Level 1 Strategic Flood Risk Assessment

Final Report

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Newcastle-under-Lyme Borough Council

JBA Project Manager

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Revision History

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04/10/2019	Final Report	Jemma March, Planning Policy, Newcastle-under-Lyme Borough Council

Contract

This report describes work commissioned by Karl Conyon on behalf of Newcastle-under-Lyme Borough Council via Faithful & Gould in accordance with the PAGABO professional framework services on the 20th July 2018. Hannah Hogan, Freyja Scarborough and Erin Holroyd of JBA Consulting carried out this work.

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Purpose

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- Newcastle-under-Lyme Borough Council;
- Stoke-on-Trent City Council;
- Staffordshire County Council;
- Environment Agency;
- Severn Trent Water;
- United Utilities;
- The Canal and Rivers Trust; and,
- Planners at the neighbouring authorities

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Executive summary

About this report

This report provides a comprehensive and robust evidence base on flood risk issues to support the production of the joint Local Plan for Stoke and Newcastle-under-Lyme to 2033. This is a Level 1 Strategic Flood Risk Assessment (SFRA) and it 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. This report covers the Borough of Newcastle-under-Lyme. A separate report covers Stoke-on-Trent City Council.

Introduction

This Strategic Flood Risk Assessment (SFRA) document replaces the 2008 Level 1 SFRA. The study provides a comprehensive and robust evidence base to support the new Joint Local Plan for Newcastle-Under-Lyme and Stoke-on-Trent. The key objectives are:

- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the borough. This assessment will enable NULBC to apply the Sequential Test in the preparation of the Local Plan, steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective and sustainable manner.
- To form part of the evidence base and inform the council's joint Local Plan.
- To provide guidance for developers and planning officers dealing with applications as well as to enable Staffordshire County Council to fulfil their role as LLFA including advice on the application of SuDS.
- To provide guidance for developers and planning officers on planning requirements.
- To ascertain if land will be required for current and future flood management that should be safeguarded as set out in the NPPF.
- To reflect current national policy documentation including the NPPF and its accompanying Flood Risk and Coastal Change Planning Practice Guidance to enable NULBC to meet its obligations as defined by the NPPF.
- To supplement current policy guidelines and to provide a straightforward risk-based approach to development management in the area.
- To make recommendations on the suitability of potential development sites based on flood risk for NULBC's Local Plan.
- To assess surface water flood risk, using the Environment Agency's (EA) third generation surface water flood map, the Risk of Flooding from Surface Water map (RoFSW).
- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site-specific Flood Risk Assessments (FRAs) where necessary.
- To consider a precautionary approach to climate change.
- To provide a suite of interactive GeoPDF flood risk maps.
- To assess any strategic flooding issue which may have cross boundary implications and investigate any strategic solutions which can be implemented to reduce the risk
- To consider and make recommendations to reduce the impact of the cumulative impact of developments.

Summary of flood risk

- Historic flooding records highlight the risk from the Lyme Brook, culverted watercourses and surface water. The areas most affected have been Kidsgrove and Silverdale/ Newcastle.
- Flooding occurs from a number of different and combined sources and pathways; it can present a range of levels of risk and hazard. Both the causes and consequences of flooding in any given location is very site specific depending on local conditions

such as topography, development or the presence of watercourses. The wide scale scope of this Level 1 investigation, therefore, makes it difficult to emphasise one principal cause of flooding over others at a borough-wide scale. Across the Borough there is flood risk from various sources including fluvial, surface water and sewers.

- The main risk of fluvial flooding is from the Lyme Brook in Newcastle-under-Lyme, Silverdale and Knutton. There is also a risk of flooding from the River Lea in Madeley and Madeley Heath and smaller tributaries across the Borough.
- There is a recognised risk of surface water flooding in the borough, particularly in the urbanised areas of Newcastle and Kidsgrove. Incidents were reported in Kidsgrove in 2007, 2009 and 2012. This included flooding due to surface water run-off and excess discharge through drainage systems and culverts. The Local FRM Strategy estimates 632 properties are at risk in the urban area of Newcastle and Silverdale.
- STW and United Utilities are the water companies responsible for the management of public sewers across different areas of the Borough. The Severn Trent Water Hydraulic Flood Risk Register (HFRR) register has 148 historical reports of sewer flooding in the Newcastle-under-Lyme area.
- United Utilities have recorded 624 incidents of sewer flooding in the Newcastle-under-Lyme area. The majority of these incidents have been in Kidsgrove, where there are known issues with the capacity of the sewer network.
- Areas at risk of flooding from groundwater sources are displayed in Appendix A. These maps also display the Detailed River Network showing known ordinary watercourses.
- There is no record of historic canal overtopping and breach within the study area.
- There is no risk of flooding in the Borough from large raised reservoirs.
- Climate change modelling has been undertaken for all the supplied most up to date Environment Agency models. Due to this, the Climate Change outlines are using the most up to date data and in some areas may not be comparable with the broadscale mapped extents used to inform Flood Zone 3a and Flood Zone 2.
- There are important cross-boundary flood risk impacts to consider in the borough of Newcastle-under-Lyme. Due to catchment topography, a number of watercourses flowing through the borough drain out into other local authorities and feed into other catchments such as the Trent, Severn and Weaver (Figure 9-1). Therefore, any proposed development in the borough must consider cross-boundary impacts from fluvial and surface water flooding.

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.
- Review of historic flooding incidents.
- Appraisal of all potential sources of flooding, including Main River, ordinary watercourse, surface water, overland flows - considering both flood routes/paths and storage, sewers, groundwater (including interactions between the aquifers and perched water tables), reservoirs, canals, infrastructure failure and any other significant bodies of water.
- Mapping showing distribution of flood risk across all flood zones from all sources of flooding including surface water flooding and climate change allowances.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Identification of any strategic flooding issues which may have cross boundary implications.
- 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.

Coastal and Tidal Flooding, including estuarial flooding, is not considered to be a material flood risk consideration for the study area.

The Local Planning Authority (LPA) provided its latest potential sites data and information for assessment. An assessment of flood risk to all 32 sites is provided to assist the LPA in its decision-making process for sites to take forward as part of the Local Plan. This assessment has shown there to be 8 sites at varying risk from fluvial and surface water flooding. Table 1-1 summarises the number of sites at risk from each flood zone as per the Environment Agency's Flood Map for Planning. Table 1-2 summarises those sites at risk of flooding from surface water. Please see section 8 for more information about where the data in the following tables comes from.

Table 1-1: Number of Potential Development Sites at Risk from Flood Map for Planning Flood Zones

Potential Development Site	Flood Zone 1*	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Residential	14	3	3	2
Employment	14	1	1	2
Total	28	**4**	**4**	4
*Sites with 100% area within Flood Zone 1				

Table 1-2: Number of Potential Development Sites at Risk from the Environment Agency risk of flooding from surface water

Potential Development Site	3.3% AEP	1% AEP	0.1% AEP
Residential	9	11	12
Employment	10	11	12
Total	**19**	**22**	**24**

(Sites provided by the Council from preferred residential and employment options which were undertaken in 2019 - see Section 8 for more details).

Strategic recommendations, in Section 8.1 of this report, are made for each site at risk, broadly entailing the following:

- Consider withdrawing the site based on level of flood risk (Strategic recommendation A);
- Exception Test required if site passes Sequential Test (Strategic recommendation B);
- Consider site layout and design if site passes Sequential Test (Strategic recommendation C);
- Site-specific FRA required (Strategic recommendation D); and
- Site permitted on flood risk grounds due to no perceived risk, subject to consultation with the LPA / LLFA (Strategic recommendation E)

In summary:

- Out of the 32 sites provided for assessment by Newcastle-under-Lyme Borough Council, 4 are within or partially within the functional floodplain (Flood Zone 3b) (Table 1-3). As none of these sites have more than 10% land at risk in Flood Zone 3b (functional floodplain), depending on whether the location of highest risk would affect safe access and egress during a flood, it may be possible to develop on the parts of the sites at lower risk, having firstly considered whether there are reasonable alternative sites at a lower risk of flooding. Alternatively, site boundaries can be redrawn to exclude the functional floodplain. When doing so care needs to be taken to ensure there are no areas adjacent to watercourses that are left inaccessible and not maintained.

Table 1-3 Identified sites within or partially within Flood Zone 3b (functional floodplain)

Site Name	Site Number	Proposed Use	Area (ha)	% area within FZ3a	% area within FZ3b
Rowhurst Close, Chesterton	NL36	Employment	15.38	0%	2%
Land between Lower Milehouse Lane and Brymbo Road	NL21	Employment	1.90	8%	54%
London Road, Chesterton	HD12	Residential	2.59	0.16%	0.16%
Land west of Loomer Road, Holditch	HD14	Residential	2.27	13%	6%

- Based on this initial screening there are 4 sites which require further investigation into the significant risk from surface water flooding. For example, if it is possible to provide enough space for both measures to manage the overland flow such as ponds, swales and designated flow routes alongside the form of the development itself. If not, they could be recommended for withdrawal based on significant surface water flood risk. This could be undertaken through a Level 2 Strategic Flood Risk Assessment.

Table 1-4 Sites identified as at risk from surface water flooding

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within 1 in 30 Year Outline (RoFSW)	% Area within 1 in 100 Year Outline (RoFSW)	% Area within 1 in 1000 Year Outline (RoFSW)
NL10	Former Wolstanton Colliery Stock Yard, West Ave, Wolstanton	Employment (use unknown)	1.62	1%	2%	31%
KG12	Land at Newchapel Road, Newchapel	Residential	2.52	22%	33%	39%

- Additionally, there are 4 sites where Climate Change is considered to be significant enough that further investigation is required.

Table 1-5 Sites that require investigation due to risk from climate change

Site	Site number	Within Flood Zone 3b Outline	Within 100-year Climate Change Central	Within 100-year Climate Change Higher Central	Within 100-year Climate Change Upper End
Land between Lower Milehouse Lane and Brymbo Road	NL21	8%	8.98%	9.02%	13.84%
Land west of Loomer Road, Holditch	HD14	5.94%	5.94%	5.94%	5.96%
Rowhurst Close	NL36	2%	3.77%	3.95%	4.48%
London Road, Chesterton	HD12	0.16%	0.24%	0.24%	17.26%

Included along with this report as part of the SFRA are:

- Detailed interactive GeoPDF maps showing all available flood risk information, including areas at risk of groundwater flooding and the Detailed River Network displaying known ordinary watercourses - Appendix A;
- Development Site Assessment spreadsheet detailing the risk to each site with recommendations on development - Appendix B;
- Further information regarding the data sources used in this SFRA – Appendix C;
- A list of relevant flood risk studies – Appendix D;
- Detailed tabulation and mapping of the Environment Agency Flood Warning and Flood Alerts – Appendix E;
- A summary of flood risk across the borough – Appendix F;
- Staffordshire County Councils Sustainable Drainage Systems Handbook - Appendix G

Contents

List of Figures

List of Tables

Abbreviations

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
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) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
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 a method 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.

Floods 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.
FRCC-PPG	Flood Risk and Coastal Change [National] Planning Policy Guidance
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
HFRR	Hydraulic Flood Risk Register
IDB	Internal Drainage Board
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
Jflow	2D generalised hydrodynamic modelling software.
LFRMS	Local Flood 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
NULBC	Newcastle-under-Lyme Borough Council
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 of 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's	Regional Flood and Coastal Committee
RFRSM	Risk of Flooding from Rivers and Sea Map
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
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 - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
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

JBA Consulting were commissioned by Stoke-on-Trent City Council (on behalf of Newcastle-under-Lyme Borough Council (NULBC)) to prepare a Strategic Flood Risk Assessment (SFRA). This study provides a comprehensive and robust evidence base to support the production of the Joint Stoke and Newcastle Local Plan to 2033. It replaces the 2008 Strategic Flood Risk Assessment (SFRA) undertaken by Halcrow.

The 2019 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. This report covers the Borough of Newcastle-under-Lyme. A separate report covers Stoke City Council.

The Local Plan will set out the long-term land allocations and other planning policies that will guide development proposals in the borough and will be used to determine planning applications. This SFRA update will help to provide the evidence base in making decisions on where to direct new development to ensure development is located in sustainable locations, in terms of flood risk. This will enable the council to initiate the sequential risk-based approach to the allocation of land for development and to identify whether the application of the Exception Test is likely to be necessary.

This update has been carried out in accordance with the Government's latest development planning guidance including the National Planning Policy Framework (NPPF) and flood risk and planning guidance called the Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG). The latest guidance is available online.

Other parts of the National Planning Practice Guidance that are relevant to flood risk management include guidance on:

- Water Supply, Wastewater and Water Quality, including measures to ensure the Local Plan contributes to a catchment-based approach to water and supports the Humber River Basin Plan:

  https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality

- Natural Environment and Green Infrastructure, measures to encourage green infrastructure can help improve drainage and manage flooding and water resources):

  https://www.gov.uk/guidance/natural-environment

- Climate change (ID6), including considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development:

  https://www.gov.uk/guidance/climate-change

1.1 Newcastle-under-Lyme Borough Council Level 1 SFRA Update

This updated SFRA makes use of the most up-to-date flood risk datasets to assess the extent of risk, at a strategic level to potential development allocation sites identified by Newcastle-under-Lyme Borough Council (NULBC). Included within the SFRA is this report together with appendices containing SFRA maps showing the most up to date flood risk information on all sources and considering the impact of climate change and a Development Site Screening spreadsheet indicating the level of flood risk to each site following a strategic assessment of risk. This information will allow NULBC to identify the strategic development options that may be applicable to each site and to inform on the need for the application of the Sequential Test.

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 Newcastle-under-Lyme Borough Council 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.

1.1.1 Scope and Objectives:

The objectives of this Level 1 SFRA update are:

- To update the previous 2008 SFRA using new or updated flood risk information including the climate change allowances.
- To understand flood risk from all sources, and to investigate and identify the extent and severity of flood risk throughout the borough. This assessment will enable NULBC to apply the Sequential Test in the preparation of the Local Plan, steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective and sustainable manner.
- To form part of the evidence base and inform the council's joint Local Plan.
- To provide guidance for developers and planning officers dealing with applications as well as to enable Staffordshire County Council to fulfil their role as LLFA including advice on the application of SuDS.
- To provide a reference document (this report) to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To provide guidance for developers and planning officers on planning requirements.
- To ascertain if land will be required for current and future flood management that should be safeguarded as set out in the NPPF.
- To reflect current national policy documentation including the NPPF and its accompanying Flood Risk and Coastal Change Planning Practice Guidance to enable NULBC to meet its obligations as defined by the NPPF.
- To supplement current policy guidelines and to provide a straightforward risk-based approach to development management in the area.
- To make recommendations on the suitability of potential development sites based on flood risk for NULBC's Local Plan.
- To assess surface water flood risk, using the Environment Agency's (EA) third generation surface water flood map, the Risk of Flooding from Surface Water map (RoFSW).
- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site-specific Flood Risk Assessments (FRAs) where necessary.
- To consider a precautionary approach to climate change. A precautionary approach entails creating and actioning protective or preparatory measures above and beyond the level of the evidence base from climate change assessments. This is to ensure and maintain the effective level of protection from these measures in an inherently uncertain and unknown future scenario.
- To provide a suite of interactive GeoPDF flood risk maps.
- To assess any strategic flooding issue which may have cross boundary implications and investigate any strategic solutions which can be implemented to reduce the risk
- To consider and make recommendations to reduce the impact of the cumulative effect of proposed developments by assessing their impacts in catchments identified as being at high risk of surface water and fluvial flooding.
- To recommend opportunities offered by new development to reduce the causes and impacts of flooding including to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and of storage for flood water.

This report begins by outlining the connections between the planning framework and flood risk policy thus discussing legislation, planning policy, flood risk management policy and the roles and responsibilities of key stakeholders. All available sources of flood risk are then examined within the local authority area before an assessment of flood risk to the potential development sites. Conclusions and recommendations are cited at the end of the report.

1.2 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.
- Review of historic flooding incidents.
- 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.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.
- Consideration of the cumulative impact of new development on flood risk
- Flood Risk Assessment guidance for developers.
- Guidance on the use of Sustainable Drainage Systems.

1.3 Consultation

The following parties (external to Newcastle-under-Lyme Borough Council) were consulted to inform the SFRA:

- Environment Agency
- Staffordshire County Council
- Canal & River Trust
- Severn Trent Water & United Utilities
- Staffordshire Moorlands District Council
- Stoke-on-Trent City Council
- Stafford Borough Council

1.4 Use of SFRA data

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

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

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.

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.

1.5 SFRA Study Area

Newcastle-under-Lyme Borough Council's administrative area covers an area of approximately 211km^2 and has a population of approximately 123,900 (2011 census).

Newcastle-under-Lyme is bound by Stoke-on-Trent City Council, Staffordshire Moorlands District Council, Shropshire Council and Stafford Borough Council. Newcastle-under-Lyme has a mixture of rural and urban areas with the primary urban areas being Newcastle-under-Lyme and Kidsgrove coupled with the larger villages of Audley, Baldwins Gate, Madeley and Loggerheads. The M6 also passes through the borough.

The main river in Newcastle-under-Lyme is the Lyme Brook, a tributary of the River Trent, with many other smaller watercourses flowing through the area. The Lyme Brook is a key tributary to the River Trent in Stoke-on-Trent.

The Borough sits on a ridge of relatively high land and feeds water into the catchments of the Trent (to the south east), Weaver (to the north) and Severn (to the south west).

The borough is the source for both the River Lea and the River Tern and many smaller tributaries that meet with larger rivers downstream. There are several notable minor rivers, including Checkley Brook, Coal Brook, Mere Gutter (associated with Betley Mere), Dean Brook, Valley Brook and Meece Brook. There are also a number of ponds and lakes within the study area. There is a map of the key watercourses in Figure 1-1 and also as part of Appendix A, where the Detailed River Network and known ordinary watercourses are also displayed.

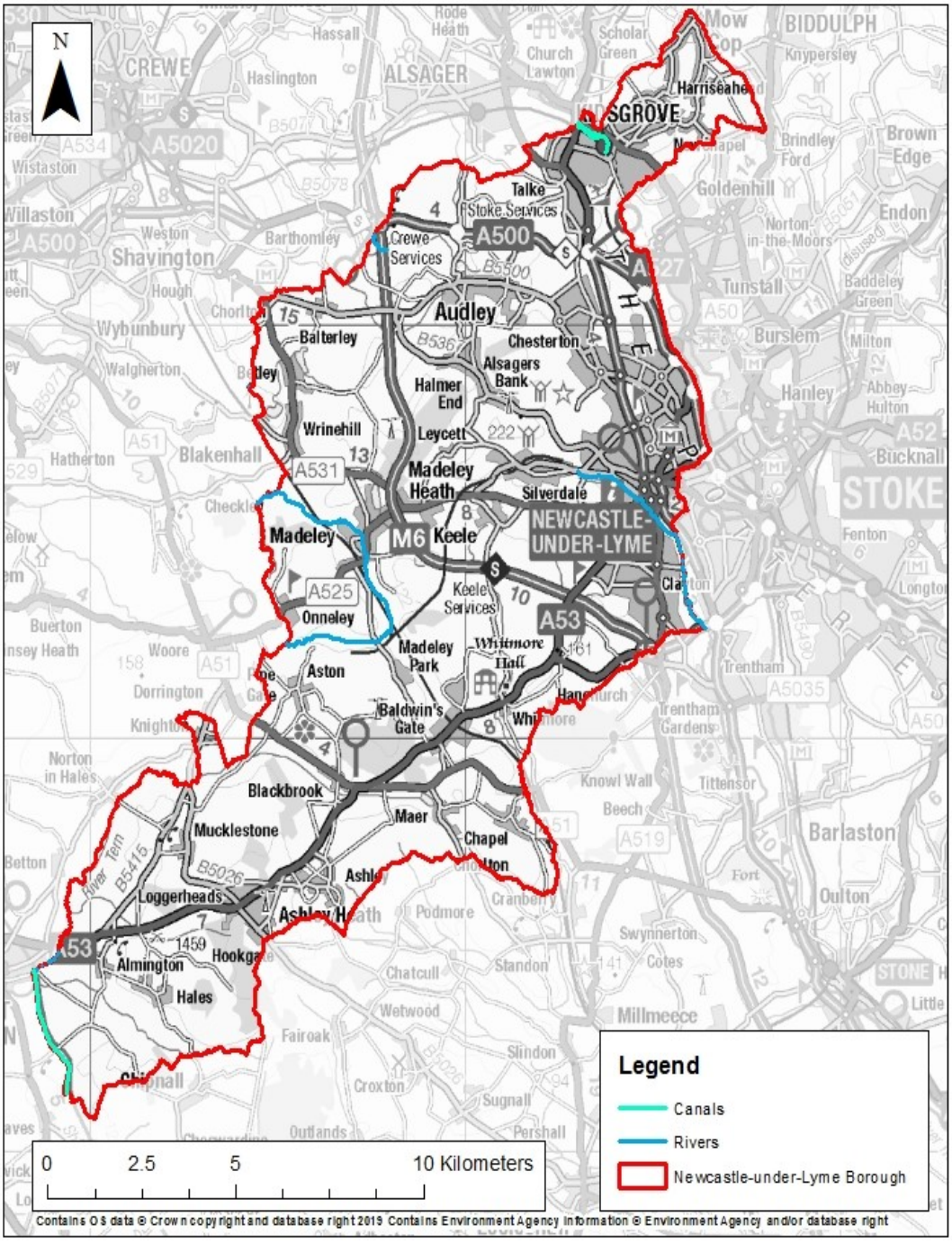


Figure 1-1: Newcastle-under-Lyme Borough Council SFRA study area

2 The Planning Framework and Flood Risk Policy

2.1 Introduction

The main purpose of this section of the SFRA is to provide an overview of the key planning and flood risk policy documents that have shaped the current planning framework.

Figure 2-1 illustrates the links between legislation, national policy, statutory documents and assessment of flood risk. The figure shows that whilst the key pieces of legislation and policy are separate, they are closely related, and their implementation should aim to provide a comprehensive and planned approach to asset record keeping and improving flood risk management within communities.

It is intended that the non-statutory SWMPs and SFRAs can provide much of the base data required to support local authorities to develop capacity, effective working arrangements and inform Local Flood Risk Management Strategies (LFRMS) and Local Plans, which in turn help deliver flood risk management infrastructure and sustainable new development at a local level. This SFRA should be used to support the Local Plan and to help inform planning decisions.

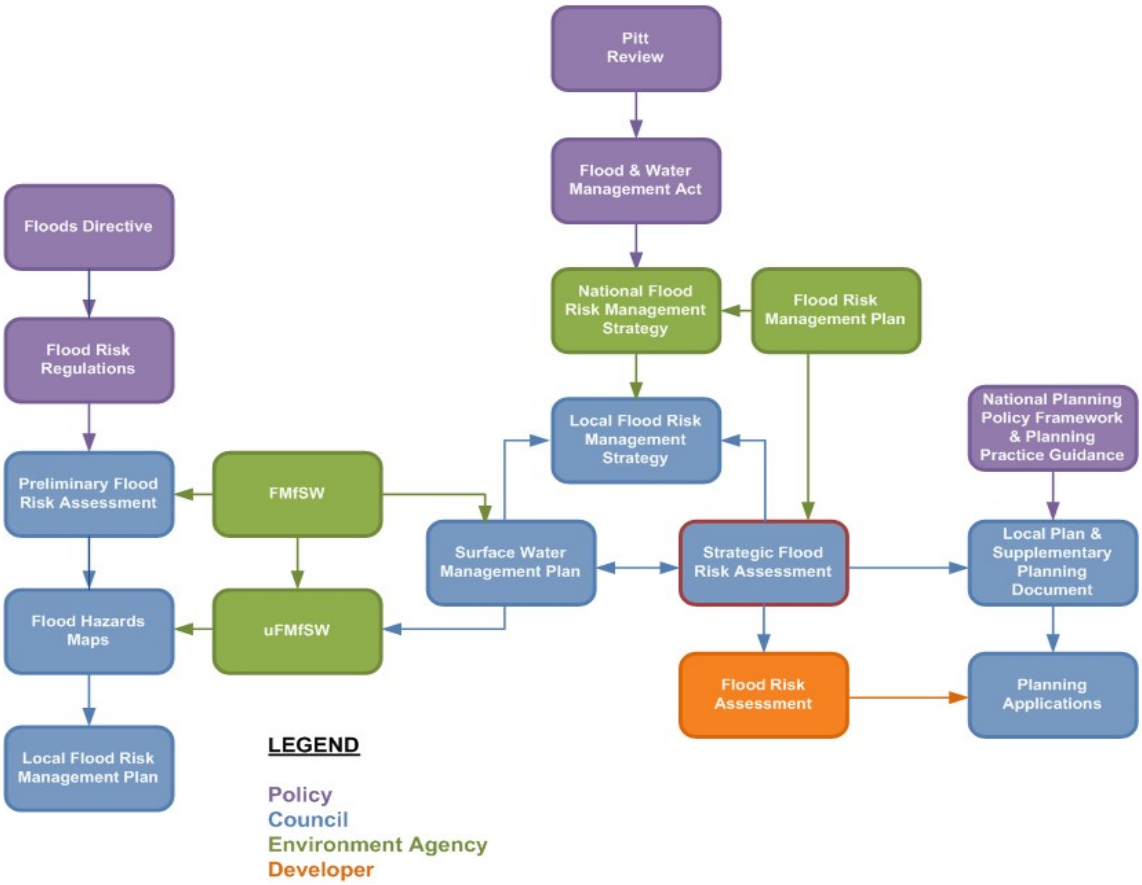


Figure 2-1: Key documents and strategic planning links with flood risk

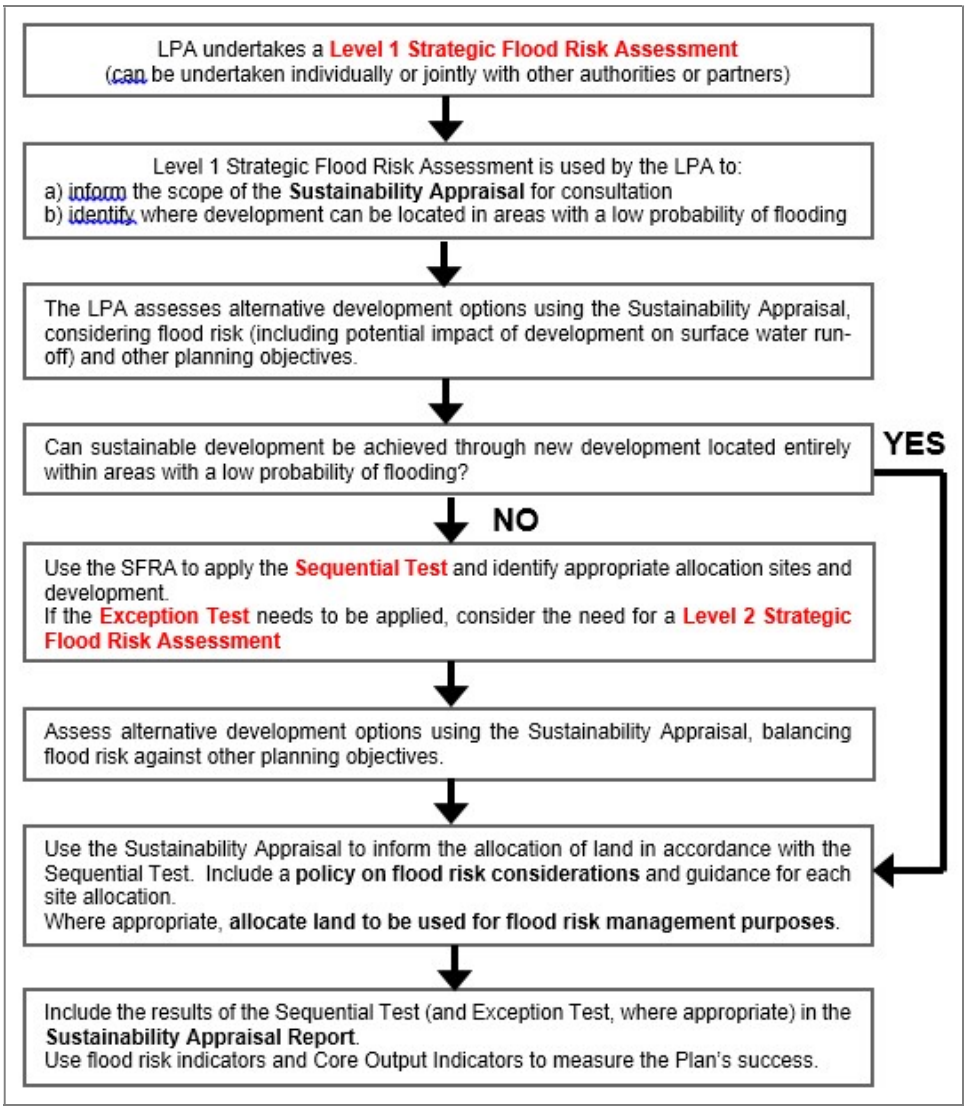
2.2 National Planning Policy Framework and Guidance

The revised National Planning Policy Framework (NPPF) was published in July 2018, replacing the 2012 version. Further edits were made in February 2019. 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, as seen in Figure 2-2.



