The Black Country Authorities Level 1 Strategic Flood Risk Assessment

Final Report

25th June 2020

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Commissioned by Sandwell Metropolitan Borough Council

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This report describes work commissioned by [redacted] on behalf of the Black Country Councils by an email dated 29th October 2018. [redacted], [redacted] of JBA Consulting carried out this work.

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Purpose

This document has been prepared as a Final Report for Sandwell Metropolitan Borough Council, for the following councils, City of Wolverhampton, Dudley Metropolitan Borough, Sandwell Metropolitan Borough and Walsall Metropolitan Borough, who will be referred to as "The Black Country Councils" from this point onwards. JBA Consulting

accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Sandwell Metropolitan Borough Council.

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- Sandwell Metropolitan Borough Council
- Dudley Metropolitan Borough Council
- Walsall Metropolitan Borough Council
- City of Wolverhampton Council
- Environment Agency;
- Staffordshire County Council
- Severn Trent Water;
- South Staffs Water;
- The Canal and Rivers Trust; and,
- Planners at the neighbouring authorities

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Executive summary

Introduction

The Level 1 Strategic Flood Risk Assessment (SFRA) 2020 document was created with the purpose of supporting the production of the Joint Black Country Local Plan. The study area comprises Sandwell District, City of Wolverhampton District, Dudley District and Walsall District; the combined authorities will be referred to throughout this document as the Black Country Authorities, and the whole study area as the Black Country. The Level 1 SFRA provides an understanding of the risk from all types of flooding across The Black Country and presents clear and robust evidence. It also provides useful information to inform future Infrastructure Planning and Neighbourhood Plans. It replaces the 2009 Black Country Level 1 Strategic Flood Risk Assessment.

Strategic Flood Risk Assessment Objectives

The key objectives of the Level 1 Strategic Flood Risk Assessment are to:

- Inform the Black Country Authorities Local Plans by assessing flood risk from all sources, current and future.
- Identify which locations are most and least vulnerable to flooding from all relevant sources.
- Produce a comprehensive set of maps presenting flood risk from all sources, including historic records, that can be used as evidence base for flood management purposes.
- Identify areas where further assessment of flood risk is needed and provide sufficient detail to enable the Sequential Test to be applied to inform allocations of land for development.
- Provide clear advice for developers undertaking site-specific flood risk assessments.
- Assess or identify existing and proposed flood defences and the maintenance requirements of these defences.
- Summarise the role that the Lead Local Flood Authority will play in the management of flood risk.
- Consider outputs from the Preliminary Flood Risk Assessment and any local flood risk strategies.
- Assess the role and functionality of culverts and their potential to cause or exacerbate flood risk.
- Take into account climate change.
- Assess the cumulative impact that development will have on flood risk.
- Produce clear and specific recommendations and guidance identifying responsible agencies and actions where appropriate, in order for the Black Country Authorities to implement recommendations effectively.

SFRA outputs

The following outputs are available:

- Identification of **policy and technical updates**.
- Recommendations of the criteria that should be used to assess future development proposals and the **development of a Sequential Test and sequential approach** to flood risk.
- Assessment of the potential increase in **flood risk due to climate change**.

- Appraisal of **all potential sources of flooding**, including Main River, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- **Mapping** showing distribution of flood risk across all flood zones from all sources of flooding including climate change allowances.
- Reporting on the **standard of protection** provided by existing flood risk management infrastructure.
- Assessment of **strategic flood risk solutions** that can be implemented to reduce risks.
- **Flood Risk Assessment guidance for developers**.
- Guidance for developers on the use of **Sustainable Drainage Systems**.
- An assessment of the implications of climate change for flood risk over an appropriate time period;
- Locations where additional development may significantly increase flood risk elsewhere;
- Identification of methods of reducing flood risk within the plan area (including identifying potential pieces of land that should be safeguarded from development in order to help manage flooding).

Summary of flood risk in The Black Country

Parts of The Black Country are at risk from the following sources; fluvial, surface water, groundwater, sewers, reservoir inundation and canal overtopping/breaches. This study has shown that the most significant sources of flood risk in The Black Country are fluvial and surface water.

- *Fluvial flooding*: The primary fluvial flood risk is along the River Tame, Stour and Smestow Brook and the tributaries of these watercourses. These present fluvial flood risk to the main urban centres, including, but not limited to Walsall, Bescot, Willenhall, Horseley Heath, Dudley Port, North Stourbridge and Newton. Recent significant flooding events across The Black Country occurred in July 2007 and 2008 and June 2016. There is a particularly high risk of flooding due to culverted watercourses blocking, becoming overwhelmed or failing.
- *Surface water:* Surface water flooding is most likely caused by intense rainfall. There are many areas at high risk of surface water flooding in The Black Country, due to the heavily urbanised nature of the area that impedes natural infiltration and drainage.
- *Sewer*: The sewers in the Black Country are managed by Severn Trent Water. Severn Trent Water provided their Hydraulic Flood Risk Register which denotes 996 properties at risk of sewer flooding in The Black Country, with the areas of highest risk/most historical incidents of sewer flooding Tipton, Claregate and Tettenhall.
- *Groundwater:* The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of the Black Country has a low risk of groundwater flooding. Parts of the study area including between the east of Wolverhampton, west Walsall and the north of Sandwell have a higher risk of groundwater flooding. The 2009 SFRA recognises that as pumping and abstraction regimes have ceased or been changed, that local groundwater flooding incidences have occurred in the north-east and south-east of Wolverhampton and along the boundary between Dudley and Sandwell Metropolitan Borough Council areas. It is therefore anticipated

that groundwater flooding issues are likely to be localised in their nature, affecting limited areas and a small number of properties.

- *Canals*: There are fifteen canals in The Black Country; These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been incidences of breach and overtopping on five of these canals although there have been no records of breach or overtopping in recent years. The most recent incident of overtopping was on the Stourbridge Canal in Merry Hill in 1985.
- *Reservoirs:* There is a potential risk of flooding from reservoirs both within The Black Country and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from the reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this should be considered in any site-specific Flood Risk Assessments (where relevant).

How to use this report

Planners

The SFRA provides **recommendations** regarding **all sources of flood risk** in the Black Country which can be used to inform policy on flood risk within the Local Plan. This includes how the cumulative impact of development should be considered and how new development could bring wider flood risk benefits to existing communities

It provides the latest flood risk data and guidance to **inform the Sequential Test** and provides guidance on **how to apply the Exception Test**. The Black Country Authorities will use this information to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed.

The SFRA provides **guidance for developers**, which can be used by Development Management staff to assess whether site specific Flood Risk Assessments meet the required quality standard.

Developers

For sites that are not strategic allocations, developers will need to use the information in this SFRA to help apply the Sequential Test. For all sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage.

When assessing sites not identified in the Local Plan (windfall sites), developers should use evidence provided in this SFRA to apply the **Sequential Test** and provide evidence to show that they have adequately considered reasonably available sites at lower flood risk.

This is a strategic assessment and does not replace the need for site specific Flood Risk Assessments where a development is either within Flood Zones 2 or 3 or greater than a hectare in Flood Zone 1. In addition, a surface water drainage strategy will be needed for all major developments in any Flood Zone to satisfy Staffordshire County Council (who act as the Lead Local Flood Authority (LLFA) for Sandwell, Walsall and Wolverhampton) and Dudley MBC.

Developers can use the information in this SFRA, alongside site specific research to help to scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this they should refer to **Chapter 6** Understanding flood in The Black Country and the **flood maps in the appendices**.

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (**including applying the latest climate change allowances**, due to be updated by the Environment Agency in 2020), inform master planning and prove, if required, whether the Exception Test can be passed.

Developers need to ensure that new development does not increase surface water runoff from a site. **Chapter 10** provides information on the surface water drainage requirements of Staffordshire County Council as LLFA. Sustainable Drainage Systems should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Flood risk assessments will need to identify how flood risk will be mitigated to ensure the development is safe from flooding. In high risk areas the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Developers should contribute to the wider strategic vision for flood risk management and drainage in an area where possible. Any developments located within an area protected by **flood defences**, where the condition of those defences is 'fair' or 'poor', where the future maintenance is uncertain or where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Recommendations for further work

A Level 2 SFRA may be necessary where there are sites that are to be taken forward for development in Flood Zones 2 or 3 or where there is a significant risk of flooding from other sources. This would inform the Exception Test required in the National Planning Policy Framework. Further detailed work could also support local strategic drainage planning for larger strategic development areas and/ or high flood risk catchments likely to see a relatively large degree of development.

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Abbreviations

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
AStGWf	Areas Susceptible to Groundwater flooding
BCAs	The Black Country Authorities (Sandwell Metropolitan Borough Council, Dudley Metropolitan Borough Council, City of Wolverhampton Council and Walsall Council)
BCCs	The Black Country Councils (Sandwell Metropolitan Borough Council, Dudley Metropolitan Borough Council, City of Wolverhampton Council and Walsall Council)
Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) can cause flooding.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	The cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second; also, m^3/s.
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
Design flood	This is a flood event of a given annual flood probability, which is generally taken as: fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or; tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
Exception Test	Set out in the NPPF, the Exception Test is used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.
FCERM	Flood and Coastal Erosion Risk Management
FEH	Flood Estimation Handbook

Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
IDB	Internal Drainage Board
Flood Risk Area	Nationally identified flood risk areas based on a definition of 'significant' flood risk set by the Minster. Relates to assessments under the EU Floods Directive.
JBA	Jeremy Benn Associates
Jflow	2D generalised hydrodynamic modelling software.
LFRMS	Local Food Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance

NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility for maintenance.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
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.
PPS25	Planning Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG
RBMP	River Basin Management Plan
RFCC	Regional Flood and Coastal Committee
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	Operating authorities who's remit and responsibilities concern flood and / or coastal risk management.
RoFfSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone

SSCs	Southern Staffordshire Councils (Lichfield District Council, Cannock Chase District Council, South Staffordshire District Council)
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - A SWMP outlines the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

JBA Consulting were commissioned by Sandwell Metropolitan Borough Council, on behalf of the Black Country authorities of Dudley Metropolitan Borough Council, Walsall Council and City of Wolverhampton Council to support the review of the Black Country Core Strategy (BCCS)). This SFRA study provides a comprehensive and robust evidence base to support the production of the Black Country Plan to 2036. It replaces the 2009 Strategic Flood Risk Assessment (SFRA).

The 2020 SFRA will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

1.2 Local Plan

The current Black County Plan (formerly The Black Country Core Strategy) for the Black Country Authorities, can be found at the link below. This SFRA will aid in informing the Local Plan. The Local Plan aims to establish a planning framework that identifies available land for housing, employment and infrastructure for future development.

- **Black Country Core Strategy**

1.3 Levels of SFRA

The Planning Practice Guidance identifies the following two levels of SFRA:

- Level 1: where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.
- Level 2: where land outside Flood Zones 2 and 3 cannot appropriately accommodate all necessary development, creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This Level 1 SFRA is intended to aid the Black Country Authorities in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 SFRA.

1.4 SFRA objectives

The key objectives of the Level 1 Strategic Flood Risk Assessment are to:

- Inform the Black Country Authorities Local Plans by assessing flood risk from all sources, current and future.
- Identify which locations are most and least vulnerable to flooding from all relevant sources.
- Produce a comprehensive set of maps presenting flood risk from all sources, including historic records, that can be used as evidence base for flood management purposes.
- Identify areas where further assessment of flood risk is needed and provide sufficient detail to enable the Sequential Test to be applied to inform allocations of land for development.
- Provide clear advice for developers undertaking site-specific flood risk assessments.
- Assess or identify existing and proposed flood defences and the maintenance requirements of these defences.

- Summarise the role that the Lead Local Flood Authority will play in the management of flood risk.
- Consider outputs from the Preliminary Flood Risk Assessment and any local flood risk strategies.
- Assess the role and functionality of culverts and their potential to cause or exacerbate flood risk.
- Take into account climate change.
- Assess the cumulative impact that development will have on flood risk.
- Produce clear and specific recommendations and guidance identifying responsible agencies and actions where appropriate, in order for the Black Country Authorities to implement recommendations effectively.

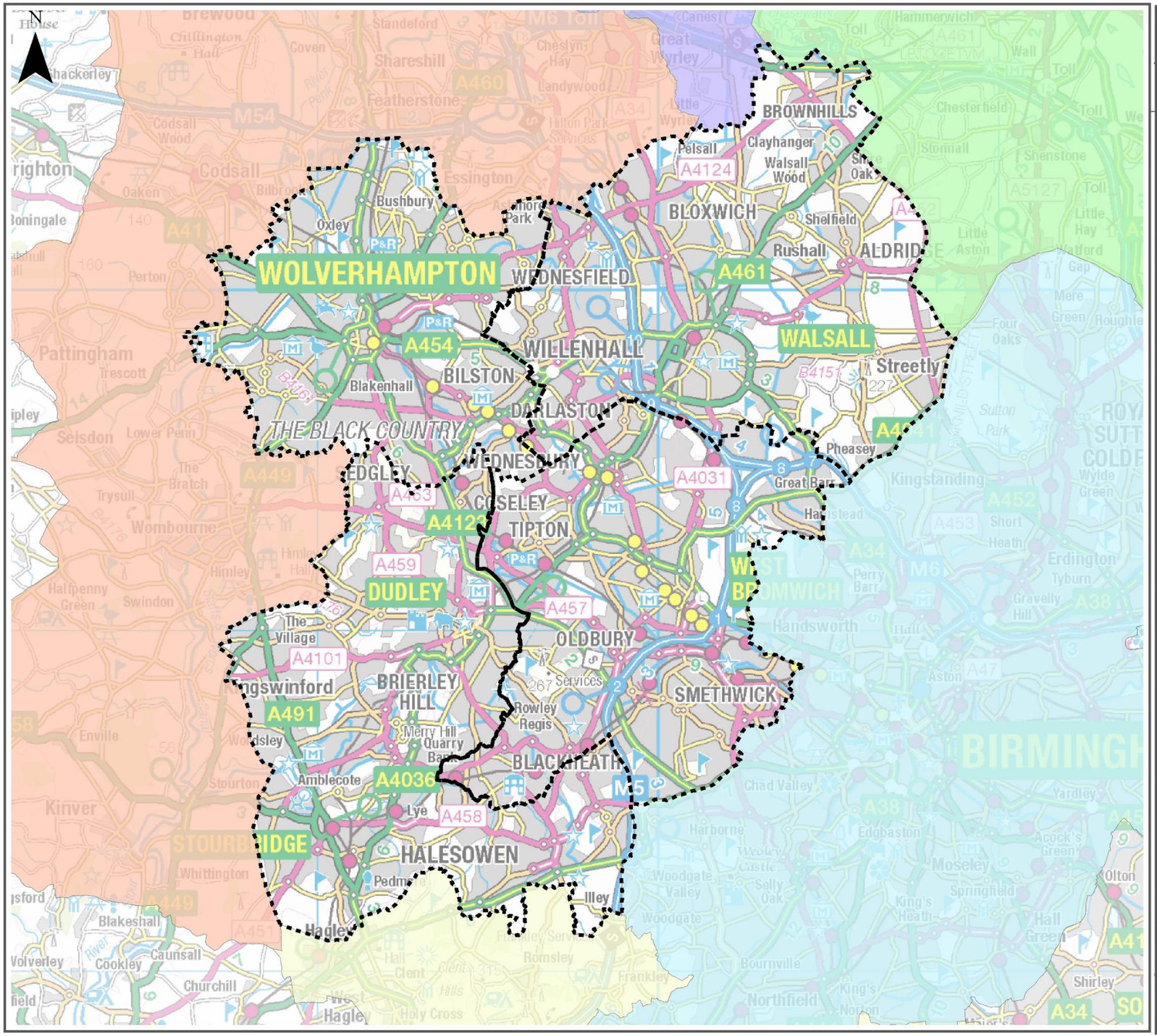
1.5 SFRA study area

The Black Country is a sub-region of the West Midlands, situated to the north-west of Birmingham and is composed of the boroughs of Dudley, Sandwell, Walsall and Wolverhampton. The area covers approximately 360km^2 and has a population of approximately 1.17 million.

There are a number of rivers and canals that flow and connect through the area. The main rivers include but are not limited to the River Tame, the River Stour, the Smestow Brook, Mousesweet Brook and Ford Brook.

There are a significant number of canals in the area (15) including the Staffordshire and Worcestershire, Birmingham, Rushall, Titford, Tame Valley and Walsall canals.

Figure 1-1 Study Area



THE BLACK COUNTRY AUTHORITIES LEVEL 1 STRATEGIC FLOOD RISK ASSESMENT

STUDY AREA

Legend

BCAs Boundaries

Neighbouring Authorities

- Birmingham District (B)
- Bromsgrove District
- Cannock Chase District
- Lichfield District
- South Staffordshire District

0 0.751.5 3 4.5 6 Km

1.6 Consultation

The following parties (external to the Black Country Authorities) were consulted to inform the SFRA:

- Environment Agency
- Staffordshire County Council (LLFA)
- Canal & River Trust
- Severn Trent Water
- South Staffs Water
- Neighbouring authorities including:
    - South Staffordshire District
    - Lichfield District
    - Cannock Chase District
    - Bromsgrove District
    - Birmingham City Council

1.7 Use of SFRA data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the Local Plan and any future flood risk policies.

Developers will still be required to undertake site-specific Flood Risk Assessments to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Hyperlinks to external guidance documents/ websites are provided in **green** throughout the SFRA.

Advice to users has been highlighted in **amber** boxes throughout the document.

On the date of publication, the SFRA contains the latest flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), flood event information, new defence schemes and updates to policy and legislation. Developers should check the **online Flood Map for Planning** in the first instance to identify any major changes to the Flood Zones, noting that for the mapping in this SFRA also takes account of more specific information for smaller watercourses in Walsall not shown on the national mapping.

1.8 Structure of this report

Section	Contents
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA Provides a short introduction to how flood risk is assessed and the importance of considering all sources
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the Councils and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.
4. The impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments
5. Understanding flood risk in The Black Country	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.
7. Cumulative impact of development and strategic solutions	This section provides a summary of the catchments with the highest flood risk and development pressures, considers opportunities for strategic flood risk solutions and makes recommendations for local planning policy based on these.
8. Guidance for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources
9. Surface water management and Sustainable	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage

Drainage Systems	Systems (SuDS) from the Lead Local Flood Authority
10. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations

Appendices:

- Appendix A: GeoPDFs - Interactive flood risk maps
- Appendix B: Site screening
- Appendix C: Summary of flood risk in the Black Country
- Appendix D: SFRA mapping supporting information
- Appendix E: Southern Staffordshire and Black Country Cumulative Impact

1.9 Understanding flood risk

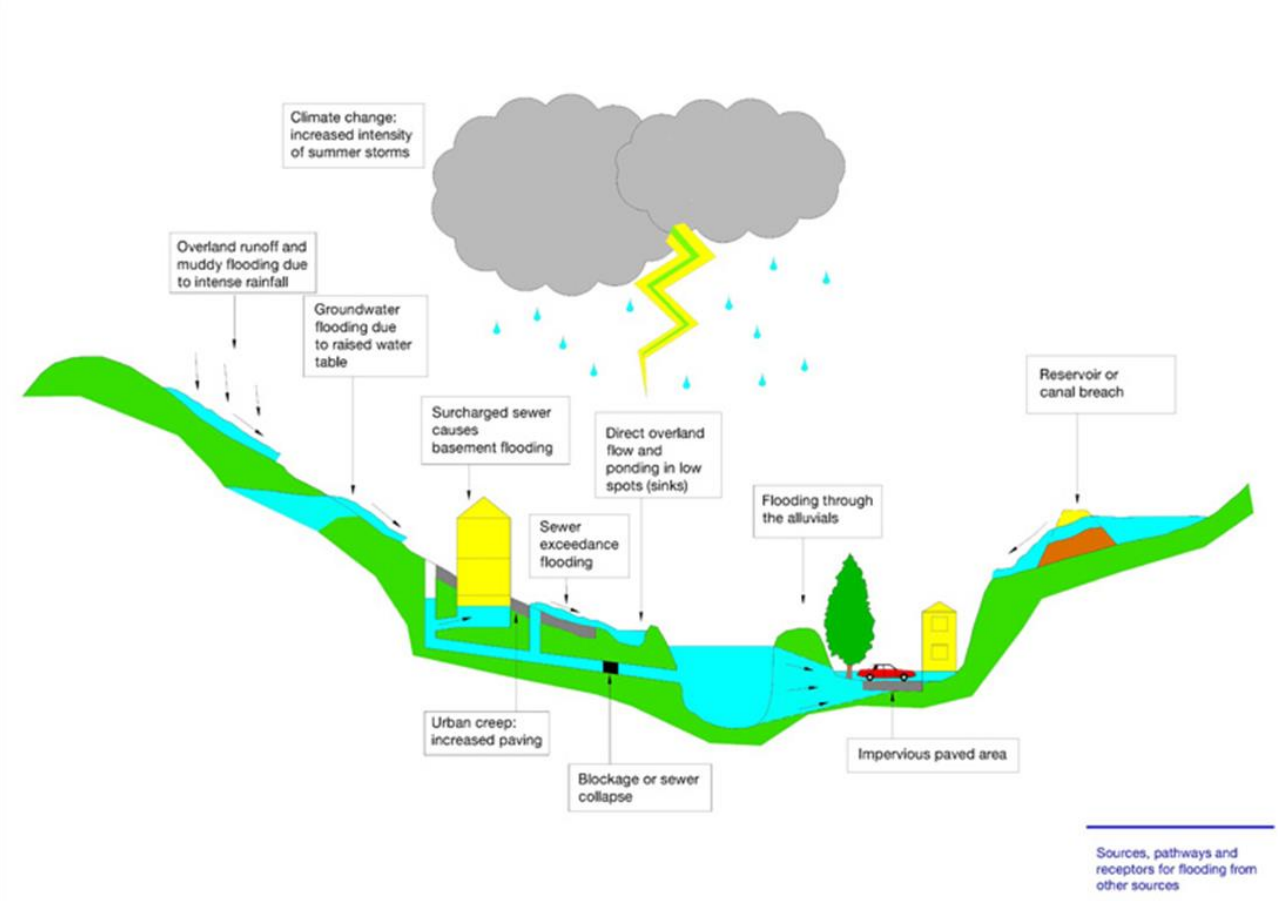
1.9.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in numerous different ways. Major sources of flooding include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.)
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging. A summary of the different sources of flooding is shown in Figure 1-2.

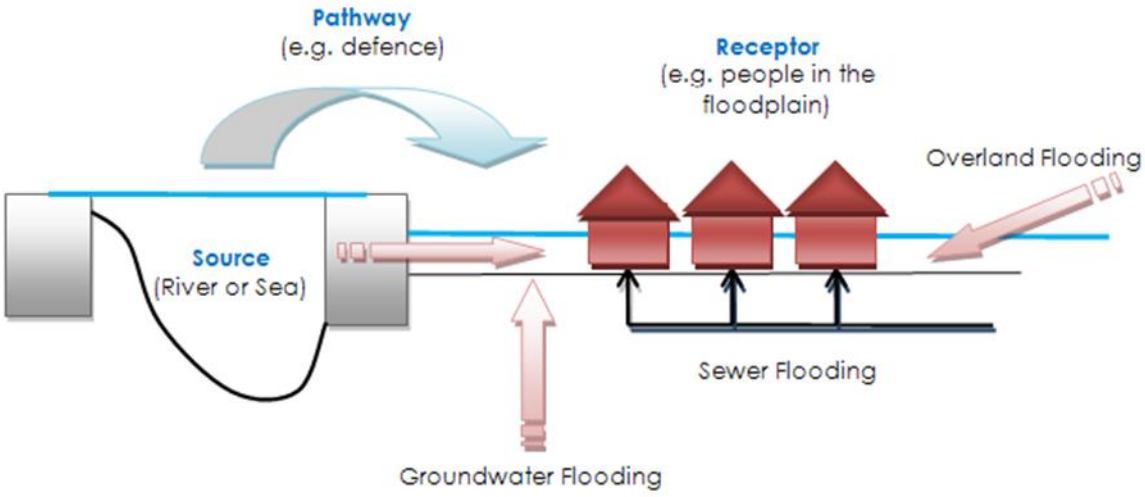
Figure 1-2 Flooding from all sources



1.10 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 1-3 below. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

Figure 1-3 Source-Pathway-Receptor Model



The principal sources are rainfall, snowmelt and high groundwater levels and the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets and the receptors can include people, their property and the environment. All these elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding, but they can block or impede pathways or increase the resilience of receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

1.11 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will only occur once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

1.12 Consequence

The consequences of flooding include fatalities, property damage and disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g.

age-structure, of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or the intensity of a rainfall event that will trigger surface water flooding. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

2 Flood risk policy and strategy

This section sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy and strategy.

2.1 Roles and responsibilities for Flood Risk Management in the Black Country

There are different organisations that cover the Black Country that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown on Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species and allowing the flow of water to pass without obstruction. More information can be found in the Environment Agency publication **'Owning a Watercourse' (2018)**.

Table 2-1 Roles and responsibilities for flood risk management within The Black Country

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	Strategic overview for all sources of flooding National Strategy Reporting and general supervision	Main rivers (e.g. River Tame, River Trent, River Stour, Ford Brook) Reservoirs	Statutory consultee for development in Flood Zones 2 and 3 or within 20m of a Main River
Black Country Authorities as Lead Local Flood Authorities (LLFAs) *Note that as of 2017, this service is provided by Staffordshire County Council for Walsall, Sandwell and Wolverhampton Councils*	Preliminary Flood Risk Assessment Local Flood Risk Management Strategy	Surface Water Groundwater Ordinary Watercourses (consenting and enforcement) Ordinary watercourses (works)	Statutory consultee for major developments
Black Country Authorities as Local Planning Authorities	Local Plans as Local Planning Authorities	Determination of Planning Applications as Local Planning Authorities Managing open spaces under Council ownership	As left

Risk Management Authority	Strategic Level	Operational Level	Planning role
Water Companies: Severn Trent Water	Asset Management Plans, supported by Periodic Reviews (business cases) Develop Drainage and Wastewater management plans	Public sewers and water supply	Non-statutory consultee
Highways Authorities: *Highways Agency (motorways and trunk roads)* Sandwell Metropolitan Borough Council; Dudley Metropolitan Borough Council; Walsall Council; City of Wolverhampton Council; *(All other adopted roads in respective Council areas)*	Highway drainage policy and planning	Highway drainage	Internal planning consultee regarding highways design standards and adoptions

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in the Black Country:

- **Flood Risk Regulations (2009)** transpose the EU Floods Directive (2000) into UK law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments (PFRAs) and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed flood maps and a Flood Risk Management Plan is produced. This is a six-year cycle of work and the second cycle started in 2017.
- **Town and County Planning Act (1990)**, **Water Industry Act (1991)**, **Land Drainage Act (1991)**, Environment Act (2005) and **Flood and Water Management Act (2010)** – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- **Land Drainage Act (1991)** and **Environmental Permitting Regulations (2016)** also set out where developers will need to apply for additional permission (as well as Planning Permission) to undertake works to an ordinary watercourse or Main River. An Environmental Permit is required for works within 8m of any flood defence structure on or within the flood plain of a main river.
- **Water Environment Regulations (2017)** transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produces River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reach 'good status'.

- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) can be appropriately applied to strategic and site-specific developments to guard against environmental damage.

