



Southern Staffordshire Surface Water Management Plan

Phase 1

Stafford Borough, Lichfield District, Tamworth
Borough, South Staffordshire District and Cannock
Chase District Councils
July 2010
Final Report
9V5955



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ROYAL HASKONING

**HASKONING UK LTD.
COASTAL & RIVERS**

5th Floor, Radcliffe House
Blenheim Court
Solihull B91 2AA
United Kingdom

+44 (0)1564 711875 Telephone

Fax

info@birmingham.royalhaskoning.com E-mail

www.royalhaskoning.com Internet

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G Davies

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EXECUTIVE SUMMARY

This report has followed the requirements of Defra's draft Surface Water Management Plan (SWMP) guidance and the requirements of the Brief to produce a Phase 1 SWMP for the Local Authority areas of Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District. As such, this report completes the first step of Defra's four stage approach to surface water flood risk management.

As stated within Defra's guidance there are three main aims of a Phase 1 SWMP:

1. Establishing a partnership between the key consultees and stakeholders;
2. Collecting and collating existing information on surface water flooding; and
3. Selecting an approach to carry out further analysis (i.e. the scope for Phase 2).

The key objective and outcome of this study was the identification of the locations within the study area at greatest risk of surface water flooding. The aims of this are to assist the Councils with determining an appropriate approach to further stages of the SWMP process, and to aid their selection of potential development sites for progression within their Local Development Frameworks (LDFs).

The start of a partnership has been formed between the key consultees and stakeholders through the formation of an Engagement Plan. This plan identifies a three-tier approach with the Local Councils taking a central role. The Core Steering Group assumes the bulk of the responsibility for surface water management and data provision. Additional data is obtained from the second tier, whereas the third tier is affected by the decisions of a SWMP rather than playing a key role in its construction. This partnership approach is still at a fledgling stage and requires cultivation throughout the SWMP process.

A key aim of this Phase 1 SWMP was the collection and collation of as much existing information regarding both historic flood events and the potential for future surface water flooding occurrences as possible. Data sources have included the Level 1 SFRAs, Council owned flood event records and Severn Trent Water Limited's (STWL) register of surface water sewer flooding. Future flood risk has been determined through interrogation of the Environment Agency's surface water flood maps and Defra's comparative analysis of UK settlements. Further information was obtained from the River Severn Catchment Flood Management Plan (CFMP) and the West Midlands Regional Flood Risk Appraisal. Reference has been made throughout the report to the Water Cycle Study (WCS) carried out by Royal Haskoning in parallel to this study, which provides greater detail on the use of Sustainable Drainage Systems (SUDS) within the study area.

Key Recommendations

A number of general and specific recommendations have been drawn out from this report. The following key recommendations apply across the study area:

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Councils as a further step towards mitigating

the source of surface water flooding problems, or by developers as part of a site specific FRA;

2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Councils with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Lichfield, Cannock Chase and South Staffordshire District Councils should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities associated with the restoration of the Lichfield and Hatherton canals;
4. Where this study has identified development sites that are at high or medium risk of surface water flooding (highlighted as red or yellow within the summary sheets), site specific FRAs prepared by developers should confirm surface water flood risk and identify runoff mitigation measures to be implemented as part of site development;
5. The Councils and developers should ensure appropriate SUDS techniques are implemented into all new developments (as per the Floods and Water Management Act which places responsibility for installation upon the developers and adoption and maintenance upon the Local Authorities) and as far as possible retrofitted into existing settlements, especially where historic flood events have been identified. This will need to involve the new SUDS Approval Board (SAB), when it has been set up by Staffordshire County Council.
6. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Councils and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
7. The Councils (or appropriate owners) should ensure that the rural watercourses are adequately maintained and regularly cleared;
8. Where relevant, the Councils should review the agricultural and land management practices within the study area and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"¹;
9. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
10. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed;
11. Emphasis should be placed upon the responsibilities of individual authorities to reduce the risk of surface water flooding, but in a coordinated approach between all members of the partnership. Progression of a centralised recording system for surface water flood events, including identification of type, recurrence, asset owner (if flooding has resulted for asset failure) and location, will greatly assist the Lead Flood Authority (Staffordshire County Council) in identifying and mitigating the sources of such flooding. Such a recording system is currently being investigated by Staffordshire County Council, but will require support and contribution of data from all stakeholders and partners.

¹ <http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm>

12. The Councils should further review the settlements classified within the analysis as having a high overall risk of surface water flooding (highlighted as red in the summary sheets), when considering the promotion of development sites within those areas. All development sites in these settlements should be reviewed by the Councils in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs. The flood risk classifications for the individual development sites provided for review within this SWMP can be found in Appendices D - H.

These 'high risk' settlements consist of:

Stafford

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

Lichfield

- Lichfield
- Armitage and the Longdons;
- Burntwood, Elford;
- Little Aston;
- Mile Oak and Fazeley; and
- Whittington.

South Staffordshire

- Penkridge;
- Wombourne;
- Codsall;
- Great Wyrley;
- Cheslyn Hay; and
- Perton.

Cannock Chase

- Cannock;
- Norton Canes; and
- Rugeley town.

Tamworth

- Tamworth

13. More specifically, the following five settlements have been noted as being at high risk of surface water flooding (based upon historic flooding occurrences, future flooding potential and severity of flooding) and are also identified as locations for a relatively high number of potential development sites. It is therefore recommended they are investigated further as part of a Phase 2 SWMP:

- Stafford town;
- Lichfield City;
- Cannock town (Norton Canes will be included within the analysis);
- Tamworth town; and
- Penkridge (South Staffordshire).

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

Local Authority specific recommendations are presented in Sections 4.3 (Stafford Borough), 5.3 (Lichfield District), 6.3 (Tamworth Borough), 7.3 (South Staffordshire District) and 8.3 (Cannock Chase District) of this report, with general recommendations presented in Section 9. For all the recommendations, the maintenance of the partnership approach and the cooperation and openness between partners and key stakeholders is paramount to the success of a sustainable surface water management strategy

Phase 2 SWMP

A number of settlements have been highlighted within this mapping exercise as 'red' with regards to overall surface water flooding. Ideally all of these areas should be investigated further within a Phase 2 SMWP. However, to undertake the modelling required for a robust SWMP the data requirements are high, especially for the topographical representation (the LiDAR data) and, as a result, so are the costs. To produce a robust, and therefore useful, representation of surface water flooding within an area, LiDAR of at least 2m resolution is required for the entire watershed in which a settlement falls. This ensures that all the water falling within the catchment of that urban area is routed appropriately across the topography and down the key drainage channels, such as roads, into the urban area in question. As such, prioritisation has been given to the procurement of LiDAR for the five key settlements listed above.

Once the LiDAR has been obtained (currently due by the end of July 2010), the Phase 2 SWMP for these five settlements will be progressed. The scope for the modelling will be agreed with the Councils and then progressed at the required level of detail, covering the area included within the watershed boundaries for each of the settlements. Dependent upon receipt of the LiDAR Phase 2 should be finalised by the end of 2010.

GLOSSARY

Antecedent Conditions	The pre-existing condition before a rain event (e.g. waterlogged soil)
Brownfield site	Any land or site that has been previously developed.
Catchment	The area contributing flow or <i>runoff</i> to a particular point on a watercourse.
Catchment Flood Management Plan	Environment Agency produced documents providing an overview of the flood risk across each river catchment and estuary and recommended ways of managing those risks now and over the next 50-100 years.
Climate change	Long-term variations in global temperature and weather patterns both natural and as a result of human activity, primarily greenhouse gas emissions.
Culvert	Covered channel or pipe that forms a <i>watercourse</i> below ground level, or through a raised embankment.
Defra	UK Government department responsible for policy and regulations on the environment, food and rural affairs.
Development	The carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.
Enmained	Watercourse designated as a <i>Main River</i>
Environment Agency	Government Agency charged with the protection of the environment.
Flood defence	Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding, to a specified <i>standard of protection</i> .
Flood probability	The estimated likelihood of a flood of a given magnitude occurring or being exceeded in any specified time period.
Flood risk	An expression of the combination of the <i>flood probability</i> and the magnitude of the potential consequences of the <i>flood event</i> .
Flood risk assessment	A study to assess the risk of a site or area flooding, and to assess the impact that any changes or development in the site or area will have on <i>flood risk</i> .

Flood Zones	Flood Zones are defined in Table D.1 of Planning Policy Statement (PPS) 25: Development and Flood Risk. They indicate land at risk by referring to the probability of flooding from river and sea, ignoring the presence of defences.
Fluvial Water	Water contained or flowing within a river or stream.
Greenfield	Previously undeveloped land.
Groundwater	Water in the ground, usually referring to water in the saturated zone below the <i>water table</i> .
Groundwater flooding	Flooding caused by <i>groundwater</i> escaping from the ground when the <i>water table</i> rises to or above ground level.
Groundwater Vulnerability	A measure of the vulnerability of groundwater stores to contamination.
Growth Points	The New Growth Points initiative was designed to provide support to local communities who wish to pursue large scale and sustainable growth, including new housing, through partnership with the Government. 29 areas were named New Growth Points and will share £40m in 2007-8 for a first round of infrastructure projects and to support growth related studies, master planning and capacity-building.
LiDAR	Data set that provides a 3D image of the surface of the earth.
Local Development Documents	Documents that set out the spatial strategy for local planning authorities which comprise development plan documents.
Local Development Framework	Framework which forms part of the statutory development plan and supplementary planning documents which expand policies in a development plan document or provide additional detail.
Local Planning Authority	Body responsible for planning and controlling development, through the planning system.
Main River	A watercourse designated on a statutory map of Main rivers, maintained by the Environment Agency.
Mitigation measure	A generic term used in this guide to refer to an element of <i>development</i> design which may be used to manage some <i>risk</i> to the <i>development</i> , or to avoid an increase in <i>risk</i> elsewhere.
Ordinary watercourse	A watercourse which is not a private drain and is not designated a <i>Main river</i> .

Outfall Height	Level at which a sewer or drain discharges into a watercourse.
Riparian Owners	Land owners with land or property alongside a river or other watercourse
Runoff	Water flow over the ground surface to the drainage system.
Standard of protection	The estimated probability of an event occurring which is more severe than those against which an area is protected by flood defences.
Strategic Flood Risk Assessment (SFRA)	A study to examine flood risk issues on a sub-regional scale, typically for a river catchment or local authority area during the preparation of a development plan.
Source Protection Zone (SPZ)	Defined areas showing the risk of contamination to selected groundwater sources used for public drinking water supply, from any activities that might cause pollution in the area.
Surface Water	Water collected or flowing over the ground not contained within a watercourse. Usually results from heavy rainfall.
Sustainable Drainage Systems (SUDS)	A sequence of management practices and control structures, often referred to as SUDS, designed to drain surface water in a more sustainable manner. Typically, these techniques are used to attenuate rates of runoff from potential development sites.
Watercourse	Any natural or artificial channel that conveys surface water.
Water Cycle Strategy (WCS)	Provides a plan and programme of Water Services Infrastructure implementation. It is determined through an assessment of the environment and infrastructure capacity for: water supply; sewage disposal; flood risk management; and surface water drainage.
Watershed	Line depicting the area within which all surface water will drain into an area of interest, such as a town or village. For the assessment of surface water this boundary is defined from the topography.

ABBREVIATIONS

CFMP	Catchment Flood Management Plan
Defra	Department for Environment Flood and Rural Affairs
DQS	Data Quality Score
FRA	Flood Risk Assessment
GIS	Geographical Information System
GWA	Ground Water Availability
IDB	Internal Drainage Board
LDF	Local Development Framework
LiDAR	Light Detecting and Ranging
LPA	Local Planning Authority
MCM	Multi Coloured Manual
MSfW	Making Space for Water
NPD	National Property Dataset
OS	Ordnance Survey
PPS25	Planning Policy Statement 25 – Development and Flood Risk
RFRA	Regional Flood Risk Appraisal
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SSSI	Sites of Special Scientific Interest
SSW	South Staffordshire Water
STWL	Severn Trent Water Limited
SUDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WCS	Water Cycle Study

WMRSS

West Midlands Regional Spatial Strategy

1 INTRODUCTION

1.1 General Overview

In November 2009 Royal Haskoning was appointed by Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District Councils (hereafter “the Councils”) to produce a Phase 1 and Phase 2 Surface Water Management Plan (SWMP) and a Phase 1 and Phase 2: Scoping and Outline Stage Water Cycle Study (WCS). This report relates to the production of the Phase 1 SWMP and has been written to the specification of the Defra’s draft Surface Water Management Plan guidance (version 1 - February 2009) and the requirements of the Brief.

1.2 Objectives of the SWMP

As shown in **Table 1.1** the Councils are at different stages in the process of preparing their Local Development Framework (LDF) submissions, as required by the Planning and Compulsory Purchase Act 2004. To inform and support their submissions, the Councils are required to present a portfolio of studies, forming an Evidence Base, of which this SWMP will form a part, along with the associated WCS.