† Based on Diagram 1 of NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 004, Reference ID: 7-005-20140306) March 2014

Figure 2-2: Flood risk and the preparation of Local Plans†

2.2.1 Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)

On 6 March 2014, the Department for Communities and Local Government (DCLG) launched their planning practice guidance, including guidance for flood risk and coastal change, which replaces the previous Technical Guidance. This new guidance is available as a web-based resource, which is accessible to all and is regularly updated. Whilst the NPPF concentrates on high level national policy, the FRCC-PPG is more detailed. The practice guidance advises on how planning can take account of the risks associated with flooding and coastal change in plan making and the development management process. This is in respect of Local Plans, SFRAs, the sequential and exception tests, permitted development, site-specific flood risk, Neighbourhood Planning, flood resilience and resistance techniques and the vulnerability of development to make development safe from flooding.

The national PPG also includes guidance for water supply, wastewater and water quality. The Local Plan will need to grapple with the contribution that can be made to a 'catchment-based approach' to water.

The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) sits alongside the NPPF and sets out detailed guidance on how this policy should be implemented.

2.3 The risk-based approach

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

2.3.1 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.

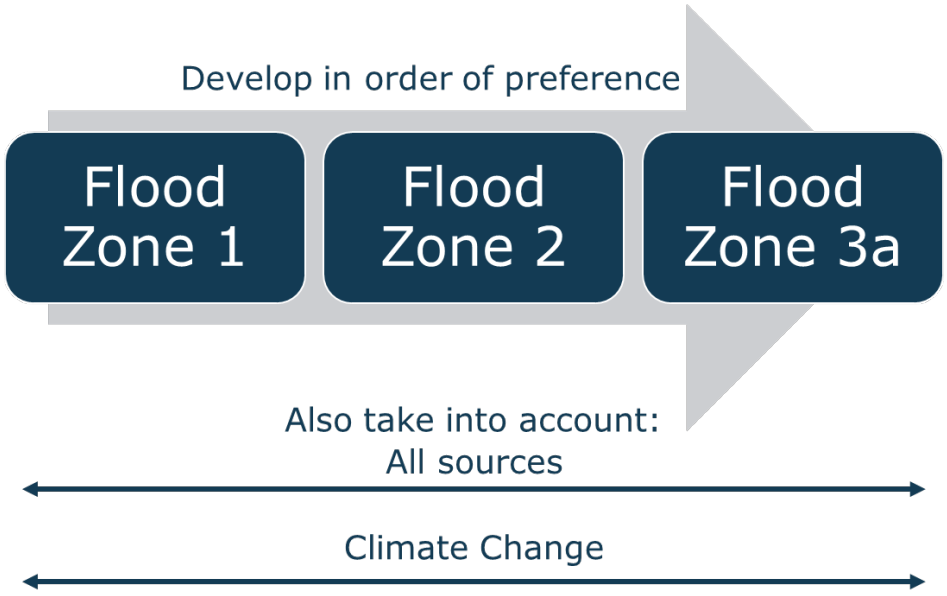
2.3.2 The Sequential Test

The Flood Zones in the Appendix A Geo-PDFs are the same as those shown on the Environment Agency's 'Flood Map for Planning'.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses. 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 watercourse 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.



The Sequential Test must be performed when considering the placement of future development and for planning application proposals. The Sequential Test is used to direct all new development to locations at the lowest probability of flooding. It states that development should not be permitted or allocated if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

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 sides 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, what vulnerability of development is suitable for that Flood Zone and where further work is needed in respect of the Exception Test.

2.3.3 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:

- 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 2-4 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.

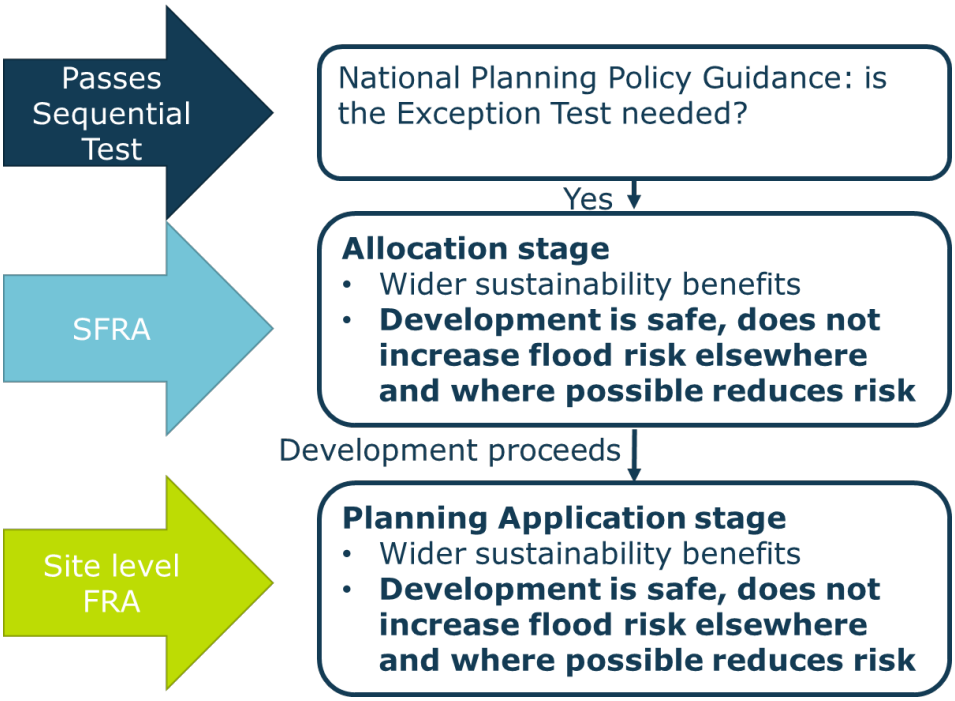


Figure 2-4 The Exception Test

There are two parts to demonstrating a development passes the Exception Test:

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

Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

- 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.

A Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations. At Planning Application stage, a site-specific Flood Risk assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

2.4 Local Plans

A Local Plan is a statutory document prepared in consultation with the local community. It is designed to promote and deliver sustainable development. Local Plans have to set out a clear vision, be kept up to date and to set out a framework for future development of the local area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure as well as safeguarding the environment and adapting to climate change and securing good design.

Local plans set the context for guiding decisions and development proposals and along with the NPPF, set out a strategic framework for the long-term use of land and buildings, thus providing a framework for local decision making and the reconciliation of competing development and conservation interests. The aim of a Local Plan is to ensure that land use changes proceed coherently, efficiently, and with maximum community benefit. Local plans should indicate clearly how local residents, landowners, and other interested parties might be affected by land use change. They are subject to regular periods of intensive public consultation, public involvement, negotiation and approval. The Local Plan should be the starting point when considering planning applications.

2.4.1 The Newcastle and Stoke-on-Trent Local Plan

The joint Newcastle and Stoke-on-Trent Local Plan, which is currently in the production phase, is scheduled for adoption by Summer 2019 and will look ahead to the year 2033. The previous Local Plan was published October 2003. The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

The Draft Local Plan will set strategic objectives relating to business, people, place and infrastructure, which will provide a basis for the policies of the Local Plan. The Council will meet the challenge of climate change and flooding from all sources by directing new development towards areas of low flood risk (Flood Zone 1), working with partners and developers to ensure the flood risk is reduced. Policy recommendations aim to reduce and mitigate flood risk and new development will be directed towards areas of low flood risk (Flood Zone 1). In considering proposals elsewhere, the sequential and exception tests will be applied.

3 Flood risk policy and strategy

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and strategic documents and flood risk responsibilities.

3.1 Relevant legislation

The following legislation is relevant to development and flood risk in Newcastle:

- **Flood Risk Regulations (2009)** – these transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments 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 done in a six-year cycle and Newcastle sits within the wider Flood Risk Management Plans that were led by the Environment Agency for the wider catchments.
- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (2005), 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.
- The **Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2016)** also set out where developers will need to reply for additional permission (as well as Planning Permission) to undertake works to an Ordinary Watercourse or Main River.
- The **Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good status'.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

3.2 Roles and responsibilities for Flood Risk Management in Newcastle-under-Lyme

There are different organisations that cover Newcastle that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown on Table 3-1 with an overview of their responsibilities.

Table 3-1: Risk Management Authorities

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 Idle, River Trent, River Poulter, River Ryton) • Reservoirs	• Statutory consultee for development in Flood Zones 2 and 3
Staffordshire County Council (SCC) as Lead Local Flood Authority (LLFA)	• 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
Newcastle Under Lyme as Local Planning Authority	• Local Plans as Local Planning Authorities	• Determination of Planning Applications as Local Planning Authorities • Managing open spaces under District Council ownership	• As left
Water Companies: • Severn Trent Water • United Utilities	• Asset Management Plans, supported by Periodic Reviews (business cases) • Develop Drainage and Wastewater management plans	• Public sewers	• Non-statutory consultee
Highways Authorities • Highways Agency (motorways and trunk roads) • SCC (other adopted roads)	• Highway drainage policy and planning	• Highway drainage	• Internal planning consultee regarding highways design standards and adoptions

3.3 Roles and Responsibilities

The responsibilities for the Risk Management Authorities (RMA) are summarised further below.

3.3.1 EA as RMA

- Has a strategic overview role for all forms of flooding;
- Has the power to request information from any partner in connection with its risk management functions;
- Must exercise its flood or coastal erosion risk management functions in a manner consistent with the National Strategy and Local Strategies;
- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA;
- Must help advise on sustainable development.

3.3.2 Newcastle-under-Lyme Borough Council Local Planning Authority as a RMA

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies;
- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA;
- Has a duty to be subject to scrutiny from the LLFA;
- Has a duty to cooperate and share information with other RMAs;

3.3.3 Staffordshire County Council Lead Local Flood Authority as a RMA

- Must develop, maintain, apply and monitor a strategy for local flood risk management. This must be consulted on with all RMAs, the public and all other partners with an interest in local flood risk, and must comply with the National Strategy;
- Is required to coordinate and share information on local flood risk management between relevant authorities and partners;
- Is empowered to request information from others when it is needed in relation to its flood risk management functions;
- Must investigate significant flooding incidents in its area where it considers it necessary or appropriate;
- Has a duty to establish and maintain a record of structures within its area that it considers to have a significant impact on local flood risk;
- Is empowered to designate structures and features that affect flooding;
- Has powers to undertake works to manage flood risk from surface runoff, groundwater and ordinary watercourses;
- Must exercise its flood and coastal erosion risk management functions in a manner consistent with the National Strategy and the Local Strategy;
- Is permitted to agree the transfer of responsibilities for risk management functions (except the production of a Local Strategy) to other RMAs;
- Must aim to contribute to sustainable development;
- Should consider flooding issues that require collaboration with neighbouring LLFAs and other RMAs.
- The LLFA is a statutory consultee of the planning process and provides advice on major planning applications.

Table 3-2 provides an overview of the key LLFA responsibilities under the FWMA.

Table 3-2: Key LLFA Duties under the FWMA

FWMA Responsibility	Description of duties and powers	SCC LLFA Status
Local Strategy for Flood Risk Management	A LLFA has a duty to develop, maintain, apply and monitor a local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk based approaches across different LA areas and catchments. The local strategy will not be secondary to the national strategy; rather it will have distinct objectives to manage local flood risks important to local communities.	Adopted
Duty to contribute to sustainable development	The LLFA has a duty to contribute towards the achievement of sustainable development.	Ongoing
Duty to comply with national strategy	The LLFA has a duty to comply with national flood and coastal risk management strategy principles and objectives in respects of its flood risk management functions.	Ongoing
Investigating Flood Incidents	The LLFA, on becoming aware of a flood in its area, has (to the extent it considers necessary and appropriate) to investigate and record details of "locally significant" flood events within their area. This duty includes identifying the relevant risk management authorities and their functions and how they intend to exercise those functions in response to a flood. The responding risk management authority must publish the results of its investigation and notify any other relevant risk management authorities.	Ongoing
Asset Register	A LLFA has a duty to maintain a register of structures or features, which it considers to have a significant effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.	Available
Duty to co-operate and Powers to Request Information	The LLFA must co-operate with other relevant authorities in the exercise of their flood and coastal erosion management functions.	Ongoing
Ordinary Watercourse Consents	A LLFA has a duty to deal with enquiries and determine watercourse consents where the altering, removing or replacing of certain flood risk management structures or features that affect flow on ordinary watercourses is required. It also has provisions or powers relating to the enforcement of unconsented works.	Ongoing
Works Powers	The Act provides a LLFA with powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area. The County Council can undertake works on Ordinary Watercourses by the request of the Borough Council.	Ongoing
Designation Powers	The Act provides a LLFA with powers to designate structures and features that affect flooding or coastal erosion. The powers are intended to overcome the risk of a person damaging or removing a structure or feature that is on private land and which is relied on for flood or coastal erosion risk management. Once a feature is designated, the owner must seek consent to alter, remove, or replace it.	Ongoing
Emergency Planning	A LLFA supports the Local Resilience Forum with emergency planning and recovery after a flood event.	Stoke and Staffordshire Local Resilience

		Forum
Community Involvement	A LLFA can engage local communities in local flood risk management issues. This might include the training of community volunteers, the development of local flood action groups and the preparation of community flood plans and general awareness raising around roles and responsibilities.	Staffordshire and Shropshire Flood Resilience Project, supported the community in Kidsgrove to implement Property Level Resilience
Planning Requirements for SuDS	Sustainable Drainage Systems (SuDS) are a planning requirement for major planning applications of 10 or more residential units or equivalent commercial development schemes with sustainable drainage. The LLFA is now a statutory planning consultee and it will be between the LPA and the LLFA to determine the acceptability of these proposed sustainable drainage schemes subject to exemptions and thresholds. Approval must be given before the developer can commence construction. Planning authorities should use planning conditions or obligations to make sure that arrangements are in place for ongoing maintenance of any SuDS over the lifetime of the development.	SUDS Handbook has been adopted and published

3.3.4 Severn Trent Water / United Utilities as a RMA

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies;
- Must be consulted on Local Strategies, if affected by the strategy, by the relevant LLFA;
- Has a duty to be subject to scrutiny from LLFAs;
- Has a duty to cooperate and share information with other RMAs;
- Is responsible for managing the risks of flooding from water and foul or combined sewer systems providing drainage from buildings and yards.

3.3.5 Highways Authority (Staffordshire County Council) and Highways England as RMAs

- Have a duty to act consistently with the National Strategy and Local Strategies;
- Have responsibility for ensuring effective drainage of local roads in so far as ensuring drains and gullies are maintained;
- Must be consulted on Local Strategies, if affected by the Strategy, by the LLFA;
- Have a duty to be subject to scrutiny from LLFAs.

3.3.6 The Local Community

- Must be consulted on Local Strategies by the LLFA;
- Has a key role in ensuring local strategies are capable of being successfully delivered within the community. They should actively participate in this process and be engaged by the LLFA.

3.3.7 Riparian Owners

A riparian owner is someone who owns land or property alongside a river or other watercourses. A watercourse is any natural or artificial channel through which water flows including flow through a culvert, ditch, drain, cut, dyke, sluice or private sewer.

Riparian owners have statutory responsibilities, including:

- Maintaining watercourses;
- Allowing the flow of water to pass without obstruction;
- Controlling invasive alien species

Further guidance for riverside property owners can be found on the government website.

3.4 Key legislation

3.4.1 Flood Risk Regulations (2009)

The Flood Risk Regulations (2009) translate the EU Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk (known as a Preliminary Flood Risk Assessment (PFRA)) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans.

The Flood Risk Regulations direct the Environment Agency to do this work for river, sea and reservoir flooding. LLFAs must do this work for surface water, Ordinary Watercourse and Groundwater flooding. This is a six-year cycle of work and the second cycle started in 2017.

The Staffordshire PFRA (2011) provides information on significant past and future flood risk from localised flooding in Staffordshire. This was updated in 2017, and no nationally significant Flood Risk Areas for localised flooding have been identified in Staffordshire.

In 2018, the Environment Agency undertook a PFRA for river, sea and reservoir flooding which identified nationally significant Flood Risk Areas for these sources.

3.4.2 Flood and Water Management Act (FWMA), 2010

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way we manage our water resources.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

3.4.3 Planning Act, 2008

This act predominantly applies to streamlining the approval of major national infrastructure development. However, this act also allowed for the streamlining of planning appeals for minor developments by allowing appeals to be heard and considered by a panel of local councillors rather than by a planning inspector. The Community Infrastructure Levy (CIL) was also formed from the Planning Act whereby a local authority could place a levy on a new development to help finance local infrastructure projects designed to benefit the local area, such as a new school, health centre or park improvements.

3.4.4 Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP). The N-U-LBC area is covered by the River Trent and North West River Basin Management Plans, managed by the EA and published in 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 Trent RBMP, 2015, includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality.

The EA is responsible for monitoring and reporting on the objectives of the WFD on behalf of Government. They work with Government, Ofwat, local government, non-governmental organisations (NGOs) and a wide range of other stakeholders including local businesses, water companies, industry and farmers to manage water.

The second management cycle of the WFD has already begun and the second river basin management plans were completed in 2015, building upon the first set of RBMPs completed in 2009.

The main responsibility for NULBC is to work with the EA to develop links between river basin management planning and the development of Local Authority plans, policies and assessments. In particular, the programme of actions (measures) within the RBMP highlights the need for:

- Water Cycle Studies to promote water efficiency in new development through regional strategies and local development frameworks,
- Surface Water Management Plan implementation,
- Considering the WFD objectives (achieving good status or potential as appropriate) in the spatial planning process, including LDDs and Sustainable Community Strategies, and
- Promoting the wide scale use of Sustainable Drainage Systems (SuDS) in new development.

The Stoke and Newcastle Water Cycle Study 2012 includes the Newcastle-U-L area (see Section 3.5.6) and the Joint WCS for Stoke-on-Trent and Newcastle-Under-Lyme, published 2019, will assist the council to select and develop sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure and flood risk.

3.5 Key national, regional and local policy document and strategies

3.5.1 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 is due to be published in 2019.

3.5.2 River Basin Management Plans

The Humber, Severn and North West River Basin District 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.

3.5.3 Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) are 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, Severn and North 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. The FRMPs draw on policies and actions identified in Catchment Flood Management Plans and Local Flood Risk Management Strategies. The Plans will be updated as part of the new cycle of the Flood Risk Regulations and are due to be published in December 2021.

3.5.4 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 River Severn Catchment Flood Management Plan, River Trent Catchment Flood Management Plan and Weaver Gower Catchment Flood Management Plan cover the study area. The actions of this were brought forward into the 2015 Flood Risk Management Plans.

3.5.5 Staffordshire Local Flood Risk Management Strategy

The Staffordshire Local Flood Risk Management Strategy was published in 2015. The Strategy sets out how Staffordshire County Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk in the County.

- The Local FRM Strategy sets out policies on:
- When the LLFA will investigate flooding incidents
- How the LLFA will collate data on flood risk assets
- Where the LLFA will designate third party assets affecting flood risk
- How the LLFA will respond to planning applications
- How the LLFA will work with others to develop flood risk schemes
- How the LLFA will preserve watercourses in their natural state
- When the LLFA will take land drainage enforcement action
- How the LLFA will seek to improve the environment

The Strategy notes that the council will seek to deliver sustainable drainage systems (SuDS) as part of new development in its roles as statutory consultee for major planning applications and non-statutory consultee for nonmajor planning applications.

The Strategy has seven objectives, which are to:

1. Develop a strategic understanding of flood risk from all sources
2. Promote effective management of drainage and flood defence systems
3. Support communities to understand flood risk and become more resilient to flooding
4. Manage local flood risk and new development in a sustainable manner
5. Achieve results through partnership and collaboration
6. Be better prepared for flood events
7. Secure and manage funding for flood risk management in a challenging financial climate

The Strategy has the specific objective to “Manage local flood risk and new development in a sustainable manner” and the keys actions are to:

- Seek the inclusion of Sustainable Drainage Systems wherever possible within new developments and prepare a Local Sustainable Drainage System (SuDS) Handbook (now published)

- Regarding Sustainable Drainage Systems, respond to planning applications within 21 days as Statutory / Non-Statutory Consultee
- Regarding river flood risk, respond to planning applications within 21 days as Statutory Consultee (Environment Agency to lead)
- Assist with the development of planning policies, site allocations, neighbourhood plans and identification of future infrastructure needs
- Work with developers and Local Planning Authorities to secure appropriate connections to sewers / IDB assets (water companies and IDBs to lead)

The Strategy also recognises the role of flood alleviation schemes that contribute to "strategic growth initiatives" such as the work of the Stoke and Staffordshire Local Enterprise Partnership.

3.5.6 Water Cycle Studies

Water Cycle Studies (WCS) – scoping, outline and 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.

A revised and joint WCS for Stoke-on-Trent and Newcastle-Under-Lyme will be published in 2019 and will assist the council to select and develop sustainable development allocations where there is minimal impact on the environment, water quality, water resources, infrastructure, and flood risk.

3.5.7 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 County Council, 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.

There is a SWMP for Kidsgrove, led by SCC working in partnership with Cheshire East Council and United Utilities in 2013. The modelling outputs from the SWMP have been embedded into the national Environment Agency Risk of Flooding from Surface Water map. A scheme to provide Property Level Protection for parts of central and northern Kidsgrove has followed on from the SWMP.

3.6 Partnership working in Newcastle-under-Lyme

Figure 3-1 shows the how partnership working between Risk Management Authorities is structured in Staffordshire.

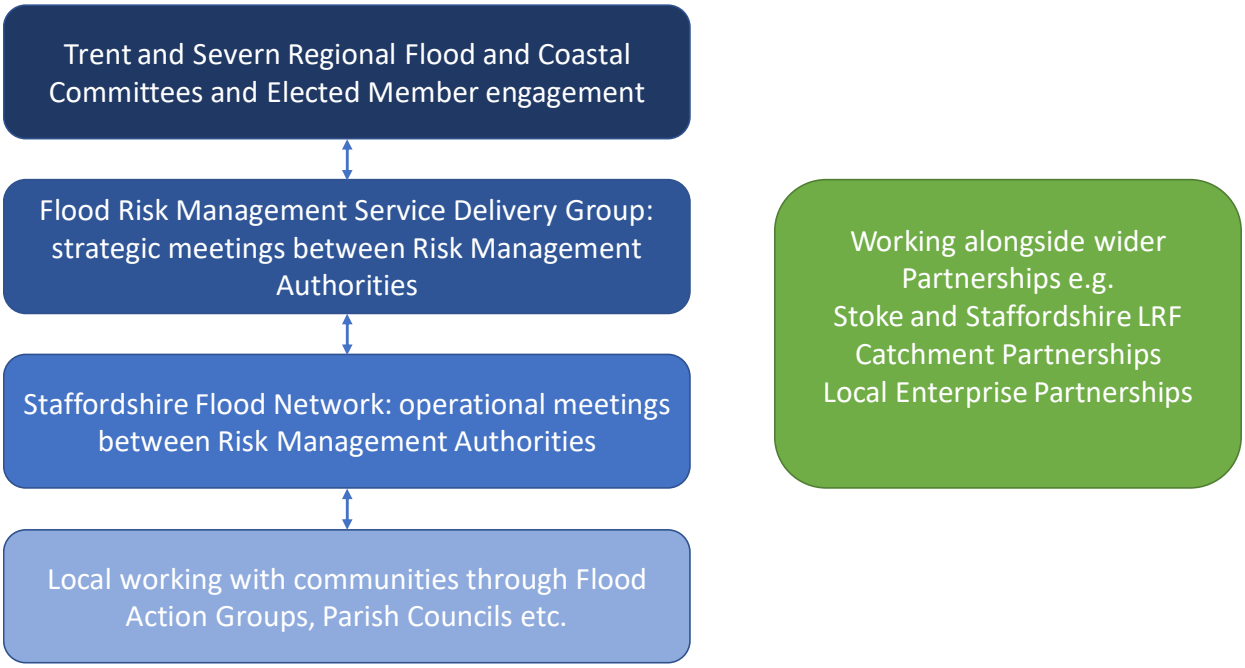


Figure 3-1 Partnership working in Newcastle-under-Lyme

Key water environment partnership projects have been set out below.

3.6.1 River Trent Headwaters Project

As part of the Staffordshire Trent Valley Catchment Partnership, the Headwaters project aims to identify locations and opportunities where the rivers and brooks, which encompass the Trent Headwaters, can be improved to create better environments for people and wildlife across Stoke-on-Trent and Newcastle-under-Lyme. The headwaters of the Trent flow through rough grazing land before entering Stoke-on-Trent and Newcastle-under-Lyme. The urban environment has a major impact on the morphology, ecology and water quality of the River Trent with diffuse pollution from roads along with misconnections and intermittent discharges from sewage systems being a significant reason for failure within this catchment along with physical modifications to the water courses. been identified as key to achieving objectives for 2027 within the Humber River Basement Management Plan, and the techniques deployed will deliver valuable morphological and ecological improvements to the benefit of all river biota. Projects and enhancements have taken place on the Scotia Brook, Ford Green Brook, Causley Brook, Fowlea Brook, the Lyme Brook and Cockster / Longton Brooks, which all feed into the headwaters of the River Trent upstream of Trentham Estate.

3.6.2 SUNRISE

The Trent SUNRISE project has identified a programme of works to link, buffer, restore and recreate habitats across Stoke-on-Trent and the urban area of Newcastle, with a special focus on improving riverside areas and grassland restoration. range of intervention to improve watercourses. Including SuDS retrofit options, barrier removal, restoration, re-routeing channels and pond creation. Works at numerous locations such as Ford Green Brook, Milton, Fowlea Brook, Cromer RD, Bucknall Park, Causeley Brook, Trent Mill, Victoria Ground, and a SuDS Retrofit Project over the City Area. Measures include the installation of woody debris and berms to encourage Rivers and brooks to meander, enhancements to riparian environment and to protect existing geomorphological features, the grassland restoration of several areas along the brook and control of invasive species such as Himalayan Balsam.

4 Understanding flood risk in Newcastle-under-Lyme authority area

This is a strategic summary of the risk. Developers should use this Section 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.

Table 4-2 contains a list of the sources of data used in the SFRA and Appendix C contains further details regarding data sources and key datasets.

4.1 Sources of Flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary inundation 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 many different ways. Major sources of flooding include (also see Figure 4-1):

- **Fluvia**l (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.

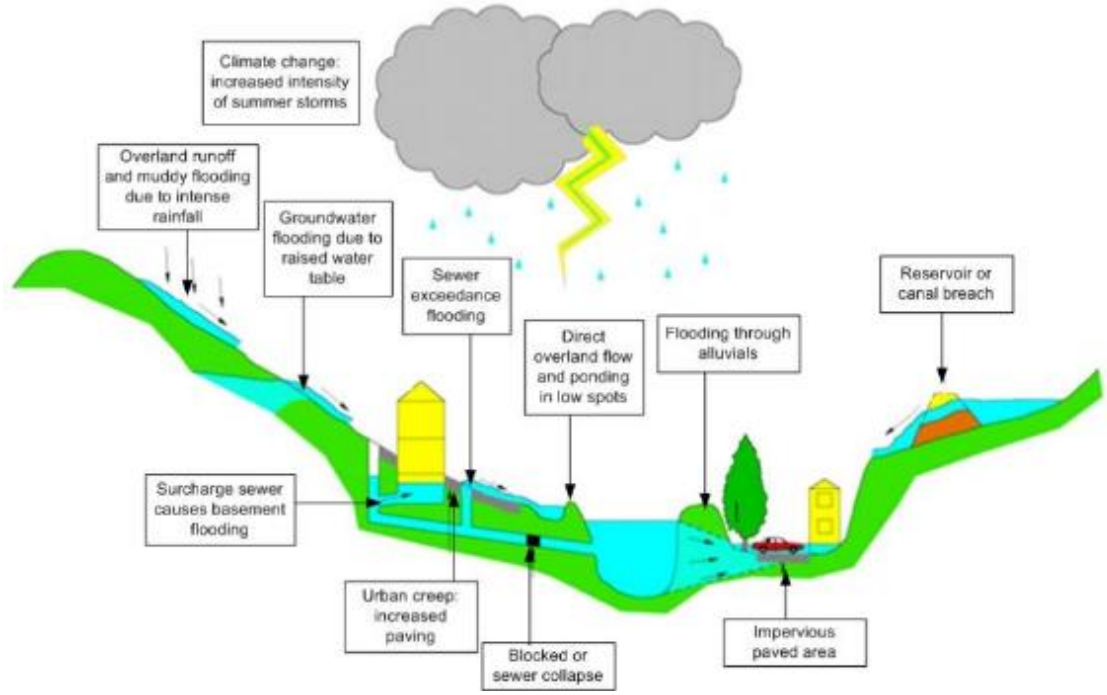


Figure 4-1: Flooding from all sources

4.2 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 4-2 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.