Relevant flood risk policy and strategy documents Table 2-2 summarises relevant national, regional and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform flood risk assessments within the Black Country area.
- Set the strategic policy and direction for Flood Risk Management (FRM) and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in The Black Country.
- Provide guidance and/ or standards that informs how a developer should assess flood risk and/ or design flood mitigation and SuDS.

Table 2-2: National, regional and local flood risk policy and strategy documents

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due (if known)
National	**Flood and Coastal Management Strategy** (Environment Agency) 2011	No	Yes	No	2020
	National Planning Policy Framework and Guidance (MCHLG) 2019/2015	No	No	Yes	-
	Building Regulations Part H (MCHLG) 2010	No	No	Yes	-
Regional	**River Trent Catchment Flood Management Plan** (Environment Agency) 2009	Yes	Yes	No	-
	Humber Flood Risk Management Plan (Environment Agency) 2015	Yes	Yes	No	2021
	Severn Flood Risk Management Plan (Environment Agency) 2015	Yes	Yes	No	2021
	Humber River Basin Management Plan (Environment Agency) 2015	No	Yes	No	2021
	Severn River Basin Management Plan (Environment Agency) 2015	No	Yes	No	2021
	Climate Change guidance for development and flood risk (Environment Agency) 2016	No	No	Yes	2020
Local	**Local Flood Risk Management Strategy** (The Black Country Councils) 2015	Yes	Yes	No	-
	SuDS Handbook (The Black Country Authorities) 2020	Yes	No	Yes	-
	Drainage and Wastewater Management Plan (Severn Trent Water) due 2023	Yes	Yes	No	-
	Wolverhampton Preliminary Flood Risk Assessment (2017)	Yes	No	No	-
	Walsall Preliminary Flood Risk Assessment	Yes	No	No	-

	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due (if known)
	(2011)				
	Sandwell Preliminary Flood Risk Assessment (2011) and **Addendum** (2017)	Yes	No	No	-
	Dudley Preliminary Flood Risk Assessment (2011)	Yes	No	No	-
	Wolverhampton Surface Water Management Plan – Phase I, II & III (2012)	Yes	No	Yes	-
	Wolverhampton Level 2 SFRA (2009)	Yes	Yes	Yes	-
	Black Country Strategic Flood Risk Assessment (2009)	Yes	Yes	Yes	2020
	Ford Brook Strategic Flood Risk Mapping	Yes	No	Yes	-
	Black Country Water Cycle Study and Scoping Surface Water Management Plan (2009)	Yes	Yes	Yes	Unknown

2.3 Key national, regional and local policy documents and strategies

2.3.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2011)

The National Flood and Coastal Erosion Risk Management Strategy for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. It was prepared by the Environment Agency with input from Defra.

The Strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. It describes how risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment.

The strategy encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to:

- ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risk;
- manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment;
- ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood forecasts, warnings and advice;
- help communities to recover more quickly and effectively after incidents.

The Strategy is currently being updated and was published for consultation in 2019. It is due to be finalised in mid 2020.

2.3.2 River Basin Management Plans

The **Humber and Severn River Basin Management Plans** (RBMPs), managed by the EA, has been updated since the first cycle in 2009. The latest version was published in December 2015. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Humber RBMP includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality. The plans include an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use and progress since the first plan in 2009. The Plans are currently being reviewed.

2.3.3 Flood Risk Regulations

The 2009 Flood Risk Regulations implement the 2007 European Floods Directive in England and Wales. They require a six year cycle of assessment, mapping and planning.

The Preliminary Flood Risk Assessments (PFRAs) are part of the six-year cycle of assessment, mapping and planning. These were last undertaken by the Councils in 2017:

Sandwell Metropolitan Borough Council PFRA (2011) and **Addendum (2017)**

Walsall Council PFRA (2011) and **Addendum (2017)**

Dudley Metropolitan Borough Council PFRA (2011) and **Addendum (2017)**

City of Wolverhampton Council (2011) and **Addendum (2017)**

The PFRAs identified the following areas as those that are considered be nationally significant in terms of the degree of localised flooding that could be experienced:

- Birmingham – this covers parts of Walsall and Smethwick and Oldbury in Sandwell
- Wolverhampton - a large part of the City is covered

The Environment Agency undertook a PFRA for river, sea and reservoir flooding in 2018. No nationally significant areas were identified for river, sea or reservoir flooding in the Black Country.

Flood Risk Management Plans (FRMPs) are also part of the six-year cycle of assessment, mapping and planning required under the Flood Risk Regulations. The Environment Agency led the development of the **Humber and Severn FRMPs**, which were published in 2015. The FRMPs summarise the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations, focussing on areas of nationally significant flood risk. The FRMPs draw on policies and actions identified in Catchment Flood Management Plans and Local Flood Risk Management Strategies. The Plans are being updated as part of the new cycle of the Flood Risk Regulations and are due to be published in December 2021.

2.3.4 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

The Black Country is covered by the **River Severn CFMP (2009)** and the **River Trent CFMP (2009)**. Within these CFMPs, The Black Country is covered by Policy Option 5 – Areas of moderate to high flood risk where further action can generally be taken to reduce flood risk.

In these Policy Options, there are specific 'actions' to manage flood risk in the area. The actions relevant to the Black Country in the **Trent CFMP** are:

- Provide a more accurate and community focussed flood warning service.
- Complete a strategy for the River Tame, focussing on opportunities to naturalise the river in rural areas and to reduce flood risk in urban areas
- Reduce the incidence of foul water flooding by involving Severn Trent Water Ltd more in flood risk management
- Investigate and promote opportunities to create green corridors along watercourses through the Black Country.
- Produce and implement an integrated urban drainage strategy.
- Investigate flood resilience for infrastructure, including roads, rail, electricity, gas, oil, water and telecommunications at risk of flooding within the nearby city of Birmingham.
- Identify locations where flood storage ponds or wetland areas could be developed within the urban areas, with associated habitat creation
- Produce an integrated flood defence asset management strategy.

The actions relevant to the Black Country in the **Severn CFMP** are:

- Ensure floodplains are not inappropriately developed. Follow the 'sequential approach' and consider land swapping opportunities.
- Encourage compatibility between urban open spaces and their ability to make space for rivers to expand as flood flows occur. One example of a flood-compatible use is playing fields. Develop strategies to create 'blue corridors' by developing/redeveloping to link these flood-compatible spaces.
- Raise awareness of flooding among the public and key partners, especially major operators of infrastructure, allowing them to be better prepared. Encourage them all to increase the resilience and resistance of vulnerable buildings, infrastructure and businesses.
- Develop better understanding of flooding from surface water, from drainage systems, and from 'non-main' watercourses. Produce a strategy for operation and investment, integrating all these with main rivers.
- Review how effective and sustainable each flood defence is. Review maintenance operations to ensure they are proportionate to flood risk. Manage fly-tipping [on floodplains and in channels].Avoid excessive silt accumulation in artificial channels [Either by channel modifications or by de-silting].

2.3.5 The Black County Local Flood Risk Management Strategy (2015)

The Black Country Authorities are responsible for developing, maintaining, applying and monitoring a Local Flood Risk Management Strategy (LFRMS). The **Black Country Flood Risk Management Strategy** is used as a means by which the LLFA co-ordinates Flood Risk Management on a daily basis.

The high-level objectives proposed in the strategy for managing flood risk include:

- Develop plans to reduce existing flood risk taking account of people, communities and the environment;
- Ensure that the area remains an attractive place for business and that flood risk is clearly communicated to the public to increase public awareness;
- Ensure that planning decisions take full account of flood risk and that emergency plans are effective so that individuals and communities understand the risks along with their role in an emergency;
- Develop a clear understanding of flood risk across the Black Country and identify national, regional and local funding mechanisms to deliver flood risk management solutions;
- Provide a clear explanation of the roles and responsibilities of the flood management authorities and how the Black Country authorities will coordinate and drive partnership approaches to manage and reduce this risk; and
- Ensure that the natural and historic environment is considered in all flood risk management activities, and where possible enhanced through flood risk management schemes.

The Local Flood Risk Management Strategy needs to be consistent with the National Flood and Coastal Erosion Risk Management Strategy that is currently being revised. It is recommended that the Local Flood Risk Management Strategy is updated in 2020 to take account of the:

- Revised and final National Flood and Coastal Erosion Risk Management Strategy, especially noting the increasing emphasis on planning for adapting to climate change that runs through the new national strategy;
- The revised government policy statement on Flood and Coastal Erosion Risk Management due to be published in Spring 2020;

- Revised flood risk datasets, including those collated for this SFRA that have emerged since 2015;
- Lessons learnt from the severe surface water flooding events of summer 2016; and
- Revised approaches to flood risk management, partnership working and funding that have emerged since 2015.

The review should ensure that the:

- Views of all relevant stakeholders are taken into account;
- Flood risk evidence base is updated for all sources of flooding and presented in such a way that it can be used to prioritise actions across the Black Country and to help justify funding for further appraisal work where this is deemed necessary;
- The objectives and actions from previous Surface Water Management Plan work and the 2015 Strategy are reviewed against the progress that has been made in local flood risk management work in the Black Country;
- A revised action plan is specific, achievable and fundable, with measurable success factors and that this can be aligned with the wider work the Black Country Councils do e.g. in terms of managing open space, highways etc.;
- A Strategic Environmental Assessment and Habitats Regulations Assessment are undertaken, if these are scoped in and appropriate;
- The revised Local Flood Risk Management Strategy must be subject to public consultation.

2.3.6 LLFAs, surface water and SuDS

The revised 2019 National Planning Policy Framework (NPPF) states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165). When considering planning applications, local planning authorities should consult the LLFA on the management of surface water in order to satisfy that:

- The proposed minimum standards of operation are appropriate
- Through the use of planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime

Staffordshire County Council's (SCC) requirements for new major developments and the inclusion of SuDS for Sandwell, Walsall and Wolverhampton Councils are set out on the SCC **website**, alongside supporting documents. At the time of writing this SFRA, Staffordshire County Council provide flood risk services to these Councils under a Collaborative Working Arrangement.

The current documents and policies relevant to SuDS and surface water are:

- **SuDS Handbook** (Staffordshire County Council, 2017) noting that the Black Country version of the Handbook (with identical Local SUDS standards) is due to be published in 2020;
- **Standing Advice** (Staffordshire County Council, 2015);
- **Black Country Core Strategy,** Policy ENV5 (adopted 2011)
- **Wolverhampton Surface Water Management Plan – Phase I, II & III** (2012)

Dudley Metropolitan Borough Council's requirements for new developments and the inclusion of SuDS are set out on their **website** and Dudley are currently developing

further SuDS guidance and a SuDS Handbook and developers are currently directed to:

- **Draft Local Guidance for Planning Applications**
- **Surface Water Drainage Flood Risk and SuDS Pro-forma for new developments**

2.3.7 Water Cycle Studies

Water Cycle Studies (WCS) – whether scoping, outline or detailed – assist Councils to select and develop sustainable development allocations in locations where there is minimal impact on the environment, water quality, water resources, infrastructure, and flood risk. WCS's provide the required evidence, and an agreed strategy, to ensure that planned growth occurs within environmental constraints (and where possible contributes to environmental improvements), with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable. This is undertaken by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts. At the time of writing this SFRA, a WCS for the Black Country Authorities was being prepared alongside the study.

2.3.8 Surface Water Management Plans

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from risk from surface runoff, groundwater, and ordinary watercourses. SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the LLFA, Local Authority, Sewerage Undertaker and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree. A Scoping Water Cycle Study and **SWMP for the Black Country** was produced in 2009 and the SWMP offered a high level picture of flood risk across the Black Country and this recommended that an Outline SWMP should be undertaken. Further work was undertaken in Sandwell and Wolverhampton.

The **Wolverhampton Surface Water Management Plan – Phase I, II & III** (2012) collated and mapped best available flood risk information; quantified the risks of surface water flooding to enable an assessment of people, properties and infrastructure at risk; identified options to manage these risks and set out requirements for an Action plan going forward and identified Critical Drainage Areas across the Wolverhampton City area.

The Phase I & II SWMP identified a number of key strategies including:

- All information contained within the SWMP should be considered when site-specific FRAs are undertaken for developments within the area. It is noted that the Risk Management Authorities consider that the Risk of Flooding from Surface Water mapping has now superseded the mapping produced for the SWMPs.
- Retrofitting of SuDS in existing developments where feasible.
- Investigation into dual use of residential roads as flow pathways, and reduction in private gardens/driveway paving where possible.
- Consider hotspots and Critical Drainage Areas to build a greater understanding of properties and areas at risk in the 1 in 30-year storm event:
    - CDA1: Woodstock Road
    - CDA2: Corve Gardens
    - CDA3: Guy Avenue
    - CDA4: Wychall Drive, Blackbrook Way and Primrose Avenue
    - CDA5: Clark Road / Compton Road / Ross Avenue
    - CDA6: Bramstead Avenue / Grove Lane

- CDA7: Marnell Drive / Gall Park
- CDA8: Oxley Moor Road

The Phase III of the SWMP was to look at options, objectives and then to a) identify and b) shortlist options for next steps and quick wins. Part IV of the SWMP was to consider how to implement any quick wins and a formal review of the actions to be delivered. This work has not yet been undertaken.

Sandwell Metropolitan Borough Council SWMP (2014) was undertaken after the area was identified as a top priority area for surface water investigation by DEFRA in 2009. A number of key stakeholders and local partners were consulted during the investigation with the objective to gain a better understanding of the cause and effects of surface water flooding across the borough. Borough wide pluvial modelling was used to improve upon existing Environment Agency RoFfSW maps. From this, six localised hotspots were chosen for detailed hydraulic modelling studies in order to assess possible mitigation measures and establish options for managing surface water within the objectives of the SWMP. These locations were:

- Elm Terrace
- Thimblemill Brook
- Tower Brook Road
- Upper St Mary's Road
- Yew Tree Brook
- Tipton Brooks – this was identified as a key development catchment

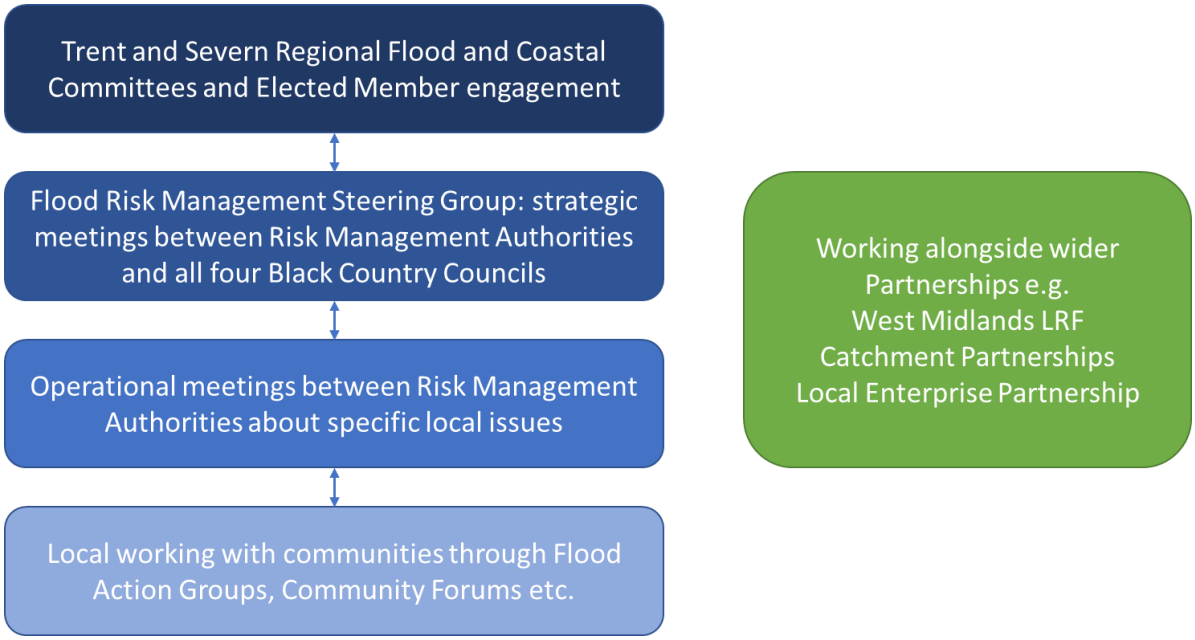
The investigation concluded in the development of an Action Plan with a number of recommendations for surface water management across the borough including:

- The identification and survey of all flood risk assets across Sandwell to assess their condition and collate an Asset Register, including those managed by the council and key stakeholders. Key assets should be checked and maintained regularly to ensure full functioning.
- Close collaboration between departments across Sandwell MBC and key stakeholders to continue, as established during this investigation
- Opportunities for the reduction of surface water flooding should be considered at the planning stage of all new developments
- Retrofitting of SuDS should be considered for existing developments. For new developments SuDS should be heavily promoted.
- The adoption of a consistent system to record flood data including causes, consequences, numbers of properties affected and estimated flood depths and extents.

2.3.9 Partnership working across the Black Country

Figure 2-1 shows how partnership working between Risk Management Authorities is structured across the Black Country.

Figure 2-1 Partnership working in the Black Country



3 Planning policy for flood risk management

This section summarises national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised National Planning Policy Framework (NPPF) was published in July 2018 and updated in February 2019, replacing the 2012 version. The NPPF sets out Government's planning policies for England. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements. The NPPF states that:

"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards".

Planning Practice Guidance on flood risk was published in March 2014 and sets out how the policy should be implemented. **Diagram 1 in the NPPG** sets out how flood risk should be considered in the preparation of Local Plans.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas.

3.2.1 The Flood Zones

The definition of the Flood Zones is provided below. The Flood Zones do not take into account defences. This is important for planning long term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change, hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

The Flood Zones are:

- Flood Zone 1: Low probability: less than a 0.1% chance of river and sea flooding in any given year
- Flood Zone 2: Medium probability: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year
- Flood Zone 3a: High probability: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes.

The Flood Zones in the Appendix A Geo-PDFs are the same as those shown on the Environment Agency's 'Flood Map for Planning', except where this SFRA has used more specific local information e.g. for some smaller watercourses in Walsall.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses if the catchment is <3km^2. As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from smaller watercourses not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is land which would flood with an annual probability of 1 in 20 years; where detailed modelling exists, the 1 in 20-year flood extent has been used to represent Flood Zone 3b (provided by the Environment Agency). For areas outside of the detailed model coverage, this is represented by Flood Zone 3a (indicative Flood Zone 3b) as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists.

3.2.2 The Sequential Test

Firstly, land at the lowest risk of flooding and from all sources should be considered for development. A test is applied called the 'Sequential Test' to do this. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. Table 2 of the NPPG defines the vulnerability of different development types to flooding. Table 3 of the NPPG shows whether, having applied the Sequential Test first, that vulnerability of development is suitable for that Flood Zone and where further work is needed.

Figure 3-1 The Sequential Test

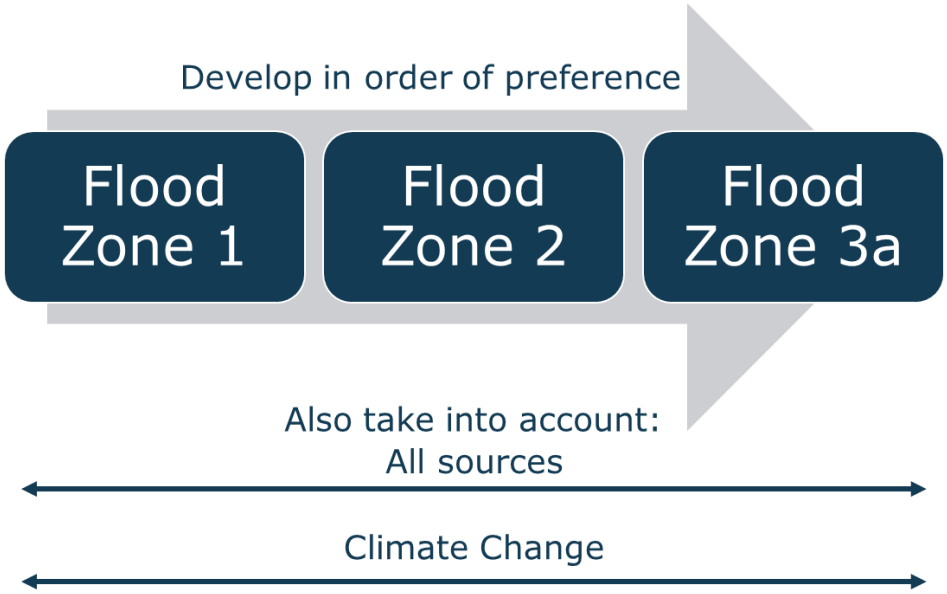
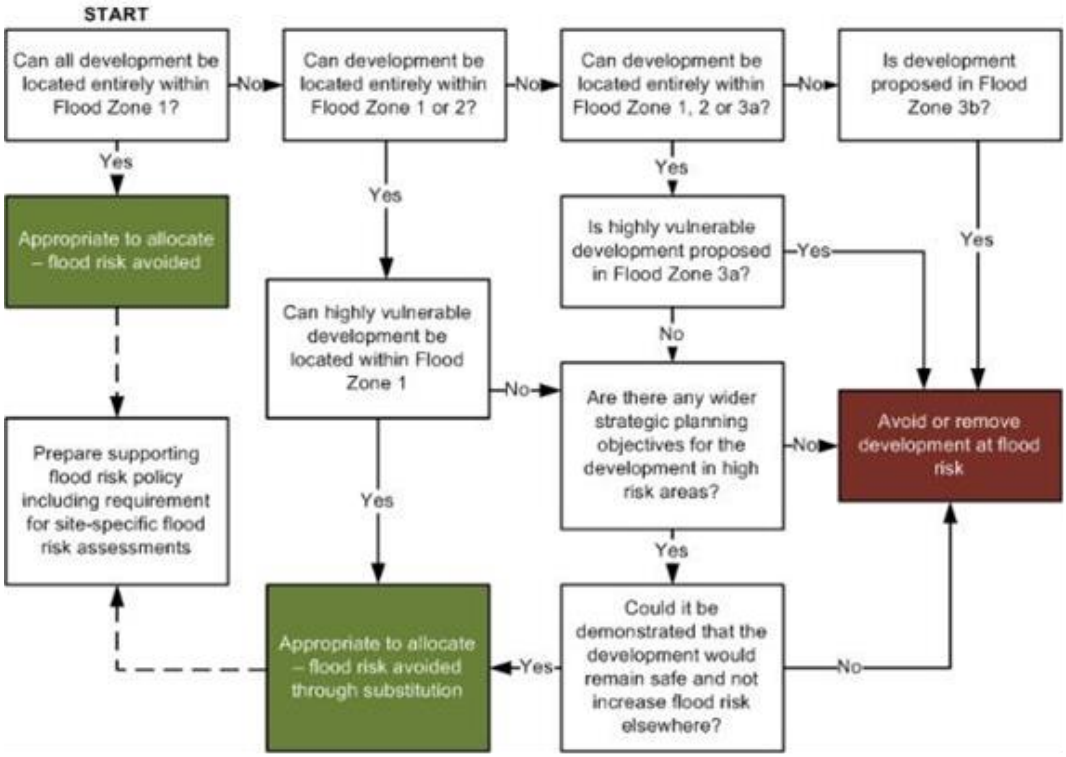


Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded.

In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate.

Figure 3-2 Local Plan sequential approach to site allocation



3.2.3 The Exception Test

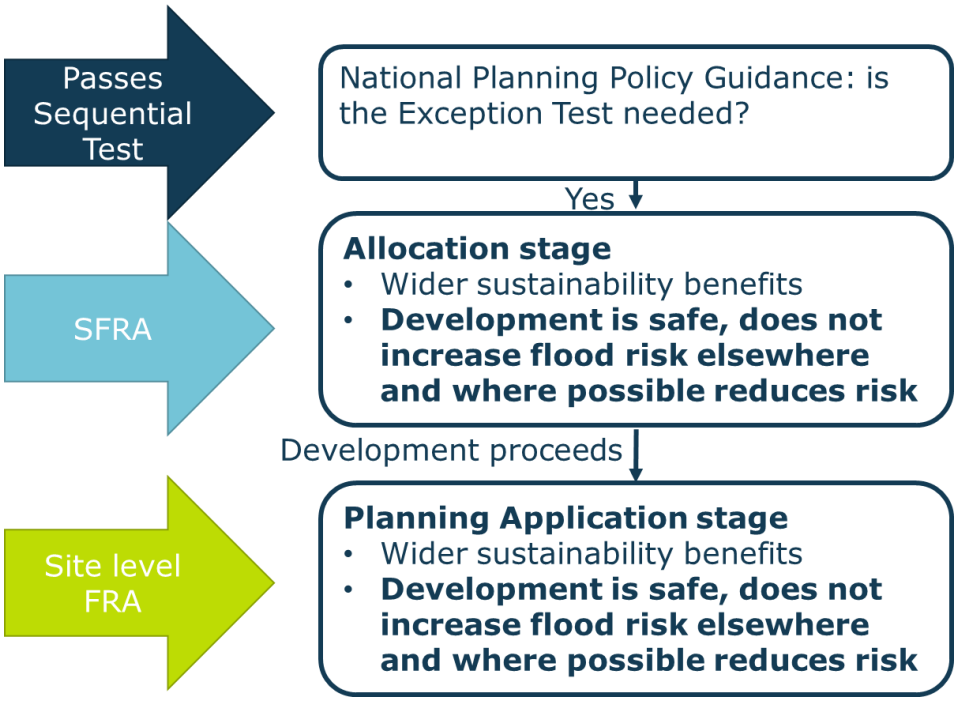
It will not always be possible for all new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances as set out in Table 3 of the NPPG:

- More vulnerable in Flood Zone 3a
- Essential infrastructure in Flood Zone 3a or 3b
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)

Figure 3-3 summarises the Exception Test. An LPA should apply the Exception Test to strategic allocations. For all developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test. This is because when a site-specific Flood Risk Assessment is done, more information on the exact measures that can manage the risk is available.

Figure 3-3 The Exception Test



3.3 Using the SFRA to apply the Sequential and Exception Tests to the Local Plan

This SFRA provides the main evidence required on flood risk to carry out the Sequential Test. This process also enables those sites that have passed the Sequential Test, and may require the Exception Test, to be identified. A Local Plan Sustainability Appraisal should be used to support any decision to locate development in higher flood risk areas in terms of wider strategic planning objectives.

It is recommended that planners use the information in this report to apply the Sequential Test alongside wider strategic planning objectives as follows:

1 Using the information on the Flood Zones, can development be allocated into the lowest flood risk areas?

2 Using the information on other sources of flooding, can development be allocated into the lowest flood risk areas?

3 Using the information on climate change, is there likely to be a significant increase in flood risk due to climate change? They should form a judgement based on the likely lifetime of a development (e.g. 60 years for commercial and 100 years for residential) as to whether the site is likely to become at unacceptable risk of flooding over time.

Where there are flood defences (shown on the maps in Appendix A), the results of the climate change modelling will not be directly comparable with the Flood Map for Planning, because it does not take the defences into account. Should a site rely heavily on defences for protection, a Level 2 SFRA is recommended that can explore in greater detail what the impact of climate change on flood hazard, depth and velocity over the lifetime of a development to inform the Exception Test, should this be required.

