between the project team; SMDC, Staffordshire County Council (SCC) (the Lead Local Flood Authority) and the Environment Agency to aid collaborative working and the exchange of available information and datasets. SMDC provided an overview of the current planning context with respect to the preparation of the Local Plan, and summarised the project

aims and objectives. The main flood risk issues in the area were identified and discussed. Other key stakeholders for data provision were identified; Canal and River Trust, Severn Trent Water, United Utilities, Highways Agency and neighbouring LPAs.

1.4.2 Data Collection and Analysis

Under Section 10 of the NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources. Flooding from the sea is not relevant to the study area.

In order to provide this assessment of all sources of flooding in the District, an extensive set of datasets was obtained from the stakeholder organisations. This information was subject to a quality review and gap analysis to determine the best datasets for inclusion in the Level 1 SFRA update. Further details of the datasets are included within the data register in Appendix A.

1.4.3 Strategic Flood Risk Maps

A series of GIS maps were produced using the data gathered during the initial part of the study. The mapping deliverables provided in Appendix B are identified in Table 1-1.

Table 1-1: Strategic Flood Risk Maps in Appendix B

FIGURE NUMBER	FIGURE TITLE
1 (Inset Maps 1a - 1f)	Level 1 SFRA Potential Development Sites
2	Topography
3	Surface Waterbodies
4	Historic Flooding Incidents
5a	Aquifer Designation Map - Bedrock Geology
5b	Aquifer Designation Map - Superficial Geology
6 (Inset Maps 6a – 6f)	Fluvial Flood Zones
7 (Inset Maps 7a – 7f)	Updated Flood Map for Surface Water
8	Areas Susceptible to Groundwater Flooding
9	Groundwater Vulnerability and Source Protection Zones
10	Historical Sewer Flooding Incidents
11	Flood Alert and Flood Warning Areas

1.4.4 Providing Suitable Guidance

Sections of this report provide specific guidance for SMDC on policy considerations, the application of the Sequential Test, guidance on the preparation of site specific FRAs and guidance of the application of SuDS in the District.

1.4.5 Need for a Level 2 SFRA

Following the application of the Sequential Test by SMDC, there may be an insufficient number of suitably available sites for development within areas identified to be at low risk of flooding and it may become necessary to consider the application of the Exception Test. Where this is necessary, the scope of the SFRA may need to be widened to a Level 2 assessment.

The increased scope Level 2 SFRA will need to consider the detailed nature of the risk characteristics within a Flood Zone including flood probability, flood depth, flood velocity, rate of onset of flooding and the duration of flooding. This may require interrogation of 2D modelling and breach / overtopping analysis for certain locations.

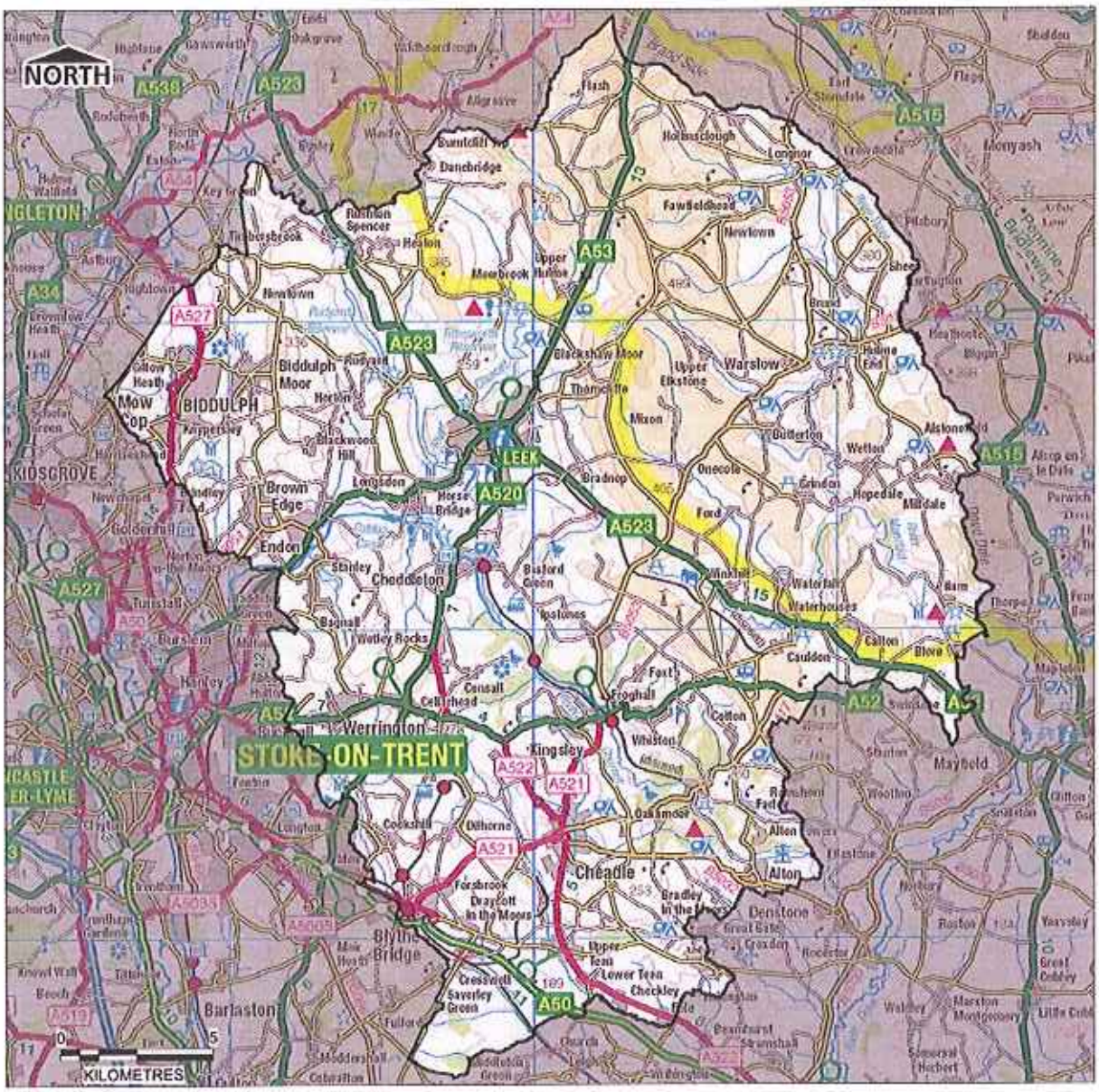
The scope of a Level 2 SFRA cannot fully be determined until the Sequential Test has been undertaken by SMDC on all possible site allocations.

2 Study Area Overview

This Section provides an overview of Staffordshire Moorlands District with respect to flood risk.

2.1 Location

The study area of this Level 1 SFRA is defined by the entire administrative boundary of SMDC as shown in Figure 2-1.



Contains Ordnance Survey 1: 250, 000 scale Raster mapping © Crown copyright, all rights reserved. License number 0100018384. Staffordshire Moorlands District Council 2015.

Figure 2-1: Staffordshire Moorlands Level 1 SFRA Study Area

The Staffordshire Moorlands District is located in the north-east of the Staffordshire County and is bordered by the administrative areas of:

- Cheshire East Council
- Newcastle Borough Council
- Stoke on Trent City Council
- Stafford Borough Council
- East Staffordshire Borough Council
- Derbyshire Dales District
- High Peak Borough Council

The District covers an area of approximately 576 km^2. The three main towns are Leek, Biddulph and Cheadle. Approximately a third of the District (approximately 200 km^2) lies within the border of the Peak District National Park. The designation 'National Park' means that there are planning restrictions to protect the area from inappropriate development, and the National Park Authority ultimately makes planning decisions in this area.

2.1.1 Level 1 SFRA Potential Development Sites

The locations of 242 potential future residential development sites as identified in the emerging Staffordshire Local Plan are shown in Appendix B Figure 1. These sites have been reviewed for the purposes of this Level 1 SFRA.