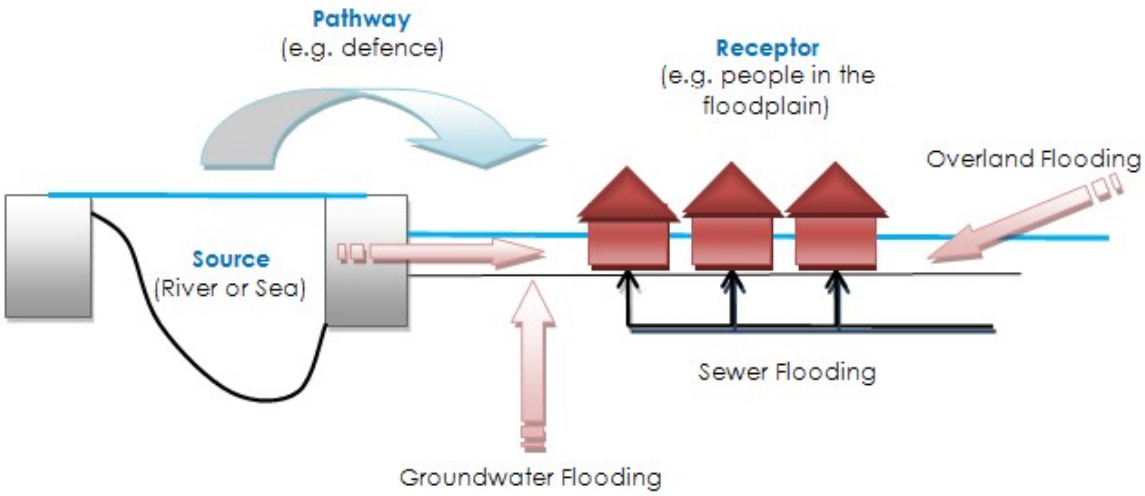


Figure 4-2: Source-Pathway-Receptor Model

The principal sources are rainfall, 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 remove receptors.

4.2.1 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 occur once every hundred years. Table 4-1 provides an example of the flood probabilities used to describe Flood Zones as defined in the FRCC-PPG and as used by the EA in their Flood Map for Planning (Rivers and Sea).

Table 4-1: NPPF Flood Zones

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

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

4.2.2 Consequence

The consequences of flooding include fatalities, property damage, 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

4.3 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 from a high spring tide that coincides with a storm surge. 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.

4.3.1 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.

4.3.2 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.

4.3.3 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.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.
- Culverted watercourses and drain in the Newcastle-under-Lyme area pose a hidden flood risk. In many areas, especially in older Victorian areas, there is noted interaction between the public sewer networks and culverted watercourses and many historic culverts are still unknown or untraced.

Parts of Newcastle 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 e.g. sleeping accommodation 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 an emergency service.

4.4 Flood Risk Datasets

This section of the SFRA provides a strategic overview of flood risk from all sources within the borough. The information contained is the best available at the time of publication and is intended to provide Newcastle-under-Lyme Borough Council with an overview of risk. Where further detail is available, then the source of information is provided. Table 4-2 provides a summary of the key datasets used in this SFRA according to the source of flooding, further details regarding the sources of the SFRA data can be found in Appendix C.

Table 4-2: Flood source and key datasets

Flood Source	Datasets / Studies
Fluvial	Environment Agency (EA) Flood Map for Planning (Rivers and Sea)
	EA Risk of Flooding from Rivers and the Sea Map
	EA Flood Risk Mapping Studies (See Appendix D)
	Historic evidence – EA Historic Flood Map
	Trent, Severn and Weaver Gower Catchment Flood Management Plans
Pluvial (surface water runoff)	EA Risk of Flooding from Surface Water (RoFfSW)
	Newcastle-under-Lyme Borough Council Preliminary Flood Risk Assessment
Sewer	Historic Flood Risk Register
	Drainage Area Zones
Groundwater	EA Areas Susceptible to Groundwater Flooding (AStGWF) ** Please note this data is available but was not provided at this stage of the study**
Canal	Canal & River Trust Open Data
Reservoir	EA Reservoir Flood Maps (available online)
All sources	Staffordshire Local Flood Risk Management Strategy
	Staffordshire Fire Brigade historic flood incident data
	Trent River Basin Management Plan
	Trent Flood Risk Management Plan
	Kidsgrove Surface Water Management Plan
	Newcastle-under-Lyme Borough Council Level 1 SFRA (2008)
Flood risk management infrastructure	EA flood defence data

4.4.1 Data Gaps

A review of the supplied data has indicated potential further assessment areas or data gaps, which could be facilitated through flood modelling. Recommendations have been made for more detailed modelling work or future investigations, which would provide a greater level of flood risk information and more confidence in results. This has been undertaken by reviewing the Environment Agency's Flood Zone mapping in those areas not covered by existing detailed hydraulic models:

- The Environment Agency's Flood Zone maps do not cover every watercourse (for example if <3km2 catchment area), or Ordinary Watercourses. Hydraulic modelling may be required for more detailed Flood Risk Assessment studies, or as part of a Level 2 SFRA, to provide the required detail to support a site's development. If a watercourse or drain is shown on OS mapping but is not covered by a Flood Zone, this does not mean there is no potential flood risk. A model would likely be required at detailed site-specific level to confirm the flood risk to the site.
- Locations where surface water flooding is the predominant flood risk could be investigated further by use of surface water hydraulic modelling, or in combination with fluvial modelling, to assess the interactions between the two in more detail. Similarly, for any locations which suffer from sewer flooding or sewer capacity issues; this data can be incorporated into hydraulic models to more accurately represent the surface water system.
- It is known that there are inconsistencies and/ or uncertainties in the Flood Zones:
- Flood Zone 3b has been represented as the 1 in 20-year flood extent where detailed hydraulic modelling outputs were available. Outside of detailed model coverage, Flood Zone 3b has been represented by Flood Zone 3a (this is called the "indicative Flood Zone 3b", and provides a conservative indication. Flood Zone 3b in these locations would need to be confirmed as part of a more detailed site-specific assessment by developers.

- Whilst it is acknowledged that the Flood Zones in these areas are inconsistent, these should not be dismissed. The existing Flood Zone dataset should be used in conjunction with anecdotal evidence to establish the fluvial flood risk. Guidance and requirements for developers concerning FRAs are discussed in Section 10.1.3.
- An objective of the SFRA was to identify any specific locations within Newcastle-under-Lyme at risk of sewer flooding and if so, to consider whether there is a need for hydraulic modelling to be undertaken. The data used to inform the sewer flood risk was the HFRR Register supplied by Severn Trent Water and United Utilities; however, this register is not a comprehensive 'at risk register' and consequently, specific locations within Newcastle-under-Lyme at risk of sewer flooding cannot be identified solely based on this dataset without a caveat, e.g. the register does not account for blockages and only represents a snapshot in time. Flood risk management authorities could consider investigating this source of flooding further if it is deemed to pose a flood risk, to assist with the identification of at-risk communities / areas. If deemed relevant, flood risk management authorities could consider developing a combined surface water / sewer model for urban settlements in Newcastle-under-Lyme which have experienced such flooding.
- At site-specific level, any developments shown to be at residual flood risk, for example from a breach or overtopping scenario (e.g. reservoir, canal, perched watercourse), may require modelling if deemed required by the Environment Agency.
- Assessment of groundwater flood risk should be based on the Areas Susceptible to Groundwater mapping, found in Appendix A.

4.5 Topography, Geology and Soils

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 extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

Topography

The topography of the Newcastle-under-Lyme district is illustrated in Figure 4-3 and is characterised by a ridge of high elevation running from the North East through the centre of the district to the South West. This area of higher elevation is broken up by the main watercourses in the area, the lower elevations correlating with the locations of the River Lea, River Tern, Meece Brook and Lyme Brook. The North West/Western section of the district the elevation quickly falls where it will eventually merge with the low-lying Cheshire Plain.

Geology

The underlying geology in the Newcastle-under-Lyme district is predominately sandstone, siltstone and mudstone. Both the Warwickshire group and the Millstone grit groups are composed of these rocks. The Pennine Coal measures (also known as the South Wales coal measures) are composed of ironstone and ferricrete, as well as the mud, silt and sandstones. The Permian and Triassic rocks are undifferentiated, conglomerates. See Figure 4-4.

The superficial geology in the area is predominately till, both glacial (diamicton) and river terrace deposits from historical flood events as seen in Figure 4-5.

Soils

There are a mix of slowly permeable and freely permeable soils within the borough. These are a mix of slightly acidic, loamy, clayey and sandy soils.

In the Newcastle-under-Lyme district the topographical characteristics cause water to drain from the high ridges running through the centre of the district into the low-lying valleys where the main rivers are located. Slowly permeable soils present across some areas of the borough lead to a higher likelihood of surface ponding and overland flow in these areas during high rainfall events as rainfall rate can exceed the infiltration rate.

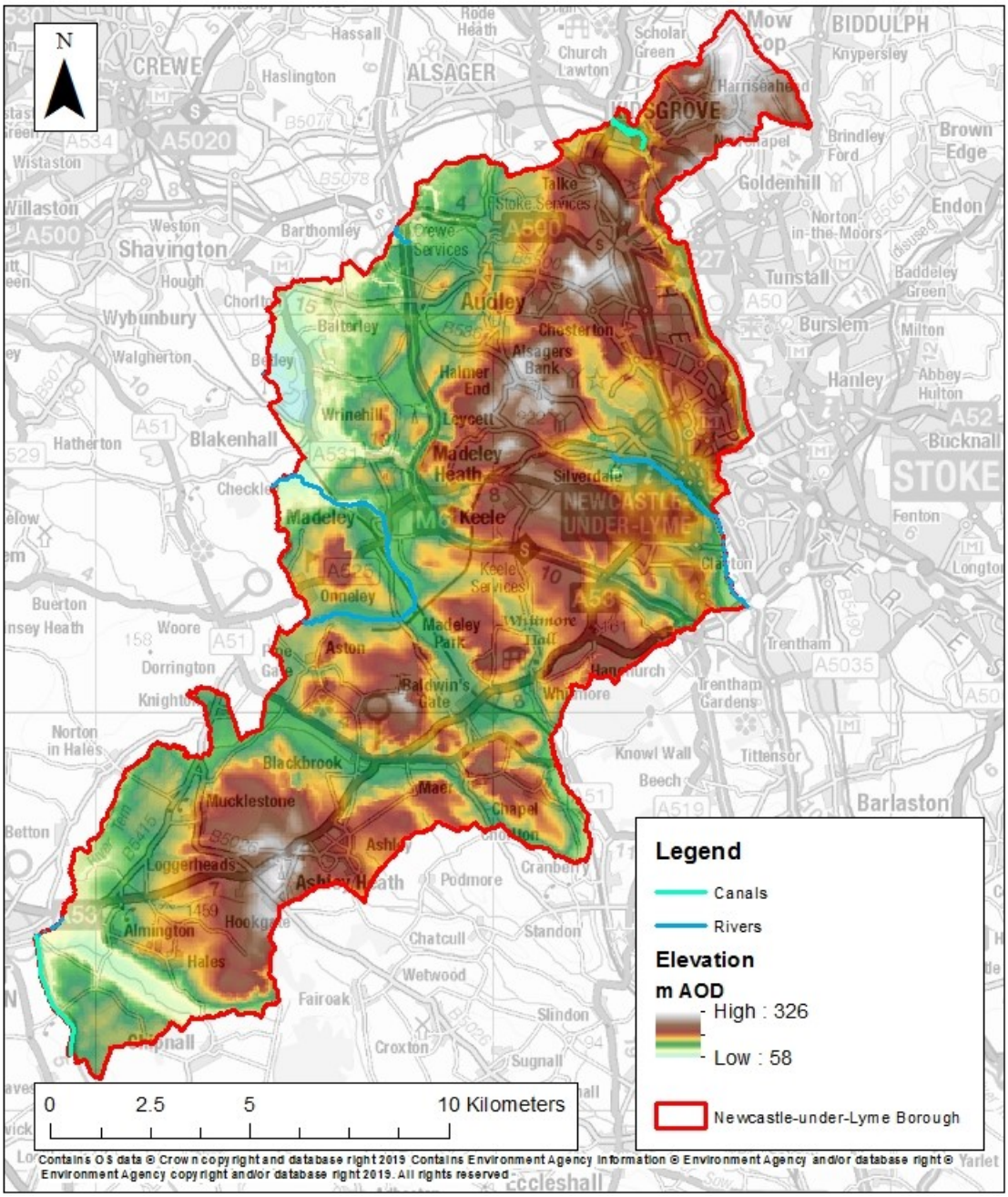


Figure 4-3: Topography of the district, with the canals and main rivers highlighted

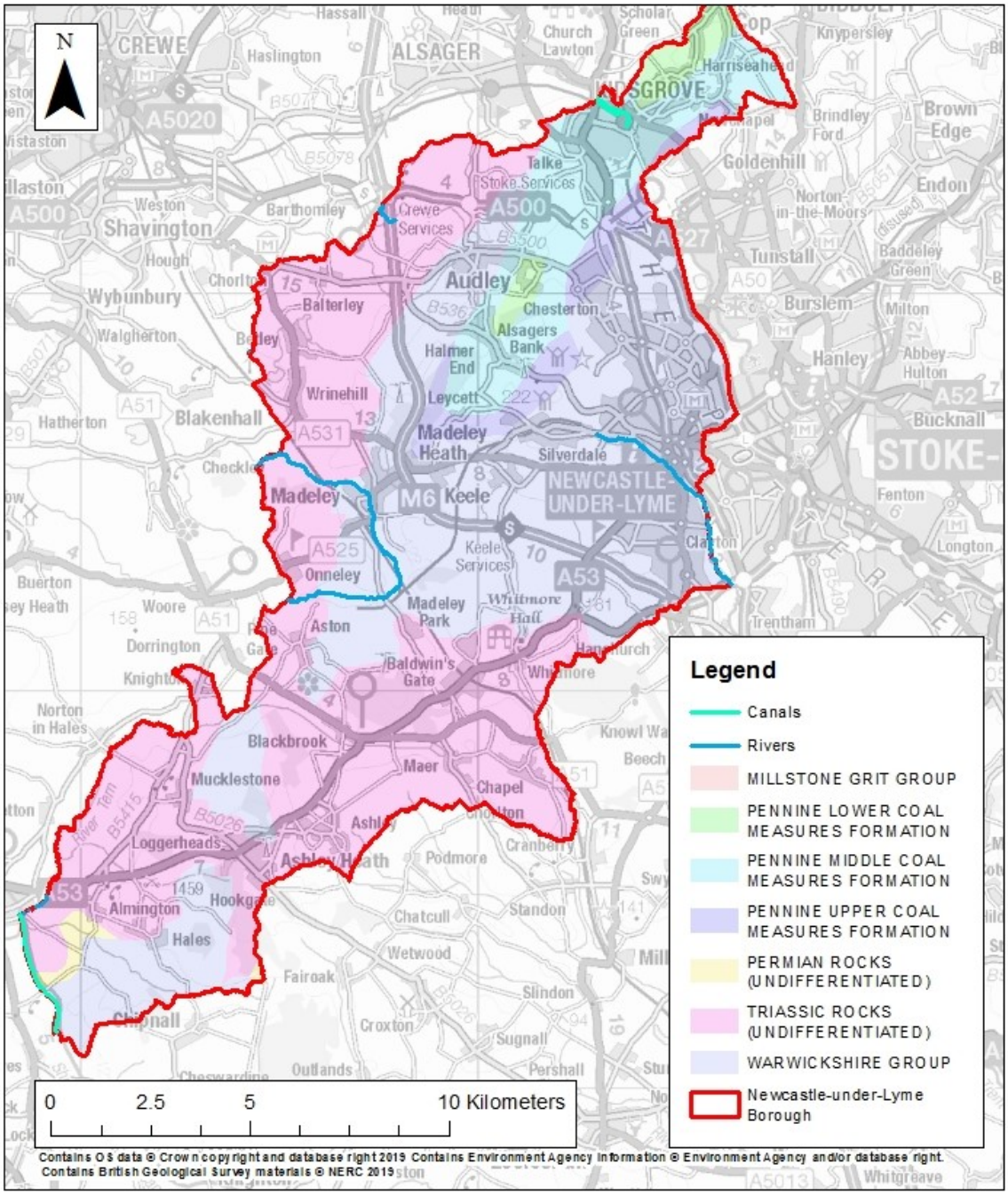


Figure 4-4: Bedrock Geology within Newcastle under Lyme district

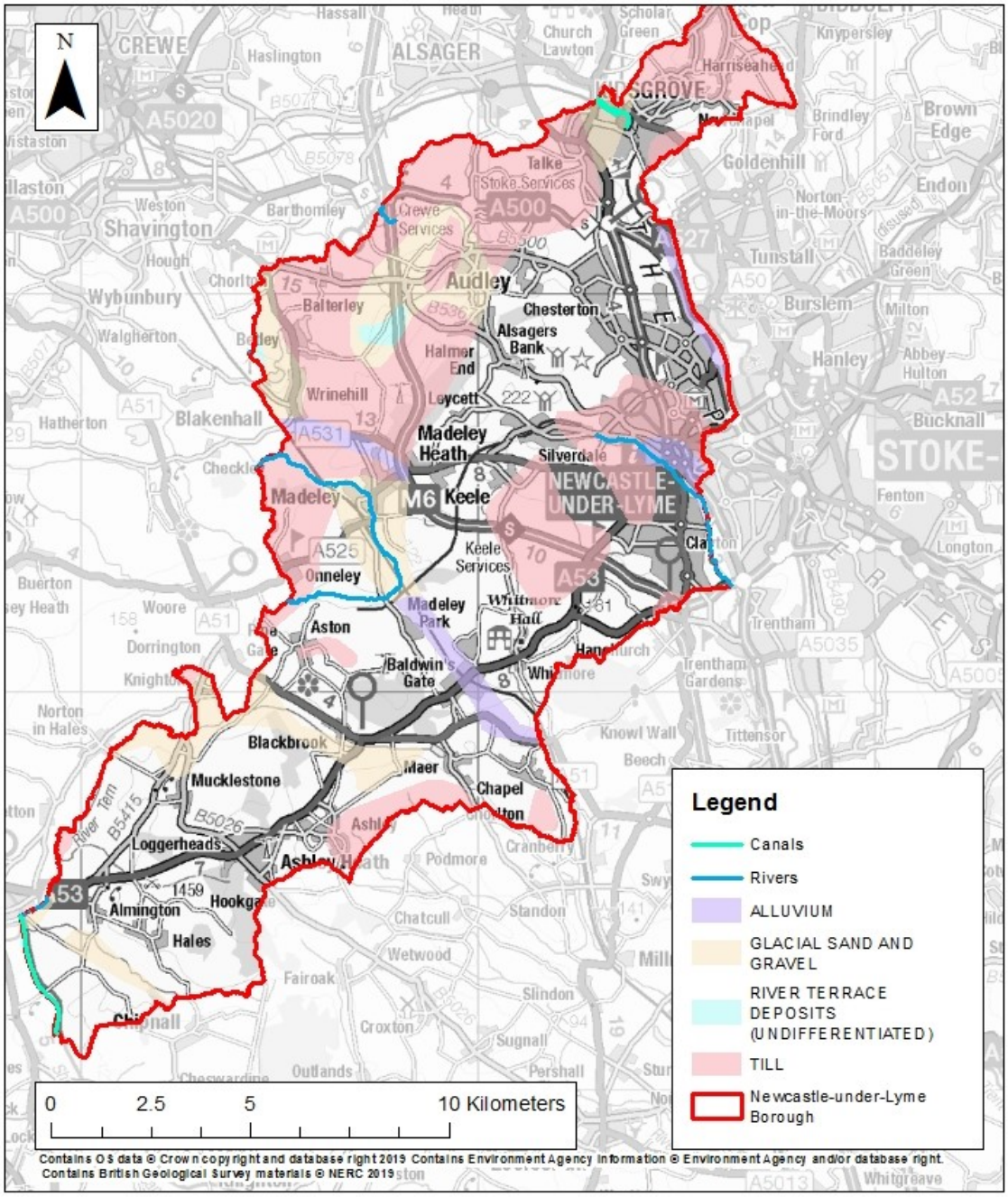


Figure 4-5: Superficial Deposits within Newcastle under Lyme

4.6 Fluvial Flooding

Fluvial flooding is associated with the exceedance of channel capacity during higher flows. The process of flooding from watercourses depends on a number of characteristics associated with the catchment including geographical location and variation in rainfall; steepness of the channel and surrounding floodplain; and infiltration and rate of runoff associated with urban and rural catchments.

The primary fluvial flood risk in Newcastle is along the Lyme Brook, a tributary of the River Trent. This presents a fluvial flood risk, primarily, to the town centre, including Brook Lane and the Poolfields area. There is also a risk of flooding from the Lyme Brook in the villages of Silverdale, Knutton and Cross Heath. To the south of the town centre, the Newcastle-U-L ward of Clayton is also at risk from flooding from the Lyme Brook.

The River Lea presents a flood risk to the villages of Madeley and Madeley Heath. The flood risk here is confined to the course of the river as it flows through and between these two villages, particularly affecting the residential areas to the east of Madeley village.

There are many smaller tributaries and brooks throughout the borough. Checkley Brook, Coal Brook, Mere Gutter (associated with Betley Mere), Dean Brook, Valley Brook, Meece Brook and Fowlea Brook all have localised flooding in their immediate areas. The areas that these smaller watercourses affect are predominantly rural.

4.6.1 Environment Agency Flood Map for Planning

The Environment Agency (EA) Flood Map for Planning is the main dataset used by planners for predicting the location and extent of fluvial and tidal flooding. This is supported by the CFMPs and FRMPs along with a number of detailed hydraulic river modelling reports which provide further detail on flooding mechanisms.

The Flood Map for Planning provides flood extents for the 1 in 100 AEP fluvial event (Flood Zone 3), the 1 in 200 AEP tidal event (also Flood Zone 3) and the 1 in 1000 AEP fluvial and tidal flood events (Flood Zone 2). Flood zones were originally prepared by the EA using a methodology based on the national digital terrain model (NextMap), derived river flows from the Flood Estimation Handbook (FEH) and two-dimensional flood routing. Since their initial release, the EA has regularly updated their flood zones with detailed hydraulic model outputs as part of their national flood risk mapping programme.

The EA Flood Map for Planning is precautionary in that it does not take account of flood defence infrastructure (which can be breached, overtopped or may not be in existence for the lifetime of the development) and, therefore, represents a worst-case scenario of flooding. The flood zones do not consider sources of flooding other than fluvial and tidal, and do not take account of climate change.

The Flood Zone maps for Newcastle-under-Lyme are in Appendix A. 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). The interactive SFRA Maps in Appendix A present the EA's Flood Map for Planning which shows the fluvial coverage of flood zones 2 and 3 across the borough.

The EA also provides a 'Risk of Flooding from Rivers Map'. This map shows the EA's assessment of the likelihood of flooding from rivers, at any location, and is based on the presence and effect of all flood defences, predicted flood levels and ground levels. This dataset is not used in the assessment of flood risk for planning applications. This dataset is further discussed in Section 4.6.3.

4.6.2 Functional Floodplain (Flood Zone 3b)

The functional floodplain forms a very important planning tool in making space for flood waters when flooding occurs. Development should be directed away from these areas.

Table 1, Paragraph 065 of the FRCC-PPG defines Flood Zone 3b as:

"…land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency."

Paragraph 015 of the FRCC-PPG explains that *the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point to help identify the functional floodplain.*

The area identified as functional floodplain should take into account the effects of all flood risk management infrastructure including defences. Areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be identified as functional floodplain. If an area is intended to flood, e.g. an upstream flood storage area designed to protect communities further downstream, then this should be safeguarded from development and identified as functional floodplain, even though it might not flood very often.

A technical note is provided in Appendix C which explains the methodology used in creating the functional floodplain outline. The outline is also displayed on the SFRA Maps in Appendix A.

As part of this SFRA, the Environment Agency provided all its most recent, readily available hydraulic river model 20-year defended scenario modelled flood outlines for the borough. Where

a 1 in 20 year, defended scenario outline was available, this was used to help define the functional floodplain. Where no outline has been produced, Flood Zone 3a has been used to update the indicative Flood Zone 3b floodplain.

Any site-specific FRAs should further assess areas of functional floodplain through detailed investigation and assessment of the actual risk and extent of any possible functional floodplain.

4.6.3 EA Risk of Flooding from Rivers Map

This map shows the likelihood of flooding from rivers and the sea based on the presence and effect of all flood defences, predicted flood levels and ground levels. The map splits the likelihood of flooding into four risk categories:

- High – greater than or equal to 1 in 30 (3.3%) chance in any given year
- Medium – less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year
- Low – less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year
- Very Low – less than 1 in 1,000 (0.1%) chance in any given year

The Risk of Flooding from Rivers and the Sea Map (RFRSM) is included on the SFRA Maps to act as a supplementary piece of information to assist the LPA in the decision-making process for site allocation.

This dataset is not suitable for use with any planning application nor should it be used for the sequential testing of site allocations. The EA's Flood Map for Planning should be used for all planning purposes, as per the FRCC-PPG.

4.7 Surface Water Flooding

Surface water runoff (or 'pluvial' flooding) is most likely to be caused by intense downpours e.g. thunderstorms. At times the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with very extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/ or high-water levels in watercourses that cause local drainage networks to back up.

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 Newcastle can be found in Appendix A.

Surface water flooding, in the context of the Newcastle-under-Lyme Borough Council SFRA, includes:

- Surface water runoff (also known as pluvial flooding); and
- Sewer flooding

There are certain locations, generally within urban areas, where the probability and consequence of pluvial and sewer flooding are more prominent due to the complex hydraulic interactions that exist in the urban environment. Urban watercourse connectivity, sewer capacity, and the location and condition of highway gullies all have a major role to play in surface water flood risk.

It should be acknowledged that once an area is flooded during a large rainfall event, it is often difficult to identify the route, cause and ultimately the source of flooding without undertaking further site-specific and detailed investigations.

Surface water flooding is a known and recognised risk in the Borough, that has been complicated by the rapid urbanisation of areas of urban Newcastle and Kidsgrove, where many smaller watercourses were culverted and, in some cases, built over. This both promotes excess surface water flowing over the ground as it cannot get into a watercourse and heightens the risk of flooding from culvert blockage or failure. Severn Trent Water have identified 14 post code areas within the borough that are at risk of surface water flooding. The urban area of Newcastle and Silverdale was recognised in the Local FRM Strategy as being one of the top ten urban areas at risk of surface water flooding in the County, with an estimated 632 properties at risk.

In recognition of this, Staffordshire County Council commissioned a Surface Water Management Plan for Kidsgrove, working with Cheshire East Council and United Utilities. Detailed modelling of the interactions between surface water, sewers and culverted watercourses was undertaken for this study and various options to alleviate the issue were investigated. The final outputs from the SWMP model have been integrated into the RoFSW map.

The RoFSW is the third-generation national surface water flood map, produced by the EA, aimed at helping to identify areas where localised, flash flooding can cause problems even if the Main Rivers are not overflowing. The RoFSW used in this SFRA to assess risk from surface water, has proved extremely useful in supplementing the EA Flood Map for Planning, by identifying areas in Flood Zone 1 which may have critical drainage problems.

4.7.1 Risk of Flooding from Surface Water

The EA updated the second generation uFMfSW in 2013 to produce a third-generation national surface water flood map, the updated Flood Map for Surface Water (uFMfSW), now referred to the Risk of Flooding from Surface Water map (RoFSW). RoFSW includes surface water flood outlines, depths, velocities and hazards for the following events:

- 1 in 30 AEP event (high risk)
- 1 in 100 AEP event (medium risk)
- 1 in 1000 AEP event (low risk)

The RoFSW is much more refined than the second-generation map in that:

- More detailed hydrological modelling has been carried out using several design rainfall events rather than one for the second generation,
- A higher resolution Digital Terrain Model (DTM) has been used – 2m, compared to 5m for the second generation,
- Manual edits of DTM to improve flow routes at over 91,000 locations compared to 40,000 for the second generation,
- DTM edited to better represent road network as a possible flow pathway, this was not done for the second generation,
- Manning's n roughness (used to represent the resistance of a surface to flood flows in channels and floodplains) values varied using MasterMap Topography layer compared to blanket values for urban and rural land use applied in the second-generation surface water flood map.

The National Modelling and Mapping Method Statement, May 2013 details the methodology applied. The RoFSW is displayed on the SFRA Maps and this includes the final outputs from the Kidsgrove SWMP. Therefore this represents the best and most update to date surface water flooding data for the Borough at the time of publication.

4.7.2 Critical Drainage Areas (or Council defined Areas of Critical Drainage)

The Town and Country Planning (Development Management Procedure) (England) Order 2010 defines a Critical Drainage Area (CDA) as:

"…an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

EA guidance on carrying out Flood Risk Assessments[1] states that an FRA should be carried out for sites in Flood Zone 1 that are…

"…in an area with critical drainage problems as notified by the Environment Agency."

The EA has not formally designated any CDAs within the Newcastle-under-Lyme Borough Council area.

4.7.3 Sewer Flooding

Combined sewers spread extensively across urban areas serving residential homes, business and highways, conveying waste and surface water to treatment works. Combined Sewer Overflows (CSOs), provide an EA consented overflow release from the drainage system into local watercourses or large surface water systems during times of high flows. Some areas may

1 https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas

also be served by separate waste and surface water sewers which convey waste water to treatment works and surface water into local watercourses.

Flooding from the sewer network mainly occurs when flow entering the system, such as an urban storm water drainage system, exceeds its available discharge capacity, the system becomes blocked or it cannot discharge due to a high-water level in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows. Water then begins to back up through the sewers and surcharge through manholes, potentially flooding highways and properties. It must be noted that sewer flooding in 'dry weather' resulting from blockage, collapse or pumping station mechanical failure (for example), is the sole concern of the drainage undertaker.

STW and United Utilities are the water companies responsible for the management of public sewers in the study area. Figure 4 – 6 displays the number of historical sewer flooding events in each ward of the borough.