Having applied this analysis, should there be any sites allocated in areas of high flood risk, Table 3 of the NPPG should be consulted to see if the Exception Test would apply,

with reference to the flood risk vulnerability of the development. If so, it is recommended that these sites proceed to a Level 2 SFRA to further advise on the likelihood of the allocation passing the Exception Test. In addition, sites that are at high risk of flooding from other sources and/ or where there may be significant impacts due to climate change would benefit from Level 2 SFRA.

Once the process has been completed, the LPA should then be able to allocate appropriate development sites through the Local Plan as well as prepare flood risk policy including the requirement to prepare site-specific FRAs for all allocated sites that remain at risk of flooding.

3.4 Applying the Sequential Test and Exception Test to individual planning applications

3.4.1 The Sequential Test

The Black Country Authorities, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers are required to apply the Sequential Test to all development sites, unless the site is:

- A strategic allocation and the test have already been carried out by the LPA, or
- A change of use (except to a more vulnerable use), or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m2), or
- A development in flood zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

The SFRA contains information on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Site with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood.

Ownership or land-owner agreement in itself is not acceptable as a reason not to consider alternatives.

3.4.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required (as set out in Table 3 of the NPPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception test:

- *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk*

  Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

  Applicants should detail the suitability issues the development will address and how doing so will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- *Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

  The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:

  - The design of any flood defence infrastructure.
  - Access and egress.
  - Operation and maintenance.
  - Design of the development to manage and reduce flood risk wherever possible
  - Resident awareness.
  - Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event.
  - Any funding arrangements required for implementing measures.

3.5 Existing Local Plan policy on development and flood risk

The policies relevant to development and flood risk in the **Black Country Core Strategy** are outlined below.

- Core Strategy Policy 3 (CSP3) Environmental Infrastructure: This policy states that development proposals should demonstrate that the strategic network of environmental infrastructure will be protected, enhanced and expanded at every opportunity. This comprises open space, sport and recreation facilities, areas of biodiversity and geodiversity importance, wildlife corridors, the canal network, watercourses and drainage systems. All development proposals must promote

leisure and amenity value of the Canals for beneficial and multifunctional use of the canal network.

- Core Strategy Policy 3 (ENV4) Canals: – to safeguard the operation of navigable and functional waterways whilst protecting and enhancing its special historic, architectural, archaeological and cultural interest and to protect and enhance water quality in the canal
- Core Strategy Policy 3 (ENV5) Flood Risk, Sustainable Drainage Systems and Urban Heat Island: This policy states that development will be steered sequentially to areas with a low probability of flooding and will be subject to the requirements of the Exception Test. It states that development should incorporate Sustainable Drainage Systems (SUDs), unless impractical to do so and should open up culverted watercourses where feasible. Opportunities to reinstate more naturalised channels and restore the functional floodplain to benefit rivers should be taken where possible. For sites requiring a Flood Risk Assessment, development sites must reduce surface water flows back to equivalent greenfield rates and take opportunities to create new green space, increase tree cover and/or provide green roofs. No development will be permitted within a groundwater Source Protection Zone 1 which would physically disturb an aquifer, and no permission will be granted without a risk assessment demonstrating there would be no adverse effect on water resources.

3.6 Relevant local policy on development and flood risk

Dudley Metropolitan Borough Council

- The **Dudley Borough Development Strategy (2017)**, Strategic Policy S4 states that all major development and sites shown at risk from other sources of flooding as identified in the Council's updated flood map for surface water, PFRA or identified at risk by the Council should be supported by a Flood Risk Assessment and seek to reduce flood risk through river and floodplain enhancement. Policy S5: Minimising Flood Risk and Sustainable Drainage Systems (SuDS) states that new and adapted development shall minimise flood risk, help improve water quality and promote sustainable drainage. SuDS measures should provide beneficial wildlife habitat, seeking to reduce overall run-off volumes to greenfield equivalents, and control the rate of flow. Developments shall note groundwater protection, make allowance for climate change and ensure that long-term maintenance and ownership / adoption is provided.
- **Revised Nature Conservation Supplementary Planning Document** (SPD) **(2016)** shows key wildlife corridor routes within the Dudley Borough and the SPD states that all major new commercial and residential developments should use on-site natural green space Sustainable Urban Drainage Systems to minimise surface water run-off to help reduce flood risk and utilise measures such as such as dry swales, small wetlands (detention ponds), vegetated green space areas, rather than an underground concrete storage tank which have no biodiversity or landscape benefits.

Sandwell Metropolitan Borough Council

- The **Site Allocations and Delivery Development Plan Document** is a key aspect of Sandwell Metropolitan Borough Council's LDF and builds on the Black Country Core Strategy, providing greater detail to development within the Borough until 2021 and considers site constraints, environmental opportunities and relevant policy for site areas of growth.

- The **Revised Residential Design Guide SPD** (2014) considers layout, street design and good practice to assist developers to link adopted policy to the aims of Building for Life 12 so that design solutions for proposed housing layouts are fully informed and include acceptable design principles. Section 6: Drainage states that SuDS must be considered on all new developments and includes design guidance in line with CIRIA C697: The SuDS Manual, guidance for Highways Technical Approval submissions and guidance on SuDS adoption and maintenance.

Walsall Council

- **Walsall Unitary Development Plan (2005) – 'saved policies'** Policy ENV40 Conservation, Protection and Use of Water Resources (Parts a – e) states that a) Development will only be permitted in areas where adequate water supplies are available or where they can be made available without detriment to the environment, b) Proposals will be encouraged to conserve water c) Development will not be permitted if the drainage arising from the site poses an unacceptable risk to the quality or usability of surface or ground water resources, d) Rivers, canals, lakes and pond environments will be protected, and enhanced in a comprehensive way and e) The adoption of a sequential approach, subject to other sustainable development objectives and the use of flood risk information provided by the Environment Agency.
- **Walsall Site Allocation Document** and **Town Centre Area Action Plan Delivery Strategy** and **Infrastructure Plan** These documents set out how residential, employment land and other such requirements as set out in the Black Country Core Strategy (BCCS) will be delivered in Walsall through the Site Allocation Document (SAD) and Walsall town centre Area Action Plan (AAP). It notes the presence and risk of the culverted Ford Brook through the Town Centre and the provision of an early warning system within the Town Centre.
- **Walsall Site Allocation, CIL Deliverability and Viability Study (2014)** is a report that undertook a review of development viability in relation to the sites being identified for potential allocation and to provide suggested CIL rates within a Preliminary Draft CIL Charging Schedule as part of a suite of evidence to ensure that the targets set out in the Black Country Core Strategy (BCCS) are met during the timescale to 2026. However, at the time of reporting this work is ongoing and therefore timescales will likely be altered.

City of Wolverhampton Council

- **Planning for Sustainable Communities SPD** considers new developments in light of the Wolverhampton Declaration on Climate Change and that sites must take due account of flood risk, and where it is present, take appropriate measures to reduce the risk of flooding on proposed development sites.
- **Neighbourhood Plan for the Tettenhall Wards (2014)** considers site specific policy to determine planning applications in the Neighbourhood Plan area. Policy TNP9 – Penk Rise recognises that a small culvert runs through the site from east to west that parts are prone to flooding, Policy TNP15 – Trees recognises the importance that trees contribute to the character and landscape of the area and are given maximum protection within the Plan area, as trees improve air quality, provide wildlife habitats and help to reduce the effects of flash flooding. Policy TNP16 - Sustainable Buildings states that new developments are required to integrate sustainable urban drainage systems, where ground conditions allow, to minimise the risk of localised flooding and prevent contamination of the water environment.

- **Heathfield Park Neighbourhood Plan** (2014) Policy 6: Improve the condition and use of existing housing stock encourages the introduction and use of SuDS. It recognises that Sites H1 and H2 have a culvert that intersect the sites and that proposals should consider de-culverting in this area.

3.7 Existing Area Action Plans

Dudley Metropolitan Borough Council

Below are some of the policies and principles in Dudley **Area Action Plans** that are relevant to flood risk, as part of Dudley Metropolitan Borough Council's Local Development Framework:

- **Dudley Area Action Plan (2017)** - Policy 6 – Sustainable Urban Drainage Systems (SUDS) and Flood Risk states that new development shall incorporate sustainable use and management of water for water reuse sustainable drainage and flood risk management which will ensure the long-term sustainability and reduced environmental impact of new development unless proven to be unviable or inappropriate.
- **Stourbridge Area Action Plan (2013)** - Policy 1 states that all new development within the plan areas shall Safeguard, increase and enhance existing green infrastructure for urban cooling, flood risk and climate change benefits, and for benefit of wildlife and people, along the River Stour corridor. Policy 14: The River Stour will improve the River Stour for amenity, wildlife and recreation through new development opportunities. Policy 19: Sustainable Urban Drainage System (SUDS) and Flood Risk states that new development shall include measures to help promote sustainable urban drainage, reduce flood risk through flood mitigation and make allowance for climate change.
- **Halesowen Area Action Plan (2013) –** Policy 6: Proposed Development and the River Stour states that development adjacent or close to the River Stour will be required to enhance the river and its setting, improve public access to and along the river, guard against adding to flood risk, and safeguard and enhance biodiversity, where feasible. Development should face onto the watercourse, mitigate against flood risk, include a 10m buffer from the top of bank and be subject to a site-specific Flood Risk Assessment. Policy 7: Surface Water states that the design and layout of new development will be required to take into consideration surface water issues, and to mitigate for any problems that may arise such as surface water run-off and flooding - this being achieved including by making space for water and incorporating sustainable drainage features in all development.
- **Brierley Hill Area Action Plan (2011)** – Policies 18 ,19 and 21 consider developments adjacent to the Canalside and consider the impact of developing areas adjacent to Merry Hill, as the intensification of the area will need to address significant level changes which may have drainage implications. Policy 62 considers the importance of the Wildlife Corridor network throughout the Brierley Hill area which links Fens Pool area and Saltwells Local Nature Reserve. Policy 63 – Sites of Local Importance for Nature Conservation looks to protect areas of high ecological value in the design and layout of any proposal and that developments must provide appropriate mitigation for the loss of other areas of nature conservation value.

Sandwell Metropolitan Borough Council

- **Smethwick Area Action Plan (2007)Tipton Area Action Plan (2008)**

  The Action Plan includes local policies relating to individual development sites Tip 1 – Tip 7 as identified on the AAP Proposals Map. Development schemes are to be designed in accordance with national, regional and local standards which seek to enhance the environment, including flood risk, biodiversity and geodiversity and take account of climate change. Developments should take opportunities to extend natural habitats, encourage 'climate-proofed' developments and enhance natural and built heritage assets. Development sites near the Tipton Brook should take opportunities to daylight the brook and create a more naturalised channel within the new Community Open Space areas.

- **West Bromwich Area Action Plan (2012)**

  The Action Plan includes local policies relating to the regeneration of West Bromwich, particularly the town centre. Policies include allocation of sites for new shops and offices and the regeneration of many existing spaces. Policy WBP9 references a small area between Birmingham canal and the train line in which appropriate assessments will need to take place when these sites come forwards for redevelopment at a site-specific level.

Walsall Council

- **Walsall Town Centre Area Action Plan (2019)**

  The Action Plan looks to allocate sites for new shops, leisure facilities, and offices, and strategies for improvements, over the Action Plan period including transport, design and the environment, including the consideration of Flood Risk from the culverted Ford Brook.

City of Wolverhampton Council

- **Bilston Corridor Area Action Plan (2014)**

  The Action Plan includes development areas and encourages opportunities to create multifunctional green corridors and transport links with sustainable drainage systems to provide public amenity and to reduce flood risk and provide water quality benefit. It encourages the inclusion of urban Wetlands, rain gardens as part of SuDS Schemes (SUDS) and the incorporation of trees and woodland, particularly where there are known surface water flooding issues or where wildlife habitat connectivity could be enhanced.

- **Wolverhampton City Centre Area Action Plan (2016)**

  The Wolverhampton AAP is part of the Local Plan for the City, to provide a more detailed framework at the local level to show how the Core Strategy will be delivered and sustainable development will be achieved. Policy CC10 – Delivering Environmental Infrastructure in the City Centre looks to identify opportunities to improve existing and create new environmental and ecological networks. It encourages the inclusion of urban Wetlands, rain gardens as part of SuDS Schemes (SUDS) and the incorporation of trees and woodland, particularly where there is known surface water flooding issues or where wildlife habitat connectivity could be enhanced.

- **Stafford Rd Corridor Area Action Plan (2014)** is part of the City of Wolverhampton's Development Plan to guide future development within the City area. It considers development parameters and site-specific recommendations which may impact the Fordhouses Employment Area, the Goodyear and Fordhouse Rd mixed use development areas and Fowlers fields, Park Village and Fallings Park areas.

4 Impact of Climate Change

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be taken into account.

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

4.1 Revised Climate Change Guidance

The Environment Agency published **updated climate change guidance** in late 2019 on how allowances for climate change should be included in both strategic and site specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency are currently using these to update their climate change guidance for new developments. Developers should check on the government website for the latest guidance before undertaking a detailed Flood Risk Assessment.

The UKCP18 contains high resolution mapping with peak river flow allowances at 1km grid scale that will be released later in 2020. The UKCP18 high resolution (daily and sub daily) rainfall projections are also due to be published later in 2020. Following this, the Environment Agency may update the recommended peak rainfall allowances in their guidance for planners and developers.

4.2 Applying the climate change guidance

To apply the climate change guidance, the following information needs to be known:

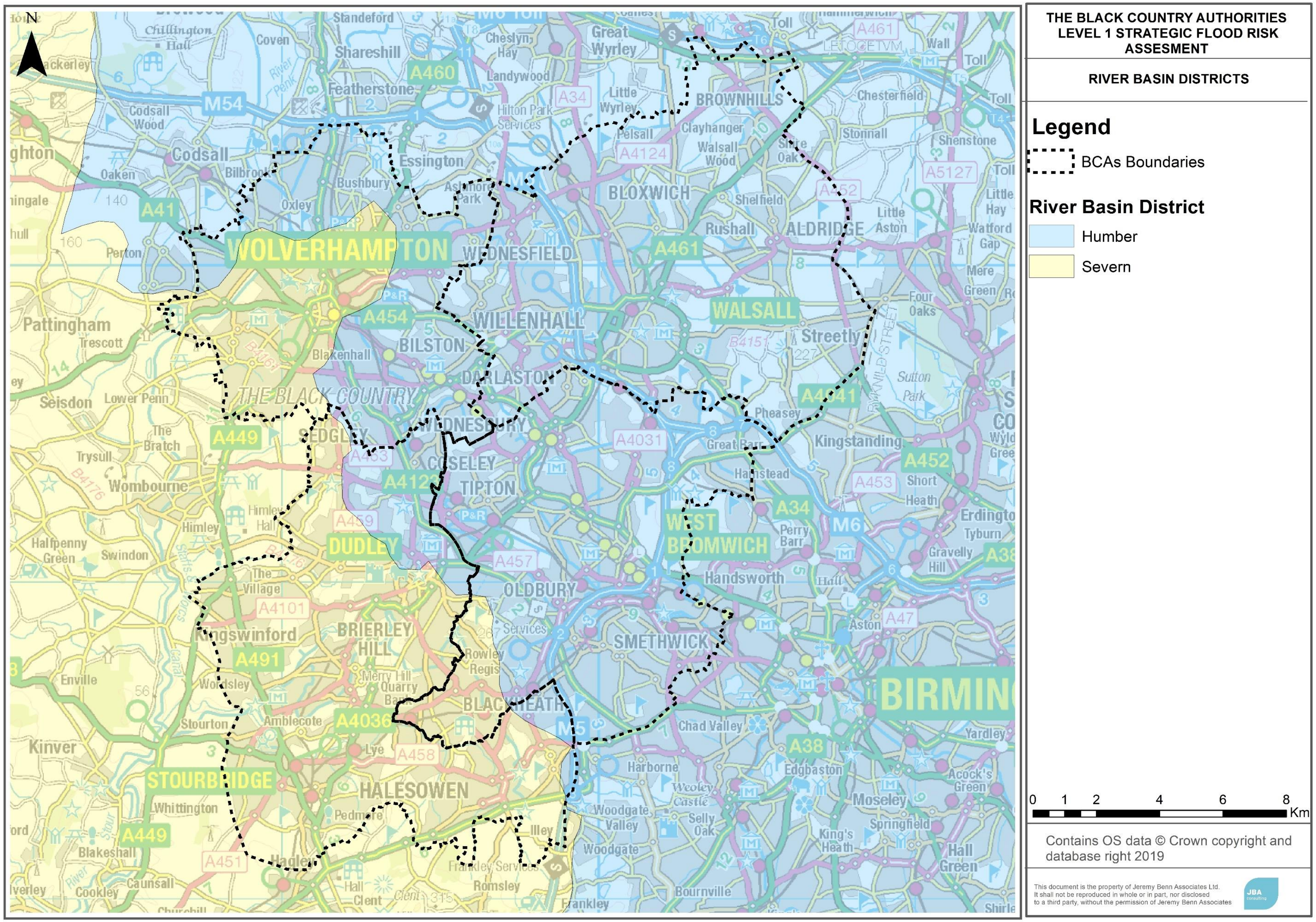
The vulnerability and lifetime of the development – see Table 2 of the **NPPG**.

When deciding which range of scenarios are appropriate, developers should consider:

- The likely lifetime of the development – in general 60 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA.
- The River Basin that the site is in – The Black Country sits largely within the Humber River Basin District, with the majority of Dudley and a large western proportion of Wolverhampton and the south-western edge of Sandwell falling within the Severn River Basin District as shown in Figure 4-1.
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s).
- The vulnerability of the development to flooding – see the **NPPG**. This is now the primary driver for which climate change scenario should be used.
- 'built in' resilience measures used, for example, raised floor levels.
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

The appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on the land uses in affected areas. In the majority of cases developers should use the higher central allowance to calculate floodplain storage compensation.

Figure 4-1 River Basin Districts in The Black Country



4.3 Relevant allowances for the Black Country

Table 4-1 and Table 4-2 shows the peak river flow allowances that apply in the Black Country.

Table 4-1 Peak river flow allowances for the Humber river basin district

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	20%	30%	50%
Higher central	15%	20%	30%
Central	10%	15%	20%

Table 4-2 Peak river flow allowances for the Severn river basin district

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

Table 4-3 shows the peak rainfall intensity allowances that apply in The Black Country. Both the central and upper end allowances should be considered to understand the range of impact.

Table 4-3 Peak rainfall intensity allowances for small urban catchments

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Important note on Climate Change Mapping in this SFRA

For this SFRA update, the existing hydraulic models provided by the Environment Agency were re-run for climate change scenarios to account for the updated 2019 climate change guidance (which at the time this report was finalised in March 2020 were still the latest available) (Ford Brook, Lutley Brook, Mousesweet Brook, Wordsley Brook, Darlaston Brook, River Tame, Smestow Brook, Illey Brook, Coalbourne Brook, Brandhall Brook and River Stour).

It should be noted that different mapping techniques have been applied, depending on the type of hydraulic model (e.g. 1D-2D or 1D-only). LIDAR ground levels will have updated in some places along with newer model software versions since some of the much older models were originally run, and hence mapped outputs may differ slightly in some areas when compared against the original studies.

The majority of The Black Country is within the Humber River Basin District and therefore the Ford Brook, Darlaston Brook and River Tame models were run with the three scenarios to reflect the three climate change allowances for the '2080s' timeframe in the Humber River Basin District, therefore the 100-year plus 20%, 30% and 50%.

The Smestow Brook, Illey Brook, Coalbourne Brook, Brandhall Brook and River Stour models fall within the Severn River Basin District and therefore were run with the three scenarios to reflect the three climate change allowances for the '2080s' timeframe in the Severn River Basin District, therefore the 100-year plus 25%, 35% and 70%. The climate change mapping reflects the defended scenario.

Where no detailed hydraulic models are present, Flood Zone 2 has been used as a proxy (Indicative Climate Change Extent). More detailed hydraulic modelling in these areas may be required at site-specific Flood Risk Assessment stage to confirm flood risk and climate change impacts.

This modelling was undertaken to assist the Black Country Authorities with the preparation of their Local Plans. Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs.

Climate change mapping has been provided in Appendix A: Geo-PDFs. The Indicative Climate Change Extent layer provided under the climate change sub-heading should be viewed in conjunction with the modelled climate change outlines. The Indicative Climate Change extent has been provided where climate change models are not available or could not be run, to serve as an indication of possible extents.

An overview of the models provided and used in this SFRA are shown in Appendix D.

It is recommended that the impact of climate change on a proposed site is considered as part of a detailed Flood Risk Assessment, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development as described in Chapter 4. The Environment Agency should be consulted to provide further advice for developers on how best to apply the 2019 climate change guidance, when this becomes available.

4.4 Requirements for site-specific Flood Risk Assessments

When undertaking a site-specific FRA, developers should:

- Confirm which national guidance on climate change and new development applies by visiting GOV.uk.
- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed lifetime of the development. If the site is just outside the indicative climate

change extents in this SFRA, the impact of climate change should still be considered because these may get affected should the more extreme climate change scenarios materialise.

- Chapter 8 provides further details on climate change for developers, as part of the FRA Guidance.

4.4.1 Adapting to climate change

The NPPG sections on climate change contain information and guidance for how to identify suitable mitigation and adaptation measure in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses.
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.

5 Understanding flood risk in The Black Country

This chapter explores the key sources of flooding in the Black Country and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses, surface water, sewers and culvert blockages.

This is a strategic summary of the risk. Developers should use this Chapter to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

5.1 Historical flooding

The Black Country has a history of documented flood events, with the main sources being fluvial and surface water. Significant historic flood events are highlighted in Table 5-1.

Figure 5-1 Historic flooding in the Black Country shows historic flooding events recorded by Staffordshire County Council and the Black Country authorities and also shows the Environment Agency's indicative flood risk areas, and historic sewer flooding incidences from Severn Trent Water. It can be seen that there are notable clusters of flooding around the main urban areas of Halesowen, Tipton and Smethwick however, historic flooding is widespread throughout the study area.

Table 5-1 Historic flooding in the Black Country

Dudley		
Area Affected	**Cause of Flooding**	**Years of event**
Halesowen (Various streets including Grange Crescent)	High intensity rainfall following sustained wet period resulting in River out of bank and surface run off together with culvert blockage	2007 & 2008
Manor Way, Halesowen	Flooding mainly associated with excessive highway run off to low area.	2007 & 2008
Rushall Close, Wordsley	Combined flooding from ordinary watercourse and culvert blockage plus excessive high run off.	2008
Kingswinford (Metfield Croft, Hinsford Close, Bromley Lane)	High intensity rainfall resulted in flooding caused by excessive run off towards low area.	2007 & 2009
Stourbridge (Canal Street)	Fluvial flooding from the River and Canal overtopping. Surface Water flooding from runoff.	2008
Stourbridge (Birmingham Street)	Flooding from runoff from the surrounding high ground.	Annual Event

Dudley		
Area Affected	**Cause of Flooding**	**Years of event**
Gornal	High intensity storm produced excessive run off from large open space area towards residential properties.	2007
Hawbush Road, Bromford Primary School.	High intensity storm results in run off from surrounding land	May 2009
N. Dudley, Including Sedgley and Coseley. Church Street and Forest Road.	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Brierley Hill	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Halesowen	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016

Sandwell		
Area Affected	**Cause of Flooding**	**Years of event**
West Bromwich	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Wednesbury	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Rowley Regis	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Smethwick	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Oldbury	A high intensity storm which resulted in excessive surface water runoff and sewer network capacity exceedance.	June 2016
Tipton	A high intensity storm which resulted in excessive	June 2016

Sandwell		
Area Affected	**Cause of Flooding**	**Years of event**
	surface water runoff and sewer network capacity exceedance.	
Biddleston Grove, Brakendale Drive and Spruce Road, Yew Tree	Blockage of grid at upstream end of culverted watercourse	Unknown
Monksfield Avenue, Grove Vale	Overtopping of Red House Park pool/possible blockage of outfall grid	Unknown
Spouthouse Lane, Hamstead	Flooding from the Gorse Farm Woods as overland flow. A culvert blockage also occurred.	Unknown
Chatsworth Road, West Bromwich	Overland surface water flows from higher land and groundwater flows.	Unknown
Beaconsfield Street, West Bromwich	Blockage of grid	Unknown
Rosefield Road and Watery Lane, Smethwick	Flooding from surcharging manholes along culverted watercourse/surface water sewers	Unknown
Smethwick	Highway flooding and entering factory in Rabone Lane.	Unknown
Brook Road, Titford	Flooding from Brandhall Brook.	Unknown
Penncricket Lane, Titford	Backing up of flows at culvert entrance.	Unknown

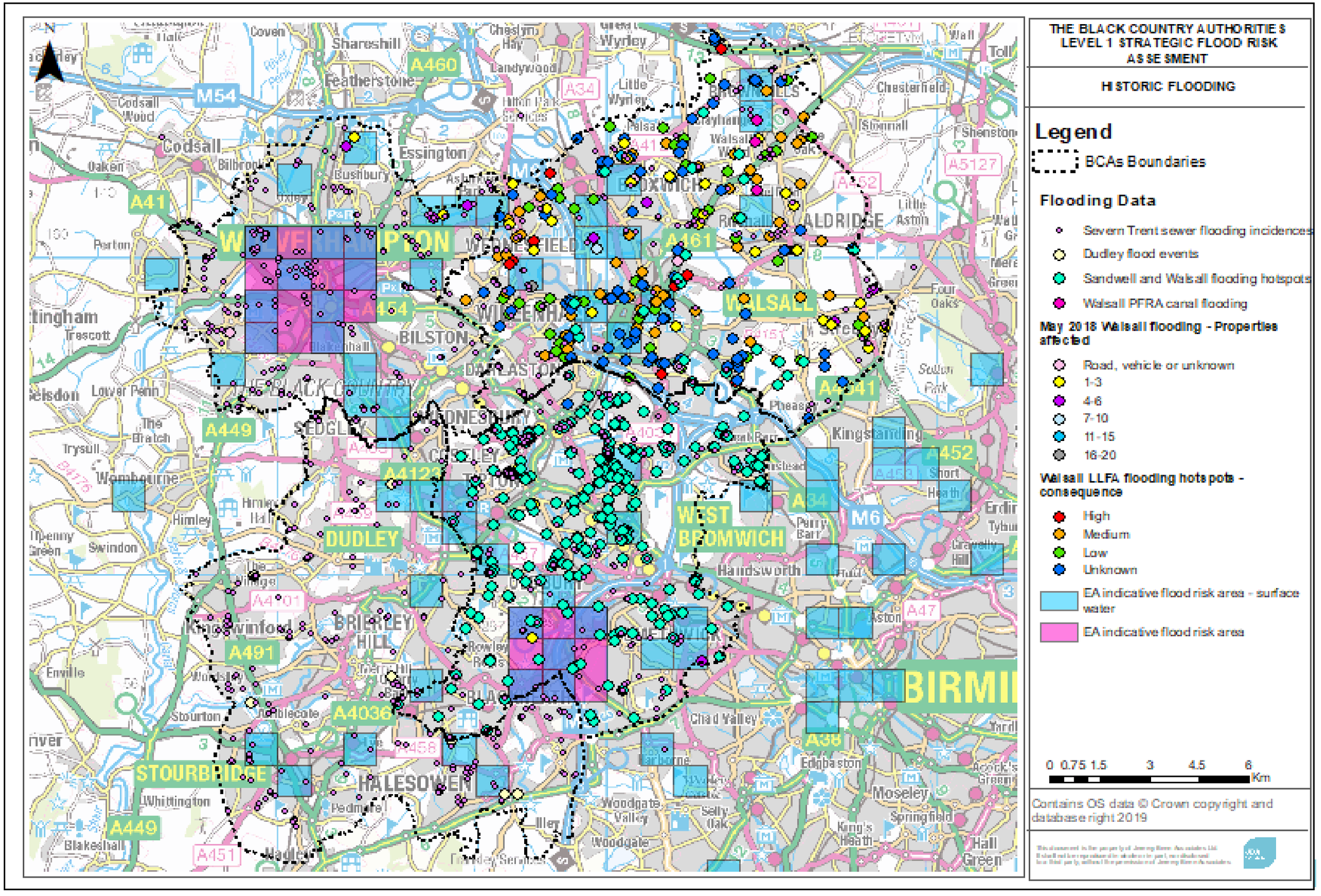
Walsall		
Area Affected	Cause of Flooding	Years of event
Darlaston Road, Including Station Street and Kendricks Road.	Surface Runoff exacerbated by poor drainage systems.	2009 & 2010
Localised issues boroughwide	Surface water flooding overwhelmed drainage infrastructure	2012
Barr Beacon	Surface water runoff from agricultural land	2012
Streetly, Pheasey, Bloxwich, Rushall	Surface water flooding overwhelmed drainage infrastructure	2016
Rushall, Willenhall	Surface water flooding overwhelmed drainage infrastructure	2018

Wolverhampton		
Area Affected	Cause of Flooding	Years of event
Penn	Surface water flooding	1998
Penn Road	Surface water and sewer flooding	Unknown

Black Brook Way	Surface water flooding	Unknown
Tettenhall	Surface water flooding	Unknown
Pinfold Grove	Fluvial flooding from Merry Hill Brook.	Unknown
Wightwick Mill Farm	Flooding from interaction between Smestow Brook and Canal.	Unknown
Pendeford Brook	Fluvial flooding from Pendeford Brook	1998
Eccleshall Avenue	Fluvial flooding from Oxley Brook.	Unknown
Graiseley Brook	Fluvial flooding from Graiseley Brook.	1998
Pendeford	Worcestershire Canal overtopping	July 2007
Newbolds, Scotlands, Merry Hill, Bradmore and Blakenhall	Groundwater flooding	Unknown
Amanda Avenue, Ashmore Park, Low Hill, Hobnock Road, New Cross Hospital and the Wolverhampton Ring Road	Surface water and sewer flooding	Unknown

During Autumn 2019, there were additional flooding events with a wider scale impact. On the 30th September there was heavy rainfall across the West Midlands which resulted in flooding across the Black Country and beyond on the 30th September and the 1st October. There was torrential rain on the 25th, 26th and 27th October which resulted in road closures and train cancellations. The M5 had two lanes closed around Rowley Regis. A water mains pipe burst in a house in Tipton on the 14th October, which caused substantial damage. Severe rainfall on the 7th and 8th October also caused widespread flooding to roads across the Black Country.