2.2 Topography

Topography has a large influence over the water cycle and flood risk within Staffordshire Moorlands. As illustrated in Appendix B Figure 2, much of the north and east of the District falls within the Peak District, within which the highest point of Staffordshire Moorlands is located (approximately 520 mAOD) in the vicinity of the village of Flash. From the far north east of the District, moorland hills and ridges occur along the central spine of the South West Peak, which includes distinctive hill and ridge summits, including the steep slopes of the Roaches and Morridge.

Along the border of the Peak District, the landscape is steeply sloping, with plateaus and valleys, including Butterton Moor and Grindon Moor, and the steep sided valleys associated with the River Manifold and River Dove.

The landscape in the remaining area of the District to the south and west is strongly undulating or sloping, comprising steep-sided valleys cut by small scale streams. The lowest point within the District (approximately 90 mAOD) is located in the River Churnet Valley towards Alton, where the landscape consists of deeply incised wooded valleys with narrow winding watercourses. The valley continues north west, around Leek, and into the north west of the District via Rudyard Reservoir. To the west, higher land around Biddulph Moor comprises of undulating slopes with localised steep sided valleys. In the far south of the District, the undulation of the topography is gentler with flat open valleys.

2.3 Geology

The underlying geology can influence the presence and nature of groundwater in an area, and therefore the potential flood risk from groundwater. The geology can also impact on the potential for infiltration based drainage systems. In general, towards the north of the District the peaty soils retain moisture and when saturated, can result in periods of standing water and localised flooding. Further south, within the lower lying areas around the floodplains, the soils are loamy containing clays and are prone to waterlogging. The geological information was obtained from the Environment Agency in the form of their Aquifer Designation maps generated from British Geological Survey data. Appendix B Figure 5a illustrates the underlying bedrock geology and Figure 5b shows the superficial deposits within the District as defined by the Environment Agency's Aquifer Designation maps.

The underlying bedrock geology within the District consists of a number of different formations, but largely consists of Sandstones and Mudstones, such as the Millstone Grit Group, Bowland High Group and Craven Group, interspersed with Carboniferous limestone and coal measure sequences. The north of the District is

characterised by the White Peak, an area of limestone overlain by sands and grits with dramatic landforms such as the Roaches and Ramshaw Rocks, surrounded by moorlands.

To the south of the District, the geology comprises a mixture of conglomerates, sandstones and clay rich argillaceous rocks. Limestone underlies much of the eastern boundary of the District associated with the White Peak Character Area, where a number of Limestone quarries are situated.

Superficial deposits of predominantly Till are found in the west of the District towards Stoke-on-Trent and Biddulph in the north west. Stretches of alluvium, alluvial fan deposits and river terrace deposits underlie the main rivers and many of the ordinary watercourses within the District, with some areas of Head deposits and Peat found in the east and north east within the Peak District.

2.4 Watercourses

2.4.1 Main Rivers

Appendix B Figure 3 identifies the locations of key waterbodies within the District including designated main rivers (see Table 2-1) defined as watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Flood and Rural Affairs (Defra). The Environment Agency has permissive powers to carry out works necessary for flood defence purposes on these rivers. The overall responsibility for maintenance however, lies with the riparian owner.

Table 2-1: Main Rivers within the Staffordshire Moorlands District

NAME	APPROX. CATCHMENT AREA WITHIN DISTRICT (km^2)	CATCHMENT DESCRIPTION
River Churnet	231	The River Churnet rises in the Peak District National Park, flowing south through the District around the major settlement of Leek. The topography of the catchment is of moderate relief with mixed geology. Land use is largely low grade agriculture or pasture. Major tributaries include Endon Brook and Combes Brook. South of Cheddleton, the river is canalised for approximately 1.6km as the Caldon Canal, before returning to natural river channel, flowing south out of the District and joining the River Dove.
River Dane	58	The River Dane borders the north of the District for approximately 15 km flowing west, with its source in the Peak District. A predominantly rural catchment with a steep topography and mixed geology.
River Tean	48	The River Tean rises to the east of Stoke on Trent and flows south east out of the District, before joining the River Dove north of Uttoxeter in East Staffordshire. The catchment is largely rural, except for the town of Cheadle. The Cecilly Brook is a major tributary.
River Blithe	42	Catchment drains the most southerly region of the District, rising to the south of Stoke-on-Trent and flowing south east out of the District and ultimately draining into the River Dove, south of Uttoxeter. Land use is largely mixed arable farming and grassland. Fors Brook is a major tributary.
Biddulph Brook	27	Biddulph Brook and its associated catchment drains a small area to the far west of the District, around the town of Biddulph, ultimately draining to the River Dane east of Congleton.

The locality of the District in the upper catchments of watercourses and the associated steep topography results in a 'flashy' hydrology, whereby watercourses (the majority of which rise in the Peak District) have steep sided valleys and narrow floodplains.

The Shropshire and Staffordshire Local Flood Risk Management Strategy (see Section 3.4.2), identifies that the Staffordshire Moorlands District contains approximately 12% of the combined length of main rivers found within the County of Staffordshire. In contrast, the District contains the greatest combined length of ordinary watercourses than any of the other eight Districts/Boroughs within the County, containing nearly a third (30%) of the ordinary watercourses found within the County.

2.4.2 Ordinary Watercourses

Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows, above ground or culverted, which is not designated as a main river. Due to the significant length of ordinary watercourses within the District, a list of the named ordinary watercourses has been provided below. This list is not comprehensive however, as the majority of ordinary watercourses are unnamed.

- Warslow Brook
- River Manifold
- Ravensclough Brook
- Horton Brook
- Ellis Hill Brook
- Combes Brook
- Black Brook
- Warilow Brook
- River Hamps
- Rad Brook
- Hoo Brook
- Dingle Brook
- Broadgate Hall Brook
- Biddulph Brook
- Shirley Brook
- River Dove
- Oakenclough
- Head of Trent
- Cotton Brook
- Blake Brook

Appendix B Figure 3 identifies the locations of key waterbodies within the District including these ordinary watercourses.

2.5 Artificial Water Bodies

2.5.1 Canals and Feeders

In addition to the natural watercourses described, the Caldon Canal also runs through the District in a roughly south-north direction. At Horse Bridge, it turns west towards Stoke-on-Trent and passes Hazelhurst locks, where the Leek Branch of the canal begins and travels east towards Leek for approximately 4.6 km. In addition to the canal, a number of feeder channels from associated reservoirs exist within the District including the Rudyard Feeder, Stanley Feeder and Knypersley Feeder.

2.5.2 Lakes and Reservoirs

As a result of the topography and hydrology of the District, a number of lakes and reservoirs have been built or impounded for the supply of drinking water and industry. These lakes and reservoirs are listed in Table 2-2 along with the responsible owner.

Table 2-2: Lakes and Reservoirs within the Staffordshire Moorlands District

WATERBODY NAME	APPROX. SIZE (HA)	OWNER / OPERATOR
Hales Hall Pool	1.4	SMDC
Ladderedge Storage Reservoir[6]	0.8	ST
Knypersley Reservoir	13.6	CRT
Rudyard Lake / Reservoir	63.2	CRT
Serpentine	4.9	SCC
Stanley Pool	11.4	CRT
Tittesworth Reservoir	72.2	ST

[6] Severn Trent Water (2015) Tittesworth Water. Available at: http://www.stwater.co.uk/leisure-and-learning/reservoir-locations/tittesworth-water/*/tab/about/

Appendix B Figure 3 identifies the locations of key waterbodies within the District including the canals and reservoirs.

2.6 Hydrogeology

Aquifer designation relates to the importance of aquifers as groundwater resources such as drinking water supply, as well as for supporting surface water flow[7]. The use of infiltration techniques will be dependent on the ground and groundwater conditions. However, other SuDS techniques may be suitable even if groundwater conditions preclude infiltration.

The Environment Agency provides the following definitions for the Aquifer Designations:

- **Principal Aquifer** – *"layers of rock or drift deposits that...usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer"*;
- **Secondary A Aquifer** – *"permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers"*;

Factors that will influence the vulnerability of an aquifer to contamination include whether the aquifer is classed as confined or unconfined; the depth of the aquifer; whether a pathway exists to the aquifer i.e. if impermeable layers lie above an aquifer; and the soil vulnerability.