This data particularly highlights the impact of sewer flooding in the Kidsgrove area, where there are known issues with the capacity of the sewer network. The area's that have seen the highest occurrence of sewer flooding are the most densely populated, in particular South Kidsgrove and Talke, North Kidsgrove and Mow Cope and Audley and Bignall End. Other areas that are also impacted by sewer flooding are Madeley and some other rural areas around the district.

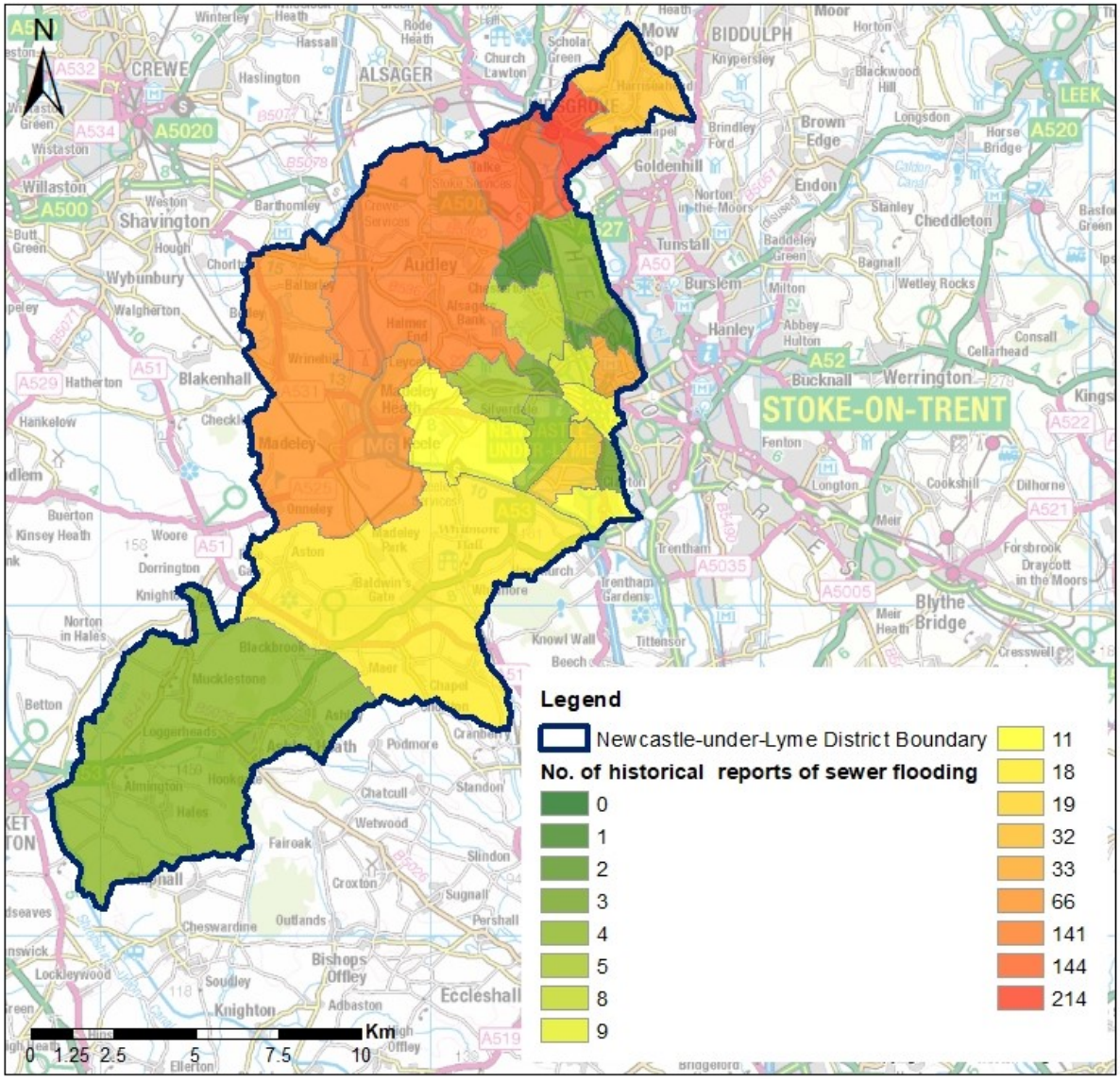


Figure 4-6: Historical reports of sewer flooding

4.8 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, for example where there are major aquifers or when mining stops. The Coal Authority do monitor groundwater levels in parts of the City area and the records show that groundwater levels have been rising over time since mining has stopped. However, no incidents have been reported within the borough as a result of mining water discharge. Further information is also available from the British Geological Survey on their website.

4.8.1 Areas Susceptible to Groundwater Flooding (AStGWF)

The EA's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), is a low resolution map which uses four susceptibility categories to show the proportion of a network of 1 km grid squares where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and is not suitable for planning considerations at a site-specific level. It should only be used as a trigger for further investigation as to the possibility of groundwater flooding.

The AStGWF is shown on the SFRA Maps in Appendix A.

4.9 Canal and Reservoir Flood Risk

4.9.1 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.

There are two canals in Stoke-on-Trent and Newcastle: Trent and Mersey Canal and Caldon Canal, which can be seen in Figure 4-3.

- The Trent and Mersey Canal. There are historic records of canal breaches in Burslem (caused by culvert failure) and by Northwood Bridge (caused by the installation of pipes adjacent to the embankment).

The risk of flooding along a canal is considered residual and is dependent on a number of factors. As canals are manmade systems that are heavily controlled, it is unlikely they will

respond in the same way as a natural watercourse during a storm event. Flooding is more likely to be associated with residual risks, similar to those associated with river defences, such as overtopping of canal banks, breaching of embanked reaches or asset (gate) failure as highlighted in

Table 4-3. Canals can also have a significant interaction with other sources, such as watercourses that feed them and minor watercourses or drains that cross underneath.

Table 4-3: Canal flooding mechanisms

Potential Mechanism	Significant Factors
Leakage causing erosion and rupture of canal lining leading to breach	Embankments Sidelong ground Culverts Aqueduct approaches
Collapse of structures carrying the canal above natural ground level	Aqueducts Large diameter culverts Structural deterioration or accidental damage
Overtopping of canal banks	Low freeboard Waste weirs
Blockage or collapse of conduits	Culverts

The risks associated with these events are also dependent on their potential failure location with the consequence of flooding higher where floodwater could cause the greatest harm due to the presence of local highways and adjacent property. The focus should be on areas adjacent to raised embankments. The pound length of the canal also increases the consequence of failure, as flows will only cease due to the natural exhaustion of supply. Stop plank (log) arrangements, stop gates and the continued inspection and maintenance of such assets by the Canal & River Trust help to manage the overall risk of a flood event.

4.9.2 Reservoirs

A reservoir can usually be described as an artificial lake where water is stored for use. Some reservoirs supply water for household and industrial use, others serve other purposes, for example, as fishing lakes or leisure facilities. The risk of flooding associated with reservoirs is residual and is associated with failure of reservoir outfalls or breaching. This risk is reduced through regular maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. LAs are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. LAs should work with other members of the Stoke and Staffordshire Local Resilience Forum to develop these plans.

4.9.3 Reservoir Flood Maps

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 2019. 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 three reservoirs upstream of Newcastle-under-Lyme district (shown on
Table 4-4) that could cause flooding in the borough. The reservoir inundation extents are shown on the EA's long term flood risk website.

Table 4-4 Reservoirs with the potential to cause flooding in the area

Reservoir	Location - grid reference	Reservoir owner	Local Authority Area	Is the reservoir located within the study area?
Bathpool Park Lake	383795, 353254	Newcastle Under Lyme Borough Council	Staffordshire	No
Coopers Green	378709, 350775	Severn Trent Water Authority	Staffordshire	Yes
The Old Wood (Betley Hall)	375250, 348997	Mansfield	Staffordshire	Yes

In the event of a breach, the modelled inundation extent from the Old Wood Reservoir at Betley Hall is mostly confined within the banks of the downstream watercourse. Where it does overtop the watercourse banks it would affect a number of properties including those south of Betley Common and in the north west of Betley. The modelling of a breach at Coopers Green Reservoir shows that flows would split both south east and north west. To the south, the inundation follows the topographical low points towards the Dean Brook, remaining mostly in bank to Weston. To the east, the inundation affects farms and open spaces following an unnamed drain, flowing along a reach of the A500 towards Henbury Lee. The Bathpool Park Lake reservoir is outside the Borough and flooding from a breach would follow the Trent and Mersey canal. The impact of this reservoir breach is confined to properties along the canal banks.

4.9.4 Culverted Watercourses

The term watercourse includes all open, bridged, culverted or piped rivers, streams, ditches, drains, cuts, dykes, sluices and passages through which water flows. Culverted watercourses pose a real risk to many areas throughout Newcastle and many historic culverts are still unknown or untraced. There is a residual risk from such watercourses should they become blocked or collapse.

The culverting of an 'ordinary watercourse' does not change its status to that of a sewer, and the responsibility for maintenance of the watercourse remains with the riparian owner or owners. It is assumed that the riparian owner owns up to the middle of the watercourse, unless land registry records or land ownership agreements indicate otherwise. Where riparian responsibility is shared, there may be past agreements or common law agreements historically. Where there may be a land boundary dispute, we have no powers to enforce.

Reinstatement of open watercourses provides continuity of the watercourse corridor habitat with recreational opportunities; furnishes additional capacity for flood water conveyance and storage; alleviates difficulties in identifying pollution sources; removes blockage, safety and maintenance hazards; and permits aquifer recharge or base flow support.

Any culvert should be surveyed by CCTV to inform an assessment of the condition of the existing culvert to determine it has sufficient capacity receive additional flows and to carry the loading from the development.

4.9.5 Historic Flooding

There is limited data for historical flooding in the Newcastle area. However, flooding was recorded in Kidsgrove (2007, 2009 and 2012), Whitmore (2010) and Silverdale (2010). Betley, Wrinehill, Madeley, Kidsgrove and Newcastle-under-Lyme town centre have also been affected by flooding in the past.

The prominent sources of flooding are surface water and fluvial flooding. Additionally, the Whitmore (2010) event was influenced by a utility pumping station failure, causing three of the flood events recorded in this area.

Kidsgrove has had a serious issue with surface water flooding and drainage, with flood events affecting large areas in 2007, 2009 and 2012 from blocked culverts and drainage issues. In 2007, surface water run-off caused flooding at the top of White Hill and to properties at the junction of High Street and Gloucester Road; additional flooding was reported on Liverpool Road as culverted watercourses were overwhelmed. Due to the existing risk in the Kidsgrove Area a specific Surface Water Management Plan was produced and incorporated into the Environment Agency's Risk of Flooding from Surface Water maps.

4.9.6 EA Historic Flood Map

The Historic Flood Map (HFM) contains outlines of past fluvial and groundwater flooding though does not contain any information regarding flood source, return period or date of flood.

The HFM outlines show no flooding in the Borough. The absence of coverage by Recorded Flood Outlines for an area does not mean that the area has never flooded, only that the Environment Agency do not currently have records of flooding in this area.

4.9.7 Summary of flood risk in Newcastle-under-Lyme

Appendix F contains a summary of the key flood risks to different areas of Newcastle-under-Lyme.

5 Flood Risk Management

The aim of this section of the SFRA is to identify existing Flood Risk Management (FRM) assets and previous / proposed FRM schemes across the Borough Council area. The location, condition and design standard of existing assets will have a significant impact on actual flood risk mechanisms. Whilst future schemes in high flood risk areas carry the possibility of reducing the probability of flood events and reducing the overall level of risk. Both existing assets and future schemes will have a further impact on the type, form and location of new development or regeneration.

5.1 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 contains 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.

5.1.1 EA Assets

The EA provided an ArcGIS shapefile of its flood defence dataset which shows that there is a network of flood defence infrastructure along the Lyme Brook. A series of flood embankments and flood walls provide a standard of protection (SoP) up to the 1 in 100 year. There are however some minor flood defences in the Borough and these are shown on Table 5-1.

Table 5-1: Flood defences in Newcastle under Lyme

Watercourse	Location	NGR	Type	Design SOP	Condition Rating
Lyme Brook	Flood bank tying into side of buildings adjacent to St Pauls Rd, Silverdale. Bandwidth 10m	SJ 83997 46131	Embankment	100	2 (Good)
Lyme Brook	Flood bank running parallel to Silverdale Rd. Bandwidth 10m	SJ 84200 46118	Embankment	100	2(Good)
Lyme Brook	Flood bank adjacent to St Pauls Rd tying into wall. bandwidth 10m	SJ 84140 46016	Embankment	100	2(Good)
Lyme Brook	Raised defence. Bandwidth 12m	SJ 83149 46362	Embankment	100	3 (fair)
Lyme Brook	SMP bank protection	SJ 84713 45755	Wall	100	3(fair)
Lyme Brook	Flood bank tying into side of buildings adjacent to St Pauls Rd, Silverdale. Bandwidth 10m	SJ 83997 46131	Embankment	100	2(Good)
Lyme Brook	Flood bank running parallel to Silverdale Rd. Bandwidth 10m	SJ 84200 46118	Embankment	100	2(Good)
Lyme Brook	Masonry bank defence. Sheet piled wall with brick facing.	SJ 84668 45793	Wall	100	3(fair)
Lyme Brook	Flood wall adjacent to St Pauls Rd, Silverdale. New embankment completed March 2012.	SJ 84027 46120	Wall	100	2(Good)

As well as the ownership and maintenance of a network of formal defence structures, the EA carries out a number of other flood risk management activities that help to reduce the probability of flooding, whilst also addressing the consequences of flooding. These include:

- Maintaining and improving the existing flood defences, structures and watercourses.
- Enforcement and maintenance where riparian owners unknowingly carry out work that may be detrimental to flood risk.
- Identifying and promoting new flood alleviation schemes (FAS) where appropriate.
- Working with local authorities to influence the location, layout and design of new and redeveloped property and ensuring that only appropriate development is permitted relative to the scale of flood risk.
- Operation of Floodline Warnings Direct and warning services for areas within designated Flood Warning Areas (FWA) or Flood Alert Areas (FAA). EA FWAs are shown on the SFRA Maps in Appendix A and also in Appendix E.
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are therefore sufficiently prepared in the event of flooding.
- Promoting resilience and resistance measures for existing properties that are currently at flood risk, or may be in the future as a result of climate change.

5.1.2 Local Authority Assets

Newcastle-under-Lyme Borough Council and Staffordshire County Council, as Highways Authority, will own and maintain a number of assets throughout the borough which may include culverts, bridge structures, gullies, weirs and trash screens. The majority of these assets will lie along ordinary watercourses within smaller urban areas where watercourses may have been culverted or diverted, or within rural areas. All these assets can have flood risk management functions as well as an effect on flood risk if they become blocked or fail.

As part of their FWMA duties as LLFA covering the Newcastle-under-Lyme area, Staffordshire County Council has a duty to maintain a register of structures or features, which are considered to have a significant effect on flood risk, including details on ownership and condition as a minimum.

The Asset Register should include those features relevant to flood risk management function including feature type, description of principal materials, location, measurements (height, length, width, diameter) and condition grade. The Act places no duty on the LLFA to maintain any third-party features, only those for which the authority has responsibility as land / asset owner. A copy of the register is available to view on request from Staffordshire County Council.

5.1.3 Water Company Assets

The sewerage infrastructure within Newcastle-under-Lyme is likely to be based on Victorian sewers from which there is a risk of localised flooding associated with the existing drainage capacity and sewer system. The drainage system may be under capacity and / or subject to blockages resulting in localised flooding of roads and property. Severn Trent Water and United utilities are responsible for the management of public sewers. This includes surface water and foul sewerage. There may however be some private surface water sewers in the borough as only those connected to the public sewer network transferred to the water companies under the Private Sewer Transfer in 2011. Surface water sewers discharging to watercourses did not transfer and would therefore not be under the ownership of a water company, unless adopted under a Section 104 adoption agreement. Water company assets include Wastewater Treatment Works, Combined Sewer Overflows, pumping stations, detention tanks, sewer networks and manholes.

5.2 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.

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 and the actual and residual risk further in a site-specific Flood Risk Assessment.

5.2.1 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 effectually drainage their area. What this means in practise 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

5.3 Current and Future Flood Risk Management Work Programmes

There is understood to be one scheme on the current flood risk management work programme in the Borough (up to 2021), which is Kidsgrove Property Flood Resilience scheme. Beyond 2021, further schemes to address issues with culverted watercourses in Silverdale and sewers in Central Kidsgrove may come forward, but there is limited detail available on such schemes at this time.

The SWMP for Kidsgrove identified the Rookery area as being at high risk of flooding from surface water and a culverted watercourse. The Kidsgrove Property Flood Resilience scheme provides previously flooded properties with practical and cost effective steps to help lower flood risk, through the use of bespoke products. Staffordshire County Council, as Lead Local Flood Authority, are currently implementing a scheme to offer and implement measures such as flood guards, flood doors, non-return valves and air brick covers to residents.

Any new development sites in the Rookery area should seek to further address flood risk issues offsite wherever possible, by holding back water e.g. through flood storage/ oversized sustainable drainage/ green infrastructure features to capture overland flows and help to reduce flows in downstream watercourses.

6 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.

6.1 Revised Climate Change Guidance

The Environment Agency published updated climate change guidance in 2016 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. At the time of writing this report, this was due in Spring 2019.

The UKCP18 contains high resolution mapping with peak river flow allowances at 1km grid scale that will be released in Spring 2019. The regional peak river flow allowances in the 2016 guidance may not change but planners and developers may need to consider the finer resolution data where it shows a significant difference to the regional averages.

The UKCP18 high resolution (daily and sub daily) rainfall projections are due to be published in late 2019. Following this, the Environment Agency may update the recommended peak rainfall allowances in their guidance for planners and developers.

6.2 Applying the climate change guidance

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

The vulnerability of the development – see the NPPG.

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

- 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 –Newcastle-under-Lyme is within the Humber, North West and Severn RBDs. 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.
- '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

6.3 Relevant allowances for Newcastle

Table 6-1, Table 6-2 and Table 6-3 show the peak river flow allowances that apply in Newcastle.

Table 6-1: 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 6-2: Peak river flow allowances for the North West 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%	35%	70%
Higher central	20%	30%	35%
Central	15%	25%	30%

Table 6-3: 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 6-4 shows the peak rainfall intensity allowances that apply in Newcastle. Both the central and upper end allowances should be considered to understand the range of impact. Staffordshire County Council requires developers to use the peak rainfall intensity allowance in small and urban catchments of for Upper End scenario for the 2080's (40%).

Table 6-4: 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%

6.4 Climate change modelling for the 2019 SFRA

Climate change modelling for the watercourses in the study area was undertaken based on the 2016 climate change guidance. Existing Environment Agency hydraulic models were run for the 2080s period for all three allowance categories (relevant to the river basin district). Mapping of the climate change modelling outputs are provided in Appendix A. Due to this, the Climate Change outlines are using the most up to date data and in some areas may not be comparable with the broadscale mapped extents used to inform Flood Zone 3a and Flood Zone 2.

There are notable cases where the modelled extents indicate sensitivities to an increase in flows due to climate change:

- Silverdale: The flood risk extends along the Lyme Brook from Crown St. to Kinsey St.
- Knutton: Flood risk extends up to Rowhust Close.
- Church Fields: especially up to the A34 Talke Road.
- An area of the Lyme Brook affects Honey Wood and the Briars from the 100-year with 20% climate change.
- Within Newcastle-under-Lyme the flood zones extend further affecting areas such as Stanier St. and St Pauls Rd.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase compared to the 100-year current day event.

When undertaking a site-specific Flood Risk Assessment, 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.
- Contact the Environment Agency to confirm which is the most up to date model available for the area. Table 6-5 has a list of the current models in the Newcastle Borough Council area and notes which models were rerun for the SFRA.
- Section 6 provides further details on climate change for developers, as part of the FRA Guidance.

Table 6-5: Hydraulic models used to inform the SFRA

Hydraulic model	Date	Software	Watercourse
Newcastle Hazard Mapping Study	-	Estry-Tuflow	Lyme Brook
Fowlea Brook Hydraulic Modelling Study	2014	Estry-Tuflow	Fowlea Brook

6.4.1 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.

7 Development and Flood Risk

7.1 Introduction

This section of the SFRA provides a strategic assessment of the suitability, relative to flood risk, of the potential development sites provided by NULBC to be considered though the Local Plan.

The information and guidance provided in this Section (supported by the SFRA mapping in Appendix A and the Development Site Screening Spreadsheet in Appendix B) can be used by NULBC to inform their Local Plan, and provide the basis from which to apply the Sequential Approach in the development allocation and development management process.

7.2 The Sequential Approach

The Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG) provides the basis for the Sequential Approach. It is this approach, integrated into all stages of the development planning process, which provides the opportunities to reduce flood risk to people, their property and the environment to acceptable levels.

The approach is based around the flood risk management hierarchy, in which actions to avoid, substitute, control and mitigate flood risk is central. For example, it is important to assess the level of risk to an appropriate scale during the decision-making process, (starting with this Level 1 SFRA). Once this evidence has been provided, positive planning decisions can be made, and effective flood risk management opportunities identified.

Figure 7-1 illustrates the flood risk management (FRM) hierarchy with an example of how these may translate into the council's management decisions and actions.

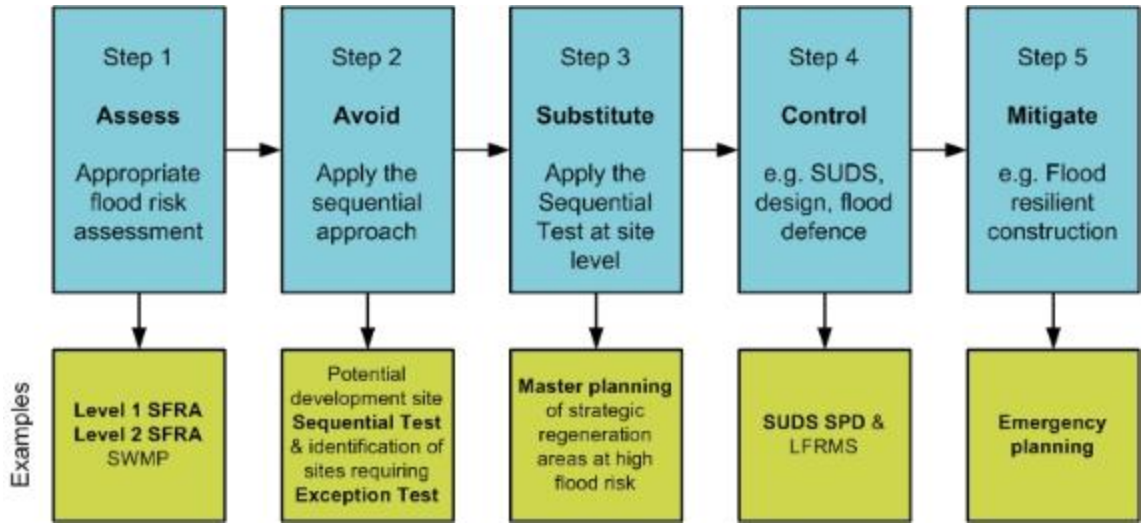


Figure 7-1: Flood Risk Management hierarchy

The overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3, be considered. This should take into account the flood risk vulnerability of land uses and the likelihood of meeting the requirements of the Exception Test if required.

There are two different aims in carrying out the Sequential Approach depending on what stage of the planning system is being carried out i.e. LPAs allocating land in Local Plans or determining planning applications for development. This SFRA does not remove the need for a site-specific Flood Risk Assessment at a development management stage.

The following sections provide a guided discussion on why and how the Sequential Approach should be applied, including the specific requirements for undertaking Sequential and Exception Testing.

7.3 Local Plan Sequential and Exception Test

NULBC, as the LPA, should seek to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk and ensuring that all development does not increase risk and where possible can help reduce risk from flooding to existing communities and development. **Guidance on the application of the Sequential and Exception tests through the development management process is provided in Section 10.1.1 of this report**.

At a strategic level, this should be carried out as part of the Local Plan. This should be done by:

1. Applying the Sequential Test and if the Sequential Test is passed, applying the Exception Test, if required;
2. Safeguarding land from development that is required for current and future flood management;
3. Using opportunities offered by new development to reduce the causes and impacts of flooding and where climate change is expected to increase flood risk so that existing development may not be sustainable in the long term;
4. Seeking opportunities to facilitate the relocation of development including housing to more sustainable locations.

Figure 7-2 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.

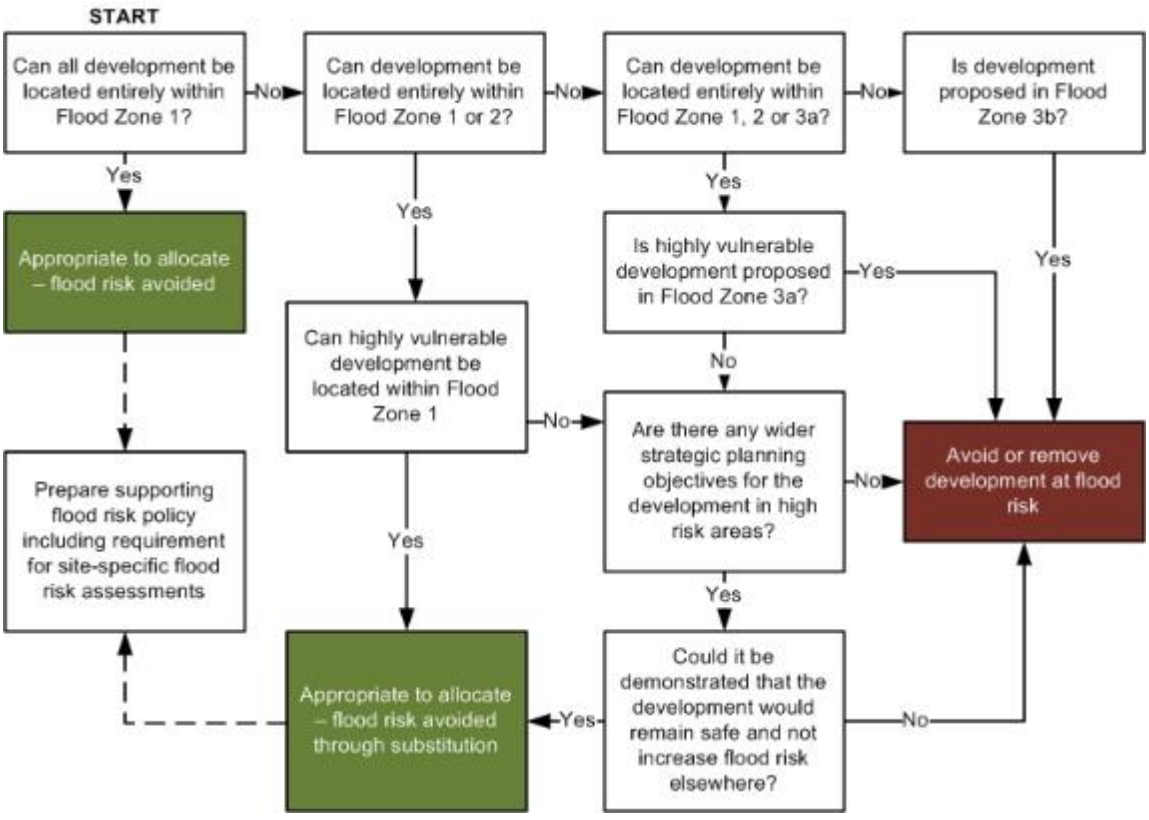


Figure 7-2: Local Plan sequential approach to site allocation

This SFRA provides the main evidence required. This process also enables those sites that have passed the Sequential Test, and may require the Exception Test, to be identified.

The NPPF Paragraph 160 states that for the Exception Test to be passed it should be demonstrated that:

a. *The development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
b. *The development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the test will have to be passed for development to be allocated or permitted.

At a Planning Allocation stage NuLBC should be able to apply the Exception Test by using the information contained in a SFRA to answer the following questions:

a. Can development within higher risk areas be avoided or substituted?
b. Is flood risk associated with possible development sites considered too high; and will this mean that the criteria for Exception Testing are unachievable?
c. Can risk be sustainably managed through appropriate development techniques (resilience and resistance) and incorporate Sustainable Drainage Systems without compromising the viability of the development?
d. Can the site, and any residual risks to the site, be safely managed to ensure that its occupiers remain safe during times of flood if developed?

In order to fully answer questions b to d, further, more detailed assessment may be required through a Level 2 SFRA.

Where it is unlikely that the Exception Test can be passed due to few wider sustainability benefits, the risk of flooding being too great, or the viability of the site being compromised by the level of flood risk management work required, then the LPA should consider avoiding the site all together.

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.

7.3.1 Sustainability Appraisal and Flood Risk

The Sustainability Appraisal should help to ensure that flood risk is taken into account at all stages of the planning process with a view to directing development away from areas at flood risk, now and in the future, by following the sequential approach to site allocation, as shown in Figure 7-2.

By avoiding sites identified in this SFRA as being at significant risk, such as those listed in Recommendation A or by considering how changes in site layout can avoid those parts of a site at flood risk, such as any site included within Recommendation C, the Council would be demonstrating a sustainable approach to development.

In terms of surface water, the same approach should be followed whereby those sites at highest risk should be avoided or site layout should be tailored to ensure sustainable development.