Figure 5-1 Historic flooding in the Black Country



5.2 Topography, geology, soils and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it (the permeability) affects the amount of surface water run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils cause rapid surface runoff, whereas more permeable rock such as limestone and sandstone can mean a catchment takes longer to respond to rainfall.

Topography

The topography of the Black country is dominated by the two watersheds for two main rivers. To the SW the River Stour and its surrounding catchment drains into the River Severn. To the NE the River Tame drains into the Trent. The topography can be defined by steep sided valleys and narrow waterway corridors. This combined with the heavily culverted waterways or concreted channels can cause a flashy and a 'rapid response' response to rainfall. Figure 5-2 shows the topography of the Black Country.

Geology and soils

Figure 5-3 and Figure 5-4 show the bedrock (solid permeable) formations in the study area and the superficial (permeable, unconsolidated (loose)) deposits. These are classified as the following:

- Principal: layers of rock or drift deposits with high permeability which, therefore, provide a high level of water storage
- Secondary A: rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers
- Secondary B: lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater
- Secondary undifferentiated: rock types where it is not possible to attribute either category a or b
- Unproductive Strata: rock layers and drift deposits with low permeability and therefore have negligible significance for water supply or river base flow.

The bedrock in the Black Country is predominately Secondary A; rock layers or drift deposits capable of supporting water supplies at a local level and, in some cases, forming an important source of base flow to rivers. Along the Western and Eastern edges, the bedrock is Principle; layers of rock or drift deposits with high permeability which, therefore, provide a high level of water storage. Across the area there are also some outcrops of Secondary B; lower permeability layers of rock or drift deposits which may store and yield limited amounts of groundwater.

The majority of the superficial deposits are across the north west of the Black country with the metropolitan area of Dudley having very few superficial deposits. The predominant superficial deposit across the area is secondary undifferentiated; rock types where it is not possible to attribute either category a or b. The Tame river valley is dominated by secondary A.

The area is well known for having ample mineral resources, with the name 'Black Country' associated with the south Staffordshire coal seam '30 foot seam' which lies below the area. Additionally, there has been both limestone and coal mining in the area which gives indications to the underlying geology.

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Figure 5-2 Topography of The Black Country

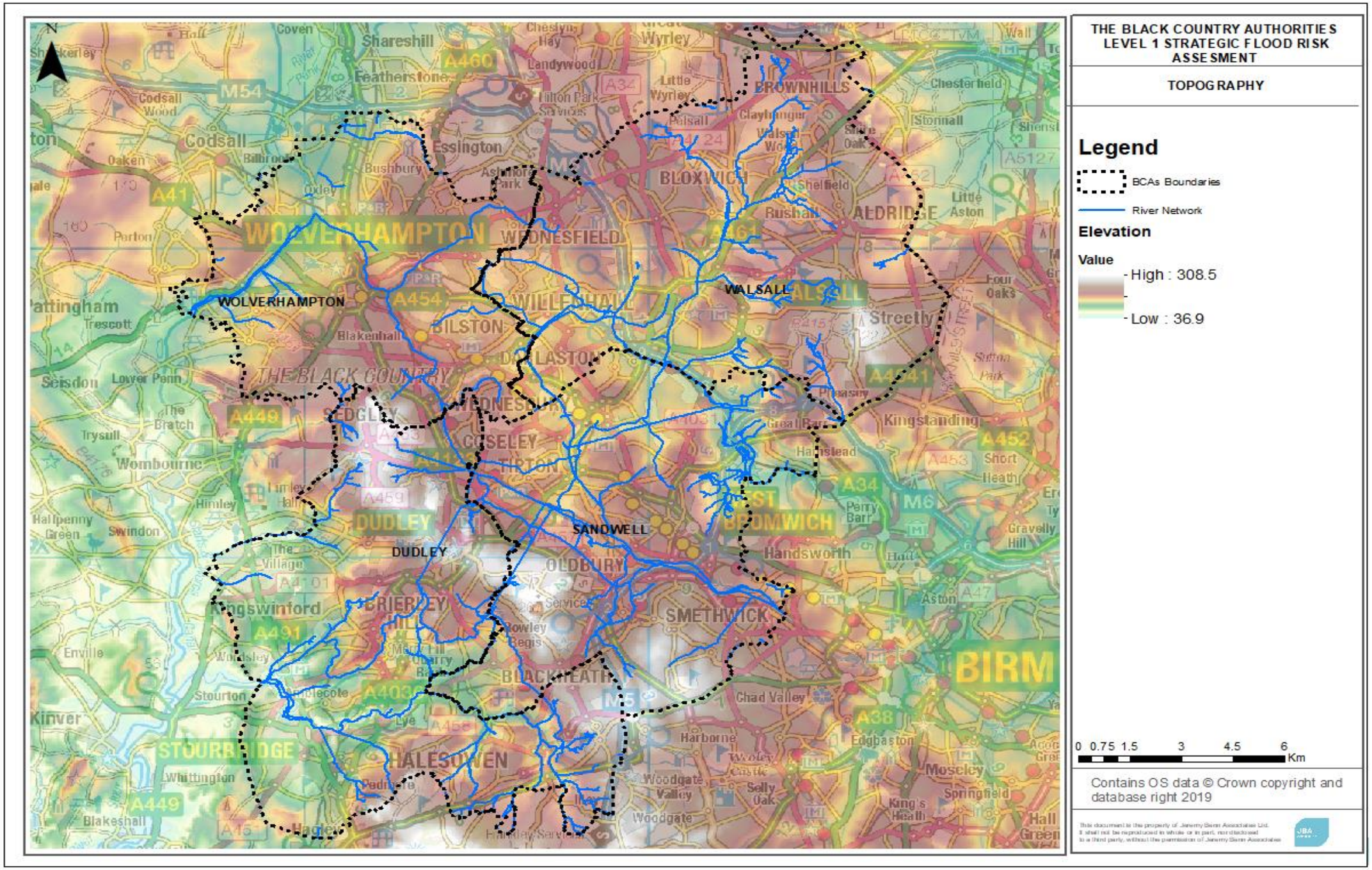


Figure 5-3 Bedrock geology in The Black Country

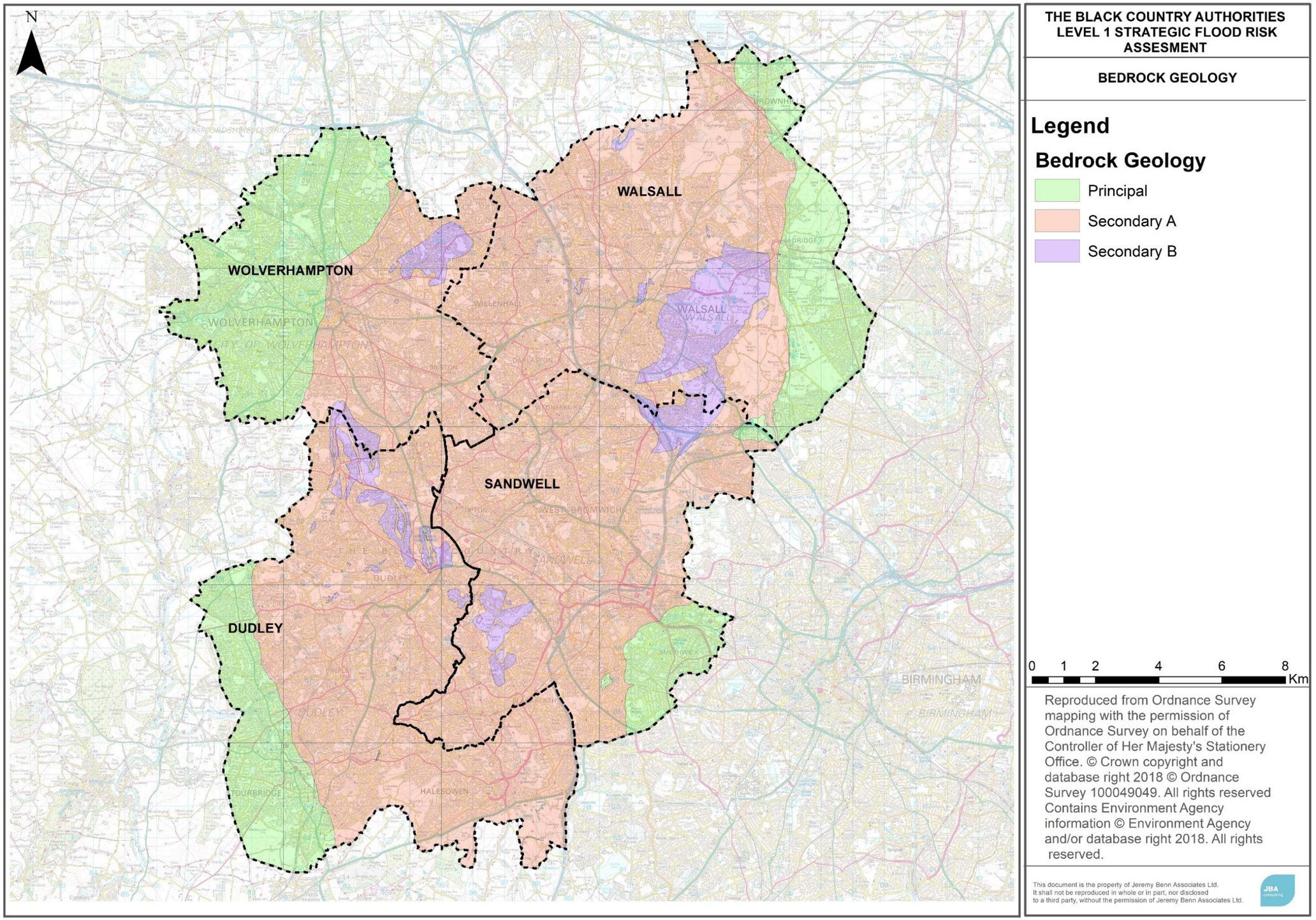
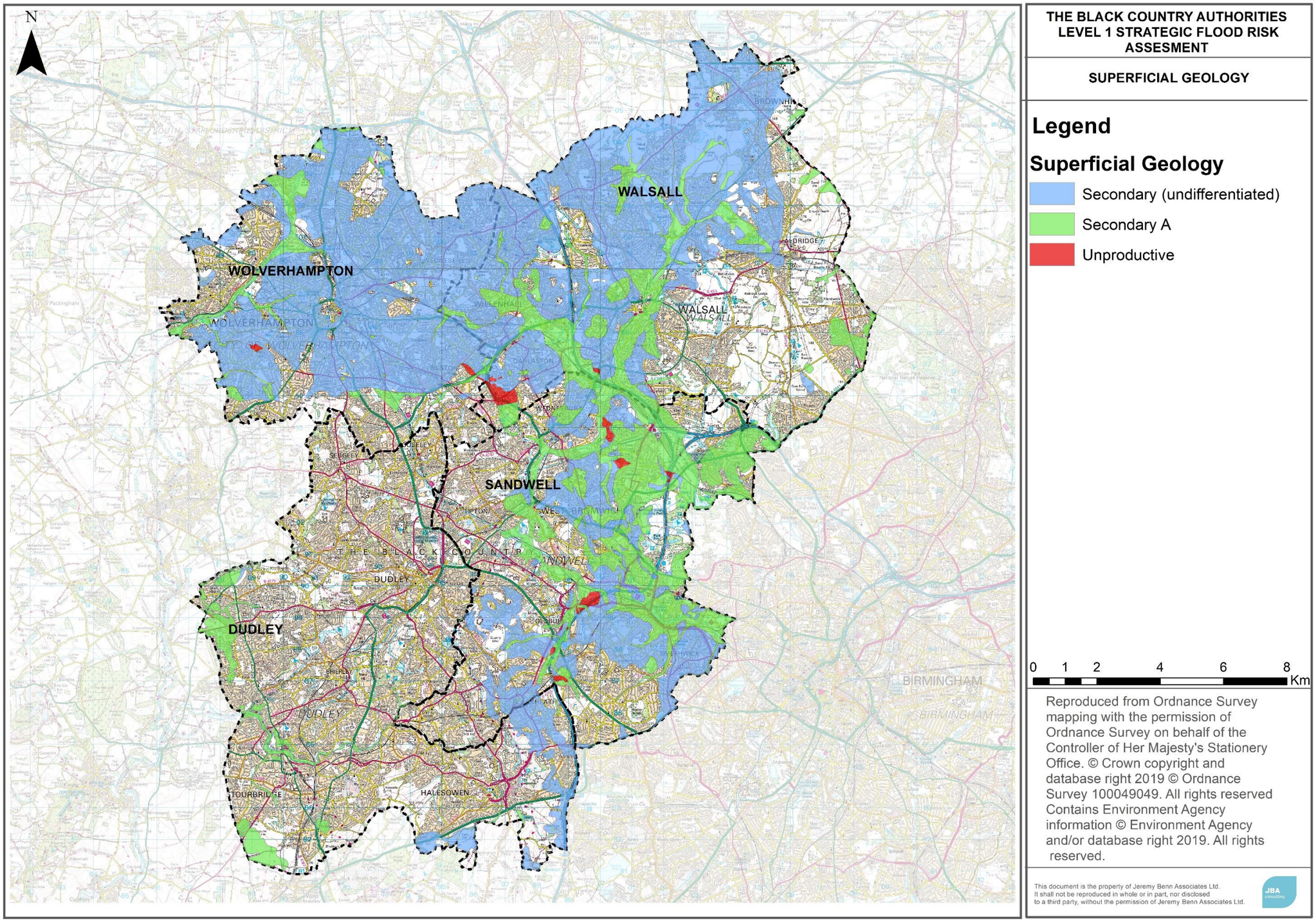


Figure 5-4 Superficial deposits in The Black Country



5.3 Watercourses

The major rivers in the Black Country are the River Stour and the River Tame which drain into the rivers Severn and Trent respectively. Other main watercourses are the Ford Brook, the Smestow Brook and the Mousesweet Brook.

Figure 5-5 shows the key watercourses and river basin districts in the study area. Key watercourses and main rivers are also included in the Appendix A mapping.

5.4 Fluvial (river) flood risk

The main areas at risk from flooding are along the River Tame and its tributaries, and along the River Stour and Smestow Brook.

The main areas at risk of flooding in the Black Country are Bescot, Willenhall, Horseley Heath, Dudley Port, North of Stourbridge and Newton (especially around the M6 Motorway).

The Flood Zone maps for the Black Country are shown in Appendix A GeoPDFs. These are interactive maps and show Flood Zones 2, 3a and 3b (including an 'indicative 3b' where FZ3a acts as FZ3b in the absence of detailed model data).

Flood Zones 2 and 3a reflect the Environment Agency's Flood Map for Planning Flood Zones at the time of preparing the SFRA, with outputs of any new available modelling spliced into the Flood Zones to create the SFRA Flood Zones 2 and 3a.

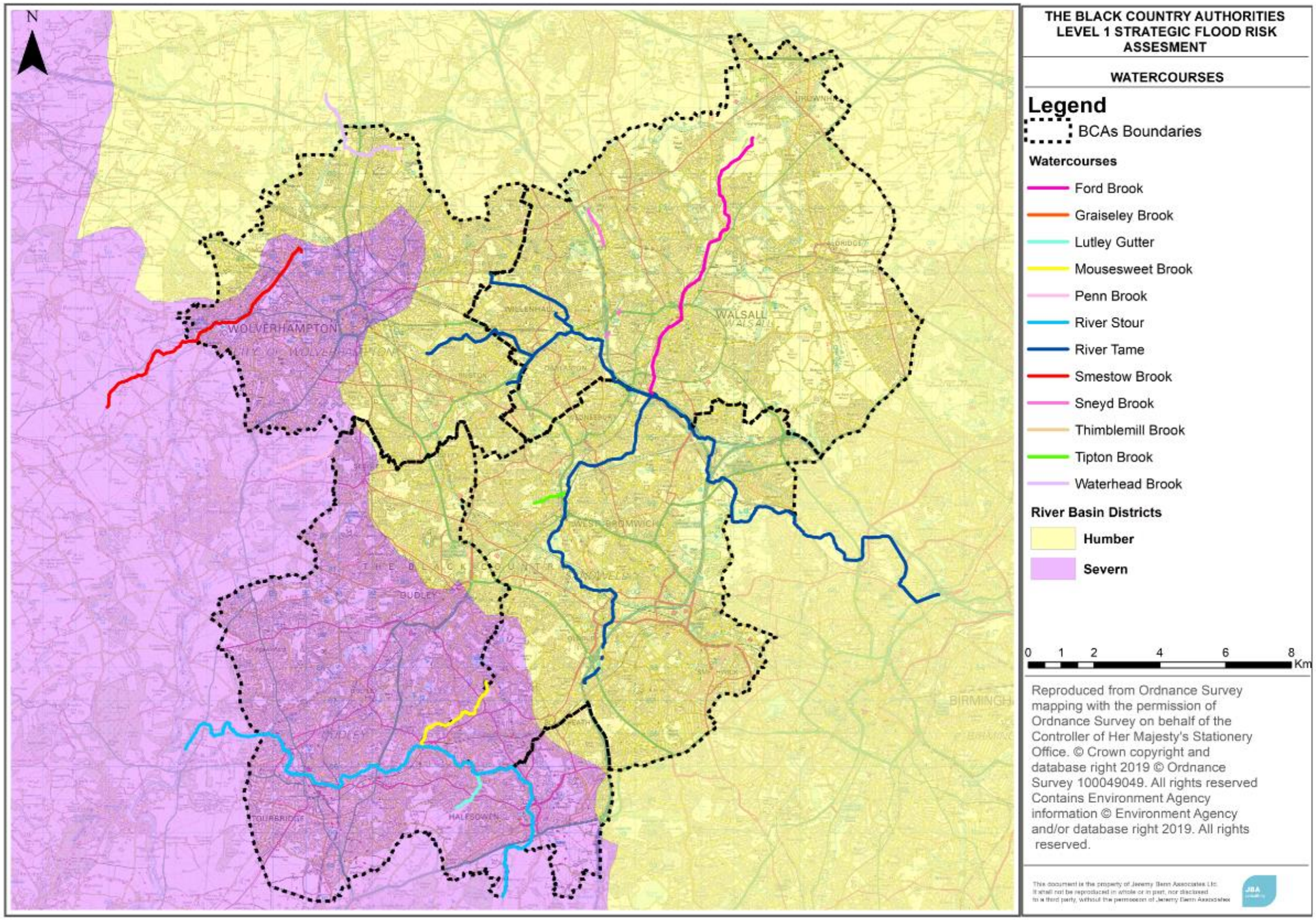
Indicative Flood Zones 2 and 3a contain the results of the 2013 Jflow modelling of ordinary watercourses in the Walsall Council area which has not been formally adopted by the Environment Agency. The area modelled in Willenhall has been removed where this has been superseded by the 2017 Waddens & Bentley Flood Relief Culvert study in this area.

For Flood Zone 3b, the 20-year defended scenarios have been used and where these have not been provided, the 25-year defended model outputs were used as a substitute. For areas outside of detailed model coverage, Flood Zone 3a is used as a conservative indication of Flood Zone 3b. This information is compiled in the 'Indicative Flood Zone 3b' output. For this SFRA, in the Walsall Council area, the 2013 Jflow modelling of ordinary watercourses in the Walsall Council area replaces areas of Flood Zone 3a in the Indicative Flood Zone 3b output.

Where areas are covered by indicative flood zones, further work should be undertaken as part of a detailed site-specific flood risk assessment to define flood extents where no detailed modelling exists.

The data used to inform the Flood Zones where detailed hydraulic modelling exists is outlined in Appendix D.

Figure 5-5 Key watercourses in The Black Country[1]



[1] The River Tame shown on the map in Figure 5-5 includes the Waddens and Bentley Flood Relief Culvert and the Tame Tunnel Culvert.

5.5 Culverted watercourses

Many of the watercourses in the Black Country have been heavily modified over time. Watercourses may have been piped (culverted), straightened, narrowed, disconnected from their floodplains by land raising and the shape of the channel may have been artificially altered. There is a residual, but real flood risk from such watercourses should they become blocked, surcharge or collapse. This might cause localised flooding where a culvert screen becomes partially blocked or major flooding if a culvert becomes completely blocked, overwhelmed by the amount of water or if it fails.

Where a watercourse passes through a development site an opportunity exists to restore the watercourse to a more natural condition, for example by opening up culverts, reinstating a natural, sinuous channel and restoring functional floodplain (places where water is designed to flow or be stored at times of flood). Doing so can help to reduce flood risk, improve water quality, benefit biodiversity and add amenity value.

Throughout the Black Country, there is an estimated 63km of culverted watercourses. There are known major culverts across the authorities, with known culverted sections of the Smestow Brook (Wolverhampton), Ford Brook, Darlaston Brook/ Tame Tunnel, Waddens and Bentley flood relief culvert (Walsall) and Swan Brook (Dudley). There is an extensive network of culverted Ordinary Watercourse across the Black Country on minor watercourses and under highways. The LLFAs hold some data on culverted watercourses, but given how extensive the network is, detailed records do not exist for every culvert. The approximate spatial locations of culverts that are known about can be found in Appendix A within the Interactive mapping.

Where a watercourse passes through a site (open or culverted) the developer should demonstrate that they have considered the above matters in developing their proposals for development.

5.5.1 Culvert Blockage Study for Walsall

The residual risk of flooding from culvert blockage or failure should be taken into account when planning and designing new developments.

A Culvert blockage study was undertaken in Walsall in 2013 by JBA Consulting which assessed the culvert capacity for the 1 in 30 and 1 in 100-year flows and the effects of the 90%, 75% and 50% blockage scenarios. 25 Culverts were assessed as part of this study and are shown in Figure 5-6 and Table 5-2. The results from this study can be found in Table 5-3 and the maps found in Appendix A. Appendix A shows the results for the 1 in 100-year flood event and the 50% and 90% blockage scenarios.