Some strata have a high leaching potential and have very little ability to slow or halt the progress of contaminants and transmit them readily to the underlying aquifer. Other strata have a low leaching potential and are thus either impermeable or have a number of natural factors that can slow or stop the leaching of contaminants. Principal Aquifers with a high vulnerability tend to be those with a more permeable surface geology.

It is important to note that Aquifer Designation mapping is intended to be used at a strategic scale and further site-level investigation may be necessary.

The majority of the District is designated by the Environment Agency as a Secondary A Aquifer associated with the bedrock geology, with some smaller areas designated as Principal Aquifers (see Appendix B Figure 5a). The Alluvium and River Terrace Deposits within Staffordshire Moorlands District located in corridors along the River Churnet, River Tean, River Manifold and River Blithe, are designated as Secondary A aquifers. The Head deposits associated with the River Churnet, Blake Brook and the River Hamps are defined as Secondary (undifferentiated) aquifers (see Appendix B Figure 5b).

[7] Environment Agency (2015) Aquifer Designation Maps. Available at: http://apps.environment-agency.gov.uk/wiyby/117020.aspx

3 Legislative and Planning Policy Context

3.1 Introduction

Since the previous SMDC Level 1 was completed, updates to national planning policy and flood risk guidance have emerged. This Section highlights the main updates and the impacts they have on the SFRA. The information presented should be used by SMDC to establish robust policies in relation to flood risk as part of their emerging Local Plan.

3.2 National Planning Policy Framework (2012)

The NPPF[1] was published on 27th March 2012 together with accompanying Technical Guidance. The NPPF revoked most of the previous Planning Policy Statements (PPS) and Planning Policy Guidance. However, the NPPF did not revoke the PPS25: Development and Flood Risk Practice Guide[5]. This was then revoked on the 6th March 2014 along with the NPPF Technical Guidance, when it was replaced by the Flood Risk and Coastal Change[2] section of the PPG.

The NPPF consists of a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities.

The overall approach to flood risk is broadly summarised in NPPF Paragraph 103:

"*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 FRA 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.*"

Further detail regarding the Sequential and Exception Tests is included in Section 6.

3.3 Planning Practice Guidance (2014)

The NPPF is supported by a series of Planning Practice Documents referred to as the PPG[2]. This PPG: Flood Risk and Coastal change document outlines how LPAs should use the SFRA, as follows:

- SFRAs should assess the flood risk to an area from all sources, both in the present day, and in the future. The impacts of climate change should be considered when assessing future flood risk;
- The impact on flood risk of future development and changes to land use should also be considered;
- The SFRA should provide the foundation from which to apply the Sequential and Exception Tests in the development allocation and development management process (see Table 6-1 and Table 6-2). Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA (to a Level 2 SFRA) to provide the information necessary for application of the Exception Test;
- The SFRA should inform the sustainability appraisal of the Local Plan and Site Allocations Development Plan Document';
- The SFRA should outline requirements for site-specific FRAs, with specific requirements for particular locations;

- The SFRA should define the flood risk in relation to emergency planning's capacity to manage flooding;
- Opportunities to decrease the existing flood risk within the study areas should be explored, such as surface water management, provision of flood storage and managing conveyance of flood flows.

SFRAs should be prepared in consultation with the Environment Agency, emergency response and drainage authority functions of the LPA, Lead Local Flood Authorities (LLFAs) and where appropriate Internal Drainage Boards (IDBs).

3.4 The Flood and Water Management Act (2010)

Following the devastating national floods of 2007, one of the recommendations from Sir Michael Pitt's review[8] was that "*the role of local authorities should be enhanced so that they take on responsibility for leading the co-ordination of flood risk management in their areas*".

The Flood and Water Management Act (FWMA)[9] (2010) brings in new roles and responsibilities for local authorities. In particular, the Act defines the role of the LLFA, which includes Unitary Authorities or County Councils. Staffordshire County Council (SCC) is the LLFA for Staffordshire, which includes Staffordshire Moorlands District. LLFAs are encouraged to bring together relevant bodies and stakeholders to effectively manage local flood risk, which may include County, City and Borough/District Councils, IDBs, highways authorities, water companies and the Environment Agency. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses).

The Act also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility for a strategic overview of the management of all sources of flooding and coastal erosion remains that of the Environment Agency. The Agency also has operational responsibility for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.

3.4.1 National Strategy for Flood and Coastal Erosion Risk Management

In accordance with the Act, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM)[10] in England. This Strategy provides a framework for the work of all flood and coastal erosion risk management authorities.

The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It sets the context for, and informs the production of local flood risk management strategies by LLFAs, which will in turn provide the framework to deliver local improvements needed to help communities manage local flood risk.

3.4.2 Shropshire and Staffordshire draft Local Flood Risk Management Strategy

As LLFA, SCC has a statutory duty under the FWMA to develop, maintain, apply and monitor a strategy for local flood risk management. In July 2014, SCC along with Shropshire County Council published their joint Local Flood Risk Management Strategy[11] (LFRMS) which sets out their approach for the management of flood risk associated with local sources of flooding such as surface water, ordinary watercourses and groundwater. Part 2 of the report sets out the policies and procedures specific to Staffordshire. Consultation began in September 2014 and responses are currently being used to finalise the LFRMS.

3.4.3 River Trent Catchment Flood Management Plan

A Catchment Flood Management Plan (CFMP) is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The Environment Agency engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change.

[8] Cabinet Office (2008) The Pitt Review - Learning Lessons from the 2007 Floods
[9] HMSO (2010) The Flood and Water Management Act
[10] Defra, Environment Agency (2011) The National Flood and Coastal Erosion Risk Management Strategy for England.
[11] Shropshire County Council, Staffordshire County Council (2014) Shropshire and Staffordshire Local Flood Risk Management Strategy. Available at: http://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Flood-Risk-Management-Strategy.aspx

The CFMPs are used to inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive (WFD), so that future development in the catchment is sustainable in terms of flood risk. CFMPs will remain active, with their future need as strategic plans for river and estuary flooding being reviewed in 2015 and 2016 as Flood Risk Management Plans become active (see Section 3.6.2 and 3.6.3). The policies listed within the CFMP's and used to identify the appropriate approach to flood risk management across all CFMPs, will continue to be used in the FRMPs.

The approach that the Environment Agency would like to see taken to flood risk management within Staffordshire Moorlands is currently outlined in the River Trent CFMP (2010)[12]. The CFMP aims to identify flood risk management policies for the catchment and sets out the preferred plan for sustainable flood risk management in the Trent region over the next 50 to 100 years. The River Trent CFMP identifies different policies for different 'sub-areas' of the River Trent catchment. These policies are considered using a catchment approach rather than for independent sub-areas.

The general approach to be taken is to accept the existing risk but take action to ensure that risk is not increased from the current level, for example due to the potential impacts of climate change. The CFMP outlines key messages for the Peaks and Moorlands policy unit:

- Reduce unsustainable long-term dependence on raised flood defences, by taking opportunities to restore sustainable natural storage of floodwater on undeveloped floodplains;
- Reduce the number of people at risk from deep and fast flowing waters or fast onset of flooding through the town of Leek;
- Sustain and improve the status of environmentally designated areas through appropriate frequency, extent and duration of flooding, including using existing and future flood storage areas and floodplains more to benefit nature conservation;
- Support and encourage land management and land use in the River Derwent and River Dove catchments that will reduce runoff rates from upland areas;
- Identify potential sites for Biodiversity Action Plan (BAP) habitat creation and sustain existing sites.

Staffordshire Moorlands falls into the 'Peaks and Moorlands' policy unit and the preferred policy for SMDC in the CFMP is Policy 6 – 'Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits'. Proposed actions to implement this policy, and which are relevant to this SFRA include:

- Investigating opportunities for storing or reducing conveyance upstream of urban areas;
- Study options and feasibility of using water supply reservoirs within the upper reaches of the River Churnet to provide some support to flood risk management;
- Identification of locations where flood attenuation ponds or wetland areas could be developed with associated habitat improvement;
- Progress land use changes which will provide flood risk management benefits; and
- Develop a land use management plan for the Peaks and Moorlands.