Once the Council has decided on a final list of sites following application of the Sequential Test and, where required, the Exception Test (which may require a Level 2 SFRA), a phased approach to development should be carried out to avoid any cumulative impacts that multiple developments may have on flood risk. For example, for any site where it is required to develop in Flood Zone 3, detailed modelling would be required to ascertain where water displaced by development may flow and to calculate subsequent increases in downstream flood volumes. The modelling should investigate scenarios based on compensatory storage techniques to

ensure that downstream or nearby sites are not adversely affected by development on other sites.

Using a phased approach to development, based on modelling results of floodwater storage options, should ensure that any sites at risk of causing flooding to other sites are developed first in order to ensure flood storage measures are in place before other sites are developed, thus ensuring a sustainable approach to site development. Also, it may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites. This is especially important for large strategic sites that are likely to be brought forward as sub parcels in separate phases.

8 Local Plan Sites Assessment

As assessment of the Preferred Option sites will inform the preparation of the council's Local Plan. LPAs have a requirement under the National Planning Policy Framework (NPPF) to demonstrate a sufficient supply of potential sites suitable for residential development to meet local housing requirements as well as sites for economic development uses. The preferred options show the levels of housing and employment growth that Newcastle-under-Lyme Borough Council are planning for over a twenty-year period and the initial set of preferred housing and employment site locations to accommodate this growth.

Housing sites have been identified from a broad range of sources as suggested in PPG, and include sites promoted through an annual "call for sites" exercise; which was last undertaken as part of the consultation on the draft Local Plan. The assessments assess sites on their suitability for development, availability and the likelihood of development being financially viable. The assessments are used to inform the Local Plan, but it does not make policy decisions on future site allocations. The inclusion of a site in the assessment does not mean it will be developed, or that the LPA would view an application on the site favourably.

Sites included within the assessments have been considered by this SFRA update. 32 potential sites overall have been assessed and subdivided into several proposed uses including:

- Residential - 17 sites
- Employment - 15 sites

In order to inform the first part of the Sequential Approach for allocation of development through the Local Plan (illustrated in Figure 7-2), this SFRA has carried out a high-level GIS screening exercise which involved overlaying the potential sites against Flood Zones 1, 2, 3a and 3b.

Surface water risk to sites has also been assessed through the EA's updated Flood Map for Surface Water dataset to help identify those sites that may have critical drainage problems. An assessment of the potential future flood risk has been assessed by overlaying the potential sites against the three 100-year Climate Change allowances, Central, Higher Central and Upper End. The Development Site Screening spreadsheet, included in Appendix B, provides a breakdown of each site and the area (ha) and percentage coverage of each flood zone, each surface water flood zone and Climate Change outline.

The Environment Agency Flood Zones occur in a nested structure and are indicative of the risk of flooding occurring within that zone. Sites in Flood Zone 3b, at the highest risk of flooding, are therefore, in general, contained within Flood Zone 3a and included in the total count of sites within Flood Zone 3a. The total number of sites within Flood Zone 2 includes those within Flood Zones 3a and 3b.

Error! Reference source not found. provides a count of the number of sites within each Flood Zone. Of the 32 proposed development sites in the borough, 4 sites lie within or partially within Flood Zone 3b. Therefore, these 4 sites are also counted within the total number of sites in Flood Zone 3a and Flood Zone 2.

Table 8-1: Number of potential development sites at risk from Flood Map for Planning flood zones

Potential Development Site	Flood Zone 1*	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Residential	14	3	3	2
Employment	14	1	1	2
Total	28	**4**	**4**	**4**

*Sites with 100% area within Flood Zone 1

When assessing a site for development Zones 3b, 3a and 2 are considered in isolation. Risk of flooding at each site is assessed sequentially by addressing those sites at higher risk first. Any site which has any area within Flood Zone 3b is excluded from consideration in Flood Zone 3a.

Any site with an area within Flood Zone 3a is excluded from Flood Zone 2. This results in each site being associated with the highest zone of risk that it falls within.

N-U-LBC should use the Development Site Screening spreadsheet in Appendix B to identify which sites should be avoided during the Sequential Test. If this is not the case, or where wider strategic objectives require regeneration in areas already at risk of flooding, then NULBC should consider the compatibility of vulnerability classifications and Flood Zones (refer to FRCC-PPG) and whether or not the Exception Test will be required before finalising sites. The decision-making process on site suitability should be transparent and information from this SFRA should be used to justify decisions to allocate land in areas at high risk of flooding.

8.1 Potential Development Sites Review

This section of the report assesses flood risk to the 32 potential sites. Section 8.1.1 provides high level broad-brush recommendations for those sites within the flood zones of the Flood Map for Planning. Section 8.1.2 reviews the surface water risk to the potential sites by way of the updated Flood Map for Surface Water. An assessment of the sites at risk from Climate Change is outlined in Section 8.1.3.

It is important to note that each individual site will require further investigation, as local circumstances may dictate the outcome of the recommendation. Such local circumstances may include the following:

- Flood depths and hazards will differ locally to each at risk site therefore modelled depth, hazard and velocity data should be assessed for the relevant flood event outlines, including climate change (using the EA's February 2016 allowances), as part of a site-specific FRA.
- Current surface water drainage infrastructure and applicability of SuDS techniques are likely to differ at each site considered to be at risk from surface water flooding. Further investigation would therefore be required for any site at surface water flood risk.
- If sites have planning permission but construction has not started, the SFRA will only be able to influence the design of the development e.g. finished floor levels. New, more extensive flood extents (from new models) cannot be used to reject development where planning permission has already been granted.
- It may be possible at some sites to develop around the flood risk. Planners are best placed to make this judgement i.e. will the site still be deliverable if part of it needs to be retained to make space for flood water.
- Surrounding infrastructure may influence the scope for layout redesign/removal of site footprints from risk.
- Current land use. A number of sites included in the assessment are likely to be brownfield, thus the existing development structure could be taken into account as further development may not lead to increased flood risk.
- Existing planning permissions may exist on some sites where the EA may have already passed comment and/or agreed to appropriate remedial works concerning flood risk. Previous flood risk investigations/FRAs may already have been carried out at some sites.

Development viability is assessed, based on the flood risk vulnerability classification in Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance2 (FRCC-PPG), and subsequent strategic recommendations were made and are discussed in this report.

The following strategic recommendations may apply to a site, following application of the Sequential Test by the LPA:

- Strategic Recommendation A - consider withdrawing the site based on significant level of fluvial or surface water flood risk;
- Strategic Recommendation B - Exception Test required if site passes Sequential Test;

2 http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/

- Strategic Recommendation C - consider site layout and design around the identified flood risk, if site passes Sequential Test
- Strategic Recommendation D – site can be permitted on flood risk grounds due to limited perceived risk, subject to consultation with the LPA/LLFA;
- Strategic Recommendation E – can be allocated on flood risk grounds subject to consultation with the LPA/LLFA

Table 8-2 summarises the number of sites that each recommendation applies to.

Table 8-2: Number of sites per Strategic Recommendation (Following Council review of flood risk and development)

Site/Proposed use	Strategic Recommendation				
	A	B	C	D	E
Residential	0	1	1	12	5
Employment	0	1	1	8	3
Total	**0**	**2**	**2**	**20**	**8**

8.1.1 Flood Map for Planning Site Assessment

The following recommendations provide only a guide, based on the flood risk information made available for this Level 1 SFRA. Information regarding local, site specific information is beyond the scope of this SFRA. It is NULBC's responsibility to carry out sequential testing of each site using the information provided in this SFRA and more specifically using their local, site specific knowledge and advice from the EA. These sections should be read alongside the Development Site Screening spreadsheet in Appendix B.

Recommendation A – Consider withdrawal of site

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation A applies to any site within the functional floodplain where the following criteria is true:

- 10% or greater of the site area is within Flood Zone 3b (areas below this indicative threshold are more likely to be manageable through avoidance and development layout). The FRCC-PPG flood risk vulnerability classification states that only water-compatible uses and essential infrastructure should be permitted in Flood Zone 3b, though any essential infrastructure must pass the Exception Test. Land allocated for housing falls in to the more vulnerable category and sites for employment; retail; recreation and leisure; and mineral and waste are in the less vulnerable category, though waste management sites for hazardous materials fall with the more vulnerable category. Gypsy and traveller sites fall within the highly vulnerable category. Mixed use sites should be placed into the higher of the relevant classes of flood risk sensitivity. Development should not be permitted for sites within the more vulnerable and less vulnerable categories that fall within Flood Zone 3b. If the developer is able to avoid 3b however, then part of the site could still be delivered.

The 10% threshold is not included within any policy, it is merely considered that it would likely prove difficult for developers to deliver a site where 10% or more of the site area is considered as undevelopable, based on the NPPF. This 10% threshold does not account for local circumstances therefore it may be possible to deliver some of the sites included with Recommendation A upon more detailed investigation. It may also be possible to deliver part of some of the larger sites, dependent upon further investigation, where a significant area is not within Flood Zone 3b. Strategic recommendation A applies to none of the potential development sites.

Table 8-3: Sites which apply to strategic recommendation A

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3A	% Area within FZ3b
N\A	N\A	N\A	N\A	N\A	N\A

Recommendation B – Exception Test

Recommendation B applies to sites where it is likely the Exception Test would be required. This does not include any recommendation on the likelihood of a site passing the Exception Test. These sites may need to be examined as part of a more in-depth Level 2 SFRA. The developer / LPA should attempt to avoid the risk area where possible.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation B applies to sites where the following criteria is true:

- 10% or greater of any residential site or essential infrastructure site that is within Flood Zone 3a. Water-compatible and less vulnerable uses of land do not require the Exception Test if in Flood Zone 3a.
- All development proposals in Flood Zone 3a must be accompanied by a FRA.
- If a proposed development is classed as more vulnerable, an Exception Test is required regardless of the percentage of the site that falls within Flood Zone 3a.

The 10% threshold is not included within any policy; it is merely considered that it would be very difficult for developers to avoid Flood Zone 3a when 10% or more of the site area is within it. This 10% threshold does not account for local circumstances therefore it may be possible to avoid Flood Zone 3a altogether for some of the sites included with Recommendation B. It may also be possible to deliver part of some of the larger sites, dependent upon further investigation, where a significant area is not within the FZ3a.

It should be considered that, based on climate change, the 1 in 20 and 1 in 25 year flood event outlines used to create the functional floodplain, may increase in extent in 100 years' time meaning a larger number of sites or a larger percentage area of these sites may be at risk from the 1 in 20 / 25 year flood events. Table 8-4 lists those sites where Recommendation B should apply based on the 10% threshold of site area within Flood Zone 3a. The Development Site Assessment spreadsheet in Appendix B illustrates that there are two sites where Recommendation B would need to be applied.

Table 8-4: Sites which require Exception test

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3A	% Area within FZ3b
HD14	Land west of Loomer Road, Holditch	Residential	2.27	13%	6%
NL21	Land between Lower Milehouse Lane and Brymbo Road	Employment	1.90	54%	8%

Recommendation C – Consider site layout and design

This recommends a review of site layout and / or design at the development planning stage in order for development to proceed. A Level 2 SFRA may be required or a site-specific FRA would be required to inform on site layout and design.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation C applies to sites where the following criteria is true:

- <10% of the area of any site type is within Flood Zone 3b.
- <10% of any residential site is within Flood Zone 3a.

The 10% threshold is not included within any policy, it is merely considered that it may be possible for developers to avoid Flood Zone 3b and Flood Zone 3a when less than 10% of the site area is at risk. This 10% threshold does not account for local circumstances.

The Development Site Assessment spreadsheet in Appendix B categorises those sites with <10% of their area within Flood Zone 3b where site layout should be examined with a view to removing the site footprint from Flood Zone 3b. Depending on how much of the site is at risk and whether the location of highest risk would affect safe access and egress during a flood, it may be possible to develop on the parts of the site at lower risk, having firstly considered whether there are reasonable alternative sites at a lower risk of flooding. Alternatively, site boundaries can be redrawn to exclude the functional floodplain. When doing so care needs to be taken to ensure there are no areas adjacent to watercourses that are left inaccessible and not maintained.

Also, listed within the spreadsheet are the residential use sites with <10% of their area within Flood Zone 3a and where site layout and / or design should be examined with a view to

removing the site footprint from Flood Zone 3a or incorporating on-site storage of water into site design. Depending on local circumstances, if it is not possible to adjust the site boundary to remove the site footprint from Flood Zone 3a to a lower risk zone or to incorporate on-site storage of water within the site design, then the Exception Test should be undertaken and passed as part of a site-specific FRA.

A precautionary approach to accounting for climate change should be considered by assuming that Flood Zone 2 will become Flood Zone 3a in 100 years' time and Flood Zone 3a could become Flood Zone 3b, though depending on local circumstances.

Any site layout and design should take account of the 8-metre easement buffer along watercourses, from the top of the bank or the landward to of a defence on main rivers, where development is not permitted. This easement buffer is recommended by the EA to allow ease of access to watercourses for maintenance works. Any site redesign, where Flood Zone 3a is included within the site footprint, should allow water to flow naturally or be stored in times of flood through application of suitable SuDS.

The FRCC-PPG (Paragraph 050) states:

Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally

Table 8-5: Sites to consider layout and design to avoid risk areas

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within FZ3a	% Area within FZ3b
HD12	London Road. Chesterton	Residential	2.59	0.16%	0%
TB23	Land west of Galingale View, Thistleberry	Residential	4.08	2%	0%

Recommendation D – Development could be allocated subject to FRA

This recommends that development could be allocated, assuming a site-specific FRA shows the site can be safe and it is demonstrated that the site is sequentially preferable. A site within Flood Zone 2 could still be rejected if the conclusions of the FRA decide development is unsafe or inappropriate.

This recommendation DOES NOT take account of local circumstances, only that part of a site area falls within a Flood Zone.

Recommendation D applies to sites where the following criteria is true:

- Any site within Flood Zone 2 that does not have any part of its footprint within Flood Zone 3a, except for highly vulnerable developments (such as gypsy and traveller sites) which would be subject to, and have to pass, the Exception Test.
- Any site 100% within Flood Zone 1 where surface water flood risk is apparent on site and therefore recommended for investigation through a site-specific FRA.
- Any site 100% within Flood Zone 1 that is greater than or equal to 1 hectare in area.

Recommendation D applies to 20 potential sites overall. Whilst all of these sites are contained 100% within Flood Zone 1, they have an area greater than 1 hectare.

As discussed previously for other recommendations, a precautionary approach to accounting for climate change should be considered by assuming that Flood Zone 2 will become Flood Zone 3a in 100 years' time.

All development proposals within Flood Zone 2 or Flood Zone 3a must be accompanied by a site-specific Flood Risk Assessment. Any sites 100% within Flood Zone 1 that are equal to or

greater than 1 hectare in area must be accompanied by a site-specific Flood Risk Assessment to determine vulnerability to flooding from other sources as well as fluvial and tidal. The FRA should determine the potential of increased flood risk elsewhere as a result of the addition of hard surfaces on-site and the effect of new development on surface water runoff.

The FRCC-PPG states:

"Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally." (Paragraph 50).

Table 8-6 Sites where development can be allocated subject to FRA

Site ID	Site Name	Proposed use	Site Area (ha)	% **Area within FZ1**
Silverdale Business Park, Cemetery Road, Silverdale	NL3	Employment	1.5	100%
Former Wolstanton Colliery Stock Yard, West Ave, Wolstanton	NL10	Employment	1.62	100%
Chatterley Valley (east of mainline), Chatterley	NL4	Employment	6.47	100%
Keele Science Park Phase 3, University of Keele	NL40	Employment	28.81	100%
Rowhurst Close, Chesterton	NL36	Employment	15.38	100%
Chatterley Valley (west of mainline), Chatterley	NL5	Employment	44.28	100%
West Avenue, Kidsgrove	NL37	Employment	2.06	100%
Land to S&E of New Development Site, Keele	NL24	Employment	18.11	100%
Jamage South	NL15	Employment	44.89	100%
Chemical Lane Site (Chatterley Valley South)	NL43	Employment	2.57	100%
Unit 1, Valley Park, Watermills Road, Chesterton (Plot B)	07/00499/FUL	Employment	1.12	100%
Land at Pennyfields Road, Newchapel	KG13	Residential	1.85	100%
Land at Newchapel Road, Newchapel	KG12	Residential	2.52	100%
Clayton Road, Clayton	WL7	Residential	3.69	100%
Land south east of Keele University	KL14	Residential	26.25	100%
Former Keele Municipal Golf Course	SP11	Residential	81.01	100%
Ash Way, Seabridge (Seabridge Centre)	WL9	Residential	2.40	100%

Clough Hall Playing Fields, Talke	BL18	Residential	13.25	100%
Land off Whitmore Road, Seabridge	TB19	Residential	45.31	100%
Land of St Martins Road, Talke	TK17	Residential	4.69	100%

Recommendation E - Should be allocated on flood risk grounds subject to consultation with the LPA / LLFA

This recommends that development should be allocated on flood risk grounds, based on the evidence provided within this SFRA. Further investigation may be required by the developer and an FRA is required to assess flood risk in detail at a site-specific level.

Recommendation E applies to any site with its area 100% within Flood Zone 1 and with either no risk or minimal risk from surface water, based on the Risk of Flooding from Surface Water map

As discussed previously for other recommendations, a precautionary approach to accounting for climate change should be considered. For these 8 sites, the SFRA Maps in Appendix A should be consulted to ascertain which sites are in close proximity to Flood Zones 2 and 3a and may therefore be at risk from either flood zone in 100 years' time.

Table 8-7: Sites which should be allocated subject to consultation with the LPA and LLFA

Site ID	Site Name	Proposed use	Site Area (ha)
14/00806/FUL	Unit 1 Valley Park, Watermills Roads, Chesterton	Employment	0.10
15/00190/FUL	Keele University Science and Business Park IC5, Plot 5, Keele	Employment	0.88
14/00205/FUL	Unit 1 Valley Park, Watermills Roads, Chesterton	Employment	0.22
TK2	Thomas Street, Talke	Residential	0.41
TC3	Liverpool Road, Cross Heath (Bus Depot)	Residential	0.82
SB8	Land between Seabridge Lane and Roe Lane Playing Fields, Westlands	Residential	0.18
KS24	Land south of St Bernard's Rd	Residential	0.20
KS25	Land off Camillus Rd, Knutton	Residential	0.20

Strategic recommendation summary

Table 8-8 summaries the strategic recommendations made for the sites at fluvial and tidal flood risk. Table 8-9 lists the number of sites to which each strategic recommendation applies.

Table 8-8: Summary of strategic recommendations

Recommendation	Outcome	Reasons
A	Consider Withdrawal of Site	10% or greater of the site footprint is within Flood Zone 3b The scale of surface water risk on the site is considered large enough that possible mitigation of the risk on site is deemed unlikely to be achievable
B	Exception Test	10% or greater of the footprint of any residential site or essential infrastructure site is within Flood Zone 3a
C	Consider site layout and design	Less than 10% of the footprint of the area of any site type is within Flood Zone 3b Less than 10% of the footprint of any residential site is within Flood Zone 3a
D	Development could be allocated subject to FRA	Any site within Flood Zone 2 that does not have any part of its footprint within Flood Zone 3a Employment sites within Flood Zone 3a assuming the site use falls within the less vulnerable or water-compatible category of the flood risk vulnerability classification of the FRCC-PPG. No part of the site can be within Flood Zone 3b Any site 100% within Flood Zone 1 where surface water flood risk is apparent on site and therefore recommended for investigation through a site-specific FRA. Any site 100% within Flood Zone 1 that is greater than or equal to 1 hectare in area
E	Should be allocated on flood risk grounds subject to consultation with the LLFA	Any site 100% within Flood Zone 1 that is less than or equal to 1 hectare in area and has no surface water flood risk issues.

Table 8-9: Number of sites per strategic recommendations

Site/Proposed use	Strategic Recommendation				
	A	B	C	D	E
Residential	0	1	1	12	5
Employment	0	1	1	8	3
Total	**0**	**2**	**2**	**20**	**8**

Rejection of site

A site which fails to pass the Sequential Test and / or the Exception Test should be rejected. Rejection would also apply to any residential (including gypsy and traveller) or employment site, or mixed-use schemes with an element of residential development, as this falls into the more vulnerable, less vulnerable or highly vulnerable categories within Flood Zone 3b for which development should not be permitted. The Flood Risk and Coastal Change PPG flood risk vulnerability classification states that only water-compatible uses and essential infrastructure should be permitted in Flood Zone 3b, though any essential infrastructure must pass the Exception Test and clearly demonstrate that it does not increase or exacerbate flood risk. If the developer is able to avoid 3b, part of the site could still be delivered, as part of the Exception Test.

In terms of surface water flood risk, if risk is considered significant or where the size of the site does not allow for on-site storage or application of appropriate SuDS then such sites could be rejected. There are 5 sites which require further investigation as they are at significant risk of

surface water which can be seen in Table 8-10 however if appropriate SuDS or on-site storage is acceptable these sites may not be rejected.

Exception Test required

For those sites that, according to the FRCC-PPG vulnerability tables, would require the Exception Test. Only water-compatible and less vulnerable uses of land would not require the Exception Test in Flood Zone 3a. More vulnerable uses, including residential, and essential infrastructure are only permitted if the Exception Test is passed and all development proposals in Flood Zone 3a must be accompanied by a Flood Risk Assessment. To avoid having to apply the Exception Test, the developer / LPA should attempt to avoid the risk area altogether.

Consideration of site layout and design

Site layout and site design is important at the site planning stage where flood risk exists. The site area would have to be large enough to enable any alteration of the developable area of the site to remove development from the functional floodplain, or to leave space for on-site storage of flood water within Flood Zone 3a. Careful layout and design at the site planning stage may apply to such sites where it is considered viable based on the level of risk. Surface water risk and opportunities for SuDS should also be assessed during the planning stage. Developers should refer to the Staffordshire County Council Local Standards for Sustainable Drainage which provides details when and where SuDS are required.

Depending on local circumstances, if it is not possible to adjust the site boundary to remove the site footprint from Flood Zone 3b to a lower risk zone then development should not be permitted. If it is not possible to adjust the developable area of a site to remove the proposed development from Flood Zone 3a to a lower risk zone or to incorporate the on-site storage of water within site design, then the Exception Test would have to be passed as part of a site-specific Flood Risk Assessment.

Any site layout and design options should take account of the 8-metre easement buffer along watercourses, from the top of the bank or the landward toe of a defence on main rivers, where development is not permitted. This easement buffer is recommended by the EA to allow ease of access to watercourses for maintenance works. Any site redesign, where Flood Zone 3a is included within the site footprint, should allow water to flow naturally or be stored in times of flood through application of appropriate SuDS techniques, as per the Staffordshire County Council Local Standards for Sustainable Drainage.

Site-Specific Flood Risk Assessment

According to the FRCC-PPG (Para 030), a site-specific FRA is:

"…carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 20 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2 – Flood Risk Vulnerability of PPG)."

The FRCC-PPG doesn't contain any further detail on the minimum requirements for site-specific FRAs. It is therefore important that the EA's FRA guidance is referred to and also the site-specific Flood Risk Assessment Checklist in paragraph 068 of the FRCC-PPG should be consulted. CIRIA's report 'C624 Development and Flood Risk' also provides useful guidance.

According to NPPF footnote 20, a site-specific FRA should be prepared when the application site is:

- Situated in Flood Zone 2 and 3; for all proposals for new development (including minor development and change of use)
- 1 hectare or greater in size and located in Flood Zone 1
- Located in Flood Zone 1 where there are critical drainage problems
- At risk of flooding from other sources of flooding, such as those identified in this SFRA
- Subject to a change of use to a higher vulnerability classification which may be subject to other sources of flooding

The LPA may also like to consider further options for stipulating FRA requirements, such as:

- Situated in an area currently benefitting from defences
- Situated within 20 metres of the bank top of a Main River
- Situated over a culverted watercourse or where development will require controlling the flow of any river or stream or the development could potentially change structures known to influence flood flow

These further options should be considered during the preparation and development of the Local Plan

Sites passing the Sequential and Exception Tests

Development sites can be allocated where the Sequential Test and the Exception Test (if required) are passed. This Level 1 SFRA informs the Sequential Test. If the Exception Test is required, further and more detailed work would be needed as part of a Level 2 SFRA.

All development proposals within flood zones 2 or 3 must be accompanied by a Flood Risk Assessment. Any sites 100% within Flood Zone 1 that are 1 hectare or more in area must be accompanied by a Flood Risk Assessment to determine vulnerability to flooding from other sources as well as fluvial. The FRA should determine the potential of increased flood risk elsewhere as a result of the addition of hard surfaces on-site and the effect of new development on surface water runoff.

The Flood Risk and Coastal Change PPG states:

"Local authorities and developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally." (Paragraph 50).

8.1.2 Surface Water Risk to Potential Sites

This section assesses surface water risk to each of the 32 proposed development sites according to the RoFSW. The Development Site Screening spreadsheet in Appendix B isolates each of the surface water outlines so that any area of a site within the higher risk 1 in 30 year outline is excluded from the medium risk 1 in 100 year outline and any area within the 1 in 100 year outline is excluded from the lower risk 1 in 1000 year outline. This allows a sequential assessment of risk at each site. Table 8-10 shows the number of sites at risk for each event. A number of these sites are also at fluvial flood risk.

NOTE: This assessment of surface water risk to sites DOES NOT take account of local circumstances, only that part of a site area falls within a surface water flood outline of the updated Flood Map for Surface Water.

Table 8-10 displays a count of sites that have any area falling within a RoFSW event outline. Additionally, it details the number of these sites where the risk of surface water flooding is considered to be significant enough that it may be difficult to develop these sites and where further work as part of a Level 2 SFRA may be beneficial. This is based on a percentage threshold of the site area that may lie within each event outline. Similarly to fluvial flooding, sites within the higher risk outlines tend to be contained within the lower risk outlines and included in the count.

Table 8-10: Number of sites at risk from surface water flooding

RoFSW event outline	Number of sites at risk	Number of sites with >10% for 30 & 100 yrs. >20% for 1000yrs area at risk
1 in 30 year	19	1
1 in 100 year	22	1
1 in 1000 year	24	2
In reality, sites within the 1 in 30-year outline will also be in the 1 in 100-year outline and those within the 1 in 100-year outline will also be in the 1000-year outline.		

Of the 19 sites at risk from the higher risk 1 in 30-year event, 1 site has 10% or more of its site area at risk. 1 sites has 10% or more of its area at risk from the medium risk 1 in 100-year event and for the lower risk 1 in 1,000-year extreme event, 2 sites have 20% or more of their area at risk.

As explained with the fluvial flood zones, the percentage thresholds are not included within any policy, it is merely considered that where a site has 10% or greater of its area at risk from the 1 in 30 or 1 in 100 year event outlines, or 20% or greater for the 1 in 1000 year event, then it could prove difficult to manage this surface water on-site. Therefore, a site-specific FRA should be carried out to investigate possible surface water flood mitigation measures. The percentage thresholds do not consider local conditions. Table 8-11 lists the sites where surface water flood risk is considered to be significant enough that it may be difficult to develop these sites.

Table 8-11: Sites requiring further investigation based on surface water risk

Site ID	Site Name	Proposed use	Site Area (ha)	% Area within 1 in 30 Year Outline (RoFSW)	% Area within 1 in 100 Year Outline (RoFSW)	% Area within 1 in 1000 Year Outline (RoFSW)
NL10	Former Wolstanton Colliery Stock Yard, West Ave, Wolstanton	Employment (use unknown)	1.62	1%	2%	31%
KG12	Land at Newchapel Road, Newchapel	Residential	2.52	22%	33%	39%

For sites at surface water flood risk the following should be considered:

- Possible withdrawal, redesign or relocation of the site, certainly for those sites at higher risk from the 1 in 30-year event and those with a large percentage area at risk. This applies to the sites listed in Table 8-11 where further investigation is recommended;
- A detailed site-specific Flood Risk Assessment incorporating surface water flood risk management;
- A FRA may want to consider detailed surface water modelling, particularly for the larger sites which may influence sites elsewhere;
- The size of development and the possibility of increased surface water flood risk caused by development on current Greenfield land, and cumulative impacts of this within specific areas;
- Management and re-use of surface water on-site, assuming the site is large enough to facilitate this and achieve effective mitigation;
- Larger sites could leave surface water flood prone areas as open greenspace, incorporating social and environmental benefits;
- Effective surface water management should ensure risks on and off site are controlled;
- SuDS should be used where possible. Appropriate SuDS may offer opportunities to control runoff to Greenfield rates. Developers should refer to the Staffordshire County Council Local Standards for Sustainable Drainage. Restrictions on surface water runoff from new development should be incorporated into the development planning stage. For brownfield sites, where current infrastructure may be staying in place, then runoff should attempt to mimic that of Greenfield rates, unless it can be demonstrated that this is unachievable or hydraulically impractical;
- Whether the delineation of areas of critical drainage may be appropriate for areas particularly prone to surface water flooding. Detailed analysis and consultation with the LLFA, STW and the EA would be required. It may then be beneficial to carry out a Surface Water Management Plan (SWMP) or drainage strategy for targeted

locations with any such areas of critical drainage. Investigation into the capacity of existing sewer systems would be required in order to identify critical parts of the system. Drainage model outputs could be obtained to confirm the critical parts of the drainage network and subsequent recommendations could then be made for future development i.e. strategic SuDS sites, parts of the drainage system where any new connections should be avoided, and parts of the system that may have any additional capacity and recommended runoff rates.

