Newcastle-under-Lyme Level 1 Strategic Flood Risk Assessment

Final Report

June 2024

Prepared for:
Newcastle-under-Lyme Borough Council

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This report describes work commissioned by Newcastle-under-Lyme Borough Council by an instruction dated 12 January 2024. The Client's representative for the contract was Allan Clarke of Newcastle-under-Lyme Borough Council. Chloe Connett, Dylan Nattrass, and Sarah Hambling of JBA Consulting carried out this work.

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Abbreviations

ACDP	Area with Critical Drainage Problems
AEP	Annual Exceedance Probability
AStGWF	Areas Susceptible to Groundwater Flooding
CC	Climate Change
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EU	European Union
FAA	Flood Alert Area
FCERM	Flood and Coastal Erosion Risk Management
FFL	Finished Floor Level
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWA	Flood Warning Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GSPZ	Groundwater Source Protection Zone
IDB	Internal Drainage Board
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LPU	Local Plan Update
mAOD	metres Above Ordnance Datum
MMO	Marine Management Organisation
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NRD	National Receptor Database
NUL	Newcastle-under-Lyme Borough Council

NVZs	Nitrate Vulnerable Zones
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBD	River Basin District
RBMP	River Basin Management Plan
RFCC	Regional Flood and Coastal Committee
RMAs	Risk Management Authorities
RoFSW	Risk of Flooding from Surface Water
SCC	Staffordshire County Council
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SoP	Standard of Protection
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
WFD	Water Framework Directive

Definitions

1D model: one-dimensional hydraulic model

2D model: two-dimensional hydraulic model

Annual Exceedance Probability: the probability (expressed as a percentage) of a flood event occurring in any given year.

Brownfield: previously developed parcel of land

Catchment Flood Management Plan: a high-level planning strategy through which the EA 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.

Climate Change: long term variations in global temperature and weather patterns caused by natural and human actions.

Cumecs: the cumec is a measure of flow rate. One cumec is shorthand for cubic metre per second (m^3/s).

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 surface water flooding likely to occur with a 1% annual probability (a 1 in 100 change each year), plus an appropriate allowance for climate change, against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

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. As set out in Paragraph 170 of the NPPF (December 2023), the exception test should demonstrate that: development that has to be in a flood risk area will provide wider benefits to the community that outweigh flood risk; and 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.

Flood defence: Infrastructure used to protect an area against floods such as floodwalls and embankments; they are designed to a specific standard of protection (design standard).

Flood Map for Planning: The EA 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 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.

Fluvial Flooding: Flooding resulting from water levels exceeding the bank level of a river (main river or ordinary watercourse).

Green Infrastructure: a network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity (NPPF, December 2023).

Greenfield: undeveloped parcel of land.

Indicative Flood Risk Area: nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.

Lead Local Flood Authority: the unitary authority for the area or if there is no unitary authority, the county council for the area.

Main river: a watercourse shown as such on the statutory main river map held by the Environment Agency. They are usually the larger rivers and streams. The Environment Agency has permissive powers (not duties) to carry out maintenance and improvement works on main rivers).

Major development: defined in the National Planning Policy Framework (NPPF) as a housing development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more, or as a non-residential development with additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015 available here.

Ordinary watercourse: any river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows but which does not form part of a main river. The local authority or internal drainage board has permissive powers (not duties) on ordinary watercourses.

Permissive Powers: authorities have the power to undertake flood risk management activities, but not a duty to do so. This will depend on priorities in flood risk management.

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: see surface water flooding.

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 Management Authority: the Environment Agency; a lead local flood authority; a district council in an area where there is no unitary authority; an internal drainage board; a water company and a highway authority.

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.

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. The sequential test is a risk-based approach, taking into account all sources of flood risk and climate change.

Sewer flooding: Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

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.

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% AEP (1 in 100 year) standard of protection.

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.

Surface Water Management Plan: SWMPs are non-statutory plans which are used to assess existing surface water problems in an area, identify options to manage the level of surface water risk, and inform investment decisions and planning decisions for new development. They also provide an evidence base for the development of local flood risk management strategies.

Sustainable Drainage Systems: SuDS are methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques, such as grates, gullies, and channels.

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.

Windfall site: a site which becomes available for development unexpectedly and therefore not included as allocated land in a planning authority's Local Plan.

Executive Summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the review and update of the planning policies for Newcastle-under-Lyme Borough Council (referred to hereafter as the Council). The review process is known as the Local Plan Update (LPU). This report uses the best available information, including input from key stakeholders. The SFRA applies the latest national planning policy and guidance, including the National Planning Policy Framework (NPPF), which was revised in July 2021 and further updated in December 2023, the updated August 2022 Planning Practice Guidance (PPG), and the updates to the EA climate change guidance in July 2021 and May 2022.

Introduction

To support the review and update of Local Plans for the Council, the key objectives of the assessment are:

- To collate and analyse the latest available information and data for current and future (i.e., climate change) flood risk from all sources, and how these may be mitigated for development.
- To inform decisions in the emerging LPU, including informing the sustainability appraisal, the selection of development sites, and planning policies.
- To provide evidence to support the application of the sequential test for the allocation of new development sites, to support the Council in the preparation of the LPU.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the update to the Local Plan.
- To help decide when a Flood Risk Assessment (FRA) will be required for individual planning applications.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments (FRAs), including those at risk from sources other than river flooding, or at risk of flooding in the future due to climate change, and outline specific measures or objectives that are required to manage flood risk.
- To provide the basis for applying the sequential test on planning applications, including by identifying sources of flooding other than those in 'Flood Zones' and those at risk of flooding in the future.
- To identify opportunities to reduce the causes and impacts of flooding and gather information on the land that is likely to be required for flood risk management structures.

Summary of the borough and flood risk

This SFRA covers the borough of Newcastle-under-Lyme. The main urban areas in the borough are located in the north and east; the largest of the settlements is Newcastle-under-Lyme, with other settlements including Kidsgrove, Talke, Silverdale, and Keele. The south and west of the borough are more rural, comprised of smaller settlements such as Madley, Audley, Almington, and Ashley.

Flood risk from all sources has been assessed in this SFRA. Parts of the borough are shown to be at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation, and overtopping/ breach of canals. This study has shown that the most significant sources of flood risk across the borough are fluvial, and surface water. The points below summarise the findings:

- **Fluvial**: The primary sources of fluvial flood risk in the borough are the River Lea, Lyme Brook, and Checkley Brook, as well as their associated tributaries. The River Lea and Checkley Brook both flow in a north easterly direction, flowing through Madley and Madley Heath. Lyme Brook is a primary source of flood risk, flowing in a south easterly direction through the urban centre of Newcastle-under-Lyme. *Fluvial flood risk is discussed in Section 4.3 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*
- **Surface Water**: The Risk of Flooding from Surface Water map shows prominent overland flow routes that largely follow the lower topography of watercourses in the borough, including Lyme Brook, Coal Brook, and the River Lea. There are some areas where there are additional flow paths and areas of ponding, for example where water is impounded at road or rail embankments and in low-lying areas. The south and west of the borough is largely rural, while the north and east are more urbanised with the largest risk of surface water flooding to key infrastructure. There are considerable flow routes following the roads and watercourses through the main urban areas of Kidsgrove, Newcastle-under-Lyme centre, Porthill, and Clayton, alongside isolated areas of ponding, which may affect many properties across these settlements. *Surface water flood risk is discussed in Section 4.4 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*
- **Climate Change**: Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas, due to climate change. Flood extents will increase; in some locations, this may be minimal, but flood depth, velocity and hazard may have more of an impact due to climate change. This SFRA provides an assessment of the impacts of climate change on fluvial and surface water flood risk. *The approach to climate change is discussed in Section 5 and the flood extents are also shown in the GeoPDFs in Appendix A*. It is recommended that the Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development when developing climate change plans and strategies for the borough.

- **Sewer:** United Utilities and Severn Trent Water provide water services and sewerage services across the borough and have provided details of historic sewer flooding across the borough. Postcodes identified with a number of previous sewer flooding cover areas of Newcastle-under-Lyme town, including Cross Heath, Gloster Gate, Clayton, Audley, Kidsgrove, Harriseahead, and Silverdale. *Sewer flood risk is discussed in Section 4.5*.
- **Groundwater:** The Areas Susceptible to Groundwater Flooding map shows that in general, the main areas with greater than 50% susceptibility to groundwater flooding are located towards the west and south of the borough around Kidsgrove, Madley and Almington. The JBA Groundwater Emergence Map emulates this with large parts of the west and south of the borough having groundwater levels within 0.5m of the surface, particularly around shows groundwater in Aston, Baldwin's Gate, and Almington. There are further areas with groundwater emergence levels within 0.5m of the surface in the northeast of the borough across Newcastle-under-Lyme town. Whilst no national mapping of groundwater risk is available, emergence mapping when considered in conjunction with topography and surface water flow paths can indicate areas where groundwater is likely to emerge, and where it might flow in this case. *Groundwater flood risk is discussed in Section 4.6 and Appendix E, and the AStGWF map and JBA emergence map are shown in the GeoPDFs in Appendix A.*
- **Canals**: The Trent and Mersey Canal runs in a northerly direction along the eastern border of the borough and then flows in a westerly direction through the northern end of the borough, through Kidsgrove. In the north end of the borough the Macclesfield Canal branches off from the Trent and Mersey Canal and flows in a northerly direction away from the borough. The Shropshire Union Canal runs along the southwest boundary of the borough. The Canal and River Trust were consulted as part of this study and provided details of two recorded canal overtopping incidents within the borough and no recorded breaches. *Canal flood risk is discussed in Section 0.*
- **Reservoirs**: There are four reservoirs located within the borough, and one located outside the study area where the 'wet day' or 'dry day' scenarios encroach into the borough. There is a potential risk of flooding from reservoirs both within the borough and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRAs (where relevant) in accordance with the updated PPG. *Reservoir flood risk is discussed in Section 0 and Appendix E. The 'Dry Day' and 'Wet Day' flood extents are shown in the GeoPDFs in Appendix A.*

Defences

The EA Asset Information Management System (AIMS) dataset provides information on flood defence assets across the borough. The main defence type across the borough is 'Natural High Ground', located along the River Lea, Lyme Brook, and many of the smaller watercourses along the west and southwest of the borough. Engineered defences include sections of embankments and engineered high ground along sections of Lyme Brook. *Further information on defences across the borough is available in Section 6.4 and shown in the GeoPDFs in Appendix A.*

Development and flood risk

The sequential and exception test procedures for both Local Plans and FRAs have been documented, along with guidance for planners and developers. Links have been provided for relevant guidance documents and policies published by other Flood RMAs such as the Lead Local Flood Authority (LLFA) and the Environment Agency (EA).

The risk of flooding should be reviewed as early as possible in the development process to ensure that opportunities are taken to reduce the risk of flooding on and off the site. Where necessary, development and redevelopment within the borough will require an FRA appropriate to the scale of the development and to the scope as agreed with the LLFA and/or EA. FRAs should consider flood risk from all sources including residual risk, along with promotion of Sustainable Drainage Systems (SuDS) to create a conceptual drainage strategy and safe access/egress at the development in the event of a flood. Latest climate change guidance (last updated in May 2022) should also be taken into account, for the lifetime of developments. Planners and developers must check that modelling in line with the most up to date EA climate change guidance has been run.

How to use this report

Planners

The SFRA provides recommendations regarding all sources of flood risk across the borough, which can be used to inform policy on flood risk within the emerging LPU. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the sequential test, for both allocations and individual planning applications, and provides guidance on how to apply the exception test. The Council can use this information to apply the sequential test to strategic allocations and identify where the exception test will also be needed.

The SFRA provides guidance for the development industry and development management officers to establish when an FRA is required and to assess whether site-specific FRAs meet the required quality standard. It can be used to help identify which locations and development may require emergency planning provision.

Developers

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the sequential test. For both strategic allocations and windfall sites, developers will need to apply the exception test in the following cases:

- Highly vulnerable development in Flood Zone 2
- Essential infrastructure in Flood Zone 3a or 3b
- More vulnerable development in Flood Zone 3a
- Proposed development in locations affected by surface water flood risk

A site-specific FRA should be used to inform the exception test at the planning application stage.

This SFRA is a strategic assessment and does not replace the need for site-specific FRAs where a development is either within Flood Zones 2 or 3 or greater than a hectare in Flood Zone 1, is less than a hectare and located in an area affected by sources of flooding other than rivers, or is in an area within Flood Zone 1 which has critical drainage problems as notified by the EA. In addition, a sustainable surface water drainage strategy will be needed for development requiring an FRA, or in any other case for major category development, to satisfy Staffordshire County Council, the LLFA. Further assessments may also be required at this stage to manage the risk from sewer flooding to a site, and developers should contact United Utilities or Severn Trent Water for further advice.

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed FRA. To do this, they should refer to Section 4, Appendix A (Interactive GeoPDF mapping), and Appendix B (Data sources used in the SFRA). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses and sewers to verify flood extent (including latest climate change allowances, last updated in May 2022), inform master-planning, and demonstrate, if required, that the exception test is satisfied. As part of the EA's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of the impact of climate change on flood risk to the site as part of the planning application process when preparing FRAs. Additionally, at planning application stage, flood risk from other sources should be assessed if identified at the development site.

Developers need to check and ensure that new development does not increase surface water runoff rates and volumes from a site or contribute to cumulative effects at sensitive locations, see Section 7 and Appendix F: Cumulative Impact Assessment (CIA). Section 8.5.1 provides information on the surface water drainage requirements of the LLFA. SuDS should be considered at the earliest stages that a site is planned to be developed which will help to minimise costs and overcome any site-specific constraints.

Site-specific FRAs will need to identify how flood risk will be mitigated so development is safe from flooding for its lifetime and does not have an adverse effect on third parties or

other areas. The FRA will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Any developments located within an area protected by flood defences and where the Standard of Protection (SoP) is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements to the defences.

Neighbourhood Plans

Neighbourhood planning groups can use the information in this SFRA to assess the risk of flooding to sites within their community, using Section 4, the sources of flooding across the borough and the interactive flood mapping in Appendix A. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas. Similarly, all known available recorded historical flood events across the borough are listed in Section 4.1. This can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned within the borough are outlined in Section 6 and Section 8.3 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Mapping

The SFRA mapping highlights on a strategic scale flood risk from fluvial, surface water and reservoirs sources, and where groundwater emergence may occur; as well as where the effects of climate change are most likely. The maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or depict small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this mapping. Similarly, all known available recorded historical flood events across the study area are listed in Section 4.1. This can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by the Council or EA are outlined in Section 6.5, and Section 8.3 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area. The mapping data should always be supplemented by direct consultation with the relevant wastewater company to ascertain if there is any site-specific risk from a public sewer. This is because sewer flood risk information is not publicly available and would need to be considered on a site-specific basis.

Cumulative Impact Assessment (CIA)

Under the NPPF, strategic policies and their supporting SFRAs, are required to ‘consider cumulative impacts in, or affecting, local areas susceptible to flooding’ (Paragraph 166). A Cumulative Impact Assessment (CIA) has identified which catchments in the study area are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment (SFRA)

“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 EA and other relevant flood RMAs, such as lead local flood authorities and internal drainage boards.” (NPPF, Paragraph 166).

In January 2024, Newcastle-under-Lyme Borough Council commissioned an update to their existing Level 1 SFRA to reflect the latest legislation and guidance, and to inform the updates to their Local Plans. This SFRA replaces the previous joint Level 1 SFRA undertaken by Newcastle-under-Lyme Borough Council and Stoke-on-Trent City Council in 2019.

This 2024 SFRA will be used to inform decisions on the location of future development and the preparation of land use planning policies for the long-term management of flood risk, reflecting the implications of the August 2022 changes to the PPG.

As the data available for SFRAs and the relevant legislation is continually changing, an SFRA should be updated to reflect changes where applicable and reasonably practicable. Under any changes in guidance or legislation, the implications on the SFRA should be considered and a review undertaken where this is deemed reasonably necessary.

1.2 Local Plan

The Council as the Local Planning Authority (LPA) are responsible for producing a Local Plan, determining planning applications, enforcement in response to breaches of planning control, and supporting neighbourhood planning.

The Council are currently compiling the evidence base to support the update to their existing Local Plan, which is available on the Council website here.

The review process is known as the Local Plan Update (LPU). The LPU will guide where and how growth will take place across the Council area. Further information on the progress and timescales of the LPU are available on the Council website, here.

1.3 Levels of SFRA

The PPG identifies the following two levels of SFRA:

This is a Level 1 SFRA assessment. If all the development proposed is not located outside areas of flood risk, a Level 2 assessment may be required to inform the exception test.

- All LPAs are required to undertake a Level 1 assessment. Where potential site allocations are not at major flood risk and where development pressures are low a Level 1 assessment is likely to be sufficient, without the LPA progressing to a Level 2 assessment. The Level 1 assessment should be of sufficient detail to

enable application of the sequential test, to inform the allocation of development to areas of lower flood risk.

- A Level 2 assessment is required where land outside flood risk areas cannot appropriately accommodate all necessary development, creating the need to apply the NPPF's exception test, or if an LPA believe they may receive high numbers of applications in flood risk areas on sites not identified in the Local Plan. 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.

1.4 SFRA Outputs

This SFRA aims to provide the following outputs:

- Identification of existing national and local policy and technical updates.
- Identification of any strategic flooding issues or cumulative effects which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, and reservoirs.
- Review of historic flooding incidents.
- Reporting on the Standard of Protection (SoP) provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Mapping defining the extent of Flood Zone 3b (the functional floodplain).
- Assessment of the potential increase in flood risk due to climate change to identify areas at risk of flooding in the future.
- FRA guidance for developers.
- Identification of developments that require emergency planning provision.
- Assessment of strategic surface water management issues, how these can be addressed through development management policies and the application of SuDS.
- 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 strategic flood risk solutions that can be implemented to reduce risks.
- Information to assist identifying land that is likely to be needed for flood risk management infrastructure.

1.5 SFRA Study Area

The study area for this SFRA is the borough of Newcastle-under-Lyme, which is located in the northeast Staffordshire, in west-central England.

The main urban areas in the borough are located in the north and east; the largest of the settlements is Newcastle-under-Lyme, with other settlements including Kidsgrove, Talke, Silverdale, and Keele. The south and west of the borough are more rural, comprised of smaller settlements such as Madley, Audley, Almington, and Ashley.

The study area is bounded by five other authorities, shown in Figure 1-1:

- Cheshire East
- Staffordshire Moorlands
- Stoke-on-Trent
- Stafford
- Shropshire

The water service and sewerage provider for the majority of the borough is Severn Trent Water, with small areas along the western border provided by United Utilities. The water service provider boundaries are shown in Figure 1-2 and the sewerage provider boundaries are shown in Figure 1-3. Some developments within the study area may be supplied by New Appointment and Variations (NAV) suppliers; but there are currently no NAV suppliers within the borough. Locations where these companies supply can be found on the UK Parliament website, here.

The LLFA across the borough is Staffordshire County Council. The three neighbouring LLFAs of the borough are Cheshire East, City of Stoke-on-Trent, and Shropshire, shown in Figure 1-4.

The key watercourses which run through the borough are Lyme Brook, the River Tern, and the River Lea, and their main tributaries, including Checkley Brook, Coal Brook, and Park Brook. These watercourses are shown in Figure 1-5.

1.6 Consultation

SFRAs should be prepared in consultation with other Risk Management Authorities (RMAs). In addition to the Council LPA the following parties have been consulted during the preparation of this version of the SFRA through data requests and draft report reviews:

- Staffordshire County Council (SCC) LLFA
- Environment Agency (EA)
- Severn Trent Water (STW)
- United Utilities (UU)

In addition, the following parties were consulted through data requests during the preparation of this SFRA:

- Neighbouring LPAs to provide data on cross-boundary development implications:
  - Cheshire East Council
  - Shropshire Council
  - Stafford Borough Council
  - Staffordshire Moorlands District Council
  - Stoke-on-Trent City Council
- Canal and River Trust
- Natural England
- Staffordshire Wildlife Trust

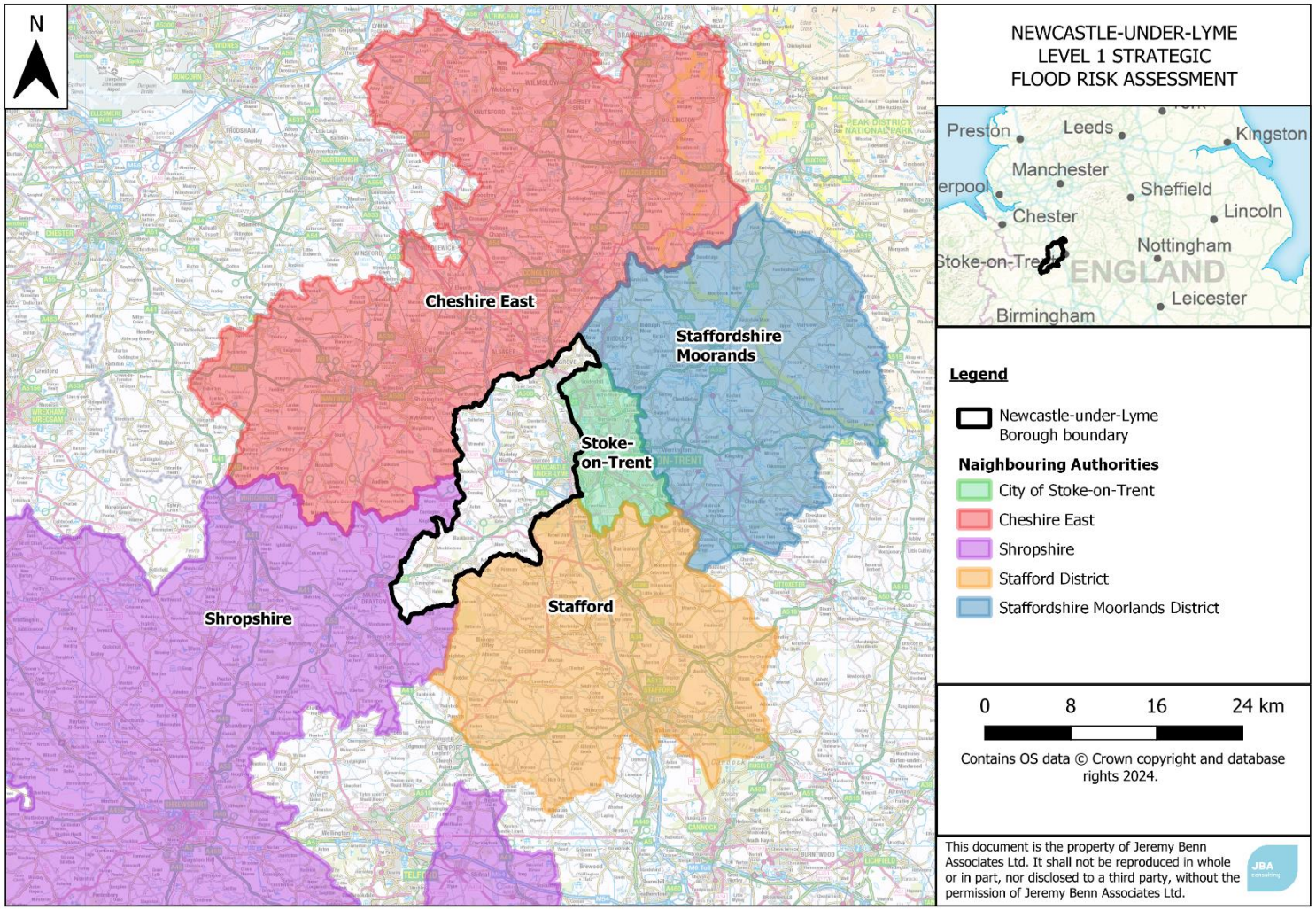


Figure 1-1: Newcastle-under-Lyme borough and its neighbouring authorities.

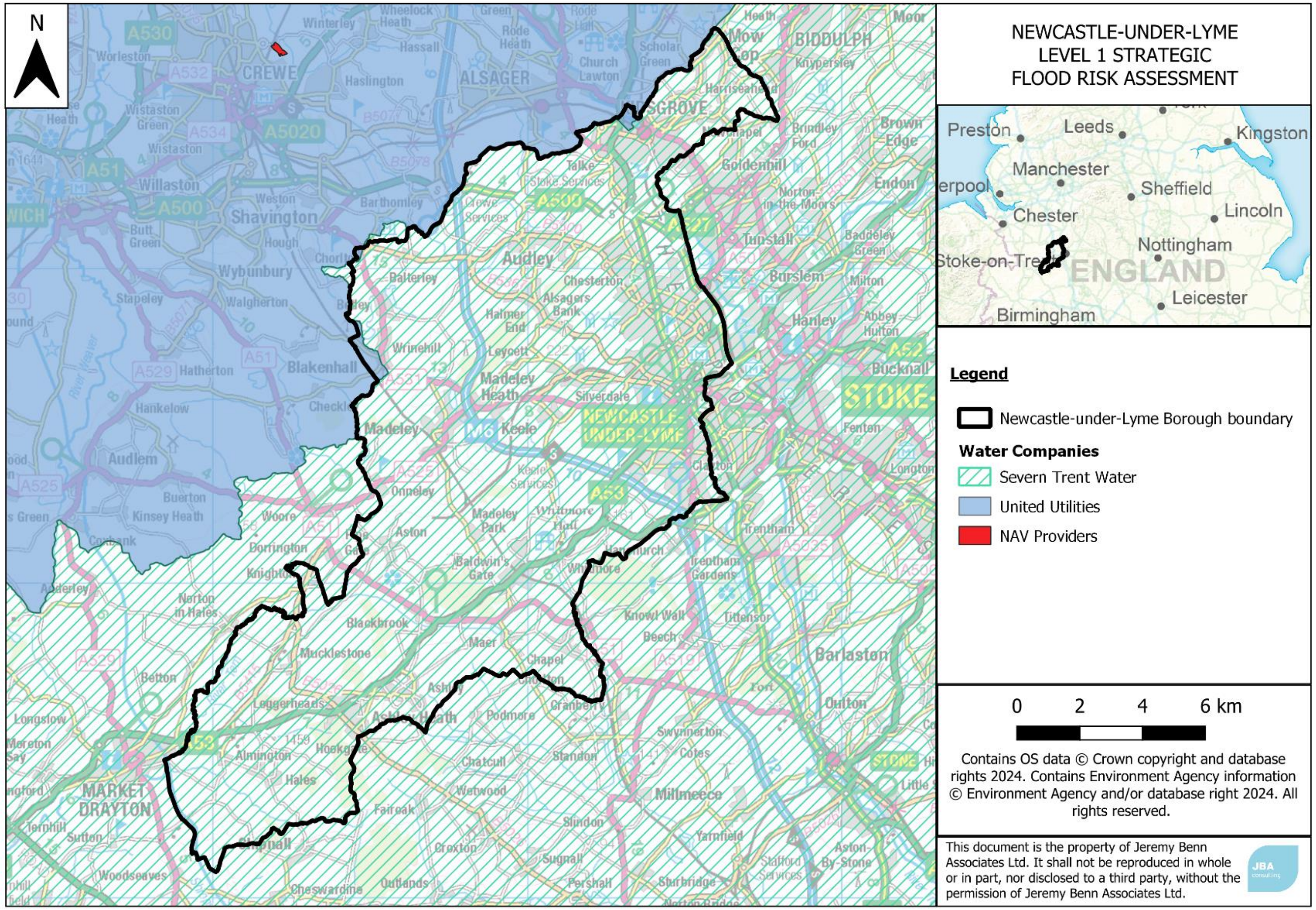


Figure 1-2: Water supplier coverage across the borough.

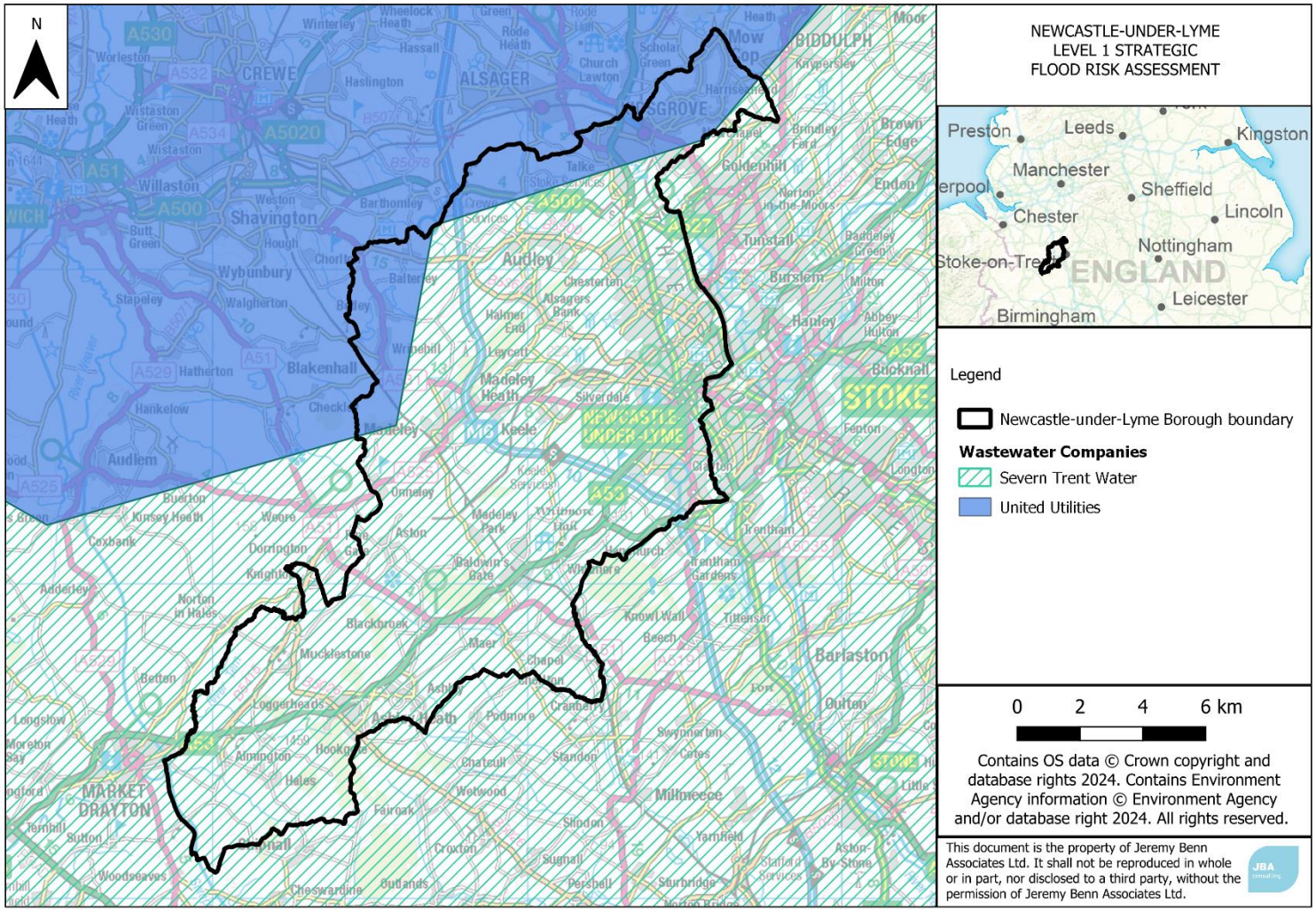


Figure 1-3: Sewerage provider coverage across the borough.

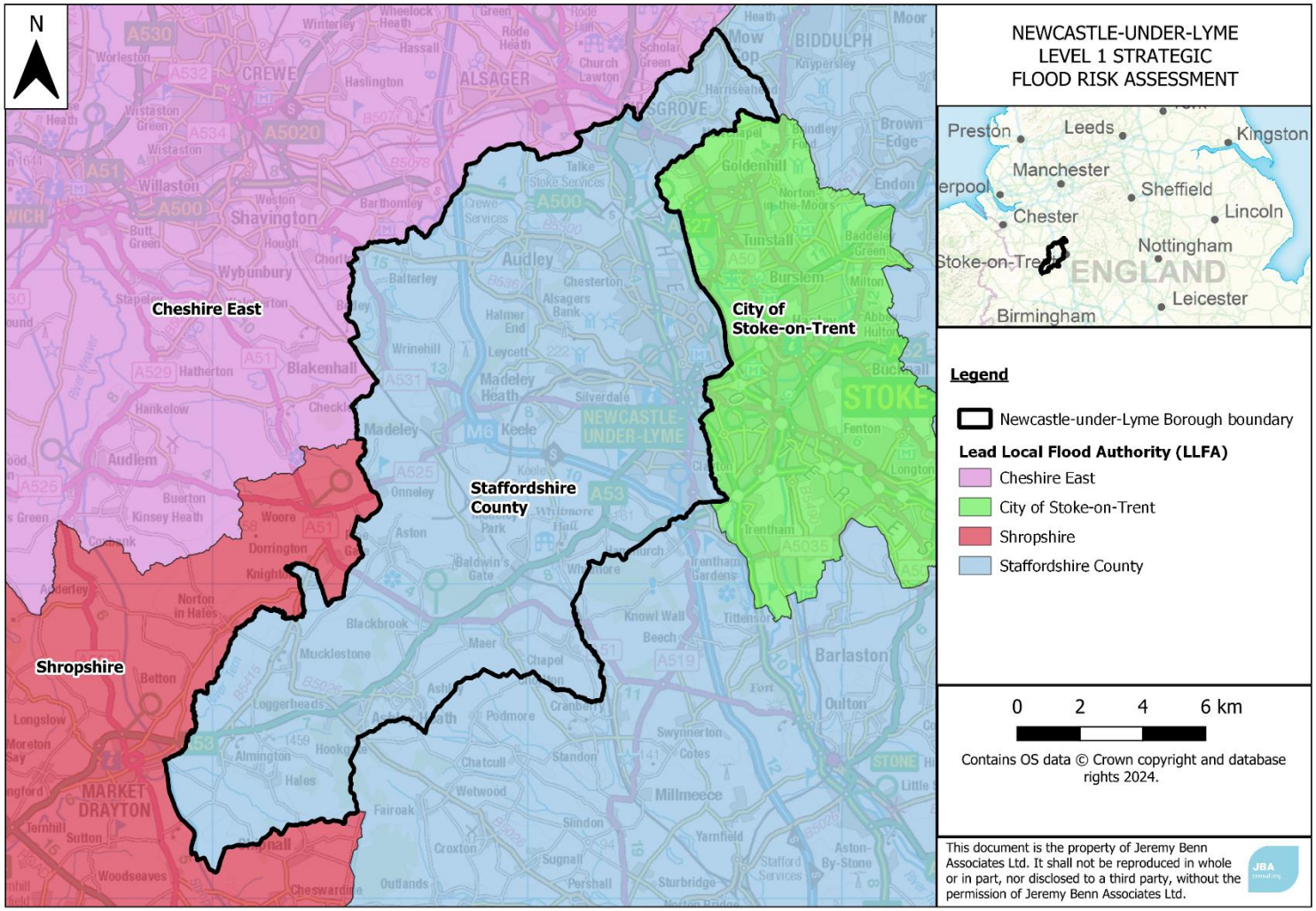


Figure 1-4: LLFA coverage across the borough and neighbouring authorities.