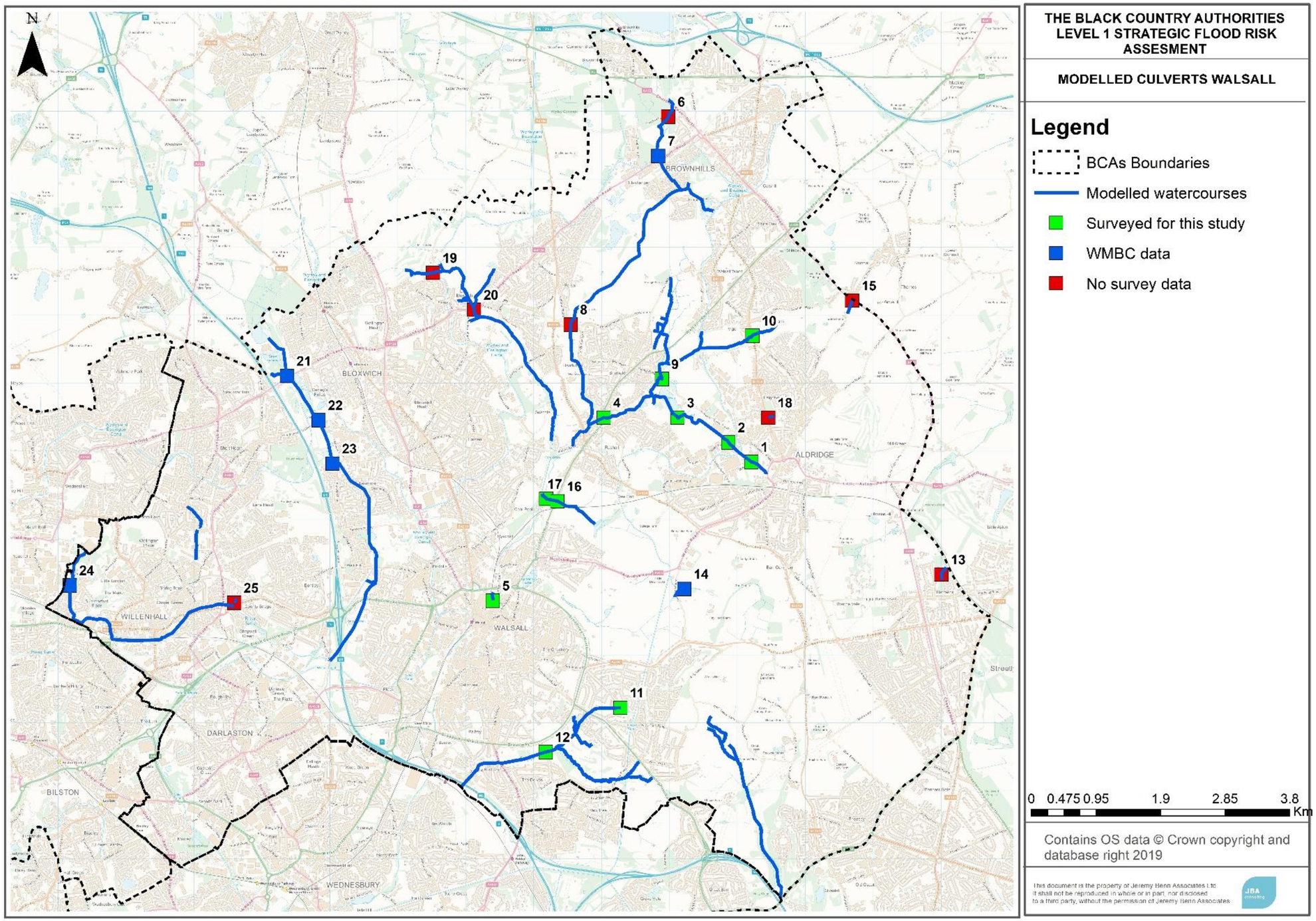
Table 5-2 Culverts considered in the modelling study

Reference number	Location
1	Middlemore Lane, Aldridge
2	Wharf Approach, Aldridge
3	Barns Lane, 290m south-west from intersection with Stubbers Green Road, Rushall
4	Lichfield Road A461, 20m south from the intersection with The Parkway, Shelfield
5	Hatherton Road, next to the Civic Centre, Walsall
6	Coppice Lane, 230m west from the intersection with Chester Road North A452
7	Pelsall Road A4124, 50m north from Croft Close
8	Vicarage Road, 70m east from Station Road, Pelsall
9	Stubbers Green Road, 70m south-east from Brook Meadow Road roundabout, Shelfield
10	Northgate, 70m south from the Fire Station, Vigo
11	Lake Avenue, Walsall
12	Delves Green Road, 180m south from Broadway, The Delves
13	Hardwick Wood, 130m east from Lindrosa Road, Streetly
14	Longwood Lane, 370m south from Aldridge Road A454 roundabout
15	Chester Road A452, next to the intersection with Lazy Hill
16	Lichfield Road A461, next to Lady Pool
17	Cartbridge Lane South, opposite the Works
18	Northgate, 90m south from Shenstone Drive, Leighswood
19	Fishley Lane, 60m north from Fishley Close, Fishley
20	Lichfield Road / Wolverhampton Road, 90m east from Livingstone Road, Little Bloxwich
21	Lichfield Road A4124, next to the intersection with Vernon Way, Dudley's Fields
22	Wood Lane, 200m west from Willenhall Lane, Leamore
23	Hatherton Primary School grounds, close to Bloxwich Lane
24	Northern end of Holman's Close, Neachells
25	Area between Warwick Avenue, Lincoln Avenue and Wolverhampton Road West, Willenhall

Table 5-3 Modelled culvert capacity

Reference number	Full capacity (m³/s)	50% blockage (m³/s)	75% blockage (m³/s)	90% blockage (m³/s)
1	1.03	0.515	0.2575	0.103
2	10.92	5.46	2.73	1.092
3	1.65	0.825	0.4125	0.165
4	8.04	4.02	2.01	0.804
5	13.44	6.72	3.36	1.344
6	0.41	0.205	0.1025	0.041
7	0.19	0.095	0.0475	0.019
8	0.706	0.353	0.1765	0.0706
9	0.13	0.065	0.0325	0.013
10	1.34	0.67	0.335	0.134
11	0.57	0.285	0.1425	0.057
12	68.68	34.34	17.17	6.868
13	0.235	0.1175	0.05875	0.0235
14	1.74	0.87	0.435	0.174
15	0.349	0.1745	0.08725	0.0349
16	1.04	0.52	0.26	0.104
17	1.61	0.805	0.4025	0.161
18	0.71	0.355	0.1775	0.071
19	0.01	0.005	0.0025	0.001
20	0.301	0.1505	0.07525	0.0301
21	14.47	7.235	3.6175	1.447
22	4.6	2.3	1.15	0.46
23	4.36	2.18	1.09	0.436
24	6.43	3.215	1.6075	0.643
25	1.052	0.526	0.263	0.1052

Figure 5-6 Modelled culverts within the blockage study



THE BLACK COUNTRY AUTHORITIES LEVEL 1 STRATEGIC FLOOD RISK ASSESMENT

MODELLED CULVERTS WALSALL

Legend

- BCAs Boundaries
- Modelled watercourses
- Surveyed for this study
- WMBC data
- No survey data

0 0.475 0.95 1.9 2.85 3.8 Km

5.5.2 Culvert Blockage Study for Sandwell, Wolverhampton and Dudley

Sandwell, Wolverhampton and Dudley Metropolitan Borough Councils have confirmed their intention to undertake culvert blockage modelling that is similar to that available for Walsall Council for Ordinary Watercourses. The Councils should be contacted for further information as to the progress of this further study.

5.6 Surface water flooding

Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours and usually occurs in lower lying areas, often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems can be inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding. This can be made worse by local insufficient drainage capacity. Where discharge is directly to a watercourse, locally high-water levels can cause back-up and prevent water from draining into the drainage system.

The Environment Agency Risk of Flooding from Surface Water mapping (RoFfSW) provided by the Environment Agency shows that a number of communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in the majority of cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, e.g. properties situated at the foot of surrounding hills. The RoFfSW mapping for the Black Country can be found in Appendix A.

Walsall: The main areas at risk are those impacted by the flow paths draining into the River Tame.

Sandwell: The flow paths drain northwards from the South-West /South to the lower elevations in the North and North-East, with the M6 being particularly affected by pluvial flow paths.

Dudley: The main surface water flooding flow paths drain from the North-East to the South-West with the areas of Bramford, Swan Village (in Coseley) and West Coseley in the North-East being highly affected as they are located in an area where the higher elevation quickly drops away towards the Smestow Brook valley in the Wolverhampton administrative area.

Wolverhampton: There are numerous major flow paths in this area, the majority draining towards the Smestow Brook river valley. The west of the area is most affected by these flow paths and also by surface water flooding and pooling as this is a lower topographical area.

5.7 Groundwater flooding

In general, less is known about groundwater flooding than other sources. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes
- Where there are long culverts that prevent water easily getting into watercourses.

Groundwater flooding is different to other types of flooding. It can last for days, weeks or even months and is much harder to predict and warn for. Monitoring does occur in certain areas, from example where there are major aquifers or when mining stops.

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater (AStGWF) dataset. The AStGWF dataset is a strategic scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate where groundwater might emerge. However, it does not show the likelihood of groundwater flooding occurring and does not take into account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the susceptible area are actually likely to suffer the consequences of groundwater flooding.

The AStGWF data is indicative and should only be used in combination with other information, for example, local or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Mapping of the district has been provided showing the risk from groundwater flooding dataset and is shown in Appendix A. Notable areas at higher risk from groundwater flood are in the centre of the Black Country between the east of Wolverhampton, west Walsall and the north of Sandwell.

Whilst the likelihood of groundwater flooding in the Black Country is relatively low, there are records of flooding in parts of northeast and southeast Wolverhampton since groundwater abstraction for industry has stopped. The area that borders Sandwell and Dudley has also experienced some groundwater flooding in the past from high water tables. The **British Geological Survey** provides further information on groundwater flooding on their website.

5.8 Flooding from canals

Canals are regulated waterbodies and are unlikely to flood, unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g. collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure and have equipment in place to steam breaches in the highest risk locations.

There are several canals in The Black Country these are shown in Table 5-4 and Figure 5-7.

Table 5-4 shows incidences of breach and overtopping in The Black Country. There have been no records of canal breach or overtopping in recent years within the Black Country.

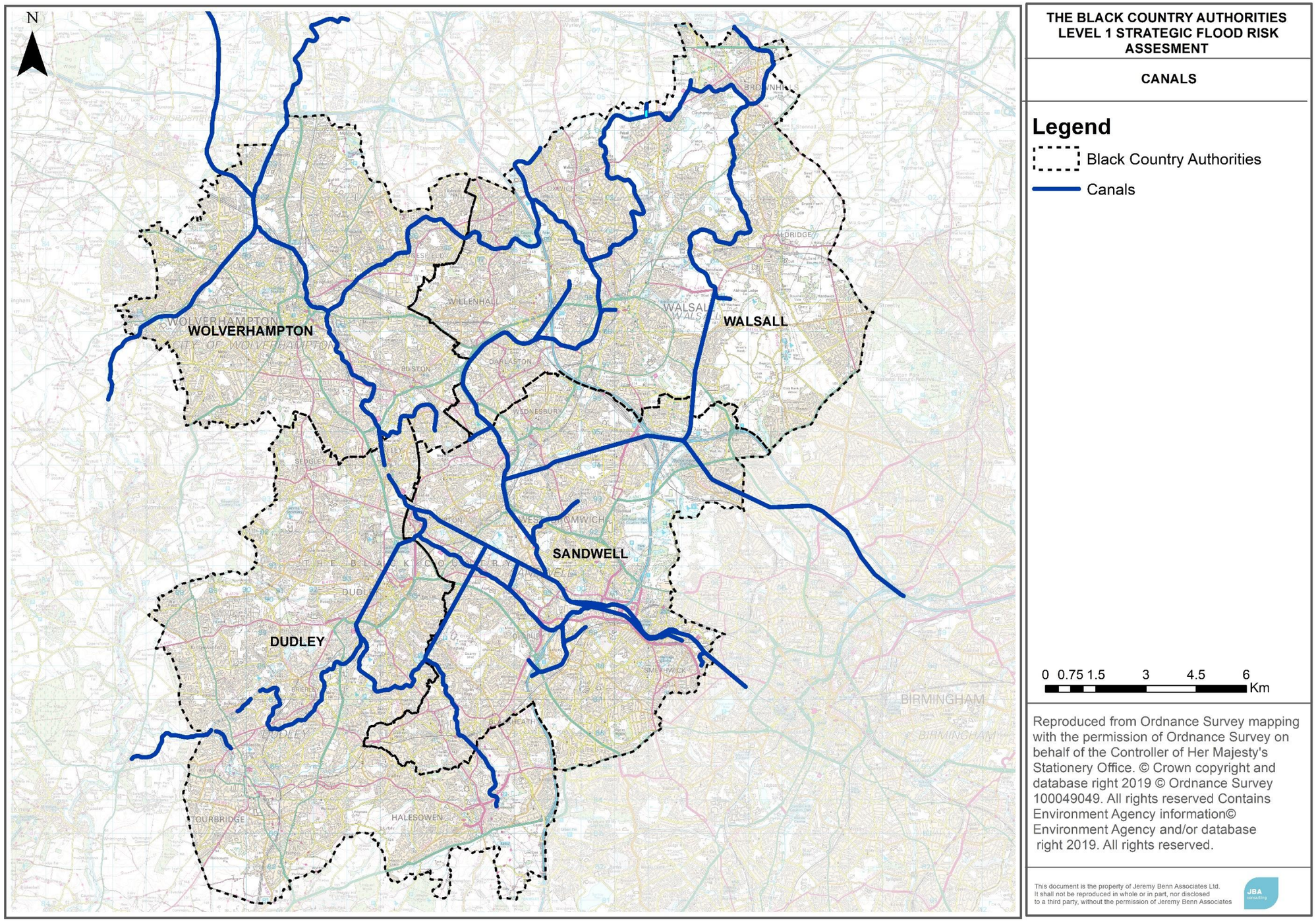
Modelling was undertaken in 2012 for Walsall Council to show the effects of a breach on the Daw Mill Canal at Daw End. The area is a known issue for subsidence within the limestone geology, which could make the canal more prone to breach. These results

are available from Walsall Council and are most suitable for emergency planning purposes.

Table 5-4 Incidents of canal breach and overtopping in The Black Country

Canal	Record of Breach?	Details
Balls hill Branch	No	
Birmingham Canal	Yes	1870 - Tipton Breach, Mining Subsidence.
Causeway Green Branch	No	
Daw end Branch	Yes	1970 - Barnett & Beddows Breach, third party works.
Dudley Canal	Yes	1899- Dudley Port Burst 1888- Hollis Bridge or Gawn Old Mill Breach (Dudley Canal) 1890- Gawn Colliery & Weir near Hollis Bridge Breach
Hay head branch	No	
Netherton Tunnel Branch	No	
Rushall Canal	No	
Shropshire Union Canal	No	
Staffordshire and Worcestershire Canal	Yes	1981 - Smestow Brook Culvert Collapse (Culvert Failure) (date unknown) Graisley Brook (Henwood Close) Breach (Culvert Failure)
Stourbridge Canal	Yes	Two records of breach, 11 of overtopping. 1985 - Merry Hill Failure (Date Unknown) Brierley Hill Breach/ Wheeler's Basin Breach, Mining subsidence
Tame Valley Canal	No	
Titford Canal	No	
Walsall Canal	No	
Wyrley and Essington Canal	No	

Figure 5-7 Canals in The Black Country



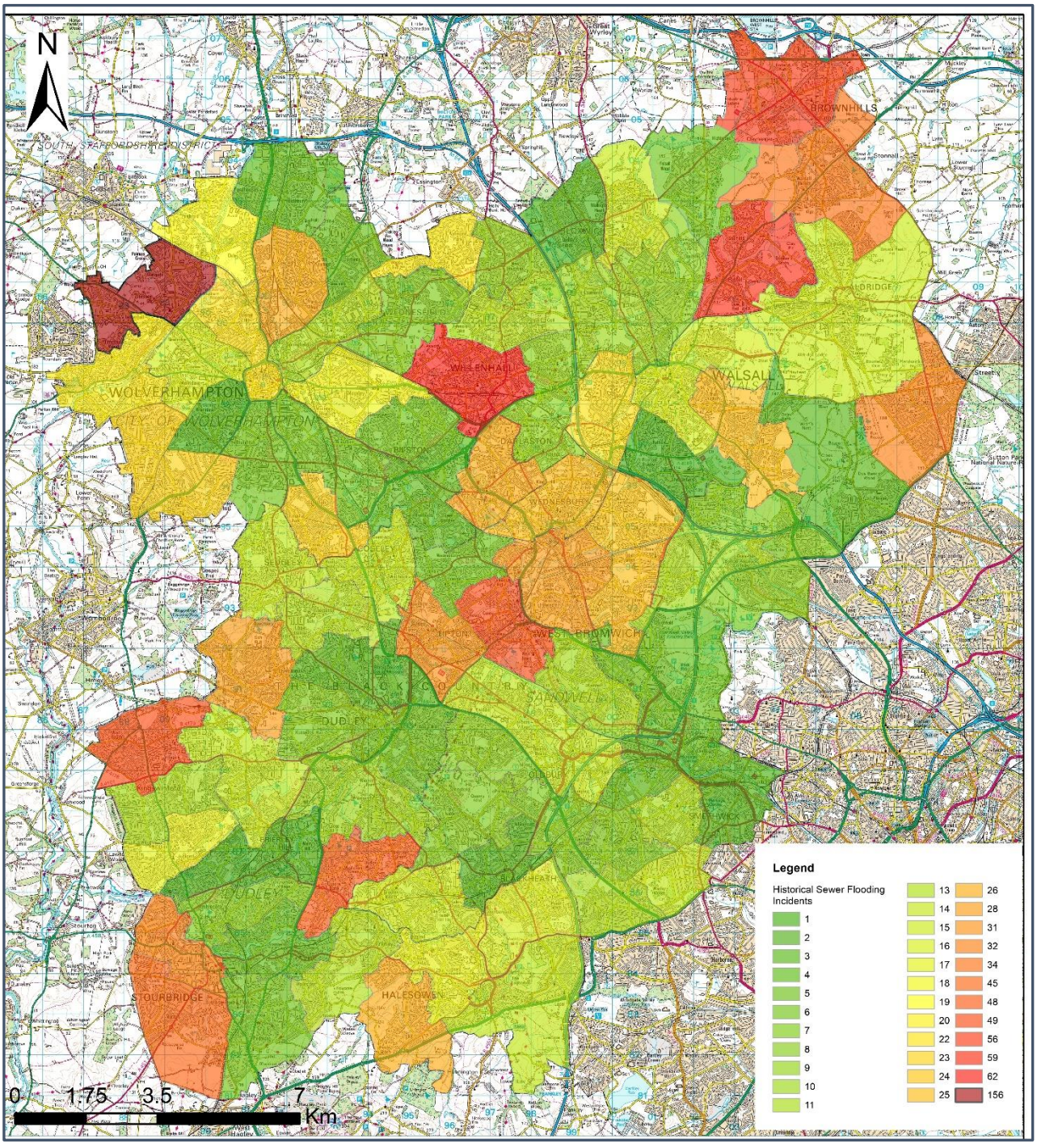
5.9 Flooding from sewers

Sewer flooding occurs when intense rainfall/ river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels. Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30-year chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that sewers will be overwhelmed in larger rainfall and flood events. Existing sewers can also become overloaded as new development adds to the surface water discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Severn Trent Water and South Staffordshire Water record sewer flooding on their Historic Flooding Incidents Registers. This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. For confidentiality reasons this data has been supplied on a postcode basis. The datasets were supplied on the 03/01/2019. STW are the water company responsible for the management of public sewers in the study area, with historical reports of flooding from the HFRR, tabulated in Figure 5-8 below

Figure 5-8: Heatmap illustrating historical sewer incidents recorded by Severn Trent Water across the Black Country



5.10 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975 and are on a register held by the Environment Agency. The level and standard of inspection and maintenance required under the Act means that the risk of flooding from reservoirs is very low.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low

compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The Environment Agency hold mapping showing what might happen if reservoirs fail. They are currently updating the mapping and new data should be available in late 2020. Developers and Planners should check the **Long-Term Risk of Flooding website** before using the reservoir mapping shown in this SFRA to make sure they are using the most up to date mapping.

The current mapping shows that there are 26 reservoirs shown to affect The Black Country; this includes reservoirs located within the study area and a number of reservoirs outside of the area whose inundation mapping is shown to affect The Black Country. These are shown in Table 5-5.

The only recent incident of flooding related to reservoirs in the Black Country was due to a water mains failure close to Barr Beacon reservoir in November 2011 (it was not the failure of the reservoir itself that caused the flooding). This caused the flooding of 150 properties in Streetly and a major incident response was put in place by the Emergency Services.

Table 5-5 Reservoirs that may potentially affect The Black Country in the event of a breach

Reservoir	Location - grid reference	Reservoir Owner	Local Authority Area	Reservoir within Council's area?
Fens Pools - Upper Pool	391804, 288605	Canal & River Trust	Dudley	Yes
Dimmingsdale	385951, 295855	Canal & River Trust	Staffordshire	No
Shavers End No.2	393317, 291180	South Staffordshire Water Plc	Dudley	Yes
Chillington Pool	385808, 305450	Giffard	Staffordshire	No
Ridings Brook, Cannock (Mill Green)	398765, 309966	Environment Agency	Staffordshire	No
Himley Hall Pool	388248, 291292	Dudley Metropolitan Borough Council	Staffordshire	No
Pool Hall	385826, 297265	Pikerace Ltd	Staffordshire	No
Fens Pools - Lower Pool	391164, 288257	Canal & River Trust	Dudley	Yes
Fens Pools - Middle Pool	391277, 288526	Canal & River Trust	Dudley	Yes
Lodge Farm	393559, 287437	Dudley Metropolitan Borough Council	Dudley	Yes
Sheepwash Country Park	397366, 291676	Environment Agency	Sandwell	Yes
Sneyd Reservoir	398387, 302268	Walsall Metropolitan	Walsall	Yes

Reservoir	Location - grid reference	Reservoir Owner	Local Authority Area	Reservoir within Council's area?
ID220		Borough Council		
Perry Barr	408297, 295199	Severn Trent Water	Birmingham	No
Perry Pool	406648, 292741	Birmingham City Council	Birmingham	No
Dartmouth Boating Lake	401614, 291397	Sandwell Metropolitan Borough Council	Sandwell	Yes
Great Barr Lower Lake (ID 44)	405599, 294616	BCG Lakes Limited	Walsall	Yes
Rotton Park	404608, 286950	Canal & River Trust	Birmingham	No
Perry Hall Playing Fields Flood Detention Reservoir	406360, 291422	Environment Agency	Birmingham	No
Little Aston Pool	408950, 300447	Foster, Keogh	Staffordshire	No
Barr Beacon No.1	406036, 297414	South Staffordshire Water Plc	Walsall	Yes
Barr Beacon No.2	406063, 297593	South Staffordshire Water Plc	Walsall	Yes
Chasewater (Cannock Chase)	404090, 307378	Staffordshire County Council	Staffordshire	No
Sandwell Valley Storage Lake	403475, 292498	Environment Agency	Sandwell	Yes
Bescot	400936, 296054	Environment Agency	Walsall	Yes
Swan Pool	402597, 292195	Sandwell Metropolitan Borough Council	Sandwell	Yes
Sedgley Beacon Southern	392126, 294796	South Staffordshire Water Plc	Dudley	Yes

5.11 Flood alerts and flood warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3.

There are currently four Flood Alert Areas (FAA) and fourteen Flood Warning Areas (FWAs) covering the Black country. A list of the Flood Alert and Flood Warning Areas is available in Table 5-6 and 7.

Table 5-6 Flood alert areas

Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
033WAF305	Bourne Brook (Tamworth)	Bourne Brook	Low-lying land and roads between Shenstone and Fazeley
033WAF312	River Sow and River Penk	Sandyford Brook, Ridings Brook, Saredon Brook	Low-lying land and roads between Great Bridgeford and Shugborough on the River Sow, between Coven and Stafford on the River Penk, on the Sandyford Brook, on the Rising Brook, on the Ridings Brook and on the Saredon Brook
033WAF330	River Stour and Smestow Brook in the Black Country and South Staffordshire	River Stour, Smestow Brook	River Stour and Smestow Brook in the Black Country and South Staffordshire
033WAF303	Upper Tame	River Tame, Ford Brook	Low-lying land and roads between Horseley Heath and Castle Vale on the River Tame and Bescot on the Ford Brook

Table 5-7 Flood warning areas

Flood Warning Code	Flood Warning Name	Watercourse	Coverage
033FWF3FORD01	Ford Brook at Bescot	River Tame	Ford Brook at Bescot including Bescot Crescent and Wednesbury Road
033FWF3CRADLEY	River Stour at Cradley Heath	River Stour	River Stour at Cradley Heath from Bridge Street to Wood lane including Works at Maypole Fields

033FWF3TAME003	River Tame at Holloway Bank	River Tame	River Tame at Holloway Bank from Smith Road to Woden Road South
033FWF3TAME004	River Tame at Wednesbury	River Tame	River Tame at Wednesbury including Hydes Road, The Woods and Bescot areas
033FWF3STOURBRIDGE	River Stour at Stourbridge	River Stour	River Stour at Stourbridge Town Centre, Amblecote and Prestwood.
033FWF3STAMBERMILL	River Stour at Stambermill	River Stour	River Stour at Stambermill including Old Forge Trading Estate and Bagley Street
033FWF3TAME002	River Tame at Golds Hill	River Tame	River Tame at Golds Hill from Waterside Park to Smith Road
033FWF3TAME005	River Tame at Bescot	River Tame	River Tame at Bescot railway station area
033FWF3TAME001	River Tame at Horseley Heath and Great Bridge	River Tame	River Tame at Horseley Heath and Great Bridge from John's Lane to the Walsall Canal
033FWF3TAME006	River Tame at Ray Hall Water Works	River Tame	River Tame at Ray Hall Water Works including Sandhurst Way, Manorford Avenue, Mayford Drive, Kelverley Grove and Brook Bridge
033FWF3SMES01	Smestow Brook at Wightwick	Smestow Brook	Smestow Brook at Wightwick and Compton
033FWF3FORD02	Ford Brook at Walsall	Ford Brook	Ford Brook at Walsall Town Centre including Lower North Street, Lichfield Street, Bridgeman Street and Long Street.
033FWF3TAME008	River Tame at Hamstead	River Tame	River Tame at Hamstead including Woodend, Greenway, Woolcott Drive and Hampstead Industrial Estate areas
033FWF3TAME007	River Tame at Sandwell Valley	River Tame	River Tame at Sandwell Valley including Forge Mill Farm area

5.12 Summary of flood risk in the Black Country

A table summarising the key flood risks in the Black Country for each Council area can be found in Appendix C.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in The Black Country. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

Risk Management Authorities hold databases of flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams.
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the Flood and Water Management Act (2010).
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes.
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA has full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific Flood Risk Assessment.

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with 100-year SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time, the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and as a consequence, the standard of protection offered by flood defences in the area, may differ from those discussed in this report.

Developers should consider the standard of protection provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and Local Authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highways Authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water Companies

have a duty to effectively drain their area. What this means in practice is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highways or sewer flooding.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at culverts or bridges.

Developers should not assume that any defence, asset or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and ensure future users of the development are aware of their obligations to maintain watercourses.

6.4 Major flood risk management assets in The Black Country

The Flood Map for Planning contains information on Areas benefitting from defences. This shows areas that benefit from the defences that provide a Standard of Protection (SoP) of at least a 100-year river flood event. It does not show areas that benefit from protection for more frequent events.

There are also additional flood defences on Main Rivers in The Black Country, and these are shown on Table 6-1. There are no 'Areas benefitting from defences' associated with these defences because they provide a lesser degree of protection than a 1 in 100-year flood event.

There are a number of other flood risk management assets in the study area. A summary of these assets was provided by Staffordshire County Council and are shown in Table 6-2. More details relating to assets in the Black Country area can be obtained from Staffordshire County Council (for Sandwell, Walsall and Wolverhampton) or Dudley Metropolitan Borough Council.

Table 6-1: Flood defences in The Black Country on Main Rivers

Council	Watercourse	Location	NGR	Type	Design SoP	Approximate length	Condition rating	Comments
Wolverhampton	Smestow Brook	Claregate	389781 300731	wall	5 years	21.36	Fair (3)	Brick lined channel Left and Right banks.
	Smestow Brook	Claregate	389772 300738	wall	5 years	13.18	Fair (3)	Flood wall on by-pass channel
	Smestow Brook	Claregate	389853 300625	wall	5 years	72.18	Fair (3)	Small overflow side weir, both sides of the river.
	Smestow Brook	Claregate	389851 300626	wall	5 years	11.25	Fair (3)	Dunstall Water Bridge
	Smestow Brook	Claregate	389848 300648	wall	Unknown	24.86	Fair (3)	Brick floodwall
	Smestow Brook	Claregate	389856 300630	wall	Unknown	18.99	Fair (3)	Aqueduct wall
Dudley	Unnamed Watercourse	Amblecore	390154 285758	wall	50 Years	58.91	Fair (3)	Flood wall that protects industrial units
	River Stour	Halesowen	396874 283128	wall /embankment	25 Years	113.15	Fair (3) to Good (2)	Maintained channel and gabion wall with flood bank for flood attenuation area.
	Unnamed Watercourse	Halesowen	397202 283617	wall	100 Years	44.67	Poor (4)	A private floodwall, built to benefit one property.
	River Stour	Halesowen	396721 283659	embankment	25 Years	193.41	Fair (3)	New Flood Embankment now in place
Walsall	River Tame	Bentley	398181 298149	Wall	50 Years	281.5m	Fair (3) to Good (2)	Flood Wall south of Bentley Road to the south of the wall.