3.5 NPPF PPG for Sustainable Drainage Systems (2015)

Following a consultation by Defra on the delivery of SuDS[13], in April 2014 the Department for Communities and Local Government (DCLG) issued a Written Ministerial Statement[14] outlining the Government's response regarding the future of SuDS. This was followed by a consultation exercise carried out in December 2014[15] by DCLG on the proposal to make LLFAs statutory consultees for planning applications with regards to surface

[12] Environment Agency (December 2010) River Trent Catchment Flood Management Plan
[13] Defra / DCLG (September 2014) Delivering Sustainable Drainage Systems: Consultation
[14] Department for Communities and Local Government (April 2014) House of Commons Written Statement (HCWS161) Sustainable Drainage Systems.
[15] DCLG (December 2014) Consultation on Further changes to statutory consultee arrangements for the planning application process

water management, and the Government published its formal response in March 2015[16]. The PPG has subsequently been amended to reflect the new approach to implementation of SuDS in development.

The proposed approach is to strengthen the planning system as a way of delivering SuDS, rather than implement Schedule 3 of the FWMA, as written, which would have established a new SuDS Approval Body that would have sat outside the existing planning system.

From 6th April 2015, LPAs are required to ensure that local planning policies and decisions on planning applications relating to major development[17] include SuDS for the management of run-off, unless demonstrated to be inappropriate. Minor developments with drainage implications would continue to be subject to existing planning policy (Section 103 of the NPPF) and smaller developments in flood risk areas should still give priority to the use of SuDS.

The PPG has been amended to state:

> *"Sustainable drainage systems may not be practicable for some forms of development (for example, mineral extraction). New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering major development, sustainable drainage systems should be provided unless demonstrated to be inappropriate."*

LPAs should consult the relevant LLFA when considering major development. In considering planning applications SMDC will need to:

- Consult SCC, as the LLFA, on the management of surface water for major development (request a copy of SCC's LLFA Planning Consultation Guidance and refer to their consultation matrix to determine if/when SCC should be consulted on statutory or non-statutory issues);
- Satisfy themselves that the proposed minimum standards of operation are appropriate; and
- Ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

LPAs are also advised to consult as appropriate:

- The relevant sewerage undertaker where a connection with a public sewer is proposed;
- The Environment Agency, if the drainage system directly or indirectly involves the discharge of water into a main river;
- The relevant highway authority for an affected road;
- The Canal and River Trust, if the drainage system may directly or indirectly involve the discharge of water into or under a waterway managed by them;
- An Internal Drainage Board (IDB), if the drainage system may directly or indirectly involve the discharge of water into an ordinary watercourse (within the meaning of section 72 of the Land Drainage Act 1991) within the board's district."

The decision on whether a sustainable drainage system would be inappropriate in relation to a particular development proposal is a matter of judgement for the LPA. In making this judgement the LPA will seek advice from the relevant flood risk management bodies, principally the LLFA.

From 6th April 2015 SCC, as the LLFA, has become a statutory consultee for planning applications for major developments that have a drainage implication. As a statutory consultee, SCC is under a duty to respond to the LPA and report on their performance on providing a substantive response within deadlines set out in legislation.

[16] Department for Communities and Local Government (March 2015) Further changes to statutory consultee arrangements for the planning application process: Government response to consultation.
[17] The definition for Major and Minor developments are set out in the Town and Country Planning Order 2010

3.6 Flood Risk Regulations (2009)

As well as the duties under the Act to prepare a LFRMS, SCC have legal obligations under the EU Floods Directive[18] that was transposed into UK Law through the Flood Risk Regulations 2009[19] ('the Regulations').

3.6.1 Preliminary Flood Risk Assessment

Under the Regulations, all LLFAs were required to prepare a PFRA report. This is a high level screening exercise to identify areas of significant risk as Indicative Flood Risk Areas across England where 30,000 people or more are at risk from flooding for reporting to Europe.

SCC prepared a PFRA[20] to provide a high level overview of flood risk from local flood sources and includes flooding from surface water (i.e. rainfall resulting in overland runoff), groundwater, ordinary watercourses (smaller watercourses and ditches) and canals. It excludes flood risk from main rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency.

The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report was used to help SCC in the development of their LFRMS required under the FWMA.

3.6.2 Humber River Basin District draft Flood Risk Management Plan

Under the EU Floods Directive and UK Flood Risk Regulations, LLFAs must prepare Flood Risk Management Plans (FRMPs) in formally identified Flood Risk Areas where the risk of flooding from local sources is significant (i.e. surface water, groundwater, ordinary watercourses), and the Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs.

There are no formally defined Flood Risk Areas within Staffordshire Moorlands District, therefore SCC are not required to prepare a FRMP. As such, the draft Humber River Basin District FRMP[21] has been published for consultation by the Environment Agency and sets out the proposed measures to manage flood risk in the Humber River Basin District from 2015 to 2021 and beyond. The first cycle of FRMPs are due to be published in December 2015.

The draft Humber River Basin District FRMP covers the majority of Staffordshire Moorlands District and identifies objectives, measures and actions for each catchment. Staffordshire Moorlands District is mostly covered by two catchments of the Humber RBD: Dove Catchment; and Trent Valley Staffordshire Catchment. On-going, agreed and proposed measures to manage flood risk from 2015 to 2021 and beyond are identified for each catchment in the draft FRMP. The draft on-going and proposed measures for the two catchments covering Staffordshire Moorlands District are summarised below. There are no agreed measures further than those already on-going or proposed for Staffordshire Moorlands District.

Draft Proposed Measures: Dove Catchment

- Access/Egress - 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;
- Development behind defences - Within defended the areas the maximum water level should be assessed from a breach analysis;
- Development behind defences - Properties situated within close proximity to formal defences or water retaining structures (reservoirs/canals) will require a detailed breach and overtopping assessment to ensure that the potential risk to life can be safely managed throughout the lifetime of the development;
- De-culverting - Where possible, avoid further culverting and building over of culverts. All new developments with culverts running through their site should seek to de-culvert for flood risk management conservation benefit. Where this is not possible for larger, deeper culverts in the study area, an assessment of its structural integrity should be made, with any remedial actions taken prior to the development of the site. In addition, a maintenance regime should be agreed to reduce the likelihood of blockage;

[18] European Union (2007) EU Floods Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT
[19] HSMO (2009) The Flood Risk Regulations. Available at: http://www.legislation.gov.uk/uksi/2009/3042/contents/made
[20] Royal Haskoning (2011) Staffordshire County Council PFRA
[21] Environment Agency (October 2014) Humber River Basin District Consultation on the draft Flood Risk Management Plan. Available at: https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063510

- Flood Risk Reduction - Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas;
- Existing Assets - An assessment of the condition of existing assets (For example, bridges, culverts, river walls) should be made. Refurbishment or/and renewal should be investigated to ensure the lifetime is commensurate with lifetime of the development. Developer contributions could be sought for this purpose;
- Basement - Basements should not be used for habitable purposes. Where basements are permitted for commercial use, it is necessary to ensure that the basement access points are situated 300 mm above the 1 in 100 year flood level plus climate change;
- Easement - Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip.

The final plans are due to be published in December 2015 and the proposed measures may differ from those included in the draft documents.

Draft On-going Measures: Trent Valley Staffordshire Catchment

- In Brown Edge, promote awareness and local action on flood risk activities, while investigating potential flood mitigation measures.

3.6.3 North West River Basin District draft Flood Risk Management Plan

The draft North West River Basin District FRMP[22] covers the far north and north west of Staffordshire Moorlands District, within one catchment: Weaver and Gowy Catchment. There are no draft on-going or draft proposed measures for this catchment proposed for Staffordshire Moorlands District.

3.7 Staffordshire Moorlands District Council Local Plan (2014)

The Local Plan will consist of a number of Development Plan Documents (DPDs) which outline the spatial planning strategy for the District. The Core Strategy provides the framework for future Local Plan documents which identify specific sites for development in the District (Site Allocations DPD) and provide detailed guidance to supplement the policies (Supplementary Planning Documents).