Table 1.1 - Local Authority Development Plan Status (January 2010)

Local Authority	Commencement	Publication*	Submission*	Adoption*
Stafford Borough²				
Core Strategy	October 2007	June 2011	November 2011	May 2012
Site Specific Documents	October 2009	December 2010	April 2011	December 2011
Lichfield District³				
Core Strategy	March 2007	October 2009	January 2010	August 2010
Site Specific Documents	July 2009	November 2010	February 2011	November 2011
Tamworth Borough⁴				
Core Strategy	2007	October 2010	February 2011	January 2012
Site Specific Documents	October 2008	July 2010	October 2010	May 2011
South Staffordshire District⁵				
Core Strategy		November 2010	March 2011	November 2011
Site Specific Documents	July 2009	November 2011	March 2012	November 2012
Cannock Chase District⁶				
Core Strategy	September 2004	December 2009	March 2010	May 2010
Site Specific Documents	September 2009	September 2011	December 2011	February 2012

NB Shaded cells represent completed items

**Progression of all the Core Strategies is delayed due to RSS Phase 2 Review delays and guidance that is awaited following the formation of a new Government. All figures are correct at the time of print.*

² Stafford Borough Council Local Development Scheme, November 2008

³ Lichfield District Council, Local Development Scheme, July 2009

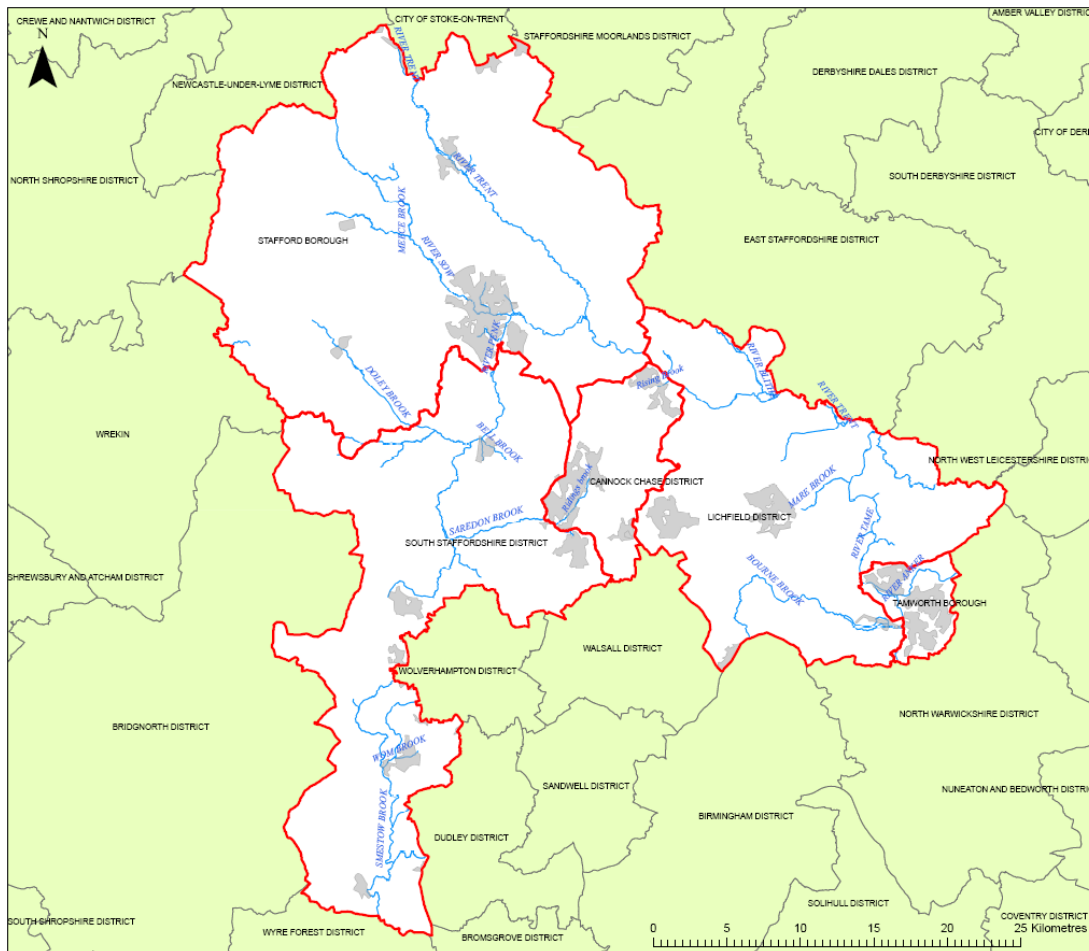
⁴ Tamworth Borough Council, Local Development Scheme, September 2009

⁵ South Staffordshire District Council, March 2007

⁶ Cannock Chase District Council, April 2009. Please note, the Council is currently re-considering its timetable in light of delays primarily related to the potential impacts of development upon the Cannock Chase Special Area of Conservation. Further information on the most up to date timetable should be sought from the Council.”

The study area for this project covers the administrative areas of Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District, totalling an area of just under 1,450km², as shown in **Figure 1.1**. Due to the cross boundary issues associated with the targeted growth (explained further in Section 3), it is important for this area to be studied as a whole. The locations identified for development should be selected carefully with due consideration of all the sources and types of surface water flooding, both within and beyond Local Authority boundaries. Consideration of the findings of this SWMP and the Phase 2 SWMP, when complete, alongside the conclusions of the other strategic studies undertaken for this study area (including the existing Level 1 SFRAs and the WCS) will enable the Councils to make informed decisions regarding the most sustainable locations for their planned developments.

Figure 1.1 - Study Area



One of the primary aims of the UK Government’s strategy for flood and coastal erosion risk management, Making Space for Water (MSfW) is manage flood risk more effectively through the adoption of a holistic, joined-up and integrated approach. Highlighted within the Pitt Review following the summer 2007 floods, surface water flooding is a widespread problem across the country. During heavy rainfall events rainwater rapidly

exceeds the capacity of the existing drainage networks, causing widespread flooding and disruption. This is most notable within urban areas where the sewerage networks and culverted watercourses often cannot accommodate the rapid and extreme runoff from the impermeable surfaces. The main objective of this SWMP is therefore to inform the Councils as to the occurrence and cause of surface water flooding within their boundaries and the appropriate mitigation strategies to assist in managing this risk in a sustainable manner.

1.3 Scope of the SWMP

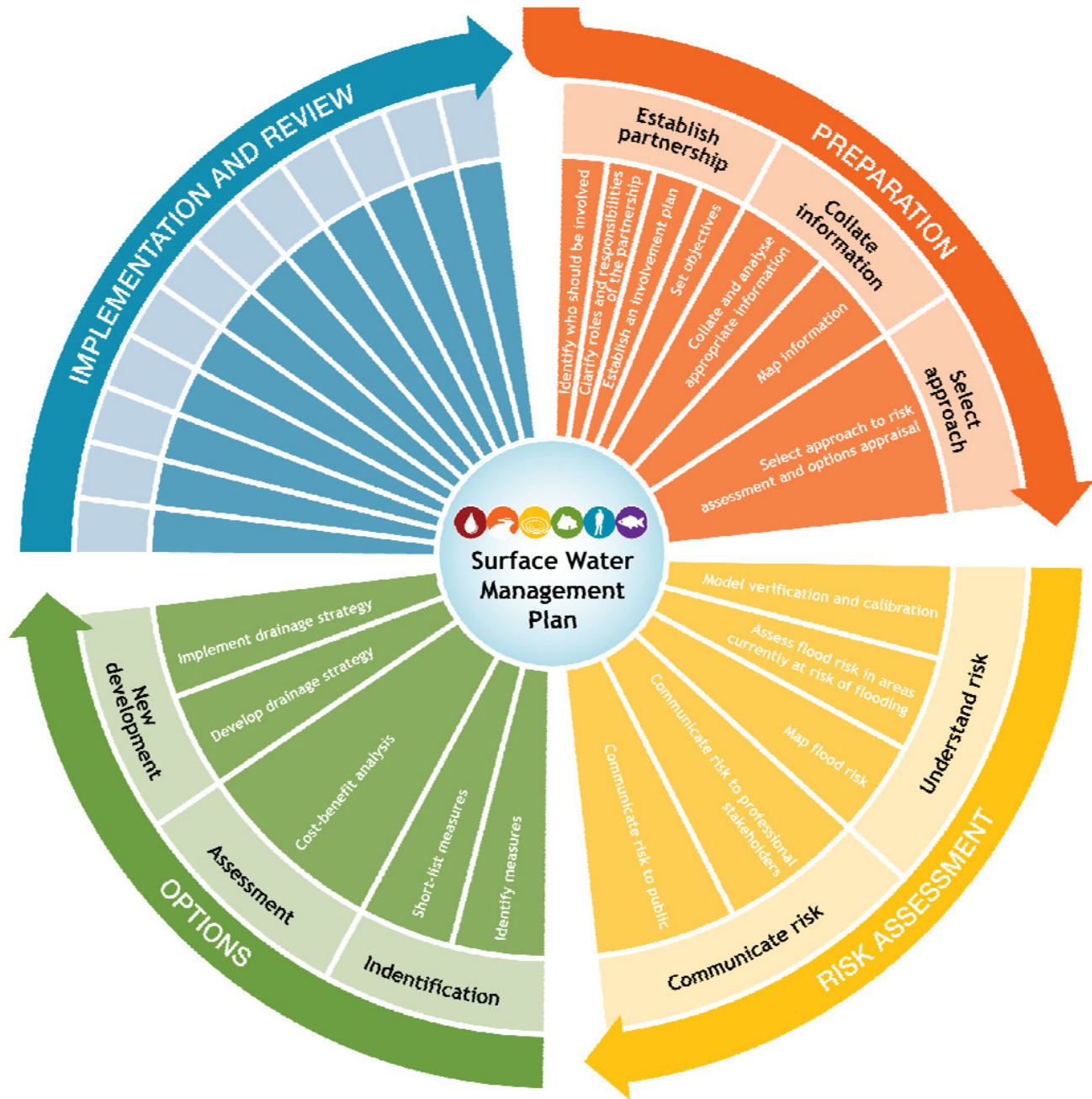
Defra's SWMP guidance states there are four main stages to producing a SWMP, as shown graphically in **Figure 1.2**:

- Phase 1 - Preparation;
- Phase 2 - Risk Assessment;
- Phase 3 - Options; and
- Phase 4 - Implementation and Review.

As shown in **Figure 1.2** these four phases are interlinked into a linear process that extends from the identification of a problem through to the implementation of actions to resolve the situation. Within each of these Phases there are a number of sub-tasks, around which the structure of this Phase 1 study has been based. This commission encompasses only the first two Phases of this process, namely the Preparation and Risk Assessment, with this report focussing solely upon Phase 1. The key objectives of these two Phases are discussed further in Sections 1.3.1 and 1.3.2 below.

Please note: As this commission was awarded in 2009, the scope is based upon the requirements of Defra's draft SWMP Technical guidance, published in February 2009 and not the requirements of the updated guidance, published in March 2010. However, the key Phases have remained the same and the overall approach is similar, although the subcategories and division of tasks within each phase has now been superseded. Despite these changes, the final outcomes from both methodologies are the same. As a result, it is not thought to be necessary to update this report to the new guidance document.

Figure 1.2 - Key Elements of a SWMP



(Taken from draft SWMP Technical Guidance, Defra, February 2009: pp xxviii)

1.3.1 Phase 1 - Preparation

This phase focuses on preparing and scoping the requirements of the SWMP at a strategic level. The overall objective is to determine which locations within the study area require further analysis and the best method by which this analysis should be undertaken. There are three key aims to this stage:

1. Establishing a partnership between the key consultees and stakeholders;
2. Collecting and collating existing information on surface water flooding; and
3. Selecting an approach to carry out further analysis (i.e. the scope for Phase 2).

The first two of these stages have been addressed further within Sections 2 and 3 of this report, split into the subsections shown within **Figure 1.2**. Sections 4 to 8 present the mapping, analysis and conclusions for the five separate Local Authorities, with Section 9 presenting the summary conclusions and recommended approach for further stages of the SWMP. The approach to this SWMP has been devised and agreed in consultation with the Environment Agency. This includes approval of a technical note, dated 23rd February 2010, detailing the methodology for displaying the mapped information.

1.3.2 Phase 2 - Risk Assessment

The risk assessment approach to SWMPs involves the selection of an appropriate modelling technique to assist in determining the risk of particular areas from surface water flooding at a more local scale. The modelling approaches vary in detail from relatively simple 'Rolling Ball' models which analyse the topography of an area to determine flow pathways, to 'Detailed' combined models which include the drainage networks, such as sewers within an urban area. Further detail on the varying modelling techniques is provided within the updated SMWP guidance⁷. The appropriate area and scale of modelling to be considered by a Local Authority is guided by the analysis carried out as part of Phase 1 and therefore the conclusions of this report.

As all the modelling approaches for a SWMP rely upon an accurate representation of the topography of an area, a key data requirement to progress a SWMP beyond Phase 1 is access to topographic data of a fairly high resolution, namely LiDAR data with a resolution of $\geq 2\text{m}$. At the start of this commission the available data was reviewed and it immediately became evident that insufficient LiDAR coverage was available for this study area. As a result Phase 2 of this commission was placed on hold until the appropriate LiDAR data was procured. To assist the Councils in the progression of their LDF documents, this Phase 1 report has been drafted as an intermediate step.

⁷ Surface Water Management Plan Technical Guidance, March 2010.

2 ESTABLISHING A PARTNERSHIP

There are many causes and sources of surface water flooding, illustrated within Box 2 of the draft SWMP guidance:

Box 2 Surface water flooding

In this context, **surface water flooding** describes flooding from sewers, drains, small water courses and ditches that occurs during heavy rainfall in urban areas. It includes:

- Pluvial flooding; flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity.
- Sewer flooding; flooding which occurs when the capacity of underground systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters.
- Flooding from small open-channel and culverted urban watercourses which receive most of their flow from inside the urban area
- Overland flows from the urban/rural fringe entering the built-up area, including overland flows from groundwater springs.

(Taken from draft SWMP Technical Guidance, Defra, February 2009: pp xxiv)

A key starting point for a SWMP is therefore to identify all the appropriate partners and stakeholders involved with the management and maintenance of the drainage networks. Through this process the SWMP can be seen as a framework through which key local partners with responsibility for surface water and drainage work together to understand and agree the most sustainable and cost effective method for managing surface water flood risk. The aim of this method is to ensure that a strategic approach is applied across a region, rather than on a site by site basis.