Council	Watercourse	Location	NGR	Type	Design SoP	Approximate length	Condition rating	Comments
	River Tame	Bentley	39911 297077	Wall	50 Years	134.49m	Fair (3) to Good (2)	Flood wall on South West Bank, protects trainline. Sheet Piling to the south of the wall.
Sandwell	River Tame	Forge Mill Lake	402915 292890	Embankment	50 Years	1650.08m	Fair (3) to Good (2)	Embankments on both sides of the river, separating from the Forge Mill Lake.
	River Tame	Hamstead	404513 292811	Embankment	50 Years	236.06m	Poor (4)	Earth Embankment parallel to the train line between the river and the line.
	River Tame	Charlemont	402219 294162	Embankment	50-100 Years	787.12m	Fair (3) to Good (2)	Embankments both sides of the River protecting properties in Keverley Grove and Manorford Avenue and the train lines from high levels.
	River Tame	Newton	400492 293580	Wall/Embankment	50 years	252.33m	Fair (3) to Good (2)	Wall on the North bank of the river with embankments either side of the train line.
	River Tame	Wednesbury	398094 29485	Wall/Embankment	50-100 years	1341.19m	Fair (3) to Good (2)	Embankments along the river from the Walsall boundary line along the river through Mesty Croft.

Council	Watercourse	Location	NGR	Type	Design SoP	Approximate length	Condition rating	Comments
	River Tame	Wednesbury (Balls Hill)	399868 294372	Wall/Embankment	50 years	416.84m	Poor (4) to Fair (3)	Runs along the north bank of the River and separates from a body of water.
	River Tame	Wednesbury (Golds Green)	398306 294224	Wall/Embankment	50 Years	439.93	Poor (4) to Fair (3)	Ocker Hill storage lake embankment and inlet weir and walls to protect properties off smith road.
	River Tame	Toll End	397878 292663	Wall	50 Years	452.33m	Poor (4) to Good (2)	Pairs of defences on both banks of the River Tame.
	River Tame	Horsely Heath, Sheepwash Lake.	397380 291715	Embankment	50 Years	1078.4m	Fair (3) to Good (2)	Embankments protecting properties in Horsley heath and sheepwash storage lake from high levels.
	River Tame	Oldbury	398359 290461	Wall/Embankment	50 Years	110.82m	Poor (4) to Fair (3)	Defences protecting Balaji Avenue and Union Road from high Levels.
	River Tame	Oldbury	399359 290075	Wall	50 Years	310.92m	Fair (3) to Good (2)	Walls protecting properties surrounding the Sandwell and Dudley Train station.
	Tributary of the River Tame	Land South of Yew Tree.	402391 294945	Embankment	50 Years	78.34m	Good (2)	Earth embankment
	Unnamed watercourse,	Brandhall	399301 286534	Embankment	25 Years	206.02m	Good (2)	Brandhall embankment and a

Council	Watercourse	Location	NGR	Type	Design SoP	Approximate length	Condition rating	Comments
	tributary of the river Tame.							Dam / Embankment protecting properties around heron road and Causeway Green.
	Unnamed watercourse, tributary of the river Tame.	Titford	398515 287480	Embankment	5 Years	209.57m	Poor (4) to Good (2)	Small embankments to prevent flooding from trash screen blockage to Ashes Road Screen.
	Unnamed watercourse, tributary of the river Tame.	Langley	398316 287781	Wall	50 Years	80.22m	Fair (3)	Pre-cast concrete flood wall
	Unnamed watercourse, tributary of the river Tame.	Langley, off Joseph Street	398492 288700	Wall	Unknown	101.75m	Good (2)	Private floodwall
	River Stour	Briery Coppice, Hawne	395931 284945	Wall	25 Years	43.64m	Fair (3)	Protecting properties around Hayseech.

Table 6-2 Flood management assets in The Black Country

COUNCIL	ASSET	LOCATION	INFORMATION
Sandwell council	Culvert inlet screen	Alexandra Road, Tipton	Utl
	Culvert inlet screen	Wendover Road, Cradley Heath	Utl
	Culvert inlet screen	Cotterills Road, Tipton	Tipton Brook
	Culvert inlet screen	Hyett Way, Tipton	Utle
	Culvert inlet screen	Hyett Way, Tipton	Utle

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert inlet screen	Great Bridge Road, Tipton	Utl
	Culvert inlet screen	Hyett Way, Tipton	Utle
	Culvert inlet screen	Hanover Road, Oldbury	Utl
	Culvert inlet screen	Lansdown Road, Dudley	Utl
	Culvert inlet screen	Birchfield Lane, Oldbury	Utl
	Culvert inlet screen	Dudley Road, Tividale	Utl
	Culvert inlet screen	Churchbridge, Oldbury	Whiteheath Brook
	Culvert inlet screen	Old Park Road, Wednesbury	Utl
	Culvert inlet screen	Brook Road, Oldbury	Utl
	Culvert inlet screen	Brook Road Oldbury	Utl
	Culvert inlet screen	Oldbury Ringway Oldbury	Utl
	Culvert inlet screen	Oldbury Ringway Oldbury	Utl
	Culvert inlet screen	Oldbury Ringway Oldbury	Utl
	Culvert inlet screen	Oldbury Ringway Oldbury	Utl
	Culvert inlet screen	Kelvin Way Industrial Estate, West Bromwich	Utl
	Culvert inlet screen	Kelvin Way Industrial Estate, West Bromwich	Utl
	Culvert inlet screen	Denbigh Drive, West Bromwich	Inlet of canal overflow
	Culvert inlet screen	Birmingham Road, West Bromwich	Utl
	Culvert inlet screen	Norman Road, Smethwick	Utl
	Culvert inlet screen	Manor Road, Smethwick	Utl
	Culvert inlet screen	Hadley Stadium, Smethwick	Utl
	Culvert inlet screen	Shireland Road, Smethwick	Utl
	Culvert inlet screen	Cheshire Road, Smethwick	Utl
	Culvert inlet screen	Cheshire Road, Smethwick	Utl
	Culvert inlet screen	Newton Road	Utl
	Culvert inlet screen	Tame Valley Canal	Utl
	Culvert inlet screen	Monksfield Avenue	Utl
	Culvert inlet screen	M6 Motorway	Utl
	Culvert inlet screen	M6 Motorway	Utl
	Culvert outlet screen	Forge Lane	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Westgate	Utl
	Culvert outlet screen	Forge Lane	Utl
	Culvert outlet screen	New Pool Road	
	Culvert outlet screen	Greenfield Avenue	Utl
	Culvert outlet screen	Macarthur Road	Utl
	Culvert outlet screen	Cradley Road	
	Culvert outlet screen	Cradley Road	Pipe from MH 2455 abandoned
	Culvert outlet screen	Cradley Road	
	Culvert outlet screen	Saint Annes Road	Utl
	Culvert outlet screen	Woodall Street	Utl
	Culvert outlet screen	Foxoak Street	Utl
	Culvert outlet screen	New Town Lane	Utl
	Culvert outlet screen	New Town Lane	Utl
	Culvert outlet screen	Bannister Street	Utl
	Culvert outlet screen	Corngreaves Road	
	Culvert outlet screen	Corngreaves Road	Utl
	Culvert outlet screen	Haden Hill Park	
	Culvert outlet screen	Hayseech	Utl
	Culvert outlet screen	Park Street	Utl
	Culvert outlet screen	Brook Lane	
	Culvert outlet screen	Hickmans Avenue	
	Culvert outlet screen	Hickmans Avenue	
	Culvert outlet screen	Mildred Road	Utl
	Culvert outlet screen	Highland Road (Playing Field)	Utl
	Culvert outlet screen	Mildred Road	Utl
	Culvert outlet screen	Halesowen Road	Utl
	Culvert outlet screen	Halesowen Road	Utl
	Culvert outlet screen	Bluebell Road	Utl
	Culvert outlet screen	Gawne Lane	Utl
	Culvert outlet screen	Gawne Lane	Utl
	Culvert outlet screen	Mousesweet Close	Utl
	Culvert outlet screen	Mousesweet Close	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Gawne Lane	Utl
	Culvert outlet screen	Doulton Road	Utl
	Culvert outlet screen	Doulton Industrial Estate	Utl
	Culvert outlet screen	Dudley Road	Utl
	Culvert outlet screen	Dudley Road	Utl
	Culvert outlet screen	Watery Lane	Utl
	Culvert outlet screen	Watery Lane	Utl
	Culvert outlet screen	Locarno Road	Utl
	Culvert outlet screen	Haden Hill Road	Utl
	Culvert outlet screen	High Haden Road	
	Culvert outlet screen	Granville Road	
	Culvert outlet screen	Crendon Road	Utl
	Culvert outlet screen	Oakham Road	Utl
	Culvert outlet screen	Laburnum Croft	Utl
	Culvert outlet screen	Coneygree Road	Utl
	Culvert outlet screen	Dudley Port	Utl
	Culvert outlet screen	Oakley Avenue	Utl
	Culvert outlet screen	Oakley Avenue	Utl
	Culvert outlet screen	Alexandra Road (Playing Field)	
	Culvert outlet screen	Brookfield Way	
	Culvert outlet screen	Alexandra Road (Playing Field)	
	Culvert outlet screen	Lower Church Lane	Utl
	Culvert outlet screen	Great Bridge Road	Utl
	Culvert outlet screen	Hyett Way	Utle
	Culvert outlet screen	Great Bridge Road	Utl
	Culvert outlet screen	Hyett Way	Utle
	Culvert outlet screen	Hyett Way	Utle
	Culvert outlet screen	Beverston Road	Utl
	Culvert outlet screen	Glyn Avenue	Utl
	Culvert outlet screen	New Birmingham Road	Utl
	Culvert outlet screen	Britannia Street	Utl
	Culvert outlet screen	New Birmingham Road	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Shelbourne Close	Utl
	Culvert outlet screen	Johns Lane	Utl
	Culvert outlet screen	Johns Lane	Utl
	Culvert outlet screen	Morrison Road	Utl
	Culvert outlet screen	Arnhem Way	
	Culvert outlet screen	Open Land Rear Macdonald Close	Utl
	Culvert outlet screen	Open Land Rear Macdonald Close	
	Culvert outlet screen	Open Land Rear Macdonald Close	Utl
	Culvert outlet screen	Arnhem Way	
	Culvert outlet screen	Tame Road	Utl
	Culvert outlet screen	Beddoe Close	Utl
	Culvert outlet screen	Fisher Street	Utle
	Culvert outlet screen	Brickhouse Lane South	
	Culvert outlet screen	Market Place	Abandoned
	Culvert outlet screen	Market Place	
	Culvert outlet screen	Greta Western Way	
	Culvert outlet screen	Toll End Road	Utl
	Culvert outlet screen	Toll End Road	Utl
	Culvert outlet screen	Bankfield Road	Utl
	Culvert outlet screen	Toll End Road	Utl
	Culvert outlet screen	Toll End Road	Utl
	Culvert outlet screen	Black Country New Road	
	Culvert outlet screen	Bagnall Street	Utl
	Culvert outlet screen	Black Country Spine Road	Utl
	Culvert outlet screen	Bagnall Street	Utl
	Culvert outlet screen	Eagle Industrial Estate	Utl
	Culvert outlet screen	Farmer Way	
	Culvert outlet screen	Lansdown Road	Utl
	Culvert outlet screen	York Road	
	Culvert outlet screen	York Road	Utl
	Culvert outlet screen	Titford Road	Utl
	Culvert outlet screen	Ashes Road	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Ashes Road	Utl
	Culvert outlet screen	Cakemore Road	
	Culvert outlet screen	Titford Road	Utl
	Culvert outlet screen	Titford Road	Utl
	Culvert outlet screen	Lion Farm Playing Fields	
	Culvert outlet screen	Texas Store Birchley Island	
	Culvert outlet screen	Lion Farm Playing Fields	Utl
	Culvert outlet screen	Birchfield Lane	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Wolverhampton Road	Utl
	Culvert outlet screen	Churchbridge	Utl
	Culvert outlet screen	Pearsall Drive	Utl
	Culvert outlet screen	Dudley Road	Utl
	Culvert outlet screen	Portway Road	Utl
	Culvert outlet screen	Theodore Close	
	Culvert outlet screen	Open Land Rear Theodore Close	Utl
	Culvert outlet screen	Roway Lane	
	Culvert outlet screen	Roway Lane	Utl
	Culvert outlet screen	Union Road	
	Culvert outlet screen	Oldbury Road	Utl
	Culvert outlet screen	Brandon Way Industrial Estate	Utl
	Culvert outlet screen	West Bromwich Street	
	Culvert outlet screen	West Bromwich Street	
	Culvert outlet screen	Albion Road	Utl
	Culvert outlet screen	Union Road	Utl
	Culvert outlet screen	Ryders Green Road	Utl
	Culvert outlet screen	Phoenix Street	
	Culvert outlet screen	Great Bridge	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Great Bridge	
	Culvert outlet screen	Great Bridge	
	Culvert outlet screen	Richmond Street	Utl
	Culvert outlet screen	Siddons Industrial Estate	Utl
	Culvert outlet screen	Smith Road	Utle
	Culvert outlet screen	Smith Road (Off)	Utl
	Culvert outlet screen	Holloway Bank	Utl
	Culvert outlet screen	Holloway Bank	Utl
	Culvert outlet screen	Holloway Bank	Utl
	Culvert outlet screen	Old Park Road	Utl
	Culvert outlet screen	Old Park Road	Utl
	Culvert outlet screen	Old Park Road	Utl
	Culvert outlet screen	Saint Matthews Road	Utl
	Culvert outlet screen	Saint Matthews Road	Utl
	Culvert outlet screen	Heron Road	Utl
	Culvert outlet screen	Heron Road	Utl
	Culvert outlet screen	Saint Matthews Road	Utl
	Culvert outlet screen	Saint Matthews Road	Utl
	Culvert outlet screen	Brandhall Golf Course	Utl
	Culvert outlet screen	Brandhall Lane	Utl
	Culvert outlet screen	Queensway	Utl
	Culvert outlet screen	Old Park Lane	Utl
	Culvert outlet screen	Park Street	Utl
	Culvert outlet screen	Park Lane	Utl
	Culvert outlet screen	Park Lane	Utl
	Culvert outlet screen	Park Lane	Utl
	Culvert outlet screen	Park Lane	Utl
	Culvert outlet screen	Tat Bank Road	Utl
	Culvert outlet screen	Seven Stars Road	Utl
	Culvert outlet screen	Flash Road	Utl
	Culvert outlet screen	Mckean Road	
	Culvert outlet screen	Broadwell Road	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Parsonage Street	Utl
	Culvert outlet screen	Kelvin Way Industrial Estate	Utl
	Culvert outlet screen	Crystal Drive	Utl
	Culvert outlet screen	Cornwallis Road	Utl
	Culvert outlet screen	Cornwallis Road	Utl
	Culvert outlet screen	Credenda Road	Utl
	Culvert outlet screen	Blakemore Road	Utl
	Culvert outlet screen	Bromford Road	Utl
	Culvert outlet screen	Bromford Lane	Utl
	Culvert outlet screen	New Gas Street	
	Culvert outlet screen	Swan Lane	
	Culvert outlet screen	Meyrick Road	
	Culvert outlet screen	Francis Ward Close	Utl
	Culvert outlet screen	Woden Road South	Utl
	Culvert outlet screen	Woden Road South	Utl
	Culvert outlet screen	Hampshire Road	Utl
	Culvert outlet screen	Woden Road South	
	Culvert outlet screen	Hydes Road	Utl
	Culvert outlet screen	Woden Road South	Utl
	Culvert outlet screen	Hydes Road	Utle
	Culvert outlet screen	Hydes Road	Utl
	Culvert outlet screen	Axletree Way	Abandoned
	Culvert outlet screen	Axletree Way	Abandoned
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	Utl
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	Abandoned
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Axletree Way	
	Culvert outlet screen	Axletree Way	Utl
	Culvert outlet screen	Wood Green Road	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Valentine Road	
	Culvert outlet screen	Salop Road	Utl
	Culvert outlet screen	Broadmoor Avenue	Utl
	Culvert outlet screen	Norman Road	
	Culvert outlet screen	Norman Road	
	Culvert outlet screen	Cemetery Road	Utl
	Culvert outlet screen	Victoria Road	Utl
	Culvert outlet screen	Victoria Road	Utl
	Culvert outlet screen	Manor Road	Utl
	Culvert outlet screen	Manor Road	Utl
	Culvert outlet screen	Kelvin Way Industrial Estate	Utl
	Culvert outlet screen	Beresford Road	Utl
	Culvert outlet screen	Spon Lane South	Utl
	Culvert outlet screen	Spring Road	
	Culvert outlet screen	Spon Lane South	Utl
	Culvert outlet screen	Spon Lane South	Utl
	Culvert outlet screen	Houghton Street	Utl
	Culvert outlet screen	Union Street	Utl
	Culvert outlet screen	Gordon Avenue	Utl
	Culvert outlet screen	Johnson Road (Playing Fields)	
	Culvert outlet screen	Kilvert Road	Utl
	Culvert outlet screen	Price Street	Utl
	Culvert outlet screen	Friar Park Road	Utl
	Culvert outlet screen	William Green Road (Adj To)	Utl
	Culvert outlet screen	William Green Road (Adj To)	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Collins Road	Utl
	Culvert outlet screen	Crankhall Lane	Utl
	Culvert outlet screen	Crankhall Lane	Utl
	Culvert outlet screen	Harewood Avenue (Rear Of)	Utl
	Culvert outlet screen	Collins Road	Utl
	Culvert outlet screen	Bloomfield Crescent	Utl
	Culvert outlet screen	Collins Road	Utl
	Culvert outlet screen	Park Hill	Utl
	Culvert outlet screen	Tame Avenue	Utl
	Culvert outlet screen	Tame Avenue	Utl
	Culvert outlet screen	Devon Road	Utl
	Culvert outlet screen	Shelton Close	Utl
	Culvert outlet screen	Shelton Close	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Broadmoor Avenue	Utl
	Culvert outlet screen	Norman Road	Utl
	Culvert outlet screen	Stanhope Road	Utl
	Culvert outlet screen	Stanhope Road	Utl
	Culvert outlet screen	Dale Close	Utl
	Culvert outlet screen	Manor Road	Utl
	Culvert outlet screen	Margaret Gardens	Utr
	Culvert outlet screen	Londonderry Lane	Utl
	Culvert outlet screen	High Street	Utl
	Culvert outlet screen	Saint Albans Road	Utl
	Culvert outlet screen	Brasshouse Lane	Utl
	Culvert outlet screen	North Western Road	Utl
	Culvert outlet screen	Saint Albans Road	Utl
	Culvert outlet screen	Kenrick Way	
	Culvert outlet screen	Oldbury Road	Utl
	Culvert outlet screen	Everest Close	Utl
	Culvert outlet screen	Great Arthur Street	Utl
	Culvert outlet screen	Saint Cuthberts Close	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Offini Close	Utl
	Culvert outlet screen	Europa Avenue	
	Culvert outlet screen	Saint Martins Close	Utl
	Culvert outlet screen	Saint Valentines Close	Utl
	Culvert outlet screen	Saint Caroline Close	
	Culvert outlet screen	Saint Eleanor Close	
	Culvert outlet screen	Europa Avenue	
	Culvert outlet screen	Saint Johns Close	Utl
	Culvert outlet screen	Europa Avenue	Utl
	Culvert outlet screen	Dagger Lane	
	Culvert outlet screen	Dartmouth Golf Course	Utle
	Culvert outlet screen	Dartmouth Golf Course (Pond)	Utl
	Culvert outlet screen	Newton Road	Utl
	Culvert outlet screen	Wychnor Grove	Utl
	Culvert outlet screen	Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	New Walsall Road	Utl
	Culvert outlet screen	Collumbine Close	Utl
	Culvert outlet screen	Stanhope Road	Utl
	Culvert outlet screen	Edward Road	Utl
	Culvert outlet screen	Dorset Road	Utl
	Culvert outlet screen	Shireland Road	Utl
	Culvert outlet screen	North Western Road	Utl
	Culvert outlet screen	Victoria Avenue	Utl
	Culvert outlet screen	Rolfe Street	Utl
	Culvert outlet screen	Colliery Road	
	Culvert outlet screen	Park Lane	Utl
	Culvert outlet screen	Water Lane	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Wigmore Lane	Utl
	Culvert outlet screen	Charlemont Road	
	Culvert outlet screen	Wigmore Lane	Utl
	Culvert outlet screen	Newton Road	Utl
	Culvert outlet screen	Newton Road	Utl
	Culvert outlet screen	Newton Road	Utl
	Culvert outlet screen	Wigmore Lane	Utl
	Culvert outlet screen	Ray Hall Lane	
	Culvert outlet screen	Newton Road	
	Culvert outlet screen	Newton Road	
	Culvert outlet screen	Newton Road	Utl
	Culvert outlet screen	Newton Road	
	Culvert outlet screen	Ray Hall Lane	
	Culvert outlet screen	Newton Gardens	
	Culvert outlet screen	Newton Gardens	
	Culvert outlet screen	Beacon View Road	Utl
	Culvert outlet screen	River Tame (Adj)	Utl
	Culvert outlet screen	River Tame (Adj)	Utl
	Culvert outlet screen	Manorford Avenue	Utl
	Culvert outlet screen	River Tame	Utl
	Culvert outlet screen	Wolfsbane Drive	Utl
	Culvert outlet screen	Pimpernel Drive	Utl
	Culvert outlet screen	M5 Motorway (Beneath)	Utl
	Culvert outlet screen	River Tame (Adj)	Utl
	Culvert outlet screen	Ray Hall Lane	Utl
	Culvert outlet screen	Orchard Road	Utl
	Culvert outlet screen	Pear Tree Close (Rear Of 21)	Utl
	Culvert outlet screen	Ray Hall Sewage Works	Utl
	Culvert outlet screen	Brooklands (Rear Of)	
	Culvert outlet screen	Brooklands (Rear Of)	
	Culvert outlet screen	Cranford Street	Utl
	Culvert outlet screen	Woodburn Road	Utl

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Foundry Lane	
	Culvert outlet screen	Wellington Street	Utl
	Culvert outlet screen	Wellington Street	Hockley brook
	Culvert outlet screen	Perrott Street	
	Culvert outlet screen	Perrott Street	Utl
	Culvert outlet screen	Perrott Street	Utl
	Culvert outlet screen	Rabone Lane	Utl
	Culvert outlet screen	Brookside(Adjacent Railway)	Utl
	Culvert outlet screen	Tanhouse Avenue	Utl
	Culvert outlet screen	Newton Close	Utl
	Culvert outlet screen	Newton Close	Utl
	Culvert outlet screen	Grove Vale Avenue	Utl
	Culvert outlet screen	Grove Vale Avenue	Utl
	Culvert outlet screen	Chatsworth Avenue	Utl
	Culvert outlet screen	Chatsworth Avenue	Utl
	Culvert outlet screen	Grove Vale Avenue (62)	Utl
	Culvert outlet screen	Red House Park	
	Culvert outlet screen	Fairyfield Avenue	Utl
	Culvert outlet screen	Red House Park	Utl
	Culvert outlet screen	Biddleston Grove	Utl
	Culvert outlet screen	Walcot Drive (River Tame)	Utl
	Culvert outlet screen	Hamstead Road (Rear Of 369)	
	Culvert outlet screen	Old Walsall Road	Utl
	Culvert outlet screen	Old Walsall Road (Rear of garage)	
	Culvert outlet screen	Hamstead Road (School Field)	Utl
	Culvert outlet screen	Brookside	Utl
	Culvert outlet screen	Hamstead Road	
	Culvert outlet screen	Spouthouse Lane (Open Space)	Utl
	Culvert outlet screen	Spouthouse Lane (Open Space)	Utl
	Culvert outlet screen	Greenhill Gardens	Utl
	Culvert outlet screen	Anderson Crescent	Utl
	Culvert outlet screen	Birmingham Road	

COUNCIL	ASSET	LOCATION	INFORMATION
	Culvert outlet screen	Whitecrest	Utl
Walsall council trash screens	Trash screen – maintained by WMBC	Pelsall Road (becks bridge)	Brownhills Brook
	Trash screen – maintained by WMBC	Northgate by fire station	Vigo Brook
	Trash screen – maintained by WMBC	Stubbers Green Road	Vigo Brook
	Trash screen – maintained by WMBC	Middlemore Lane	Anchor Brook
	Trash screen – maintained by WMBC	Wolverhampton Road	Rough Brook
	Trash screen – maintained by WMBC	Fishley Lane	Rough Brook
	Trash screen – maintained by WMBC	Sneyd Lane (boatyard)	Sneyd Brook
	Trash screen – maintained by WMBC	Wood Lane (caravan site)	Sneyd Brook
	Trash screen – maintained by WMBC	Bloxwich Lane/ jenner close	Sneyd Brook
	Trash screen – maintained by WMBC	Delves Green Road	Full Brook
	Trash screen – maintained by WMBC	Noose Crescent	Waddens Brook
	Trash screen – maintained by WMBC	Hatherton Road	Old Ford Brook
	Trash screen – maintained by WMBC	Lindrosa Road/ Hardwick Wood	Lindrosa Brook
	Trash screen – maintained by WMBC	Vicarage Road	Ford Brook
	Trash screen – maintained by WMBC	Barns Lane	Anchor Brook
	Trash screen – maintained by WMBC	Lichfield Road (parkway)	Anchor Brook
	Trash screen – maintained by WMBC	Northgate (nr Leighswood Pool)	Anchor Brook
	Trash screen – maintained by WMBC	Cartbridge Lane South	Ladypool Brook
	Trash screen – maintained by WMBC	Lazy Hill	Lazy Brook
	Trash screen – maintained by WMBC	Lichfield Road (Navys Bridge)	Ladypool Brook
	Trash screen – maintained by WMBC	Longwood Lane	Arboretum Brook
	Trash screen – maintained by WMBC	Lake Avenue Pool	Full Brook
	Trash screen – maintained by WMBC	Wharf approach	Anchor Brook
	Trash screen – maintained by WMBC	Wolverhampton Road/ Warwick Ave	Un-named Brook
	Trash screen – maintained by WMBC	Coppice Lane	Brownhills Brook
	Trash screen – maintained by WMBC	Pelsall Road (Becks Bridge)	Brownhills Brook
Dudley Metropolitan Borough Council	Grill - Quarterly inspection	Hurst Green Park	
	Grill - Quarterly inspection	Maidensbridge	
	Grill - EA maintained	Dawley Brook Road	
	Grill - EA maintained	Dawley Brook Road	
	Grill - EA maintained	Mayfair Drive	