3.7.1 Adopted Core Strategy Development Plan Document

The SMDC Core Strategy[23] was adopted in March 2014, and is a strategic District wide plan which influences how and where Staffordshire Moorlands will develop in the future. It provides the overarching strategy for planning policies in the District, including a number of policies relevant to flood risk and management, and water quality:

Policy SD1 – Sustainable Use of Resources

The Council will require all development to make sustainable use of resources, and adapt to climate change. This will be achieved by:

Giving encouragement to development on previously developed land in sustainable locations in allocating land for development and determining planning applications, except where:

- a previously developed site performs poorly in sustainability terms and could not be made otherwise acceptable;
- development upon a previously developed site would cause harm to some asset of acknowledged importance or if it would create an unacceptable flood risk.

[22] Environment Agency (October 2014) North West River Basin District Consultation on the draft Flood Risk Management Plan. Available at: https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063519
[23] Staffordshire Moorlands District Council (2014) Core Strategy Development Plan Document

Policy SD4 – Pollution and Flood Risk

Development proposed within the floodplain will be guided to first make use of areas at no or low risk of flooding before areas at higher risk, where this is viable or possible and compatible with other polices aimed at achieving a sustainable pattern of development. Development deemed acceptable within areas at risk of flooding due to national or other policies or other material considerations, must be subject to a flood risk assessment. Additionally, approved schemes must be designed and controlled to mitigate the effects of flooding on the site and the potential impact of the development on flooding elsewhere in the floodplain. In all cases, schemes will be determined after having considered both individual and cumulative impacts.

When considering planning applications and future allocations in the Site Allocations DPD, the Council will also have regard to all relevant Catchment Flood Management Plans affecting the District, Flood Risk Management Plans and Local Flood Risk Management Strategies.

Policy C3 – Green Infrastructure

The Council will, through partnership working with local communities, organisations, landowners and developers, develop an integrated network of high quality and multi-functional green infrastructure that will:

- Support and improve the provision of open space, sport and recreational facilities for local communities and enhance the settings of neighbourhoods;
- Link existing and potential sites of nature conservation value and historic landscape features, create new wildlife habitats, increase biodiversity, and increase tree cover where it is appropriate to the landscape;
- Enhance the natural, man-made and cultural features that are crucial to the local landscape and create opportunities for the restoration of degraded landscapes and the enhancement of the urban fringe;
- Mitigate the negative effects of climate change and maximise potential climate change benefits including effective flood risk and waterways management;
- Create appropriate access for a wide range of users to enjoy the countryside, including improved linkages to and provision of formal and informal recreation opportunities and accessible woodland areas, encouraging walking, cycling and horse riding;
- Contribute to the diversification of the local economy and tourist development through the enhancement of existing, and provision of new facilities.

The Council will identify, protect and enhance Green Infrastructure assets through the Site Allocations DPD and the Green Infrastructure Strategy.

3.7.2 Adopted Biddulph Town Centre Area Action Plan Development Plan Document

The Biddulph Town Centre Area Action Plan (AAP) DPD[24] adopted in February 2007 will be incorporated and replaced by the Local Plan for Staffordshire Moorlands. The AAP has 'saved' some general policies, those of relevance to this SFRA have been provided below.

F4 – Drainage

Planning permission will not be granted for development proposals which would inhibit or damage the drainage function of the natural watercourse system, or cause or aggravate flooding problems at the site or further downstream unless adequate mitigating measures are carried out prior to the development coming into use. This will include development:

- in areas which form part of the floodplain and areas at risk from flooding;
- preventing access to watercourses for maintenance;
- giving rise to substantial changes in the characteristics of surface water run-off; and
- causing adverse effects upon the integrity of fluvial defences.

[24] Staffordshire Moorlands District Council (February 2007) Biddulph Town Centre Area Action Plan Development Plan Document. Available at: http://www.staffsmoorlands.gov.uk/sm/council-services/area-action-plans/biddulph-town-centre-area-action-plan

3.8 Peak District National Park Management Plan (2012 – 2017)

The Peak District National Park Management Plan[25] aims to encourage integrated approaches that make the best use of resources, meet the needs of the communities, conserve and enhance the National Park. The plan seeks to address the need to manage the increasing demands and pressures on the services provided by natural systems (i.e. flood storage) in order to promote sustained economic growth, prospering communities and personal wellbeing.

ES3 Environmental Goods

The Peak District landscape will be managed by farmers and other land managers to increase the potential economic return from public goods, such as clean water, carbon storage and renewables.

Farming and land management in the National Park will have a growing role in the provision of environmental goods and services. This includes the maintenance of essential ecological systems such as soils, watercourses and habitats. River basin management helps reduce flood risks and ensures that water supplied from the National Park is cleaner.

3.9 Water Framework Directive (WFD) (2000)

SMDC have a duty to consider the WFD in all plans and decision making processes, and have the opportunity to deliver wider environmental objectives and requirements, as set out in the Water Framework Directive[26]. The WFD was transposed into UK national law through The Water Environment Regulations 2003[27], and states that SMDC should have regard to the River Basin Management Plans (RBMPs) when exercising its functions as a public body.

The Environment Agency is responsible for preparing RBMPs for river basin districts in England and Wales. The plans outline the characteristics of the river basin district, identify the pressures that the local water environment faces, and specify the actions that will be taken to address any problems before 2015.

3.9.1 Humber River Basin Management Plan

In 2009 the Environment Agency published their River Basin Management Plan for the Humber River Basin District[28]. The Dove catchment, within the Humber River Basin District, includes the River Dove, Churnet Manifold and Hamps, covering much of the Staffordshire Moorlands District. Within the Dove catchment, only 12 out of 37 river water bodies are artificial or heavily modified as a consequence of development, flood risk management, navigation and water supply. As a result, 68% of the assessed water bodies within the Dove catchment are regarded as having an ecological status of at least "good".

Flood risk management activities are expected to have a significant impact on the ability of the UK to comply with the requirements of the WFD, as flood protection can involve substantial alteration to the natural properties of a river.

3.9.2 North West River Basin Management Plan

In 2009 the Environment Agency published their River Basin Management Plan for the North West River Basin District[29]. A small portion of the Weaver Gowy catchment, within the North West River Basin District, includes the Biddulph Brook and River Dane in the north west of the Staffordshire Moorlands District, both of which were assessed as having "good" ecological status.

[25] Peak District National Park Authority (2012) A Partnership for Progress. Available at http://www.peakdistrict.gov.uk/__data/assets/pdf_file/0005/274298/npmp-summary.pdf
[26] European Union (2000) Water Framework Directive. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT
[27] HMSO (2003) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Available at: http://www.legislation.gov.uk/uksi/2003/3242/contents/made
[28] Environment Agency (2009) River Basin Management Plan – Humber River Basin District. Available at: https://www.gov.uk/government/publications/river-basin-management-plan-humber-district
[29] Environment Agency (2009) River Basin Management Plan – North West River Basin District. Available at: https://www.gov.uk/government/publications/north-west-district-river-basin-management-plan

4 Flood Risk Sources within Staffordshire Moorlands

4.1 Introduction

This Section provides the strategic assessment of flood risk across the District from each of the sources of flooding outlined in the NPPF. For each source of flooding, the datasets used for the assessment are described, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read in conjunction with the mapping in Appendix B.

4.2 Overview of Historic Flooding

As the LLFA, SCC routinely receives and records details of flooding incidents throughout the County of Staffordshire, with records dating back to 1979. A review of the flood incidents relevant to Staffordshire Moorlands has been carried out to provide an indication as to when the most significant flooding occurred. The greatest numbers of flood incidents (>20 recorded incidents) were reported in 2006, 2003, 2004 and 2009. The incidents were found to occur across the District, but predominantly outside of the area within the Peak District and concentrated around the more urbanised areas including Biddulph, Endon, Cheddleton and Cheadle.

Through a search of local media sources, more recent flood events have been reported, including as recent as June 2014 when flash floods were reported on the A53 in Leek[30] caused by heavy rainfall which overwhelmed the drains.