2.1 Identification of Partners

The key partners to be involved in this SWMP were identified at the Initiation meeting for this study, which took place on 20th November 2009 and at which representatives from all the local Councils, the County Council, Severn Trent Water and Royal Haskoning were present.

Three main groups were identified, consisting of the following partners and stakeholders:

Core Steering Group (Partners)

- Local Councils (Stafford Borough, Lichfield District, Tamworth Borough, South Staffordshire District and Cannock Chase District);
- Staffordshire County Council
- Royal Haskoning;
- The Environment Agency; and

- Water Companies (Severn Trent Water Limited and South Staffordshire Water).

Additional Data Providers / Key Consultees (mix of Partners and Stakeholders)

- Natural England
- British Waterways
- Environmental Groups
- Internal Drainage Boards
- Public Flood Risk Forums
- Lichfield and Hatherton Canal Restoration Trust

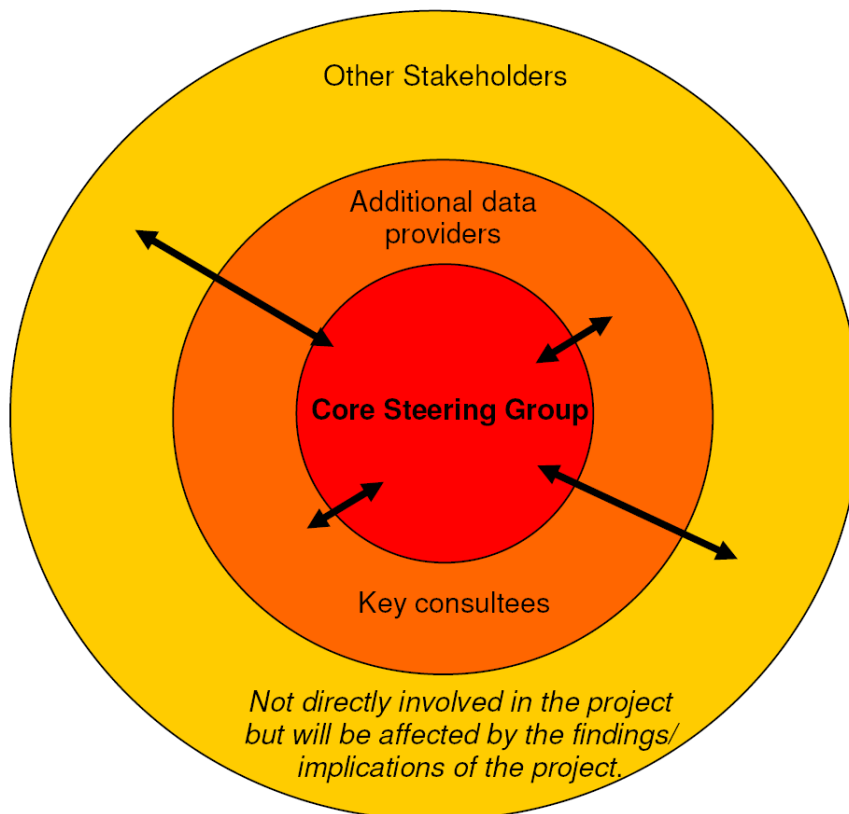
Other Stakeholders (Stakeholders)

- Public
- Riparian Owners
- Developers

N.B: Partners have a role to take responsibility for the decisions or actions, whereas stakeholders are affected by the problem or solution and, as such, hold an interest in the study.

The interconnections between these various partners and stakeholders are illustrated in the following relationship diagram:

Figure 2.1 - Partner Relationship Diagram



2.2 Roles and Responsibilities

The roles and responsibilities of these various stakeholders were also defined following the Initiation meeting. The roles of the *Core Steering Group* members are defined within **Table 2.1** below:

Table 2.1 - Roles and Responsibilities of Core Steering Group

Member	Engagement with....	Role/Method
Councils	Coordination of other Steering Group members	Throughout project life and beyond
	Additional data providers	Assisting RH with data collection
	Other Stakeholders	Meetings/Workshops/Presentations
		Day to day communication
	Implementation of development	
Royal Haskoning	Rest of Steering Group	Data requests/queries
		Steering Group progress meetings
	Presentation	
	Additional data providers	Telephone/Email/Meetings
	Other Stakeholders	Presentation to members - assisting the Council in disseminating the key messages from the SMWP.
Environment Agency	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
Severn Trent Water	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings
South Staffordshire Water	Steering Group	Provision of data
	Other Stakeholders	Either directly through day to day responsibilities or to assist the Council in dissemination of findings

It was established that the Local Councils would be the main contact with the 'outside ring' of partners, including the public, riparian owners and developers, although they would be supported in this role by the other Steering Group members. To enable this approach to be successful all these members were identified to have a responsibility for openness and cooperation within the Core Steering Group, which was identified as being a key requirement.

The second tier of *Additional Data Providers and Key Consultees* was identified to have a role as providers of additional, but not key, data and information. As such they were identified to have a responsibility to correspond with the Steering Group when required (e.g. through the provision of data).

The third tier of *Other Stakeholders* was not identified as holding any data or information for the high level Phase 1 and possibly Phase 2 studies. However, as they would be affected by the implications of the SWMP, the key findings should be communicated to them, for example through presentations before any future Phases (3 and/or 4) were undertaken.

2.3 Engagement Plan

As a result of the discussions with the Steering Group at the start of the commission an Engagement Plan was drafted to summarise the key outcomes. This is included within **Appendix A**.

2.4 Objectives

The main objectives of this Phase 1 SWMP, as defined in the draft Defra SWMP guidance are to:

- Establish a partnership with the Steering Group and additional stakeholders;
- Clarify the roles and responsibilities of partners;
- Draw up an Engagement Plan;
- Determine and map the historic occurrences of surface water flooding across the Study Area;
- Define the areas at greatest risk of surface water flooding and therefore which areas require further investigation as part of Phase 2; and
- Advise the Councils as the 'next steps' for the SWMP.

3 COLLATE AND MAP INFORMATION

3.1 Data Collection and Quality

As the Phase 1 SWMP is a strategic study covering a large geographical area, a key focus has been placed upon the collection and analysis of existing information regarding historic and future surface water flooding. Data has been requested and received from all the partners and a vast majority of the stakeholders identified in Section 2 above. This has been undertaken through direct phonecalls and emails, in addition to the downloading of publically available information on the internet. A full data register of the information received is shown in **Appendix B** (it must be noted that this register includes the information obtained for use in both the SWMP and parallel WCS). Key consultees at this stage have included:

- Stafford Borough Council
- Lichfield District Council
- Tamworth Borough Council
- South Staffordshire District Council
- Cannock Chase District Council
- Staffordshire County Council
- Environment Agency
- Severn Trent Water
- Lichfield and Hatherton Canal Restoration Trust

Although as much information as possible has been collected during this Phase 1 study not all stakeholders and partners were able to provide data useful at a strategic scale. It will therefore be beneficial to use the conclusions of this Phase 1 study as a basis for further discussion with the consultees at the start of the Phase 2 stage. This will assist in the identification of more detailed surface water flood risk and, potentially, mitigation strategies that adopt a partnership approach. Two key consultees who were unable to provide information for this study but who may be able to assist within Phase 2 and to provide comment upon the conclusions of Phase 1 are British Waterways and the Sow and Penk IDB. This will be discussed further within the following Sections of this report.

The main aim of this Phase 1 SWMP is to identify which locations within the Study Area are at highest risk of surface water flooding, based upon available information. There are two main areas into which the collected data has been categorised:

1. The location of historic flooding events; and
2. The locations at highest risk of future flooding events.

The methodology for analysing this information was agreed by the Councils and Environment Agency in March 2010 following a technical note submitted by Royal Haskoning and is discussed in more detail in Sections 3.1.1 and 3.1.2 below. As the Councils are yet to finalise the locations of the proposed development, analysis within this report has focussed upon the main settlements within each of the Local Authority areas. The locations of these settlements are shown in **Figures A1 - A5** within **Appendix C** and match those assessed within the WCS.

Data Quality

As this SWMP is based upon the collection and assimilation of data, an important element was to assess the quality and confidence of the data received. This was undertaken using the data quality scale outlined within the Flood Hazard Research Centre's (FHRC) Multi Coloured Manual. This scale grades data quality based upon the confidence the user can have in its accuracy to give a Data Quality Score (DQS) as shown in **Table 3.1** below:

Table 3.1 - Multi Coloured Manual Data Quality Assessment

Data Quality Score (DQS)	Description	Explanation	Examples given in draft SWMP guidance
1	'Best of Breed'	No better available; unlikely to be improved on in near future	High resolution LiDAR River/sewer flow data Raingauge data
2	Data with deficiencies	To be replaced as soon as third parties re-issue	Typical sewer or river model that is a few years old
3	Gross assumptions	Not invented but deduced by the project team from experience or related literature/data sources	Location, extent and depth of much surface water flooding Operation of unmodelled highway drainage 'Future risk' inputs e.g. rainfall, population
4	Heroic assumptions	No data sources available or yet found; data based on educated guesses	Ground roughness for 2d models

This system has been used to grade the data collected and therefore assists in highlighting the potential shortfalls in the analysis. The background OS Mapping used in this Phase 1 study has been given a DQS of 1. The rest of the data used is discussed further and graded within the relevant sections below.

3.1.1 Historic Flood Event Data

Key Data Sources and Interpretation

The key starting point for this study was to collect as much information regarding the locations of historic flooding as possible. The key sources of this data consisted of the Local Authorities, Staffordshire County Council and Severn Trent Water Limited and the data collected, its source and the assigned DQS are listed in **Table 3.2** on the following page:

Table 3.2 - Historic Flooding Data

Data	Source	Information Included	Extent	DQS
SFRA Shapefiles	Stafford BC*, South Staffordshire DC and Cannock Chase DC	All sources of flooding available at time of SFRA publication.	All Boroughs/ Districts	3
"Historic Flooding Highways Hotspots"	Staffordshire County Council via Stafford Borough Council	Location of all sources of flooding.	Entire Study Area	3
Lichfield 'Hot Spots'	Lichfield DC	Unspecified flooding	Lichfield District	3
Floods2 Database	Severn Trent Water Limited	Sewer flooding (1991 - 2009)	Entire Study Area	3

*This data set covers Stafford Borough, Tamworth Borough and Lichfield District

As all this data has been deemed to be of an equivalent quality it has not been differentiated by source within the analysis. However, it must be appreciated that, due to the nature of this type of data, it is not comprehensive and cannot be quantified or checked in its accuracy. As such it only provides a guide to the areas vulnerable to surface water flooding.

To review the historic flood events they have been mapped, together with the potential development sites within each Local Authority area, shown in **Appendix C (Figures B1 - B5)**. Many of the data sets have been made available in the form of GIS shapefiles and, as such, their locations accurately placed as points on the map. However, as the accuracy of these locations and the reports of flooding cannot be verified, the locations should not be considered definite and, to avoid the blighting of individual properties, the markers on the maps have been expanded in size with each covering a number of properties. Where there are overlaps between the different datasets, the points are overlaid. Care must be taken with these locations as they may refer to the same incident that has been recorded as originating from differing sources within the different data sets.

In addition to the location of the flood event, most of the data sets also state the type of flood event and the date on which the flooding occurred. This enables the events to be split in terms of 'source' and 'recurrence'. As many of the data sets include fluvial flooding as well as surface water, these fluvial events have firstly been removed. The rest relate to the causes of flooding listed on page 7 and have been differentiated on the analysis maps through use of the following symbols:

Figure 3.1 - Flood Event Key

☆	Surface Water
○	Canal
□	Highways
△	Sewer
◡	Artificial Drainage
+	Groundwater
☼	Unknown

The dates of flooding included within the datasets have been used to assess the recurrence, and therefore the persistence of the flood events. In many cases surface flooding occurs as a 'one-off' event that relates to a temporary blockage in a system and/or very unusual rainfall and/or antecedent conditions. Although these events indicate weak points within the system they could be isolated events and therefore may not warrant a full investigation unless associated with other more frequent recurring events. They should however be recognised, especially where they occur in an area associated with other flood events. The repeating flood events indicate problematic locations which require further investigation. These are discussed further in Sections 4 to 8. To illustrate this variation in recurrence the flood events located as points have been colour coded on **Figures B1 to B5** using the methodology shown in **Table 3.3**.

Table 3.3 - Flood Event Regularity Key

Colour	Regularity	Data Classification	Data Source
Red Points	Repeat Occurrence	3+ records within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Orange Points	Occasional Occurrence	2 records within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Yellow Points	Rare Occurrence	1 record within the data set OR As stated	Floods2 SFRA point data Historic Flooding Highways Hotspots database
Blue Points	Exceptional Occurrence	As stated	Historic Flooding Highways Hotspots database

Postcode Area Sewer Flooding Records

One of the datasets of historic flooding, the sewer flooding records included within the SFRA reports could not be marked on the maps in the form of points. This information is only available in the form of postcode areas with an associated number of events. As there is likely to be overlap between this information and the Floods2 database, this dataset has not been included on the printed maps. It is, however, included in the interactive PDFs for reference. Table 3.4 below shows the colour key to the information shown.