COUNCIL	ASSET	LOCATION	INFORMATION
	Grill - EA maintained	Mayfair Drive	
	Grill - EA maintained	Coalborne Brooke - School Drive	
	Grill - EA maintained	Watery Lane	
	Grill - EA maintained	Rectory Fields	
	Grill - EA maintained	Brierley Hill Road	
	Grill - EA maintained	Primrose Hill	
	Grill - Quarterly inspection	Oak Park Road	
	Grill - Quarterly inspection	Oak Park Road	
	Grill - Quarterly inspection	Audnam	
	Grill - Post storm inspection	Ploverdale Crescent	
	Grill - Quarterly inspection	Worcester Lane	
	Grill - EA maintained	School Drive	
	Grill - EA maintained	Coalbourne Brook - Middle Path Bridge	
	Grill - Severn Trent maintained	Coalbourne Brook- rear of Collis Street	
	Grill - Quarterly inspection	Hawbush Road	
	Grill - Quarterly inspection	Bull Street	
	Grill - Quarterly inspection	Chelford Crescent	
	Grill - Post storm inspection	Cinder Road, Kingswinford	
	Grill - Post storm inspection	The Alley	
	Grill - Quarterly inspection	Himley Road	
	Grill - Quarterly inspection	Himley Road	
	Grill - Post storm inspection	Ham Lane	
	Grill - Post storm inspection	Ham Lane	
	Grill - Quarterly inspection	Pedmore Lane	
	Grill - Post storm inspection	Fieldfare Road	
	Grill - Post storm inspection	Fieldfare Road	
	Grill - Quarterly inspection	Greenfinch Road	
	Grill - Quarterly inspection	Chawn Park Drive	
	Grill - Quarterly inspection	Hunts Mill Drive	
	Grill - Quarterly inspection	Coopers Bank Road	
	Grill - Quarterly inspection	Sandstone Close	
	Grill - Post storm inspection	Wolverhampton Road	

COUNCIL	ASSET	LOCATION	INFORMATION
	Grill - Post storm inspection	Wolverhampton Road East access to Rodway Close	
	Grill - Post storm inspection	Wolverhampton Road East access to Rodway Close	
	Grill - Quarterly inspection	Spring Street	
	Grill - Quarterly inspection	Spring Street	
	Grill - Quarterly inspection	Wollescote Dingle, off Wollescote Road	
	Grill - Quarterly inspection	Wollescote Dingle, off Wollescote Road	
	Grill - Post storm inspection	Wollescote Road / Hodge Hill Avenue	
	Grill - Quarterly inspection	Mears Coppice	
	Grill - Quarterly inspection	Mears Coppice	
	Grill - Severn Trent maintained	Milking Bank Pool, Outfall and adj spillway	
	Grill - Severn Trent maintained	Milking Bank Pool, outfall and adj spillway	
	Grill - Quarterly inspection	Turls Hill Road	
	Grill - Quarterly inspection	Wynall Lane South	
	Grill - EA maintained	Mushroom Green - Mousesweet Brook	
	Grill - Quarterly inspection	Saltwells Wood	
	Grill - Quarterly inspection	Saltwells Wood	
	Grill - Post storm inspection	Lodge Farm Reservoir	
	Grill - Post storm inspection	Woodsetton Close	
	Grill - Post storm inspection	Woodsetton Close	
	Grill - Quarterly inspection	Bourne Street	
	Grill - Quarterly inspection	Bourne Street	
	Grill - Quarterly inspection	Bourne Street	
	Grill - Quarterly inspection	St Kenelms Avenue	
	Grill - Quarterly inspection	Lutley School, Brookwillow Road, Halesowen	
	Grill - Quarterly inspection	Lutley School. Brookwillow Road, Halesowen	
	Grill - Quarterly inspection	Fallowfield Road	

COUNCIL	ASSET	LOCATION	INFORMATION
	Grill - Quarterly inspection	Fallowfield Road	
	Grill - Quarterly inspection	Fallowfield Road	
	Grill - Quarterly inspection	Netherton Park	
	Grill - Quarterly inspection	Shaw Road	
	Grill - Quarterly inspection	Frieghtliner Site, Dudley	
	Grill - Quarterly inspection	Bean Road	
	Grill - Quarterly inspection	Bean Road	
	Grill - Quarterly inspection	Bean Road	
	Grill - Post storm inspection	Crimmond Rise	
	Grill - EA maintained	Lutley Gutter - Drews Holloway	
	Grill - EA maintained	Lutley Gutter - Shelton Lane	
	Grill - Quarterly inspection	Green Park Road	
	Grill - Quarterly inspection	Yates Lane	
	Grill - EA maintained	Netherton Road, Halesowen	
	Grill - EA maintained	Hickmans Road Playing Fields, Netherton	
	Grill - Private or other	Clancey Way	
	Grill - Private or other	Rear of Stourbridge Golf Club	
	Grill - Quarterly inspection	Greystoke Drive Kingswinford	
	Grill - Post storm inspection	Cotwall End Road, Netherton	
	Grill - Post storm inspection	Coombes Wood off st Ambrose Close, H'owen	
	Grill - Quarterly inspection	Netherton Park	
	Grill - Quarterly inspection	Castle Hill / Freightliner Site, Dudley	
	Grill - Post storm inspection	Troutbeck Drive, Brierley Hill	
	Grill - Post storm inspection	Saltwells Road, Quarry Bank	
	Grill - Private or other	Hulland Place, Brockmoor	
Wolverhampton council	Trash Screen	Penk Rise	
	Trash Screen	Penk Rise	
	Trash Screen	Penk Rise	
	Trash Screen	Racecourse Dunstall - by waterbridge	
	Trash Screen	Racecourse Dunstall - by waterbridge	

COUNCIL	ASSET	LOCATION	INFORMATION
	Trash Screen	Racecourse Dunstall - by waterbridge	
	Trash Screen	Blaydon Road - Pendeford	
	Trash Screen	Blaydon Road - Pendeford	
	Trash Screen	Blaydon Road - Pendeford	
	Trash Screen	Murdoch Road	
	Trash Screen	Murdoch Road	
	Trash Screen	Murdoch Road	
	Trash Screen	Linton Road	
	Trash Screen	Linton Road	
	Trash Screen	Wynn Road	
	Trash Screen	Wynn Road	
	Trash Screen	Pinfold Grove - Library	
	Trash Screen	Pinfold Grove - Library	
	Trash Screen	Finchfield Lane	
	Trash Screen	Finchfield Lane	
	Trash Screen	Chestnut Way	
	Trash Screen	Chestnut Way	
	Trash Screen	Tip Area - North of the Droveway	
	Trash Screen	Tip Area - North of the Droveway	
	Trash Screen	Primrose Avenue / Cavalier Circuse	
	Trash Screen	Primrose Avenue / Cavalier Circuse	
	Trash Screen	Northycote Lane / Wooded Area	
	Trash Screen	Northycote Lane / Wooded Area	
	Trash Screen	Fowlers Park	
	Trash Screen	Fowlers Park	
	Trash Screen	Watery Lane	
	Trash Screen	Watery Lane	
	Trash Screen	Watery Lane	
	Trash Screen	Clark Road	
	Trash Screen	Clark Road	
	Trash Screen	Pendeford High School	
	Trash Screen	Pendeford High School	

COUNCIL	ASSET	LOCATION	INFORMATION
	Trash Screen	Osbourne Road	
	Trash Screen	Straithfield Walk	
	Trash Screen	Turners Farm	
	Trash Screen	Cannock Road - Old Hampton Lane	
	Trash Screen	Compton Park - College View	
	Trash Screen	Primrose Avenue / Railway Line	
	Trash Screen	Gypsy Site - Showell Road	
	Trash Screen	The Lunt	
	Trash Screen	Spring Road	
	Trash Screen	Ward Grove	
	Trash Screen	Beech Road, Oxley	
	Trash Screen	Castlecroft Road	
	Trash Screen	Compton Allottments	
	Trash Screen	Darlaston Lane	
	Trash Screen	Highfields Pool	
	Trash Screen	Rocket Pool	
	Trash Screen	Grapes Pool (Moseley Road)	
	Trash Screen	Hawkeswell Drive	
	Trash Screen	Linthouse Lane	
	Trash Screen	Linthouse Lane - Headwall.	
	Trash Screen	Not Maintained by Highways (West Park)	

6.5 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

6.5.1 Actual flood risk

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development. Note that it is not likely to be acceptable to allocate developments in existing undefended areas on the basis that they will be protected by developer works, unless there is a wider community benefit that can be demonstrated.

The assessment of the actual risk should take into account that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe guarded that is required for affordable future flood risk management measures.
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.5.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been taken into account. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water. This can cause culverted watercourses to become overwhelmed.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close, failure or blockage of culverted watercourses or failure of pumping stations.
- Parts of The Black Country rely on formal flood defences for protection against fluvial flooding. Consequently, there are areas vulnerable to rapid inundation in the event of a breach / failure. The assessment of the residual risk should take into account:
    - The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
    - The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage on parts of the site

and considering the design of the development to keep people safe and / or ensuring all sleeping accommodation is above the flood level

- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.

7 Cumulative impact of development, schemes and strategic solutions

This chapter provides a summary of flood alleviation schemes, catchments with highest flood risk and makes recommendations for local planning policy based on these and summarises strategic solutions applicable to The Black Country.

7.1 Introduction

Under the revised 2018 NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRA), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para. 156), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory they should not increase flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

7.2 Cross-boundary issues

The topography of the district means that a number of major watercourses such as the River Tame and River Stour flow through the study area and into neighbouring authorities. As such, future development, both within and outside the Black Country can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation. The Black Country has boundaries with the following Local Authorities, which can be seen in Figure 1-1:

- South Staffordshire District
- Lichfield District
- Cannock Chase District
- Bromsgrove District
- Birmingham City Council

Development control should ensure that the impact on receiving watercourses from development in the Black Country has been sufficiently considered during the planning stage and appropriate development management decisions put in place to ensure there is no adverse impact on flood risk or water quality.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments near watercourses in neighbouring authorities comply with the latest guidance and legislation relating to flood risk and sustainable drainage, they should result in no increase in flood risk within the Black Country.

The neighbouring authorities were contacted for information on their site allocations, to determine where development in neighbouring authorities may have an impact on

flood risk within the Black Country area. A large amount of development is proposed on the border of Southern Staffordshire (Lichfield, Cannock Chase and South Staffordshire Districts) and this has been considered in the cumulative impact assessment in Chapter 7.3.

7.3 Cumulative Impact Assessment

The cumulative impact assessment was undertaken in conjunction with the Black Country Authorities (BCAs) who neighbour the Southern Staffordshire Councils (SSCs) to the south of the study area, as a large number of proposed sites from both the SSCs and the BCAs lie on the border between the two areas and therefore could both influence flood risk in the other area.

Southern Staffordshire and the Black Country were split into river catchments using the ArcGIS hydrology toolset and 50m DTM and a number of datasets were used to determine which catchments are at the highest risk of flooding and where the cumulative impact of development may have the biggest effect. Historic flood risk, surface water flood risk, potential development, predicted flood risk from increased runoff upstream and sewer flooding were all considered during the assessment, and each catchment was ranked within each of these categories. The individual rankings were combined to give and overall risk ranking for each catchment and these were then allocated a Red, Amber, Yellow or Green rating corresponding to high-risk, medium-risk, lower-risk and low-risk overall. More detailed information on the methodology, assumptions and considerations of the cumulative impact assessment can be found in Appendix E.

The results of the cumulative impact assessment are summarised below and in Figure 7-1. Policy recommendations for the below catchments can be found in section 10.3.

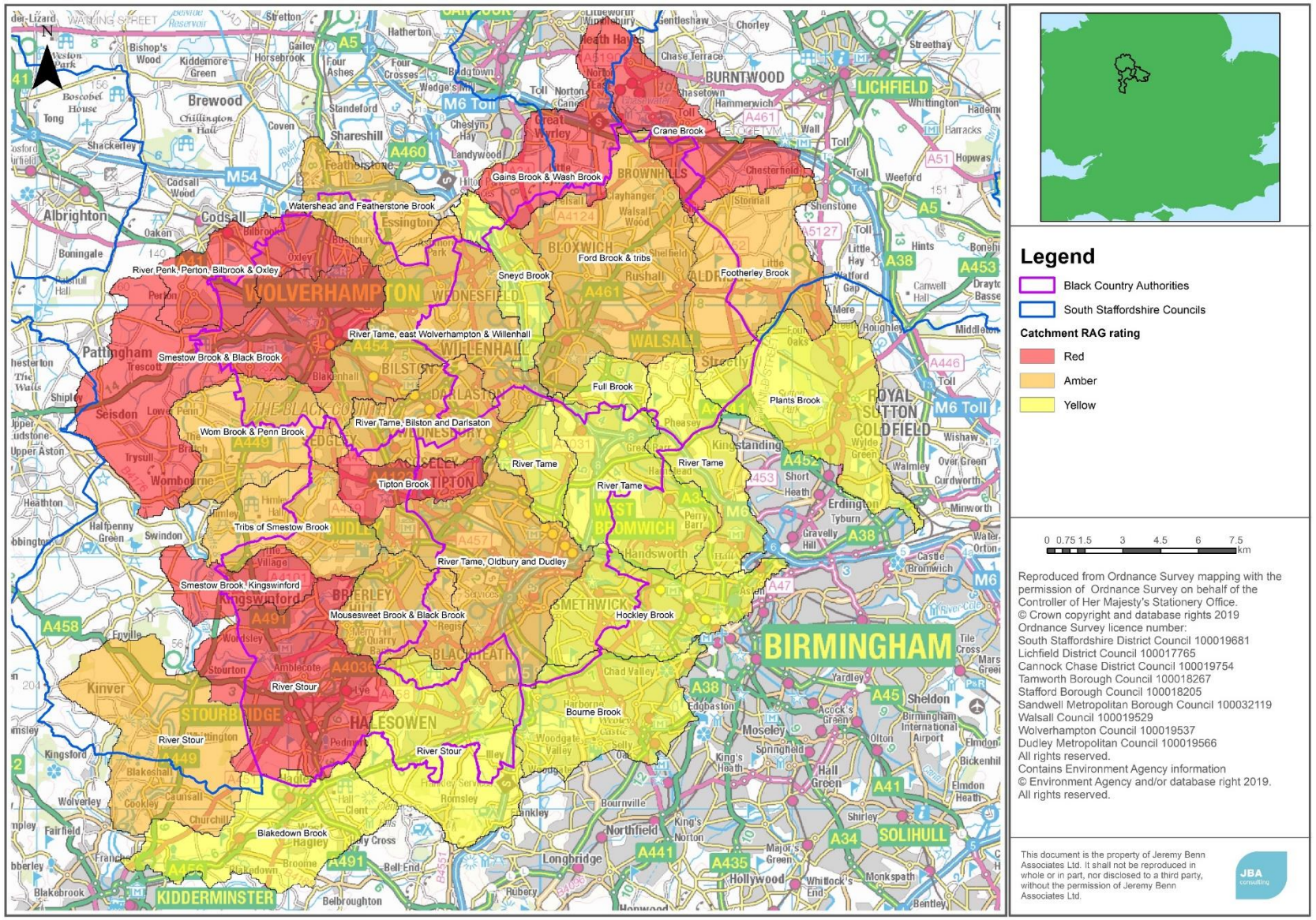
The catchments rated as **high-risk (red)** are:

- River Penk, including Perton, Tettenhall, Bilbrook and Oxley
- River Stour, Stourbridge and Brierley Hill
- Smestow Brook, including Kingswinford
- Smestow Brook and Black Brook, Wolverhampton and Seisdon
- Gains Brook and Wash Brook, including Norton Canes
- Crane Brook, Burntwood, draining towards Shenstone
- Tipton Brook

The catchments rated as **medium risk (amber)** are:

- River Tame East Wolverhampton and Willenhall
- Ford Brook and tributaries, Brownhills and Walsall
- Mousesweet Brook and Black Brook, including Rowley Regis, Blackheath and south Dudley
- River Tame source to Tipton Brook, including Oldbury and Dudley
- Tributaries of the Smestow Brook, draining towards Hinksford
- at risk
- Wom Brook and Penn Brook, draining towards Wombourne
- River Stour, including Kinver and Dunsley, draining towards Kidderminster
- Footherley Brook, draining towards Shenstone
- Watershead and Featherstone Brook, draining towards Cove
- River Tame Bilston and Darlaston

Figure 7-1 RAG rating of catchments in Black Country and border catchments with Southern Staffordshire



7.4 Flood Alleviation Schemes

Information and location of flood alleviation schemes within The Black Country can be found on the Environment Agency's **Programme of flood and coastal erosion risk management (FCERM) schemes**.

7.4.1 Ashes Road Capital Maintenance Scheme – Sandwell (Sandwell Metropolitan Borough Council)

Sandwell Metropolitan Borough Council Potential Scheme at appraisal stage for a capital maintenance scheme in Warley to provide better protection to 46 houses at flood risk with an envisaged completion date of 2021.

7.4.2 Thimblemill Brook, Smethwick, Flood Alleviation Scheme – Sandwell (Sandwell Metropolitan Borough Council)

A major potential scheme at appraisal stage to better protect 255 homes by a series of interventions in or adjacent the Thimblemill Brook in the Warley area, currently programmed in to be completed and delivered by 2021.

7.4.3 Collins Road Sheet Pile Refurbishment - Sandwell (Environment Agency)

Environment Agency scheme in construction to refurbish sheet piling at Collins Road adjacent to the River Tame at Wednesbury to improve the structural integrity of the hard-engineered banks benefitting 62 properties at risk.

7.4.4 Ockerhill Flood Storage Area Repairs - Sandwell (Environment Agency)

Repairs and amendments to be undertaken by the Environment Agency to an existing flood storage area to ensure a good standard of protection to 22 properties. Currently in early assessment stage, with capital repairs due by 2021.

7.4.5 Upper Tame - Titford Culvert (Environment Agency)

Scheme in construction upgrading the River Tame Titford culvert and benefitting 145 properties in Oldbury to be completed by 2019.

7.4.6 Old Ford Brook, Walsall, Culvert Recondition Works – (Walsall Council)

Investigation and reconditioning works to maintain capacity and integrity of the Old Ford Brook culvert, led by Walsall Council to provide better protection to 12 homes in with an envisaged delivery date by 2021.

7.4.7 Waterhead Brook, Wolverhampton, Flood Alleviation Scheme (City of Wolverhampton Council)

Potential scheme on the Environment Agency programme to be delivered by City of Wolverhampton Council to benefit 11 properties at flood risk to provide an appropriate standard of protection.

7.4.8 The Beck, Mousesweet Brook, Dudley Flood Alleviation Scheme (Environment Agency)

Completed scheme by the Environment Agency to better protect and offer benefit to 46 properties in Cradley and Cradley Heath, as the Mouseweet Brook forms the boundary between Sandwell and Dudley.

7.4.9 Mushroom Green Dam, Dudley, Mousesweet Brook, FAS

Mushroom Green embankment had been subject to seeping in the past and Dudley Metropolitan Borough Council are working in partnership with the EA and Severn Trent Water to replace a failing asset with an oversized culvert, through the existing culvert, with other environmental improvements to benefit 42 properties.

7.5 Strategic solutions

The Risk Management Authorities have a vision for the future management of flood risk and drainage across The Black Country. This concerns flood risk management, alongside wider environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ FRM schemes, new defences and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems.

Chapter 2 sets out the strategic plans that exist for The Black Country. The list below summarises the key outcomes these are seeking to achieve and strategic solutions that can be implemented within the Black Country. This vision needs to be delivered by new development alongside retrofitting and enhancing green infrastructure and flood defence schemes in the existing developed area.

- Risk Management Authorities working in partnership to manage all sources of flooding.
- Managing flood risk to existing communities, infrastructure and the environment in a sustainable manner.
- De-culverting and restoring watercourses and, where this is unfeasible, to take the opportunity to upsize culverted watercourses, including taking opportunities presented by new development to do so.
- Recognising that new development is one of the best ways to manage flood risk, by avoiding inappropriate development in flood risk areas and ensuring that new development does not increase flood risk elsewhere.
- Encouraging the take up of multi-functional Sustainable Drainage Systems and retrofitting and enhancing green infrastructure.
- Promoting the use of Natural Flood Management through multi-agency projects led by the Birmingham and Black County Wildlife Trust.
- Ensuring communities are prepared for flood events (and that the residual risk to new developments has been considered and planned for).
- Reconnecting the floodplain with the River Tame, in areas around the Oldbury Arm near Wednesbury and Sandwell Valley and any flood betterment or ecological opportunities to improve water quality around the M5 corridor.
- Recognising the role of strategic solutions in reducing flood risk to enable regeneration as well as the protection of existing communities, infrastructure and the environment.
- Recognising the potential for developers to contribute towards such flood risk management measures that reduce risk to their development sites, facilitate regeneration and the wider community.

8 Guidance for developers

This chapter provides guidance on site-specific Flood Risk Assessments (FRAs). These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk in the Black Country. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and any defences at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed FRA may show that a site is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

8.1 Principles for new developments

Apply the Sequential and Exception Tests

Developers must provide evidence that the Sequential Test has been passed for windfall developments. If the Exception Test is needed, they must also provide evidence that all parts of the Test can be met for all developments, based on the findings of a detailed Flood Risk Assessment.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

Consult with statutory consultees at an early stage to understand their requirements.

Developers should consult with the Environment Agency, The Black Country Authorities as LLFAs and Severn Trent Water, at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, Developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the 2019 Environment Agency climate change guidance and ensure the development has taken into account climate change adaptation measures.

Ensure that the development does not increase flood risk elsewhere

Chapter 9 sets out these requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

Ensure the development is safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site (**Chapter 6.5**).

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard.

Manage the surface water runoff rates of new development

On greenfield sites surface water runoff rates should not be increased and on brownfield sites surface water runoff should be reduced to the greenfield rate wherever practical. Approved development proposals will be expected to be supplemented by appropriate maintenance and management regimes for surface water drainage.

Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment.

Consider and contribute to wider flood mitigation strategy and measures in the area and apply the relevant local planning policy

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or natural flood management or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in The Black Country can be found in **Chapter 7.3**. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1).
- Where evidence of historical or recent flood events have been passed to the LPA.
- In an area of significant surface water flood risk (consult the LLFA for their latest requirements)

8.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature and location of the development. Site-specific FRAs should establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether a proposed development will increase flood risk elsewhere;
- whether the measures proposed to deal with the effects and risks are appropriate;
- the evidence, if necessary, for the local planning authority to apply the Sequential Test; and
- whether, if applicable, the development will be safe and pass the Exception Test.

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and the Black Country Authorities. Guidance and advice for developers on the preparation of site-specific FRAs include:

- **Standing Advice on Flood Risk** (Environment Agency);
- **Flood Risk Assessment for Planning Applications** (Environment Agency);
- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPF PPG, Defra);
- **SuDS and Standing Advice Information** (Staffordshire County Council);
- **Walsall Council 'Guidance on Development & Flood Risk for Developers (2013)** (Walsall Council)
- **Dudley Metropolitan Borough Council Draft Local Guidance for Planning Applications: SuDS** (Dudley Metropolitan Borough Council)
- **Staffordshire County Council Land Drainage Consents**;

Guidance for local planning authorities for reviewing flood risk assessments submitted as part of planning applications has been published by Defra in 2015 – Flood Risk Assessment: Local Planning Authorities.

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones, to higher ground, while more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as Green Infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

8.3.2 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above

the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C62430.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

8.3.3 Raised floor levels

If raised floor levels are proposed, these should be agreed with the Black Country Authorities and the Environment Agency. The minimum Finished Floor Level (FFL) may change depended on the vulnerability and flood risk to the development.

The Environment Agency advises that minimum finished floor levels should be set 600mm above the 100-year plus climate change peak flood level, where the new climate change allowances have been used (see **Chapter 4** for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

8.3.4 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered, as set out in **Chapter 6**.

8.3.5 Developer contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS). Where possible, opportunities should be sought to work with other bodies and landowners to encourage and promote implementation of natural flood management measures which will contribute towards delivering a reduction in local and catchment-wide flood risk and the impacts of climate change as well as

achieve other wider environmental benefits. Further information can be found about where strategic flood risk solutions are being planned in **Chapter 7.3**.

8.4 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible, and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before resistance and resilience measures are relied upon. The effectiveness of these forms of measures are often dependent on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned responsibility for maintenance and the cost of replacement when they deteriorate. The following measures are available:

- *Permanent barriers:* Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers.
- *Temporary barriers:* Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.
- *Community resistance measures:* These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
- *Flood resilience measures:* These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk.

8.5.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a drainage impact assessment shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

8.5.3 Culverted watercourses

Where a watercourse passes through a site (open or culverted) the developer should demonstrate that they have considered it when developing their proposals for development. They should do this by:

- Undertaking ground truthing to locate in detail the presence of any culverted watercourse e.g. through historic mapping and utility searches, site visits, CCTV and ground investigation work should there be any suspicion of a culvert running under the site.
- Undertaking a detailed CCTV assessment of the extent and condition of any culverts present on site
- Undertaking flood modelling to assess the capacity of any culverts on site

Developments should naturalise urban watercourses and open up underground culverts, to provide biodiversity net gain as well as amenity improvements. Culverts are only acceptable for essential infrastructure crossings e.g. a short length for site access crossings, where a culvert passes under a gas main and the length of culvert should be limited to that which is essential.

In exceptional circumstances where it is not possible to open up a culvert (e.g. due to the significant depth of the feature) the structural loading of surrounding properties should be taken into account, with an appropriate easement of at least 8m on either side of the culvert. Access should be provided for future maintenance of the culvert and the condition of the culvert should be improved so that it is sufficiently safe against failure for the lifetime of the development. Trash screens should be provided on culvert headwalls that are designed in line with best practise and appropriate maintenance secured to ensure the structure is kept clear for the lifetime of the development.

Where a site is shown on the SFRA mapping (or the outputs available from subsequent Council studies) to be potentially affected by flooding from a culvert blockage either on or off site, the developer should:

- Undertake more detailed modelling of the culverted watercourse network based on detailed survey of the culverts, watercourse structures and site topographical survey to ascertain in more detail the extent and flood hazards from potential blockage
- If the condition of the culvert is considered to be at least 'Fair': Design the development such that properties will not be flooded to account for a culvert blockage scenario during a 1 in 100year flood event, where the culvert would be at least 50% blocked. Ensure that safe access and egress from the site is available in such a scenario.
- If the condition of the culvert is considered to be 'Poor' or 'Very Poor' or is unknown: Design the development such that properties will not be flooded to account for a culvert blockage scenario during a 1 in 100 year flood event, where the culvert would be at least 90% blocked. Ensure that safe access and egress from the site is available in such a scenario.

- In all instances: Prepare a Flood Warning and Evacuation Plan to account for a culvert blockage scenario during a 1 in 100 year flood event, where the culvert would be at least 90% blocked.
- In all instances: Safe internal refuge should be available above the flood depths that might be expected should the culvert block by at least 90% in an extreme 1 in 1000 year flood event.
- Liaise with the Council about any potential to contribute towards on/ off site works to help to alleviate known flooding issues related to the culverts. If such works can be taken forward, the effect of such works should be modelled as above and planned for in the site design.

It should be noted that opening up watercourses significantly reduces the chance of blockage and developers should seek to open up watercourses off site working with third parties where this can be proven to be feasible.

8.5.4 Canals

Developers should consult with the **Canal and Rivers Trust** who have produced a **checklist for developments** close to canals.

8.5.5 Reservoirs

The risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage. Developers should contact the reservoir owner for information on:

- the Reservoir Risk Designation
- reservoir characteristics: type, dam height at outlet, area/volume, overflow location;
- operation: discharge rates / maximum discharge;
- discharge during emergency drawdown; and
- inspection / maintenance regime.
- The EA and NRW online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent, depths and velocities shown in these online maps.