8.1.3 Climate change

This assesses the climate change risk to each site according to the climate changes outlines created as part of this SFRA. Planners should also consider whether there is a significant increase in flood risk due to climate change, using the maps in Appendix A and Development Site Screening in Appendix B, and how much of the site is affected. 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. Table 8-12 sets out which sites are at increasing risk due to climate change from river flooding and shows how this risk might increase, depending on which emissions scenario is taken into account. A number of these sites are also at surface water flood risk.

In order to take account of the implications of climate change, "a sequential approach should be used in areas known to be at risk now or in the future from any form of flooding" (NPPF, paragraph 158). It is not uncommon that the modelled Flood Zone 3a plus climate change outline can be more extensive than present day Flood Zone 2, and may even intrude into Flood Zone 1. Sites or opportunities in these areas have the potential to not be considered in the application of the Sequential Test.

NOTE: This assessment of climate change risk to sites DOES NOT take account of local circumstances, only that part of a site area falls within a Climate change flood outline of the Climate Change outline created as part of this SFRA.

Table 8-12: Number of sites at risk from climate change

Climate change event outline	Number of sites at risk	Number of sites with >10%
Within 100-year Climate Change Central	4	0
Within 100-year Climate Change Higher Central	4	0
Within 100-year Climate Change Upper End	4	2
Total	**4**	**2**

Table 8-12 summarises the number of sites at risk from each climate change allowance. Of the 32 sites, 4 sites are at risk of flooding from the three SFRA Climate Change outlines. Of the 4 sites at risk from only 2 sites have 10% or more of their site area at risk.

Existing Environment Agency hydraulic models were run for the 2080's period for all three allowance categories to create the SFRA Climate Change outputs. Where there is no existing EA model at the time of writing of this SFRA, there is no data within the Climate Change outline. This does not mean there is no risk of flooding only that there is insufficient data to predict the effect of climate change.

Where there are climate change outputs (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 Flood Zone 3a and Flood Zone 2, because it has been calculated using broadscale modelling. Should a site be within any of the Climate Change outlines, a Level 2 SFRA or FRA is recommended that can explore in greater detail the impact of climate change in relation to the Flood Zones. Table 8-13 compares the sites where Climate Change is considered to be significant enough that further investigation is required with Flood Zone 3b.

Table 8-13: Comparison of the sites with Flood Zone 3b with the three climate change allowances

Site	Site number	Within Flood Zone 3b Outline	Within 100-year Climate Change Central	Within 100-year Climate Change Higher Central	Within 100-year Climate Change Upper End
Land between Lower Milehouse Lane and Brymbo Road	NL21	8%	8.98%	9.02%	13.84%
Land west of Loomer Road, Holditch	HD14	5.94%	5.94%	5.94%	5.96%
Rowhurst Close	NL36	2%	3.77%	3.95%	4.48%
London Road, Chesterton	HD12	0.16%	0.24%	0.24%	17.26%

Three sites have been identified at being at future risk and currently have red line boundaries that encompass areas of functional floodplain (flood zone 3b). For example, 8.98% of Land between Lower Milehouse Lane and Brymbo Road will be at risk from the 100-year central climate change allowance, whilst in the 100 year higher central band, 9.02% of the site will be at future flood risk with an envisaged 13.84% of the site at risk in the 100-year upper end climate change allowance.

For sites at future flood risk, taking into account the impacts of climate change, the following recommendations should be considered:

- Possible withdrawal, redesign or relocation of the site for those sites at upper end or higher central climate change flood risk and those with a large percentage area at risk. This applies to the sites listed in Table 8-13 where further investigation is recommended;
- Undertake an appropriately detailed flood risk assessment to help evaluate flood risk over the lifetime of the development and to ensure that the risk and proposed mitigation are sufficient for the proposed use with no increased flood risk elsewhere.
- Demonstrate that the design, fabric and structure of the building/s are sufficiently resilient to withstand a climate change flood event and appropriate for use on the site.
- If a site is affected by the climate change Higher Central or Upper End allowances, the site should give precedence to developing areas at lesser risk of flooding and site buildings should be located where the depth/velocity and hazard ratings are shown to be low.
- Raise finished floor levels to above the required design flood level, depending on the flood risk vulnerability and the lifetime of the development, with adequate freeboard and to incorporate safe access and egress routes and resilience / resistance measures, where necessary.

9 Cumulative impact of development and strategic solutions

This section considers the cumulative impact that development may have on flood risk and opportunities for future development to contribute towards strategic solutions to manage flood risk.

Under the revised 2019 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.

The cumulative impact of development should be considered at the planning application and development design stages and the appropriate mitigation measures undertaken to ensure flood risk is not exacerbated, and where possible, the development should be used to improve flood risk. Conditions imposed by Newcastle-under-Lyme Borough Council should allow for mitigation measures so any increase in runoff as a result of development is properly managed and should not exacerbate flood risk issues, either within, or outside of the Council's administrative area.

9.1.1 Cross-boundary issues

Figure 9-1 shows the catchments covering the Borough mapped against the topography. This shows that Newcastle-under-Lyme's catchments largely drain out into other local authorities. Consequently, development in Newcastle-under-Lyme is more likely to have the potential to increase flood risk outside of the Borough, rather than development in other local authority areas affecting the Borough. The boundaries with the other Local Authorities are shown on Figure 9-2.

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.

Policy recommendations with regards to managing the cumulative impact of development have been made in Section 13. This will help to ensure there is no incremental increase in flood risk both within and downstream of the Newcastle-under-Lyme Borough.

The Newcastle-under-Lyme Borough has boundaries with the following Local Authorities, which can be seen on Figure 9-2:

- City of Stoke-on-Trent
- Staffordshire Moorlands District
- Stafford
- Cheshire East
- Shropshire

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments 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 Newcastle-under-Lyme.

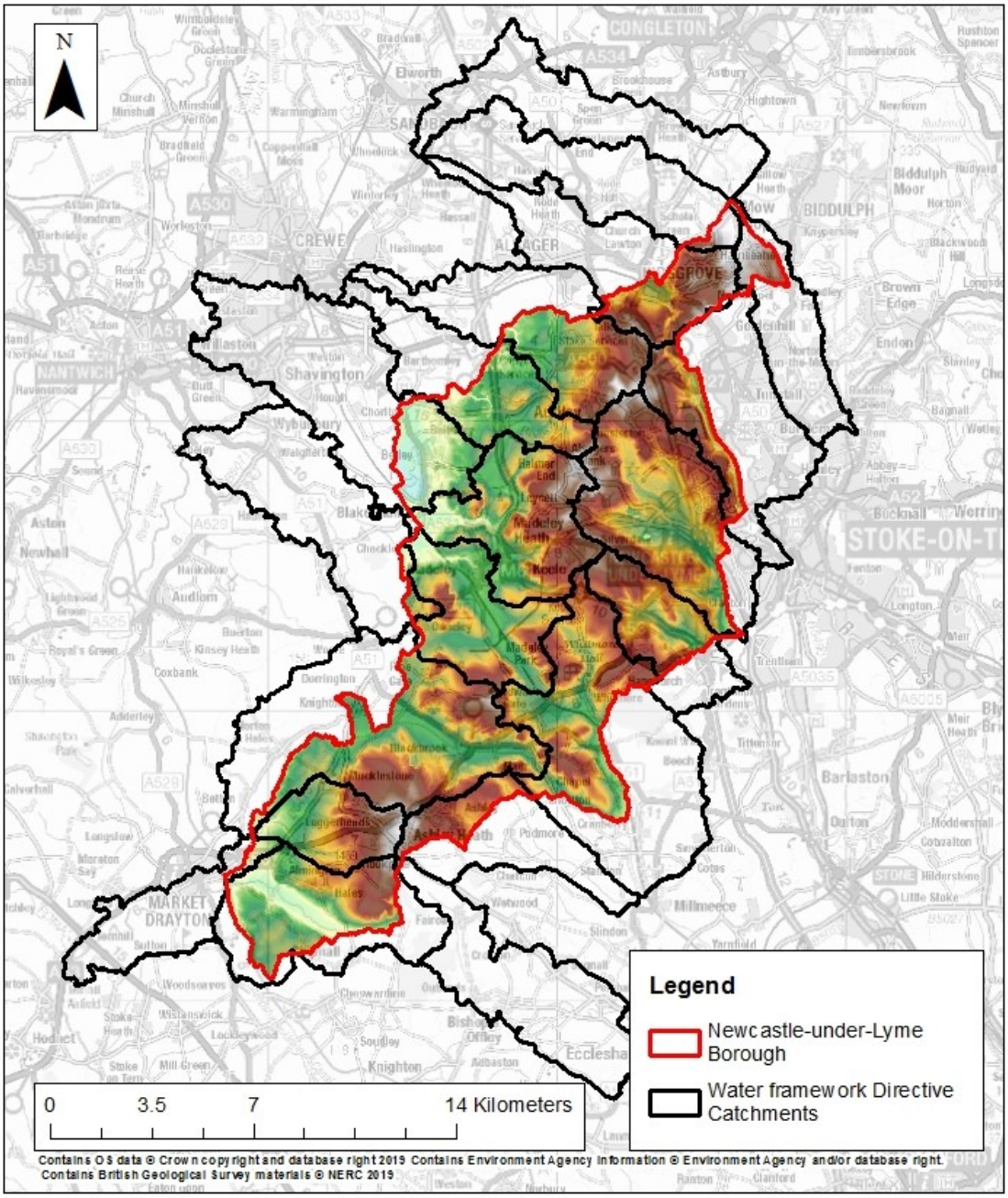


Figure 9-1: Elevation and surrounding river catchments.

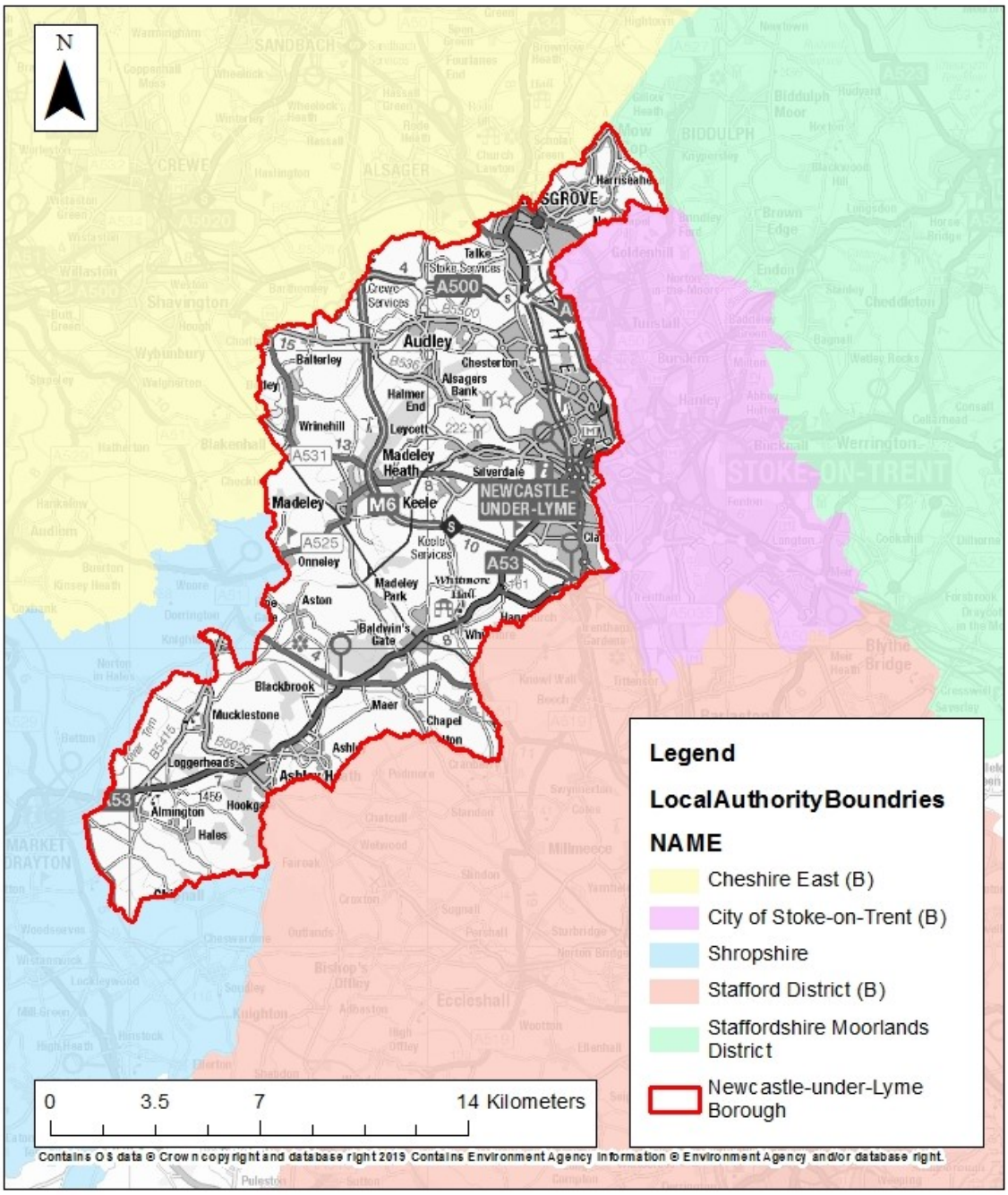


Figure 9-2: Surrounding Authorities.

9.2 Strategic solutions

The Risk Management Authorities have a collective vision for the future management of flood risk and drainage in the study area. 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.

Section 3.5 sets out the strategic plans that exist for the Borough. The list below summarises the key outcomes theses are seeking to achieve that are relevant to new development and the planning system.

- 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, 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,
- Ensuring communities are prepared for flood events (and that the residual risk to new developments has been considered and planned for),
- 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, and
- 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.

9.2.1 Natural flood management

Natural flood management (NFM) or Working with Natural Processes (WwNP) is a type of flood risk management used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood and coastal erosion risk. WwNP has the potential to provide environmentally sensitive approaches to minimising flood risk, to reduce flood risk in areas where hard flood defences are not feasible and to increase the lifespan of existing flood defences. NFM and WwNP are used interchangeably in the UK though the term NFM will be used throughout this report.

A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes in order to store or slow down flood waters before they can damage flood risk receptors (e.g. people, property, infrastructure, etc.). NFM involves taking action to manage flood and coastal erosion risk by protecting, restoring and emulating the natural regulating functions of catchments, rivers, floodplains and coasts. Techniques and measures, which could be applied in Newcastle-under-Lyme include:

- Peatland and moorland restoration in upland catchments
- Offline storage areas
- Re-meandering streams
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS

Both the European Commission and UK Government are actively encouraging the implementation of NFM measures within catchments and coastal areas in order to assist in the delivery of the requirements of various EC Directives relating to broader environmental protection and national policies. It is fully expected that the sustained interest in NFM implementation across the UK will continue in the post-Brexit era as a fundamental component of the flood risk management tool kit.

Evidence base for NFM to reduce flood risk

There has been much research on NFM, but it has never been synthesised into one location. This has meant that it has been hard for flood risk managers to access up-to-date information on NFM measures and to understand their potential benefits. The EA has now produced the NFM evidence base.

Mapping showing the potential for NFM can be found at the following website. These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them. There are limitations with the maps, however it is a useful tool to help start dialogue with key partners.

The effectiveness of NFM measures is site-specific and depends on many factors, including the location and scale at which they are used. It may not always be possible to guarantee that these measures alone will deliver a specified standard of defence. Consequently, flood risk management measures should be chosen from a number of options ranging from traditional forms of engineering through to more natural systems. The research gaps that need to be addressed to move NFM into the mainstream are identified in the evidence directory.

9.2.2 Cumulative Impact Assessment

A cumulative impact assessment was undertaken for the SFRA. This considered urban catchments at highest risk of localised flooding, rural villages at high and low flood risk and the implications of significant localised new development in specific new settlements. The findings from this assessment can be used to support a tiered approach to flood risk assessment and planning, with bespoke policy depending on the location of the development. It can be used to identify catchments that may need further consideration at a Level 2 SFRA, assessing more specific areas or in more detail, at an individual site level.

The cumulative impact assessment considers historic flood risk in each river catchment (as identified in Figure 9-1) through historic records held by the LLFA. Alongside this, predicted surface water flood extents from the 100-year and 1000-year surface water flood events were used to determine the number of properties in each catchment at risk of flooding due to increased flood risk from upstream as a result of increased development within the catchment. Catchments labelled as high risk are identified as those at the greatest combined risk.

High risk catchments identified in the Cumulative Impact Assessment can be found in Figure 9-3. These include:

- Lyme Brook
- Ford Green Brook
- Park Brook
- Chatcull Brook

The policy recommendations regarding this cumulative impact assessment can be found in Section 13.

Specific policies relate to:

- Largely urban catchments draining towards Stoke
- Kidsgrove
- Ashley Heath: This village is located within a high-risk catchment (Chatcull Brook from Source to Meece Brook).
- Lower risk catchments
- Those that are applicable to all catchments Borough wide (including the lower risk ones)

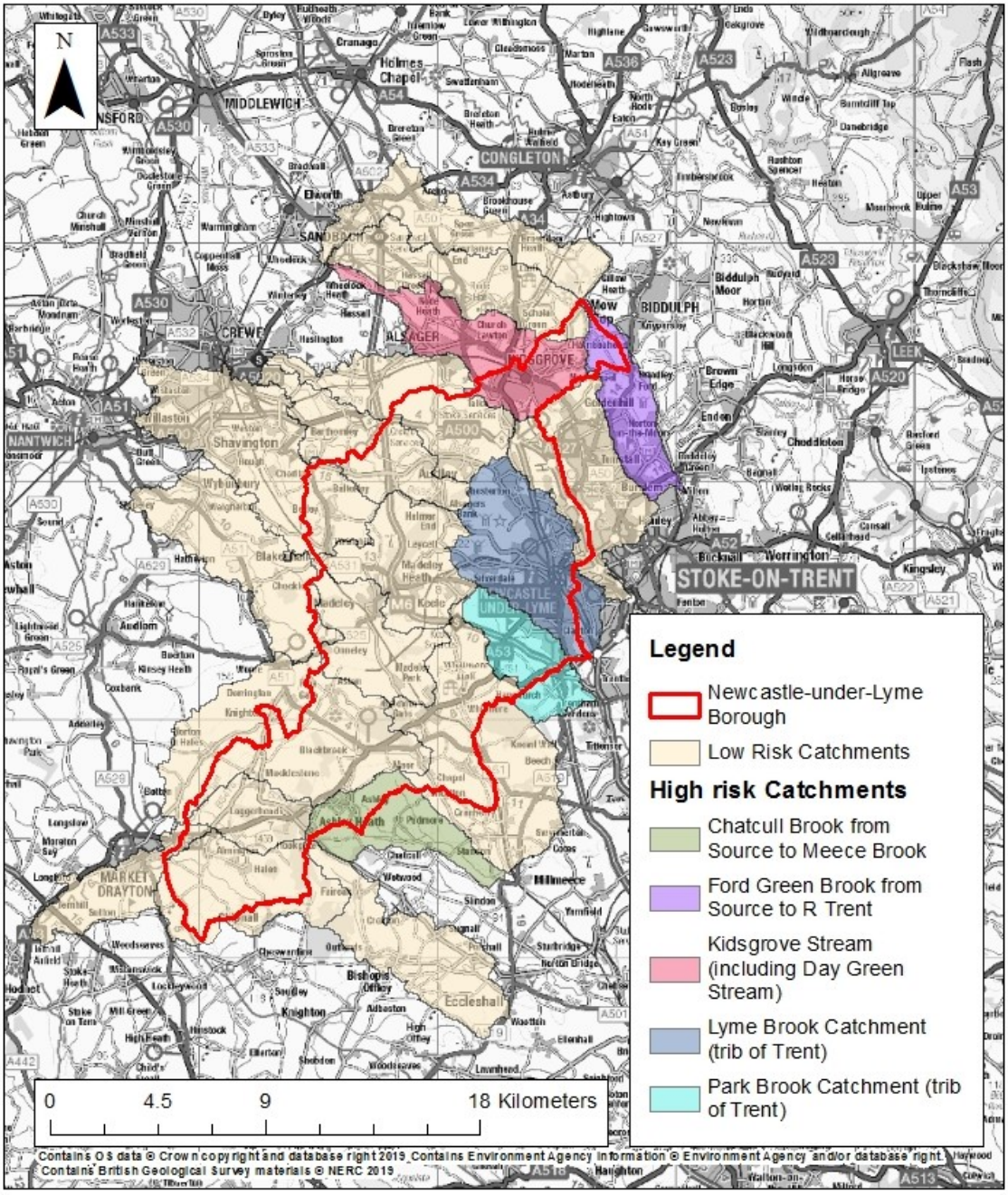


Figure 9-3: High risk catchments in Newcastle-under-Lyme

10 Guidance for Developers

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and strategic documents and flood risk responsibilities.

This section 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 Newcastle. 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.

This SFRA provides the evidence base for developers to assess flood risk at a strategic level and to determine the requirements of an appropriate site-specific FRA.

The aim of this section is to provide guidance for developers on using this SFRA.

When initially considering the development options for a site, developers should use this SFRA, the NPPF and the Planning Practice Guidance to:

- ***Identify whether the site is***
    - *A windfall development, allocated development, within a regeneration area, single property or subject to a change of use to identify if the Sequential and Exception Tests are required.*
- ***Check whether the Sequential Test and / or the Exception Test have already been applied***
    - *Request information from the LPA on whether the Sequential Test and whether applicable the Exception Test, have been assessed;*
    - *If not, provide evidence to the LPA that the site passes the Sequential Test*
    - *Where the Exception Test applies, all developers will need to prove that the site passes the Test at planning application stage, even if it has already been applied at allocation stage*
- ***Consult with the LPA Development Control, the LLFA and the EA and the wider group of flood risk consultees, where appropriate, to scope an appropriate FRA if required***
    - *Guidance on FRAs provided this SFRA;*
    - *Also refer to the EA Standing Advice, CIRIA Report C624, Staffordshire SUDS Handbook, the NPPF and the Planning Practice Guidance;*
    - *Consult LLFA (Staffordshire County Council).*
- ***Submit FRA to Development Control and the EA for approval, where necessary***

Table 10-1 identifies, for developers, when the Sequential and Exception Tests are required for certain types of development and who is responsible for providing the evidence and those who should apply the tests if required.

Table 10-1: Development types and application of Sequential and Exception Tests for developers

Development	Sequential Test Required	Who Applies the Sequential Test?	Exception Test Required?	Who Applies the Exception Test?
Allocated Sites	No (assuming the development type is the same as that submitted via the allocations process)	LPA should have already carried out the test during the allocation of development sites	Dependent on land use vulnerability	The developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Windfall Sites	Yes	Developer provides evidence, to the LPA that the test can be passed. An area of search will be defined by local circumstances relating to the catchment and for the type of development being proposed	Dependent on land use vulnerability	The developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Regeneration Sites Identified Within Local Plan	No	-	Dependent on land use vulnerability	The developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Redevelopment of Existing Single Properties	No	-	Dependent on land use vulnerability	The developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA
Changes of Use	No (except for any proposal involving changes of use to land involving a caravan, camping or chalet site	Developer provides evidence, to the LPA that the test can be passed	Dependent on land use vulnerability	The developer must provide evidence that the test can be passed by providing planning justification and producing a detailed FRA

10.1.1 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.

Having first applied the Sequential Test, 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, Staffordshire County Council as LLFA and the relevant water and sewerage company 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

This 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 latest 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.

Section 10.3.8 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 (Section 4.3.1).

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.

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 across the Borough

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 can be found in Section 9.2. Developers must demonstrate in an FRA how they are contributing towards this vision.

10.1.2 Requirements for site-specific Flood Risk Assessments

10.1.3 Site-Specific Flood Risk Assessment

According to the FRCC-PPG (Para 030), a site-specific FRA is:

"…*carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 20 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2 – Flood Risk Vulnerability of PPG).*"

10.1.4 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.

10.1.5 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 Staffordshire County Council. 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);and
- Site-specific Flood Risk Assessment: CHECKLIST (NPPF PPG, Defra)
- 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.

The FRCC-PPG doesn't contain any further detail on the minimum requirements for site-specific FRAs. It is therefore important that the EA's FRA guidance is referred to and also the site-specific Flood Risk Assessment Checklist in paragraph 068 of the FRCC-PPG should be consulted. CIRIA's report 'C624 Development and Flood Risk' also provides useful guidance.

10.2 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.

10.2.1 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.

10.2.2 Raised floor levels

If raised floor levels are proposed, these should be agreed with Newcastle-under-Lyme Borough Council 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 Section 6 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.

10.2.3 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 Section 5.

10.2.4 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). Further information can be found about where strategic flood risk solutions are being planned in Section 9.2.

10.2.5 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 replied on. The effectiveness of these forms of measures are often dependant 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.

10.3 Reducing flood risk from other sources

10.3.1 Ground Water

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.

Susceptibility to groundwater flooding is partially influenced by underlying or superficial geology and by soil cover. Some areas of the borough are overlain by more permeable soils where infiltration drainage could be a suitable measure for mitigation of groundwater flooding.

However, 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.

10.3.2 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.

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.

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.

10.3.3 Canals

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

10.3.4 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 Stoke and Staffordshire 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

10.4 Permits and consents for undertaking work to watercourses

Under the Environmental Permitting Regulations 2016 certain works within 8m of a main river, or within 8m of any flood defence structure on or within the floodplain of a main river, require a Flood Risk Activity Permit from the Environment Agency. You can find more information on permit requirements using the following link: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits. If a permit is required, it must be obtained prior to beginning the works.

Under the Land Drainage Act 1991 certain types of work within a ordinary watercourse may not be permitted due to the potential increase in flood risk. Staffordshire County Council have guidance on their website setting out where consents will be required for works that could affect flows in watercourses.

10.5 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 2019 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 Stoke and Staffordshire LRF 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 also available from:

- The National Planning Policy Guidance

- The Environment Agency and DEFRA's standing advice for FRAs
- Staffordshire County Council's "Preparing for emergencies"
- 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

When is a Site-Specific FRA Required?

According to NPPF footnote 20, a site-specific FRA should be prepared when the application site is:

- Situated in Flood Zone 2 and 3; for all proposals for new development (including minor development and change of use)
- 1 hectare or greater in size and located in Flood Zone 1
- Located in Flood Zone 1 where there are critical drainage problems
- At risk of flooding from other sources of flooding, such as those identified in this SFRA
- Subject to a change of use to a higher vulnerability classification which may be subject to other sources of flooding

The LPA may also like to consider further options for stipulating FRA requirements, such as:

- Situated in an area currently benefitting from defences
- Situated within 20 metres of the bank top of a Main River
- Situated over a culverted watercourse or where development will require controlling the flow of any river or stream or the development could potentially change structures known to influence flood flow

These further options should be considered during the preparation and development of the Local Plan

11 Surface water management and SuDS

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and consequently a potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure. Managing surface water discharges from new development is therefore crucial in managing and reducing flood risk to new and existing development downstream. Carefully planned development can also play a role in reducing the amount of properties that are directly at risk from surface water flooding.

As previously noted, Staffordshire County Council has a Local SuDS Handbook a specific appendix which should be referred to alongside this SFRA (Appendix G).

The FWMA, 2010, originally transferred the adoption and maintenance of SuDS to Sustainable Drainage Systems Approval Bodies (SABs) that were supposed to be established by local authorities, or LLFA's, under Schedule 3 of the Act. However, the designation of a SAB has since been removed following lengthy consultation, with the announcement from the Department for Communities and Local Government (DCLG) in December 2014 that local planners will be responsible for delivering SuDS. Changes to planning legislation give provisions for major applications of ten or more residential units or equivalent commercial development to require sustainable drainage within the development proposals in accordance with the non-statutory technical standards for sustainable drainage systems, published in March 2015. This builds on the existing planning system, the NPPF, which developers and local authorities are already using. Policy changes to the planning system can also be introduced relatively quickly ensuring that flood risk benefits from sustainable drainage systems can be brought forward as part of planning application proposals.

The NPPF continues to reinforce how planning applications that fail to deliver SuDS above conventional drainage techniques could be rejected and sustainable drainage should form part of integrated design secured by detailed planning conditions so that the SuDS to be constructed must be maintained to a minimum level of effectiveness.

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

In April 2015 Staffordshire County Council was 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.

When considering planning applications, Staffordshire County Council will provide advice NULBC on the management of surface water. As LPA, NULBC 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.

11.2 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 11-1), will be required, where source control is the primary aim.