Table 3.4 - Postcode Sewer Data Regularity Key

Colour	Regularity	Data Classification	Data Source
Light Red Shading	Repeat Occurrence	10 + records of flooding within postcode area	Postcode Polygons
Light Orange Shading	Occasional Occurrence	5 - 10 records of flooding within postcode area	Postcode Polygons
Light Yellow Shading	Rare Occurrence	1- 5 records of flooding within postcode area	Postcode Polygons
No fill	None	No records of flooding within postcode area	Postcode Polygons

Additional Data Sources

Other sources of historic flooding information have included the West Midlands Regional Flood Risk Appraisal (RFRA)⁸. This has identified some occurrences of surface water flooding within all five Local Authority areas, with particular review of Tamworth and Cannock towns. Although not mapped this information is discussed further within Sections 4 to 8. Unfortunately the River Trent Catchment Flood Management Plan (CFMP) has not yet been finalised so is unavailable for use in this study. The River Severn Catchment Flood Management Plan (CFMP), however, has been finalised and covers the western edge of the study area and the southern half of South Staffordshire District. Although it recognises that surface water is a flood issue within the catchment as a whole it does not identify any particular locations of relevance to this study.

3.1.2 Future Flood Risk Data

As this study relies upon the collection and collation of existing data there are three main sources of information relating to the predicted surface water flood risk that may occur in the future: the Environment Agency's surface water flood map; Defra's ranking of UK settlements; and the feasibility studies for the reconstruction of the Lichfield and Hatherton canals.

Surface Water Flood Map

The Environment Agency have recently commissioned the production of a surface water 'flood map' of the UK. This mapping utilised a fairly crude modelling technique whereby a single rainfall event was run over the topography of the land to determine where surface water may collect and pool. However it does not include underground sewerage and drainage systems, small over ground drainage systems or buildings. The terrain data used for this assessment was also 5m resolution, which is coarser than recommended for accurate surface water management analysis. This resolution, for example, does not identify important surface water flow routes such as roads. It therefore indicates the susceptibility of an area to surface water flooding and does not prescribe exact locations. As such this data set has been ascribed a DQS of 2.

⁸ West Midlands Regional Assembly Regional Flood Risk Appraisal Update FINAL February 2009

For this Phase 1 assessment of available data this map has been used to assess, on a more comparative rather than accurate basis, locations at risk of possible future flooding. Three bands of flooding are defined in these flood maps, indicating 'less' to 'more' susceptibility to surface water flooding, shown in varying grades of purple. These extents for the study area are shown in **Figure C1, Appendix C**.

Due to the inaccuracies of this data at a small scale the flood zone outlines have not been used to assess individual development areas or settlements, or shown on a scale smaller than the study area. Instead, an alternative approach has been agreed with the Environment Agency to assist in interpretation of the data. This approach converts the flood risk posed to the key settlements⁹ from a Flood Zone extent to a colour coded flag using the following methodology:

1. Determine the number of properties located within the largest surface water flood zone extent within the settlement in question by overlaying the National Property Dataset (NPD) with the surface water 'Less' susceptible extent. (Using this largest flood zone provides a worst case estimate of properties at risk);
2. Colour the flag dependent upon the number of properties at risk - see the colour banding shown in **Table 3.5**. The numbers of properties chosen to fall within each band have been selected as a representation of the variation across the study area in question. This is based upon our judgement of the study area and range of results - there is no set standard for each colour band, although the splits used in this study were agreed with the Environment Agency in advance. We believe this banding highlights the settlements at highest comparative risk as compared to the other settlements within the study.;
3. Attach a number to the flag indicating the number of properties at risk; and
4. Overlay these flags onto the surface water flood maps (**Figures B1 - B5**) with the historic flood event data.

Table 3.5 - Surface Water Flood Map Flag Classifications

Colour of Flag	Number of Properties at Risk
None	0
White	1 - 20
Purple	21 - 50
Blue	51 - 100
Yellow	101 - 350
Orange	351 - 999
Red	1000+

As this is a simple approach and the area selection for each of the settlements may include too many properties, including those surrounding the settlement in question, or not enough (the NPD is cropped to the study area and therefore the selections will not be accurate for those areas located on the boundaries). However, we believe it, in general, offers a conservative estimate and therefore a useful guide to compare different areas within the study region.

⁹ Due to the extent of the study area it was not possible to analyse all the settlements within each Local Authority area. Instead, focus has been placed upon the key settlements, as shown on **Figures A1 - A5 in Appendix C**.

Defra's Assessment

Following the completion of the Environment Agency's surface water flood map, and in order to assist with the prioritisation of funding, Defra analysed the EA's results. The output from this analysis was a national ranking of settlements in order of surface water flood risk. The analysis provided two key figures - the number of properties at risk within the settlement and the rank of the settlement within the country (with "1" indicating the settlement at highest risk of surface water flooding, out of a total of 4,350).

In addition to the flag system developed for use in this study, we have also included reference to Defra's analysis. However there are three main uncertainties with this data which results in differing conclusions to our own:

1. The numbers are rounded;
2. Defra split the entire UK into sections, which will cover different geographical areas to our settlement specific selections; and
3. It is not clear which of the surface water flood extents were used in Defra's analysis or the date of the NPD used.

To avoid confusion we have not mapped the numbers resulting from Defra's analysis amongst our own, although they are included, for reference, in Sections 4 to 8.

It must be noted that the housing figures provided from Defra's analysis are, in many cases significantly different to the number produced within our 'flag' analysis. This could be the result or combination of any of the three uncertainties listed above and highlights that the numbers associated with the flags and our analysis are worst case estimates. Rather than providing an empirical answer, they should be purely used to provide guidance as to which settlements should be assessed further with regards to surface water flood risk. For further information regarding the methodology used in Defra's analysis please see their website¹⁰

Canal Restoration

All development has the potential to exacerbate surface water flooding from both additional runoff and the blocking of existing drainage routes. However, there is an additional type of development planned across the southern areas of the study area which may also impact on the surface water flooding regime, namely the reconstruction of the Hatherton and Lichfield canals. This construction may assist in alleviating surface water flooding through acceptance and conveyance of surface water discharge which would also provide a source of water to top up canal water levels. Appropriate sizing of new culverts for existing watercourses could be used for attenuation of water course peak flow rate and source control.

Whilst the restored canals can provide positive benefits in any surface water management regime there are also risks which will need to be considered. These include overtopping of the canal in extreme rainfall events or flooding risk associated

¹⁰ <http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/sw-methodology.pdf>

with new culverts that have not been provided with suitable capacity at watercourse crossing points. Another potential issue raised by the Lichfield and Hatherton Canal trust is that there is a high probability that the surface water sewer draining all of southern Lichfield is currently located in the bed of the proposed Lichfield canal. To restore the canal this pipe will require removal and therefore cooperation and agreement between STWL, Lichfield District Council and the Canal Trust

It is therefore essential that the Canal Trust are considered within any surface water management regime. The associated risks and effects are outlined within the feasibility studies for the two canals, which are discussed further, where relevant, within Sections 4 to 8¹¹.

3.2 Mapping and GIS

As part of a Phase 1 SWMP the draft SWMP guidance recommends the production of a number of maps of the study area, as discussed below and included within **Appendix C**. In addition, we have provided Summary Sheets highlighting the key sources of flood risk on a smaller scale and have included recommendations regarding any requirements for further assessment. These sheets focus upon the key settlements within each of the Local Authority areas, as shown in **Figures A1 - A5** within **Appendix C** and discussed within Section 3.1. All the datasets used within the following maps will also be provided with the final report in GIS format to enable the Councils to mix and match the various shapefiles to suit their requirements.

3.2.1 Surface Water Flooding

All the available information regarding both historic incidences of surface water flooding and future risk has been mapped and recorded within a GIS. The aim of this is to assist the Local Authorities and other Partners in developing their understanding of the existing surface water flood risk situation within the study area. Local Authority specific maps have been produced showing the following information:

- Locations of historic flood events, indicating type and recurrence of flooding;
- Flags indicating the vulnerability of each settlement to future flooding and the number of properties at risk, as located within the Environment Agency's 'Less' surface water flood extent;
- Locations of Main Rivers and Canals; and
- Potential development sites as provided by each of the Local Authorities.

The aim of these maps is to provide each Local Authority with a visual representation of their Borough or District which illustrates the areas that have experienced the highest density of historic surface water flooding events and the settlements which are most vulnerable to experiencing future surface water flood events, based upon the data available and the methodology outlined in Section 3.1.

¹¹ This can be viewed in more detail at <http://www.lhcr.org.uk>

3.2.2 Flood Risk Assets

As stated within the draft SWMP guidance, one of the recommendations of the Pitt Review is that:

“Local Authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition”

Recommendation 16 of the Pitt Review

As part of this SWMP, data has been collected regarding a number of flood risk management and drainage assets. To assist the Councils in meeting this recommendation we have mapped this data, highlighting which organisation owns each asset and is therefore responsible for maintenance, as shown in **Figure C2 (Appendix C)**. Within GIS this information can be plotted alongside the layers showing historic flooding and therefore may assist the Phase 2 analysis and by matching up flood events with assets. Unfortunately, due to the conditions of their confidentiality statement, we are unable to display the locations of STWL’s sewers. We recommend the Councils look to obtain this information for their own reference.

3.2.3 SUDS Map

For all developments Sustainable Drainage Systems (SUDS) will be required to minimise surface runoff and therefore not increase flood risk elsewhere. As such the application of SUDS techniques is a key recommendation for all settlements and development sites. PPS25 recommends runoff from developed sites does not exceed Greenfield runoff. For the Local Authority areas in question the Environment Agency have the following current requirements for surface water run-off:

- a) Greenfield developments – the rate of surface water run-off should not exceed the existing Greenfield run-off rate, the general accepted rate for annual run off is considered to be approximately 5l/s/ha in this area (unless demonstrated otherwise).
- b) Brownfield redevelopments – a minimum of 20% reduction in flows when compared to the historic run-off rates, although further betterment is strongly encouraged.
- c) Redevelopment sites situated at an upstream point of a catchment subject to significant flood risk (site-specific locations) – run-off to be limited to less than Greenfield rates where possible in order to provide wider flood risk reduction downstream.

In addition, a result of the implementation of the Flood and Water Management Act, the right to connect surface water to a public sewer has been removed. As a result, STWL are no longer obliged to accept new surface water connections to their network (although they may consider applications on an individual basis). As such almost all surface water must be collected and managed on site through the implementation of SUDS storage and infiltration systems. The underlying geology of each site has implications for the types of SUDS techniques that will be appropriate at that site. In addition, the proximity of the site to any water supply aquifers and the susceptibility of

the underlying strata to pollution must be accounted for. The various techniques and applications are discussed in detail with the WCS report associated with this SWMP and should be that referenced for further information, which includes maps and a constraints matrix illustrating the restrictions on SUDS application for each of the key development sites within the study area, including discussion of Groundwater Vulnerability (GWV) and Source Protection Zones (SPZ). Please see Figures 5.8, 6.8, 7.8, 8.8 and 9.8 within the WCS report¹².

3.2.4 Summary Sheets

To assist the Local Authorities with their interpretation of these surface water flood risk maps, the information shown has been captured and summarised for each of the key settlements within settlement specific summary sheets, contained within **Appendix D - H**. These sheets outline the risk to both the settlement as a whole and to individual key development sites for historic, future and overall flood risk using the methodology outlined below. A traffic light colour code is provided for historic, future and overall flood risk to indicate the action that should be taken for the site, as shown in **Table 3.6**:

Table 3.6 - Surface Water Flood Risk Traffic Light Colour Code

Colour	Meaning
Red	Area should be investigated further as part of a Phase 2 SWMP or site specific study.
Yellow	Area would benefit from further investigation. Development should be reviewed with reference to the surface flood maps and causes of historic flooding should be investigated.
Green	Based on current data no detailed further analyses required, although the topography of individual sites should be reviewed before development and all new development should utilise SUDS methods.

An annotated example template of a summary sheet is shown in **Figure 3.2**. The tables to which the annotations refer follow the example figure.

¹² Southern Staffordshire Phase 2 Water Cycle Study Draft Report, Royal Haskoning, April 2010

Figure 3.2 - Summary Sheet Template

Snapshot of key settlement, taken from Figures B1 - B5.

Map key, taken from Figures B1 - B5.

Historic Flooding section details the occurrences of historic flooding shown within and around the settlement in question.

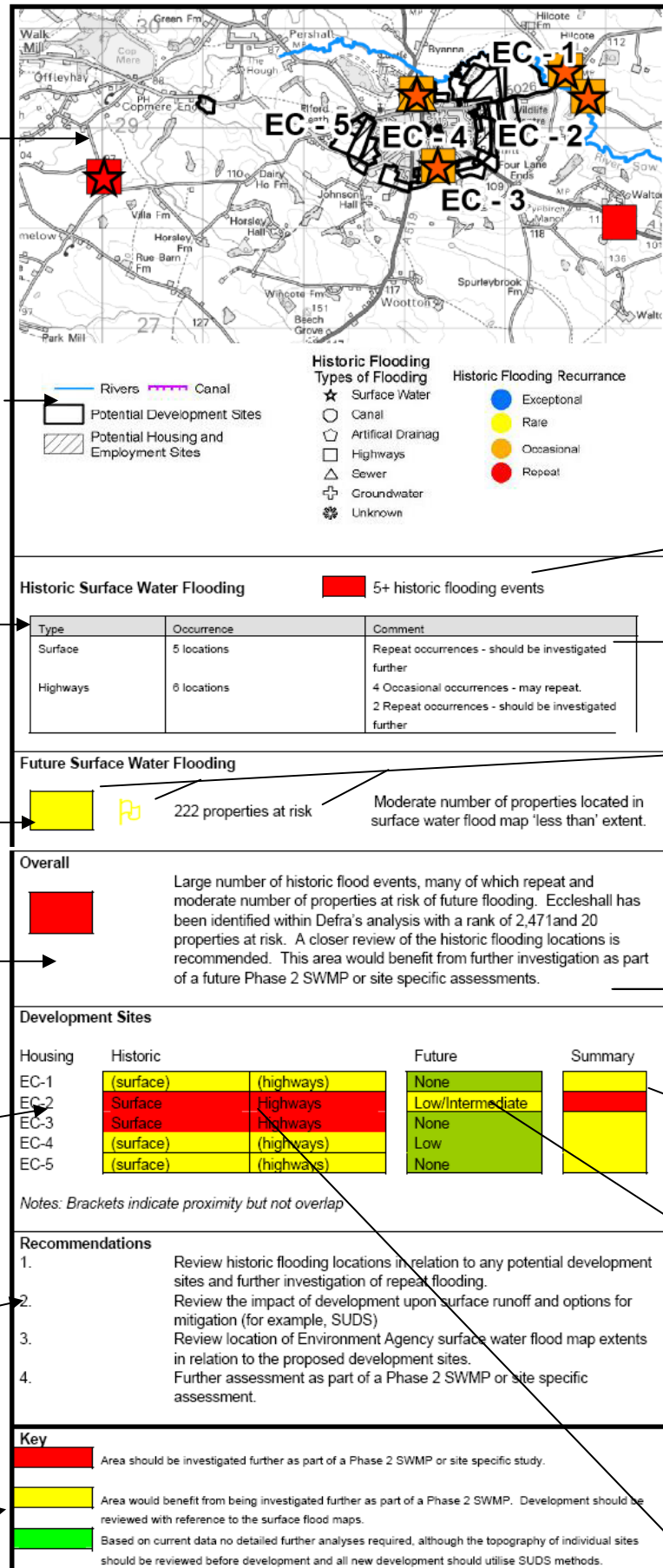
Future Flooding section outlines the results from the conversion of the Environment Agency's surface water flood map into a flagged system (see Section 3.1.2 for more detail)

Overall Flooding section summarises the combined results for the settlement, accounting for both historic and future flooding.