Developers should consult the **West Midlands Conurbation Local Resilience Forum** about emergency plans for reservoir breach.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond.
- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site specific emergency plans if necessary and ensure the future users of the development are aware of these plans

8.6 Flood warning and emergency planning

Emergency planning covers three phases: before, during and after a flood. Measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. National Planning Policy takes this

into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The 2018 NPPF requires site level Flood Risk Assessments to demonstrate that

"d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites
- Sites with transient occupants e.g. hostels and hotels
- Developments at a high residual risk of flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences
- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of the Councils will not normally be appropriate.

The **West Midlands Conurbation Local Resilience Forum** is made up of seven metropolitan Councils (Birmingham, Coventry, Dudley. Sandwell, Solihull, Walsall and Wolverhampton) and has a high-density urban area. Under the Civil Contingencies Act 2004, it ensures that Category 1 responders such as local authorities, emergency services and Category 2 responders (i.e. gas and water companies) all work in partnership and provide a consistent level of civil protection. The resilience forum provides Emergency Planning relevant information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including preparation, understanding warnings, actions to limit exposure to risk and recovery. Further information is available from:

- The **National Planning Policy Guidance**
- The **Environment Agency and DEFRA's** standing advice for FRAs
- **West Midlands Prepared Campaign**
- Environment Agency's **"How to plan ahead for flooding"**
- Sign up for **Flood Warnings** with the Environment Agency
- **National Flood Forum**
- GOV.UK - Make a **Flood Plan guidance** and templates

9 Surface water management and SuDS

This chapter provides guidance and advice on managing surface water runoff and flooding.

9.1 Role of the LLFA and Local Planning Authority in surface water management

In April 2015, all the Black Country Councils were made a statutory planning consultee on the management of surface water. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals. As of April 2017, Staffordshire County Council provides this advice to developers and planners on behalf of Sandwell, Walsall and Wolverhampton Councils.

When considering planning applications, the LLFAs will provide advice to the Planning Department on the management of surface water. As LPAs, the Black Country Authorities should satisfy themselves that the development's proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS.

9.2 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place. Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

The runoff destination should always be the first consideration when considering design criteria for SuDS including the following possible destinations in order of preference:

- To ground;
- To surface water body;
- To surface water sewer;
- To combined sewer.

Effects on water quality should also be investigated when considering runoff destination in terms of the potential hazards arising from development and the sensitivity of the runoff destination. Developers should also establish that proposed outfalls are hydraulically capable of accepting the runoff from SuDS through consultation with the LLFA, EA, and STW.

The non-statutory technical standards for sustainable drainage systems (March 2015) set out appropriate design criteria based on the following:

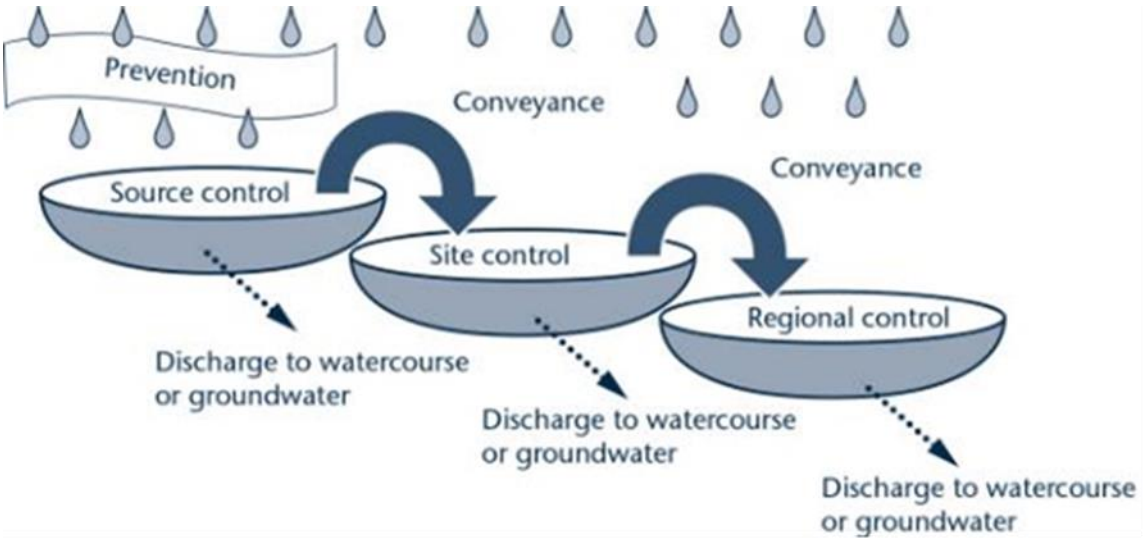
- Flood risk outside the development;
- Peak flow control;
- Volume control;

- Flood risk within the development;
- Structural integrity;
- Designing for maintenance considerations;
- Construction.

In addition, the Local Planning Authority may set local requirements for planning permission that include more rigorous obligations than these non-statutory technical standards. More stringent requirements should be considered where current Greenfield sites lie upstream of high-risk areas. This could include improvements on Greenfield runoff rates. CIRIA has also produced a number of guidance documents relating to SuDS that should be consulted by the LPA and developers.

Many different SuDS techniques can be implemented. As a result, there is no one standard correct drainage solution for a site. In most cases, a combination of techniques, using the Management Train principle (see Figure 9-1), will be required, where source control is the primary aim.

Figure 9-1 SuDS Management Train Principles



The effectiveness of a flow management scheme within a single site is heavily limited by land use and site characteristics including (but not limited to) topography; geology and soil (permeability); and available area. Potential ground contamination associated with urban and former industrial sites should be investigated with concern being placed on the depth of the local water table and potential contamination risks that will affect water quality. The design, construction and ongoing maintenance regime of any SuDS scheme must be carefully defined as part of a site-specific FRA. A clear and comprehensive understanding of the catchment hydrological processes (i.e. nature and capacity of the existing drainage system) is essential for successful SuDS implementation.

Maintenance options must clearly identify who will be responsible for SuDS maintenance and funding for maintenance should be fair for householders and premises occupiers; and, set out a minimum standard to which the sustainable drainage systems must be maintained.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

The **C753 CIRIA SuDS Manual** (2015) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging

from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

9.3.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

9.3.3 Black Country SuDS Handbook

The Black Country Authorities have worked in partnership with five other West Midlands LLFAs to produce the SuDS Handbook. The front end of the document is identical across LLFAs and each LLFA has a specific appendix in their version setting out local design considerations, constraints, case studies and arrangements for SuDS maintenance.

The SuDS Handbook presents design guidance alongside Local SuDS Standards that developers should meet when proposing SuDS systems on new developments. It also contains a proforma that a developer should submit with a Flood Risk Assessment/ Surface Water Drainage Strategy.

The Local SUDS Standards are identical in the Black Country SuDS Handbook that will be published later in 2020 to the Staffordshire SuDS Handbook, which was published in 2017.

The Local Standards are that:

Design Principles

Local Standard A – Phased Development and Drainage Strategies

For phased developments, the LLFA will expect planning applications to be accompanied by a Drainage Strategy which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase.

Local Standard B – Pollution Prevention and Control

The LLFA will expect the SuDS to demonstrate how pollutants are prevented or controlled as part of the SuDS scheme. This should include consideration of the sensitivity of receiving waterbodies and particular attention should be given to the first 5mm of rainfall ('first flush' that mobilises the most pollutants).

Local Standard C – Conformity with the SuDS Management Train Principles

The LLFA will expect the SuDS design to demonstrate how the principles of the SuDS Management Train have been taken into account.

Local Standard D – Multiple Benefits

The LLFA will expect the SuDS design to demonstrate, where appropriate, how environmental site constraints have been considered and how the features design will provide multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features.

Volume Control

Local Standard E – Climate Change

The LLFA will expect SuDS design to include an allowance for a 30%* increase in rainfall for a 1% Annual Exceedance Probability rainfall event in order to accommodate climate change. (*note that guidance may be subject to change and therefore the most up to date information should be referenced).

Local Standard F – Urban Creep

The LLFA will expect the SuDS design to include an allowance for an increase in impermeable area to accommodate urban creep.

Local Standard G – Emergency Overflows

The LLFA will expect an emergency overflow to be provided for piped and storage features above the predicted water level in a 1% Annual Exceedance Probability rainfall event, with an allowance for climate change.

Local Standard H – Freeboard Levels

The LLFA will expect all surface water storage ponds to provide a 300mm freeboard above the predicted water level arising from a 1% Annual Exceedance Probability rainfall event inclusive of an allowance for climate change. Care must be taken to ensure that excavations do not take place below the ground water level.

Flood Risk Within the Development

Local Standard I – Exceedance Flows

The LLFA will expect exceedance flows, originating from both within and outside of the development site, must be directed through areas where the risks to both people and property are minimised.

When considering exceedance routes, particular attention should be paid to:

i. The position of walls, bunds and other obstructions that may direct water but must not cause ponding

ii. The location and form of buildings (e.g. terraces and linked detached properties) that must not impede flows or cause ponding

Submitted drawings and calculations must identify sources of water entering a site pre-development, how flows will be routed through a site, where flows leave the site pre-development and where they leave the site post development.

Local Standard J – Watercourse Floodplains

The LLFA will expect the floodplains of ordinary watercourses to be mapped to an appropriate level of detail considering the nature of the application (i.e. detailed flood modelling should be undertaken to support full planning applications). The layout of the development will then take a sequential approach, siting the least vulnerable parts of that development in the highest flood risk areas.

Local Standard K – Retention of Natural Drainage Features

The LLFA will expect natural drainage features on a site should be maintained and enhanced. Culverting of open watercourses will not normally be permitted except where essential to allow highways and / or other infrastructure to cross. In such cases culverts should be designed in accordance with CIRIA's Culvert Screen and Outfall manual (C786).

Where a culverted watercourse crosses a development site, it should be reverted back to open channel. In such a case the natural conditions deemed to have existed prior to the culverting taking place should be re-instated.

Local Standard L – Impact of Downstream Water Levels

If high water levels within a receiving watercourse into which a SuDS scheme discharges are anticipated, the LLFA will expect that they will not adversely affect the function of that SuDS system.

Designing for Maintenance Considerations

Local Standard M – Maintenance Requirements

The LLFA will expect SuDS to be designed so that they are easy to maintain. Proper use of the SuDS management train, including surface features, is one way to achieve this.

The developer must set out who will maintain the system, how the maintenance will be funded and provide a maintenance and operation manual.

Local Standard N – Minimising the Risk of Blockages

The LLFA will expect the SuDS design to minimise the risk of blockage as far as is reasonably possible e.g. by using suitable pipe sizes and making underground assets as visible and accessible as possible.

Local Standard O – Use of Pumped Systems

If it can be demonstrated that a partial or completely pumped drainage system is the only viable option, the LLFA will expect the residual risk of flooding due to the failure of the pumps to be assessed. The design flood level must be determined under the following conditions:

- If the pumps were to fail
- If the attenuation storage was full, and
- If a design storm occurred.

The finished floor levels of the affected properties should be raised above this level and all flooding should be safely stored onsite.

An emergency overflow must be provided for piped and storage features above the predicted water level arising from a 1% Annual Exceedance Probability rainfall event inclusive of allowances for climate change and urban creep.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

The Environment Agency have published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on **Defra's interactive mapping.**

9.4.2 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones near groundwater abstraction points. These protect areas of groundwater used for drinking water. The Groundwater SPZ requires attenuated storage of runoff to prevent infiltration and contamination. Groundwater Source Protection Zones can be viewed on the **Environment Agency's website** under the non-statutory land-based designations section.

Depending on the nature of the proposed development and the location of the development site with regards to SPZs, restrictions may be in place on the types of SuDS used within appropriate areas. For example, infiltration SuDS are generally accepted within Zone 3, whereas in Zones 1 (Inner Protection Zone) or 2 (Outer Protection Zone), the Environment Agency will need to be consulted and infiltration SuDS may only be accepted if the correct treatments and permits are put in place. Any restrictions imposed on the discharge of the site generated runoff by the Environment Agency will be determined on a site by site basis using risk-based approach.

Large areas of The Black Country are not within a groundwater source protection zone. There are some areas within Zone 3. The west of Wolverhampton is widely covered by an area of Zone 3 from Fordhouses to Penn and west of Dudley from Wall Heath to South Stourbridge including the surrounding areas, and areas covering Smethwick in Sandwell and Streetly in Walsall. There are also many smaller areas covered by Zones 1 and 2 within Zone 3, including Tettenhall, around Bath Road (Centre of Wolverhampton), Springfield, East of Aldridge, Wordesly and around an unnamed reservoir to the south of Dudley.

9.5 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The Black Country is entirely within an NVZ. The NVZ coverage can be viewed on the **Environment Agency's online maps**.

10 Summary and Recommendations

This Level 1 SFRA delivers a strategic assessment of risk from all sources of flooding in The Black Country. It also provides an overview of policy and provides guidance for planners and developers.

10.1.1 Sources of flood risk

Parts of The Black Country are at risk from the following sources; fluvial, surface water, groundwater, sewers, reservoir inundation, canal overtopping/ breaches. This study has shown that the most significant sources of flood risk in The Black Country are fluvial and surface water.

- *Fluvial flooding*: The primary fluvial flood risk is along the River Tame, Stour and Smestow Brook and the tributaries of these watercourses. These present fluvial flood risk to rural communities as well as some of the main urban centres, including, but not limited to Bescot, Willenhall, Horseley Heath, Dudley Port, North Stourbridge and Newton. More recent significant flooding events across The Black Country occurred in July 2007 and 2008 and June 2016.
- *Surface water:* Surface water flooding is most likely caused by intense rainfall. There are many areas at high risk of surface water flooding in The Black Country, with many urban areas within flow paths draining into the main rivers.
- *Sewer*: The sewers in The Black Country are managed by Severn Trent Water. Severn Trent Water provided their Hydraulic Flood Risk Register which denotes 996 properties at risk of sewer flooding in the Black Country, with the areas of highest risk/most historical incidents of sewer flooding including Tipton, Claregate and Tettenhall.
- *Groundwater:* The Areas Susceptible to Groundwater Flooding map shows that in general, the majority of the Black Country has a low risk of groundwater flooding. Parts of the study area including between the east of Wolverhampton, west Walsall and the north of Sandwell have a higher risk of groundwater flooding. As pumping and abstraction regimes have ceased or been changed, local groundwater flooding incidences have occurred in the north-east and south-east of Wolverhampton and along the boundary between Dudley and Sandwell Metropolitan Borough Council areas. It is therefore anticipated that groundwater flooding issues are likely to be localised in their nature, affecting limited areas and a small number of properties.
- *Canals*: There is a network of fifteen canals within The Black Country; These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. There have been incidences of breach and overtopping on five of these canals although there have been no records of breach or overtopping in recent years. The most recent incident of overtopping was on the Stourbridge Canal in Merry Hill in 1985.
- *Reservoirs:* There is a potential risk of flooding from reservoirs both within The Black Country and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from the reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this should be considered in any site-specific Flood Risk Assessments (where relevant).

10.2 Recommendations for the Councils

Reduction of flood risk through site allocations and appropriate site design

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to Flood Zone 1. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken.

- After application of Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and to make space for water.
- Ensure development is 'safe'. Dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then as assessment should be made to detail the flood duration, depth, velocity and flood hazard rating in the 1 in 100-year plus climate change flood event, in line with FD2320.
- Raise residential and commercial finished floor levels 600mm above the 1 in 100 year plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- Safeguard functional floodplain from future development.
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Promote SuDS to mimic the natural drainage routes to improve water quality

- SuDS design to demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features.
- Planning applications for phased developments, should be accompanied by a Drainage Strategy which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase;
- Use of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody
- SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.

Reduce surface water runoff from new developments and agricultural land

- SuDS should be considered and implemented as part of all new development, in line with the Black Country SUDS Handbook.
- Space should be provided for the inclusion of SuDS on all allocated sites and outline proposals.
- Promote biodiversity, habitat improvements and **Countryside Stewardship schemes** to help prevent soil loss and to reduce runoff from agricultural land.

Enhance and restore river corridors and habitats

- Assess condition of existing assets and upgrade, if required, to ensure that the infrastructure can accommodate pressures / flows for the lifetime of the development.
- Opportunities should be sought to open up culverted watercourses wherever possible and reduce the residual risk from their blockage or failure.
- Natural drainage features should be maintained and enhanced.
- Identify opportunities for river restoration / enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and / or other infrastructure to cross, in line with CIRIA's

Culvert Screen and Outfall manual (C786) and the Black Country LFRM Strategy to restrict development over culverts and to daylight, where feasible.

- There should be no built development within 8m from the top of a watercourse or Main River, including culverted watercourses, for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

Mitigate against risk, improved emergency planning and flood awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 100-year rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 1 in 1000-year event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within the Black Country

10.3 Recommendations from the cumulative impact analysis

Policy recommendations for the Black Country

The cumulative impact assessment for the Black Country has highlighted that the potential for development to have a cumulative impact on flood risk is relatively high across the authorities. Many of the catchments are red and amber rated and those that are yellow still have levels of flood risk higher than many of the rural catchments in surrounding local authority areas in Southern Staffordshire.

This supports the need for incremental action and betterment in flood risk terms across all four Black Country Authority areas. The policy recommendations made here have been based on a review and recommended changes to policy ENV5 in the 2011 Black Country Core Strategy.

Policy ENV5: Flood Risk, Sustainable Drainage Systems and Urban Heat Island, Black Country Core Strategy 2011

The Black Country Authorities will seek to minimize the probability and consequences of flood risk by adopting a strong risk-based approach in line with PPS25. Development will be steered to areas with a low probability of flooding first through the application of the sequential test. The Exception test will then be required for certain vulnerable uses in medium and high probability flood areas.

Proposals for development must demonstrate that the level of flood risk associated with the site is acceptable in terms of the Black Country Strategic Flood Risk Assessment and its planning and development management recommendations as well as PPS25 depending on which flood zone the site falls into and the type of development that is proposed (see PPS25, table D1: Flood Zones to explain appropriate uses in flood zones).

To assist in both reducing the extent and impact of flooding and also reducing potential urban heat island effects, all developments should:

a) Incorporate Sustainable Drainage Systems (SUDs), unless it would be impractical to do so, in order to significantly reduce surface water run-off and improve water quality. The type of SUDs used will be dependent on ground conditions;

b) Open up culverted watercourses where feasible and ensure development does not occur over existing culverts where there are deliverable strategies in place to implement this;

c) Take every opportunity, where appropriate development lies adjacent to the river corridors, or their tributaries or the functional floodplain, to benefit the river by reinstating a natural, sinuous river channel and restoring the functional floodplain within the valley where it has been lost previously;

d) On sites requiring a Flood Risk Assessment, reduce surface water flows back to equivalent greenfield rates;

e) Create new green space, increase tree cover and/or provide green roofs; No development will be permitted within a groundwater Source Protection Zone 1 which would physically disturb an aquifer, and no permission will be granted without a risk assessment demonstrating there would be no adverse effect on water resources.

The evidence in this SFRA continues to support the ethos of ENV5, which is to reduce flood risk through new development and provide wider sustainability benefits e.g. from opening up culverts and creating new amenity spaces for people and wildlife. However, since the Black County Core Strategy was published in 2011, there have been changes in the roles and responsibilities for flood risk management as well as National Planning Policy and Guidance and the evidence in this SFRA supports the following amendments to the policy:

The risk based approach

The Black Country Authorities will seek to minimise the probability and consequences of flooding by adopting a strong risk-based approach in line with National Planning Policy Framework.

The Sequential Test should be firstly applied to all developments to ensure that development takes place in the lowest flood risk areas. The Sequential Test should take account of the information on river (fluvial) flooding and all other sources of flooding, using the information provided in the 2020 Strategic Flood Risk Assessment. It should also take into account the impact of climate change over the lifetime of that development.

The vulnerability of the development type to flooding should then be considered with regards to the Flood Zone information in the 2020 SFRA:

- Where the site is Functional Floodplain (Flood Zone 3b) development should be resisted (including extensions and intensification of use and changes of use) and opportunities to relocate development out of the floodplain should be sought. The only development that can be permitted in Flood Zone 3b is essential infrastructure, subject to the Exception Test.
- Where the site is High Probability (Flood Zone 3a):
- Residential dwellings can be permitted, subject to the Exception Test
- A site specific Flood Risk Assessment must be submitted with a Planning Application for all sites in Flood Zone 3.

To pass the Exception Test, developments will need to:

- Provide a demonstrable benefit to the wider sustainability of the area. Matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport should be considered. Applicants should detail the suitability issues the development will address and how doing so will outweigh the flood risk concerns for the site e.g. by

facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- Prove that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Where the site is Medium Probability (Flood Zone 2): most development can be permitted, subject to a site specific Flood Risk Assessment. Highly vulnerable developments, such as caravans, mobile homes and park homes with permanent residential use can be permitted, subject to the Exception Test.

Where the site is Low Probability (Flood Zone 1), the information in the 2020 SFRA should be used to assess if a development is at risk from other sources of flooding and/ or if there is an increased risk of flooding in the future due to climate change. If this site is shown to be at risk, a site specific Flood Risk Assessment should accompany a planning application.

Sustainable drainage and surface water management

Developers should:

- Incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites (of any size). SUDS must be designed in line with the Black Country Local Standards for SUDS. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area where practicable. The Black Country SUDS Handbook provides guidance on SUDS design and selection
- For all major developments, reduce surface water flows back to equivalent greenfield rates. If greenfield runoff rates are not considered to be feasible for viability reasons then the developer must submit evidence demonstrating what the constraints are to achieving this and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates. Under no circumstances will post runoff rates that are greater than pre development runoff rates be permitted. Surface Water Drainage Strategies are required for all major developments, regardless of their size and the Flood Zone and catchment they are in to meet the requirements of the LLFA. These should take into account all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.

Watercourses and flood mitigation

Developments should naturalise urban watercourses (by reinstating a natural, sinuous river channel and restoring the functional floodplain) and open up underground culverts, to provide biodiversity net gain as well as amenity improvements. Developers should set out how the mitigation designs will ensure that there is no net increase to fluvial flood risk downstream and where practicable how the development could help mitigate against downstream fluvial flood risk. Development should not proceed over culverted watercourses.

There should be no built development within 5m of an Ordinary Watercourse and 8m of the top of the bank of a main river." Top of bank should be defined by a site specific survey. This is for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

Where there is a known or suspected culverted watercourse either on or immediately downstream of a site where the SFRA highlights there may be a risk of flooding, developers should:

- Confirm the location and presence of a watercourse (or otherwise) through ground truthing strategic datasets and undertaking an assessment of the culvert extent and condition

- Confirm by survey, modelling and mapping, the flood extents of the watercourse, as many of the flood outlines associated with such watercourses have been carried out at a broadscale level and may not take into specific local features, such as culverts, bridges and detailed topographical survey. Design the development to accommodate the floodplain of the watercourse and mitigate against flooding to properties on site. This includes a consideration of residual flood risk e.g. if a culvert were to block downstream.

All developments should seek to provide wider betterment by demonstrating in site specific Flood Risk Assessments and Surface Water Drainage Strategies (where required) what measures can be put in place to contribute to a reduction in flood risk downstream. This may either be by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors and/or by providing a Partnership Funding contribution towards wider community schemes (both within the Black Country and in shared catchments with Southern Staffordshire and Birmingham). Consultation on the site-specific requirements should be undertaken with the Councils, the Environment Agency and Severn Trent Water (where this is a sewer flooding issue) at the earliest opportunity.

Urban heat island

Create new green space, increase tree cover and/or provide green roofs; No development will be permitted within a groundwater Source Protection Zone 1 which would physically disturb an aquifer, and no permission will be granted without a risk assessment demonstrating there would be no adverse effect on water resources.

Reasoned justification

The Black Country is a densely populated and in places, steeply sloping urban area. This makes it prone to rapid surface water flooding following heavy rainfall and flooding from smaller watercourses that are tributaries of the Rivers Tame and Severn. The industrial legacy leaves complex urban drainage challenges, with many watercourses that heavily modified and culverted in places, providing little if any biodiversity benefit and making them prone to blockage.

Climate change will increase the likelihood of surface water and localised flooding from smaller and culverted watercourses. At the same time, the condition of many culverted watercourses is falling, as they age, they may not be maintained and the likelihood of blockage or failure increases. Sustainable Drainage Systems provide a great opportunity to replicate natural drainage systems through new development, which will help to reduce flood risk, improve water quality and provide wider environmental benefits. Hence an approach is needed to new development that recognises local flood risk constraints and contributes wherever possible to wider environmental and flood risk improvements.

Development Management recommendations contained within the Black Country Level 1 Strategic Flood Risk Assessment (SFRA) assist in providing a robust and sustainable approach to the potential impacts that climate change may have upon the sub region over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time. Attention should be paid to these when considering proposals for development. The requirements for Flood Risk Assessments (FRAs) within each delineated flood zone are set out in the Black Country SFRA, the National Planning Policy Framework and National Planning Policy Guidance.

All new developments in these catchments that meet the following criteria should be accompanied by a Flood Risk Assessment and Surface Water Drainage Strategy that sets out how the development will provide a betterment in flood risk terms i.e. help to reduce flood risk both on and off site. More than one of these criteria may apply:

- Where the site is within Flood Zones 2 or 3
- Where the site is greater than 1 hectare and in Flood Zone 1
- Where the site has 10 or more houses or is greater than 0.5 hectares and residential i.e. a major residential development
- Where the site has at least 0.1 hectares of commercial development i.e. a major commercial development
- Where the site is a minerals or waste development
- Where the site is within 5m of an Ordinary Watercourse*
- Where the site is within 20m of a known flooding hotspot*
- Where the site is within the 1 in 30-year or 1 in 100-year flood extent based on the Risk of Flooding from Surface Water Map*

**This is a requirement for developers in Staffordshire. Developers should consult Staffordshire County Council on behalf of Walsall, Sandwell Metropolitan District and Wolverhampton City Councils and Dudley Metropolitan Borough Council to confirm the latest approach being taken for developments within the Black Country. Based on the evidence in this SFRA they should consider a similar approach to Staffordshire for developer requirements in the Black Country.*

Recommendations for further work

10.3.1 Level 2 SFRA

To further inform the site allocations and development of local planning policies, a Level 2 SFRA should be undertaken to:

- Review flood risk issues further for all sites allocations significantly impacted by floodplain which is indicative or where there is uncertainty around its accuracy,
- Apply the flood risk elements of the Exception Test where this is required in high flood risk areas,
- Review the possibilities for surface water mitigation measures on sites at high risk of surface water flooding,
- Consider the actual and residual flood risk in greater detail on a site-specific basis,
- Explore flood hazard in greater detail should sites be allocated in high flood risk areas and the Exception Test required,
- Explore in greater detail the impact of climate change in relation to the Flood Zones, and
- Undertake more detailed drainage strategy work as part of a Level 2 SFRA when considering the cumulative impact of developments clustered in high flood risk catchments.

Appendices

A Interactive Flood Risk Mapping

The SFRA appendices are published separately to the main SFRA report.

B Site Screening information

The SFRA appendices are published separately to the main SFRA report.

C Summary of flood risk in the Black Country

The SFRA appendices are published separately to the main SFRA report.

D SFRA mapping supporting information

The SFRA appendices are published separately to the main SFRA report.

E Southern Staffordshire & Black Country Cumulative Impact

The SFRA appendices are published separately to the main SFRA report

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