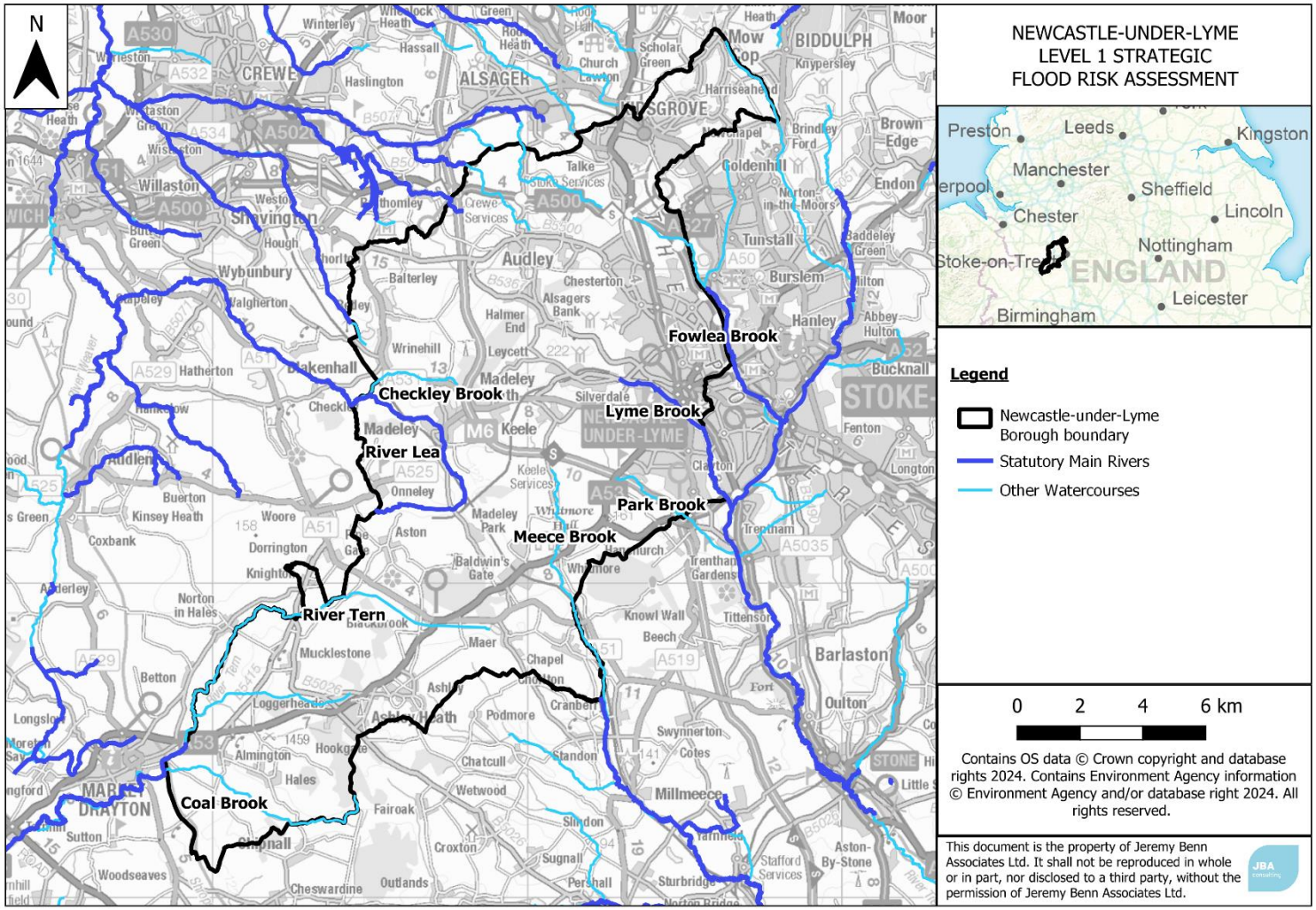


Figure 1-5: Main rivers and other watercourses across the borough.

1.7 Use of SFRA data

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

Developers will still need to undertake site-specific FRAs where required 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-specific level.

Appendix C presents a SFRA User Guide, further explaining how this SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for sequential and exception tests.

As per the date of this report, this SFRA contains the latest available 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), updated information on other sources of flood risk or evidence showing future flood risks, new flood event information, new defence schemes and updates to policy, legislation, and guidance. The EA are currently producing new national flood risk mapping (NaFRA2) which is due to go live in August 2024, although these timescales are subject to change due to the complexities of the project. Developers should check the online Flood Map for Planning in the first instance to identify any major changes to the Flood Zones and the long-term flood risk mapping portal for any changes to flood risk from surface water or inundation from reservoirs.

1.8 Structure of this report

Table 1-1: Sets out the contents of the report and how to use each section.

Section	Contents	How to use
Executive summary	This section focuses on how the SFRA can be used by planners, developers, and neighbourhood planners.	Users should refer to this section for a summary of the Level 1 findings and recommendations.
1. Introduction	This section provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA. It also provides a short introduction to how flood risk is assessed and the importance of considering all sources.	Users should refer to this section for general information and context.

Section	Contents	How to use
2. Flood risk policy and strategy	This section sets out the relevant legislation, policy, and strategy for flood risk management at a national, regional, and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	This section provides an overview of both national and existing Local Plan policy on flood risk management. This includes the Flood Zones, application of the Sequential Approach and sequential/exception test process. It provides guidance for the Councils and developers on the application of the sequential and exception test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the sequential and exception tests.
4. Understanding flood risk in the study area	This section provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	This section should be used to understand all sources of flood risk across the study area including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendix B.
5. Impact of climate change	This section outlines the latest climate change guidance published by the EA and how this was applied to the SFRA. It also sets out how developers should apply the guidance to inform site-specific FRAs.	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
6. Flood alleviation schemes and assets	This section provides a summary of current flood defences and asset management and future planned schemes. It also introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site specific stage.

Section	Contents	How to use
7. Cumulative impact of development and strategic solutions	This section introduces the Cumulative Impact Assessment (CIA), which is included as Appendix F.	Planners should use this section to help develop policy recommendations for the cumulative impact of development, in conjunction with Appendix F.
8. Flood risk management for developers	This section contains guidance for developers on FRAs, considering flood risk from all sources.	Developers should use this section to understand requirements for FRAs and what conditions/guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	This section provides an overview of SuDS, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for SuDS from the LLFA.	Developers should use this section to understand what national, regional, and local SuDS standards are applicable. Hyperlinks are provided.
10. Summary and recommendations	This section summarises sources of flood risk in the study area and outlines planning policy recommendations. It also sets out the next steps.	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering site specific assessments.
Appendices	Appendix A: GeoPDFs Appendix B: Data sources used in the SFRA Appendix C: SFRA User Guide Appendix D: Flood Alert and Flood Warning Areas Appendix E: Summary of flood risk across the study area Appendix F: Cumulative Impact Assessment (CIA)	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the sequential and exception tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

The following content provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

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

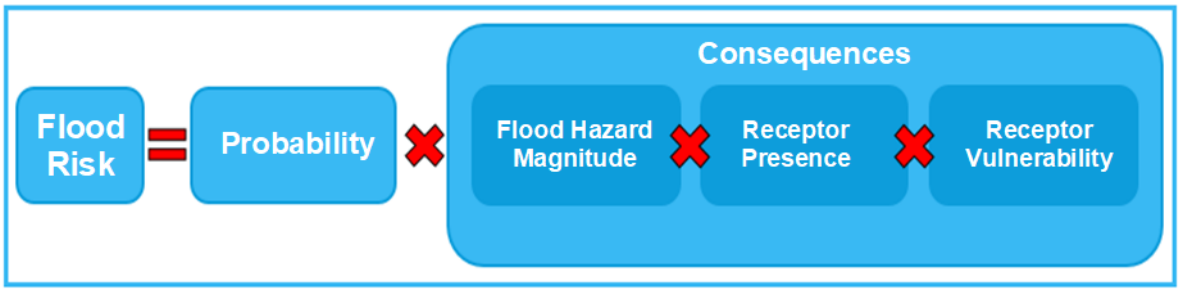
- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - direct run-off from adjacent land.
- Sewer flooding - surcharging of piped drainage systems, including public sewers.
- 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; industrial processes; burst water mains; blocked sewers or failed pumping stations.
- Other sources of flooding including breaching of flood defences, overwhelmed canals, lakes, and other artificial sources.

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.

1.9.2 Defining flood risk

Section 3 (subsection 1) of the Flood and Water Management Act 2010 (FWMA) defines the risk of a potentially harmful event (such as flooding) as ‘a risk in respect of an occurrence is assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences.’

Thus, it is possible to summarise flood risk as:



1.9.2.1 Source-Pathway-Receptor model

Flood risk can be assessed using the Source-Pathway-Receptor model where:

- The source is the origin of the floodwater, principally rainfall.
- A pathway is a route or means by which a receptor can be affected by flooding, which includes rivers, drains, sewers, and overland flow.
- A receptor is something that can be adversely affected by flooding, which includes people, their property, and the environment.

This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. All these elements must be present for flood risk to arise. Having applied the Source-Pathway-Receptor model it is possible to mitigate the flood risk by addressing the source (often very difficult), blocking, or altering the pathway, or removing the receptor, e.g., steer development away.

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

1.9.2.2 Probability

The probability of flooding is expressed as a percentage based on the average frequency measured or extrapolated from records over many 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 at least once every hundred years.

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

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

1.9.2.3 Consequences

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), the receptors that are present and the vulnerability of these receptors (type of development, nature, e.g., age-structure, of the population, presence, and reliability of mitigation measures etc).

2 Flood risk policy and strategy

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

2.1 Roles and responsibilities for Flood Risk Management across the borough

There are different organisations in and around the study area that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are listed in Table 2-1 with a summary of their responsibilities.

Further information on the roles and responsibilities of the RMAs is available in Annex A of the National Flood and Coastal Erosion Risk Management Strategy (FCERM) for England, available from the Government website here.

The Local Government Association also provide further information on the roles and responsibilities for managing flood risk on their website here.

Table 2-1: Roles and responsibilities for RMAs.

Risk Management Authority	Strategic Level	Operational Level	Planning role
EA	Strategic overview for all sources of flooding, National Strategy, and general supervision	Main River (e.g., Lyme Brook and Fowlea Book) and reservoirs (Flood Risk Activity Permits (FRAPs), enforcement, and works)	Statutory consultee for certain development in Flood Zones 2 and 3 and all works within 20 metres of a main river. Advice on when to consult the EA is here.
SCC as LLFA	Coordination of Local Flood Risk Management and maintaining a Local Flood Risk Management Strategy (LFRMS)	Surface water, groundwater, and ordinary watercourses (consenting, enforcement, and works)	Statutory consultee for major developments
Severn Trent Water and United Utilities	Asset Management Plans, supported by Periodic Reviews (business cases), develop drainage	Public sewers and some reservoirs	Non-statutory consultee for planning applications

Risk Management Authority	Strategic Level	Operational Level	Planning role
	and wastewater management plans		
Highways Authorities - National Highways for motorways and trunk roads and SCC for non-trunk roads	Highway drainage policy and planning	Highway drainage	Statutory consultee regarding highways design standards and adoptions

2.1.1 Riparian ownership

Land and property owners are responsible for the maintenance of watercourses either on or next to their properties, called Riparian Owners. Riparian Owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species, and allowing the flow of water to pass without obstruction. More information can be found on the Government website in the EA publication 'Owning a watercourse' (2018), available from the Government website here.

When it comes to undertaking works to reduce flood risk, the EA, and Staffordshire County Council as LLFA do have permissive powers, but limited resources must be prioritised and targeted to where they can have the greatest effect. Permissive powers mean that RMAs are permitted to undertake works on watercourses but are not obliged.

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in the study area. Hyperlinks are provided to external documents:

- Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), which set out the regulations for development on land in England and Wales.
- 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 Flood Risk Management.
- The Land Drainage Act (1991, as amended) and Environmental Permitting Regulations (2018) also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an ordinary watercourse or main river.

- The Water Environment Regulations (2017) – these transpose the European Water Framework Directive (WFD) (2000) into law and require the EA to produce River Basin Management Plans (RBMPs). These aim to improve/maintain the water quality of aquatic ecosystems, riparian ecosystems, and wetlands so that they reach 'good' status.
- The Environment Act 2021 requires developers to provide Biodiversity Net Gain (BNG) and for LPAs to develop Local Nature Recovery Strategies (LNRS). Strategic site allocations in Local Plans which present opportunities for BNG or areas for habitat improvement/creation identified by the LNRS could have parallel opportunities to contribute to reduced flood risk from a range of sources.
- 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.
- Flood Risk Regulations (2009) - these transpose the European Floods Directive (2000) into law and require the EA and LLFAs to produce PFRAs and identify nationally significant Flood Risk Areas.
- The Planning and Compulsory Purchase Act (2004) Section 19(1A) requires local planning authorities to include in their Local Plans 'policies designed to secure that the development and use of land in the local planning authority's area contribute to the mitigation of, and adaptation to, climate change.'

2.3 Key national, regional, and local policy documents and strategies

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

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

The following sections provide further details on some of these documents and strategies.

Please note that the links to these documents may change over time and any requests for these documents should be directed toward the author.

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

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
National	Flood and Coastal Management Strategy (EA) 2020	Yes	Yes	No	2026
National	National Planning Policy Framework updated in December 2023	Yes	Yes	Yes	-
National	Planning Practice Guidance (PPG) updated in August 2022	Yes	Yes	Yes	-
National	Building Regulations Part H (MHCLG) 2010	Yes	No	Yes	-
Regional	River Trent Catchment Flood Management Plan (EA) 2010	Yes	Yes	No	-
Regional	River Severn Catchment Flood Management Plan (EA) 2009	Yes	Yes	No	-
Regional	Weaver Gowy Catchment Flood Management Plan (EA) 2009	Yes	Yes	No	-
Regional	Humber River Basin District River Management Plan (EA) 2022	Yes	Yes	No	2028
Regional	Severn River Basin District River Basin Management Plan (EA) 2022	Yes	Yes	No	2028
Regional	North West River Basin District River Basin Management Plan (EA) 2022	Yes	Yes	No	2028
Regional	Humber River Basin District Flood Risk Management Plan (EA) 2022	Yes	Yes	No	-
Regional	Severn River Basin District Flood Risk Management Plan	Yes	Yes	No	-

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
Regional	North West River Basin District Flood Risk Management Plan	Yes	Yes	No	-
Regional	United Utilities Water Resources Management Plan 2019	Yes	No	No	-
Regional	Severn Trent Water resources management plan 2022	Yes	No	No	-
Regional	United Utilities Drainage and Wastewater Management Plan 2023	Yes	No	No	-
Regional	Severn Trent Water Drainage and Wastewater management plan	Yes	No	No	-
Regional	Climate change guidance for development and flood risk (EA) last updated May 2022	Yes	No	Yes	-
Local	Staffordshire Preliminary Flood Risk Assessment 2011	Yes	No	No	-
Local	Staffordshire Local Flood Risk Management Strategy	Yes	Yes	No	2027

2.3.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion in England. The EA brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy looks ahead to 2100 and the actions needed to address the challenge of climate change.

The Strategy has been split into three high level ambitions:

- Climate resilient places
- Today's growth and infrastructure resilient in tomorrow's climate
- A nation ready to respond and adapt to flooding and coastal change.

Measures within the Strategy include:

- Updating the national river, coastal, and surface water flood risk mapping and producing a new set of long-term investment scenarios to improve understanding of future risk and investment needs.
- Trialling new and innovative funding models to contribute to the investment needs for flood and coastal resilience.
- Flood resilience pilot studies.
- Developing an adaptive approach to the impacts of climate change by seeking nature-based solutions towards flooding and erosion issues, integrating Natural Flood Management (NFM) into the new Environmental Land Management scheme, and considering long term adaptive approaches in Local Plans.
- Maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals, investing in flood risk infrastructure that supports sustainable growth, and developing world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences.
- Aligning long term strategic planning cycles for flood and coastal work between stakeholders.
- Consistent approaches to asset management and record keeping.
- Updating guidance on managing high risk reservoirs considering climate change.
- Development of digital tools to communicate flood risk, transforming the flood warning service, supporting communities to plan for flood events, increasing flood response and recovery support, and mainstreaming property flood resilience measures and 'building back better' after flooding.

The Strategy was laid before parliament in July 2020 for formal adoption and published alongside a New National Policy Statement for Flood and Coastal Erosion Risk Management, which can be accessed from the Government website. The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. Upgrading and expanding flood defences and infrastructure across the country,
2. Managing the flow of water to both reduce flood risk and manage drought,
3. Harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. Better preparing communities for when flooding and erosion does occur, and
5. Ensuring every area of England has a comprehensive Local Plan for dealing with flooding and coastal erosion.

It can be expected that the implementation of the National Strategy will lead to the publication of new guidance and practice that is focused on resilience and adaptation over the coming years. It will be important to adjust the content of the SFRA so that changes in approach are captured in the delivery of the Local Plan.

For further information, the Government has published the full National Flood and Coastal Erosion Risk Management Strategy (FCERM).

2.3.2 Flood Risk Regulations (2009)

The Flood Risk Regulations (FRRs) 2009 translated the European Union (EU) Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk, known in England 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 (FRMPs). This cycle is repeated on a six-yearly basis. As of 1 January 2024, the Retained EU Law (Reform and Revocation) Bill automatically repealed any retained EU law (REUL) not otherwise preserved or replaced in UK law before the end of 2023, including the FRRs 2009 which transposed the EU Floods Directive into legislation. This is because much of the FRRs is duplicated in existing domestic legislation, namely the Flood and Water Management Act 2010. The EA and LLFAs in England will therefore no longer be required to comply with a third cycle of planning, however the government expects to see continued implementation of the FRMPs 2021-2027.

The FRRs direct the EA to do this work for river, sea, and reservoir flooding. LLFAs must do this work for surface water, ordinary watercourse, and groundwater flooding.

The first cycle of planning ran from 2009 until 2015. Within this time LLFAs published their first PFRAs. The first FRMPs were also published.

The second cycle of planning commenced in 2016. Within this cycle, LLFAs published addendums to their existing PFRAs, the EA published their PFRA, and the second cycle FRMPs were published in December 2022, with actions to manage flood risk across England for the period 2021 to 2027.

The EA PFRA (2018) for river, sea and reservoir flooding identifies nationally significant Flood Risk Areas for these sources. This PFRA identified forty FRAs in the Humber RBD, eight FRAs in the North West RBD and five FRAs in the Severn RBD, however none of these affect the borough. The full PFRA can be found on the Government website.

The SCC PFRA, published in 2011, is a high-level screening exercise which identifies the areas of significant flood risk within Staffordshire County based on the data from the county council, all eight Borough/District Councils, the EA, Staffordshire Civil Contingencies, Parish Councils, British Waterways, Highway Agency, United Utilities and Severn Trent Water. This identified 1,663 records of historical flood events, 28% of these records were within the borough, with four of these regarded as having had significant harmful consequences. But no Flood Risk Areas were identified within Newcastle-under-Lyme. No Flood Risk Areas were also identified during the addendum to the SCC PFRA, published in 2017. In the 2017 addendum there were two additional significant flood events identified, in June 2012, and June 2016. The original 2011 SCC PFRA can be accessed here, and the 2017 addendum to the PFRA is available on the Government website here.

The borough lies within the Humber, North West, and Severn River Basin Districts (RBDs). The second cycle FRMPs are plans to manage the risk from all sources of flooding in nationally identified Flood Risk Areas. No Flood Risk Areas have been identified within the borough within any of the RBDs.

More information on district and national scale measures is available on the EA's online interactive mapping.

2.3.3 Flood and Water Management Act (2010)

The FWMA was passed in April 2010 following the recommendations made within the Pitt Review (2009) following the flooding in 2007. It aims to improve both flood risk management and the way water resources are managed.

The FWMA (2010) 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 Local Authorities, 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. Schedule 3 of the FWMA 2010 is expected to be implemented by the government in the short term, following periods of consultation, making SuDS mandatory for new developments in England. Further information on Schedule 3 is provided in Section 9.1.

The content and implications of the FWMA (2010) provide considerable opportunities for improved and integrated land use planning and flood risk management by Local Authorities 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.

2.3.4 The Water Framework Directive and Water Environment Regulations and River Basin Management Plans

The purpose of the 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 RBMPs.

The WFD requires the production of RBMPs for each RBD. RBMPs support the government's framework for the 25-year environment plan and allow local communities to find more cost-effective ways to further improve our water environments. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques.

The EA manages the RBMPs and must review and update them every six years. The first cycle of RBMPs were published in 2009 and were most recently updated in 2022.

The borough lies across the Humber, North West, and Severn RBDs. The updated Humber RBD RBMP for 2022 can be found here, the North West FBD RBMP here and Severn FBD RBMP here.

2.3.5 Strategic Flood Risk Assessment guidance

This Level 1 assessment is undertaken in accordance with the 'How to prepare a Strategic Flood Risk Assessment guidance', which was last updated in May 2024. The guidance sets out the approaches to both Level 1 and Level 2 assessment and can be accessed on the Government website.

2.3.6 Catchment Flood Management Plans

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

The Newcastle-under-Lyme borough lies across several CFMP areas: the River Trent CFMP, the River Severn CFMP, and the Weaver Gowy CFMP. These set out policies relating to flooding from rivers, surface water, and groundwater within their respective catchment areas. Measures set out within the FRMPs that are applicable to Newcastle-under-Lyme Borough include:

- Research and work with partners and Non-Governmental Organisations to identify planning and development risks and opportunities in Staffordshire.
- Map funding and external partnership opportunities in Staffordshire.
- Exploit opportunities to store water or manage run-off in identified areas in the North West of England.
- Identify and map opportunities to deliver nature-based solutions on Risk Management Authority owned land in the North West of England.
- Work together to deliver conventional, innovative, and nature-based improvements to flood risk, water, and habitat quality in the North West of England.
- Work together with Planning authorities, Local Enterprise Partnerships, and communities in the North West of England.

- Work with local planning authorities, developers and other placemakers to ensure the wider use and adoption of Sustainable Drainage practices in the North West of England.
- Work with regional groups and other partner organisations to identify opportunities, develop and if possible, deliver joint water management solutions in the Environment Agency West Midlands Area.
- Monitor the effectiveness of NFM interventions in the Environment Agency West Midlands Area.

The Environment Agency (EA) Explorer Map provides further information on regional and national measures set out as part of the FRMPs.

2.3.7 Staffordshire Local Flood Risk Management Strategy (LFRMS) 2024

SCC is responsible for developing, maintaining, applying, and monitoring a LFRMS. The LFRMS is used as a means by which the LLFA co-ordinates Flood Risk Management on a day-to-day basis. SCC undertook an update of their LFRMS, initially published in 2015, in 2024. They intend to undertake a more detailed review when Schedule 3 of the FWMA 2010 is initiated. Further information is available on the SCC website here.

The LFRMS aims to set out how flood risk will be reduced and managed in the study area, with five main objectives, available on the SCC website here:

- **Improve our understanding of flood risk and be prepared for flood events.**
  - Continue to gather information on different sources of flood risk and how various drainage systems interact.
  - Provide better records for historic flooding, particularly investigating the causes.
  - Use improved information on flood risk to ensure emergency services, partner organisations and communities better understand the nature of local flood risk and improve their preparedness and encourage communities to take part in preparing for flood events.
- **Manage flood risk and new development in a sustainable manner**.
  - Engage local communities and provide them with improved flood risk information to increase understanding and enhance their readiness for, protection against, response to, and recovery from flooding.
    Offer strategic infrastructure support for all flood-prone areas through a targeted approach to community identification and collaboration.
- **Seek and secure funding for flood alleviation schemes and work with partners.**
  - Collaborate with partner organisations to reduce the duplication of effort.
  - Priorities flood risk management funding for areas that are most in need and where solutions will have the greatest impact.
  - External funding for flood risk projects will be actively pursued, prioritising based on evidence of flooding and sustainability of solutions.

- Local stakeholders' engagement will be prioritised in the development of local flood alleviation schemes, allowing communities to influence design, contribute and maximise the scheme potential.
- Consistent methods will be adopted and partnerships with RMAs, organisations, landowners, and community groups, will be strengthened to effectively target resources, coordinate funding and expertise.
- Improve collaborations across catchment and authority boundaries to advance multi-benefit schemes for communities.

- **Work with others to ensure communities are more aware, informed, and resilient to flooding.**
  - Provide local communities with updated flood risk information, including advised actions, to increase understanding and facilitate informed decision making to increase resilience.
  - Engage with communities to help them better prepare for, protect against, respond to, and recover from, flooding.
  - Provide strategic infrastructure to identify flood prone communities and work with them.
- **Promote effective management of drainage and flood defence assets.**
  - Raise awareness of the responsibilities of both man-made and natural drainage systems.
  - This will involve a series of measures including disseminating publicity information, engaging directly with the responsible parties for designating features, obtaining consent for works and using permissive land drainage powers as necessary to manage the ordinary watercourse network.

2.3.8 Local policy and guidance for SuDS

The 2023 NPPF states that: ‘Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate’ (Paragraph 175) and 'development should only be allowed in areas at risk of flooding where… it can be demonstrated that… c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate' (Paragraph 173). When considering major planning applications, local planning authorities (LPAs) should consult the relevant LLFA on the management of surface water to satisfy that:

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

At the time of writing this SFRA, the following documents and policies are relevant to SuDS and surface water in the study area. Hyperlinks are provided to external documents:

- SuDS Manual (C753), published in 2007 and updated in 2015.
- Defra Non-statutory technical standards for sustainable drainage systems, 2015

- Defra National Standards for sustainable drainage systems Designing, constructing (including LASOO best practice guidance), operating, and maintaining drainage for surface runoff, 2011
- Building Regulations Part H (MHCLG), 2010
- SCC Sustainable Drainage Systems (SuDS) Handbook, 2017.

The 2023 NPPF states that flood risk should be managed “using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding" (Paragraph 167). Alongside flood risk management, SuDS can provide amenity, biodiversity, recreation, community, and water resources benefits. Where possible, priority should be given to SuDS that can deliver multiple benefits.

2.3.9 Water Cycle Studies

Water Cycle Studies (WCSs) assist local authorities to select and develop growth proposals that minimise impacts on the environment, water quality, water resources, infrastructure, and flood risk and help to identify ways of mitigating such impacts.

A joint Phase 1 WCS for Stoke-on-Trent and Newcastle-under-Lyme was undertaken by JBA as part of the previous Level 1 SFRA. This was published in January 2020 and is available to download from the Council website, here. A detailed Phase 2 WCS is currently being undertaken by JBA alongside this Level 1 SFRA.

2.3.10 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are undertaken, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning, and future developments.

There is a SWMP for Kidsgrove, which was led by SCC working in partnership with Cheshire East Council and United Utilities in 2013. The modelling outputs from the SWMP were embedded into the national EA Risk of Flooding from Surface Water map. A scheme to provide Property Flood Resilience (formerly Property Level Protection) for parts of central and northern Kidsgrove followed on from the SWMP.

2.3.11 Water Resources Management Plans (WRMPs)

Under the duties set out in sections 37A to 37D of the Water Industry Act 1991, all water companies across England and Wales must prepare and maintain a WRMP. This must be prepared at least every five years and reviewed annually.

WRMPs should set out how a water company intends to achieve a secure supply of water for their customers and a protected and enhanced environment.

United Utilities published their Final WRMP in 2019, available on their website here. It defines their strategy to undertake sustainable plans for water supplies in the North West between 2020 and 2025. United Utilities has also published a draft of their new WRMP (WRMP24) which plans for an adequate supply to meet demand from 2025 to 2085, available on their website here.

Severn Trent Water published a Draft WRMP 2024 in November 2022 available on their website here. It demonstrates long-term plans to accommodate the impacts of population growth, drought, environmental obligations, and climate change. The plan looks ahead across the period between 2025 and 2085. The final WRMP is due to be published in Summer 2024.

2.3.12 Drainage and Wastewater Management Plans (DWMPs)

Water and sewage companies must produce a Drainage and Wastewater Management Plan (DWMP), covering a minimum of 25 years, which looks at current and future capacity, pressures, and risks to their networks such as climate change and population growth. They detail how a company plans to work with RMAs and drainage asset owners to manage future pressures. The water and sewage company for the study area is United Utilities.

United Utilities published their first DWMP in May 2023, which is available here. It highlights effects of future pressures on wastewater systems over the short, medium, and long term, and what can be done to address these issues. It covers the period 2023-2050. The area is separated into 14 Strategic Planning Areas (SPAs). Newcastle-under-Lyme falls within the Weaver Gowy SPA. As part of their DWMP assessment, United Utilities undertook a high-level assessment of Tactical Planning Units where future internal and external flooding risks are forecast. Areas identified within Newcastle-under-Lyme include Kidsgrove and Audley.

Severn Trent Water published their draft DWMP in June 2022, which is available here. It provides evidence to support and inform their PR24 business plan, covering the period from 2025-2030, to ensure short term investment needs align with longer-term needs of the catchments out to 2050 and beyond. There is an addendum published in October 2023 which outlines the differences between the DWMP and the PR24 business plan, which is available here. Newcastle-under-Lyme falls within two SPAs, the Upper Trent, and the Tern.

3 Planning policy for flood risk management

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

3.1 National Planning Policy Framework and Guidance

The NPPF sets out the Government's planning policies for England and is available on the Government website. It was most recently updated in December 2023. It must be considered in the preparation of Local Plans and is a material consideration in planning decisions. The NPPF advises on how flood risk should be considered to guide the location of future development and FRA 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” (Paragraph 166).

The PPG on flood risk and coastal change was published in March 2014 and sets out how the policy should be implemented. Diagram 1 in the PPG sets out how flood risk should be considered in the preparation of Local Plans. It was updated on the 25 August 2022. The most up-to-date guidance is available on the Government website.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the sequential test (as defined in Paragraph 167 of the NPPF) so that all sources of flood risk are to be included in the consideration. The requirement for the revised sequential test has been addressed by adopting the following approach:

- The test will no longer be purely based on the use of the Flood Zones describing river and sea flood risk, and instead be based on whether development can be located in the lowest risk areas (high-medium-low) of flood risk both now and in the future. The test now applies to all sources of flood risk – whereas previously the test was only performed for present day flood risk for the “Flood Zones” i.e., river and sea flood risk.
- Understanding flood risk to sites based on their vulnerability and incompatibility as opposed to whether development is appropriate.
- In addition to the flood risk mapping describing river and sea flood risk, there is mapping available to describe surface water flood risk. Although, this is not conceptually similar to the flood risk mapping for rivers and sea due to the differing nature of flooding.
- As there is no available competent risk mapping for other sources of risk it is not considered appropriate to use such mapping in a strict process that involves comparison of differing levels of flood risk. Reservoir, groundwater, and sewer

flood risk are addressed through the SFRA using a variety of datasets to analyse and describe the risk to areas across the study area.

- A more formal assessment of these sources is undertaken in a Level 2 SFRA and involves a more detailed assessment at site level of the implications of reservoir, sewer, and groundwater flood risk to establish that more appropriate locations at lower risk are not available. Consultation with the sewerage undertaker is necessary to take in to account any hydraulic incidents and the latest available modelling information on sewer flood risk.
- Consideration is given to all sources of flood risk using the available data to complete the sequential test so decisions on the selection of preferred sites for allocation address the potential implications of groundwater, reservoir, and sewer flooding. Also, where necessary it identifies sites where consideration should be given to satisfying the requirements of the exception test.

3.2.1 Flood Zones - fluvial risk

The definition of the Flood Zones is provided below. The Flood Zones do not consider defences, except when considering the functional floodplain. 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 are:

- Flood Zone 1: Low risk: less than a 0.1% chance of river flooding in any given year.
- Flood Zone 2: Medium risk: between a 1% and 0.1% chance of river flooding in any given year.
- Flood Zone 3a: High risk: between a 3.3% and 1% chance of river flooding in any given year.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood (greater than a 3.3% chance of river flooding in any given year). 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. Information on flood risk vulnerability classification is available online in Annex 3 of the NPPF, here. It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in an FRA and a suitable approach is agreed with the EA.
    - Flood Zone 3b is based on the best available modelled data:
        - 3.3% Annual Exceedance Probability (AEP) where available
        - 2% AEP where the 3.3% is not available.
        - Where model data is not available, Flood Zone 3a is used as a conservative proxy.

Flood Zones 2 and 3a consider undefended fluvial risk whilst Flood Zone 3b considers defended fluvial risk. The Flood Zones do not risk mapping for surface water, sewer,

groundwater flooding or the impacts of reservoir failure or climate change. Hence, there could still be a risk of flooding from other sources and that the level of flood risk will change over the lifetime of a development. In addition to the Flood Zones, areas at future flood risk need to be considered within the sequential test. The approach to consideration of climate change within this SFRA and the available data are set out in Section 5 and Appendix C: User Guide details the approach for assessing future flood risk within the SFRA.