Flash flooding also occurred in July[31] and August[32] 2012 along the A53 (which was closed by police as a result of the flooding) as well as reports in Endon, Blythe Bridge, Stockton Brook and Brown Edge. Later in the year (October), flood warnings were issued in Leek and Waterhouses for the watercourses River Churnet and River Hamps respectively, following heavy rainfall overnight.

Although not as recent, severe flooding in the summer of 2007 was also reported in the media, with reports of flooding in Blackshaw Moor, Cheadle Road (A520) and Rushton Spencer[33]. The flooding experienced generated changes in the way flooding is managed locally and nationally, with the Government commissioning 'The Pitt Review – Learning Lessons from the 2007 Floods[34]', and subsequently enacting the FWMA 2010[9] in response to recommendations of The Pitt Review. Flooding from all sources was experienced across the County of Staffordshire, and it is estimated in the PFRA[20] that around 500 properties were flooded.

4.3 Flooding from Rivers (Fluvial)

The Environment Agency's 'Detailed River Network' dataset has been used to identify watercourses in the study area and their designation (i.e. main river or ordinary watercourse). There are numerous designated main rivers and ordinary watercourses within the District, these have been described and listed in Table 2-1 and in Section 2.4.

[30] The Sentinel (June 9th 2014) Flash flood causes delays near Leek. Available at: http://www.stokesentinel.co.uk/Flash-flood-causes-delays-near-Leek/story-21208306-detail/story.html
[31] BBC News (10th July 2012) Flooding blocks Staffordshire roads. Available at: http://www.bbc.co.uk/news/uk-england-stoke-staffordshire-18779333.
[32] The Sentinel (August 30th 2012) Torrential rain causes flash flooding across Staffordshire. Available at: http://www.stokesentinel.co.uk/Torrential-rain-causes-flash-flooding/story-16769230-detail/story.html
[33] Leek Post & Time (5th July 2007) Floods leave workers and drivers stranded. Available at: http://www.leek-news.co.uk/Floods-leave-workers-drivers-stranded/story-20126649-detail/story.html
[34] Cabinet Office (2008) Sir Michael Pitt Report 'Learning lessons learned from the 2007 floods'. Available at: http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf

4.3.1 Historic Records of Fluvial Flooding

The Environment Agency Historic Flood Map and Recorded Flood Outlines datasets were obtained to support this Level 1 SFRA Update. The datasets include outlines for three major fluvial events known to have impacted the District, these being November 1959 and December 1964 on the River Churnet, November 1977 on the River Tean and August 1987 on the River Blithe. The combined Historic Flood Map outline is shown in Appendix B Figure 4.

The draft FRMP for the Humber River Basin District[21] does not make specific reference to flood events affecting the area covered by Staffordshire Moorlands, but does refer to the rapid run-off from the Peak District and Staffordshire Moors which results in the sudden onset of flooding in downstream towns and villages. The narrow valleys in the uplands also mean that settlements tend to be concentrated near rivers and bridges and other constrictions along the watercourses can further exacerbate the flooding within the towns and villages.

Hydrological and hydraulic modelling reports for the Fors Brook and River Blithe provided some limited information on historic flood events. Approximately 16 properties were affected by flooding of the Fors Brook in 1977 due to a blocked culvert, and 18 properties in 1976 at Poplar Close[37]. On the River Blithe, flood events have been recorded in 1987, October and November 1998 and November 2000, but no are locations specified in the report[38].

4.3.2 NPPF Flood Zones

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 4-1 and presented on the 'Flood Map for Planning (Rivers and Sea)' available on the Environment Agency website. These Flood Zones have also been presented in Appendix B Figures 6a – 6f.

The settlements of Cheddleton, Leek and Cheadle are identified in the Trent CFMP[12] as having the most properties at risk during a 1% AEP fluvial flood event, with Cheddleton having 100 – 250 properties, and Leek and Cheadle having less than 100 properties at risk.

Table 4-1: Fluvial Flood Zones (extracted from the PPG, 2014)

FLOOD ZONE	FLUVIAL FLOOD ZONE DEFINITION	PROBABILITY OF FLOODING
Flood Zone 1	Land having a less than a 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 chance of flooding in any one year). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP (1 in 1,000 chance of flooding in any one year).	Medium
Flood Zone 3a	Land having a 1% AEP 1 in 100 chance of flooding in any one year) or greater.	High
Flood Zone 3b (Functional Floodplain)	Land where water has to flow or be stored in times of flood based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a. The identification of the functional floodplain takes into account local circumstances, but for the purposes of this SFRA, land modelled to flood during a 5% AEP (1 in 20 chance of flooding in any one year) or greater has been mapped.	Very High

4.3.3 Flood Map for Planning (Rivers and Sea)

The 'Flood Map for Planning (Rivers and the Sea)' dataset is available on the Environment Agency website[35] and provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. It is the main reference for planning purposes as it contains the most up-to-date publically available dataset for Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 4-1.

The map was first developed in 2004 using national generalised modelling and is routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events.

It should be noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea. This map takes into account the presence of flood defences and so provides a more realistic overview of flood risk compared to the Flood Map for Planning, which assumes no flood defences. While flood defences reduce the level of risk they don't completely remove it as they can be overtopped or fail either due to extreme weather conditions, or poor maintenance. As a result the maps may show areas behind defences which still have some risk of flooding.

This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information for planning considerations.

4.3.4 Hydraulic Modelling Studies

Table 4-2 provides a summary of the hydraulic modelling studies that have been undertaken for the main rivers in the Staffordshire Moorlands District and used to inform the 'Flood Map for Planning (Rivers and Sea)'.

Table 4-2: Hydraulic models for main rivers in Staffordshire Moorlands

WATERCOURSE	MODELLING STUDY	DATE
Cecilly Brook[36]	1D hydraulic model for Cecilly Brook beginning at Froghall Road before the watercourse is culverted, and continues south to its confluence with the River Tean.	2006
Fors Brook[37]	Coverage: 1D/2D hydraulic model for Fors Brook from immediately upstream of Willow Way at the farthest extent of the Fors Brook urban area, to its confluence with the River Blithe downstream of the railway line.	2009
River Blithe[38]	Coverage: 1D hydraulic model for the River Blithe from its upstream extent located north of Blythe Bridge, approximately 120m upstream of the Old Mill Channel, to the downstream extent located south of the A50 bridge near Bridestone Farm.	2006
River Churnet[39]	Coverage: River Churnet A 1D model was constructed for the River Churnet channel, extending from Tittesworth Reservoir down to the confluence with the River Dove, and a 2D model included the River Churnet floodplain from Tittesworth Reservoir to Basford Bridge. Includes Endon Brook and Leek Brook.	2014

It should be noted that the scope of the modelling studies covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers are not included in the models. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' (for catchments >3 km^2) is likely to be the result of the earlier national generalised modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site whilst preparing a site-specific FRA. A challenge to the Environment Agency Flood Map would need to be made if such further detailed modelling demonstrated differing results.

[35] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx
[36] Capita Symonds (2006) MD677 Cecilly Brook SFRM
[37] Capita Symonds (2009) MD807 Fors Brook
[38] Capita Symonds (2006) MD678 River Blithe SFRM
[39] Royal HaskoningDHV (June 2014) River Churnet Hazard Mapping Report

Only a small proportion of rivers in the District are designated as main rivers, and therefore, many other rivers (main and ordinary) have not been modelled in any detail. In these circumstances, it may be a requirement for developers to consider acquiring detailed hydraulic modelling as part of their site specific FRA in order to adequately consider flood risk. This approach is also recommended as part of the site specific FRA guidance provided in Section 7.

4.3.5 Functional Floodplain (Flood Zone 3b)

The Functional Floodplain (also referred to as Flood Zone 3b), is not separately distinguished from Flood Zone 3a on the Flood Map for Planning. LPAs should identify areas of Functional Floodplain within their SFRA and in discussion with the Environment Agency and LLFA.

The PPG states that the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood during a 5% AEP or greater event, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) event, should provide a starting point for consideration and discussions to identify the functional floodplain.