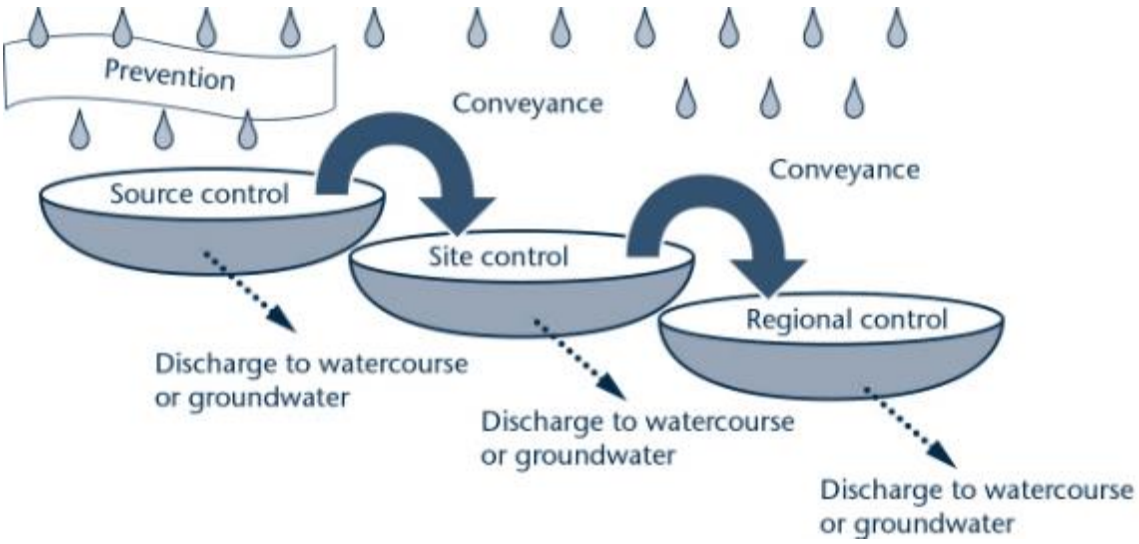


Figure 11-1: SuDS Management Train Principles

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.

11.3 Sources of SuDS guidance

11.3.1 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.

11.3.2 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.

11.3.3 Staffordshire County Council SUDS Handbook

Staffordshire County Council have worked in partnership with eight other West Midlands LLFA 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. Staffordshire County Council have widely consulted with other RMAs when preparing the document to ensure their views have been taken into account.

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 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:

- The position of walls, bunds and other obstructions that may direct water but must not cause ponding
- 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 design and operation guide, (C689).

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.

11.4 Other surface water considerations

11.4.1 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. There are various levels of groundwater vulnerability within the borough. In the southwest region, near Ashley Heath there is high vulnerability to a major aquifer. Minor aquifers are vulnerable to groundwater pollution in the northern area of the borough with vulnerability levels ranging from high to low.

The groundwater vulnerability maps should be considered when designing SuDS. Whilst areas overlain by permeable soil are more suitable for infiltration drainage measures, they may lie in areas of high vulnerability to aquifer groundwater pollution. 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.

11.4.2 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 seen in Figure 11-2.

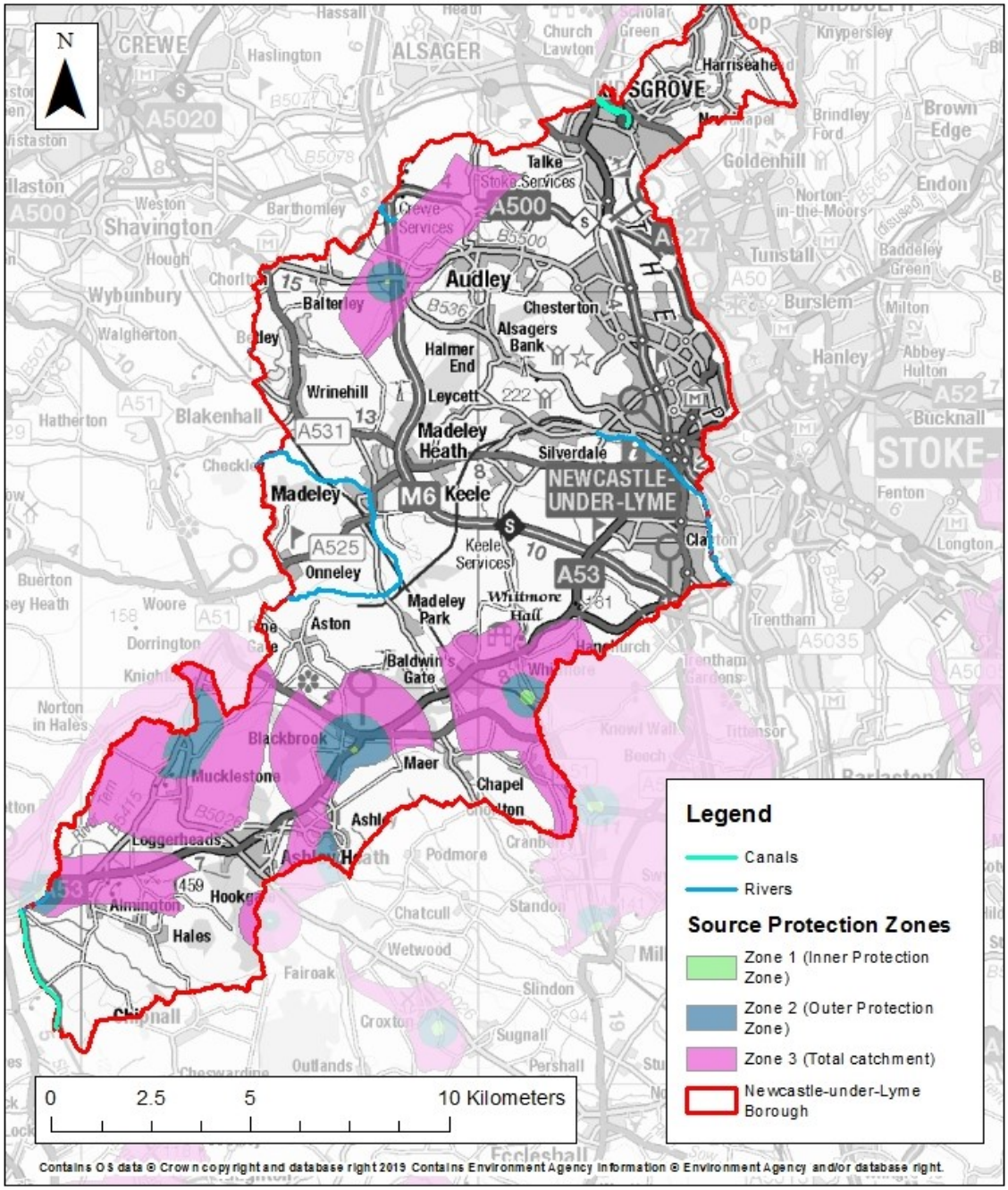


Figure 11-2: Groundwater Source Protection Zones

11.4.3 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. Newcastle-under-Lyme is part of a surface water NVZ and the south western part of the borough is in a groundwater NVZ. Additionally, Betley mere is within a eutrophic water NVZ as a eutrophic lake.

12 Emergency Planning

The provisions for emergency planning for local authorities as Category 1 responders are set out by the Civil Contingencies Act, 2004 and the National Flood Emergency Framework for England, December 2014. This framework is a resource for all involved in emergency planning and response to flooding from the sea, rivers, surface water, groundwater and reservoirs. The Framework sets out the Government's strategic approach to:

- Ensuring all delivery bodies understand their respective roles and responsibilities when planning for and responding to flood related emergencies,
- Give all players in an emergency flooding situation a common point of reference which includes key information, guidance and key policies,
- Establish clear thresholds for emergency response arrangements,
- Place proper emphasis on the multi-agency approach to managing flooding events,
- Provide clarity on the means of improving resilience and minimising the impact of flooding events,
- Provide a basis for individual responders to develop and review their own plans, and
- Being a long-term asset that will provide the basis for continuous improvement in flood emergency management.

Along with the EA flood warning systems, there are a range of flood plans at a sub-regional and local level, outlining the major risk of flooding and the strategic and tactical response framework for key responders.

This SFRA contains useful data to allow emergency planning processes to be tailored to the needs of the area and be specific to the flood risks faced. The SFRA Maps in Appendix A, Appendix E and accompanying GIS layers should be made available for consultation by emergency planners during an event and throughout the planning process.

12.1 Civil Contingencies Act

Under the Civil Contingencies Act (CCA, 2004), Newcastle-under-Lyme Borough Council is classified as a Category 1 responder and has duties to assess the risk of emergencies occurring, and uses this to:

- inform contingency planning;
- put in place emergency plans;
- put in place Business continuity management arrangements;
- put in place arrangements to make information available to the public about civil protection matters;
- maintain arrangements to warn, inform and advise the public in the event of an emergency;
- share information with other local responders to enhance coordination;
- cooperate with other local responders to enhance coordination and efficiency and to provide advice and assistance to businesses and voluntary organisations about business continuity management.

During an emergency such as a flood event, the local authority must also co-operate with other Category 1 responders (such as the emergency services and the EA) to provide the core response.

12.1.1 Local Flood Plans

This SFRA provides a number of flood risk data sources that should be used when producing or updating flood plans. Newcastle-under-Lyme Borough Council will be unable to write specific flood plans for new developments at flood risk. Developers should write their own. Guidance can be found on the government web site. Generally, owners with individual properties at risk should write their own individual flood plans, however larger developments or regeneration areas, such as retail parks, hotels and leisure complexes, should consider writing one collective plan for the assets within an area.

The information in this SFRA can be used to:

- Update these flood plans if appropriate;
- Inform emergency planners in understanding the possibility, likelihood and spatial distribution of all sources of flooding (emergency planners may however have access to more detailed information, such as for Reservoir Inundation Maps, which have not been made available for this SFRA);
- Identify safe evacuation routes and access routes for emergency services;
- Identify key strategic locations to be protected in flooding emergencies, and the locations of refuge areas which are capable of remaining operational during flood events;
- Provide information on risks in relation to key infrastructure, and any risk management activities, plans or business continuity arrangements;
- Raise awareness and engage local communities;
- Support emergency responders in planning for and delivering a proportionate, scalable and flexible response to the level of risk;
- Provide flood risk evidence for further studies.

12.2 Flood Warning and Evacuation Plans

Developments that include areas that are designed to flood (e.g. ground floor car parking and amenity areas) or have a residual risk associated with them, will need to provide appropriate flood warning and instructions so users and residents are safe in a flood. This will include both physical warning signs and written flood warning and evacuation plans. Those using the new development should be made aware of any evacuation plans.

Whilst there is no statutory requirement on the EA or the emergency services to approve evacuation plans, Newcastle-under-Lyme Borough Council is accountable under its Civil Contingencies duties, via planning condition or agreement, to ensure that plans are suitable. This should be done in consultation with Development Management Officers. Given the cross-cutting nature of flooding, it is recommended that further discussions are held internally to Newcastle-under-Lyme Borough Council between emergency planners and policy planners / development management officers, the LLFA, drainage engineers and also to external stakeholders such as the emergency services, the EA, STW, and Canal & River Trust.

Once the development goes ahead, it will be the requirement of the plan owner (developer) to make sure the plan is put in place, and to liaise with NULBC regarding maintenance and updating of the plan.

12.2.1 What should the Plan Include?

Flood warning and evacuation plans should include the information stated in Table 12-1. Advice and guidance on plans is accessible from the government website and there are templates available for businesses and local communities.

Table 12-1: Flood warning and evacuation plans

Consideration	Purpose
Availability of existing flood warning system	The EA offers a flood warning service that currently covers designated Flood Warning Areas in England and Wales. In these areas they are able to provide a full Flood Warning Service.
Rate of onset of flooding	The rate of onset is how quickly the water arrives and the speed at which it rises which, in turn, will govern the opportunity for people to effectively prepare for and respond to a flood. This is an important factor within Emergency Planning in assessing the response time available to the emergency services.
How flood warning is given and occupants awareness of the likely frequency and duration of flood events	Everyone eligible to receive flood warnings should be signed up to the EA flood warning service. Where applicable, the display of flood warning signs should be considered. In particular sites that will be visited by members of the public on a daily basis such as sports complexes, car parks, retail stores. It is envisaged that the responsibility should fall upon the developers and should be a condition of the planning permission. Information should be provided to new occupants of houses concerning the level of risk and subsequent procedures if a flood occurs.
The availability of staff / occupants / users to respond to a flood warning and the time taken to respond to a flood warning	The plan should identify roles and responsibilities of all responders. The use of community flood wardens should also be considered.
Designing and locating safe access routes, preparing evacuation routes and the identification of safe locations for evacuees	Dry routes will be critical for people to evacuate as well as emergency services entering the site. The extent, depth and flood hazard rating, including allowance for climate change, should be considered when identifying these routes.
Vulnerability of occupants	Vulnerability classifications associated with development as outlined in the FRCC-PPG. This is closely linked to its occupiers.
How easily damaged items will be relocated, and the expected time taken to re-establish normal use following an event	The impact of flooding can be long lasting well after the event has taken place affecting both the property which has been flooded and the lives that have been disrupted. The resilience of the community to get back to normal will be important including time taken to repair / replace damages.

12.3 Flood Awareness

Emergency planners may also use the outputs from this SFRA to raise awareness within local communities. This should include raising awareness of flood risks, roles and responsibilities and measures that people can take to make their homes more resilient to flooding from all sources whilst also encouraging all those at fluvial flood risk to sign up to the EA's Flood Warning System service.

It is also recommended that Category 1 responders are provided with appropriate flood response training to help prepare them for the possibility of a major flood with an increased number of people living within flood risk areas, to ensure that adequate pre-planning, response and recovery arrangements are in place.

13 Summary and recommendations

This Level 1 SFRA delivers a strategic assessment of risk from all sources of flooding in Newcastle-under-Lyme Borough. It also provides an overview of policy and provides guidance for planners and developers. The flood risk information, assessment, guidance and recommendations of the SFRA will provide the Borough Council with the evidence base required to apply the Sequential, as required under the NPPF, and demonstrate that a risk based, sequential approach has been applied in the preparation of its new Local Plan.

Key flood risk stakeholders namely the EA, Severn Trent Water, United Utilities, Staffordshire County Council as the Lead Local Flood Authority and the Canal and River Trust were consulted to collate all available and relevant flood risk information on all sources into one comprehensive assessment. Together with this report, this SFRA also provides a suite of interactive GeoPDF flood risk maps (Appendix A) and a Development Site Assessment spreadsheet (Appendix B) illustrating the level of risk to sites identified in the Preferred Options, with subsequent recommendations.

Whilst the aim of the sequential approach is the avoidance of high flood risk areas, in locations such as Newcastle-under-Lyme, Knutton, Silverdale, Kidsgrove and Madeley, where the council is looking for continued growth, this will not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies / plans and on the ground works by combining all available flood risk information together into one single repository. A screening of the Preferred Options sites against strategic flood risk information has shown that:

- Out of the 32 sites provided for assessment by Newcastle, 4 are within or partially within the functional floodplain (Flood Zone 3b) (see Table 8-1). Depending on how much of the site is at risk and whether the location of highest risk would affect safe access and egress during a flood, it may be possible to develop on the parts of the site at lower risk, having firstly considered whether there are reasonable alternative sites at a lower risk of flooding. Alternatively, site boundaries can be redrawn to exclude the functional floodplain. When doing so care needs to be taken to ensure there are no areas adjacent to watercourses that are left inaccessible and not maintained.
- Based on this initial screening there are 2 sites which require further investigation into the significant risk from surface water flooding (see Table 8-11) (for example, if it is possible to provide enough space for both measures to manage the overland flow such as ponds, swales and designated flow routes alongside the form of the development itself. If not, they could be recommended for withdrawal based on significant surface water flood risk. This could be undertaken through a Level 2 Strategic Flood Risk Assessment.
- Additionally, there are 4 sites where Climate Change is considered to be significant enough that further investigation is required (see Table 8-13).

13.1 Recommendations for local planning policy

1. Take a risk-based approach to the allocation and design of developments in flood risk areas:

- In line with the Sequential Test, to locate new development in areas of lowest risk, giving highest priority to Flood Zone 1. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for development, the Exception Test shall be undertaken, should it apply.
- Following this a sequential approach to site design will be used to reduce risk, by placing the least vulnerable parts of the site in the highest flood risk areas.
- Site Specific Flood Risk Assessments will be required for all applicable developments. Sites should be designed so that the safety of future users is accounted for and that they do not increase flood risk offsite. Both the actual and residual risk to a new development should be taken into account.

2. Developers should assess the condition of existing assets and upgrade, if required, to ensure that the infrastructure can accommodate pressures / flows for the lifetime of the development,

- Contribute to reducing flood risk off site wherever feasible
- Ensure the whole life costs and maintenance of any engineering works to reduce flood risk to the site have been accounted for

3. Protect and Promote Areas for Future Flood Alleviation Schemes

- Safeguard functional floodplain from future development
- Develop appropriate policies for brownfield sites which lie in functional floodplain to reduce risk and to provide flood risk betterment
- 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

4. Mitigate Against Residual Risk, Improved Emergency Planning and Flood Awareness

- Parts of Newcastle-under-Lyme 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:
    - Consult 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.
    - Design 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 e.g. sleeping accommodation above the flood level
    - Implement 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 an emergency service.
    - Ensure robust emergency (evacuation) plans are produced and implemented for major developments
    - Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property
- Consideration and incorporation of flood resilience measures up to the 1 in 1000-year event
    - Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors

5. Implement Sustainable Drainage Systems as standard on all developments

- SuDS should be designed following the guidance in the Staffordshire SUDS Handbook and in accordance with both the National and Local SUDS Standards.
- 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.

6. Enhance and Restore River Corridors and Habitat

- Natural drainage features should be maintained and enhanced

- Culverted watercourses should be opened up and new culverting resisted
- Identify opportunities for river restoration / enhancement to make space for water, integrated into wider plans for green infrastructure
- There should be no built development within 8m from the top of the bank of any watercourse for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement

7. Improve Emergency Planning and Flood Awareness

- Emergency Plans will be needed as part of a Flood Risk Assessment for sites within Flood Zones 2 or 3. The key elements of these plans should be communicated to future users of the site. This includes raising awareness of the risk of flooding (even if it is residual) and what to do in the event of a flood. Future users within a Flood Warning and/ or Alert area should be encouraged to sign up to receive Flood Warnings.

8. **Apply the following policy on Cumulative Impact**

- **High risk catchments draining towards Stoke.**

Mapping of these catchments can be found in Figure 9-3.

  - Ford Green Brook catchment
  - Park Brook catchment
  - Lyme Brook (including Silverdale) catchment

Flooding issues in urban Newcastle are complex as water moves in and out of the highway drainage, sewer and watercourse networks. This is further complicated by overland surface water flows and a complex network of underground culverts in Silverdale.

The recommended policy is to:

  - Undertake more detailed drainage strategy work as part of a Level 2 SFRA or detailed local area Strategic Drainage Study to consider further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
  - Seek to provide wider betterment by demonstrating in site specific Flood Risk Assessments and Surface Water Drainage Strategies 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 any flood alleviation schemes. Consultation on the site-specific requirements should be undertaken with Staffordshire County Council as LLFA and the Environment Agency at the earliest opportunity. This would help to achieve the outcomes of the:
    - Staffordshire Trent Valley Catchment Partnership Trent Headwaters project which aims to identify locations and opportunities where the rivers and brooks which encompass the Trent Headwaters can be improved to create better environments for people and wildlife.
    - Trent SUNRISE project which has identified a programme of works to link, buffer, restore and recreate habitats across Stoke and the urban area of Newcastle, with a special focus on improving riverside areas and grassland restoration.

- For the LPA to work closely with the Environment Agency, Staffordshire County Council and the Staffordshire Wildlife Trust to identify areas of land upstream of the Newcastle urban area that should be safeguarded for the future use of natural flood management features.

- **Kidsgrove**

Flooding issues in Kidsgrove are complex as water moves in and out of the highway drainage, sewer and watercourse networks. In addition, the steep and largely urban nature of the town make it prone to surface water flooding, as reported in 2007, 2009 and 2012.

In Kidsgrove the recommended policy is to:

- Undertake more detailed drainage strategy work as part of a Level 2 SFRA or detailed local area Strategic Drainage Study to consider further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
- Seek to provide wider betterment by demonstrating in site specific Flood Risk Assessments and Surface Water Drainage Strategies 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 any flood alleviation schemes. Consultation on the site-specific requirements should be undertaken with Staffordshire County Council as LLFA and the Environment Agency at the earliest opportunity. This would build on the findings of the 2014 Kidsgrove SWMP.

It is also recommended that the Environment Agency, in consultation with Staffordshire County Council, Newcastle Borough Council and Cheshire East Council should consider whether to formally designate Kidsgrove (and Alsager and Church Lawton in Cheshire East) as a Critical Drainage Area. This would mean that a detailed Flood Risk Assessment would be required for all developments that are proposed, regardless of their size.

- **Ashley Heath**

Although there are only a small number of recorded historical incidences of flooding in Ashley Heath village, there is a wider risk of surface water flooding within the catchment where the village is situated. This catchment drains out of the borough and therefore any future developments here must consider the potential increased risk of surface water flooding downstream within the Chatcull Brook catchment.

Recommendations are for:

- Developers should ensure that there is no increase in surface water flows and volumes for developments within this catchment for greenfield sites.
- Developers should seek to reduce surface water flows and volumes for developments within this catchment for brownfield sites.
- Developers should contact Severn Trent Water to identify any opportunities to contribute in kind (e.g. by the use of land for flood storage) and/ or financially towards schemes to reduce flood risk to the wider area.

- **Recommendations applicable across the Borough to minimise Cumulative Impact**

- Developers should incorporate SuDs and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the Borough where practicable.
- Staffordshire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. 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.

13.2 Recommendations for further work in a Level 2 SFRA

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

- apply the Exception Test should this be required in high flood risk areas,
- review the possibilities for surface water mitigation measures on sites at high risk of surface water flooding, and
- Undertake more detailed drainage strategy work as part of a Level 2 SFRA for high flood risk catchments draining towards Stoke and for Kidsgrove, as recommended in the Cumulative Impact assessment for the Level 1 SFRA.

Appendices

A Interactive Flood Risk Mapping

Interactive GeoPDF Maps - The SFRA appendices are published separately to the main SFRA report.

To access these, firstly open the Overview Map in Adobe Acrobat. The Overview Map contains a set of four index squares covering four quarters of the borough. Clicking on one of the four index squares will open up an Index Map for that area, by way of a hyperlink.

Each of the four Index Maps contain a further set of index squares covering different areas of the borough at a scale of 1:10,000. Clicking on one of these index squares will open up a more detailed map of that area (scale = 1:10,000) by way of a hyperlink.

Within the detailed maps, use the zoom tools and the hand tool to zoom in/out and pan around the open detailed map. In the legend on the right-hand side of the detailed maps, layers can be switched on and off when required by way of a dropdown arrow. The potential development site reference labels can also be switched on and off if, for example, smaller sites are obscured by the labels.

This SFRA appendix is published separately to the main SFRA report.

B Development Site Assessment Spreadsheet

Excel spreadsheet containing an assessment of flood risk to the potential development sites based on:

- Flood Zones 2, 3a, indicative 3b and 3b as delineated through this SFRA
- the updated Flood Map for Surface Water (RoFSW)
- Climate Change Central, Higher Central and Upper End as delineated through this SFRA
- Distance to an ordinary watercourse

This SFRA appendix is published separately to the main SFRA report.

C Data sources used in the SFRA

Fluvial flooding

Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in Appendix A, show the same extent as the online Environment Agency's Flood Map for Planning (at the time of preparing this SFRA). Over time, the online mapping is likely to be updated more often than the SFRA, so SFRA users should check there are no major changes in their area.

Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b, as shown in Appendix A, has been compiled for the study area as part of this SFRA and is based on the 5% AEP (1 in 20-year chance of flooding in any given year) or 4% AEP (1 in 25-year chance of flooding in any given year) extents produced from Environment Agency detailed hydraulic models, where outputs were available. This information is only available in the SFRA and not shown on the online map.

For areas not covered by detailed models, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

If the area of interest is in an area that has seen some major changes to the extent of the Flood Zones, having checked the online mapping, Developers will also need to remap Flood Zone 3b as part of a detailed site-specific Flood Risk Assessment

Climate change

Please refer to Section 6 for information on the approach to climate change in this SFRA.

Surface water

Mapping of surface water flood risk in study area has been taken from the Risk of Flooding from Surface Water (RoFfSW) maps published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table C-1).

Table C-13-1: RoFfSW risk categories

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale.

Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater (AStGW) dataset.

The AStGW 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 that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The AStGW data should be used only in combination with other information, for example local data 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.

Information regarding groundwater and aquifer vulnerability to pollution is based on information provided by DEFRA in their Groundwater Vulnerability Map.

Sewers

Historical incidents of flooding are detailed by Severn Trent Water and Anglian Water through their Historic Flood Risk Register (HFRR). The HFRR databases records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. The risk registers have been considered in the assessment of flood risk from sewers.

Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study. These outlines were the same as those on the Long-Term Risk of Flooding website at the time of publication. The Environment Agency are currently updating their national reservoir flood maps and SFRA users should check there are no major changes to the reservoir maps before relying on the mapping in the SFRA.

D Relevant Flood Risk Studies

Name of Study	Area Affected	Recommendations
Kidsgrove and Church Lawton SWMP 2014 (Jacobs)	Reduce risk of SWF and prepare a SW management strategy.	SCC, in partnership with CEC, take the findings and actions of this SWMP and further investigate specific Flood Risk Areas
SCC Local Flood Risk Management Strategy 2015	Sets out roles and responsibilities for flood risk management, assesses the risk of flooding in the County, where funding can be found to manage flood risk, what our policies are as a Lead Local Flood Authority and what our objectives and actions are to manage flood risk.	Objectives have been developed considering historic and predicted flood risk, relevant plans and strategies and the views of local residents, businesses and other Risk Management Authorities.
Trent Headwaters 2016	Improving the River Trent and Tributaries across Stoke-on-Trent and Urban Newcastle Under Lyme	Highlight where the rivers and brooks of the Trent Headwaters can be improved to create a better environment for both people and wildlife in Stoke-on-Trent and Newcastle-under-Lyme.
Lyme Brook and Silverdale Brook Hazard Mapping Study (2015)	To ascertain the risk, hazard and areas at risk from the two brooks	Study depicting fluvial depth, velocity and hazard to highlight areas at most significant risk
JScreen Modelling for high risk culverts in Newcastle Borough 2017 (SCC)	Reduce risk of SWF and to ascertain state, condition and capacity of culverts across Newcastle	Surveys informing where investment and improvements are required and condition rating of assets

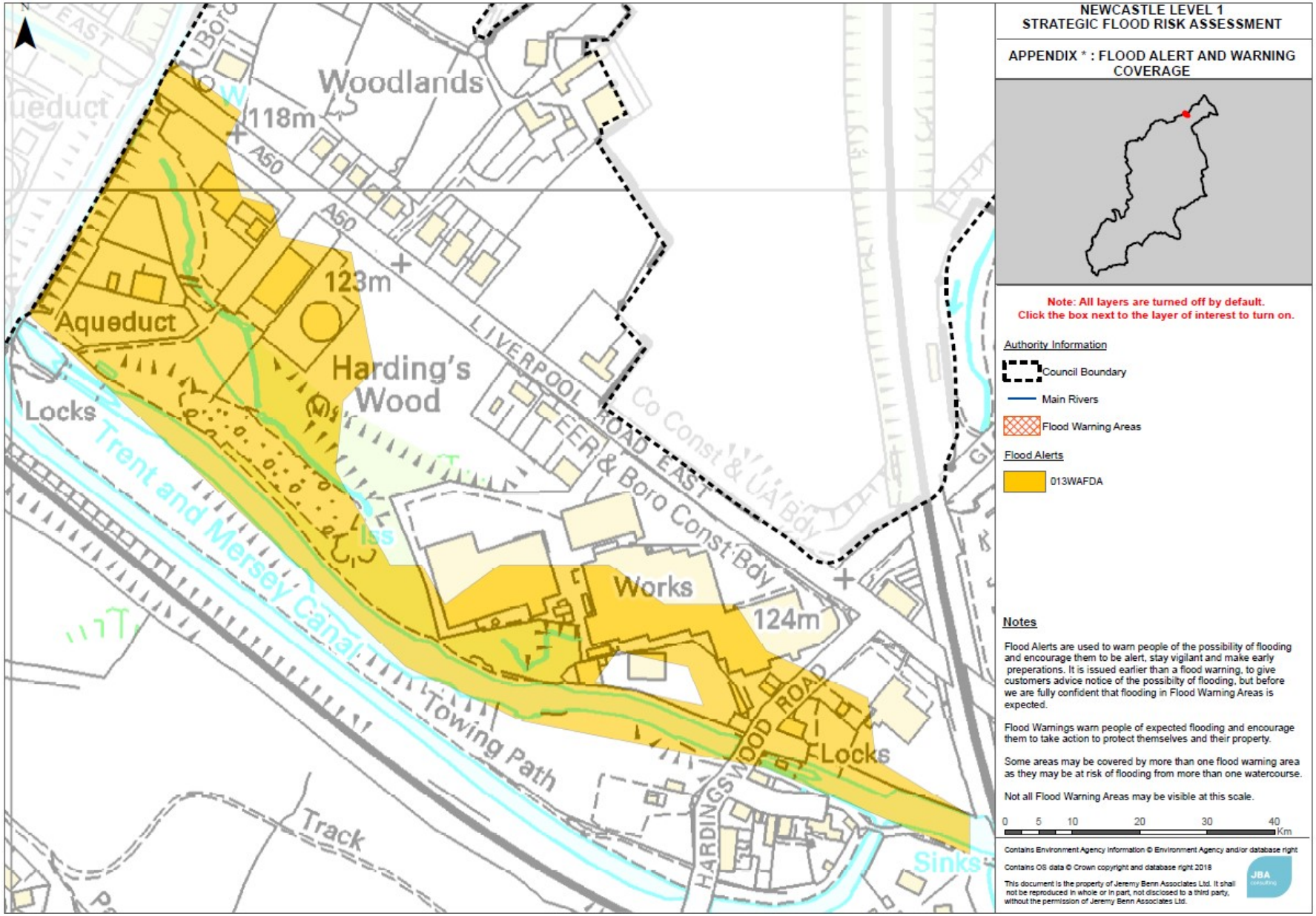
E Flood Alert and Flood Warnings

E.1 Flood Alerts

Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
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
031WAF104	Tern and Perry Catchments	River Tern, River Perry	Rivers Tern, Perry, Roden, Strine and Meese and their tributaries
033WAF309	Stoke Trent	Ford Green Brook, Lyme Brook, River Trent	Low lying land and roads between Norton Green and Darlaston on the River Trent and on the Lyme Brook and Ford Green Brook
013WAFDA	River Dane catchment including Kidsgrove, Sandbach, Congleton, Middlewich and Northeast Crewe	River Dane	The Dane catchment includes the River Wheelock, Arclid, Smoker and Fowlea Brooks and their tributaries
013WAFWE	Weaver catchment including Nantwich, Frodsham, Crewe, Winsford and Northwich	River Weaver	The Weaver Catchment includes the Rivers Weaver, Ducklow and Wheelock and their tributaries