Important note on Flood Zone information in this SFRA

Flood Zones 2 and 3a, as shown in Appendix A: GeoPDFs, show the same extent as the online EA's Flood Map for Planning (FMfP) (which incorporates latest modelled data) except for the EA's Fowlea Brook (2023) model. Here, the latest undefended model outputs have been used in preference to the EA's FMfP.

The EA Flood Zones do not cover all catchments or ordinary watercourses with areas <3km². As a result, whilst the EA Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from a smaller watercourse(s) not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 3.3% AEP (1 in 30 years), or land designated as a Flood Storage Area. Flood defences should be considered when delineating the functional floodplain. The 3.3% AEP defended modelled flood extents have been used to represent Flood Zone 3b, where available from the EA. For this SFRA, the defended 3.3% AEP extent was available for Lyme Brook. For Fowlea Brook, which is covered by a detailed EA model but with no defended 3.3% AEP output available, the 2% AEP undefended output was used as a conservative proxy. There are no designated Flood Storage Areas within the borough.

For areas outside of the detailed model coverage, Flood Zone 3a has been used as a conservative proxy for Flood Zone 3b. Further work should be undertaken as part of a Level 2 SFRA, if required, or a detailed site-specific FRA to define and refine the extent of Flood Zone 3b where no detailed modelling exists. Caution should also be applied where the conservative Flood Zone 3b extent encompasses existing urban areas which would not otherwise be "designed to flood". The Council should use local policies to set out what change of use and redevelopment may be acceptable in these existing urban areas.

The SFFRA provides an indication of Flood Zone 3b, however there are likely to be occasions where the Council wishes to alter and/or designate areas of Flood Zone 3b in light of new evidence and/or local circumstances, in consultation with the LLFA and EA. The following principles set out how this should be approached:

- In the first instance, Flood Zones should be defined using the latest available modelling.
- Where there is reason to believe modelling might be inaccurate or outdated (e.g. following significant changes in the channel, opening of culverts, construction of defences/earthworks etc.), the ideal would be for models to be updated to determine the risk.

- Where modelled outputs are not available for the 3.3% AEP fluvial event (FZ3b), the 1% AEP outline or the EA's Flood Zone 3 should be considered as Flood Zone 3b.
- If defences are proposed (excluding property flood resilience measures which protect only residential properties, but not their curtilage e.g. flood doors), there is a requirement for the developer/landowner to demonstrate through modelling that the risk is not increased elsewhere as a result, therefore the building of a defence alone without supporting modelling is not a reason to alter Flood Zones.
- Where there are known local flooding issues that are not represented in the EA's Flood Zones (for example due to being on very small watercourses) the Council may decide to designate these areas as flood zones.
- Any development proposals in areas identified as Flood Zones should be accompanied by a site specific FRA supported by detailed modelling to determine the true risk to the site (which may in turn be used to designate appropriate Flood Zones). Ultimately it is for the council to satisfy itself that evidence presented by developers is robust.
- Developers should enter into collaborative discussions with the LPA and EA where a developer considers there to be ambiguity over the flood zone classifications with Flood Zone 3.

3.2.2 Flood Zones - surface water risk

To address the requirement that flood risk from all sources is included in the sequential test in addition to the fluvial Flood Zones, a further set of surface water zones have also been defined.

The surface water zones define locations at either lower or higher risk of surface water flooding based on the extent of the 1% AEP surface water extent plus upper end climate change allowance for the 2070s. This is the upper end allowance for the 2070s epoch which the EA climate change guidance recommends is assessed within SFRAs.

- Zone A – lower risk of surface water flooding (lies outside the 1% AEP surface water extent plus an allowance for climate change)
- Zone B – higher risk of surface water flooding (lies within the 1% AEP surface water extent plus an allowance for climate change)

In some cases, it is possible for the 1% AEP event to show a greater extent that the 1% AEP plus an allowance for climate change. This may be because local surface water flood modelling has been produced and used to inform the EA RoFSW map. Further assessment at a site-specific level may be required to refine the surface water flood extents. This is discussed further in Section 5.3.2.

Surface water mapping does not strictly describe the same conceptual risk zone as is defined for river and sea flooding (even though it is notionally associated with the same probability) as the mapping is based on different assumptions. However, it does create a product that can accommodate sequential testing, as it can facilitate strategic decisions that direct development to land in a “lower risk surface water flood zone”.

Surface water flood risk can be of much shallower depth and is not normally experienced for such extensive durations as river flooding. However, the safety implications of placing proposed development at locations where there is surface water flood risk together with the potential effects on third parties is a material consideration and thus if it is proposed to place development in a Zone of high surface water flood risk then consideration should be given to the demonstrating that part “b” of the Exception Test (outlined in Section 3.2.5) can be satisfied (with the presumption that part “a” was satisfied if the land was allocated in the Local Plan).

3.2.3 Flood Zones - other sources of flooding

While all sources of flood risk should inform the sequential test, the national data available for use in this SFRA for other sources of flooding such as reservoirs are not sufficient 'risk-based' datasets to inform the sequential test in the same way as the available data for fluvial and surface water risk, and therefore a more detailed assessment will be required for these sources where a Level 2 assessment is appropriate.

A reservoir's primary function is to provide water storage; however, they can be a source of flooding and present a residual risk of flooding. The latest available mapping (Reservoir Flood Extents) now shows “wet day” and “dry day” reservoir inundation extents. The “wet day” being a reservoir breach at the same time as a 0.1% AEP river flood (as this is a likely time when a reservoir might fail) and the "dry day" shows the failure just from the water retained by the dam. However, neither set of mapping describes a risk-based scenario, as they do not indicate the relative risk to land based on the probability of dam failure but are intended to show a “worst credible case”.

By comparing the extent of Fluvial Flood Zone 2 with the Reservoir Flood Map Wet Day Extent, two zones can be defined:

1. Where reservoir flooding is predicted to make fluvial flooding worse.
2. Where reservoir flooding is not predicted to make fluvial flooding worse.

The mapping could be used to direct proposed new development away from locations that could potentially be affected by reservoir flood risk. However, it is different to the risk pertaining to river and sea flooding and further assessment would be required to understand the magnitude of the potential hazard. This mapping will also identify locations where proposed development could result in a change to the risk designation of a reservoir. If proposed sites are located in a zone at reservoir risk, it will be necessary to include a more detailed assessment in a Level 2 SFRA.

With regards to sewer and groundwater flood risk, for the purposes of this SFRA it is not possible to prepare zone maps as the appropriate analyses and data are not available nationally. Sewer flooding is presented as postcode point locations, and groundwater mapping data shows susceptibility of risk and likelihood of emergence. The latter could be viewed in conjunction with the surface water mapping to ascertain where emerging overland flows may travel above ground. The existing datasets on sewer flooding and groundwater are therefore used to inform the sequential approach to development at a site

in accordance with Paragraph 167 of the NPPF (which could in some instances result in alternative sites being considered).

Direct consultation with the relevant water and sewerage company will be necessary to further understand the history of flooding from sewers and the water network once site-specific details are known as sewer flood risk is a site-specific issue.

3.2.4 The sequential test

Firstly, land at the lowest risk of flooding from all sources should be considered for development. A test is applied called the 'sequential test' to do this, summarised in Figure 3-1. The LPA are required to undertake the sequential test to strategic allocations in the preparation of their Local Plan. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

This section sets out the sequential test for the Local Plan process. The sequential test for developers is outlined in Section 3.3.

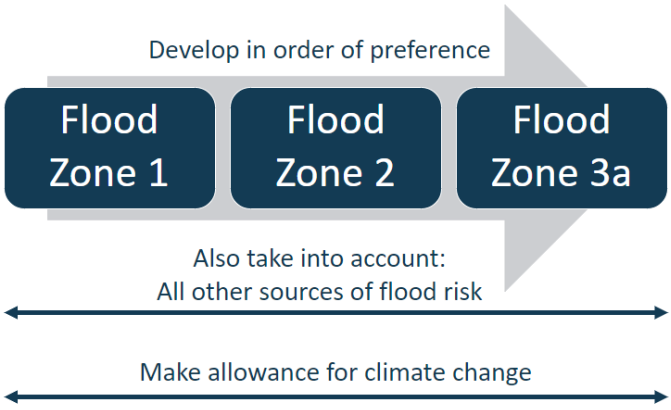


Figure 3-1: A summary of the sequential test.

The LPA should define a suitable search area for the consideration of alternative sites in the sequential test. The sequential test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land / 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. Annex 3 of the NPPF sets out the flood risk vulnerability classifications for different development types. Table 2 of the PPG defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to flooding which can be found on the Government website here.

Figure 3-2 illustrates the sequential and exception tests for Local Plan preparation 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 complex one, as several of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. The SFRA User Guide in Appendix C shows where the sequential and exception test may be required for the datasets assessed in the SFRA, and how to interpret different sources of flood risk, including recommending what proposed development sites should be assessed at Level 2.

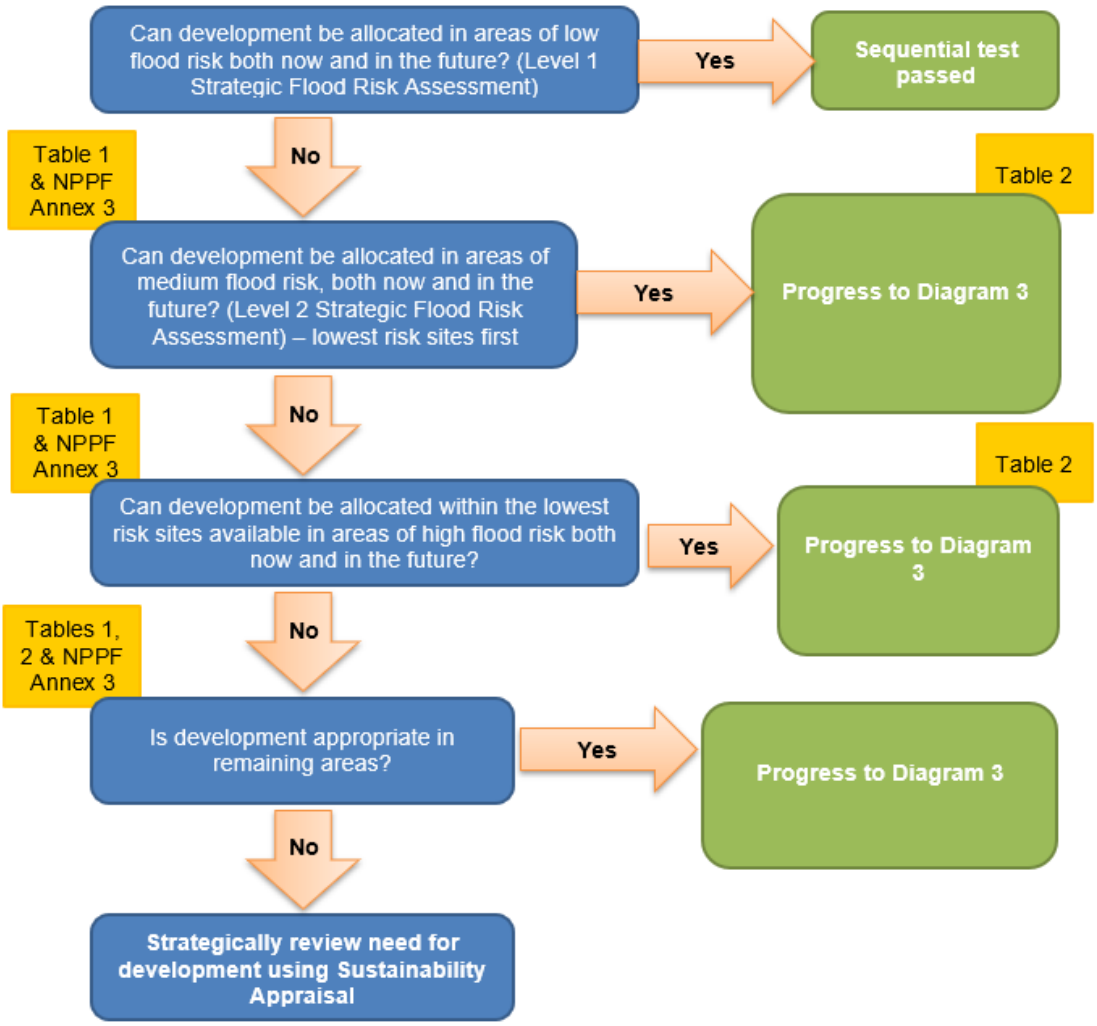


Figure 3-2: Local Plan sequential approach to site allocation.

3.2.5 The Exception Test

It will not always be possible for all new development to be located 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:

- 'Essential infrastructure' in Flood Zone 3a or 3b
- 'Highly vulnerable' development in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)
- 'More vulnerable' development in Flood Zone 3a (this is NOT permitted in Flood Zone 3b)
- Any development where a higher risk of surface water has been identified (surface water Zone B) and the site does not clearly show that development can be achieved away from the flood risk.

While current guidance in Table 2 of the PPG only applies to the EA's Flood Map for Planning, which displays risk of flooding from rivers and the sea, updated PPG (August 2022) now requires all sources of flood risk to be assessed within the sequential test and therefore it follows that, where sufficient datasets are available, the exception test should also take into account all sources of flood risk.

Figure 3-3 summarises the Exception Test. For information relating to the application of the Exception Test to plan preparation, please see Diagram 3 of the PPG.

For sites proposed for allocation within the Local Plan, the LPA should use the information in this SFRA to inform the exception test. At the planning application stage, the developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in national and local planning policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the exception test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan or where the sequential test was not applied at the development plan stage and new information becomes available that identifies a flood risk, developers must undertake the sequential and exception tests and present this information to the LPA for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the exception test for windfall sites.

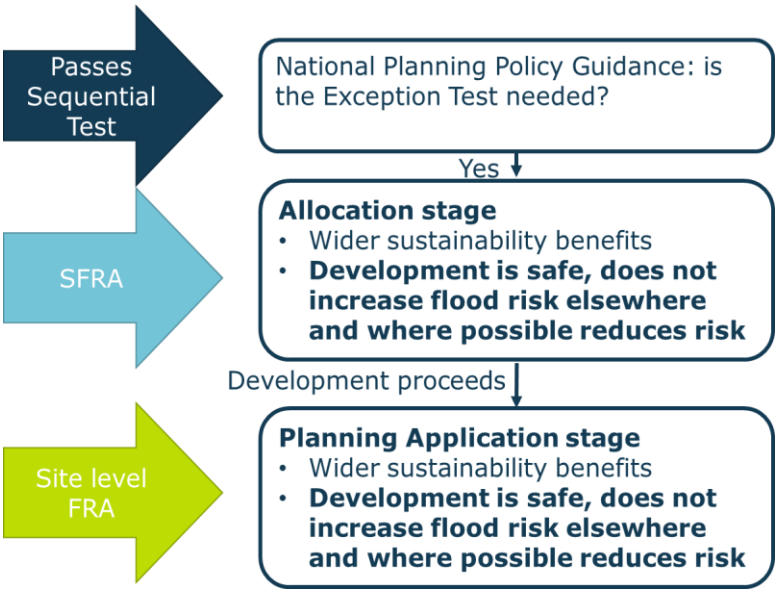


Figure 3-3: The exception test.

There are two parts to demonstrating a development passes the exception test:

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

The LPA will need to set out the criteria used to assess the exception test and provide clear advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the LPA should consider whether the use of planning conditions and / or planning obligations could allow it to pass the exception test. If this is not possible, this part of the exception test has failed, and planning permission should be refused.

At the stage of allocating development sites, the LPA should consider wider sustainability objectives, such as those set out in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, housing, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

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

2. **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.**

In circumstances where the potential effects of proposed development are material a Level 2 SFRA is likely to be needed to inform the exception test for strategic allocations to provide evidence that the principle of development can be supported. At the planning application stage, a site-specific FRA will be needed. Both will need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.6 Making a site safe from flood risk over its lifetime

The LPA will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- The actual risk is the risk to the site considering existing flood mitigation measures.
- The PPG refers to the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed. The 'design flood' is defined as the 1% AEP fluvial event or 1% AEP surface water event, plus an appropriate allowance for climate change. Allowances for climate change can be found on the EA website.
- Safe access and egress should be available during the design flood event. Firstly, the design of the development should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable. Consideration of access and egress is clearly set out in the updated PPG.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
  - A breach of a raised flood defence, blockage of a surface water conveyance system or failure of a pumped drainage system;
  - Failure of a reservoir; and
  - A flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage caused, should water enter a property. Emergency plans should also account for residual risk, e.g., through the provision of flood warnings and a flood evacuation plans where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

Section 8.2.5 discusses requirements for finished floor levels.

3.3 Applying the sequential test and exception test to individual planning applications

3.3.1 Applying the sequential test

Newcastle-under-Lyme Borough Council, with advice from the EA, are responsible for considering the extent to which sequential test considerations have been satisfied.

Developers are required to apply the sequential test to all development sites, unless the site is:

- A strategic allocation and the test has already been carried out by the LPA as part of preparing the Local Plan, or
- A change of use (except to a caravan, camping or chalet site, or to a mobile home or park home site), or
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m²), or
- A development in fluvial Flood Zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, groundwater, reservoir, sewer flooding).

It should also be noted that residential sub-divisions are exempted from the definition of minor development and therefore, by default, should also be subject to the sequential test. However, a pragmatic approach on the availability of alternative sites should be taken (PPG, Paragraph 27).

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

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

The sources of information on reasonably available sites may include but is not restricted to:

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

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

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

3.3.2 Applying the exception test

If, following application of the sequential test, it is not possible for the development to be located in areas with a lower probability of flooding the exception test must then be applied (as set out in Table 2 of the PPG).

Where a development proposal is in accordance with an allocation made in a Local Plan following the application of the sequential and exception tests, the exception test will only be required to be repeated if:

- Elements of the development that were key to it satisfying the exception test at the plan-making stage (such as wider sustainability benefits to the community or measures to reduce flood risk overall) have changed or are not included in the proposed development; or
- The understanding of current or future flood risk has changed significantly.

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

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

- Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These often consider matters such as biodiversity, green infrastructure, housing, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Applicants should assess the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

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

- The site-specific FRA should demonstrate that the site will be safe, and the residents/occupiers will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
  - The design of any flood defence infrastructure,
  - Access and egress,
  - operation and maintenance,
  - design of the development to manage and reduce flood risk wherever possible,
  - resident awareness,
  - flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event, and
  - any funding arrangements required for implementing measures.

Further guidance on FRAs for new developments can be downloaded from the government website here.

4 Understanding flood risk across the borough

This section explores the key sources of flooding in the borough and the factors that affect flooding including topography, soils, and geology. The main sources of flooding affecting the study area are from watercourses, surface water, and sewers, as detailed in information provided by the Council, SCC, the EA, and Severn Trent Water.

This is a strategic summary of the risk in the study area. Developers should use this section to scope out the flood risk issues they need to consider in greater detail in a site-specific FRA to support a Planning Application.

Appendix B contains a list of the sources of data used in the SFRA and the approach to using hydraulic model data to inform the mapping, while Appendix E contains a summary of flood risk.

4.1 Historical flooding

There have been limited records of historic flooding within the borough.

The EA's Historic Flood Map (HFM) shows areas of land that have been previously subject to flooding in the area. This includes flooding from rivers, the sea and groundwater springs but excludes surface water. The EA Recorded Flood Outlines and HFM datasets have no records of flooding within the borough.

Information on sewer flooding across the study area is included in Section 4.5 and a list of historic flooding incidences provided by Severn Trent Water is available in Table 4-1.

4.1.1 Section 19 Flood Investigations

Under the Flood and Water Management Act (2010), the Lead Local Flood Authority (LLFA) has a duty to investigate flood incidences, where considered necessary or appropriate and produce a report. Section 19 Flood Investigation reports are available for the following flood events:

- June 2016 (Staffordshire-wide): Newcastle-under-Lyme borough was identified as being one of the worst affected settlements. There were two flooding hotspots identified: one was a near miss from the SCC Flooding Hotspots data and the other was an external flooding incident from the Severn Trent Water Flooding Hotspots. The report is available here.
- October 2019 (Staffordshire-wide): one affected area was noted in Newcastle-under-Lyme, Gloucester Road, Newcastle (Kidsgrove). Two properties were reported to be affected, with one property reported to have flooded internally. The report is available here.

Further Section 19 Flood Investigation reports are available through the SCC website here.

4.2 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.

4.2.1 Topography

Figure 4-1 shows the topography of the study area. The highest elevations in the borough are generally found in the north, the southeast border and along the central areas, with the topography sloping downhill towards the northwest boundary and the eastern boundary.

The location with the highest elevation in the north of the borough is roughly 318m AOD at Mow Cop Castle. Furthermore, the central areas of the borough with high elevation are located near the settlements Bignall Hill, Alsagers Bank, Keele, and Acton. There is also an area of high elevation along the southeast border of the borough, where the settlements of Ashley Heath and Loggerheads are located.

In the west of the borough around Wrinehill, Hales and Almington the elevation is much lower, generally remaining below 60m AOD, and the topography is generally quite flat.

4.2.2 Geology

Information on the bedrock and superficial geology across the borough can be viewed online in the British Geology Society Geology Viewer.

In the northern areas of the borough, the geology is primarily comprised of Pennine Middle Coal Measures Formations consisting of sandstone, mudstone, and siltstone. To the east of the borough there are several types of bedrock geology including, Halesowen formation, Springpool Sandstone Bed, and Salop formation of sandstone, mudstone, and conglomerate, with Springpool Sandstone Bed having the largest coverage. To the west, the bedrock geology is mainly comprised of sandstone groups such as, Wilmslow Sandstone formation, Halesowen formation, and Chester formation, with some areas of Sidmouth Mudstone formation. South of Mucklestone, bedrock geology in the borough is comprised mainly of Chester formation, which consists of sandstone and conglomerate.

The EA also provides mapping of different types of aquifers, the underground layers of water-bearing permeable rock from which groundwater can be extracted. Aquifers are designated as either principal or secondary aquifers. Principal aquifers are designated by the EA as strategically important rock units that have high permeability and water storage capacity.

In the borough, the largest aquifer is Secondary A, which is located predominantly in the northern, central, and eastern areas, with a few areas in the southern end of the borough. There is a Principal aquifer which covers the south of the borough and some smaller areas to the west. There is an isolated area of Principal aquifer near Clayton. There are areas of

Secondary B aquifers along the western and south-east borders of the borough. Furthermore, there are two areas along the western border of unproductive aquifer, including near the settlements of Betley and Wrinehill. The aquifer designations across the borough for bedrock geology are shown in Figure 4-2.

In the northern, eastern, and western regions of the brough superficial glaciofluvial and till deposits are widely present, particularly at higher elevations. In the eastern side of the borough, near Newcastle-under-Lyme, and western side near Madeley, there are areas of alluvium deposits. Information on superficial deposits is not available for much of the south end of the Borough, but there are small areas of peat, alluvium, glaciofluvial and till deposits in the south-west.

4.2.3 Soils

In general, the soils across the borough are seasonally wet and slowly draining, with high groundwater levels, with reduced permeability which may impact potential infiltration across the borough.

In the northern region of the borough, soils are loamy, clayey, and sandy, slowly permeable, and seasonally wet. In the east of the borough the soils are mainly slightly acidic but base-rich loamy and clayey soils, slowly permeable and seasonally wet. Within the eastern area, there are also smaller areas of loamy and clayey floodplain soils with naturally high groundwater located near Newcastle-under-Lyme. To the southeast area of the borough soils are freely draining acidic sandy and loamy soils with smaller areas of fen peat and loamy and sandy soils with naturally high groundwater and peaty surface. Throughout the west side of the borough, the soils are mainly freely draining slightly acid loamy soils with small areas of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. In the south of the borough soils are mainly freely draining slightly acid loamy, sandy, and clayey soils with a small area of loamy and clayey floodplain soils with naturally high groundwater located south of Hales.

Soils data across the study area is available from the British Geological Survey website.

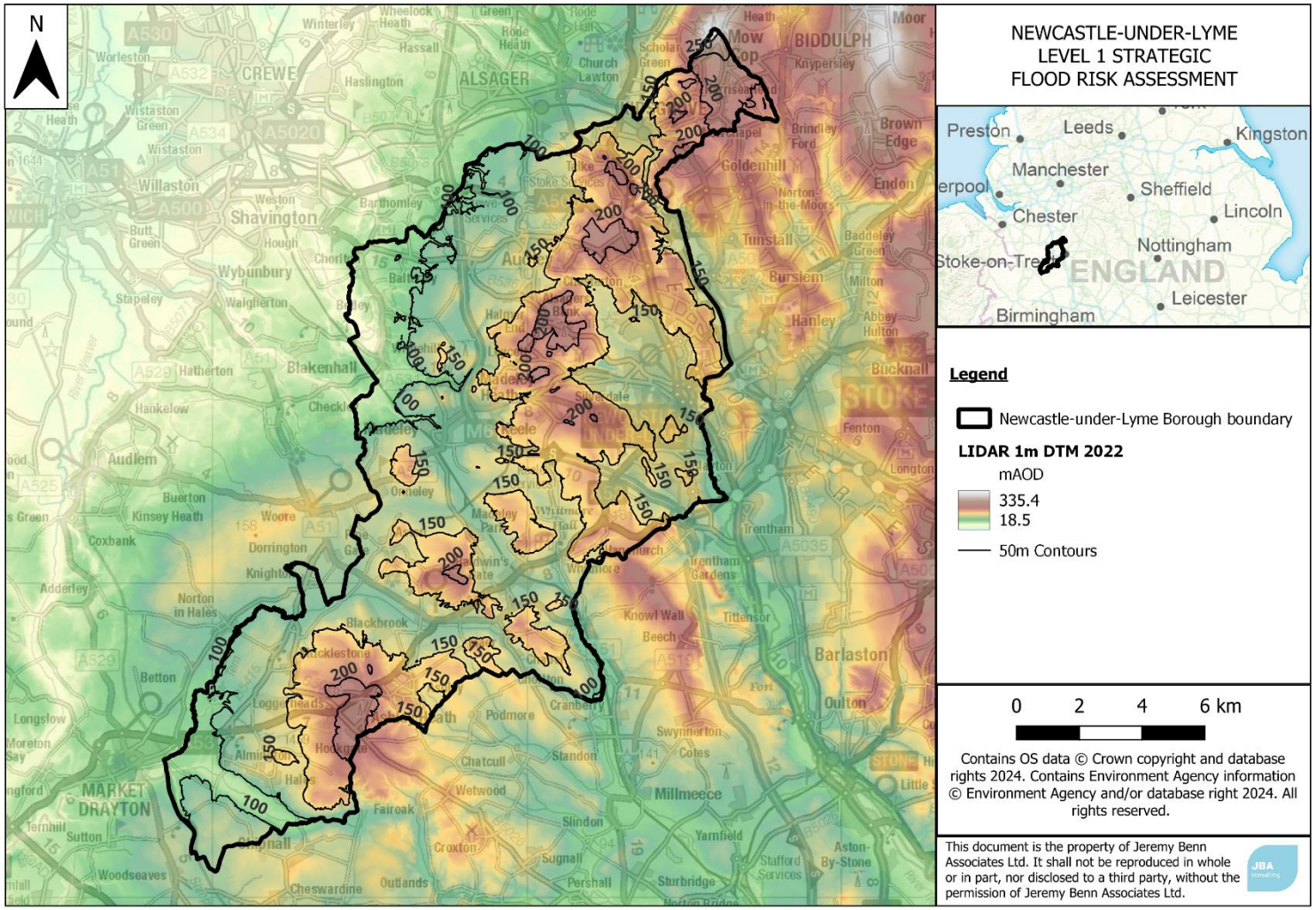


Figure 4-1: EA 1m LiDAR data showing the topography across the borough.

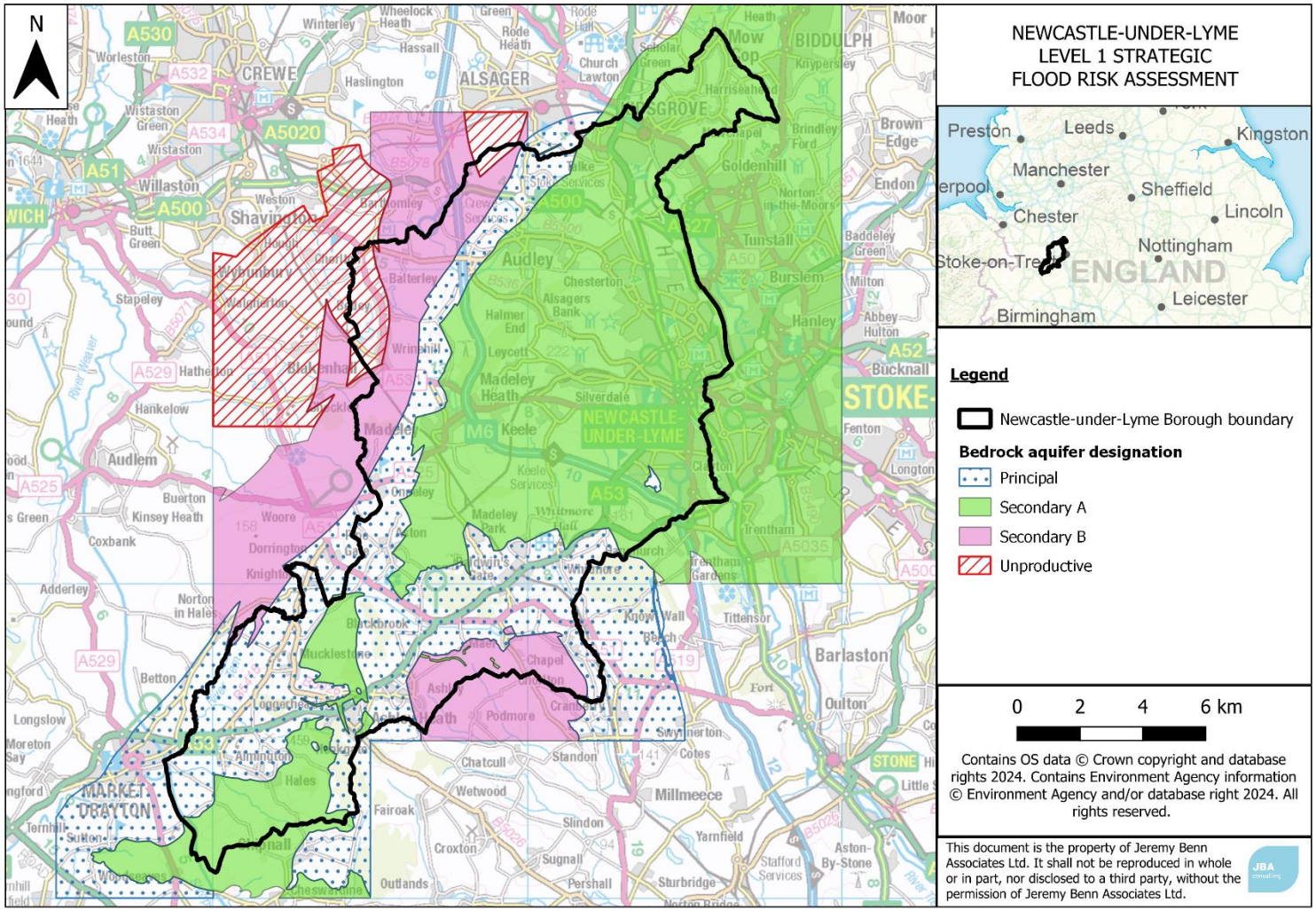


Figure 4-2: Aquifer designations based on bedrock geology across the borough.

4.3 Fluvial flood risk

The major watercourses flowing through the borough are:

- Lyme Brook
- Fowlea Brook
- River Lea
- River Tern
- Coal Brook

Tributaries of these watercourses include smaller ordinary watercourses and numerous unnamed drains. There are also several ponds and lakes within the study area. A map of the key watercourses is included in Figure 1-5 and in Appendix A: GeoPDFs.

The primary fluvial flood risk in the borough is from rivers running through developed areas such as Lyme Brook, and its tributaries including Silverdale Brook, which run through the town centre of Newcastle-under-Lyme, and the River Lea, where it runs through Madeley.

The Flood Zone maps for the study area are provided in Appendix A: GeoPDFs, split into Flood Zones 2, 3a. Section 3.2.1 describes how the fluvial Flood Zones have been derived for this SFRA. The flood risk associated with the major locations in the borough are detailed in Appendix E.

4.4 Surface water flooding

Surface water runoff 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 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 EA Risk of Flooding from Surface Water mapping (RoFSW) highlights several communities in the study area at risk from surface water flooding. Surface water flow paths generally follow the topography of existing watercourses, although there are some areas at risk from isolated ponding. Additionally, surface water flow routes are also established on roads in the more urban areas within the study area, particularly within Newcastle-under-Lyme, highlighting risk to transport networks while posing a risk to buildings which water can be routed to. The RoFSW mapping for the study area can be found in Appendix A: GeoPDFs.

The impacts of climate change on surface water flooding are discussed in Section 5.3.2.

4.5 Sewer flooding

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels.

Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a 3.3% AEP rainfall event, although until recently this did not apply to smaller private systems. This means that sewers can be overwhelmed in larger rainfall and flood events.

New developments should not cause additional pressures on existing sewers due to the requirements to maintain greenfield runoff rates. However, increases in rainfall as a result of climate change can lead to existing sewers becoming overloaded, although this can be reduced through the use of well-designed SuDS to reduce surface water runoff.

Severn Trent Water and United Utilities are the water companies responsible for the management of the sewerage networks across the study area. Most of the area is covered by Severn Trent Water, shown in Figure 1-3.

Severn Trent Water provided their Hydraulic Sewer Flooding Risk Register for the borough which includes a list of properties which have reported at least one incidence of external or internal sewer flooding between 1 January 2004 and 19 March 2024. It should be noted that multiple incidences have been recorded at some properties.

Table 4-1 below displays this data using truncated postcodes to avoid identifying specific streets or properties. The general area covered by the postcode is also detailed.

Table 4-1: Properties with sewer flooding incidences recorded by Severn Trent Water (1 January 2004 - 19 March 2024).