The PPG states that *'areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be defined as functional floodplain'*. There may be opportunities to reinstate areas which can operate as functional floodplain through the use of previously developed land adjacent to watercourses to provide space for flood water to reduce the risk to new and existing development.

It was agreed with the Environment Agency at the SFRA project inception meeting that the 5% AEP (1 in 20 chance of flooding in any one year) defended outline provided by the modelling studies listed in Table 4-2 would be used to define Flood Zone 3b. Where this is not available, the 4% AEP (1 in 25 chance of flooding in any one year) modelled event outline would be used. Where neither of these are available, a precautionary approach will be adopted, by assuming that the extent of Flood Zone 3b is equal to Flood Zone 3a.

For the purposes of this SFRA, the Functional Floodplain is therefore defined as:

Land where water has to flow or be stored in times of flood based on flood modelling of a 5%/4% AEP event (1 in 20/25 chance respectively of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). Where detailed modelling is not available, it is assumed that the extent of Flood Zone 3b is equal to Flood Zone 3a.

The PPG recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight' areas of existing urban development. It may not be practical to refuse all future development within existing urban areas falling within land which would flood during a 5% AEP event, and therefore careful consideration must be given to future sustainability.

A review of the areas across the District that are at risk of flooding during a 5% AEP (1 in 20 chance of flooding in any one year) event was carried out. The extent of the floodplain for much of the River Churnet is limited by the steep sided Churnet Valley through which the river flows.

Along the majority of the River Churnet and its main tributaries (Endon Brook and Leek Brook) Flood Zone 3b is largely constrained within areas immediately adjacent to the watercourse, with the exception of the following:

- an area to the north of Leek, where the land associated with Brough Park Fields Nature Reserve and land adjacent to the weir and flood alleviation channel is shown to flood during a 5% AEP event.
- wetland areas associated with Ladderedge Country Park upstream of the A53 and land downstream of the confluence with Combes Brook adjacent to the Churnet Valley Railway.
- across Blythe Marsh associated with Fors Brook.

The extent of Flood Zone 3b (4% AEP or 1 in 25 chance of flooding in any one year) associated with the Cecilly Brook in Cheadle and the River Blithe upstream of the A50 bridge remains within close proximity to the respective watercourse.

No functional floodplain has been modelled for the River Tean or the River Blithe downstream of the A50 bridge. The extent of the 1% AEP (1 in 100 chance of flooding in any one year) outline should therefore be used as a proxy for Flood Zone 3b in these areas.

4.3.6 Communities at Risk

The 'communities at risk' project was established to identify communities at risk of flooding from rivers and the sea. The analysis considered property number thresholds (residential and business), within a given geographical proximity to determine the size of each community area. Communities were defined by identifying all properties at risk within the fluvial and pluvial floodplain then applying a buffer around those properties to create communities. Rural areas were given a 50 m buffer zone and urban areas were given a buffer zone of 35 m, but as such not all of the properties within each community are necessarily at risk. There needed to be at least 10 properties within a group to be defined as a community.

The communities at risk dataset, illustrated in Appendix B Figures 6a to 6f, is a tool used by the Environment Agency to focus funding and engagement. The dataset is not a fundamental consideration within the planning system but could be used to inform where developments may not be feasible. Primarily the dataset should be used to identify opportunities where communities could be protected or where a developer may be able to contribute to the protection of a local community. It can also be used to identify opportunities where schemes can be put in place to protect against both fluvial and surface water flood risk potentially combining a number of funding sources to secure a better outcome.

4.3.7 Climate Change

Rising global temperatures is considered to be the most obvious consequence of climate change, however, in relation to Staffordshire Moorlands, its impact on changing weather patterns and the hydrological cycle is likely to be more significant. Predicted increases in peak rainfall intensity and river flow could result in more frequent and severe flash flood events and increased soil and river bank erosion, raising the risk of landslides. It is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

The recommended national precautionary sensitivity ranges for peak rainfall intensity and peak river flow suitable for use in the planning system are currently being revised to reflect the latest climate projections in UKCP09 and wider flood risk research published since 2009. The allowances and guidance as provided by the Environment Agency[40] should be used whilst the allowances are being revised; however the allowances numbers for planners are subject to change following publication of the approved allowances for climate change in autumn 2015 and will subsequently become out of date.

The allowances and guidance for changes to river flood flows and extreme rainfall intensity relevant to Staffordshire Moorlands have been provided in Table 4-3 and Table 4-4 respectively.

Table 4-3: Table Changes to river flood flows by river basin district compared to a 1961-90 baseline

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2020s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2050s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080s
Humber			
Upper end estimate	25%	30%	50%
Change factor	10%	15%	20%
Lower end estimate	-5%	0%	5%
NW England			
Upper end estimate	25%	35%	65%
Change factor	15%	20%	30%
Lower end estimate	5%	10%	10%

[40] Environment Agency (2015) 'Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities'. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297379/geho0711btzu-e-e.pdf

Table 4-4: Change to extreme rainfall intensity compared to a 1961-90 baseline

APPLIES ACROSS ALL OF ENGLAND	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2020s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2050s	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080s
Upper end estimate	10%	20%	40%
Change factor	5%	10%	20%
Lower end estimate	0	5%	10%

For changes beyond the 2080s, it is recommended that the 2080s changes are used. The 2020s covers the period 2015 to 2039, the 2050s the period 2040 to 2069, and the 2080s the period 2070 and 2099.

As part of the hydraulic modelling studies listed in Table 4-2, simulations have been run for the 1 in 100 year event including an allowance for the implications of climate change (1% AEP+CC) based on these allowances. It should be noted that whilst the modelling of the annual probability events to generate the NPPF Flood Zones (and Flood Map for Planning) do not account for the presence of flood defences, the simulations including an allowance for climate change do tend to include the presence of existing flood defences.

These simulations are available for the following watercourses:

- Cecily Brook,
- River Blithe,
- Fors Brook, and
- River Churnet.

The flood outline for the 1% AEP (1 in 100 year event) including climate change has been mapped for these watercourses in Appendix B Figures 6a – 6f.

It is clear that climate change will not markedly increase the extent of river flooding within most areas of the District, largely as a result of the confined floodplains within steep sided valleys, particularly notable along much of the River Churnet, where the 1% AEP flood outline differs only marginally from the 1% AEP including climate change outline. The Trent CFMP (Section 3.4.3) also states that flood risk in the Staffordshire Moorlands is not expected to increase in the future.

4.4 Flooding from Surface Water (Pluvial)

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding.

A subset of surface water flooding is typically referred to as highway flooding, which can be defined as flooding caused by heavy rainfall or overflowing from blocked drains and gullies causing water to pond within the highway network. Responsibility for management of this type of flooding depends on the ownership of the highway being flooded.

The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well as other available information, such as from the Highway Authority and/or the LLFA. SCC encourages early consultation as part of the planning application process to discuss any known local surface water flood risk issues (see Section 5.3).

4.4.1 Historic Records of Surface Water Flooding

The LFRMS makes reference to the many areas within The Moorlands where the steep topography, combined with low permeability soils, can exacerbate surface water flood risk. Changes in agricultural land management practices can also increase rates of surface water runoff. Typical issues that can have a significant impact include crop selection, removal of hedges and ditches and soil compaction from grazing and machinery.

Records of historic flooding incidents have been provided by SCC with approximately 24 incidents recorded as surface water flooding, from 1996 to 2014. The records show a relatively good correlation with the

uFMfSW, but it should be noted that some recorded flood incidents are located outside of areas shown to be at risk of surface water flooding in the uFMfSW. It is also likely that additional flood incidents have occurred and have not been reported for various reasons. Such incidents by their very nature are not shown in historic flood records. These incidents of historic flooding should therefore be interpreted with caution, as some areas within the District may appear to have significantly more historic flood incidents when compared to other areas.

Records of flooding on the highways and roads with the District, operated and maintained by SCC, have also been provided by SCC and total 21 incidents; however the majority of records do not have a corresponding date. Highways England was also consulted as part of the SFRA update and has provided information on incidents relating to flooding and standing water on the strategic road network within the County of Staffordshire. The A50 is the only major trunk road within the District, approximately 7 km in total, managed by Highways England, for which no incidents of flooding have been recorded.