Summary of key **development sites** shown within the settlement.

Recommendations are provided for the settlement as a whole.

Key refers to the implications of each of the box colours.



Number of historic flooding occurrences marked as points on the map snapshot shown above. Colour code is explained in Table 3.7

Further explanation of all historic flooding events within and around the key settlement.

Box colour explained in Table 3.8.

Flag colour explained in Table 3.5. Number of properties taken from comparison of EA surface water flood map and NPD (RH analysis)

Box colour is explained in Table 3.9

Text summarises the conclusions shown above, plus the results of Defra's analysis for the settlement.

Summary box colour is explained in Table 3.9 as a combination of Historic and Future

Future box colour refers to the EA surface water flood map extent in which the development site is either wholly or partially located: Green - overlap with 'Less' flood extent or no overlap. Yellow - overlap with 'Intermediate' flood extent. Red - overlap with 'more' flood extent.

Historic box colour explained in Table 3.7

Both the settlements (as a whole) and individual key development sites are assigned an historic flood risk traffic light colour using the methodology outlined in **Table 3.7**. In addition, a tabulated commentary is provided which summarises the type, recurrence and implication of each of the historic flood events within a settlement.

Table 3.7 - Assessment of Historic Surface Water Flood Events

Colour	Settlement Analysis ¹	Development Site Analysis
Red	Settlement contains 5+ historic flooding events	Overlaps with 1+ historical flooding events ²
Yellow	Settlement contains 1-5 historic flooding events	Located in proximity to a historic flooding event
Green	Settlement contains no records of historic surface water flood events, or contains 1 rare surface water flood event.	No historic flooding events in proximity.

NOTES:

1 - As the exact locations of SFRA sewer flooding events are not recorded at a scale smaller than a postcode area, this data is not utilised within this analysis. It is, however, included within the commentary of historic flood risk to the settlement.

2 - Due to the required size of the markers used for historic flooding on the area maps, an event overlapping with the edge of a development site may not indicate historic flooding has occurred within the site boundaries.

Future surface water flood risk is shown on the maps in the form of the coloured flags. The summary sheet identifies the colour of this flag and number of properties at risk. To bring the classification in line with the historic flooding, a three tier traffic light colour code is assigned based on the classifications shown in **Table 3.8**, condensing the full range of flag colours referenced in **Table 3.5**.

Table 3.8 - Assessment of Future Surface Water Flood Risk

Colour	Reason
Red	351+ properties at risk (Orange and Red flags)
Yellow	20 - 350 properties at risk (Purple, Blue and Yellow flags)
Green	<20 properties at risk (no or white flag).

An overall colour code is assigned to each of the settlements and key development sites using the following matrix:

Table 3.9 - Overall Surface Water Flood Risk Classification

		Historic Flooding Classification		
		Green	Yellow	Red
Future Flooding Classification	Green	G	Y	Y
	Yellow	Y	Y	R
	Red	Y	R	R

4 STAFFORD BOROUGH

4.1 Surface Water Flood Risk

The development sites and settlements assessed within the Borough are shown on **Figure A1**.

Historic Flooding

Figure B1 illustrates a fairly large number of historic surface water flood occurrences across the Borough, including sewers, highways and surface water, although one isolated incidence of canal overtopping on the Shropshire Union has also been identified. A high proportion of these flood events are listed as occasional or repeat occurrences and/or show overlaps between different flood events (although these overlaps may indicate duplications between different data sets). A number of the flood events are scattered across the rural areas of the Borough but clusters are evident within the main settlements, with Stafford town, Stone and Eccleshall being the most prominent (identified with 25, 9 and 9 incidences of surface water flooding respectively). The classification of the postcode areas with regards to sewer flooding also indicates a prominence of flood events within the urban areas and a fairly high occurrence of sewer flooding across the Borough as a whole.

Future Flooding

The surface water flood map, **Figure C1**, indicates areas in which surface water flooding is potentially a high risk, with the areas surrounding Gnosall, Eccleshall, Stafford and Weston being the most prominent. Away from the main river valleys this illustration highlights the low lying historically marshy areas of ground across the middle swathe of the Borough, which does roughly correlate with the historic flooding records.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B1**, identifies Stafford town and Stone as being the areas of highest risk with over 4,000 properties in Stafford being located within the Environment Agency's "Less" flood extent (including most of the adjoining villages of Brocton and Derrington). Defra's analysis ranks Stafford as 220 and Stone as 606¹³. For further information regarding the derivation of these numbers, please see Section 3.1.2. Beyond these two main towns, a further seven settlements have been highlighted with yellow flags indicating a 'moderate' flood risk of between 100 and 350 houses within the flood extent, including Eccleshall, Yarnfield, the Bridgeford Area, Salt and Weston, Gnosall, Hixon and Stowe and Haywood.

¹³ The lower the rank number, the higher the flood risk.

Overall

The surface water Summary Sheets for Stafford Borough are included within **Appendix D**.

Overall the following six settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

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

The reason for their classification varies between the settlements, with most suffering from both historical and the potential for future flooding. However, for the more rural areas, such as Walton and Norton Bridge, the flooding is fairly dispersed around an area much larger than the settlements. In these locations it may be more beneficial for the Council to analyse the occurrences on an individual basis and when/if a development site is progressed.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see the summary sheets in Appendix D for individual site references). However, there are also a number of development site classified as 'red', either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding (namely sites SF-12, SF-f, EC-2, GH-1, HI-1, HI-3, HA-a, HA-b, HA-c and SN-3). It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if possible, reduced.

4.2 Surface Water Management

The high number of sewer flooding incidences within the Borough indicates a general exceedence of capacity within the sewerage network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although STWL have stated that no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to

ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that it is the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A large majority of the flood occurrences within the towns are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore assist in rectifying the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is held with British Waterways to determine whether the highlighted event is a single occurrence or whether any improvements to surface water management practices within the Borough would reduce the risk of a repeat event in the future.

4.3 Recommendations

Following the analysis within this Phase 1 SWMP, the following recommendations are concluded for Stafford Borough. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites classified as red consist of: SF-12, SF-f, EC-2, GH-1, HI-1, HI-3, HA-a, HA-b, HA-c and SN-3;

4. The Council should undertake Phase 2 SWMP modelling for the town of Stafford (this is particularly important due to the identification of the town as a Growth Point and the resulting high number of development proposals);
5. The Council should consider undertaking a Phase 2 SWMP in the future for the town of Stone. The necessity for this is dependent upon the level and location of final development planned for the town and the availability of the necessary data;
6. The Council and developers should review the six settlements - *Stafford, Eccleshall and Copmere End, Salt and Weston, Stone, Walton and Norton Bridge and Yarnfield* - identified as being classified as having a high overall risk of surface water flooding within the analysis (highlighted as red in the summary sheets) when considering the promotion of development sites within those areas;
7. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
8. For the settlements not included in the more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
9. The Council 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;
10. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"¹⁴;
11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

¹⁴ <http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm>

5 LICHFIELD DISTRICT

5.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A2**.

Historic Flooding

Figure B2 illustrates a fairly large number of historic surface water flood occurrences across the District, the majority of which relate to highways, surface or unknown flooding. A high number of these events have been listed at rare occurrences, especially in and around Lichfield City. As this area was badly affected during the summer 2007 rainfall event (to which many of these records relate), this indicates that the surface water drainage network cannot cope with extreme events. The recording of such incidences is likely to have increased following this event, thereby leading to a relatively high number of individual occurrences. In addition to the flooding events mentioned above, some areas of the District have also been affected by sewer flooding and canal overtopping. Sewer flooding in particular is prominent to the northwest of the District, around the Armitage area. Canal overtopping has occurred in a couple of locations on the Birmingham and Fazeley canal, close to the border with Tamworth Borough.

A number of the flood events are scattered across the rural areas of the District but clusters are evident within the main settlements, with Lichfield City and Burntwood being the most prominent (reporting 12 and 15 incidences of surface water flooding respectively). Other areas experiencing high numbers of historic flooding incidences include Armitage and the Longdons, Elford, Mile Oak and Fazeley and Whittington.

Future Flooding

The surface water flood map, **Figure C2**, indicates areas in which surface water flooding is potentially a high risk, with a swathe of northern and eastern Lichfield District, from Rugeley past Alrewas towards Tamworth being the most prominent. Away from this area Burntwood and Lichfield City are also identified as being in particularly susceptible areas.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B2**, identifies Lichfield City as the area of highest risk with over 2,000 properties being located within the Environment Agency's "Less" flood extent. Defra's analysis ranks 'Lichfield' as 329¹⁵ (it is unclear whether any of the District, beyond Lichfield City, is included within Defra's analysis). Burntwood, Mile Oak and Fazeley, Fradley and Armitage and the Longdons have been identified as having between 350 and 1,000 properties at risk each (illustrated by the orange flags). For further information regarding the derivation of these numbers, please see Section 3.1.2.

¹⁵ The lower the rank number, the higher the flood risk.

Overall

The surface water Summary Sheets for Lichfield District are included within **Appendix E**.

Overall, the following seven settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

- Lichfield City;
- Armitage and the Longdons;
- Burntwood;
- Elford;
- Little Aston;
- Mile Oak and Fazeley; and
- Whittington

The reason for their classification varies between the settlements, although most suffer from both historical and the potential for future flooding.

A number of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see Appendix E for individual site references). However, some of the development sites are classified as 'red', either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding (namely 125, 1, 109, 102, 69, 426 and 96). It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

5.2 Surface Water Management

A large majority of the flood occurrences are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). In storm situations, such as the summer 2007 event, a number of highways flooding incidences may have resulted from the backing up of surface water drains when the water level within the watercourses has risen above the outfall height. It is recommended that the repeat occurrences and those grouped together within the urban areas are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

The high number of sewer flooding incidences to the northwest and west of Burntwood indicate a general exceedence of capacity within the network. It is recommended that

discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that it is the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is held with British Waterways to determine whether the highlighted event is a single occurrence or whether any improvements to surface water management practices within the District would reduce the risk of a repeat event in the future.

5.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Lichfield canal from Huddlesford Junction on the Coventry Canal to the Ogleby Junction on the Birmingham Canal Navigations, a distance of 7 miles, as shown in **Figure 5.1**. The feasibility study for the restoration, completed in July 2009, identifies minimal flood risk resulting from the scheme. However there are four watercourse crossings within the currently plans - two across the Darnford Brook near Huddlesford, one over the Pipehill Brook near Pipehill pumping station and one on the Crane Brook, just south of the A5. The study states that there are no planned combined canal and watercourse, flood channels and/or tunnels in the scheme.

Wherever a new crossing is made over an existing watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. As stated within the feasibility report, a Level 2 FRA is recommended for the scheme to ensure flood risk is not increased elsewhere. The canal was historically considered to be part of the surface water drainage network. The 1954 Act of Parliament which permitted its abandonment as a navigation required its retention for land drainage purposes. Culverting was permitted subject to approval of the then Trent River Authority (now the Environment Agency). It is not known whether at this time there were facilities to allow excess water to discharge from the canal to the Darnford Brook.