Postcode	No. of properties with at least one recorded incident	Area covered by postcode
ST4 6	1	Eastern border of Newcastle-under-Lyme, mostly lies outside the borough
ST5 0	10	Northeast area of Newcastle-under-Lyme between Porthill and Basford
ST5 1	9	Eastern and central area of Newcastle-under-Lyme
ST5 2	11	Central and southwestern area of Newcastle-under-Lyme
ST5 3	14	Southern area of Newcastle-under-Lyme, covering Clayton
ST5 4	10	Southern area of Newcastle-under-Lyme, covering Westbury Park, and rural settlements to the south including Acton
ST5 5	1	Keele to the north and then covers rural settlements to the south including Baldwins Gate and Maer

Postcode	No. of properties with at least one recorded incident	Area covered by postcode
ST5 6	13	Area to the west of Newcastle-under-Lyme covering Silverdale
ST5 7	5	Northwest area of Newcastle-under-Lyme, covering Chesterton
ST5 8	2	Northern area of Newcastle-under-Lyme, covering Bradwell and parts of Porthill
ST5 9	23	Northern area of Newcastle-under-Lyme, covering Cross Heath and Gloster Gate

United Utilities provided their historic flood records of external or internal sewer flooding between September 2010 and May 2024. Table 4-2 below displays this data using truncated postcodes to avoid identifying specific streets or properties. The general area covered by the postcode is also detailed.

Table 4-2: Sewer flooding incidents recorded by United Utilities within the borough between September 2010 and May 2024.

Postcode	No. recorded internal incidents	No. recorded external incidents	Total	Area covered by postcode
ST7	10	31	41	Northeastern area of Newcastle-under-Lyme, covering Audley, Kidsgrove and Harriseahead

4.6 Groundwater flooding

In general, less is known about groundwater flooding than other sources and availability of data is limited. 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.
- Perched aquifers underlain by impermeable geology, particularly in low lying areas.

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.

Two datasets were used to identify potential areas that are likely to be at higher risk of groundwater flooding:

- The EA's Areas Susceptible to Groundwater Flooding (AStGWF) dataset, showing the degree to which areas are susceptible to groundwater emergence based on geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring, i.e., it is a hazard, not risk, based dataset.
- The JBA Groundwater Emergence map, showing the likelihood of groundwater emergence posing a risk to both surface and subsurface assets, based on predicted groundwater levels. This divides groundwater emergence into five categories:
    - Groundwater levels are either at or very near (within 0.025m of) the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
    - Groundwater levels are between 0.025m and 0.5m below the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
    - Groundwater levels are between 0.5m and 5m below the ground surface. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
    - Groundwater levels are at least 5m below the ground surface. Flooding from groundwater is not likely.
    - No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

The areas at most risk of groundwater emergence are discussed in Appendix E. It should be noted that these datasets only identify areas likely to be at risk of groundwater emergence and do not allow prediction of the likelihood of groundwater flooding or quantification of the volumes of groundwater that might be expected to emerge in a given area.

The JBA Groundwater Emergence map and the EA AStGWF dataset for the study area are provided in Appendix A. In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding.

4.7 Flooding from canals

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

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

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

There are three canals within the borough: the Trent and Mersey Canal, the Macclesfield Canal, and the Shropshire Union Canal. These canals are shown in Figure 4-3. The Trent and Mersey Canal runs through the northern end of the borough, and then continues flowing south east along the east border of the borough. In the north of the borough the Macclesfield Canal branches off and rejoins the and flows southeast. Trent and Mersey Canal. The Shropshire Union Canal flows in a northeast direction along the southwest boundary of the borough.

The Canal and River Trust were consulted to identify any instances of breaches and overtopping of each of the canals. The data provided showed two recorded overtopping incidents within the borough, and no recorded breaches. The residual risk from canal flooding should be assessed as part of a site-specific FRA.

The canals have the potential to interact with other watercourses in the study area, including Coal Brook and other unnamed watercourses. These have the potential to become flow paths if these canals were overtopped or breached. Any development proposed adjacent to a canal should include a detailed assessment of how a canal breach would impact the site, as part of a site-specific Flood Risk Assessment. Guidance on development near canals is available from the Canal and River Trust website.

4.8 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoirs Act 1975, available on the Government website here, and are on a register held by the EA. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low. Some reservoirs are designated as high risk by the EA, where an uncontrolled release of water could put people's lives at risk and are subject to increased inspection and maintenance requirements. However, this designation does not mean they are at a high risk of flooding.

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 EA hold mapping showing what might happen if reservoirs fail. Developers and planners should check the Long-Term Risk of Flooding website before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. The EA provide two flooding scenarios for the reservoir flood maps: a ‘dry-day’ and a ‘wet-day’. The ‘dry day’ scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The ‘wet day’ scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood. It should be noted that these datasets give no indication of the likelihood or probability of reservoir flooding.

The current mapping shows that there are four reservoirs located within the borough with residual risk of flood extents impacting the study area, detailed in Table 4-3 with their locations shown in Figure 4-4. There is one further reservoir located outside the borough whose flood extent impacts the borough, see Table 4-4. Section 8.4.3 provides further considerations for developing in the vicinity of reservoirs. The reservoir flood mapping for both the ‘dry day’ and ‘wet day’ scenarios in the study area has been provided in and in in Appendix A: GeoPDFs. The EA maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

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 seek to contact the reservoir owner to obtain information which may include:
  - Reservoir characteristics: type, dam height at outlet, area/volume, overflow location.
  - Operation: discharge rates/maximum discharge.
  - Discharge during emergency drawdown.
  - Inspection/maintenance regime.
- Developers should apply the sequential approach to locating development within the site.
- Consult with relevant authorities regarding emergency plans in case of reservoir breach.
- The reservoir owners are contacted to confirm the Reservoir Risk Designation (if determined) and the inspection and maintenance regime of the reservoir.
- 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.
- It should also be understood that the “risk category” of a reservoir is set by the potential damage and loss of life in circumstances where there is a breach or an extreme flood event. Accordingly, it is possible that allocation of new development downstream of an existing reservoir could potentially change the risk category and result in a legal requirement (under the Reservoirs Act 1975) to improve the structural and hydraulic capacity of the dam. As the cost of implementing such works can be substantial consideration should be given to considering the implications and whether it would be more appropriate to place development in alternative locations not associated with such risk.
- The EA online Reservoir Flood Maps contain information on the extents following a reservoir breach (note: flood extents are not included for smaller reservoirs or for reservoirs commissioned after the reservoir modelling programme began in October 2016). For proposed sites located within the extents, consideration should be given to the extents shown in these online maps.
- In addition to the risk of inundation, those considering development in areas affected by breach events should also assess the potential hydraulic forces imposed by the rapid flood event and check that that the proposed infrastructure fabric can withstand the loads imposed on the structures by a breach event.

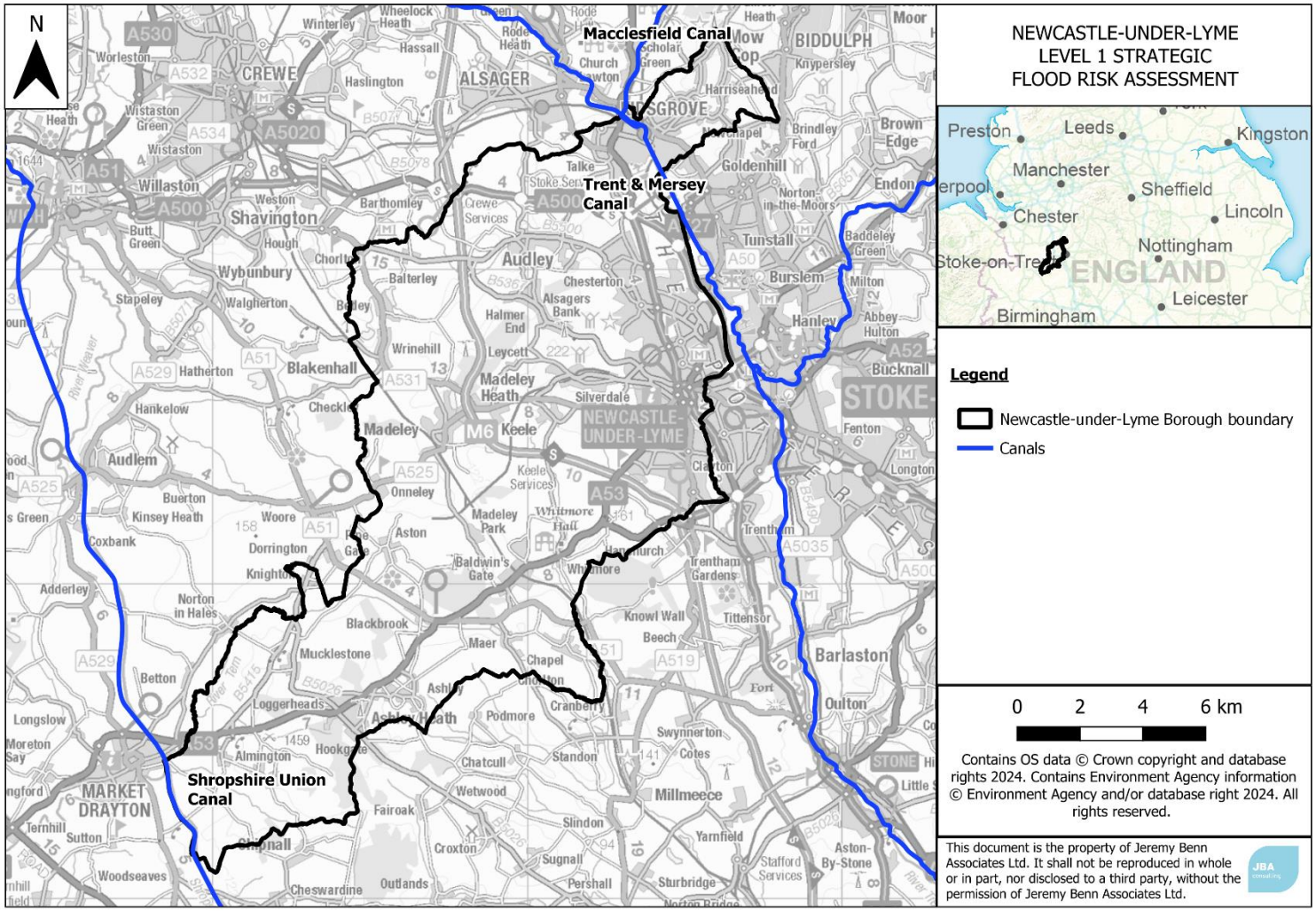


Figure 4-3: Location of the canals in the borough.

Table 4-3: Reservoirs within the borough with flood extents that impact the borough.

Reservoir	Easting and Northing	Reservoir owner	Risk Category	Local Authority
Bathpool Park Lake	383754, 353068	Newcastle-under-Lyme Borough Council	High	Staffordshire
The Old Wood (Betley Hall)	375421, 349199	Mr and Mrs Darrell and Joanne Mansfield	High	Staffordshire
Brindley Ford Flood Storage Reservoir	387747, 354814	The Coal Authority	High	Staffordshire
Coopers Green	378700, 350700	Severn Trent Water	High	Staffordshire

Table 4-4: Reservoirs located outside the borough but where the flood extents impact the borough.

Reservoir	Easting and Northing	Reservoir owner	Risk Category	Local Authority	Does reservoir impact study area in 'dry day' scenario?
Serpentine (Kids grove)	386649, 340187	Staffordshire County Council	High	Staffordshire	No

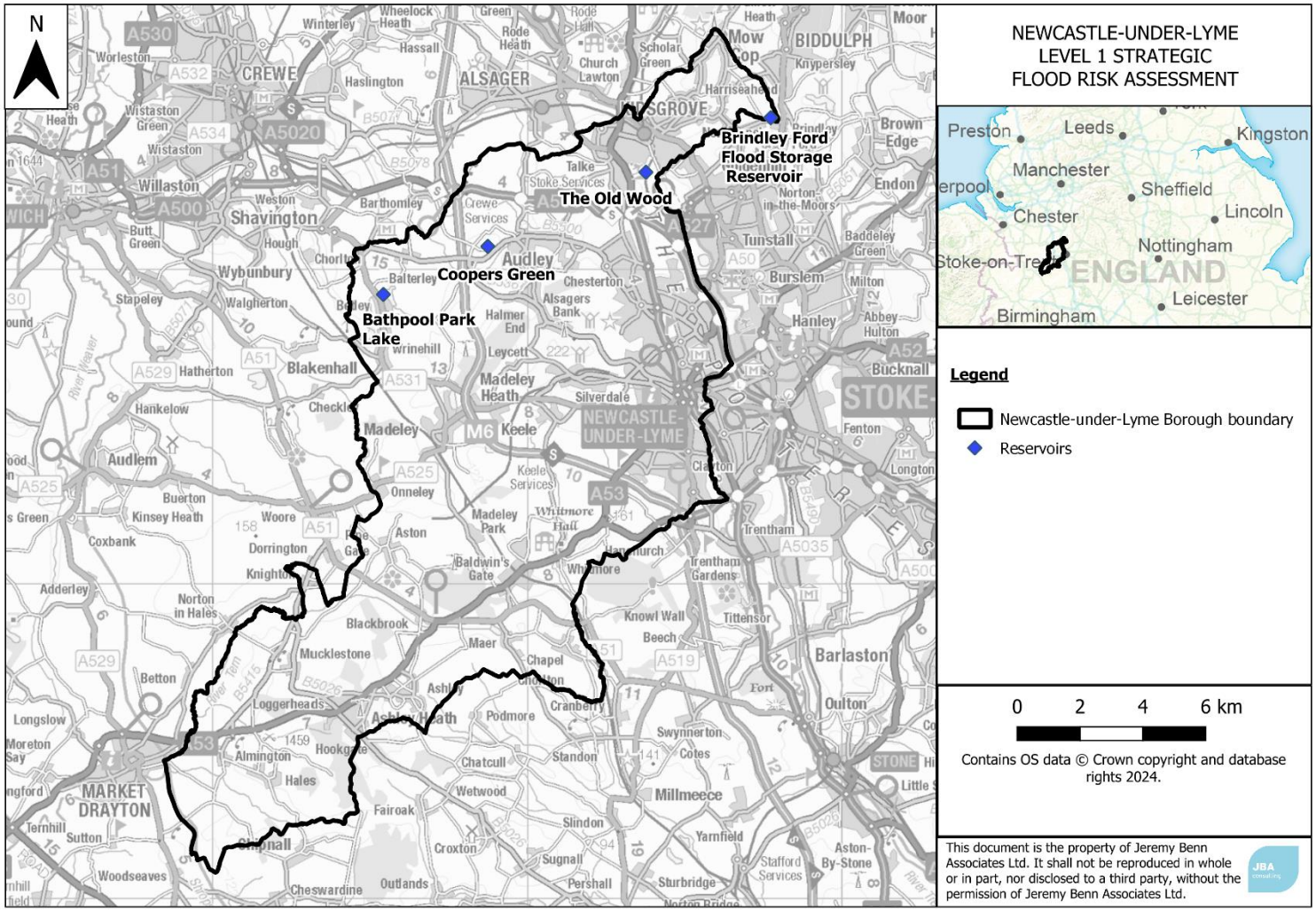


Figure 4-4: Reservoirs located in the borough with flood extents that impact the borough.

4.9 Flood alerts and flood warnings

The EA is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3. Further information on how to sign up for these warnings is available on the EA website.

There are currently five Flood Alert Areas (FAA) and two Flood Warning Areas (FWAs) covering the study area.

Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore FAAs usually cover the majority of main river reaches.

Flood Warnings are issued to designated FWAs (i.e., properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

The FAAs and FWAs are listed in Appendix D and included in Appendix A: GeoPDFs.

4.10 Summary of flood risk in the borough

A table summarising all sources of flood risk to key settlements in the study area can be found in Appendix E. For this summary, the borough has been delineated into four sub-areas which are detailed below and shown in Figure 4-5:

- Sub-area 1 covers the north of the borough, containing the town of Kidsgrove and the village of Harriseahead, and is mostly urban with rural areas to the south of the sub-area.
- Sub-area 2 is located towards the east of the borough and contains the main town of Newcastle-under-Lyme, alongside other urban areas including Porthill, Silverdale, and Chesteron. This sub-area is predominantly urban with the north-west side being rural.
- Sub-area 3 covers the centre and west of the borough and contains the settlements of Keele, Madeley, Baldwins Gate, Whitmore, Wrinehill, Betley and Audley. This sub-area is predominantly rural.
- Sub-area 4 is in the south of the borough and contains the villages of Mucklestone, Hales, Almington, Maer, Aston, Loggerheads, Ashley Heath, Ashely, and Hookgate. This sub-area is predominantly rural.

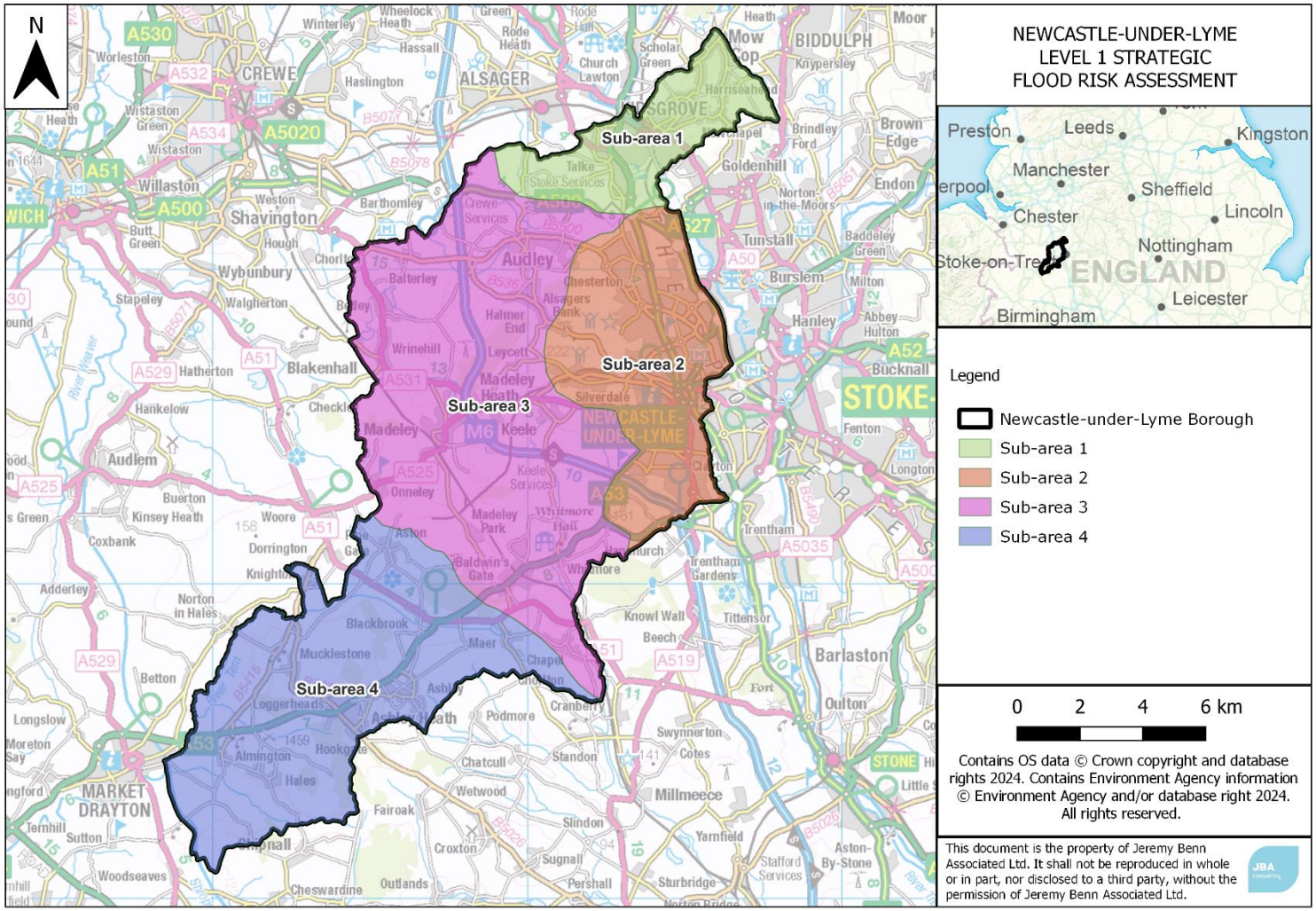


Figure 4-5: Sub-areas used to summarise the flood risk across the borough.

5 Impact of Climate Change

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.

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 considered.

5.1 Revised climate change guidance

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050. This was updated in June 2019 under the Climate Change Act 2008 (2050 Target Amendment) Order to a 100% reduction (or net zero) by 2050. The full Act is available on the Government website here and the amendment order is available on the Government website here.

In 2018, the government published new UK Climate Projections (UKCP18). The EA used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances. The EA published updated climate change guidance for fluvial risk in July 2021 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 and considers risk allowances on a management catchment level, rather than a river basin level. The guidance was further updated in May 2022 to address the changes to the requirements for peak rainfall allowances.

Before undertaking a detailed FRA, developers should check the government website for the latest guidance.

The EA also provide area specific guidance for the West Midlands in their 'New Climate Change Guidance for West Midlands', document which outlines approaches for modelling and use of nominal climate change allowances where appropriate. This document is not available online, so users should contact the EA for further information.

5.1.1 Applying the Climate Change Guidance

To apply the appropriate climate change guidance to a site, the following information is required:

- The vulnerability of the development – see Annex 3 in the NPPF.
- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed for an FRA. For development that will have an anticipated lifetime significantly beyond 100 years a higher allowance is required.

- The Management Catchment (assigned by the EA) that the site is located in (as shown in Figure 5-1). The study area lies across three Management Catchments:
    - The north and west of the study area lies within the Weaver Gowy Management Catchment.
    - The east of the study area lies within the Trent Valley Staffordshire Management Catchment.
    - The south of the study area lies within the Severn Middle Shropshire Catchment.

Developers should consider the following when deciding which allowances to use to address flood risk for a development or Local Plan allocation:

- 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 'built in' resilience measures used, for example, raised floor levels.
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

Developers should refer to the EA guidance when considering which climate change allowances to use, available on the government website here.

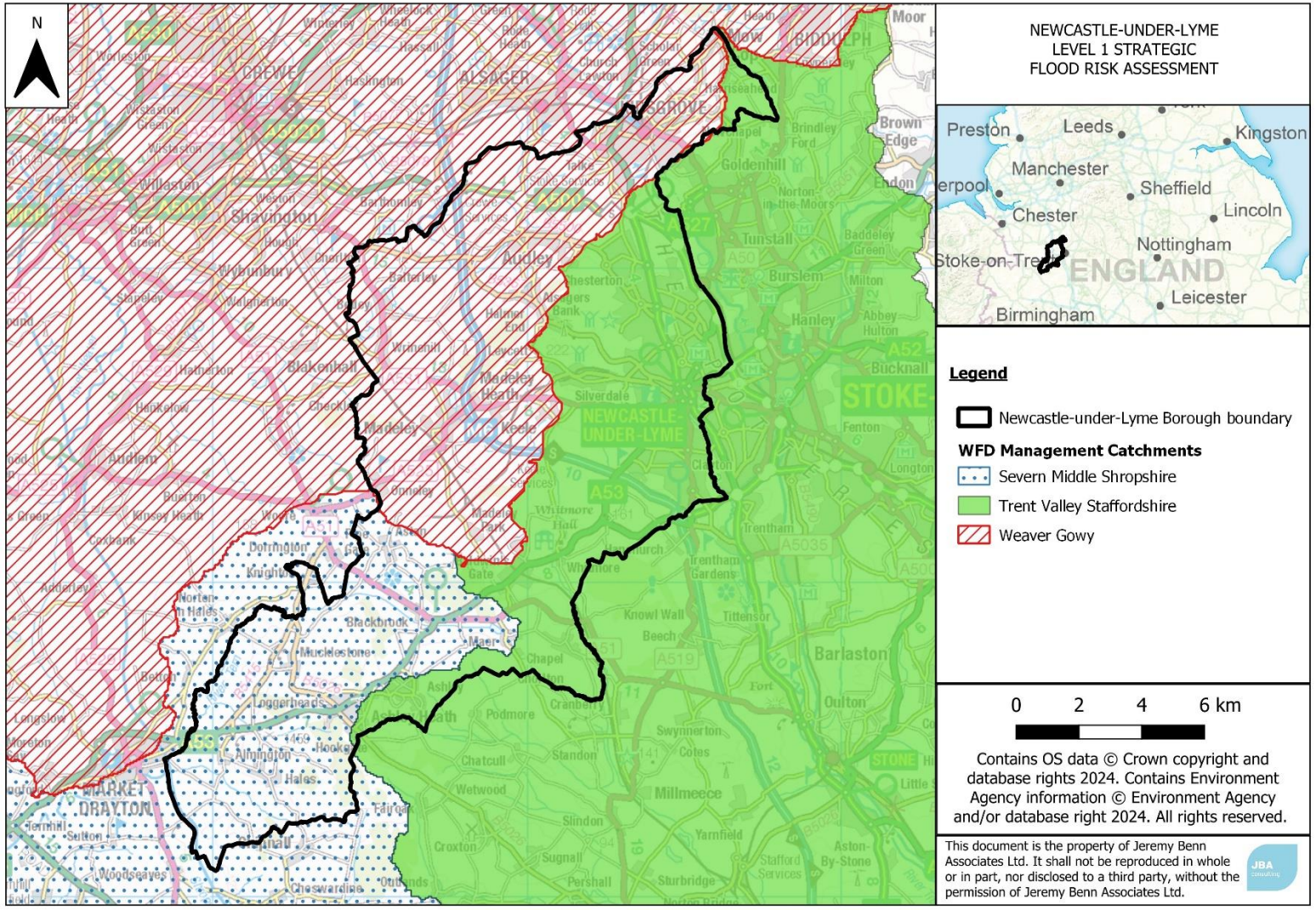


Figure 5-1: Management Catchments (assigned by the EA) across the borough.

5.2 Relevant allowances for the study area

Table 5-1 shows the updated peak river flow allowances that apply across the study area for fluvial flood risk for the Weaver Gowy, Trent Valley Staffordshire, and Severn Middle Shropshire Management Catchments. These allowances supersede the previous allowances by River Basin District.

The range of allowances are based on percentiles which describe the proportion of possible scenarios that fall below an allowance level:

- The central allowance is based on the 50th percentile (exceeded by 50% of the projections in the range).
- The higher central allowance is based on the 70th percentile (exceeded by 30% of the projections in the range).
- The upper end allowance is based on the 95th percentile (exceeded by 5% of the projections in the range).

Table 5-1: Peak river flow allowances for the Management Catchments which cover the study area.

Management Catchment	Allowance category	Total potential change (%) anticipated for '2020s' (2015 to 2039)	Total potential change (%) anticipated for '2050s' (2040 to 2069)	Total potential change (%) anticipated for '2080s' (2070 to 2115)
Weaver Gowy	Central	19	30	52
Weaver Gowy	Higher central	24	40	67
Weaver Gowy	Upper end	36	64	106
Trent Valley Staffordshire	Central	15	17	29
Trent Valley Staffordshire	Higher central	19	23	39
Trent Valley Staffordshire	Upper end	30	39	61
Severn Middle Shropshire	Central	15	18	33
Severn Middle Shropshire	Higher central	20	25	44
Severn Middle Shropshire	Upper end	30	42	72

Table 5-2 shows the updated rainfall intensity allowances that apply across the study area for surface water flood risk for the different Management Catchments. These allowances supersede the previous country wide allowances. These allowances should be used for site-specific applications and for surface water flood mapping in small catchments (less than 5km²) and urbanised drainage catchments.

Table 5-2: Peak rainfall intensity allowances for small and urban catchments for the Management Catchments which cover the study area.

Management Catchment	Allowance category	Total potential change (%) anticipated for '2050s' (2022 to 2060) 3.3% AEP	Total potential change (%) anticipated for '2050s' (2022 to 2060) 1% AEP	Total potential change (%) anticipated for '2070s' (2061 to 2125) 3.3% AEP	Total potential change (%) anticipated for '2070s' (2061 to 2125) 1% AEP
Weaver Gowy	Upper end	35	40	40	45
Weaver Gowy	Central	20	25	25	30
Trent Valley Staffordshire	Upper end	35	40	35	40
Trent Valley Staffordshire	Central	20	25	25	25
Severn Middle Shropshire	Upper end	35	40	40	45
Severn Middle Shropshire	Central	20	25	25	30

Section 5.3 details the methodology applied to represent climate change within this Level 1 SFRA. Further details on the models used can be found in Appendix B.

5.3 Representing climate change in the Level 1 SFRA

Two fluvial hydraulic models were received from the EA. These models were reviewed to determine their age, type of model, and the outputs available. A pragmatic approach was then taken to determine a methodology which aims to make best use of the available model data whilst balancing the timescales and budgets. More detailed modelling of different climate change scenarios may need to be considered further if and when a Level 2 assessment is required or during a site-specific flood risk assessment.

The sections below detail the approaches taken to consider climate change for fluvial, and surface water flooding.

5.3.1 Fluvial climate change

The sections below detail how fluvial climate change has been assessed within this report. Appendix B provides further details of the hydraulic models available for this SFRA.

5.3.1.1 3.3% AEP (Functional floodplain - Flood Zone 3b)

The Lyme Brook hydraulic model was uplifted with the latest climate change allowances for the 3.3% AEP event as part of this SFRA.

Where no existing hydraulic models are available or where the models have not been run with the latest climate change allowances (Fowlea Brook) a proxy approach should be taken. The 3.3% AEP climate change outputs will lie within the existing fluvial outputs (for example they may be commensurate with the 1% AEP extent), and as such would not provide 'new' information on areas at fluvial flood risk at this stage. This should be considered further at a Level 2 assessment or for a site-specific FRA, where developable area within the site is more of an issue.

5.3.1.2 1% AEP (Flood Zone 3a)

The Lyme Brook hydraulic model was uplifted with the latest climate change allowances for the 1% AEP event as part of this SFRA.

The Fowlea Brook baseline model was updated in 2023 and the 1% AEP event was re-run with the latest climate change uplifts for the higher central and upper end allowances (+39% and +61%). The 1% AEP event was also uplifted by +30%, which is similar to the latest central allowance of +29%. Therefore, these uplifts are deemed suitable to use for this SFRA.

For areas with no hydraulic modelling, the modelled 0.1% AEP outline is used as an indicative climate change extent. This is appropriate given the Upper End climate change estimates are often similar to the 0.1% AEP/ Flood Zone 2 extents; therefore, the differences in the effects of climate change are anticipated to be minimal.

5.3.1.3 0.1% AEP (Flood Zone 2)

The Lyme Brook hydraulic model was uplifted with the latest climate change allowances for the 0.1% AEP event as part of this SFRA. However, these model runs did present instabilities and the outputs should be used in conjunction with Appendix B, which further details the model uplifts undertaken as part of this SFRA.

For areas with no hydraulic modelling (or no suitable model extents), there is no available proxy for 0.1% AEP climate change extents. If development is proposed within close proximity of the 0.1% AEP event (Flood Zone 2) this risk should be considered further in a site-specific Flood Risk Assessment.

5.3.2 Surface water climate change

The 0.1% AEP surface water extent can be used as an indication of surface water risk, and the risk from smaller watercourses, which are too small to be covered by the EA's Flood Zones. Modelled climate change uplifts for the 3.3% and 1% AEP events for the 2070s Upper End climate change allowances were included as part of this SFRA and are presented in Appendix A: GeoPDFs. As the study area is covered by three management catchments, the following uplifts have been provided:

For the Weaver Gowy Management Catchment:

- 3.3% AEP with +40% uplift
- 1% AEP with +45% uplift

For the Trent Valley Staffordshire Management Catchment:

- 3.3% AEP with +35% uplift
- 1% AEP with +40% uplift

For the Severn Middle Shropshire Management Catchment:

- 3.3% AEP with +40% uplift
- 1% AEP with +45% uplift

It should be noted that there are areas where the climate change uplifts show a smaller extent than the EA Risk of Flooding from Surface Water (RoFSW) Map. This is due to the presence of a local surface water model across the Newcastle-under-Lyme urban centre. It is important to note that the hydraulic models uplifted as part of this SFRA are the original national generalised models developed as part of the updated Flood Map for Surface Water (uFMfSW) during 2012-13. Therefore, in areas where the outputs from a local surface water model have been supplied to the EA for inclusion in the RoFSW mapping, it is likely that these climate change results will be inconsistent with the published data. In areas where the climate change uplifts show a different extent than the EA RoFSW map, the more conservative approach should be taken; however, the surface water risk may be able to be refined by further surface water modelling as part of a site-specific FRA. The approximate coverage of the local surface water model is shown in Figure 5-2.

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing FRAs, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic survey. Developers should consult the EA to provide further advice on how best to apply the new climate change guidance.

When undertaking a site-specific FRA, developers should:

- Confirm which national guidance on climate change and new development applies by visiting the Government website here.
- 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 the site may be affected should the more extreme climate change scenarios materialise.
- Refer to Section 8 which provides further details on climate change for developers, as part of the FRA guidance, and the SFRA User Guide in Appendix C.