It should also be noted that 74 incidents of flooding whose source is unknown and 58 incidents of flooding from multiple sources have been recorded by SCC, and it is likely that many of these records include an element of surface water. No specific records of historic surface water flooding were provided by the Environment Agency for consideration in this SFRA.

4.4.2 Environment Agency updated Flood Map for Surface Water (uFMfSW)

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual exceedance probability (AEP) events: 3.3% AEP (1 in 30 chance of flooding in any one year), 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP (1 in 1,000 chance of flooding in any one year). The latest version of the mapping, published in 2013, is referred to as the 'updated Flood Map for Surface Water' (uFMfSW) and the extents have been made available to planning authorities as GIS layers. This dataset is also available on the Environment Agency website, and is referred to as 'Risk of Flooding from Surface Water'.

The uFMfSW provides all relevant stakeholders, such as the Environment Agency, SMDC, SCC and the public access to information on surface water flood risk which is consistent across England and Wales[41]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists SCC (as the LLFA) in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within the District which may have a surface water flood risk. The mapping is presented in Appendix B Figures 7a – 7f in combination with historical surface water flooding data recorded by SCC.

The modelling represents a significant improvement on previous mapping, namely the FMfSW (2010) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2009), for example:

- Increased model resolution to 2m grid;
- Representation of buildings and flow routes along roads and manual editing of the model for structural features such as flyovers;
- Use of a range of storm scenarios; and
- Incorporation of appropriate local mapping, knowledge and flood incident records.

However, it should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas;
- It does not show the susceptibility of individual properties to surface water flooding;
- The mapping has significant limitations for use in flat catchments;
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses;
- In a number of areas, modelling has not been validated due to a lack of surface water flood records; and
- As with all models, the uFMfSW is affected by a lack of, or inaccuracies, in available data.

[41] Environment Agency (2013) 'What is the updated Flood Map for Surface Water?'

This dataset provides an indication of the potential for surface water flooding and identifies that a widespread risk is present across most parts of the District. A review of the dataset and its coverage within the District was undertaken and it was concluded that areas shown to be at most risk from surface water flooding are largely associated with the fluvial floodplains and coincide with reservoirs.

The following describes those areas shown to be at particular risk from potential surface water flow paths and areas of surface water ponding, although the following list is by no means exhaustive:

- Within Biddulph, flow paths are shown to occur for all modelled events along the A527 from the roundabout with Dorset Drive in the west to the roundabout with Congleton Road in the east. Other flow paths shown to occur for the 1% AEP are seen along Pennine Way in the east of the town, Shepherd Street and High Street in the south and along the National Cycle Route 55 in the west;
- To the east of Biddulph the higher land around Biddulph Moor with undulating slopes results in narrow flow paths associated with the small ordinary watercourses and arable drainage ditches of the Horton Brook;
- Further south in Endon and around the Endon Brook, large areas of surface water ponding is shown to the west of Post Lane, to the south of Orford Road and in the field to the south of the A53 / Park Lane junction. Along the A53, ponding in Endon Bank and a flow path from the junction with Basnetts Wood to the junction with Brookfield Avenue are visible;
- Within Leek, flow paths along the A53 from the A520 junction flowing south before ponding is likely to occur in the supermarket car park and in Barnfields Industrial Estate. To the north of Leek, between Abbey Green, large areas of ponding occur in the River Churnet floodplain, flowing across agricultural land and the Brough Park Field Nature Reserve. A flow path occurring in all modelled events begins on Springfield Road flowing north west across the A53, north of the Buxton and Leek college and down Brow Hill towards Hamil Drive. A second flow path in the same area flows down Mill Street towards Harrison Park Stadium (Macclesfield Road);
- To the south of Leek, the A520 is crossed by surface water flow paths associated with the Leek Brook;
- In the west and south west of the District, the strongly undulating or sloping landscape, cut by small scale steep sided stream valleys again restricts surface water flow paths and eliminates the potential for large areas of ponding. Flow paths in the upper tributaries of the Cecilly Brook are shown in Kingsley on the junction between the A52 and Sunny Side;
- The flow path continues south along the Cecilly Brook into Cheadle, and from the north of Harewood Park into the fields just north of Oakamoor Road. Within Cheadle, surface water is predicted to flow during a 1% AEP event along the A522, Ashbourne Road, Attlee Road and Oakamoor Road;
- Surface water ponding is also largely restricted to the River Tean, River Blithe and Fors Brook narrow floodplains, with the exception of a flow path shown to occur to the east of Forsbrook village through fields in Blythe Marsh;
- Much of the District to the east and within the Peak District is not shown to be at significant risk of surface water flooding, predominantly as a result of the elevated topography and steep slopes. However, topography of this nature poses a much higher risk during intense rainfall and can generate sudden and fast flowing overland flow with little or no warning. These events would be localised occurrences and are therefore unlikely to be picked up by the Environment Agency's national scale modelling.

4.4.3 Communities at Risk

As described in Section 4.3.6, the Environment Agencies 'communities at risk' dataset, illustrated in Appendix B Figures 7a to 7f, can be used to identify opportunities where schemes can be put in place to protect against both fluvial and surface water flood risk potentially combining a number of funding sources to secure a better outcome.

4.4.4 Climate Change

The uFMfSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken; 3.3% AEP, 1% AEP and 0.1% AEP and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

4.5 Flooding from Groundwater

Groundwater flooding usually occurs in areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground. Where emergence of groundwater occurs these areas would be at greatest risk and the impact of any such occurrence would potentially be exacerbated by the influence of climate change.

4.5.1 Historic Records of Groundwater Flooding

Across both Shropshire and Staffordshire, the LFRMS[11] states that there is currently no evidence to suggest that groundwater flooding is a major problem within Staffordshire and anticipates that groundwater flooding issues are likely to be localised in their nature, affecting only a small number of properties. This is reinforced by the Humber FRMP[21], in which no historic records of property flooding from groundwater sources were recorded in the catchment.

Only one incident of potential groundwater flooding reported in Leek in July 2013 has been recorded by SCC, however, the report states it is not known whether the source is groundwater or surface water flow. No records of groundwater flooding have been provided by the Environment Agency.

4.5.2 Areas Susceptible to Groundwater Flooding

As part of the SFRA, an assessment of the risk of groundwater flooding needs to be considered; however, a quantified assessment of risk from groundwater flooding is difficult to undertake, especially on a strategic scale. This is due to lack of groundwater level records, the variability in geological conditions and the lack of predictive tools (such as modelling) that can be used to make assessments of groundwater flow and risk of groundwater flooding following rainfall events.

Appendix B Figure 8 presents the Environment Agency's dataset Areas Susceptible to Groundwater Flooding (AStGWF), which indicates where groundwater may emerge due to certain geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead should be used at a strategic level to indicate areas for further investigation.

The mapping indicates that land in proximity to the Tittesworth Reservoir, to the south and east of Cheadle and around Endon are shown to be more susceptible to groundwater flooding. These areas correlate closely with where the sources to rivers are located, including the River Churnet, Cecilly Brook, Endon Brook and Horton Brook. Outside of these areas much of the land within the District, in particular land within the Peak District, is shown to have less than 25% of each 1km grid square as being susceptible to groundwater flooding.

4.6 Flooding from Sewers

The majority of the District is served by Severn Trent Water (ST) as the sewerage undertaker, with the exception of areas along the north and north west District boundary (including the town of Biddulph) which is served by United Utilities (UU). Both sewerage undertakers have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is provided as the DG5 Flood Register. The register includes records of flooding from foul sewers, combined sewers and surface water sewers which are maintained by the respective sewerage undertaker.

During heavy rainfall, flooding from the sewer system may occur if:

1. The rainfall event exceeds the capacity of the sewer system/drainage system:
   - Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While ST, as the sewerage undertaker for Staffordshire Moorlands, is concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event. Older sewer systems may have an effective design standard of less than 3.3%