The whole length of former canal within Lichfield downstream of Chesterfield Road has been culverted to a point adjacent to the Tamworth Road next to the A38 trunk road. At this point the culvert follows a different route, discharging to the Darnford Brook. The public surface water sewer and highway drainage systems, which drain the whole of the southern portion of Lichfield, discharge via this culvert. STWL has undertaken hydraulic modelling of whole drainage system to the point of discharge into the Darnford Brook,

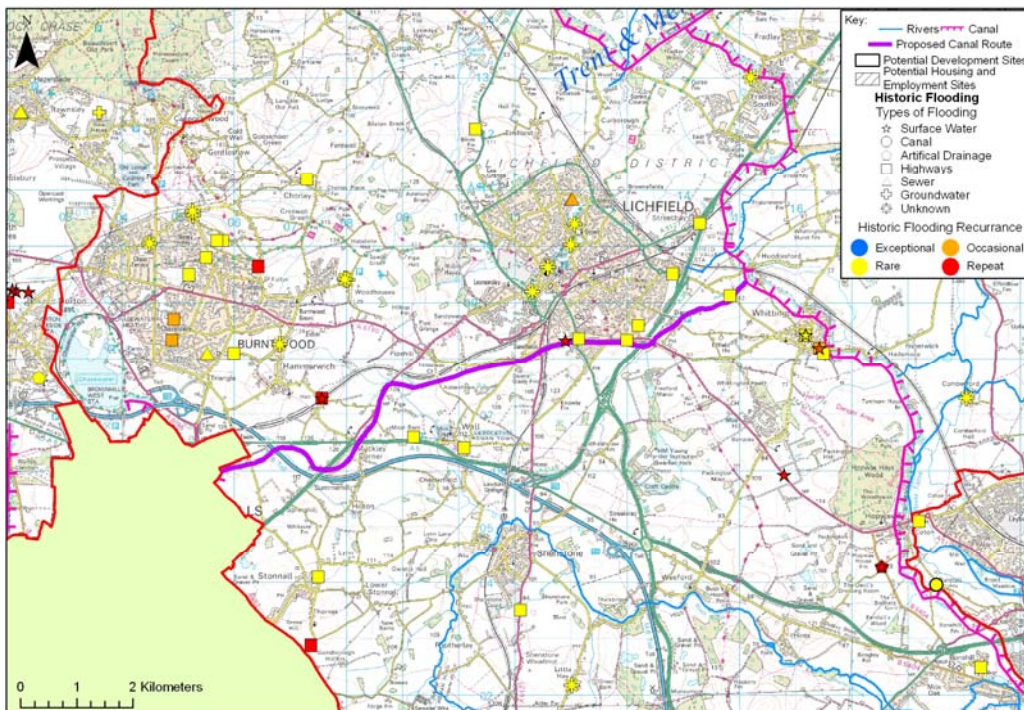
which predicts that the culvert has capacity to convey run off from a 1 in 30 year rainfall event without flooding. The Lichfield and Hatherton Canal Trust intend to use these flow rates to size the canal flow control structures.

The replacement of the culvert with the canal provides a potential opportunity to alleviate flood risk at historic flood locations in the south of Lichfield. If Lichfield is modelled within a Phase 2 SWMP, further detail may be provided both on local flooding within southern Lichfield and interlinkages between the current culvert, future canal and the Darnford Brook.

The Coventry canal is located in very close proximity to the Whittington flood events and a number of canal overtopping events have occurred to the south of Huddlesford junction to the south as shown in **Figure 5.1**. The potential impact of flows from the canal restoration on the Coventry canal should be assessed.

Given the interaction between canal and surface water sewers and watercourses it is recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 5.1 - Historic Flood Events in Proximity to the Proposed Route of the Lichfield Canal



N.B, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website¹⁶

¹⁶ This can be found at <http://www.lhcrt.org.uk/lich.htm>

5.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Lichfield District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. This should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
2. Consultation should be held between the Council, STWL and the Lichfield and Hatherton Canal Restoration Trust to investigate potential joint surface water mitigation methods;
3. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
4. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites classified as red consist of: 125, 1, 109, 102, 69, 426 and 96;
5. The Council should undertake Phase 2 SWMP modelling for the city of Lichfield (due to the high risk of surface water flooding, the impact of the summer 2007 floods and requirement for new growth);
6. The Council and developers should review the seven settlements - *Lichfield City, Armitage and the Longdons, Burntwood, Elford, Little Aston, Mile Oak and Fazeley and Whittington* - identified as being classified as having a high overall risk of surface water flooding within the analysis (highlighted as red in the summary sheets);
7. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs;
8. For the settlements not included in more detailed, Phase 2 SWMP the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA;
9. The Council 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;
10. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"¹⁷;
 11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
 12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets;
 13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

¹⁷ <http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm>

6 TAMWORTH BOROUGH

6.1 Surface Water Flood Risk

The development sites and settlements assessed within the Borough are shown on **Figure A3**.

Historic Flooding

Figure B3 illustrates a relatively low number of historic surface water flood occurrences across the Borough, as compared to the rest of the study area. Many of the events that have occurred relate to the exceedance of sewer capacity, although some incidences of highways flooding and canal overtopping have also been included. However, Tamworth is dissected by a number of large watercourses and, as such, incidences of surface water flooding may have incorrectly been identified as fluvial flooding. In addition high flows of surface water runoff may result in fluvial flooding with complex interactions between the urban drains and the watercourses. Due to Tamworth's location downstream of other Local Authorities, the impact of surface water runoff from those areas must also be considered. The area of Fazeley is one such location where there are numerous surface water flood events located upstream and very close to the border of Tamworth.

Future Flooding

The surface water flood map indicates large areas in which surface water flooding is potentially a high risk within Tamworth, with nearly 3,500 properties at risk. Tamworth has been given a rank of 330 within Defra's analysis¹⁸. For further information regarding the derivation of these numbers, please see Section 3.1.2. These results relate to the downstream location of the town within the catchments and therefore extensive low lying land. This is illustrated in **Figure C1**, with the downstream northwesterly corner of the Borough being most prominent, in addition to the northeasterly section.

Tamworth has been identified within the West Midlands RFRA as being at Medium probability of surface water flooding and medium consequence, although its probability of fluvial flooding is considered much higher.

Overall

The surface water Summary Sheets for Tamworth Borough are included within **Appendix F**. Unlike the other Local Authority areas Tamworth could not be split into separate settlements. To increase the detail of the assessment, the Borough was therefore split into five main sections within the Summary Sheets.

The south west and central sections of the Borough have been identified as being at highest risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation. Due to the interlinkages between all the drainage networks within this highly urban area and the location of large

¹⁸ The lower the rank number, the higher the flood risk.

development sites on the periphery and upstream edge of the Borough, it is highly recommended that the whole town is modelled further as part of the Phase 2 SWMP.

Some of the development sites have been classified as either 'yellow' or 'red' and would therefore benefit from some further investigation, possibly as part of a site specific FRAs, although further modelling of the Borough would clarify a number of these issues. These sites consist of:

Housing/Additional: 1, 12, 13, 15, 25

Employment: 1, 3, 5, 6, 16, 17 and 18

For these sites, site specific FRAs should be funded by the developer and approved by the Environment Agency prior to site progression. It is recommended that all sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

6.2 Surface Water Management

The relatively high number of sewer flooding incidences within the Borough (both individually marked on the maps and shown by the postcode shading) indicates a general exceedence of capacity of the sewerage network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments (by the owner). Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that it is the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A number of other flood occurrences within the towns are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

Incidences of canal overtopping are the responsibility of British Waterways (in conjunction with other authorities dependent upon the cause of the overtopping). Following the completion of this Phase 1 SWMP it is recommended that discussion is

held with British Waterways to determine whether the highlighted events are single occurrences or whether any improvements to surface water management practices within the Borough would reduce the risk of a repeat event in the future.

6.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Tamworth Borough. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The Council should undertake Phase 2 SWMP modelling for the town of Tamworth (to improve understanding as to the interactions between the surface water and fluvial flows);
2. All development sites in the settlements within Tamworth should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
3. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
4. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites in question are: 1, 12, 13, 15, 25 (Housing/Additional) and 1, 3, 5, 6, 16, 17 and 18 (Employment);
5. As part of site specific FRAs, developers should consider the flood events located upstream of and close to the Borough boundaries when reviewing potential flood risk to individual development sites. The Council should consider such risks when promoting areas of the town for development;
6. The Council 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;
7. For all development sites not included in the more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
8. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the

appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;

9. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
10. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

7 SOUTH STAFFORDSHIRE DISTRICT

7.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A4**.

Historic Flooding

Figure B4 illustrates a fairly high number of historic surface water flood occurrences across the District, including a high incidence of surface water and highways flooding events, although a number of unknown events are also included. A high proportion of these flood events are listed as occasional or repeat occurrences and/or show overlaps between different flood events (although these overlaps may indicate duplications between different data sets). A number of the flood events are scattered across the rural areas of the District but clusters are evident within and around most of the main settlements, with Penkridge, Wombourne, Codsall and Perton being the most prominent, (recorded as hosting 12, 18, 17 and 13 incidences of surface water flooding respectively). The classification of the postcode areas with regards to sewer flooding also indicates a prominence of flood events within the central swathe of the District.

Future Flooding

The surface water flood map, **Figure C4**, indicates areas in which surface water flooding is potentially a high risk, with the areas to the north and centre, corresponding to the locations identified above being the most prominent. Away from the main river valleys this illustration highlights the low lying historically marshy areas of ground to the northern area of the District around Penkridge and Gailey.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B4**, identifies Perton, Codsall, Wombourne, Penkridge and Great Wyrley and Cheslyn Hay as being the areas of highest risk with over 1,100 properties in Perton, over 350 in Codsall, over 600 in Wombourne, nearly 400 in Penkridge and nearly 1,000 being located within the Environment Agency's "Less" flood extent. Defra's analysis in particular identifies Wombourne with a rank of 637 and Great Wyrley as 538¹⁹. Beyond these main settlements, a further four villages have been highlighted with yellow flags indicating a 'moderate' flood risk of between 100 and 350 houses within the flood extent, including Brewood, Coven and Four Ashes, the area around Featherstone, Brinsford and Coven Heath and Kinver. For further information regarding the derivation of these numbers, please see Section 3.1.2.

Overall

The surface water Summary Sheets for South Staffordshire District are included within **Appendix G**.

¹⁹ The lower the rank number, the higher the flood risk.

Overall the following five settlements have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation:

- Codsall;
- Great Wyrley and Cheslyn Hay;
- Penkridge;
- Perton; and
- Wombourne.

All of these settlements suffer from both historical flooding and the potential for future flooding.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA funded by the developer and approved by the Environment Agency prior to site progression. However, there are a couple of development sites classified as 'red' (6:0004:001 and 44055 in Coven and Four Ashes; 6:0013:001 and 6:0013:002 in Featherstone, Brinsford and Coven Heath; 041 and 6:0002:001 in Great Wyrley and Cheslyn Heath; and 151 in Wombourne), either due to an overlap with historic flood events and/or overlap with areas of the Environment Agency's flood map classified as 'More' susceptible to surface water flooding. It is recommended these sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

7.2 Surface Water Management

A large majority of the flood occurrences are identified as highways flooding. This may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the settlement, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of any modelling carried out within a Phase 2 SWMP.

Another key occurrence of flooding is simply listed as 'surface water'. The exact cause of this is unknown and may be linked to any of the routes of surface water drainage. However, given the agricultural nature of this District it may be linked to direct surface runoff from the land. If so, this may be controlled through the use of appropriate agricultural practices.

Where sewer flooding incidences have been identified within the District, there is an indication of general exceedence of capacity within the network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in

general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

SUDS are therefore an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the required developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated. The Flood and Water Management Bill states that it is the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

7.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Hatherton canal from the Hatherton Junction at Calf's Heath on the Staffordshire and Worcestershire Canal to the Wyrley and Essington Canal at the currently disused Lord Hay Branch. This route, which passes through both South Staffordshire and Cannock Chase Districts is shown on **Figure 7.1**

The original route, which would have connected to the Cannock Extension Canal, has been changed due to ecological concerns. A supplementary study for restoration (completed in 2009) confirmed the feasibility of an alternative route with connection to the currently disused Lords Hay branch. The study identified a number of locations where the route of the canal will be in proximity to local watercourses, in addition to a requirement for it to cross over the Wash Brook. The design of the canal must therefore ensure that flood water from the Brook cannot enter the canal and vice versa. In addition, where the canal is required to cross over a watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. Any unintended interaction between watercourses and canals can have potentially devastating consequences, and may result in the canal breaching its banks. Such an event can have far reaching effects downstream both within and beside the existing canal network. It is therefore important to ensure that there is no unplanned interaction between the canal and the watercourses. The culvert provided to drain the Wash Brook under the canal will need careful sizing to ensure adequate capacity.

The length of canal from Hatherton Junction to the south of Cannock remains in use for land drainage purposes and provides a supply of water to the Staffordshire and Worcester Canal. The proposed route which extends to the south and east of Cannock clashed with the Birmingham Northern Relief Toll Road Motorway. At the time of motorway construction, culverts were provided to enable the future canal to pass under the motorway. It is therefore recommended that the impact of canal restoration upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in close proximity to a number of historic flood events around the south of Cannock and the boundary of South Staffordshire District, it will be important to ensure that no unplanned additional surface water can enter the canal (either from overland flow or watercourse flooding).

It is recommended that the impact of the scheme upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in proximity to a number of historical flood events around the south of Cannock and the boundary of South Staffordshire District, as shown in **Figure 7.1**, it will be important to ensure that a repeat of any of these events will not enter the canal. Due to the proximity of the proposed canal to the existing urban area of Cannock and Great Wyrley and a number of potential development sites it must be ensured that no additional surface water can enter the canal (either from overland flow or watercourse overtopping) as this may cause the canal to breach. If Cannock is modelled within a Phase 2 SWMP, further detail may be provided on the flooding within this area and the interlinkages between the surface water drainage and minor watercourses. This should be reviewed with reference to the potential impacts within South Staffordshire District.