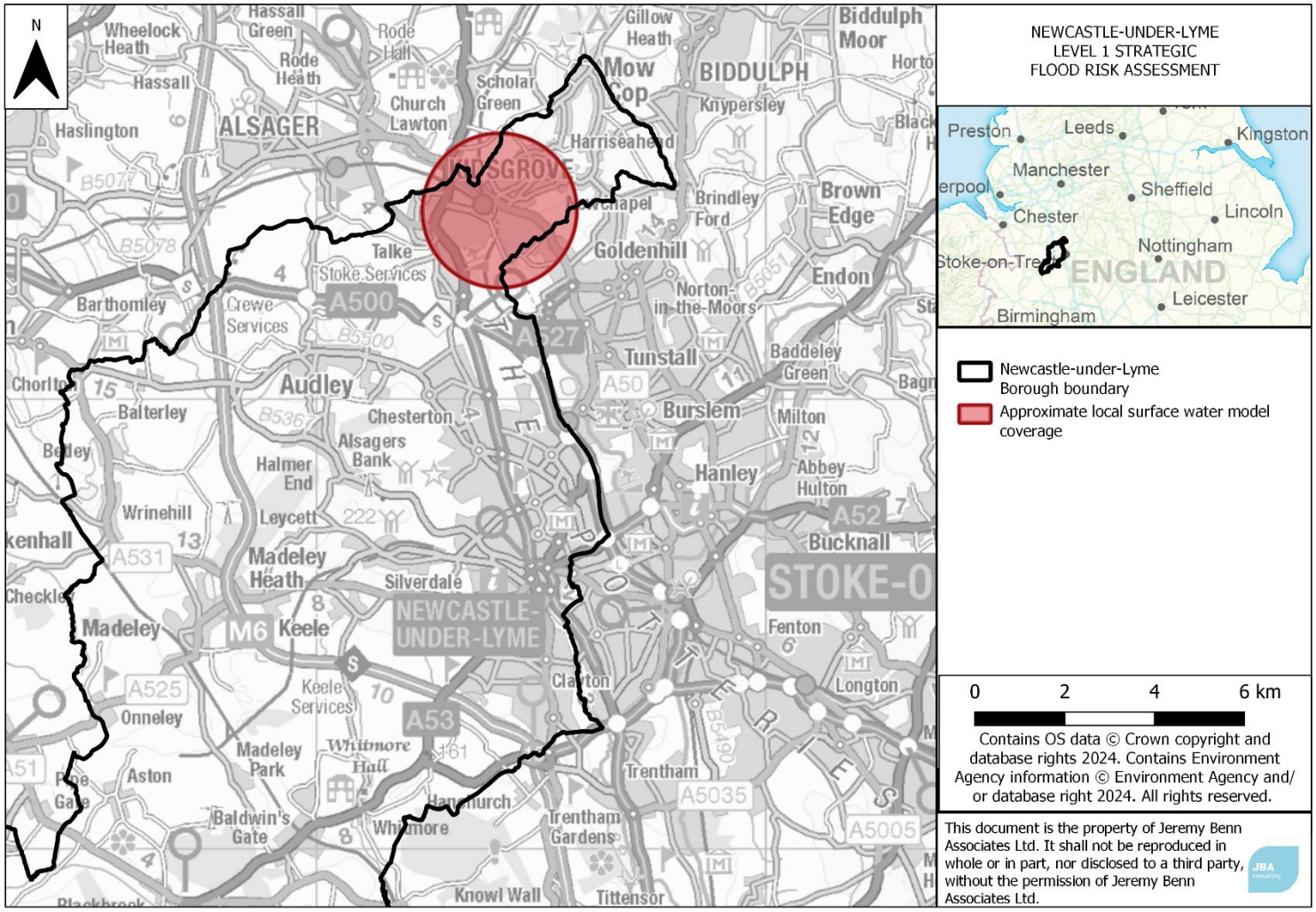


Figure 5-2: Approximate coverage of local surface water modelling across the borough.

5.4 Impacts of climate change across the borough

This section explores which areas of the borough are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that the Council works with other RMAs to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the study area.

5.4.1 Impact of climate change on fluvial flood risk

The sensitivity of an area to climate change can be analysed through comparison between present day design flood event extents and design flood events extents with modelled climate change uplifts applied. Modelled climate change extents were available for both Lyme Brook and Fowlea Brook.

Areas along Lyme Brook most sensitive to fluvial impacts of climate change are:

- Land along Lyme Valley Road and at Brook Lane in Newcastle-under-Lyme.
- Land on either side of Blackfriars Road, between Lower Street and Friarswood Road, Newcastle-under-Lyme.
- Land between Silverdale Road and Snowgoose Way, Newcastle-under-Lyme.

Areas along Fowlea Brook most sensitive to fluvial impacts of climate change are:

- Land to the west of the Stafford to Manchester railway line, between Shelton New Road and Etruria Road in Stoke-on-Trent.

Where no detailed modelling exists the 1% AEP flood extent (Flood Zone 3a) can be compared against the 0.1% AEP flood extent (Flood Zone 2), for an indication of areas most sensitive to climate change.

Areas in the study area identified as most sensitive to fluvial impacts of climate are:

- Along Vicarage Lane, Castle Lane, and Knightley, to the east of the River Lea, in the village of Madeley.
- Land to the East of the River Lea, east of the West Coast Mainline, near Netherset Hey Industrial Estate.

5.4.2 Impacts of climate change on surface water flood risk

The 1% AEP surface water event with the 2070s upper end climate change uplift can be compared to the present day 1% AEP extent for an indication of areas most sensitive to climate change.

While across the study area, a significant difference in surface water flood extents is observed, areas in the study area most sensitive to changes in surface water flood risk are typically in low lying, urban locations. In particular, the following areas are sensitive to increased surface water flooding due to climate change:

- The area between Fox Hollow and Newcastle Road in Loggerheads, affecting properties on Chestnut Road, Reynards Rise, Alder Close and Fox Hollow.
- Areas throughout Newcastle-under-Lyme urban area, including between Lower Street and Silverdale Road, between London Road and Lyme Valley Road, and in the Sutton Avenue area.
- Areas off Chapel Road and New Road, Audley.
- Areas along The Mount and Mount Road, Kidsgrove.

5.4.3 Impacts of climate change on groundwater flood risk

There is no modelling data available to assess climate change impacts on groundwater. The assessment would depend on the flooding mechanism, historic evidence of known flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

5.4.4 Adapting to climate change

The PPG Climate Change guidance contains information and guidance for how to identify suitable mitigation and adaptation measures 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 so that the 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.
- Considering the Standard of Protection (SoP) of defences and sites for future development, in relation to sensitivity to climate change. The authorities and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Section 6; and

- It is recommended that the differences in flood extents from climate change are compared by the LPA when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix C.

6 Flood alleviation schemes and assets

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

6.1 Asset management

RMAs hold databases of flood risk management and drainage assets according to their jurisdiction as follows:

- The EA 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 FWMA (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 FRA.

6.2 Standards of Protection

- Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 1% AEP 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 EA's on-going hydraulic modelling programme may revise flood risk datasets and, therefore, the SoP offered by flood defences in the area may differ from those discussed in this report.
- Developers should consider the SoP provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

Different authorities have responsibilities relating to maintenance of flood risk assets.

- The EA and local authorities have permissive powers to maintain and improve main rivers and ordinary watercourses, respectively. 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. They are also responsible for maintaining sections of watercourses where they are crossed by highways.
- Water companies have a duty to effectually drain 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 sewer flooding.
- SCC as the LLFA have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect.
- Riparian Owners are responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species, and allowing the flow of water to pass without obstruction.

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 defence 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.

It is important that the authorities work in partnership to maintain flood risk assets and manage flood risk across the study area.

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 make future users of the development aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the EA for condition is provided in Table 6-1.

Table 6-1: Grading system used by the EA to assess flood defence condition.

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.

Grade	Rating	Description
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – EA 2006

6.4 Major flood risk management assets in the borough

The EA retired the Flood Map for Planning 'Areas Benefiting from Defences' (ABD) dataset in December 2022. This dataset will no longer be available on online mapping. Instead, a developer can enter an address on the EA website here to get information about their specific site and request flood risk assessment data for planning (also known as Product 4).

The EA now provide a dataset called the 'Reduction in risk of flooding from rivers and sea' which provides areas that are offered some level of reduced flood risk from defences, but with no defined SoP. This is shown in the GeoPDFs in Appendix A. Several areas across the borough are shown to have reduced flood risk due to defences, including along Lyme Brook in the east of the borough, located in the centre of Newcastle-under-Lyme. Each cell has been assigned a suitability rating to show at what scale it is generally appropriate to use the data to assess flood risk, and how suitable the data is for a range of different uses. The data for the borough is classified as 'County to town' suitability, which is suitable for identifying approximate extents, shallower and deeper areas, but is unlikely to be reliable for a local area and is very unlikely to be reliable for identifying individual properties at risk.

The EA 'AIMS' (Asset Information Management System) flood defence dataset gives further information on flood defence assets within the study area. Table 6-2 details the locations which benefit from flood defences within the 'AIMS' dataset. Due to the number of defences within this study area, defences have been grouped by location. For further details of specific defences, developers should refer to the dataset, available to download from the EA website here. Additionally, the AIMS dataset can be viewed in Appendix A GeoPDF Mapping.

Table 6-2: Locations shown in the EA 'AIMS' data set (also shown in Appendix A: GeoPDF Mapping).

Watercourse	Location	Type	Design SoP (AEP)	Condition Rating (1-5)	Ownership
River Lea	Natural High Ground along both banks of the River Lea.	Natural High Ground	20%	Unknown	Unknown
Silverdale Brook	Natural High Ground along both banks of Silverdale Brook from Garners Garden Centre upstream to its confluence with Lyme Brook downstream.	Natural High Ground	1% / Unknown	3 / Unknown	Local Authority / Unknown
Silverdale Brook	Embankment along the left bank of Silverdale Brook, to the north of Rosemary Street	Embankment	1%	4	Private individual, Company, or Charity
Lyme Brook	Natural / Engineered High Ground along both banks of Lyme Brook from its confluence with Silverdale Brook upstream, until it leaves the borough along the eastern boundary.	Natural High Ground	1% / 4%/ Unknown	3 / Unknown	Local Authority / Private individual, Company, or Charity / Unknown
Lyme Brook	Flood wall along the left bank of Lyme Brook between Pool Dam (A525) and Blackfriars Road.	Wall	1%	3	Private individual, Company, or Charity

Watercourse	Location	Type	Design SoP (AEP)	Condition Rating (1-5)	Ownership
Silverdale Brook / Lyme Brook	Embankment and wall along the north side of Saint Paul's Road, to the south of the confluence of Silverdale Brook and Lyme Brook.	Embankment / Wall	1%	2 / 5	Local Authority
Silverdale Brook / Lyme Brook	Embankment along the north side of Lyme Brook, downstream of its confluence with Silverdale Brook.	Embankment	1%	3	Local Authority
Barthomley Brook	Natural High Ground along both banks of Barthomley Brook from the west of the M6 until it leaves the borough.	Natural High Ground	20%	Unknown	Unknown
Drainage channel	Natural High Ground along both banks of an unnamed drainage channel which runs parallel to the River Tern between the A53 and the Shropshire Union Canal.	Natural High Ground	20% / 50%	Unknown	Unknown
Basford Brook	Natural High Ground along both banks of Basford Brook along part of the western boundary of the borough.	Natural High Ground	20%	Unknown	Unknown

6.5 Existing and future flood alleviation schemes

There is currently one known fluvial flood alleviation scheme being carried out within the borough, along Fowlea Brook. The EA scheme commenced in January 2024 and completion is expected to be December 2025.

Currently, there are no existing defences; the heavily modified concrete channel will undergo a scheme involving raising flood defence walls on top of the existing channel to enhance its capacity. Additionally, repairs will be made to bring the existing channel back up to standard. Environmental enhancements are also planned, such as the removal of the 1.4m Spode weir to facilitate fish passage. The scheme will allow 214 residential properties and 119 non-residential properties to be better protected, which equates to £62 million in direct damages which are avoided. Furthermore, the removal of the Spode weir will unlock 6.5km of river for fish migration. Upon completion in December 2025, the scheme will elevate the standard of protection for over 200,000 square meters of land currently designated as Flood Zone 3. More information on the scheme can be found on the EA's website here.

6.6 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific FRA will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail (although it should be noted that Flood Zone 3b is based on the actual flood risk).

6.6.1 Actual flood risk

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

The assessment of the actual risk should consider 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 SoP afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures.

- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.6.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been considered. 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.
- It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed FRA.

The assessment of residual risk should consider:

- 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 EA 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 and emergency services.
- Climate change and/ or policy-dependent residual risks (such as those that may be created, if necessary, future defence improvements are required, or those associated with any managed adaptive strategies).

6.6.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and EA Flood Risks to People guidance document, available from the Government website here, provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage, and climate change needs to be taken in to account.

6.6.4 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Where defences are present, risk of breach events should be considered as part of the site-specific FRA. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately considered. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. Work is currently being undertaken by the EA to collate and standardise these methodologies. It is recommended that the EA are consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the approach for the breach assessment.

7 Cumulative impact of development and strategic solutions

7.1 Cumulative Impact Assessment

Under the NPPF, strategic policies and their supporting SFRAs, are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (Paragraph 166), 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 from any source, as well as the impact of increased flows on flood risk downstream. 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. Similarly, the effect of the loss of surface water flow paths / exceedance paths from sewers, surface water ponding and infiltration can also give rise to cumulative effects and potentially exacerbate flood risk. There are also risks of development causing modified flow regimes from sites creating an alignment in peak flows in downstream watercourses and resulting in greater flood risk as a result of the development.

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, and appropriate consideration is given to flow paths and storage proposals should normally not increase flood risk downstream.

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

Catchments within the study area that are most sensitive to future increases in fluvial and surface water flood risk were identified. The percentage of potential future development within each catchment was also calculated and the catchments were ranked based on their potential risk.

This CIA provides a relative assessment of the catchments within the study area and are not comparable across other boroughs/districts. The Cumulative Impact Assessment can be found in Appendix F.

7.2 Natural Flood Management (NFM)

NFM is used to protect, restore, and re-naturalise the function of catchments and rivers to reduce flood risk. 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.).

Techniques and measures, which could be applied in the study area include:

- Creation of Offline Storage Areas
- Re-meandering streams (creation of new meandering courses or reconnecting cut-off meanders to slow the flow of the river)
- Targeted woodland planting
- Reconnection and restoration of functional floodplains
- Restoration of rivers and removal of redundant structures, i.e. weirs and sluices no longer used or needed
- Installation or retainment of large woody material in river channels
- Improvements in management of soil and land use
- Creation of rural and urban SuDS

To maximise the benefits of NFM, it is important that land which is likely to be needed for NFM is protected by safeguarding land for future flood risk management infrastructure. This is particularly important for infrastructure that reduces the risk of flooding to large amounts of existing development, or where options for managing risk in other ways are limited to achieve multiple benefits for flood risk and the environment.

It is important to recognise the value of maintenance or restoration of natural riparian zones, such as grasslands, which protect the soils from erosion and ‘natural’ meadows which can tolerate flood inundation. The use of Green Infrastructure throughout river corridors can also play a vital role in enhancing the river environment as well as safeguarding land from future development, protecting people and buildings from flooding and reducing flood risk downstream.

In 2017, the EA published an online evidence base to support the implementation of NFM and maps showing locations with the potential for NFM measures. 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. The EA evidence directory can be found on the Government website here.

Other websites that provide further information about ongoing NFM schemes and community works include The Flood Hub and the Rivers Trust NFM National Map.

7.2.1 Opportunities and projects in and/or affecting Newcastle-under-Lyme Borough

7.2.1.1 Catchment Based Approach (CaBA)

The Catchment Based Approach (CaBA) was introduced by the Government to establish catchment partnerships throughout England to jointly deliver improved water quality and reduce flood risk, directly supporting achievement of many of the targets set out within the Government's 25-year Environment Plan. CaBA partnerships are actively working in all 100+ river catchments across England and cross-border with Wales. Further details are available on the CaBA website.

The Staffordshire Trent Valley CaBA Partnership, hosted by the Staffordshire Wildlife Trust, covers the Newcastle-under-Lyme urban area and the eastern side of the borough. Their vision is 'to recreate one of Britain's great networks of wetlands for wildlife and people' which will allow the catchment to 'benefit from improved resilience to climate change, flooding and pollution'. Actions that the CaBA Partnership are working to meet are set out in the Staffordshire Trent Valley Catchment Plan 2018.

The EA are also working on a number of small catchment-based projects with other partners in the area, including along Lyme Brook, looking at options for managing risk to achieve multiple benefits for flood risk and the environment.

7.2.1.2 Staffordshire Wildlife Trust

Staffordshire Wildlife Trust manage three nature reserves within Newcastle-under-Lyme Borough. These are:

- **Parrot's Drumble, Talke Pits** - an ancient woodland located to the north of Newcastle-under-Lyme.
- **Bateswood** - a former opencast mine working located between Silverdale and Madeley Heath. Home to a wide range of species, notably skylark and dragonflies.
- **Black Firs and Cranberry Bog** - nationally important peatland site located to the north of Betley.

NFM techniques could be encouraged at some of the reserves to aid flood storage and improve natural habitats. Staffordshire Wildlife Trust were consulted as part of the preparation of the SFRA and confirmed there are currently no ongoing projects relating to flood risk at their reserves within the Borough.

8 Flood risk management requirements for developers

This section provides guidance on site-specific 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 within the study area. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and the actual and residual risk and SoP and safety at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (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, windfall or other, 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 be seen as an alternative to proving these tests have been met.

8.1 Principles for new development

8.1.1 Apply the sequential and exception tests.

Developers should refer to Section 3 for more information on how to consider the sequential and exception tests. For allocated sites, the Councils should use the information in this SFRA to apply the Sequential test. For windfall sites a developer must undertake the sequential test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the sequential test should the exception test then be applied if required.

Where planning applications come forward on sites allocated in the development plan and the sequential test has been applied in the development of the local plan, applicants need not apply the sequential test again. However, the exception test will need to be applied as proposals at the application stage will need to demonstrate flood risk is not increased elsewhere and is safe.

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 the site layout be varied to reduce the number of people, the flood risk vulnerability or the building units located in higher risk parts of the site?

8.1.2 Consult with statutory and non-statutory consultees at an early stage to understand their requirements.

Developers should consult with the EA, SCC as LLFA and the relevant sewerage undertaker at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and foul and surface water drainage assessment and design. It should be noted that some of these consultees may need to charge for advice requested by developers or landowners.

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

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific FRA. At a site level, developers will need to check before commencing on a more detailed FRA that they are using the latest available datasets. Developers should apply the most up-to-date climate change guidance (last updated in May 2022) and consider climate change adaptation measures. Site-specific consultation with Severn Trent Water or United Utilities will be critical to identify any risk of flooding from the public sewer (especially when a sewer passes through a site) and if the site is located in a reservoir flood zone.

8.1.4 Confirm that the development does not increase flood risk elsewhere.

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

While there are some water compatible developments which the NPPF indicates can be acceptable in functional floodplain (subject to the sequential and exception tests) these are discouraged).

All development should consider what flood risk betterment can be provided by the proposals. The assessment should include but not be limited to river restoration, enhancement including de-culverting, removing unnecessary structures and reinstating a natural, sinuous watercourse and creation of flood alleviation measures.

Where appropriate replacement dwellings should provide a flood risk betterment both on site and to third parties.

In catchments potentially at risk from cumulative effects consideration should be given to the cumulative effect of development at locations known to be sensitive to changes in flood risk (these locations might be remote from application sites and could require measures assessed at a catchment scale).

Developers should not assume that diversion of the public sewer can take place or that levels can change on top of a public sewer as this can materially alter flood risk. Where consideration is being given to a sewer diversion/alteration, early consultation with the relevant sewerage company is recommended.

8.1.5 Make the development 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, as discussed in Section 6.6.

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 SoP is not of the required standard.

Safe access and egress will need to be demonstrated at all development sites as outlined in Section 0.

8.1.6 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. Developers should open up existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings. Access to existing infrastructure should also be maintained.

All development must explore reasonable opportunities for environmental betterment which can be provided by the proposals. The assessment should include but not be limited to river restoration, enhancement including de-culverting, removing unnecessary structures and reinstating a natural, sinuous watercourse.

Biodiversity Net Gain (BNG) is a strategy to develop land and contribute to the recovery of nature. It is making sure the habitat for wildlife is in a better state than it was before development. BNG has been applicable since November 2023 for developments in the Town and Country Planning Act 1990, unless exempt, and has been applicable to small sites since April 2024. Further information is available on the Government BNG webpage, here.

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

Wherever possible, developments should seek to help reduce flood risk in the wider area, e.g., by contributing to a wider community scheme or strategy for strategic measures, such as defences or NFM or by contributing in-kind by mitigating wider flood risk on a development site. Developers must demonstrate in an FRA how they are contributing towards this vision. Land that is required for current and future flood management should be safeguarded from development. Where development lies adjacent to or benefits from an

existing or future flood defence scheme, the developer will be expected to contribute towards the cost of delivery and/or maintenance of that scheme.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals on sites of one 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.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the EA) (see Section 9.4.4 for more information on critical drainage problems).
- Land identified in this SFRA as being at increased flood risk in the future.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding (e.g. high risk surface water flooding Zone B, groundwater, sewer, or reservoir).

8.2.2 Objectives of a site-specific FRA

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

Site-specific FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source and to explore reasonable opportunities to reduce flood risk.
- 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 LPA 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 EA, and SCC. Guidance and advice for developers on the preparation of site-specific FRAs is available from the following websites with hyperlinks provided:

- Standing Advice on Flood Risk (EA)
- Flood Risk Assessment for Planning Applications (EA); and
- Site-specific Flood Risk Assessment: Checklist (NPPF PPG, Defra)

Guidance for LPAs for reviewing FRAs submitted as part of planning applications has been published by Defra in 2015 and is available on the Government website here.

Guidance should be sought from the EA and the Council at the earliest possible stage, and opportunities should be taken to incorporate environmental enhancements and reduce flooding from all sources both to and from the site through development proposals. Developers should seek to go beyond managing the flood risk and support reduction of wider flood risk, whilst enhancing and conserving the natural environment. Further advice can be found at: Flood risk and coastal change - GOV.UK (www.gov.uk).

8.2.3 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. Developers should undertake early engagement with the EA, SCC as LLFA, and Severn Trent Water or United Utilities.

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

When designing sites, applicant should make space for sustainable drainage systems as required by planning policy. The management of surface water should be a critical component of the design process and integrated with the wider design especially the approach to site landscaping.

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 provide safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

When designing sites, developers should consider the Hierarchy of Drainage, as stated in the PPG, aiming to discharge surface water runoff as high up the drainage hierarchy as reasonably practicable:

1. into the ground (infiltration)
2. to a surface water body
3. to a surface water sewer, highway drain, or another drainage system
4. to a combined sewer

8.2.4 Modification of ground levels

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

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 (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 C624, available to download from the CIRIA website here.

Where proposed development results in a change in building footprint, the developer should confirm 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 check that it would not cause increased ponding or build-up of surface runoff on third party land. Consideration should be given to the impact of raising ground levels on adjacent properties, particularly the impact of raising ground levels on surface water runoff from a site, with potential to increase surface water flood risk.

There is a hierarchy of flood compensation, in the use of stilts and voids. The PPG states that whilst the use of stilts and voids below buildings may be an appropriate approach to mitigating flood risk to the buildings themselves, such techniques should not normally be relied upon for compensating for any loss of floodplain storage. The EA do not normally consider, and would not support, stilted development or void space under buildings as a means of flood storage compensation. Stilts are a method of flood resistant construction and are not generally an acceptable means of allowing new development in unsuitable locations, or over-development of brownfield sites.

Applicants should note that changes to manhole cover levels on public sewer and increase / displace flood risk which will require careful consideration with Severn Trent Water or United Utilities. Applicants should not assume that any alteration to a public sewer, including diversion, will be acceptable as this could have adverse flood risk consequences.

For all developments regardless of any identified sewer flood risk that is identified on or near to the site, it is good practice for the finished floor levels and manhole cover levels (including those that serve private drainage runs) to be higher than the manhole cover level at the point of connection to the receiving sewer. Where the ground level of the site is

below the ground level at the point where the drainage connects to the public sewer, care must be taken to ensure that the proposed development is not at increased risk of sewer surcharge.

8.2.5 Raised floor levels

If raised floor levels are proposed, these should be agreed with the Council and the EA. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The EA advises that minimum FFL should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used (see Section 5.2 for the climate change allowances) unless lower FFLs can be justified based on detailed evidence in a Level 2 SFRA/ site-specific FRA. 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. Lowering existing FFLs below the existing levels within the 1% AEP plus climate change floodplain would not be acceptable and should be discouraged. New development offers opportunities to improve the resilience of buildings.

The EA provide area specific guidance for the West Midlands in their 'FRA Guidance Note' which outline guidance on suitable FFLs and freeboard. This document is not available online, so users should contact the EA for further information.

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 and areas at risk of surface water flooding in the surface water flood zone B should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the exception test.

Where the ground level of a site is below the ground level at the point where the drainage connects to the public sewer, care must be taken to ensure that the proposed development is not at an increased risk of sewer surcharge. It is good practice for the finished floor levels and manhole cover levels (including those that serve private drainage runs) to be higher than the manhole cover level at the point of connection to the receiving sewer. Alternatively, mitigation measures may need to be incorporated into the proposals to protect against sewer surcharge.

8.2.6 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.

Development should consider the standard of protection as this can vary depending on the defences.

8.2.7 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). This relates to the Community Infrastructure Levy, a charge that can be levied by local authorities on new development in their area to help them deliver the infrastructure needed to support development in their area, and planning obligations including Section 106.

The EA may seek financial contributions towards their flood warning service (for related infrastructure) where a development is reliant upon such for safe development e.g. to inform flood evacuation management.

The government website provides further information on the Community Infrastructure Levy and planning obligations.

8.2.8 Buffer strips

The provision of a buffer strip allows additional capacity to accommodate climate change and means access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology, and having to construct engineered riverbank protection. Any watercourse crossings should ensure that flood risk is not impacted. A buffer strip of at least 8 metres is required from any main river. Where flood defences are present, these distances should be taken from the toe of the defence.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult. Any development in these areas will likely require Flood Risk Activity Permits from the EA alongside any permission. There should be no built development within these distances from main rivers / flood defences (where present). Further advice and guidance on Flood Risk Activity Permits is available on the government website here.

8.2.9 Making space for water

The PPG sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain. Generally, development should be directed away from these areas.

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater

creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality, and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

8.3 Resistance and resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations. However, having applied planning policy there may be some instances where development is permitted in high flood risk areas.

In these cases, the above measures should be considered before resistance and resilience measures are relied 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. Available resistance and resilience measures include:

- Permanent barriers which can include built up doorsteps, rendered brick walls and toughened glass barriers.
- Temporary barriers which consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.
- Community resistance measures which include demountable defences that can be deployed by local communities to reduce the risk of water ingress to several properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
- Flood resilience measures which aim to limit any permanent damage, prevent the structural integrity of the building being compromised and make the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls, and fixtures.

Guidance on flood resilient and flood resistant construction techniques is available on the government website, here.

There are also opportunities for 'change of use' developments to be used to improve the flood resistance and resilience of existing development, which may not have been informed by a site-specific flood risk assessment when it was first constructed.

8.4 Reducing flood risk from other sources

8.4.1 Groundwater

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

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence that this will not be a significant risk. Other underground works, such as basements, may also need to be assessed as part of a site-specific FRA in certain prone areas susceptible to groundwater issues.

8.4.2 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 Surface Water Drainage Strategy (often undertaken as part of an FRA) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff volumes and rates and SuDS for new development are met.

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

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

Consideration must also be given to attenuation and flow ensuring that flows during the 1% AEP plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques. As noted above, early consultation with Severn Trent Water or United Utilities will be critical to understand sewer flood risk especially when a sewer passes through a site. Where an existing sewer flood risk affects a site, applicants will need to carefully consider how this can be managed with Severn Trent Water or United Utilities. Sewer flood risk could affect the developable area and the detailed design of the site.

8.4.3 Reservoirs

As discussed in Section 0, 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 online Reservoir Flood Maps contain information on the predicted extents following a reservoir breach both when rivers are at normal levels and in conjunction with rivers in flood conditions (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 extents shown in these online maps. Depths and velocities were also prepared as part of this study but have not been made publicly available.

The GOV.UK website on Reservoirs: owner and operator requirements provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan, and report an incident.

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, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- 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 and/ or Off-site Plans if necessary and make the future users of the development aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

The potential implications of proposed development on the risk designation of the reservoir should also be considered, as it is a requirement that in particular circumstances where there could be a danger to life, that a commitment is made to the hydraulic capacity and safety of the reservoir embankment and spillway. The implications of such an obligation should be identified and understood before new development is permitted, to ensure it can be achieved.

8.5 Emergency planning

The Civil Contingencies Act 2004 lists Local Authorities, the Environment Agency and emergency services as Category 1 responders. Category 1 responders are responsible for reducing, controlling, and mitigating the effects of emergencies in both response and recovery phases.

The 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 2023 NPPF (Paragraph 173) requires site level FRAs to demonstrate that "any residual risk can be safely managed; and safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

In accordance with the NPPF, SFRAs, PFRAs and SWMPs can be used in the preparation and execution of a flood emergency plan as they can indicate areas that may be at risk of flooding. These can be provided as part of an FRA or as a separate document. Decisions regarding whether an Emergency Plan is required sits with the LPA, with advice from their Emergency Planning Teams, the Environment Agency and LLFA.

According to the PPG, an emergency plan is needed wherever emergency flood response is an important component of making a development safe; this includes the free movement of people during a 'design flood' and potential evacuation during an extreme flood.

Emergency plans are essential for any site with transient occupancy in areas at risk of flooding, such as holiday accommodation, hotels, caravan, and camping sites (PPG Paragraph 043).

Emergency Plans should consider:

- The type of flood risk present, and the extent to which advance warning can be given in a flood event.
- The number of people that would require evacuation from the area potentially at risk.
- The vulnerability of site occupants.
- The impact of the flooding on essential services e.g., electricity, gas, telecommunications, water supply and sewerage.
- Safe access and egress for users and emergency services.

Further information is available from the following documents / websites with hyperlinks provided:

- The National Planning Policy Guidance
- 2004 Civil Contingencies Act
- Defra (2014) National Flood Emergency Framework for England
- FloodRe
- The EA and Defra's Standing Advice for FRAs
- Staffordshire County Council Preparing for emergencies website page

- Staffordshire Fire and Rescue Civil Contingencies Unit Staffordshire Prepared Flooding website page
- EA's 'How to plan ahead for flooding'
- Sign up for Flood Warnings with the EA
- The National Flood Forum
- GOV.UK 'Prepare for flooding' page
- ADEPT Flood Risk Plans for new development

8.5.1 Staffordshire Resilience Forum

Local Resilience Forums (LRFs) are multi-agency partnerships made up of representatives from local public services, including the emergency services, local authorities, the NHS, the Environment Agency, and others (Category 1 Responders, as defined by the Civil Contingencies Act). LRFs are supported by organisations, known as Category 2 responders, such as the Highways Agency and public utility companies.

Staffordshire Resilience Forum maintain a website called Staffordshire Prepared which provides information and advice to help prepare for respond to disruptive events, including flooding. They have a designated flooding webpage which provides advice for before, during, and after a flood event.

The Staffordshire Resilience Forum have prepared a Strategic Multi-Agency Flood Plan and Tactical Flood Plan that are relevant to the borough.

The Government website provides contact details for all local resilience forums across the UK.

9 Surface water management and SuDS

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

9.1 Roles of the Lead Local Flood Authority and Local Planning Authority in surface water management

SCC as the LLFA are a statutory planning consultee. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to confirm that onsite drainage systems are designed in accordance with the current legislation and guidance.

When considering planning applications, the drainage/flood risk engineering team will provide advice to the Planning Department on the management of surface water. The LPA should satisfy themselves that the development's proposed minimum standards of operation are appropriate and, using 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 pre-application or master-planning stage. To further inform development proposals at the master-planning stage, pre-application submissions are accepted by the Council. This will assist with the delivery of well designed, appropriate, and effective SuDS. Applicants are also encouraged to engage with Severn Trent Water or United Utilities to discuss their foul and surface water proposals, especially where adoption is proposed.

Currently the implementation of SuDS is driven through planning policy. However, Schedule 3 of the FWMA 2010 is expected to be implemented in 2024 following a government review making SuDS mandatory for new developments in England. Schedule 3 will provide a framework for the approval and adoption of drainage systems, a SuDS Approving Body (SAB) within unitary and county councils, and national standards on the design, construction, operation, and maintenance of SuDS for the lifetime of the development.

9.2 Sustainable Drainage Systems (SuDS)

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 that SuDS for management of runoff are put in place, unless there is clear evidence that this would be inappropriate

(NPPF Paragraph 175). Where possible, SuDS that offer multiple benefits should be given priority. Desgieners should make space for SuDS at the start of the design process so that surface water management is intrinsically linked with the wider design of the site and that flood risk is mitigated throughout the development phases.

It is important that SuDS are maintained for the lifetime for the development so that features can function as designed. Consideration should be given to enhancing SuDS to achieve biodiversity net gain.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) provides guidance on planning, design, construction, and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document. The manual can be downloaded from the CIRIA website here.

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

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

9.3.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation (LASOO) produced their practice guidance in 2016 to give further detail to the Non-Statutory technical guidance. This guidance is available on the SUS Drain website here.

9.3.4 Water Industry Design and Construction Guidance

The Design and Construction Guidance (DCG), part of a new Codes for Adoption covering the adoption of new water and wastewater infrastructure by water companies, contains details of the water sector's approach to the adoption of SuDS and can be accessed here.

9.3.5 Local Authority SuDS Guidance

The 2023 NPPF states that flood risk should be managed "using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding" (NPPF Paragraph 167).

SCC have a Sustainable Drainage Systems (SuDS) Handbook which was published in 2017 and has been produced for use by anyone undertaking or granting and reviewing permissions to undertake construction work which has surface water drainage implication. The handbook and its appendices is available on the SCC website here.

9.4 Other surface water considerations

9.4.1 Groundwater Vulnerability Zones

The EA 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 properties within a one-kilometre grid square.

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

9.4.2 Groundwater Source Protection Zones (GSPZ)

The EA also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. Development should be considered in accordance with wider national guidance on groundwater protection including the EA position statements on their approach to managing and protecting groundwater, which are available online here. SuDS and or certain development activity may be inappropriate in these locations or need robust mitigation.

GSPZs can be viewed on Defra's interactive mapping. Three main zones are defined as follows:

- Inner protection zone (Zone 1) - areas from where pollution can travel to the groundwater source within 50 days or is at least a 50m radius.
- Outer protection zone (Zone 2) - areas from where pollution can travel to the groundwater source within 400 days or lies within the nearest 25% of the total catchment area (whichever is largest).
- Total catchment (Zone 3) - the total area needed to support removal/discharge of water from the groundwater source.