Flood Warning Code	Flood Warning Name	Watercourse	Coverage
033FWF3LYME01	Lyme Brook at Newcastle under Lyme and Trent Vale	Lyme Brook	Lyme Brook at Newcastle under Lyme and Trent Vale including Hatrell Street, Brook Lane, Lyme Valley Road and Sports Grounds

E.2 Flood Warning


Woodlands
118m
A50
A50
123m
Aqueduct
Harding's Wood
LIVERPOOL ROAD EAST
Co Const & UA Bdy
Locks
Trent and Mersey Canal
Towing Path
Works
124m
Locks
Track
Sinks
NEWCASTLE LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT
APPENDIX * : FLOOD ALERT AND WARNING COVERAGE
Note: All layers are turned off by default.
Click the box next to the layer of interest to turn on.
Authority Information
Council Boundary
Main Rivers
Flood Warning Areas
Flood Alerts
013WAFDA
Notes
Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.
Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.
Not all Flood Warning Areas may be visible at this scale.
0 5 10 20 30 40
Km
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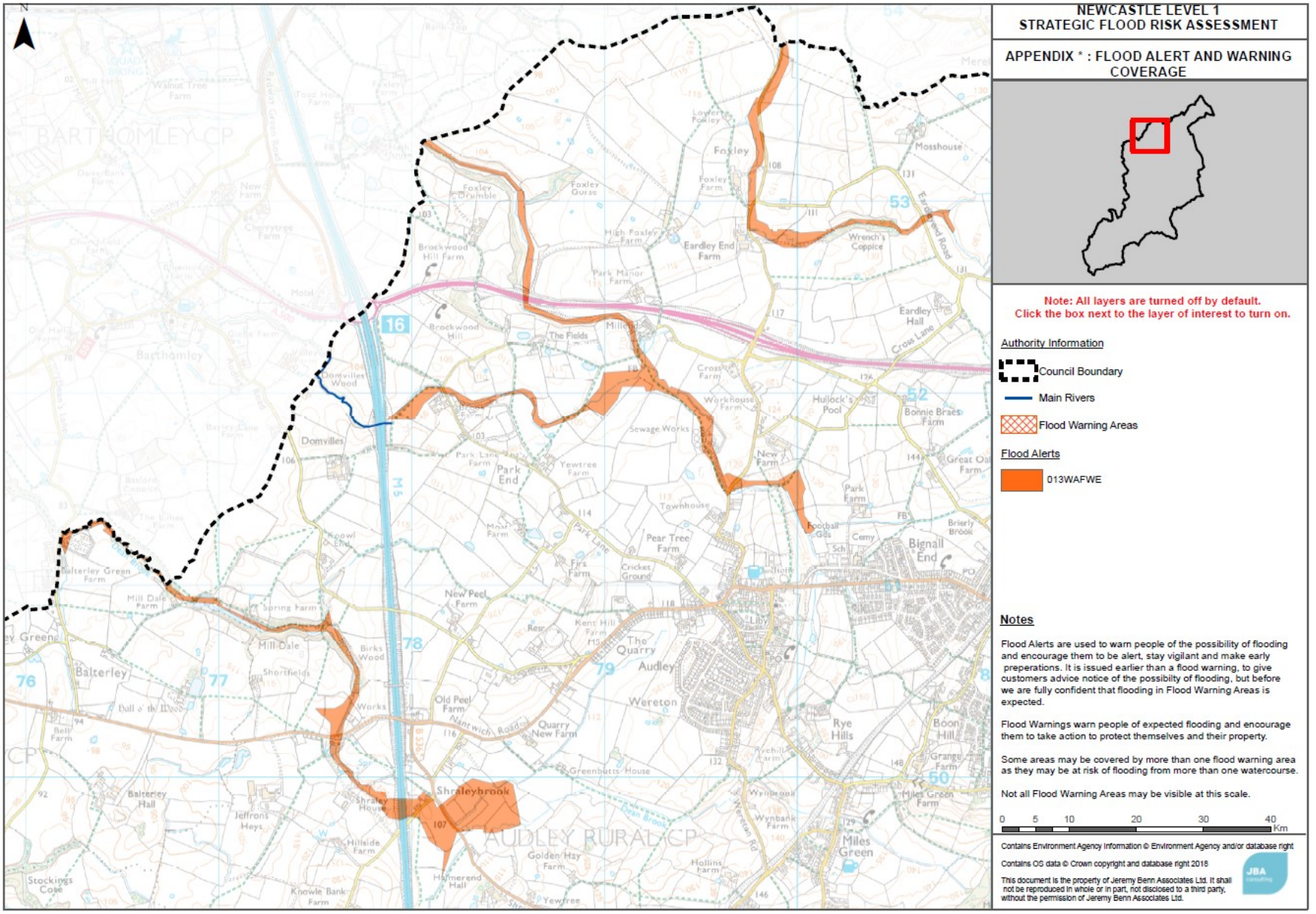
NEWCASTLE LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT
APPENDIX * : FLOOD ALERT AND WARNING COVERAGE
Note: All layers are turned off by default.
Click the box next to the layer of interest to turn on.
Authority Information
Council Boundary
Main Rivers
Flood Warning Areas
Flood Alerts
013WAFWE
Notes
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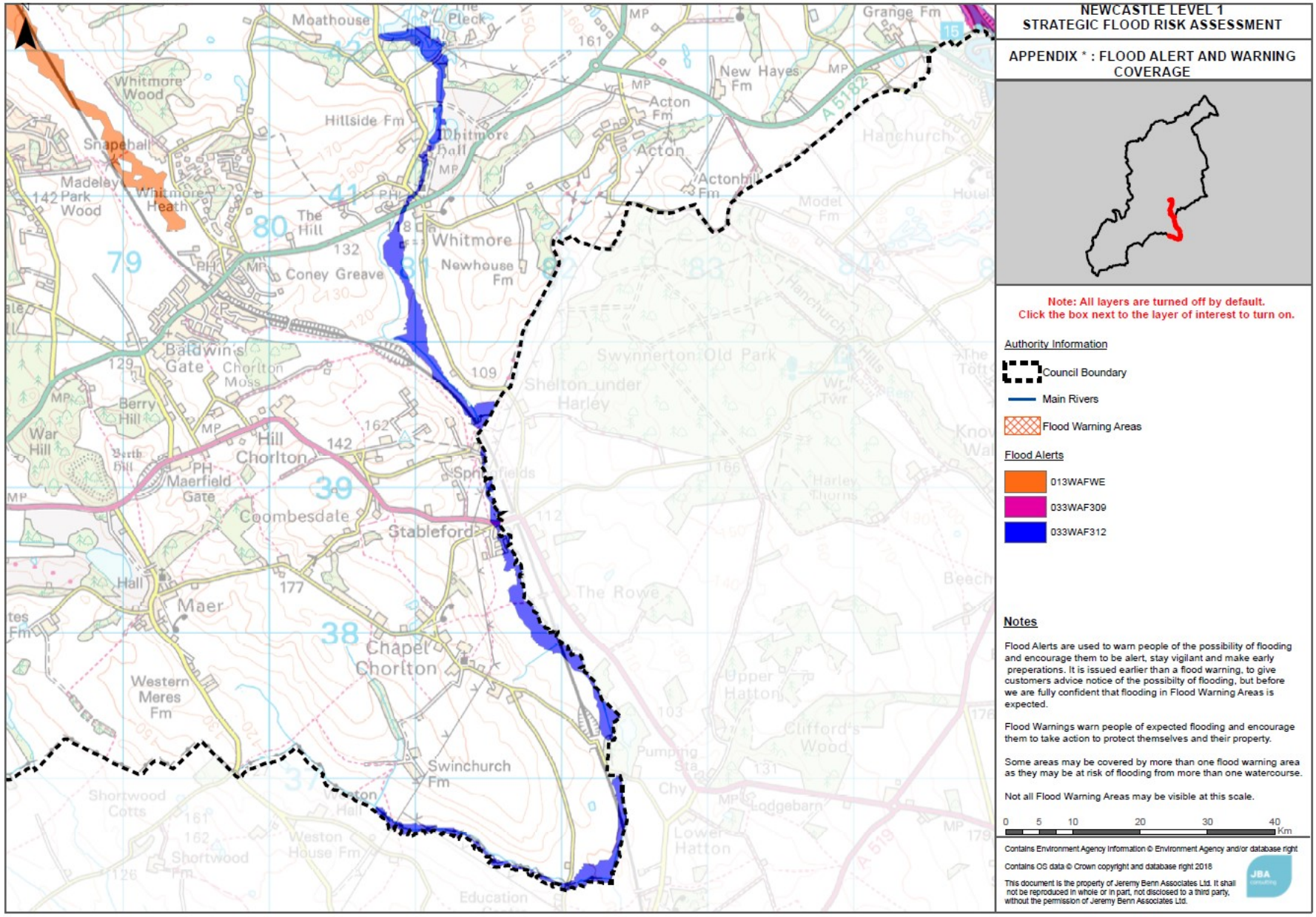
Barthomley
Audley
Wereton
Balterley
Shraleybrook
Bignall End
Foxley
Park End
AUDLEY RURAL CP


NEWCASTLE LEVEL 1
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Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.
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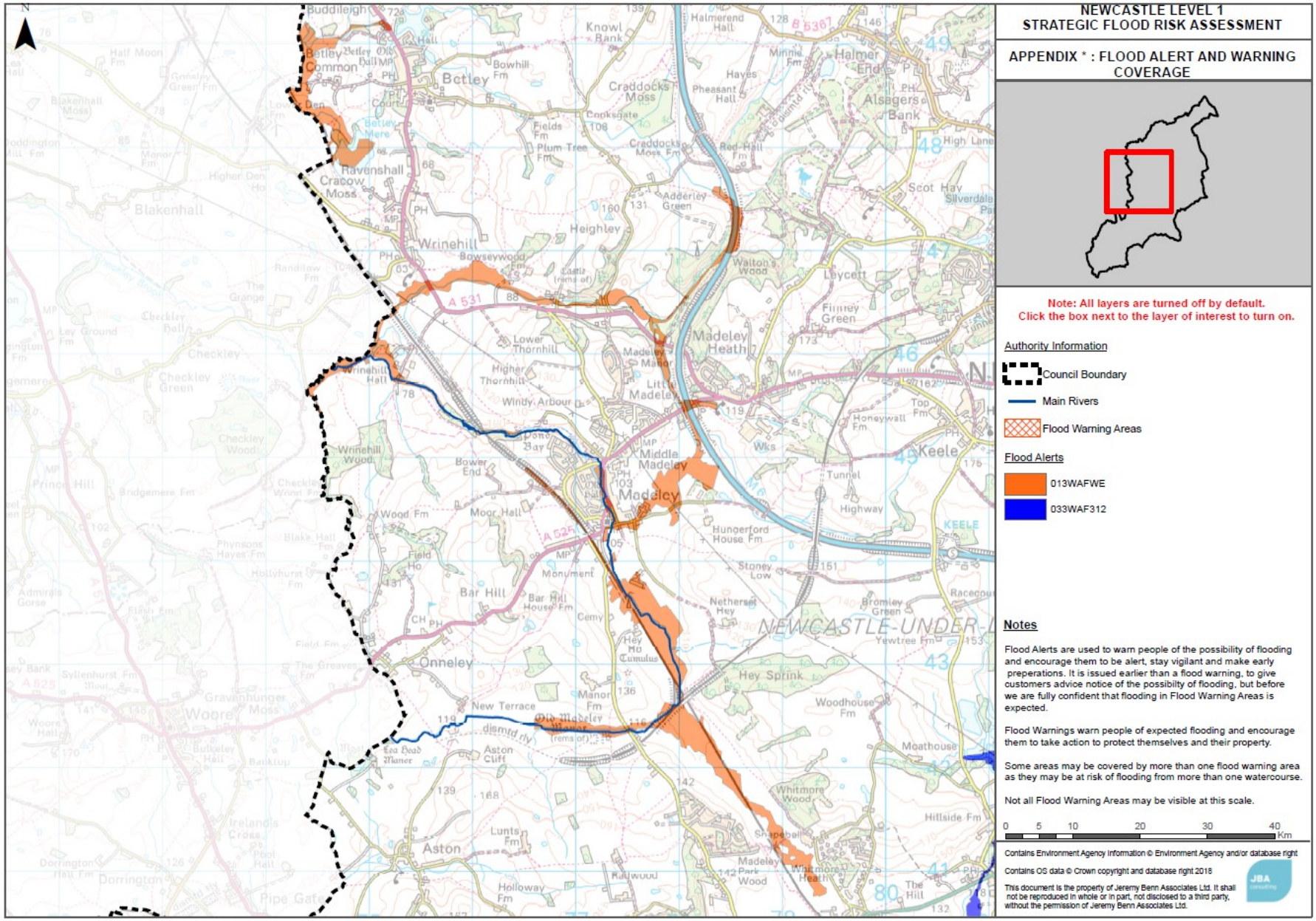
Moathouse
Whitmore Wood
Hillside Fm
Shapehall
Madeley Park Wood
Whitmore Heath
The Hill
Coney Greave
Whitmore
Newhouse Fm
New Hayes Fm
Acton Fm
Acton
Actonhill Fm
Grange Fm
Hanchurch
Baldwin's Gate
Chorlton Moss
Berry Hill
War Hill
Hill Chorlton
Maerfield Gate
Coombesdale
Stableford
Maer
Chapel Chorlton
Western Meres Fm
Swinchurch Fm
Swynnerton Old Park
Shelton under Harley
Harley Thorns
The Rowe
Upper Hatton
Lower Hatton
Clifford's Wood
Lodgebarn
Shortwood Cotts
Shortwood
Weston House Fm
Education


NEWCASTLE LEVEL 1
STRATEGIC FLOOD RISK ASSESSMENT
APPENDIX * : FLOOD ALERT AND WARNING COVERAGE
Note: All layers are turned off by default.
Click the box next to the layer of interest to turn on.
Authority Information
Council Boundary
Main Rivers
Flood Warning Areas
Flood Alerts
013WAFWE
033WAF312
Notes
Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preperations. It is issued earlier than a flood warning, to give customers advice notice of the possibilty of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.
Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.
Some areas may be covered by more than one flood warning area as they may be at risk of flooding from more than one watercourse.
Not all Flood Warning Areas may be visible at this scale.
0 5 10 20 30 40 Km
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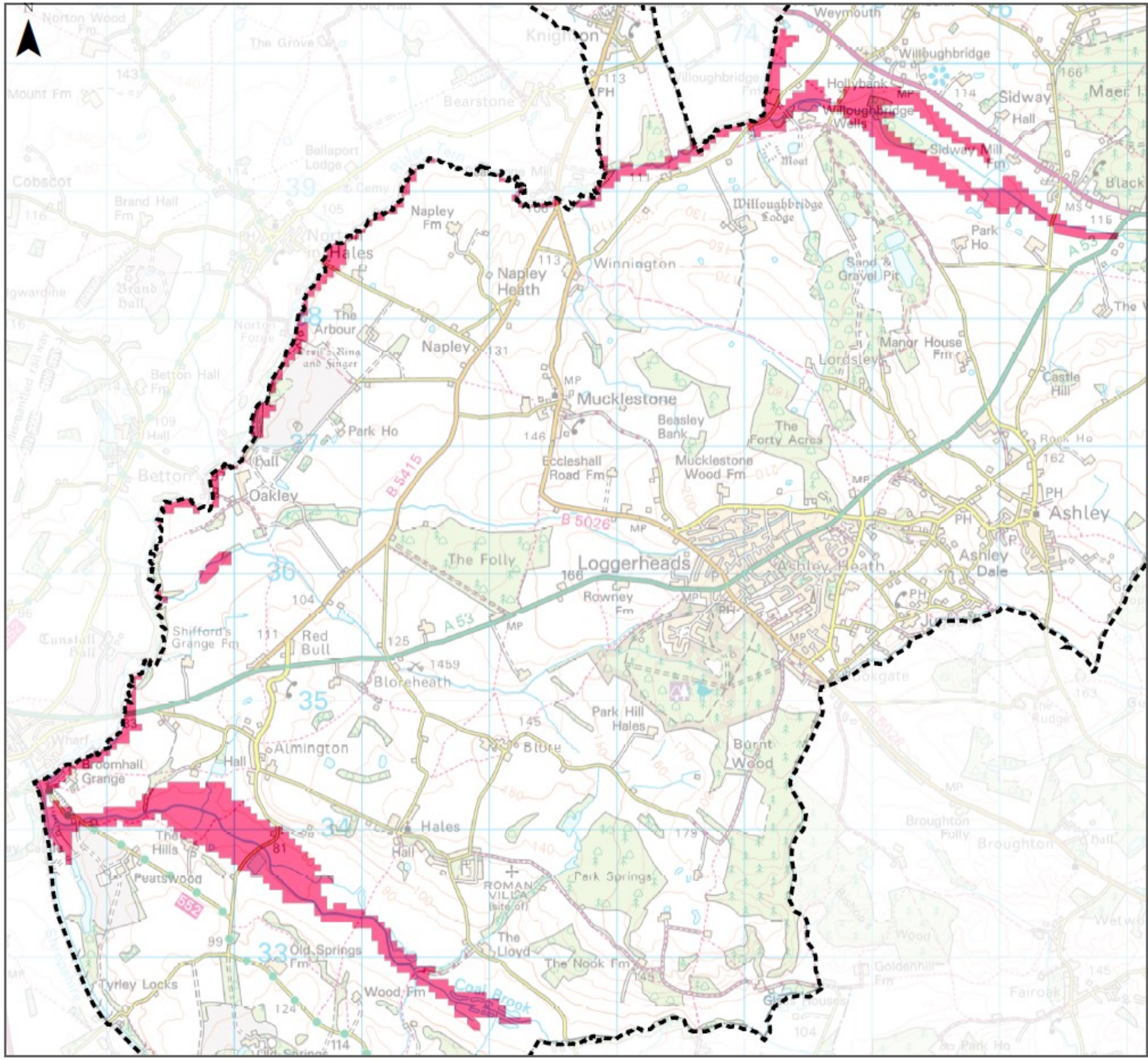
Newcastle-under-Lyme
Madeley
Keele
Wrinehill
Onneley
Aston
Betley



NEWCASTLE LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

APPENDIX * : FLOOD ALERT AND WARNING COVERAGE

Note: All layers are turned off by default.
Click the box next to the layer of interest to turn on.

Authority Information

Council Boundary

Main Rivers

Flood Warning Areas

Flood Alerts

031WAF104

Notes

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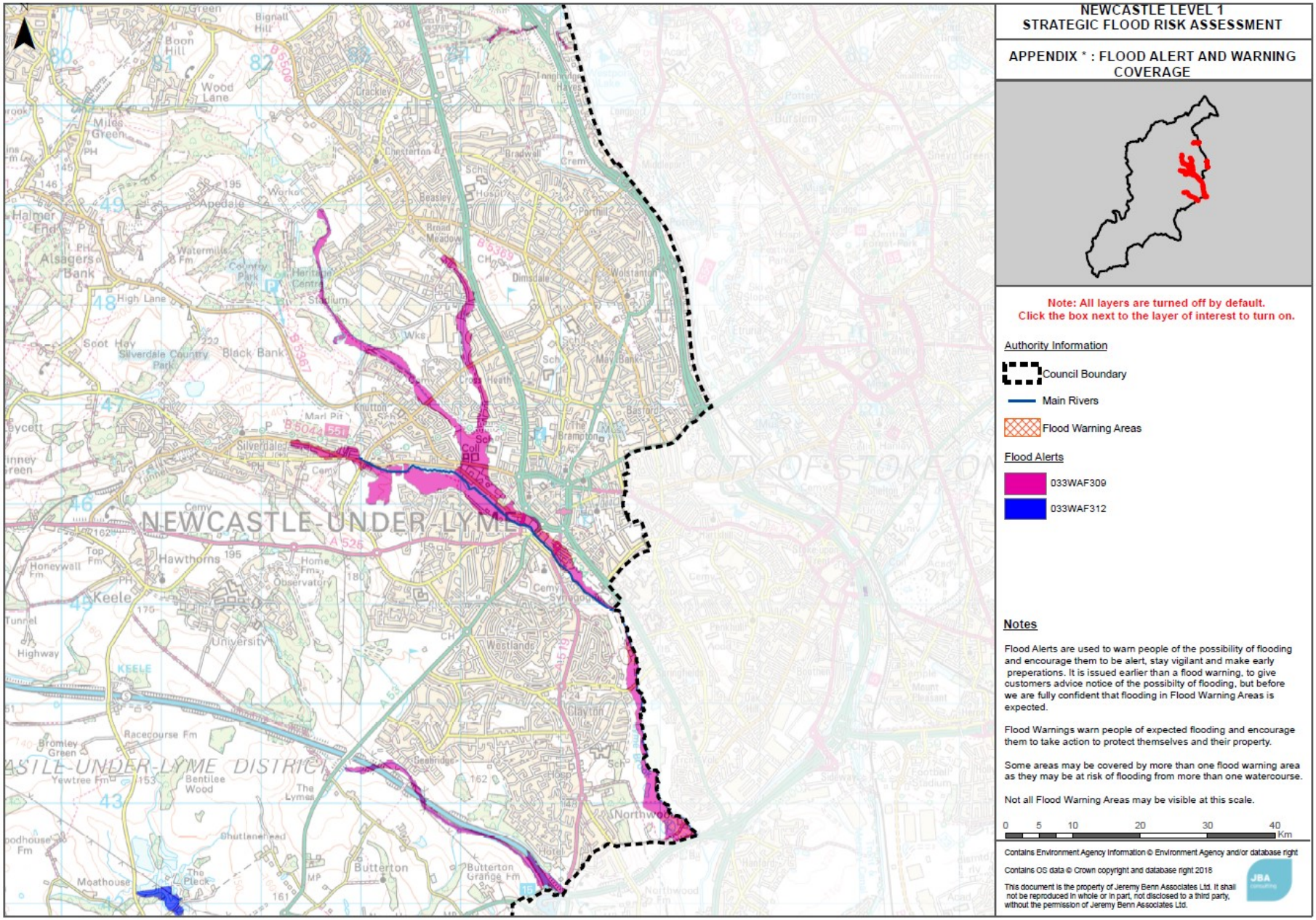
0 5 10 20 30 40 Km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Authority Information
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033WAF312
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NEWCASTLE-UNDER-LYME
KEELE

F Summary of flood risk across the Borough

Settlement	Fluvial flood risk	Existing or proposed defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Historic, recorded flood events
Audley and Bignall End	The main fluvial risk to Audley and Bignall is from the Valley Brook which has 3 tributaries within this ward. Flooding from these tributaries are predominately confined to their floodplains have a minimum effect on the wider area. However, mapping shows there are several watercourses which are not included within the EA Flood Zone's and could still present a risk to properties within Audley and Bignall End. There are a few properties at risk alongside the rivers and the potential for localized flooding along Alsager road.	None	Due to its topography, within the urban areas of Audley and Bignall End the SWF is predominately confined roads with very few properties affected. There is a small but notable impact of SWF on the A500 from the 1 in 30-year event, a key road in the area.	TBC	Roughly 132 sewer flood incidents – UU.
Clayton *	Flood Zone 2 and 3 show a low risk of fluvial in the area, with flood outlines primarily along the Lyme Brook and Park Brook. This flooding does not impact any properties and is confined to the floodplain. Flood zone 3 shows sections of the M6 motorway, from Park Brook between Seabridge and the A500 are at higher risk of flooding.	None.	There are 6 major flow paths that directly impact buildings within Clayton. These flow paths follow the topography of the area, draining into the Lyme brook and Park brook. These flow paths directly affect buildings from the 1 in 30-year events. The flow path within Seabridge is notably the largest within the Clayton area, affecting buildings from the A53 following the topography down, directly through buildings, to Park Brook. Dartmouth avenue and the M6 are key roads that are the most affected by SWF in the area.	TBC	22 incidents of sewer flooding since 1999 (ST5 4 had 10 separate incidents between 2004-2016)
Cross Heath*	Flood zones 2 and 3 have a much greater impact on properties in Cross Heath than in other areas of the district. The Flood Zones follow the floodplains of the Lyme Brook which	None	There is a large risk of SWF in the Cross Heath area as the topography of the area means the flow paths drain into the area from the surrounding higher elevations. There is a major flow path from Crakley into Cross Heath, affecting multiple properties in the	TBC	45 incidents of sewer flooding from 1999. ST5 0 and ST5 6 can be highlighted as having frequent sewer flooding issues.

	are wider, less confined and more heavily urbanised therefor affecting a greater number of properties. The area along the brook between London Road and Knutton lane all falls within flood zone 3 affecting approximately 80 properties. Mapping also shows there are several watercourses which are not included within the EA Flood Zone's and could still present a risk to properties within the area.		1 in 1000-year events. Properties on Kent Grove and Dragon square are affected from 1 in 30-year events. This flow path direct affects Spencercroft road, within broad meadow from the 1in30 year events. The A34 (Liverpool Road) around church fields is also directly impacted by SWF from the 1in100 year events. The SWF in this area also correlates with the sewer flooding in the area.		
Halmer end	The main part of this area is in Flood Zone 1, however Flood zone 2 and 3 surround the watercourses in the area (Dean Brook and Mere gutter) Betley mere is located within Flood Zone 3 and is also a eutrophic lake NVZ.	None.	Surface water flooding doesn't have a great impact in this area as the impacts affect most rural and open spaces. There's a small impact for roads in both Betley and Halmer End, and again no major impact on properties.	TBC	33 incidents of sewer flooding since 2008. The majority being in Halmer end along the high street and in Betley, along the 'Main Road' to Wrinehill.
Kidsgrove	Predominately within Flood Zone 1 with some areas of Flood zones 2 and 3 surrounding the Trent and Mersey Canal. However, there is no historical evidence of canal breach or overtopping in the area. Mapping shows there are several watercourses through Kidsgrove which are not included within the EA Flood Zone's and could still present a risk to properties within the area.	None	SWF is a major issue in the Kidsgrove with most of the area is affected by SWF or is within flow paths, both roads and buildings are affected from the 1in30 year events. The flow paths are predominantly draining into the Trent and Mersey canal. Kidsgrove is surrounded by areas of higher elevation, which influences the impact of SWF in Kidsgrove. Buildings are impacted by SWF not just flow paths. There are multiple flow paths that congregate in the centre of Kidsgrove. There is another major flow path that flows through The Rookery, from the Newchapel area, and out of the northern boundary. Further exploration of the risks for SWF in Kidsgrove should take place for specific areas as there are very few areas not impacted by SWF.	TBC	375 location of sewer flooding from the STW/UU data. Other historical flood events: 1980 - Heathcote St. 30th oct-1st Nov 2000, 60 properties suffered internal flooding, 70 properties affected overall. 16th Aug 2004 - general Kidsgrove area, 50 properties suffered from internal flooding, 70 properties affected overall. June-July 2007, general Kidsgrove area including, Red Bull junction, Gloucester Road, Newchapel Rd, Heathcote Street and The Avenue. 2009 - Woodstock Rd, Long Ln. 3rd Oct 2010 - North western Staffordshire, including Kidsgrove, Pub Flooded and >25 Properties. 2012, Woodstock Rd, Alder hay Ln, Dales Green.
Loggerheads and Whitmore	The majority of this area is Flood Zone 1 with Flood Zones 2 and 3 confined along the Coal Brook (a tributary of the River Tern), Swinchurch Brook, Meece	None	The SW here is draining out from the higher elevations within the boundary over a longer distance into the flat areas off the western boundary. Due to the predominantly rural land use in this area, flow	TBC	20 recorded incidents of sewer flooding since 2000. Baldwins gate and Stableford are both historical flooding hotspots from the

	Brook and the River Lea. These locations don't directly affect any large urban areas, and predominately affect rural, open spaces. The urban areas at risk from fluvial flooding are a small part of Whitmore, along Meece Brook, and the Train track to the north of Baldwins gate. Meece Brook has a greater impact on properties affecting a large proportion of Stableford.		paths have a lesser effect on buildings. The areas that are affected are Whitmore, which is located in a topographical low spot and part of the main flow path in this area where the SW drains into the Meece Brook. This flow path continues down the Meece Brook valley and also affects Stableford. Both are small populated areas affecting approximately 10 buildings in total. The River Tern and Lea and their associated valleys also have various SW flows draining into them, although again have no impact on buildings. Baldwins gate has some isolated pooling of SW along the trainline, this also affects buildings in the 1 in 1000-year events.		NUL data.

G SuDS Handbook - developer proforma

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