However, canals can be a useful destination for surface water runoff if it is planned and factored into the design from the start. Due to the general shortage of water supply within the area (see the WCS), surface water drainage may assist in feeding the new canal system. It is therefore recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 7.1 - Historic Flood Events in Proximity to the Proposed Route of the Hatherton Canal



NB, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website²⁰

²⁰ This can be found at <http://www.lhcart.org.uk/hatherton.htm>

7.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for South Staffordshire District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. . As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer. The sites highlighted in red consist of: (6:0004:001 and 44055 in Coven and Four Ashes; 6:0013:001 and 6:0013:002 in Featherstone, Brinsford and Coven Heath; 041 and 6:0002:001 in Great Wyrley and Cheslyn Heath; and 151 in Wombourne);
4. The Council should review the surface water flooding situation within Penkridge and Wombourne, with reference to the location of development sites to be progressed. If necessary, further analysis of the settlements as a whole should be undertaken and funded by the Council or by developers on a site specific basis, as appropriate;
5. All development sites in the settlements highlighted within this report (Penkridge, Wombourne, Codsall, Great Wyrley, Cheslyn Hay and Perton) should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
6. For the settlements not included in a more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
7. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding

may be available through Defra to undertake such initiatives via their “Farming Floodplains for the Future Scheme”²¹;

8. The Council (or appropriate owner) should ensure that the rural watercourses are adequately maintained and regularly cleared;
9. The Council should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities;
10. The Council 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;
11. To assist in the mitigation of the surface water flood risk and the promotion of development sites, the Council and developers should discuss with the appropriate Partners and Stakeholders whether any of the flood events are/have already been investigated and/or rectified;
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

²¹ <http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm>

8 CANNOCK CHASE DISTRICT

8.1 Surface Water Flood Risk

The development sites and settlements assessed within the District are shown on **Figure A5**.

Historic Flooding

Figure B5 illustrates a fairly large number of historic surface water flood occurrences across the District, with high concentrations within and around Cannock, Norton Canes and Rugeley. This flooding mainly consists of sewer and artificial drainage, with a number of events being highlighted as repeat occurrences and occurring in clusters. This is especially evident to the north of Norton Canes and south of Rugeley.

Sewer flooding is especially prominent within the District with the classification of the postcode areas highlighting these events within the urban areas. This is a clear indication that the sewer network within the area is operating under pressure. The artificial drainage flooding is most likely to relate to culverted watercourses and drainage ditches running through the urban areas which have perhaps become blocked or do not have sufficient capacity for heavy rainfall events.

Also present, especially to the south of the District, are a number of groundwater flooding incidences, relating to the disused mines within the area. Although not strictly surface water flooding incidences, this water can overflow from where it has pooled, especially during periods of heavy rainfall and infiltration and create surface water flooding problems.

Cannock has been identified within the analysis as having 17 occurrences of historic flooding, Norton Canes as having 9 and Rugeley as 11.

Future Flooding

The surface water flood map, **Figure C5**, indicates areas in which surface water flooding is potentially a high risk, with the areas to the south around Cannock, Norton Canes and the disused mines being the most prominent.

The comparative analysis of the surface water flood map and NPD points, shown on **Figure B5**, identifies Cannock and Rugeley as being the areas of highest risk of future flooding with nearly 2,500 properties in Cannock and over 2,200 in Rugeley being located within the Environment Agency's "Less" flood extent. Defra's analysis ranks Cannock as 263 and Rugeley as 305, whereas Norton Canes only scores a rank of 639²². Beyond these main settlements, there are relatively few occurrences of surface water flooding recorded or predicted. The area including Prospect Village and Cannock Wood has a very low 20 houses identified as being located within the flood extent. For further information regarding the derivation of these numbers, please see Section 3.1.2.

²² The lower the rank number, the higher the flood risk.

Cannock town has also been identified within the West Midlands RFRA as being at a low probability of surface water flooding overall but a medium consequence. The greatest risks are identified in Cannock and Rugeley. The canal network in particular was identified to have a medium consequence of flooding. This reiterates the message that surface water drainage must not interact with the canal network.

Overall

The surface water Summary Sheets for Cannock Chase District are included within **Appendix H**.

Overall Cannock, Rugeley and Norton Canes have been identified as being at a high risk of surface water flooding (indicated by a red traffic light colour code) and therefore would benefit from further investigation. All of these settlements suffer from both historical flooding and the potential for future flooding.

A large proportion of the development sites have been classified as 'yellow' and would therefore benefit from some further investigation, possibly as part of a site specific FRA, funded by the developer and approved by the Environment Agency prior to site progression (please see Appendix H for individual site classifications). Cannock Chase District is unusual in that no development sites have been classified as 'red'. However it is recommended that, given the classifications of the settlements as a whole, all potential development sites are reviewed individually before progression, especially where they are identified as overlapping with a recurring historic flood event. For all sites which are developed it will be important to reduce the Greenfield runoff rate from the site so the flood risk beyond the developed area is not increased and, if where possible, reduced.

8.2 Surface Water Management

Where sewer flooding incidences have been identified within the District, there is an indication of general exceedence of capacity within the network. It is recommended that discussion is held with STWL to identify whether these locations are already being addressed within their current strategy. The capacity of the sewerage network in general with regards to the proposed development sites is discussed further within the WCS report, although no new connections of surface water will be permitted.

As such, SUDS are an essential inclusion within all new developments and, as far as possible, the retrofitting of existing developments. Although it will be necessary to secure the necessary developer contributions ahead of granting planning permissions to ensure that the correct SUDS policies and drainage improvements are incorporated, the Flood and Water Management Bill states that it is the responsibility of Local Authorities for adopting and maintaining SUDS schemes that serve multiple properties and the responsibility of the highways authority to maintain SUDS schemes on roads.

A number of flood incidences relate to artificial drainage. As shown in **Figure C2**, these watercourses are, generally, the responsibility of the Local Authority. It is recommended that the causes of the flooding incidences recorded are investigated and the watercourses checked for blockages.

Another key occurrence of flooding is simply listed as ‘surface water’. The exact cause of this is unknown and may be linked to any of the routes of surface water drainage, including the artificial drainage listed above. In the more rural areas of the District, or on the edge of the developed area it may be linked to direct surface runoff from the land. If so, this may be maintained through the use of appropriate land management practices. This is especially important on the steeper slopes within the District.

Where flood occurrences are identified as highways flooding, this may be a result of blocked highways drains, which falls under the responsibility of the highways authority, or the overflow of ordinary watercourses or drains within the town, which are the responsibility of the owner, although Local Authorities are empowered to undertake maintenance works if necessary (for Main Rivers, shown on **Figure C2**, these powers lie with the Environment Agency). It is recommended the repeat occurrences are investigated further to determine their source and therefore rectify the problem. More detail would be provided as part of a Phase 2 modelled SWMP.

8.2.1 Canal Restoration

The Lichfield and Hatherton Canal Restoration Trust are currently looking to restore the Hatherton canal from the Hatherton Junction at Calf’s Heath on the Staffordshire and Worcestershire Canal to the Wyrley and Essington Canal at the currently disused Lord Hay Branch. This route, which passes through both South Staffordshire and Cannock Chase Districts is shown on **Figure 8.1**.

The original route, which would have connected to the Cannock Extension Canal, has been changed due to ecological concerns. A supplementary study for restoration (completed in 2009) confirmed the feasibility of an alternative route with connection to the currently disused Lords Hay branch. The study identified a number of locations where the route of the canal will be in proximity to local watercourses, in addition to a requirement for it to cross over the Wash Brook. The design of the canal must therefore ensure that flood water from the Brook cannot enter the canal and vice versa. In addition, where the canal is required to cross over a watercourse a culvert must be emplaced that does not impede drainage down the watercourse during a flood event. As these minor watercourses are likely to play an important role in transporting surface water runoff the impact of the canal construction must be considered. Any unintended interaction between watercourses and canals can have potentially devastating consequences, and may result in the canal breaching its banks. Such an event can have far reaching effects downstream both within and beside the existing canal network. It is therefore important to ensure that there is no unplanned interaction between the canal and the watercourses. The culvert provided to drain the Wash Brook under the canal will need careful sizing to ensure adequate capacity.

The length of canal from Hatherton Junction to the south of Cannock remains in use for land drainage purposes and provides a supply of water to the Staffordshire and Worcester Canal. The proposed route which extends to the south and east of Cannock clashed with the Birmingham Northern Relief Toll Road Motorway. At the time of motorway construction, culverts were provided to enable the future canal to pass under the motorway. It is therefore recommended that the impact of canal restoration upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in close proximity to a number of historic flood events

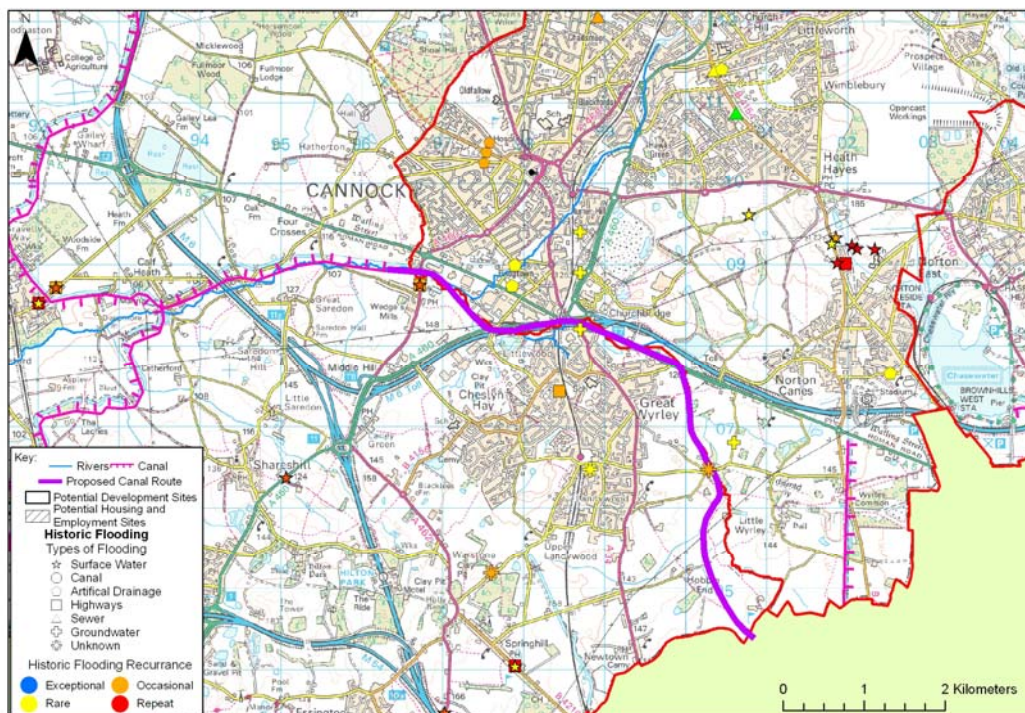
around the south of Cannock and the boundary of South Staffordshire District, it will be important to ensure that no unplanned additional surface water can enter the canal (either from overland flow or watercourse flooding).

It is recommended that the impact of the scheme upon the surface water drainage within the area is reviewed prior to construction. As the proposed canal route is located in proximity to a number of historical flood events around the south of Cannock and the boundary of South Staffordshire District, as shown in **Figure 8.1**, it will be important to ensure that a repeat of any of these events will not enter the canal. Due to the proximity of the proposed canal to the existing urban area of Cannock and Great Wyrley and a number of potential development sites it must be ensured that no additional surface water can enter the canal (either from overland flow or watercourse overtopping) as this may cause the canal to breach. If Cannock is modelled within a Phase 2 SWMP, further detail may be provided on the flooding within this area and the interlinkages between the surface water drainage and minor watercourses.

However, canals can be a useful destination for surface water runoff if it is planned and factored into the design from the start. Due to the general shortage of water supply within the area (see the WCS), surface water drainage may assist in feeding the new canal system. It is therefore recommended that the Lichfield and Hatherton Canal Restoration Trust is consulted following the submission of this Phase 1 study to explore the potential joint management options. Consultation through this stage of the study indicates that they are very keen to be involved in the process.

Figure 8.1 - Historic Flood Events in Proximity to the Proposed Route of the Hatherton Canal

NB, the route shown has been taken from the satellite image on the Lichfield and Hatherton Canal website²³



8.3 Recommendations

Following the analysis within this Phase 1 SWMP the following recommendations are concluded for Cannock Chase District. Please note that these recommendations are based upon the most recent data and all will require review following completion of the Phase 2 SWMP study. All recommendations relating to the determination of the locations most desirable for development (i.e. development of preferred options/areas) are the responsibility of the Local Authority. All recommendations relating to the progression of individual development sites are the responsibility of the developer. As a result of the Floods and Water Management Act Staffordshire County Council, as Lead Local Authority, has responsibility for monitoring and managing surface water flood risk.

1. The causes of the repeating, overlapped or clustered flood events should be investigated further, either by the Council as a further step towards mitigating the source of surface water flooding problems, or by developers as part of a site specific FRA;
2. All results from this Phase 1 SWMP should be discussed with the Partners and Key Stakeholders to identify any inconsistencies, anomalies, gaps and/or duplications within the data collected. As above, this should either be carried out by the Council with an aim to mitigate surface water flooding issues on a large scale, or by developers as part of a site specific FRA;
3. Further investigation into surface water flood risk and runoff mitigation should be carried out for the development sites identified as being at a high or medium overall risk of surface water flooding from this analysis (highlighted as red or yellow within the summary sheets), within site specific FRAs undertaken by the developer
4. The Council should undertake Phase 2 SWMP modelling for the town of Cannock. All urban areas would benefit from modelling, but due to the number of development proposals within the area, Cannock would be the most beneficial. Due to the extent of the watershed, modelling for Cannock will also incorporate the urban area of Norton Canes;
5. The Council should review the development sites in Rugeley through detailed review of the historic flood events and in consultation with the partners and stakeholders to determine the most beneficial for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs;
6. For the settlements not included in a more detailed, Phase 2 SWMP, the developer should ensure that surface water management issues are sufficiently addressed and agreed with the Environment Agency, within a site specific FRA.
7. The Council should review the agricultural and land management practices within the District and encourage farmers to not leave land bare. Some funding may be available through Defra to undertake such initiatives via their "Farming Floodplains for the Future Scheme"²⁴;
8. The Council (or other owner) should ensure that the rural watercourses are adequately maintained and regularly cleared;

²³ This can be found at <http://www.lhcr.org.uk/hatherton.htm>

²⁴ <http://www.defra.gov.uk/environment/flooding/risk/innovation/sld2314.htm>

9. The Council should consult with STWL and the Lichfield and Hatherton Canal Restoration Trust regarding potential joint surface water management opportunities;
10. The Council 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;
11. All development sites in the settlements specified above should be reviewed by the Council in consultation with partners and stakeholders to determine those most suitable for progression. This will require consideration of all the other Evidence Base studies collected as part of the LDF process. If sites are progressed, the information presented within this SWMP should also be reviewed by developers as part of site specific FRAs.
12. Councils and developers should, as far as possible, implement the site specific recommendations listed in the summary sheets.
13. All the conclusions and information included in this Phase 1 SWMP require consideration by developers and should be investigated in further detail if a site is to be progressed.