Online mapping shows there are currently five GSPZs which lie partially or wholly within the study area. It is mainly the southeast and southwest of the borough, including Whitmore, Baldwins Gate, Ashley, Mucklestone and Almington, that are affected by GSPZs. Additionally, there is also a GSPZ which impacts the western boundary of the borough, near Audley.

Where a site is located in a GSPZ used for public water supply, applicants should engage with Severn Trent Water or United Utilities to understand any concerns and any necessary mitigating measures to manage the risk of development to public water supply.

9.4.3 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.

NVZs can be viewed on the EA's website here. There are six pre appeal NVZ 2021 to 2024 areas affecting the borough:

- R tern - conf R Roden to conf R Severn
- North Staffordshire
- River Trent (source to confluence with Derwent)
- East Shropshire
- Betley Mere Eutrophic lake
- River Weaver (Dane to Frodsham)

Currently, information on the 2021 to 2024 NVZs post-appeal is unavailable. Landowners can appeal an NVZ designation once notified if their land (or part of it):

- Does not drain into water that has been identified as polluted.
- Drains into water that should not be identified as polluted.

9.4.4 Critical Drainage Areas

Areas with Critical Drainage Problems (ACDPs) is land formally notified to the LPA by the EA as having critical drainage problems. Within ACDPs, proposed development may present increased risks of flooding both on and off site if the surface water runoff is not effectively managed. A dataset containing ACDPs is available to download from the EA website here. There are currently no ACDPs identified within the study area.

Local Authorities can also choose to designate Critical Drainage Areas (CDAs) within their authority area; however, there are no CDAs currently designated within the borough.

10 Summary and recommendations

10.1 Summary of flood risk

Flood risk from all sources has been assessed in this SFRA. Parts of the borough are shown to be at risk of flooding from the following sources: fluvial, surface water, groundwater, sewers, reservoir inundation, and overtopping/ breach of canals. This study has shown that the most significant sources of flood risk across the borough are fluvial, and surface water. The points below summarise the findings:

Fluvial: The primary sources of fluvial flood risk in the borough are the River Lea, Lyme Brook, and Checkley Brook, as well as their associated tributaries. The River Lea and Checkley Brook both flow in a north easterly direction, flowing through Madley and Madley Heath. Lyme Brook is a primary source of flood risk, flowing in a south easterly direction through the urban centre of Newcastle-under-Lyme. *Fluvial flood risk is discussed in Section 4.3 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*

Surface Water: The Risk of Flooding from Surface Water map shows prominent overland flow routes that largely follow the lower topography of watercourses in the borough, including Lyme Brook, Coal Brook, and the River Lea. There are some areas where there are additional flow paths and areas of ponding, for example where water is impounded at road or rail embankments and in low-lying areas. The south and west of the borough is largely rural, while the north and east are more urbanised with the largest risk of surface water flooding to key infrastructure. There are considerable flow routes following the roads and watercourses through the main urban areas of Kidsgrove, Newcastle-under-Lyme centre, Porthill, and Clayton, alongside isolated areas of ponding, which may affect many properties across these settlements. *Surface water flood risk is discussed in Section 4.4 and Appendix E and the flood extents are shown in the GeoPDFs in Appendix A.*

Climate Change: Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas, due to climate change. Flood extents will increase; in some locations, this may be minimal, but flood depth, velocity and hazard may have more of an impact due to climate change. This SFRA provides an assessment of the impacts of climate change on fluvial and surface water flood risk. *The approach to climate change is discussed in Section 5 and the flood extents are also shown in the GeoPDFs in Appendix A*. It is recommended that the Council work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new development when developing climate change plans and strategies for the borough.

Sewer: United Utilities and Severn Trent Water provide water services and sewerage services across the borough. Severn Trent Water have provided details of historic sewer flooding across the borough. Postcodes identified with high number of previous sewer flooding events are in areas of Newcastle-under-Lyme town, including Cross Heath, Gloster Gate, Clayton, and Silverdale. *Sewer flood risk is discussed in Section 4.5.*

Groundwater: The Areas Susceptible to Groundwater Flooding map shows that in general, the main areas with greater than 50% susceptibility to groundwater flooding are located towards the west and south of the borough around Kidsgrove, Madley and Almington. The JBA Groundwater Emergence Map emulates this with large parts of the west and south of the borough having groundwater levels within 0.5m of the surface, particularly around shows groundwater in Aston, Baldwin's Gate, and Almington. There are further areas with groundwater emergence levels within 0.5m of the surface in the northeast of the borough across Newcastle-under-Lyme town. Whilst no national mapping of groundwater risk is available, emergence mapping when considered in conjunction with topography and surface water flow paths can indicate areas where groundwater is likely to emerge, and where it might flow in this case. *Groundwater flood risk is discussed in Section 4.6 and Appendix E, and the AStGWF map and JBA emergence map are shown in the GeoPDFs in Appendix A.*

Canals: The Trent and Mersey Canal runs in a northerly direction along the eastern border of the borough and then flows in a westerly direction through the northern end of the borough, through Kidsgrove. In the north end of the borough the Macclesfield Canal branches off from the Trent and Mersey Canal and flows in a northerly direction away from the borough. The Shropshire Union Canal runs along the southwest boundary of the borough. The Canal and River Trust were consulted as part of this study and provided details of two recorded canal overtopping incidents within the borough and no recorded breaches. *Canal flood risk is discussed in Section 0.*

Reservoirs: There are four reservoirs located within the borough, and one located outside the study area where the 'wet day' or 'dry day' scenarios encroach into the borough. There is a potential risk of flooding from reservoirs both within the borough and those outside. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRAs (where relevant) in accordance with the updated PPG. *Reservoir flood risk is discussed in Section 0 and Appendix E. The 'Dry Day' and 'Wet Day' flood extents are shown in the GeoPDFs in Appendix A.*

10.2 Recommendations

10.2.1 Sequential approach to development

The NPPF supports a risk-based and sequential approach to development and flood risk in England, so that development is located in the lowest flood risk areas where possible; it is recommended that this approach is adopted for all future developments within the study area.

New development and re-development of land should wherever possible seek opportunities to reduce overall level of flood risk at the site, for example by:

- Reducing volume and rate of runoff through the use of SuDS.
- Relocating development to areas with lower flood risk.
- Creating space for flooding.
- Green Infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using areas at risk of flooding as public open space.
- Consideration must be given to the potential cumulative impact of development on flood risk.

10.2.2 Site-specific flood risk assessments

Site specific FRAs are required to be produced by developers to provide a greater level of detail on flood risk and any protection provided by defences and, where necessary, demonstrate the development passes part b of the Exception Test.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances), inform development zoning within the site and prove, if required, whether the Exception Test can be passed. Developers should, where required, also undertake hydraulic assessment of sewers in liaison with the wastewater provider. The assessment should also identify the risk of existing flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk. Any flood risk management measures should be consistent with the wider catchment policies set out in the CFMP, FRMPs and LFRMS.

Developers should consult with the Council, SCC as LLFA, the EA, and Severn Trent Water or United Utilities at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling, and drainage assessment and design.

10.2.3 Sequential and Exception tests

The SFRA has identified that parts of the study area are at high risk of flooding. Therefore, it is expected that several proposed development sites will be required to pass the Sequential and, where necessary, Exception Tests in accordance with the NPPF.

The Council should use the information in this SFRA when deciding which development sites to take forward in their LPU. It is the responsibility of the Council to be satisfied that the Sequential Test has been satisfied. Once potential sites are identified, consultation with Severn Trent Water and United Utilities will be required to identify any sewer flood risk. As part of the SFRA process, United Utilities have provided site-specific comments on the Councils draft local plan allocations, where there is a modelled sewer flood risk on sites where a sewer passes through the site. Similar information should be requested from Severn Trent Water where required.

10.2.4 Council review of planning applications

The Council should refer to the EA's West Midlands area consultation procedures and utilise the National flood risk standing advice for LPAs, available on the Government website here (last updated in May 2024).

The Council will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases, also contact non-statutory consultees (e.g. Severn Trent Water or United Utilities) that have an interest in the planning application.

10.2.5 Drainage strategies and SuDS

Planners should be aware of the conditions set by the LLFA for surface water management. The enactment of Schedule 3 of the FWMA means that there will be mandatory standards for delivery and adoption of SuDS in new developments.

SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure, and the enhancement of historical features.

Planning applications for phased developments should be accompanied by a drainage strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase. Applicants will need to demonstrate a holistic and co-ordinated approach to both foul and surface water drainage and the management of flood risk.

Use of the SuDS management train to prevent and control pollutants to prevent the ‘first flush’ polluting the receiving waterbody.

SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.

10.2.6 Residual risk

Residual risk is the risk that remains after mitigation measures are considered. The residual risk includes the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the defences, e.g. flood bank collapse. Residual risks should be considered as part of site-specific FRAs.

Further, any developments located within an area protected by flood risk management measures, where the condition of those defences is ‘fair’ or ‘poor’, where the standard of protection is not of the required standard or where the failure of the intended level of service gives rise to unsafe conditions should be identified.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. They should seek to contact the reservoir owner to obtain information and should apply the sequential approach to locating development within the site. Developers should also consult with relevant authorities regarding emergency plans in case of reservoir breach.

Consideration should be given to the potential for safe access and egress in the event of rapid inundation of water due to a breach with little warning.

10.2.7 Reduction of flood risk through site allocations and appropriate site design:

- To locate new development in areas of lowest risk, in line with the sequential test, by steering sites to Flood Zone 1 from the Flood Map for Planning and avoiding where possible areas with a higher risk of surface water flooding and by avoiding any other sources of flooding. If a sequential test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the exception test shall be undertaken. If development can’t be avoided in the higher risk surface water Zone (Zone B), then part “b” of the exception test should be satisfied.
- After application of the exception test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and to make space for water.
- Ordinary watercourses not currently afforded flood maps should be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development.
- Identify opportunities for brownfield sites in functional floodplain to reduce risk and 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.

10.2.8 Safe access and egress

According to the Government's guidance on 'Preparing a flood risk assessment: standing advice' minimum FFLs for vulnerable development in Flood Zone 2 should normally be the higher of the following:

- 600mm above average ground level of the site.
- 600mm above the adjacent road level to the building.
- 600mm above estimated river flood level.

The estimated river flood level is the 1% AEP fluvial flood level with an appropriate allowance for climate change.

Higher or lower values may be appropriate in some cases and developers should refer to the Government's guidance for further detail.

For development in Flood Zone 3, as the risk of flooding is greater, the standard of mitigation sought will be higher. While the minimum FFLs outlined above are applicable to development in Flood Zone 2, they are not necessarily applicable to development in Flood Zone 3.

Safe access and egress will need to be demonstrated at all development sites. Emergency vehicular access should be possible during times of flood. If at risk, then as assessment should be made to detail the flood duration, depth, velocity, and flood hazard rating in the 1% AEP plus climate change flood event, in line with FD2320.

Where development is located behind, or in an area benefitting from, defences, consideration should be given to the potential safety of the development, FFLs and for safe access and egress in the event of rapid inundation of water due to a defence breach with little warning.

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

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

10.2.10 Reduce surface water runoff from new developments and agricultural land

- Space should be provided for the inclusion of SuDS on all allocated sites, outline proposals and full planning applications.
- Promote biodiversity, habitat improvements and Countryside Stewardship schemes help prevent soil loss and to reduce runoff from agricultural land.
- Identify opportunities to maintain and enhance permeable surfaces and greenspaces to help reduce surface water runoff whilst promoting other benefits, including biodiversity and wellbeing.

10.2.11 Enhance and restore river corridors and habitat

- Assess condition of existing assets and upgrade, if required, to confirm that the infrastructure can accommodate pressures/flows for the lifetime of the development.
- Natural drainage features should be maintained.
- Identify opportunities for river restoration/enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and/or other infrastructure to cross, in line with CIRIA's Culvert design and operation guide, (C689) and to restrict development over culverts.
- There should be no built development within 8m from the top of a watercourse or main river for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.
- Access to utility assets must be maintained.

10.2.12 Mitigate against risk, improved emergency planning and flood awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 1% AEP rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 0.1% AEP event.
- Produce and implement robust emergency (evacuation) plans for major developments.
- Increase awareness and promote sign-up to the EA Flood Warnings within the study area.

10.3 Requirements for Level 2 SFRA

Following the application of the sequential test, where sites cannot be appropriately accommodated in low-risk areas, the Council will apply the NPPF's exception test. In these circumstances, a Level 2 SFRA may be required, to assess in more detail the nature and implications of the flood characteristics.

As part of this Level 1 SFRA, an initial site screening exercise has been undertaken for the Council to help inform the application of the sequential test and subsequent potential requirement for a Level 2 SFRA.

In the absence of broadscale sewer flooding information, United Utilities also provided site-specific comments on the Councils draft local plan allocations, based on modelled flood risk where there is a sewer which passes through a site. However, as this information is not available borough-wide, it is used to inform specific sites rather than strategic allocations / sequential test.

10.4 Technical recommendations

10.4.1 Updates to SFRA

SFRAs are high-level strategic documents and, as such, do not go into detail on an individual site-specific basis. This SFRA has been developed using the best available information, supplied at the time of preparation.

The EA regularly reviews its hydrology, hydraulic modelling, and flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a site-specific FRA. When using the SFRA to prepare FRAs it is important to check that the most up to date information is used, as is described in amendments to the flood mapping prepared and issued by the EA at regular intervals.

Other datasets used to inform this SFRA may also be updated periodically and following the publication of this SFRA, new information on flood risk may be provided by RMAs.

10.4.2 Modelling updates

Where development is planned in an area where detailed hydraulic modelling is not available, or where the latest climate change uplifts and functional floodplain outputs are not available, further detailed modelling is likely to be required either as part of a Level 2 SFRA or within a site-specific FRA.

Appendices

A GeoPDF Mapping and User Guide

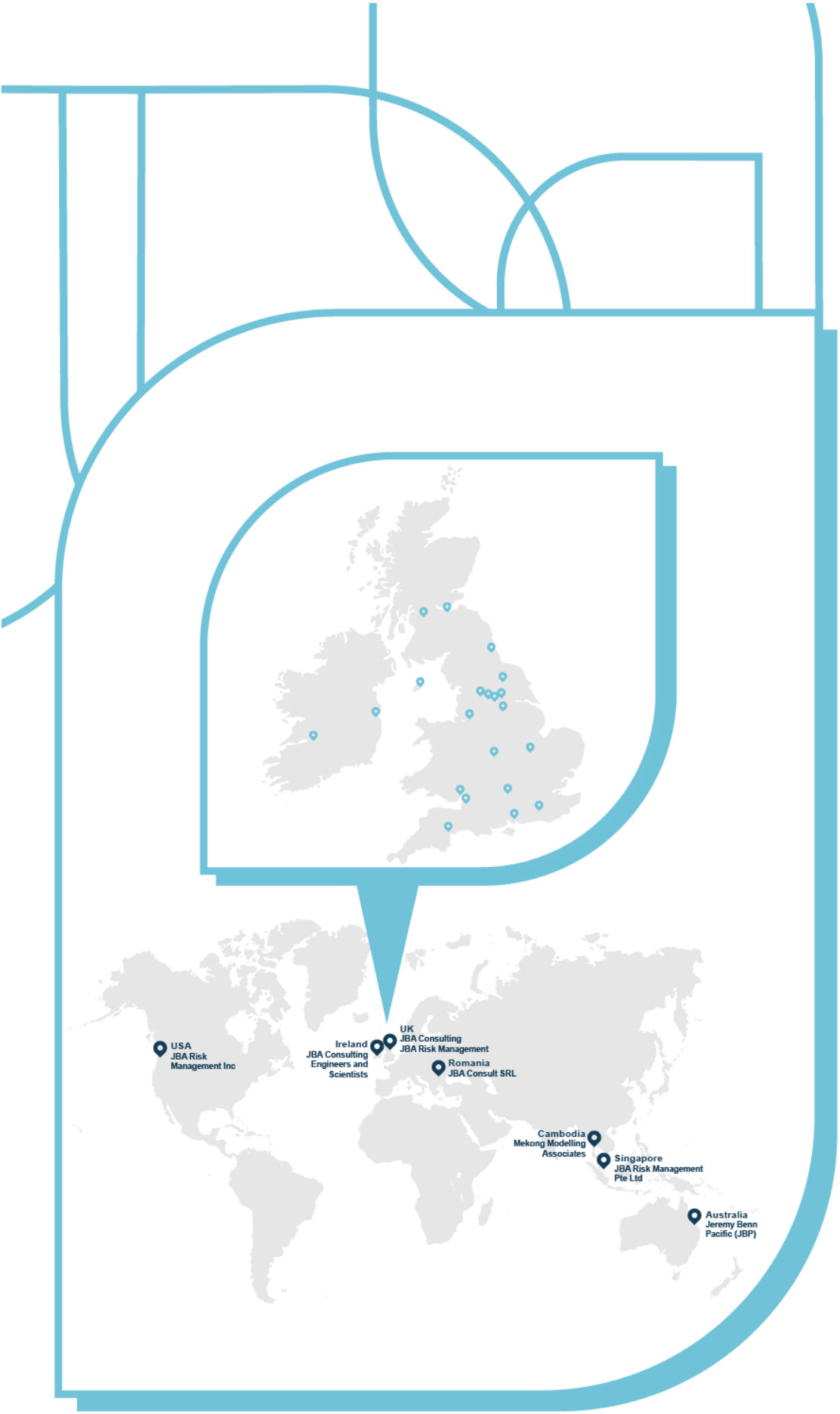
B Data Sources used in this SFRA

C SFRA User Guide

D Flood Alerts and Flood Warnings

E Summary of flood risk across the borough

F Cumulative Impact Assessment (CIA)



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Appendix A: GeoPDF User Guide

Please tick the boxes next to the dataset titles in the map legend to display the data. If data does not display, it means it is not present in that particular area. For the tickbox functionality to work, the GeoPDFs must be downloaded locally to your PC and opened with Adobe.

Legend	Description	Reference
Authority Information Newcastle-under-Lyme boundary	The boundary of Newcastle-under-Lyme Borough, the study area for this SFRA.	**Section 1.5** SFRA Study Area
Watercourses Main Rivers All Watercourses 8m watercourse buffer Canals	**Main Rivers** – the Environment Agency (EA) statutory main rivers map detailing the watercourses which are designated a Main River by the EA. **All Watercourses** – the OS Watercourse Link dataset based off the Ordnance Survey (OS) MasterMap for surface features. **8m watercourse buffer** - this shows the area of land within 8m of a watercourse, as shown in the OS Watercourse Link dataset. **Canals** - WFD Artificial Water Bodies – Canals Cycle 1, is a polyline shapefile dataset containing Water Framework Directive (WFD) attributes that have been collated as defined for the implementation of the WFD. The WFD defines an 'artificial water body' as a body of surface water created by human activity.	**Section 1.5** SFRA Study Area **Section 4.3** Fluvial flood risk
Defences Embankment Engineered High Ground Natural High Ground Spillway	The EA Asset Information Management System (AIMS) spatial Flood Defence dataset, shows flood defences currently owned, managed, or inspected by the EA. A defence is any asset that provides flood defence or coastal protection functions.	**Section 6.4** Major flood risk management assets in the borough **Table 6-2** Locations shown in the 'EA AIMS' data set

Legend	Description	Reference
Flood Zones Modelled Flood Zone 3b Indicative Flood Zone 3b Flood Zone 3a Flood Zone 2	The Flood Zones are for use in development planning and flood risk assessments. **Modelled Flood Zone 3b** – Functional Floodplain: This zone comprises land where water must flow or be stored in times of flood, identified as land which would flood with an annual probability of 3.3% AEP (1 in 30 years). The 3.3% AEP defended modelled flood extents have been used to represent Flood Zone 3b, where available from the EA. For this SFRA, the defended 3.3% AEP extent was available for Lyme Brook. For Fowlea Brook, which is covered by a detailed EA model but with no defended 3.3% AEP output available, the 2% AEP undefended output was used as a conservative proxy. **Indicative Flood Zone 3b** – Where no detailed hydraulic modelling exists, Indicative Flood Zone 3b should be used, which shows the same extent as Flood Zone 3a. **Flood Zone 3a** – High probability: greater or equal to a 1% chance of river flooding in any given year (Excludes Flood Zone 3b, which is derived as part of the SFRA). **Flood Zone 2** – Medium probability: between a 1% and 0.1% chance of river flooding in any given year. Flood Zones 2 and 3a show the same extent as the online EA's Flood Map for Planning (FMfP) (which incorporates latest modelled data) other than for Fowlea Brook where additional detailed modelling was available that has not been incorporated into the FMfP and was used in preference.	**Section 3.2.1** Flood Zones – fluvial risk **Appendix B** – for model details

Legend	Description	Reference
Climate Change Extent (Modelled) 3.3% AEP + 29% CC 3.3% AEP + 39% CC 3.3% AEP + 61% CC 1% AEP + 29/30% CC 1% AEP + 39% CC 1% AEP + 61% CC 0.1% AEP + 29% CC 0.1% AEP + 39% CC 0.1% AEP + 61% CC	These extents are from existing hydraulic models, where the 3.3%, 1%, and 0.1% AEP flows have been upscaled by the EA's climate change allowances for the 2080s epoch for the relevant management catchment. The defended outputs are presented in the mapping. The mapping includes climate change extents for Lyme Brook and Fowlea Brook. The Lyme Brook hydraulic model was uplifted with the latest climate change allowances for the 3.3%, 1%, and 0.1% AEP events as part of this SFRA. Climate change extents for Fowlea Brook were only available for the 1% AEP event. These are in line with latest guidance, except for the central allowance where the +30% uplift was provided. This is similar to the latest guidance of +30% so has been included within the SFRA.	**Section 5** Impact of Climate Change **Appendix B** – for model details
Reservoir Flood Extents (EA) Dry Day Wet Day	The EA reservoir flood extents show the predicted flooding which would occur if a dam or reservoir fails. The EA provide two scenarios: • **Dry Day** – the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. • **Wet Day** – the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood.	**Section 4.8** Flooding from reservoirs
Risk of Flooding from Rivers and Sea (EA) Very Low	The Risk of Flooding from Rivers and Sea maps have been generated from the EA's National Flood Risk Assessment (NaFRA) and National Receptor Dataset (NRD).	**Section 4.3** Fluvial flood risk **Appendix E**

Legend	Description	Reference
Low Medium High	• Very low risk: each year there is a chance of flooding of less than 1 in 1000 (0.1%) • Low risk: each year there is a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) • Medium risk: each year there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) • High risk: each year there is a chance of flooding of greater than 1 in 30 (3.3%)	Summary of flood risk
Reduction in Risk of Flooding from Rivers and Sea (EA)	The Reduction in Risk of Flooding from Rivers and Sea is a spatial dataset that indicates where areas have reduced flood risk from rivers and sea due to the presence of flood defences.	**Section 6** Flood alleviation schemes and assets
Risk of Flooding from Surface Water (EA) 3.3% AEP 1% AEP 0.1% AEP	The EA's Risk of Flooding from Surface Water (RoFSW) flood maps give an indication of the broad areas likely to be at risk of surface water flooding. This includes flooding that takes place from the surface runoff generated by rainwater. The data includes the extent, velocity, depth, and hazard mapping for the 3.3%, 1% and 0.1% AEP events. The extent of flooding for each of the events is shown in the mapping.	**Section 4.4** Surface water flooding **Appendix E** Summary of flood risk

Legend	Description	Reference
Climate Change Surface Water Extent (Modelled) 3.3% AEP Upper End 2070s 1% AEP Upper End 2070s	The RoFSW was uplifted with the upper end 2070s allowances to represent the impact of climate change on surface water flood risk. As the borough falls across three different Management Catchments, the allowances vary across the borough. The following outputs and allowances are displayed in the mapping: **3.3% AEP Upper End 2070s** • 3.3% AEP with a 40% uplift for the Weaver Gowy and Severn Middle Shropshire Management Catchments. • 3.3% AEP with a 35% uplift for the Trent Valley Staffordshire Management Catchment. **1% AEP Upper End 2070s** • 1% AEP with a 45% uplift for the Weaver Gowy and Severn Middle Shropshire Management Catchments. • 1% AEP with a 40% uplift for the Trent Valley Staffordshire Management Catchment.	**Section 4.4** Surface water flooding **Section 5** Impact of Climate Change
Groundwater Emergence Mapping (JBA) Less than 0.025m below surface Between 0.025-0.5m below surface Between 0.5-5m below surface At least 5m below surface No risk.	JBA's Groundwater Flood emergence map shows the level of groundwater below the surface, at a resolution of 5m. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding, which may occur at sites other than those shown in the emergence mapping.	**Section 4.6** Groundwater flooding **Appendix E** Summary of flood risk

Legend	Description	Reference
Groundwater Flooding Susceptibility (EA) <25% >=25% <50% >=50% <75% >=75%	The EA's groundwater flooding susceptibility data shows the degree to which areas of England, Scotland and Wales are susceptible to groundwater flooding on the basis of geological and hydrogeological conditions. This is shown at a resolution of 50m. It does not show the likelihood of groundwater flooding occurring, i.e. it is a hazard not risk-based dataset.	**Section 4.6** Groundwater flooding **Appendix E** Summary of flood risk
Water Company Boundaries Severn Trent Water United Utilities	The coverage of Severn Trent Water and United Utilities, the water service and sewerage providers across the borough.	**Section 1.5** SFRA Study Area
Flood Alert and Warning Areas EA Flood Alert Areas EA Flood Warning Areas	The EA issue flood warnings to designated Flood Warning Areas when a river level hits a certain threshold or when heavy rainfall or high tides and strong winds are forecast. "Flooding is expected, immediate action is required". Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment and when forecasts indicate flooding may be possible. "Flooding is possible, be prepared". Both datasets are a polygon GIS shapefile where the above are issued; they are not flood extents.	**Section 4.9** Flood alerts and flood warnings **Appendix D** Flood Alerts and Flood Warnings

Appendix B - Data sources used in the SFRA

1 Historical flooding

Staffordshire County Council provided information on historic flood incidents through their published Section 19 Flood Investigation Reports and list of flooding hotspots.

The Environment Agency's (EA's) Historic Flood Map and Recorded Flood Outlines dataset were also used to understand the flood history across the study area.

Section 4.1 of the Main Report documents the historic flooding records obtained.

2 Fluvial flooding

2.1 Hydraulic models

JBA received two fluvial hydraulic models from the EA. These models were reviewed to determine their age, type of model, and the outputs available. Table 2-1 below provides details of the two models and the outputs available for use within the SFRA.

Table 2-1: Details of models available for use within this SFRA.

Model	Water-course	Year	Software	Model outputs availability
Newcastle Hazard Mapping Study	Lyme Brook	2015	Estry-TuFLOW	3.3% AEP - Yes (defended) 2% AEP - Yes (defended) 1% AEP - Yes (defended and undefended) 0.1% AEP - Yes (defended and undefended)
Fowlea Brook	Fowlea Brook	2023	Estry-TuFLOW	3.3% AEP - No 2% AEP - Yes (undefended) 1% AEP - Yes (undefended) 0.1% AEP - Yes (undefended)

The Fowlea Brook model has been updated since the previous Level 1 SFRA, by Arup in 2023. They were commissioned by the EA to progress detailed design for the proposed Fowlea Brook Flood Risk Management Scheme. The 'Do Minimum' baseline model has been used in this SFRA as the modelled defences are not currently constructed. The SFRA has made best use of the available model data whilst balancing the authority's timescales and budgets. No new modelling has been carried out as part of this Level 1 SFRA.

2.2 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in Appendix A: GeoPDFs, show the same extent as the online EA's Flood Map for Planning (FMfP) (which incorporates latest modelled data) except for the EA's Fowlea Brook (2023) model. Here, the latest undefended model outputs have been used in preference to the EA's FMfP. The extents of the models used for this SFRA are shown in Figure 2-1. 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.

2.3 Functional Floodplain (Flood Zone 3b)

Flood Zone 3b, as shown in Appendix A mapping, has been compiled for the study area as part of this SFRA and is based on the 3.3% AEP (1 in 30-year chance of flooding in any given year) extents produced from detailed hydraulic models, where available, which is in line with the latest Planning Practice Guidance (PPG). For this SFRA, the defended 3.3% AEP extent was available for Lyme Brook. For Fowlea Brook, which is covered by a detailed EA model but with no defended 3.3% AEP output available, the 2% AEP undefended output was used as a conservative proxy.

For areas not covered by detailed hydraulic 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 (1% AEP). 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 (FRA) to define the extent of Flood Zone 3b. If the area of interest is located somewhere that shows 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 FRA.

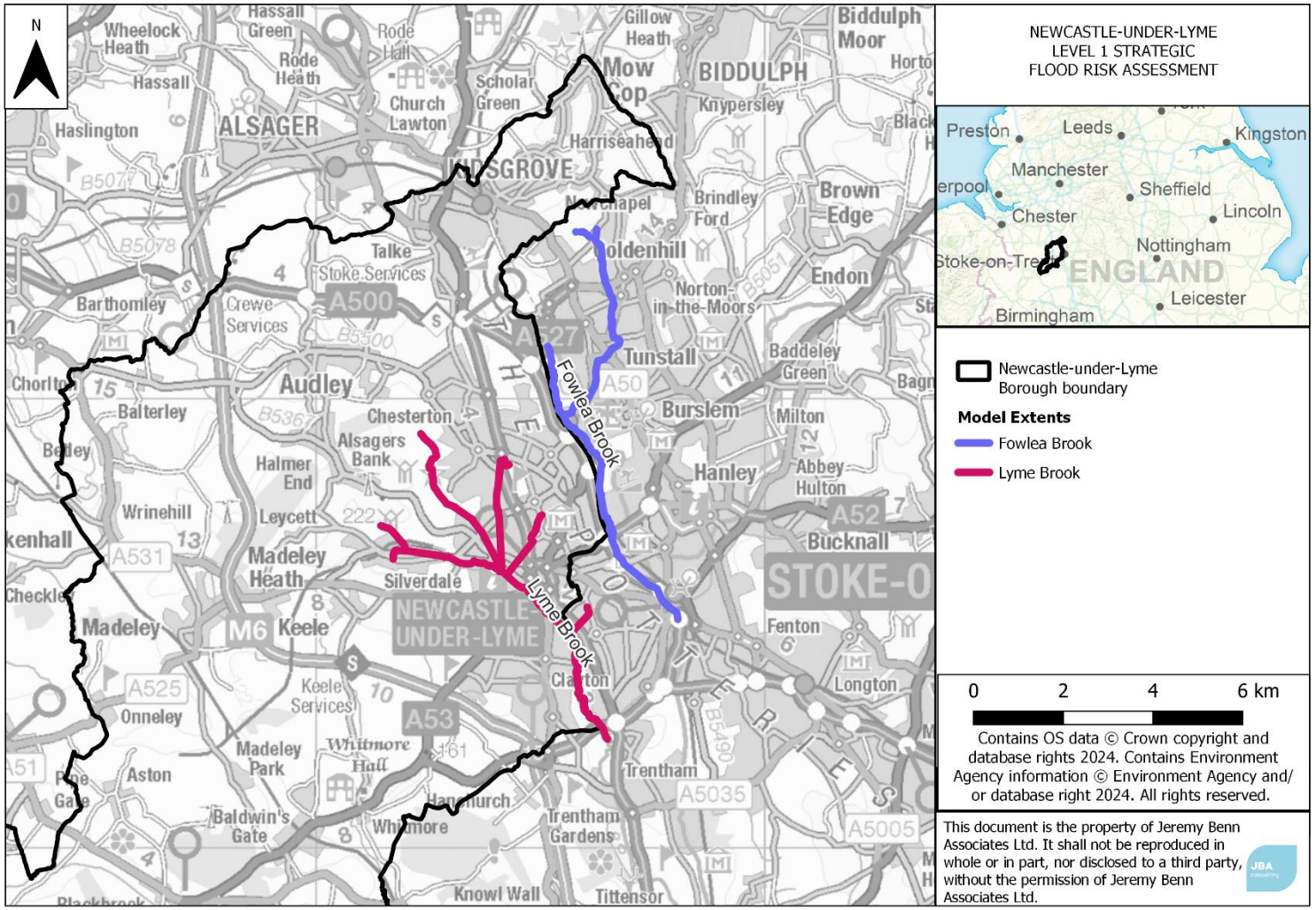


Figure 2-1: Extents of the fluvial hydraulic models used in this SFRA.

3 Surface water flooding

Mapping of surface water flood risk in the study area has been taken from the Risk of Flooding from Surface Water (RoFSW) maps published online by the EA. 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 EA, and any potential developers to focus their management of surface water flood risk.

The RoFSW 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 3-1: RoFSW 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.

Whilst the categories in Table 3-1 are used in the national RoFSW mapping, we have used the following approach to inform the sequential test.

Surface water zones have been used to define locations at either lower or higher risk of surface water flooding based on the extent of the 1% AEP plus 2070s upper end climate change surface water event:

- Zone A – lower risk of surface water flooding (lies outside the 1% AEP surface water extent plus an allowance for climate change)
- Zone B – higher risk of surface water flooding (lies within the 1% AEP surface water extent plus an allowance for climate change)

In some cases, it is possible for the 1% AEP event to show a greater extent that the 1% AEP plus an allowance for climate change. This may be because local surface water flood modelling has been produced and used to inform the EA RoFSW map. Further assessment at a site-specific level may be required to refine the surface water flood extents.

Although the RoFSW 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 EA mapping to be at risk from surface water flooding, a more detailed assessment should be considered to illustrate the flood risk more accurately at a site-specific scale.

4 Climate change

4.1 Fluvial flooding

4.1.1 Hydraulic modelling

Detailed EA hydraulic models for Lyme Brook and Fowlea Brook were obtained under licence for the SFRA.

Lyme Brook

As Lyme Brook and its tributaries run through the main urban centre of Newcastle-under-Lyme, the model was uplifted as part of this SFRA with the latest 2080s climate change allowances for the Trent Valley Staffordshire Management Catchment (+29%, +39%, and +61%) for the 3.3%, 1%, and 0.1% AEP defended events.