9 SELECTION OF AN APPROACH FOR FURTHER ANALYSIS

9.1 Key Conclusions and Recommendations

Through the review of the data collected and assimilated as part of this Phase 1 SWMP, a number of common conclusions for the study area have emerged. Although informative and extremely useful for this analysis, the records of historic flood data must be viewed with some caution regarding their viability, comprehensiveness and singularity. An initial recommendation for the study area would therefore be to promote the recording of surface water flooding information, perhaps in the form of a single incident spreadsheet. This would require cooperation between the varying authorities, but would provide a very useful tool to assist in the targeting of future surface water management initiatives. Such a scheme has already been initiated by Staffordshire County Council and should be encouraged and set up to include event location, type, recurrence, time and date, severity of the rainstorm and the authority responsible for the failed/exceeded drainage asset. If such a dataset was stored in GIS then the results of this Phase 1 SWMP could be constantly updated and improved.

A second key conclusion of this SWMP regards the importance of data sharing between the different authorities, further neighbouring Councils, the key Partners and Stakeholders. The analysis of settlements located on the boundary of the study area has been limited due to the restriction of available data to the study area in question. The Councils may find it useful to review the conclusion of SWMPs carried out in the neighbouring Boroughs/Districts when and if they are undertaken. Such an approach is vital to achieving the goal of strategic and sustainable development.

Discussions with stakeholders and partners and sharing of the mapping following the publication of this Phase 1 SWMP is vital to incorporate additional knowledge, fill in any gaps in the data and verify the flood events that have been recorded. We recommend such a discussion takes place as soon as possible, before the Phase 2 SWMP is undertaken. The most important consultees who may be able to provide additional information include British Waterways, the Sow and Penk IDB, the Hatherton and Lichfield Restoration Trust and STWL.

A number of settlements and potential development locations across the study area have been identified as being at risk of surface water flooding - either due to the occurrence of historic flooding events or recognised possibility of surface water flooding occurring in that location in the future. Such settlements and sites should be investigated further to determine whether any improvements can be made to the management techniques to reduce the risk in the future, as detailed within Sections 4-8. In many cases this will relate to increased maintenance of existing drainage channels. In other areas additional surface water drainage capacity may be required for significant storm events. The best way to identify the cause of the flooding and therefore the most appropriate management strategy is to undertake site specific assessment of the areas in question or, where feasible, undertake further modelling of the surface water drainage network. Such an approach will identify which parts of the drainage network are failing to cope with severe rainfall events and within which organisation's responsibility the maintenance falls.

The key organisations responsible for the maintenance of surface water assets within the study area have been shown in **Figure C2**. For the repeating events plotted within **Figures B1 to B5**, the Councils should work closely with all these organisations to promote the partnership approach to tackling surface water flooding. In many locations flooding is occurring due to the combination of a number of flooding sources and, for such locations, a strategic management strategy will be vital.

For all locations the implementation of SUDS practices is paramount. This should become standard practice in all new developments and as far as possible retrofitted into existing developments. The existing combined sewer networks do not have the capacity to transmit both foul and surface water and, as such, there is an important need to accommodate surface water discharges on site, although the Councils must understand where their responsibilities lie with regards to such practices. The Floods and Water Management Bill requires developers to incorporate SUDS into their designs and the Local Authority responsibility for approving, adopting and maintaining new SUDS where they affect more than one property. More information regarding appropriate SUDS techniques for different parts of the study area is included within the associated WCS.

This document should be used as part of the Evidence Base of Local Development Documents to support the Council in their LDF submissions.

9.2 Phase 2 SWMP

A number of settlements have been highlighted within this mapping exercise as 'red' with regards to overall surface water flooding. Ideally all of these areas should be investigated further within a Phase 2 SMWP. However, to undertake the modelling required for a robust SWMP the data requirements are high, especially for the topographical representation (the LiDAR data) and, as a result, so are the costs. To produce a robust, and therefore useful, representation of surface water flooding within an area, LiDAR of at least 2m resolution is required for the entire watershed in which a settlement falls. This ensures that all the water falling within the catchment of that urban area is routed appropriately across the topography and down the key drainage channels, such as roads, into the urban area in question.

The watersheds and LiDAR availability for the following five key settlements are shown in **Figure 9.1**:

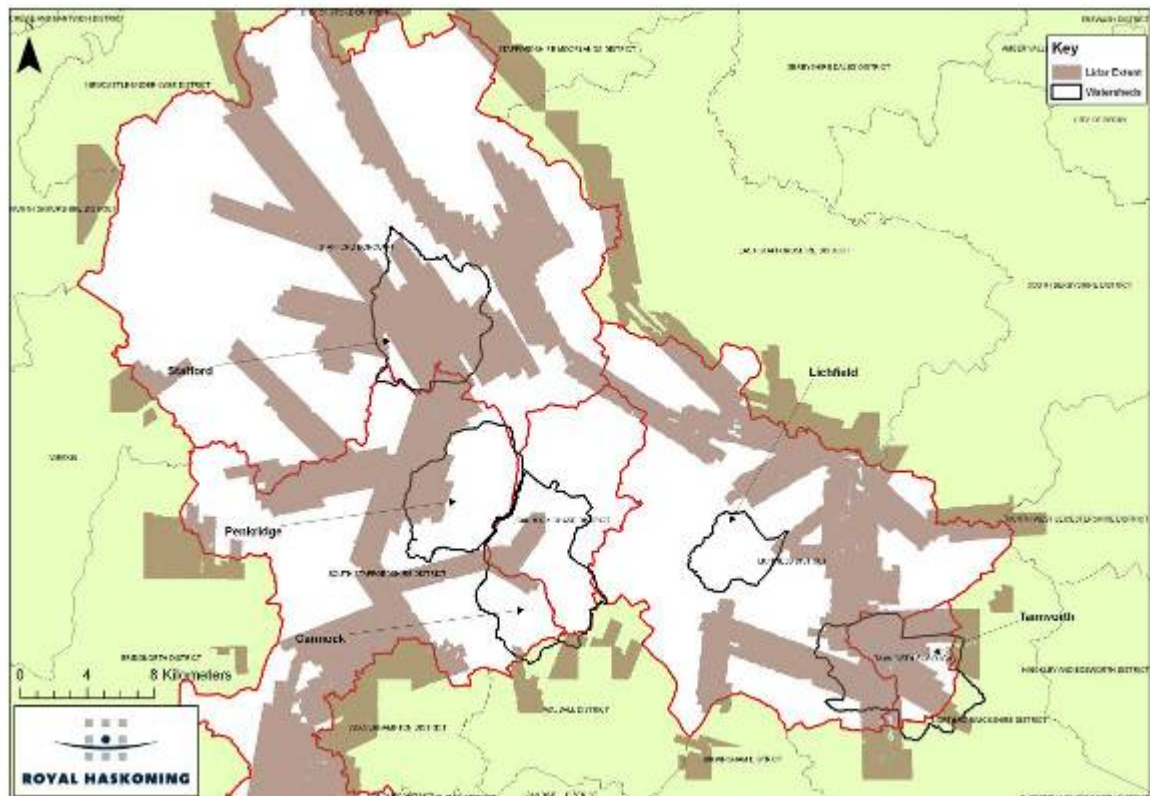
- Stafford town;
- Cannock town;
- Lichfield City;
- Tamworth town; and
- Penkridge.

These settlements have been chosen for progression as part of the Level 2 SWMP based upon historic flooding occurrences, future flooding potential, severity of flooding and the development plans/potential of the settlement:

The gaps and insufficiencies in the LiDAR data are immediately evident. As such the modelling cannot be progressed until sufficient data is received. Before the modelling commences, the most appropriate modelling technique must also be discussed with the

Councils. Due to the range of flood sources (including the combination of sewer and surface drainage), a more detailed combined approach would be the most comprehensive. If data is available a simpler review of the surface topography and potential flow routes/pooling locations in the additional 'at risk' settlements and individual development sites may be more appropriate.

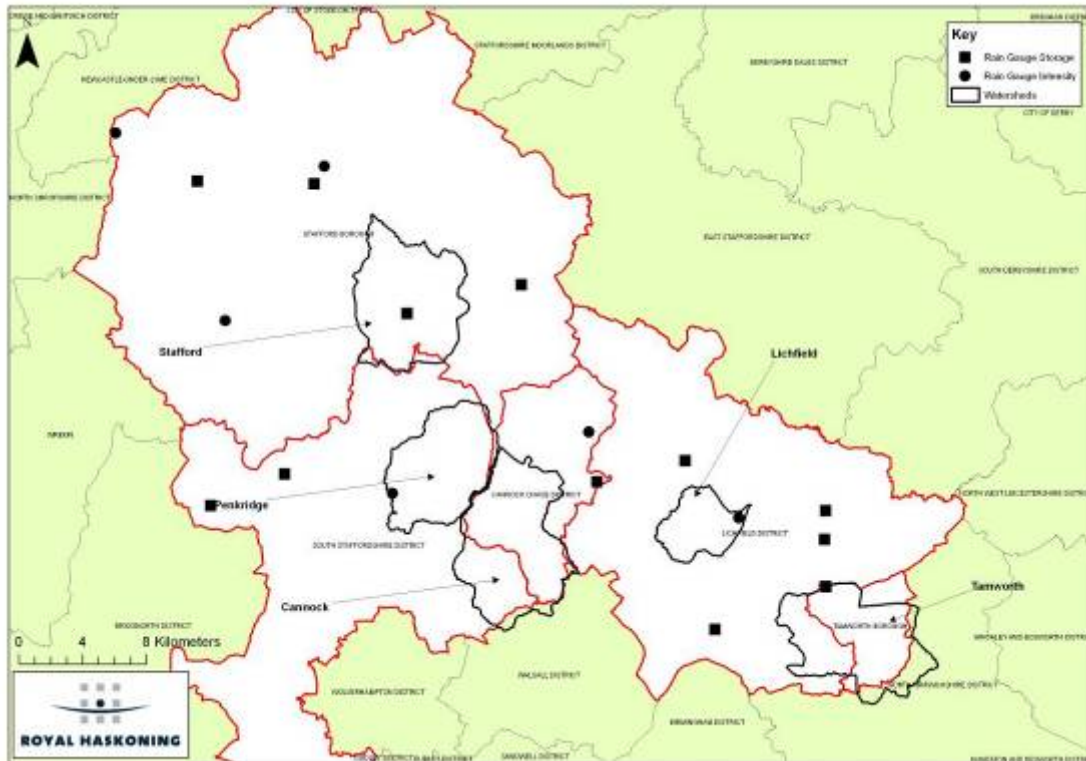
Figure 9.1 - Watershed Location and LiDAR Coverage



The other key settlements identified within the analysis as also being at high risk of surface water flooding, include Wombourne, Stone, Burntwood and Rugeley. These require further review, but, for the time being, this is best pursued through further interrogation of the existing data and discussion with the partners/stakeholders and maintenance organisations. If feasible, they may benefit from further modelling at a later date.

In addition to the LiDAR another key data requirement is rainfall information. **Figure 9.2** shows the location of rain gauges within the study area, as provided by the Environment Agency. The coverage is fairly extensive and, provided all the gauges have a consistent record of information, there should be sufficient data to carry out the analysis. Further details will be discussed with the Councils prior to the initiation of Phase 2 once the modelling areas and approach have been confirmed.

Figure 9.2 - Rain Gauge Locations Within the Study Area



The next steps for this SWMP for the Councils to follow are:

1. Discuss the findings of the SWMP with the relevant partners/stakeholders, updating and extending the information where necessary;
2. Identify the locations to be modelled as part of the Phase 2 SWMP;
3. Agree the scope of the required modelling;
4. Undertake any site specific analysis/further review of settlements and/or sites not assessed within the Phase 2 SMWP before progression; and
5. Confirm management roles, responsibilities and requirements of all the surface water asset maintainers.

9.3 Summary

In summary, this Phase 1 SWMP has achieved all the objectives set at the start:

- ✓ A partnership has been established with the Steering Group and additional stakeholders;
- ✓ The roles and responsibilities of partners have been established;
- ✓ An Engagement Plan has been drawn up for use during the res of the study
- ✓ The historic occurrences of surface water flooding have been determined and mapped across the study area;
- ✓ The areas at greatest risk of surface water flooding and therefore areas which require further investigation as part of Phase 2 have been defined; and
- ✓ The Councils have been advised as the 'next steps for the SWMP'.

Appendix A Engagement Plan

Appendix B Data Register

Appendix C Figures

Appendix D

Stafford Borough Summary Sheets

Appendix E

Lichfield District Summary Sheets

Appendix F Tamworth Borough Summary Sheets

Appendix G

South Staffordshire District Summary Sheets

Appendix H

Cannock Chase District Summary Sheets

Appendix I Response to Comments