Uplifting existing models with climate change allowances for the 0.1% AEP event presents practical issues as most existing models are not built to run events of this magnitude, and often present instabilities as the events are significantly greater than the normal run bounds of a modelling study. During the 0.1% AEP plus 61% event, there are some instabilities towards the upstream end of some of the reaches, due to overtopping of structures in extreme events and considerable depths sat on the HX lines. These issues were not rectified as part of the uplifts as major re-configuring of the already-accepted EA model goes beyond the scope of this SFRA.

The extents along Silverdale Brook should be treated with caution due to the inflow being applied close to a structure. In doing this, the model will try to create an unrealistic head loss to force flows through the structure. Also, as the flows are already restricted by the structures, the uplifts may also not be representative in this area. It is noticeable in this area that there is a minimal increase in extent between the 1% AEP and 0.1% AEP events. The extents in all other areas of the model appear to be representative.

Fowlea Brook

There is a small section of the Fowlea Brook model within the study area to the north of Bradwell Woods; however, the extent of the model falls mainly outside of the study area, following the eastern boundary of the borough. Within the 0.1% AEP undefended scenario, there is small encroachment in the east of the study area around Garner

Street Business Park, but the remainder of the model extent remains outside the study area.

As such, the most up-to-date outputs available from this model have been used to inform SFRA Flood Zones, which includes the latest climate change uplifts for the 1% AEP event. However, the model has not been re-run for the 3.3% AEP climate change event, or 3.3% and 0.1% AEP climate change extents, due to the minor extent within the study area and limited benefits for this broadscale Level 1 assessment of flood risk. If any development is proposed along this eastern boundary, where the 0.1% AEP model extents encroach into the borough, then further modelling may be required during Level 2 assessment or a site-specific FRA.

The Fowlea Brook baseline model was updated in 2023 and the 1% AEP event was re-run with the latest climate change uplifts for the higher central and upper end allowances (+39% and +61%). The 1% AEP event was also uplifted by +30%, which is similar to the latest central allowance of +29%. Therefore, these uplifts are deemed suitable to use for this SFRA.

The climate change extents are shown in Appendix A: GeoPDF mapping.

4.1.2 Proxy approach

Where there were no detailed models available, or the existing models could not be re-run with the updated climate change guidance, a proxy approach has been taken. This is detailed in Section 5.3.1 of the Main Report.

4.2 Surface water flooding

The 0.1% AEP surface water extent can be used as an indication of surface water risk, and risk to smaller watercourses that are too small to be covered by the EA's Flood Zones.

Modelled Climate Change uplifts for the 3.3% and 1% AEP events were developed as part of this SFRA and are presented in in Appendix A: GeoPDFs as 'Climate Change Surface Water Extent (Modelled)' for the following events and scenarios:

Management Catchment	3.3% AEP 2070s upper end	1% AEP 2070s upper end
Weaver Gowy	40%	45%
Severn Middle Shropshire	40%	45%
Trent Valley Staffordshire	35%	40%

5 Groundwater

Two datasets were used to assess potential areas that are likely to be at higher risk of groundwater flooding:

- The EA's Areas Susceptible to Groundwater Flooding 2010 (AStGWF) dataset, showing the degree to which areas are susceptible to groundwater flooding based on geological and hydrogeological conditions on a 1km square grid. It does not show the likelihood of groundwater flooding occurring, i.e., it is a hazard, not risk, based dataset. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.
- The JBA groundwater emergence map, showing the risk of groundwater flooding to both surface and subsurface assets, based on predicted groundwater levels on a 5m square grid. For each grid cell, a depth range is given for modelled groundwater levels in the 1% AEP event. It takes account of factors including topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties.

Section 4.6 of the Main Report details the approach adopted in this SFRA to assess the risk of groundwater flooding.

6 Sewers

Severn Trent Water provided their Hydraulic Sewer Flooding Risk Register for the borough which includes a list of properties which have reported at least one incidence of external or internal sewer flooding between 1 January 2004 and 19 March 2024.

United Utilities provided their historic flood records of external or internal sewer flooding between September 2010 and May 2024. The data using truncated postcodes to avoid identifying specific streets or properties.

Section 4.5 of the Main Report presents this data.

7 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 Reservoir Flood Mapping (RFM) study and are shown online on the Long-Term Risk of Flooding website at the time of publication.

The EA provide two flooding scenarios for the reservoir flood maps: a ‘dry-day’ and a ‘wet-day’. The ‘dry-day’ scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The ‘wet-day’ scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood.

Section 4.8 of the Main Report presents the reservoirs affecting the borough.

8 Flood defences

The EA supplied the location of all flood defences within the district in their AIMS database, including information relating to the type of flood defence and their standard of protection. Section 6 of the Main Report provides information on flood defences and schemes.

9 Overview of supplied data

Table 9-1 below provides an overview of the supplied data from stakeholders which has been used to inform the Newcastle-under-Lyme Borough SFRA. Hyperlinks are provided where the datasets are openly available for download.

Table 9-1: Summary of supplied to inform the Newcastle-under-Lyme Borough SFRA.

Source of flood risk	Data used to inform the assessment	Data supplier
Historic (all sources)	Historic flood map Recorded flood outlines	Environment Agency
Historic (all sources)	Section 19 Flood Investigation Reports Flood hotspots	Staffordshire County Council
Fluvial (including climate change)	Fowlea Brook (2023) 1D-2D ESTRY-TuFLOW model Lyme Brook (2015) 1D-2D ESTRY-TuFLOW model	Environment Agency
Fluvial (including climate change)	Flood Map for Planning Flood Zone 3 and Flood Zone 2 Risk of Flooding from Rivers and Sea Flood Storage Areas	Environment Agency
Surface water (including climate change)	Risk of Flooding from Surface Water	Environment Agency
Canals	Records of overtopping and/or breach incidents	Canal and River Trust
Sewers	Internal and external historic drainage	Severn Trent

Source of flood risk	Data used to inform the assessment	Data supplier
	records	Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset Source Protection Zones	Environment Agency
Groundwater	Groundwater emergence map	JBA
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map) - Dry Day extents and Wet Day extents	Environment Agency
Flood defences	AIMS Spatial Flood Defences Reduction in Risk of Flooding from Rivers and Sea due to defences	Environment Agency
Flood warnings and alerts	Flood Warning Areas Flood Alert Areas	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	Planners at neighbouring authorities (Cheshire East, Staffordshire Moorlands, Stoke-on-Trent, Stafford, Shropshire)
Other datasets	Aquifer Designation maps (Bedrock Geology and Superficial Deposits)	Environment Agency (via Newcastle-under-Lyme Borough Council)

Appendix C – SFRA User Guide

This SFRA User Guide provides guidance on how the SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for how each source of flood risk should be considered within the sequential and exception tests.

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future	Sequential and Exception Tests	Relevant sections of the SFRA
Fluvial	Greater than 1% AEP (1 in 100 year) (FZ3)	Between 1% and 0.1% AEP (1 in 100 and 1 in 1000 year) (FZ2)	Less than 0.1% AEP (1 in 1000 year) (FZ1)	EA's Flood Zones (FZs) 1, 2 and 3 use a risk-based approach. Functional Floodplain (FZ3b) is displayed using the best available model data, see Section 3.2.1 of the Main Report and Appendix B for details of the models used. Where model data is not available, Fluvial FZ3a is used as a proxy for FZ3b.	EA's Flood Zones 1, 2 and 3 use a risk-based approach. Climate change uplifts should be assessed as part of the screening process. Where significant parts of a site's area is shown to be at risk in the 0.1% AEP event, a review of whether the site is sequentially appropriate may be required following a Level 2 assessment. This may result in slightly larger numbers of sites requiring assessment at Level 2. The Lyme Brook model was uplifted with latest climate change allowances for all Flood Zones and should be used to assess sites in this location. Where climate change datasets are not available to define FZ3b, the 1% AEP event should be used. Where climate change datasets are not available to define FZ3a the 0.1% AEP event should be used. There is no suitable proxy to use to define FZ2 into the future and the current 0.1% AEP event should be used, noting the comment above about re-screening following any Level 2 assessment.	Sites at high or medium risk of fluvial flooding either now or in the future should be explicitly addressed in a Sequential Test and may require preparation of further evidence to substantiate that the Exception Test can be satisfied. Evidence from a Level 2 SFRA (including detailed modelling of the impact of climate change) is required to demonstrate that the principle of development is supported.	3.2.1 – Flood Zones – fluvial risk. 4.3 – Fluvial Flood Risk 5.3.1 – Fluvial climate change Appendix A – GeoPDF Mapping Appendix E – Summary of Flood Risk
Surface Water	Greater than 1% AEP plus 2070s upper end	N/A	Less than 1% AEP plus 2070s upper end	Different assumptions are used to derive surface water risk than is the case for fluvial flood	Different assumptions are used to derive surface water risk than is the case for fluvial flood	Sites at high risk of surface water flooding should be explicitly addressed in a	3.2.2 Flood Zones – surface water

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future	Sequential and Exception Tests	Relevant sections of the SFRA
	climate change (Zone B)		climate change (Zone A)	zones. The RoFSW dataset potentially does not provide the confidence or certainty required to define areas of high medium and low flood risk that are comparable with the risk zones for river flooding. Therefore, a precautionary approach should be taken so development is located in areas of lower flood risk. This approach will require that sites where proposed development is located in a higher risk surface water zone, and do not clearly show that development can be achieved away from the flood risk, are assessed in more detail in the Level 2 SFRA.	zones. The RoFSW dataset potentially does not provide the confidence or certainty required to define areas of high, medium, and low flood risk that are comparable with the risk zones for river flooding. Therefore, a precautionary approach should be taken so development is located in areas of lower flood risk. This approach will require that sites where proposed development is located in a higher risk surface water zone, and do not clearly show that development can be achieved away from the flood risk, are assessed in more detail in the Level 2 SFRA. Climate change datasets exist for the upper end climate change allowances for the 2070s for the 3.3% and 1% AEP events. Surface water flood risk into the future should be sequentially assessed using the extent of the 1% AEP extent the 2070s upper end uplift for Climate Change.	Sequential Test and may require preparation of further evidence to substantiate that the Exception Test can be satisfied. Evidence from a Level 2 SFRA (including detailed modelling of the impact of climate change) is required to demonstrate that the principle of development is supported.	risk 4.4 – Surface water flooding 5.3.2 – Surface water climate change Appendix A – GeoPDF Mapping Appendix E – Summary of Flood Risk
Groundwater	Groundwater flood risk is assessed on a case-by-case basis using best available data.	Groundwater flood risk is assessed on a case-by-case basis using best available data.	Groundwater flood risk is assessed on a case-by-case basis using best available data.	Datasets do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from groundwater as with surface water and fluvial flood risk. Therefore, a precautionary approach should be taken, and the level of groundwater flood risk identified through the 3-step screening process will determine the level of risk and further assessment in the Level 2 SFRA. This screening process comprises of:- Groundwater risk zoning- Emergence mapping	Datasets do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from groundwater as with surface water and fluvial flood risk. Therefore, a precautionary approach should be taken, and the level of groundwater flood risk identified through the 3-step screening process will determine the level of risk and further assessment in the Level 2 SFRA. This screening process comprises of:- Groundwater risk zoning- Emergence mapping	Level 2 SFRA required to provide evidence that the principle of development is supported.	3.2.3 – Flood Zones – other sources of flooding 4.6 – Groundwater flooding Appendix A – GeoPDF Mapping Appendix E – Summary of Flood Risk

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future	Sequential and Exception Tests	Relevant sections of the SFRA
				and flow routes- Consultation with the LPA.	and flow routes- Consultation with the LPA.		
Sewer	Sewer flood risk is assessed on a case-by-case basis using best available data.	Sewer flood risk is assessed on a case-by-case basis using best available data.	Sewer flood risk is assessed on a case-by-case basis using best available data.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from sewers. Therefore, further assessment will be undertaken at a Level 2 SFRA where significant risk from sewers is noted. This may be through historical sewer flood records and additional information from water companies.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from sewers. Therefore, further assessment will be undertaken at a Level 2 SFRA where significant risk from sewers is noted. This may be through historical sewer flood records and additional information from water companies.	Level 2 SFRA required to provide evidence that the principle of development is supported.	3.2.3 – Flood Zones – other sources of flooding 4.5 – Sewer flooding
Reservoir	Sites where reservoir flooding is predicted to make fluvial flooding worse to be assessed in a Level 2 SFRA.	Sites where reservoir flooding is predicted to make fluvial flooding worse to be assessed in a Level 2 SFRA.	Sites where reservoir flooding is predicted to make fluvial flooding worse to be assessed in a Level 2 SFRA.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from reservoirs. In addition, the reservoir flood map identifies the consequence of a reservoir breach rather than risk, so applying high, medium, and low 'risk' is not possible using this dataset. Therefore, a precautionary approach should be taken and sites where reservoir flooding is predicted to make fluvial flooding worse for development will be assessed in Level 2 SFRA and the implications for sequential selection of alternative locations considered at that stage.	Datasets potentially do not have the confidence or certainty required to provide mapping that enables a comparative assessment to be made of the risk of flooding of land from reservoirs. In addition, the reservoir flood map identifies the consequence of a reservoir breach rather than risk, so applying high, medium, and low 'risk' is not possible using this dataset. Therefore, a precautionary approach should be taken and sites where reservoir flooding is predicted to make fluvial flooding worse for development will be assessed in Level 2 SFRA and the implications for sequential selection of alternative locations considered at that stage.	Level 2 SFRA required to provide evidence that the principle of development is supported.	3.2.3 – Flood Zones – other sources of flooding 4.8 – Flooding from reservoirs Appendix A – GeoPDF Mapping Appendix E – Summary of Flood Risk

Appendix D - Flood Alert and Flood Warning Areas

To register for the free Targeted Flood Warning Service, visit the.gov.uk website here, or call Floodline on 0345 988 1188. Once registered, you will be alerted by phone, email, or text when flooding is expected in your area.

For more information on managing flood and coastal risk, visit FloodHub here.

1.1 Flood Alert Areas

Flood Alert Code	Flood Alert Name	Watercourse(s)	Local Authority Area	Coverage
013WAFDA	River Dane catchment including Kidsgrove, Sandbach, Congleton, Middlewich and Northeast Crewe	River Dane	Cheshire East, Cheshire West and Chester, Derbyshire, Halton, Staffordshire, Warrington	The Dane catchment includes the River Wheelock, Arclid, Smoker and Fowle Brooks and their tributaries
031WAF104	Tern and Perry catchments	River Tern, River Perry	Shropshire, Staffordshire, Telford and Wrekin, Wrexham	Rivers Tern, Perry, Roden, Strine and Meese and their tributaries
033WAF312	River Sow and River Penk	Sandyford Brook, Ridings Brook, Saredon Brook	Staffordshire, Wolverhampton	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

Flood Alert Code	Flood Alert Name	Watercourse(s)	Local Authority Area	Coverage
033WAF309	Stoke Trent	Ford Green Brook, Lyme Brook, River Trent	Staffordshire, Stoke-on-Trent	Low-lying land and roads between Norton Green and Darlaston on the River Trent and on the Lyme Brook and Ford Green Brook
013WAFWE	Weaver catchment including Nantwich, Frodsham, Crewe, Winsford and Northwich	River Weaver	Cheshire East, Cheshire West and Chester, Halton, Shropshire, Staffordshire	The Weaver Catchment includes the Rivers Weaver, Ducklow and Wheelock and their tributaries

1.2 Flood Warning Areas

Flood Warning Code	Flood Warning Name	Watercourse(s)	Local Authority Area	Coverage
033FWF3ASHFIELD	Ashfield Brook at Newcastle-Under-Lyme	Ashfield Brook	Staffordshire	Ashfield Brook at Newcastle-under-Lyme from Meadow Lane to Knutton Lane
033FWF3LYME01	Lyme Brook at Newcastle under Lyme and Trent Vale	Lyme Brook	Staffordshire, Stoke-on-Trent	Lyme Brook at Newcastle-under-Lyme and Trent Vale including Silverdale Road, Stanier Street, St Pauls Road, Orme Road, Pool Dam, Hatrell Street, Brook Lane, Lyme Valley Road and Sports Grounds off Rosetree Avenue

Appendix E – Summary of flood risk in Newcastle-under-Lyme borough

The tables below summarise the areas where there are notable flood risks within Newcastle-under-Lyme borough. For this summary the study area has been delineated into four sub-areas, as shown in Figure 1-1. Further information on these sub-areas can be found in Section 4.10 of the main report.

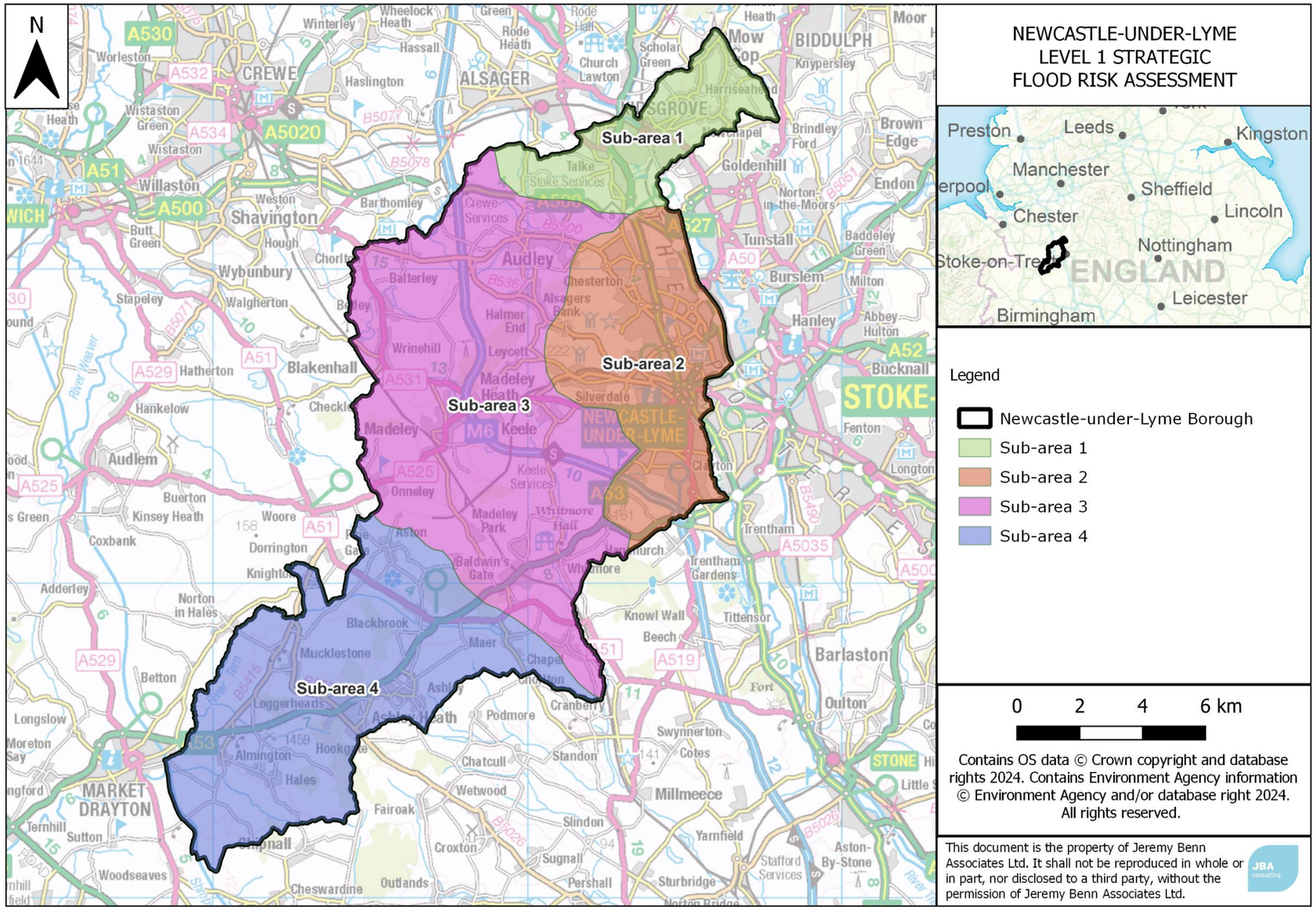


Figure 1-1: Sub-areas used to summarise the flood risk to the study area.

Sub-area 1: Kidsgrove and Talke

Fluvial flood risk	This area is largely urban and is located in the north of the study area. There are two canals within the sub-area: the Trent and Mersey Canal flows through the centre of the sub-area through Kidsgrove where the Macclesfield Canal branches off and then flows along the northwest border of the sub-area. There is an unnamed watercourse which flows in a westerly direction to the north of the canals, in the west side of Kidsgrove. There is also an unnamed watercourse located in the southwest of the sub-area and which flows in a north-westerly direction. The fluvial flood risk across the sub-area is shown to be minimal. There is fluvial flood risk shown in two areas in the west side of the sub-area, which follow the route of the unnamed watercourses. The western side of Kidsgrove is shown to be at fluvial flood risk in both Flood Zones 2 and 3a, with a number of industrial buildings shown to be at flood risk. The largest area of fluvial flood risk follows the unnamed watercourse in the southwest of the sub-area, but the floodplain is shown to be mainly rural, and the flood risk is limited to local roads. Mapping showing these flood extents can be seen in Appendix A.
Existing defences	The EA AIMS dataset shows no existing defences within the sub-area.
Surface water flood risk	Sub-area 1 shows extensive surface water flood risk. The surface water flow paths follow the topography of the land, with multiple significant flow paths flowing in a westerly direction across the sub area, channelled by the routes of multiple watercourses, including the unnamed watercourses and both the Trent and Mersey Canal and Macclesfield Canal. The largest area affected by surface water flooding is Kidsgrove. The water is channelled through the area along local roads, the railway line, and the canals. In the north of the sub-area, Harriseahead is affected by several small, isolated areas of surface water ponding. Users should refer to Appendix A mapping for more detail on which areas have the greatest risk of flooding from surface water.
Susceptibility to groundwater flood risk	The ASGWF shows the western side of this sub-area around Kidsgrove has a susceptibility to groundwater flooding of greater than 50%. The JBA groundwater emergence map emulates this, showing that the western side of the sub-area around Kidsgrove is particularly susceptible to groundwater emergence, with groundwater levels between 0.025m and 0.5m below the surface, with some areas with groundwater levels within 0.025m of the ground surface. There are also considerable areas shown with groundwater levels within 0.5m of the surface in the rural southwest of the sub-area around the village of Dunkirk. The ROFSW suggests than any surface water emerging from the areas detailed above is likely to flow west, channelled along the lower topography of the unnamed watercourses and the Trent and Mersey and Macclesfield Canals. The AStGWF data set and JBA groundwater emergence map are shown in Appendix A mapping.
Reservoir inundation risk	The sub-area is impacted by the Bathpool Park Lake reservoir in both the ‘Dry Day’ and ‘Wet Day’ scenarios. The reservoir is located in the southeast of the sub-area and the reservoir flood extent flows from the southeast corner in a north-westerly direction and exits the sub-area through the western border. The flood extent is channelled north along the railway line and then follows the path of the Trent and Mersey Canal and unnamed watercourse to the north of the canal. The ‘Wet Day’ extent follows the same flow path of that of the ‘Dry Day’ extent, but the ‘Wet Day’ extent extends further south along the railway line and is wider in places, particularly to the northeast of the reservoir. The ’Dry Day’ and ‘Wet Day’ reservoir extents are shown in Appendix A mapping.
Historic, recorded flood events	The Environment Agency Historic Flood Map and Recorded Flood Outline datasets have no records of flooding within this sub-area.

Sub-area 2: Newcastle-under-Lyme

Fluvial flood risk	This sub-area is mostly urban, encompassing the Newcastle-under-Lyme urban area, with a small rural area to the west. The most significant source of fluvial flood risk within the sub-area is from Lyme Brook and its tributaries, including Silverdale Brook, which originate in the northwest of the sub-area and flow in a south-easterly direction through the centre of the sub-area and then flow along the southeastern border. Where Silverdale Brook flows through Silverdale there are a number of properties shown to be at risk, particularly along Church Street, and the residential streets to the south of Church Street. In this area, Flood Zones 2 and 3a show similar extents. There is also considerable risk at the confluence of Silverdale Brook and Lyme Brook, with key areas of risk along Silverdale Road, Stanier Street, and Saint Paul's Road. Flood Zone 2 extends further than Flood Zone 3a in this area with several more properties shown to be at flood risk. There are two further areas of fluvial flood risk in the north of Newcastle-under-Lyme, following tributaries of Lyme Brook, with several roads and properties shown to be at flood risk, particularly around the Holditch Industrial Estate and along Douglas Road where Ashfield Brook flows. Additionally, there is an area of isolated fluvial flood risk from a pond located in the Silverdale Community Park. There is a small area in the northeast corner of the sub-area which is at fluvial flood risk from Fowlea Brook. Fowlea Brook originates in the northeast corner of the sub-area, flowing in an easterly direction and then in a southerly direction along the eastern border of the sub-area. A small area of the A500 and a couple of industrial buildings are shown to be affected by the Flood Zone 2 extent. Park Brook originates in Springpool Wood in sub-area 3 and flows in a south-westerly direction through the south of this sub-area following the route of the M6. The M6 and the western edge of Clayton are shown to be at risk in both Flood Zones 2 and 3a, which show similar extents. Mapping showing these flood extents can be seen in Appendix A.
Existing defences	The EA AIMS dataset shows natural and engineered high ground and a couple of sections of flood wall along both banks of Silverdale Brook downstream of Rosemary Street and then along both banks of Lyme Brook downstream of its confluence with Silverdale Brook. There are also a few small embankments in the sub-area. One is located along the north side of Saint Paul's Road providing protection to a number of properties, one is on the north side of Lyme Brook just upstream of its confluence with Ashfield Brook, and one is along the south side of Silverdale Road to the north of Rosemary Street. The EA AIMS dataset is shown in the mapping in Appendix A.
Surface water flood risk	There is extensive surface water risk across this sub-area. Surface water flow paths follow the topography of the land, with three significant flow paths flowing in a south-easterly direction through the centre of the study area through the main urban area, channelled along the route of Lyme Brook and its tributaries. There are also a large amount of smaller flow paths which join the main larger, defined flow paths. Surface water is also shown to be channelled along the roads throughout Newcastle-under-Lyme alongside areas of surface water ponding across the settlement. Users should refer to Appendix A mapping for more detail on which areas have the greatest risk of flooding from surface water.
Susceptibility to groundwater flood risk	The ASGWF shows large parts of the eastern border of the sub-area have a susceptibility to groundwater flooding of greater than 50%. There is also an area in Silverdale with a susceptibility to groundwater flooding of greater than 50%. There are two areas of the sub-area, in the northeast corner and in Newcastle-under-Lyme centre, where there is a susceptibility to groundwater flooding of greater than 75%. The JBA groundwater emergence map mirrors this, with the eastern side of the sub-area being particularly susceptible, with emergence levels between 0.025m and 0.5m below the surface. There are a few areas where the groundwater emergence levels are within 0.025m of the ground surface, mainly in the northeast corner and in the centre of Newcastle-under-Lyme. The ROFSW suggests than any surface water emerging from the areas detailed above is likely to flow southeast channelled along the routes of Fowlea Brook and Lyme Brook. The AStGWF data set and JBA groundwater emergence map are shown in Appendix A mapping.
Reservoir inundation risk	There are no reservoir flood extents which impact the area during the 'Dry Day' scenario. The Serpentine (Kidsgrove) reservoir impacts the area during the 'Wet Day' scenario. This reservoir is located to the northeast of the study area and the flood extent follows the path of the River Trent to the east of the study area and only impacts the sub-area in the southeast corner. A small area of the Michelin Sports and Conference Facility grounds is inundated where the flood extent extends slightly upstream along the path of Lyme Brook. The 'Dry Day' and 'Wet Day' reservoir extents are shown in Appendix A mapping.
Historic, recorded flood events	The Environment Agency Historic Flood Map and Recorded Flood Outline datasets have no records of flooding within this sub-area

Sub-area 3: Keele and Madeley

Fluvial flood risk	This is the largest sub-area and is mostly rural with a few urban settlements, including Madeley Heath, Madeley, Keele, Whitmore, and Baldwins Gate, the largest located towards the east. The most significant source of fluvial flood risk within the sub-area is from the River Lea, which originates in the southwest of the sub-area and flows in a north westerly direction through the west of the sub-area. Where the River Lea flows through Madeley there are a number of properties shown to be at risk, specifically along Castle Lane, and the residential areas north of Castle Lane. The River Lea flood extents result in flood risk to transport infrastructure, including Bar Hill road (A525) and the West Coast Mainline. In this area, Flood Zone 2 shows a wider extent than Flood Zone 3a, particularly around Castle Lane and Netherset Hey Industrial Estate. There is also considerable risk from Meece Brook, which originates in the southeast of the sub-area and flows in a southerly direction through the southeast of the sub-area and then flows along the southeast border. Where Meece Brook flows through Whitmore, there are a few properties and infrastructure shown to be at risk, to the southeast and southwest of Three Mile Lane, and properties south of Stone Road (A51), particularly Stableford Carvan Park. The West Coast Mainline is also shown to be at flood risk from Meece Brook. In this area, Flood Zones 2 and 3a show similar extents. Additionally, in the centre of the sub-area, there is flood risk at the confluence of Checkley Brook and Hazeley Brook, with the M6 and the A531 being impacted, however no settlements are shown to be at risk. In this area, Flood Zones 2 and 3a show similar extents. There is a small area, in the centre of the west border of the sub-area, which is at fluvial flood risk from Mere Gutter. Mere Gutter originates near the western border of the sub-area and flows in a north westerly direction out of the sub-area. A small area of the A531, which runs through the settlement of Betley is shown to be at flood risk in both Flood Zones 2 and 3a. There are also small areas in the northwest of the sub-area which are shown to be at risk from Dean Brook and two unnamed watercourses, which originate in the northwest of the sub-area and flow in a north westerly direction. Dean Brook is not shown to impact any settlements but several roads, including Nantwich Road (B5500), Limbrick Road (B5367) and the M6 are shown to be at flood risk in both Flood Zones 2 and 3a. The two unnamed watercourses present a flood risk to the M6, properties around Mill End, and infrastructure including a sewage treatment works and some local roads. In this area, Flood Zones 2 and 3a show similar extents. Mapping showing these flood extents can be seen in Appendix A.
Existing defences	The EA AIMS dataset shows a series of natural high ground along all both banks of the River Lea, located in the west of the sub-area, providing protection to a number of properties. There is also natural high ground along both banks of Barthomley Brook. The EA AIMS dataset is shown in the mapping in Appendix A.
Surface water flood risk	Surface water flow paths follow the topography of the land, with two significant flow paths flowing in a westerly direction, through the centre of the sub-area through the urban areas of Madeley and Madeley Heath, channelled along the routes of the River Lea, Hazeley Brook, and Checkley Brook. There is a smaller flow path in the southeast corner of the sub-area, flowing in a southerly direction through Whitmore, channelled along the path of Meece Brook. There are also small, isolated, areas of surface water ponding, which may suggest localised flood risk. Users should refer to Appendix A mapping for more detail on which areas have the greatest risk of flooding from surface water.
Susceptibility to groundwater flood risk	The ASGWF shows large parts of the west border and southeast border have a susceptibility to groundwater flooding of greater than 50%. There is also an area in Madeley Heath with a susceptibility to groundwater flooding of greater than 50%. There are also several areas where there is a susceptibility to groundwater flooding of greater than 75%, along the northwest border, and further south in Madley and Whitmore. The JBA groundwater emergence map partially mirrors this, with the western side of the sub-area being particularly susceptible, with groundwater levels between 0.025m and 0.5m below the surface. There are a few areas where the groundwater levels are within 0.025m of the ground surface, mainly along the eastern border, in the southwest and southeast corners. The JBA groundwater emergence map differs from the ASGWF slightly, as it shows several areas near the eastern border of the sub-area with groundwater levels within 0.5m of the ground surface. The ROFSW suggests than any surface water emerging from the areas detailed above is likely to flow west channelled along the routes of the River Lea, Hazeley Brook, Checkley Brook. The AStGWF data set and JBA groundwater emergence map are shown in Appendix A mapping.
Reservoir inundation risk	The sub-area is impacted by the Coopers Green reservoir during the ‘Dry Day’ scenario. The reservoir is located in the northwest corner of the sub-area and the reservoir flood extent flows from the northwest in a westerly direction and exits the sub-area through the western border. The flood extent is channelled west along the flow paths of Dean Brook and Barthomley Brook. The sub-area is also impacted by The Old Wood (Betley Hall) reservoir in both the ‘Dry Day’ and ‘Wet Day’ scenarios. The reservoir is located near the west border of the sub-area and the reservoir extent flows west and exits the sub-area through the western border. The flood extent is partially channelled west along the flow path of Mere Gutter. The ‘Wet Day’ extent follows the same flow path as that of the ‘Dry Day’ extent, but the ‘Wet Day’ extent extends further south along the western border and is wider in places. The ’Dry Day’ and ‘Wet Day’ reservoir extents are shown in Appendix A mapping.
Historic, recorded flood events	The Environment Agency Historic Flood Map and Recorded Flood Outline datasets have no records of flooding within this sub-area.

Sub-area 4: Loggerheads and Ashley Heath

Fluvial flood risk	This sub-area is mostly rural but with several urban settlements located near the eastern border and in the southern end of the sub-area, including Ashely, Ashely Heath, Loggerheads, Maer, Hales, Mucklestone, and Almington. There are three main areas of fluvial flooding, however none of these are shown to pose a fluvial flood risk to any urban settlements in the sub-area. The most significant flow path within the sub-area is from Coal Brook, which originates outside the southeast border of the sub-area and flows in a westerly direction through the sub-area and exits through the southwest border. The flood risk is limited to Tyrley Road. The River Tern originates in the north of the sub-area and flows in a south westerly direction and then flows along the western border of the sub-area. The fluvial flooding from this watercourse is shown to affect Newcastle Road (A53). There is also an unnamed watercourse, which originates in the centre of the sub-area and flows in a westerly direction and then flows along the west border of the sub-area. The fluvial flooding from this watercourse is shown to affect Newcastle Road (A53) and the B5415. In all areas of the sub-area, Flood Zone 2 and 3a show similar extents. Mapping showing these flood extents can be seen in Appendix A
Existing defences	The EA AIMS dataset shows natural high ground along the banks of an unnamed drain through the fish farm located adjacent to the River Tern. The EA AIMS dataset is shown in the mapping in Appendix A.
Surface water flood risk	Surface water flow paths follow the topography of the land, with three significant flow paths flowing in a westerly direction, channelled along the flow routes of an unnamed watercourse, Coal Brook, and the River Tern. The surface water flow path channelled along Coal Brook, impacts the settlements of Alimington and Hales. The flow path channelled along the route of the unnamed watercourse located in the centre of the sub-area, and smaller flow paths which join this main surface water flow path, impact Ashley Heath, Hookgate, and Loggerheads. The surface water flow path channelled along the path of the River Tern is not shown to impact any settlements. In the north of the sub-area, Maer is affected by small, isolated, areas of surface water ponding. Users should refer to Appendix A mapping for more detail on which areas have the greatest risk of flooding from surface water.
Susceptibility to groundwater flood risk	The ASGWF shows the western border of the sub-area has a susceptibility to groundwater flooding of greater than 50%. There is also an area in the north of the sub-area, around Weymouth with a susceptibility to groundwater flooding of greater than 50%. There are multiple areas in the sub-area, in the north, along the southeast and southwest border, which have a susceptibility to groundwater flooding of greater than 75%. The JBA groundwater emergence map mirrors this, with the western side of the sub-area having groundwater levels of between 0.025m and 0.5m below the surface. There are a few areas where the groundwater levels are within 0.025m of the ground surface, mainly on the west side of the sub-area, where the River Tern, Coal Brook and unnamed watercourse are located. The ROFSW suggests than any surface water emerging from the areas detailed above is likely to flow west channelled along the routes of the River Tern, Coal Brook, and the unnamed watercourse. The AStGWF data set and JBA groundwater emergence map are shown in Appendix A mapping.
Reservoir inundation risk	There are no reservoir flood extents which impact the area during the ‘Dry Day’ or ‘Wet Day’ scenarios.
Historic, recorded flood events	The Environment Agency Historic Flood Map and Recorded Flood Outline datasets have no records of flooding within this sub-area.

Appendix F - Cumulative Impact Assessment

1 Background

1.1 Introduction

The cumulative impact of development should be considered at both the Local Plan making stage and the planning application and development design stages. Paragraph 166 of the National Planning Policy Framework (NPPF, 2023) states:

'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.'

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 minimal impact on flood risk, the cumulative effect of multiple developments may be more severe. There are also risks of development causing modified flow regimes from sites creating an alignment in peak flows in downstream watercourses and resulting in greater flood risk as a result of the development.

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 Councils' administrative area.

The cumulative impact of development should be considered at both the Local Plan making and the planning application and development design stages. Appropriate mitigation measures should be undertaken to ensure flood risk is not exacerbated, and where possible the development should be used to reduce existing flood risk issues.

To understand the impact of future development on flood risk in Newcastle-under-Lyme Borough, catchments were identified where development may have the greatest potential effect on flood risk, and where further assessment would be required within a Level 2 Strategic Flood Risk Assessment (SFRA) or site-specific Flood Risk Assessment (FRA). To identify the catchments at greatest risk, various factors were considered, including the potential change in developed area within each catchment and communities sensitive to increased risk of surface water and fluvial flooding. Where catchments have been identified as sensitive to the cumulative impact of development, the assessment sets out planning policy recommendations to help manage the risk.

1.2 Assessment of Cross-Boundary Issues

The study area is bordered by Cheshire East District along the northwest boundary, Staffordshire Moorlands District to the northeast, Stoke-on-Trent City to the east, Stafford District to the southeast and Shropshire to the southwest. The neighbouring authorities are shown in Figure 1-1.

The highest elevations in the borough are through the centre, sloping downhill towards both the southeast and northwest boundaries. The lowest elevations are along the northwest boundary and in the south of the area, along the path of Coal Brook.

The underlying topography of the borough means that most watercourses originate within the borough and then flow either east or west into the neighbouring authorities.

In the northeast of the borough Lyme Brook originates within the borough and then flows in a southeasterly direction through the urban centre of Newcastle-under-Lyme and then into Stoke-on-Trent City. Fowlea Brook also originates within the borough and then flows south along the eastern border, within Stoke-on-Trent City. Park Brook also originates within the southeast of the borough and flows in a south-easterly direction into Stafford District and then into Stoke-on-Trent City. These watercourses all eventually join the River Trent.

Meece Brook originates within the southeast of the borough and flows in a southerly direction into Stafford District where it joins the River Sow, a tributary of the River Trent.

The River Lea, Checkley Brook and a number of unnamed watercourses originate within the northwest and western areas of the borough and flow in a north-westerly direction into Cheshire East.

The River Tern has its source in the south of the borough and flows in a westerly direction out of the borough and then in a southerly direction along the border between Newcastle-under-Lyme and Shropshire, before heading through Shropshire in a westerly direction. Coal Brook, a tributary of the River Tern, has its source just east of the borough on the border between Stafford and Shropshire and then flows in a westerly direction along the southern boundary of the borough and then through the south of the borough to join the River Tern.

Section 1.5 of the Main Report provides further details on the study area.

Due to the topography of the study area, it is unlikely that future development outside of the study area will impact on flood risk within the study area, however future development within the study area, as well as climate change, have the potential to affect flood risk to existing development and the surrounding areas through increased runoff volumes.

The neighbouring authorities were contacted for information on their site allocations, to determine where development in neighbouring authorities may be impacted by development within Newcastle-under-Lyme.

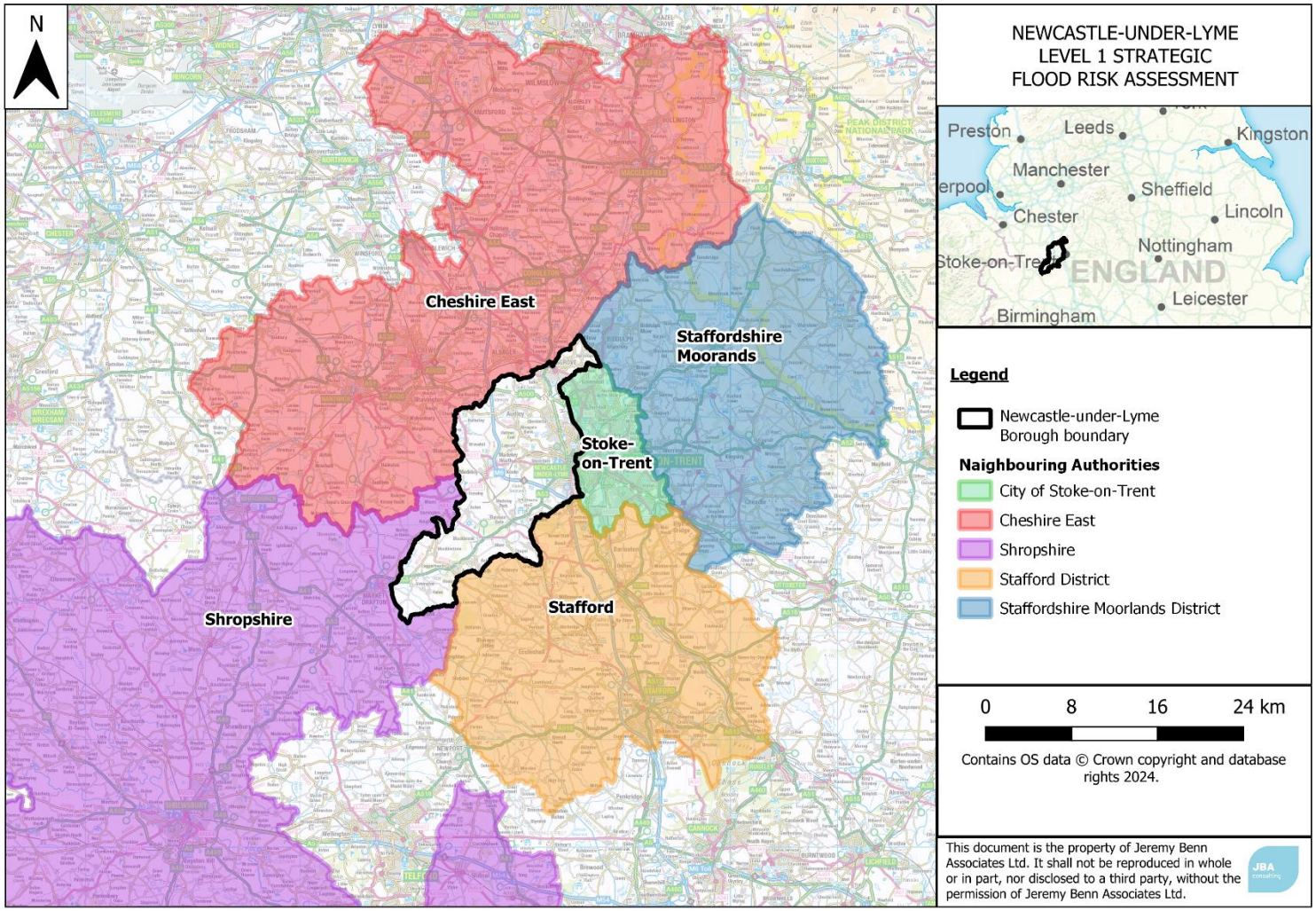


Figure 1-1: Neighbouring authorities to Newcastle-under-Lyme Borough.

2 Cumulative Impact Assessment

2.1 Methodology

For the Cumulative Impact Assessment (CIA), Newcastle-under-Lyme Borough was assessed at a catchment level using the Water Framework Directive (WFD) catchments, with these catchments shown in Figure 2-1. There are a total of 22 WFD catchments which fall within the borough to some extent, however, four of these have less than 1% of their area within the district, and are not areas with proposed allocations within Newcastle-under-Lyme Borough, so these were therefore removed from the assessment:

- Arclid Brook
- Ellerton Bk - source to conf R Meese
- Sow from Source to Brockton Brook
- Trent from Fowlea Brook to Tittensor

There are three stages to the Level 1 CIA:

1. Assess sensitivity to fluvial and surface water flood risk.
    - This will be assessed by calculating the change in the number of properties at risk from the 1% AEP to the 0.1% AEP events for fluvial and surface water flooding respectively, given as a percentage of the total properties in the catchment.
2. Assess the catchments with the highest degree of proposed new development.
    - This will be assessed by calculating the percentage area of each catchment covered by proposed development.
3. Identify the catchments at greatest risk.
    - Rank catchments in each category.
    - Discussion of catchments which are at high risk in all categories/individual categories.
    - Policy recommendations for developments in higher risk catchments.
    - Identify catchments needing further consideration within a Level 2 SFRA (if required).

GIS based historical flooding incidents across the borough were not available for this assessment, so historical flooding has not been considered.

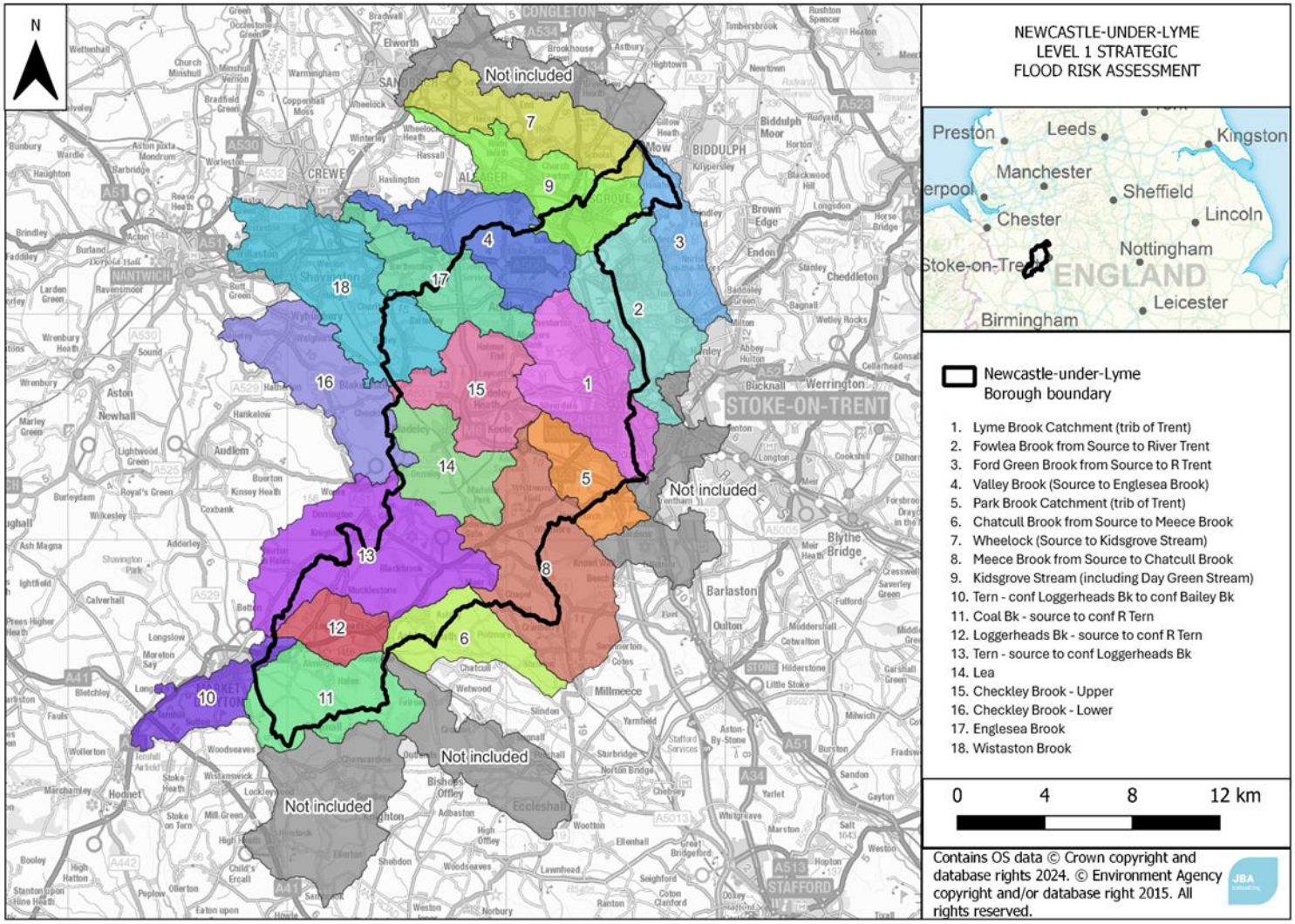


Figure 2-1: WFD Catchments across Newcastle-under-Lyme Borough.

Table 2-1 summarises the datasets used within the Newcastle-under-Lyme CIA.

Catchments within the study area were ranked on three metrics: sensitivity to increased fluvial flood risk, sensitivity to increased risk of surface water flooding, and the area of new development proposed within the catchment.

The final results of this assessment gave a rating of low, medium, or high risk for each metric, for each catchment within the study area, the boundaries of which were derived from the WFD. The rating of each catchment in each of these assessments was combined to give an overall ranking.

Table 2-1: Summary of datasets used within the Broadscale CIA.

Dataset	Coverage	Sources of Data	Use of Data
Catchment boundaries	Newcastle-under-Lyme Borough and neighbouring authorities	Water Framework Directive Catchments	Assessment of susceptibility to cumulative impacts of development by catchment
OS Open Code Point Data	Newcastle-under-Lyme Borough and neighbouring authorities	Ordnance Survey (Open source)	Proxy for the number of properties for the assessment of flood risk
Risk of Flooding from Surface Water	Newcastle-under-Lyme Borough and neighbouring authorities	EA	Assessing the number of properties at risk of surface water flooding within each catchment
Fluvial Flood Zones 2 and 3a	Newcastle-under-Lyme Borough and neighbouring authorities	EA Flood Map for Planning	Assessing the number of properties at risk of fluvial flooding within each catchment
Future development areas (recently built out sites/sites under construction/sites with planning permission/previously allocated sites/currently allocated sites)	Newcastle-under-Lyme Borough and neighbouring authorities	Newcastle-under-Lyme Borough and neighbouring authorities	Assessing the impact of proposed future development on risk of flooding

2.1.1 Sensitivity to increases in fluvial flooding

This is the measure of the increase in the number of properties at risk of fluvial flooding from the 1% AEP event to the 0.1% AEP event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk.

The OS Postcode point data was used as a proxy to identify the properties within the catchments. The postcode points were intersected with the 1% and 0.1% AEP fluvial flood extents separately to determine the number of properties in each catchment, in each flood extent. The difference between the two values was then taken as a percentage of the total number of properties within the catchment to allow comparison between catchments of different sizes.

2.1.2 Sensitivity to increases in surface water flooding

This is the measure of the increase in the number of properties at risk of surface water flooding in a 1% AEP event to a 0.1% AEP event and follows the same process as for fluvial flood risk, see Section 2.1.1 above.

2.1.3 Growth in the area

Newcastle-under-Lyme provided their latest working assumption of proposed site allocations for their Regulation 19 (as of 5 April 2024). This is the best available data for the proposed new development within the catchment and therefore was used within this assessment.

Site allocations were also provided by the neighbouring authorities:

- Cheshire East - provided their allocated sites within their current local plan, which was adopted in 2022.
- Shropshire - provided their allocated sites within their current local plan and their local plan review which is currently at examination stage.
- Stafford - provided their current local plan allocations which show no existing allocations fall within the cross boundary catchments.
- Staffordshire Moorlands - provided their allocated sites within their current local plan, which was adopted in 2020.
- Stoke-on-Trent City - provided their SHLAA which was filtered so that only the sites marked as developable or deliverable were included within the assessment.

The area of new development within each catchment was calculated for each option, expressed as a percentage of the total catchment area to determine the potential for increases in flood risk as a result of new development. At this stage the whole area of each development was considered, with no land use assumptions for the development areas.

2.1.4 Ranking the results

The results for each assessment were ranked into high, medium, and low risk as shown in Table 2-2. Ranking delineations were given at natural breaks in the results.

The ranking results were combined from the three assessments to give an overall high, medium, and low ranking for all catchments within Newcastle-under-Lyme Borough. Each catchment was assigned a score for each assessment based on its ranking (high = 3, medium = 2, low = 1) and these were then averaged to produce a final score and ranking. Any catchment producing an overall score of greater than 2 was considered high risk.

There is currently no national guidance available for assessing the cumulative impacts of development. These rankings provide a relative assessment of the catchments within Newcastle-under-Lyme Borough and are not comparable across other boroughs/districts. The thresholds used have been based on natural breaks in the data and professional judgement.

Table 2-2: Ranking assessment criteria

Flood risk ranking	Percentage of properties at increased risk of fluvial flooding	Percentage of properties at increased risk of surface water flooding	Percentage area of catchment covered by new development
Low risk	<0.5	<=0.8	<=2
Medium risk	0.5 to 1	<=1.5, >0.8	<=4, >2
High risk	>1	>1.5	>4

2.1.5 Assumptions

The assumptions made when conducting the CIA are shown in Table 2-3.

Table 2-3: Assumptions of the CIA.

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk; Flood Zone 2 and 3a	Total number of properties	The 2021 National Receptor Dataset (2021) was not available for this assessment. Therefore, the OS Code Point Open postcode points were used for this assessment. These points are plotted at the average co-ordinates representative of all individual addresses within a particular postcode.	This was the most up to date and accurate data available.

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Fluvial flood risk	Climate change proxy	Used the Flood Map for Planning Flood Zone 2 as an indicative estimate of the impacts of climate change across the district.	Although detailed climate change modelling was available for some watercourses, the broader Flood Map for Planning covers the entire area of the catchments both within and outside the district and therefore provided a consistent approach for this high level assessment.
Surface water flood risk	Climate change proxy	Used the 0.1% AEP extent from the Risk of Flooding from Surface Water Map as an indicative estimate of the impacts of climate change across the study area.	Although the Risk of Flooding from Surface Water Map was uplifted for climate change as part of this study, the uplifts were only applied to the study area, the Risk of Flooding from Surface Water Map covers the entire area of the catchments both within and outside the study area and therefore provided a consistent approach for this high level assessment.

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Development	Area of development	Have assumed all promoted sites provided by the neighbouring authorities are taken forward to development, unless otherwise specified in Section 2.1.3. For Newcastle-under-Lyme, sites include all Regulation 19 working assumption sites provided by the Council as of the 5 April 2024. Have not considered whether sites are greenfield or brownfield sites (with brownfield regeneration having the potential to reduce flood risk) or the proposed allocation type and land use of the site.	This is a reasonable worst-case scenario as we do not have further information to inform which sites are most likely to go forward to development.

2.2 Results

2.2.1 Sensitivity to fluvial flooding

The number of properties located within Flood Zone 2, but not presently within Flood Zone 3a was calculated, as a percentage of the total properties across the whole catchment. These properties are considered sensitive to increased flood risk as a result of climate change. Flood Zone 2 can be used as an indicative climate change extent given the upper end climate change estimates are often similar to the 0.1% AEP/ Flood Zone 2 extents.

The fluvial flood risk is shown to be generally low across the district. Catchments with greater than 1% of properties at increased risk were considered to be highly sensitive.

2.2.2 Sensitivity to surface water flooding

The number of properties located within the 0.1% AEP surface water extent not presently within the 1% AEP extent was calculated, as a percentage of the total properties across the whole catchment. These properties are considered sensitive to increased flood risk as a result of climate change.

Catchments with greater than 1.5% properties at increased risk were considered to be highly sensitive.

2.2.3 Area of proposed development

Newcastle-under-Lyme Borough Council and neighbouring authorities provided shapefiles of promoted development sites and the total area of new development in each catchment was measured, as a percentage of catchment area.

Due to the scale of proposed developments in comparison to the catchment areas, catchments with more than 4% of their area earmarked for development were considered high risk.

2.3 Overall rankings

A Red-Amber-Green (RAG) rating has been applied to the catchments, with red being high sensitivity, amber being medium sensitivity and green being low sensitivity. The RAG ratings are shown in Figure 2-2. The catchments with an average score of greater than 2 were deemed to have a high sensitivity and are shown in Table 2-4.

Despite scoring a combined score of 2, the Englesea Brook catchment was increased from medium to high risk on the account of ranking high for development risk with a large proportion of the proposed site allocations falling within the borough. The catchment was shown to have medium sensitivity to increases in fluvial flood risk.

The rest of the designated high risk catchments ranked as high or medium across all three assessments.

Policy recommendations with regards to managing the cumulative impact of development have been made in Section 3 below. This will help to ensure there is no incremental increase in flood risk both within and downstream of Newcastle-under-Lyme Borough.

Table 2-4: Catchments deemed highly sensitive as shown in Figure 2-2.

Waterbody name	Average score
Lyme Brook Catchment (trib of Trent)	2.33
Fowlea Brook from Source to River Trent	2.33
Valley Brook (Source to Englesea Brook)	2.33
Englesea Brook	2.00

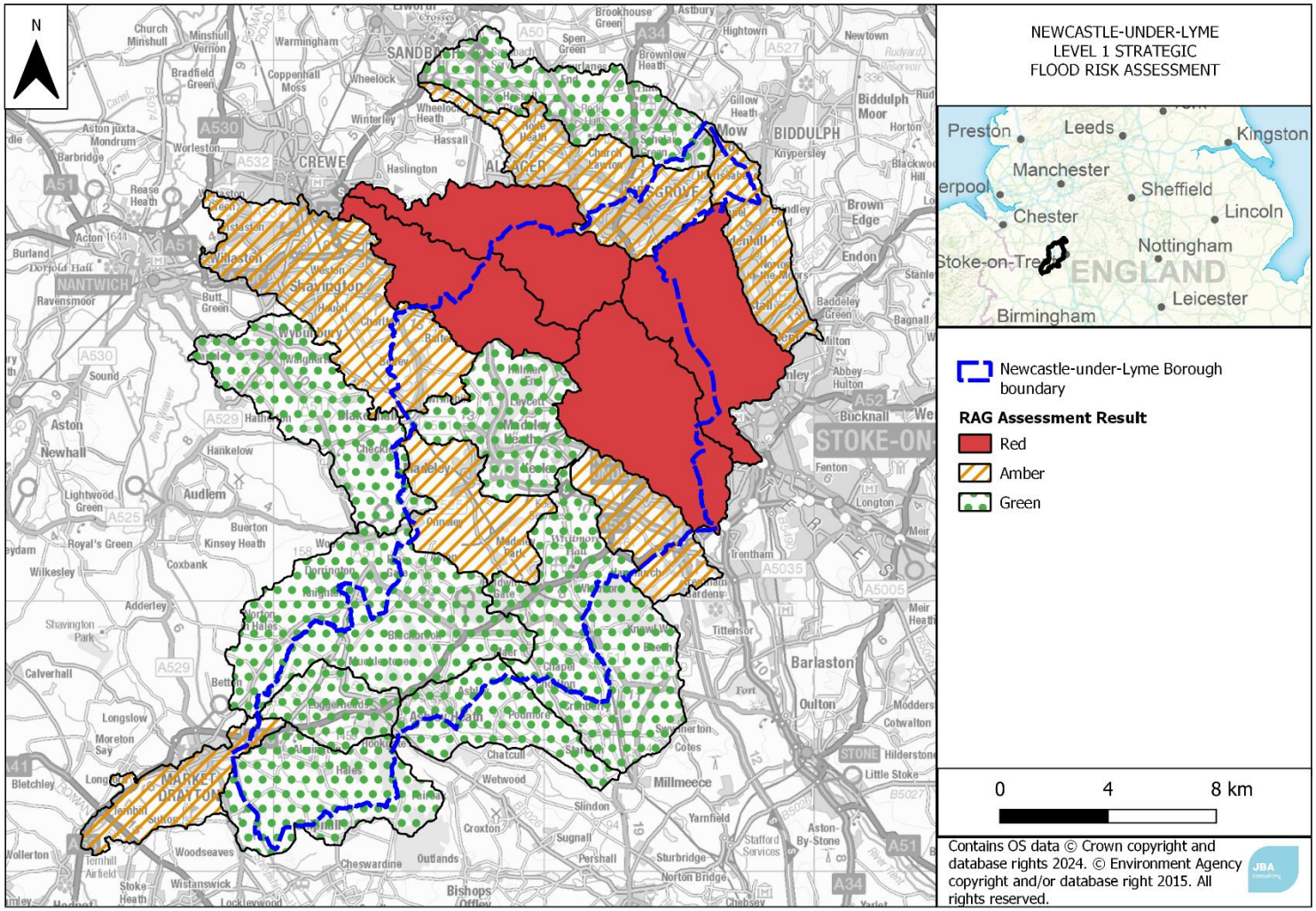


Figure 2-2: Results of the RAG assessment for Newcastle-under-Lyme.

3 Level 1 SFRA Policy recommendations

3.1 Broadscale recommendations

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, and appropriate consideration is given to surface water flow paths and storage, proposals should normally not increase flood risk downstream.

The high-level CIA for Newcastle-under-Lyme Borough has highlighted areas where there is the potential for development to have a cumulative impact on flood risk. Catchments have been identified as high, medium, or low risk, relative to the other catchments within the borough.

Flood risk can be affected by several different factors, which have been assessed as part of the CIA. As a result, incremental action, and betterment in flood risk terms across the entire borough should be supported where possible.

The following policy recommendations therefore apply to all catchments within the study area:

- Newcastle-under-Lyme Borough Council should work closely with neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the area to other local authorities in order to minimise any cross boundary issues of cumulative impacts of development. The topography and location of the borough means that the primary consideration is the potential for development within the borough to impact upon other local authority areas downstream.
- 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 where practicable. Developers should refer to the relevant Lead Local Flood Authority (LLFA) guidance for the requirements for SuDS in Newcastle-under-Lyme Borough. Further guidance on SuDS can be found in Section 8 of the main report.
- 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 consider all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Where appropriate, the opportunity for NFM in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should not be

supported, and day-lighting existing culverts should be promoted through new developments.

- Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites) unless it can be demonstrated that this is not practicable. If it is demonstrated that greenfield rates are not practicable then the runoff rates should be restricted to the closest rate that is practicable but not exceeding the existing brownfield runoff rate.
- Where required, site-specific FRAs should explore opportunities to provide wider community flood risk benefits through new developments. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered. This may be either by the provision of additional storage on site e.g. through oversized SuDS, NFM techniques, green infrastructure, and green-blue corridors, and/ or by providing a Partnership Funding contribution towards any flood alleviation schemes.
- Newcastle-under-Lyme Borough Council should consider requiring developers to contribute to community flood defences outside of their red line boundary to provide wider benefits and help offset the cumulative impact of development.

Section 7 of the main report details the local requirements for mitigation measures.

Specific recommendations are made for high and medium risk catchments below. If any future windfall sites are proposed within these catchments, then developers should also consider the recommendations detailed so that existing flooding issues in the catchment are not exacerbated by any future development and options for betterment are considered.

3.2 Recommendations for high risk catchments

The high risk catchments are detailed in Section 2.3. High-level recommendations for flood storage and betterment have been proposed for sites in each of the high risk catchments. These recommendations should be considered by developers as part of a site-specific assessment, but more detailed modelling must be undertaken by the developer to ascertain the true storage needs and potential at each site at the planning application stage. The FRA should consider the potential cumulative effects of all proposed development and how this affects sensitive receptors.

The following recommendations are made for high risk catchments:

- Developers should include a construction surface water management plan to support the Construction Drainage Phasing Plan. This should provide information to the EA, the LLFA and the Local Planning Authority (LPA) regarding the proposed approach to surface water management in storm events during the construction phase.
- The LLFA and LPA should consult with Local Not-For-Profit organisations such as wildlife trusts, rivers trusts, and catchment partnerships. This will help to understand ongoing and upcoming projects where NFM, flood storage and attenuation, and environmental betterment may be possible alongside developments and aid in reducing flood risk.

- The LPA should work closely with the EA and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and NFM features. Investigations should seek to determine where developments have the potential to contribute towards works to reduce flood risk and enable regeneration in catchments as well as contributing to the wider provision of green infrastructure.

3.3 Development within medium risk catchments

Catchments that have scored an overall ranking of medium, but where development is proposed should also consider the following recommendations:

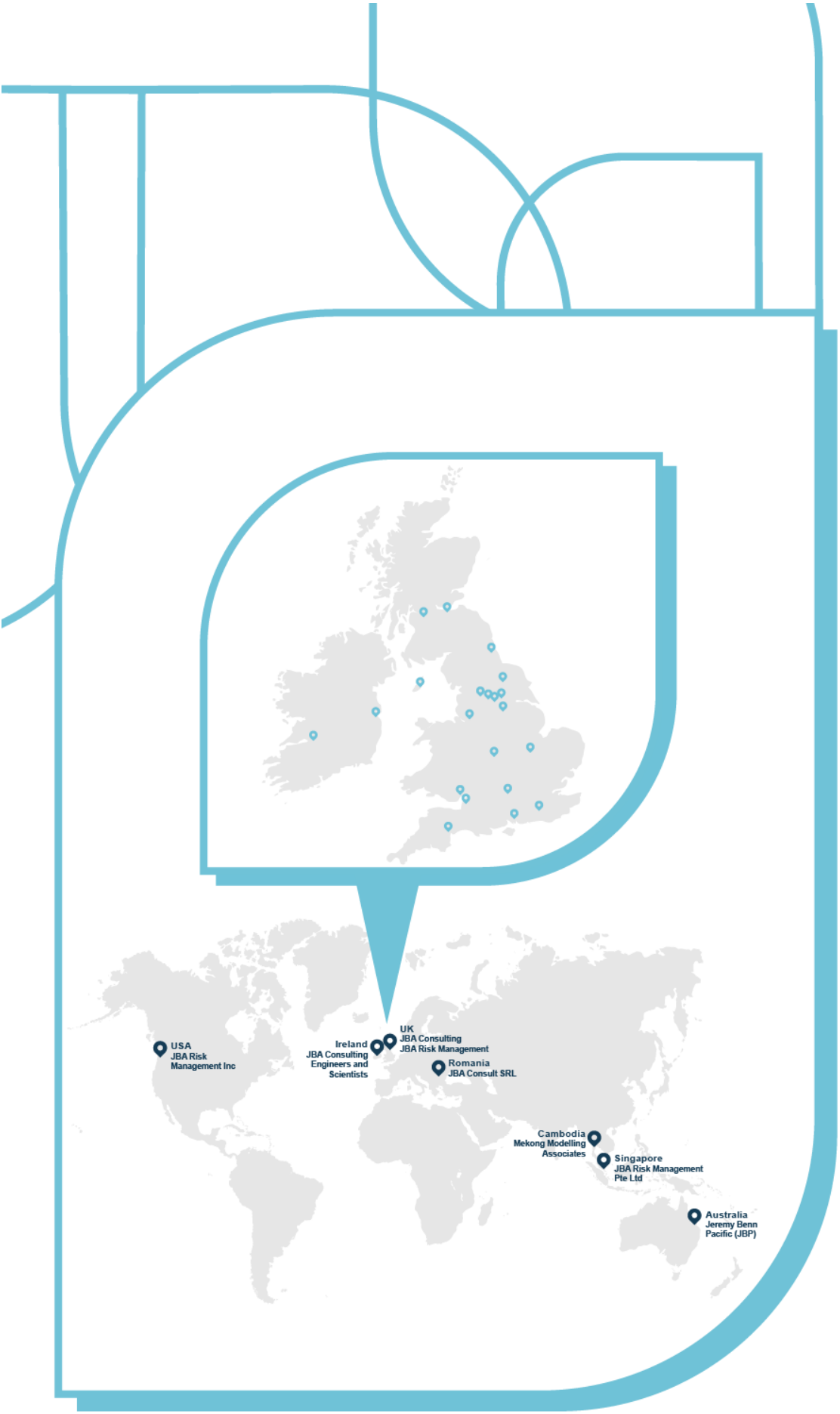
- The LPA should work closely with the EA and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and NFM features.
- There is the potential for development in these catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.

This is applicable to the following catchments:

- Park Brook Catchment (trib of Trent)
- Lea
- Kidsgrove Stream (including Day Green Stream)

The following catchments ranked medium but have no current proposed site allocations within the borough:

- Ford Green Brook from Source to R Trent
- Tern - conf Loggerheads Bk to conf Bailey Bk
- Wistaston Brook



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