Appendix B - Data sources used in the SFRA

1 Historical Flooding

Warwickshire County Council provided records of flooding in the area. These are presented in Table 5-1 of the Main Report. The Environment Agency's Historic Flood Map is also presented in Appendix A: GeoPDF Mapping.

Section 5.1 documents historic flooding records obtained.

2 Fluvial flooding

2.1 Flood Zones 2 and 3a

The Environment Agency's Flood Map for Planning Flood Zones 2 and 3a shown in the Appendix A mapping.

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.

2.2 Flood Zone 3b (the Functional Floodplain)

The following detailed models were available for use in this Level 1 SFRA:

- Anker 2015 – 3.3% AEP (30 year) defended
- Sowe 2010 – 3.3% AEP (30 year) defended
- Warwickshire County Council Nuneaton model – 3.3% AEP (30 year) defended

Where detailed models were not available, a precautionary approach has been adopted for Flood Zone 3b with the conservative assumption that the extent of Flood Zone 3b is equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

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

3 Climate change

From the modelled outlines available, the following allowances have been included:

Central allowance:

- River Anker (2015) – 3.3%, 1% and 0.1% AEP plus **22%** CC
- River Sowe (2010) – 3.3%, 1% and 0.1% plus **21%** CC
- WCC Nuneaton (2023) – 3.3%, 1% and 0.1% plus **22%** CC

Higher Central allowance:

- River Anker 2015 – 3.3%, 1% and 0.1% plus **30%** CC

- River Sowe (2010) – 3.3%, 1% and 0.1% plus **32%** CC
- WCC Nuneaton (2023) – 3.3%, 1% and 0.1% plus **30%** CC

Upper End allowance:

- River Anker 2015 – 3.3%, 1% and 0.1% plus **51%** CC
- River Sowe (2010) – 3.3%, 1% and 0.1% plus **59%** CC
- WCC Nuneaton (2023) – 3.3%, 1% and 0.1% plus 51% CC

For watercourses where detailed hydraulic modelling was unavailable, Flood Zone 2 of the EA's Flood Map for Planning can be used as an indication of climate change.

Surface Water Climate Change uplifts were modelled for this assessment for the following events and scenarios:

- 3.3% AEP CC+25%
- 3.3% AEP CC+35%
- 1% AEP CC+25%
- 1% AEP CC+40%

Please refer to Chapter 4 for information on the approach to climate change in this SFRA.

4 Surface water flooding

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

The 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 B-1: EA 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%).

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

Although the 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 Environment Agency 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.

5 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding 2010 (AStGWF) dataset and the JBA Groundwater Flood Risk map.

The AStGWF dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

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

The JBA Groundwater Flood Risk map shows groundwater flood risk on a 5m square grid. For each grid cell, a depth range is given for modelled groundwater levels in the 100-year return period flood event. It takes into account factors including topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties.

Section 5.7 of the Main Report explains groundwater flooding.

6 Sewers

Severn Trent Water provided a list of recorded internal and external sewer flooding incidents from their Hydraulic Sewer Flooding Risk Register, last updated on the 5 September 2022.

This information is included in Table 5-2 of the Main Report.

7 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the Nuneaton and Bedworth Borough 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**.

The Environment Agency 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 5.9 of the Main Report presents the reservoirs affecting the Nuneaton and Bedworth Borough.

8 Flood Defences

The Environment Agency 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. The Areas Benefitting from Defences shapefile was also considered. Chapter 6 of the Main Report provides information on flood defences and schemes.

9 Overview of supplied data

Overview of supplied data for the Nuneaton and Bedworth Borough SFRA from stakeholders is as follows:

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines	Environment Agency
	Historic flooding incident records	Warwickshire County Council
Fluvial (including climate change)	Flood Map for Planning Flood Zones Detailed models (as described above)	Environment Agency
Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
	SW CC Uplifts (as described above)	JBA Consulting
Sewers	Internal and external historic drainage records	Severn Trent Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
	Groundwater Flood Risk Map	JBA
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map)	Environment Agency
Flood Defences	Location and description of flood defences	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	North Warwickshire Borough Council Rugby Borough Council Coventry City Council

Other datasets	Partner Data Catalogue: - Source Protection Zones - Aquifer Designation Maps - Areas Susceptible to Groundwater Flooding - Detailed River Network - Flood Alert Areas - Flood Warning Areas - Flood Maps for Planning - Groundwater Vulnerability - Historic Flood Map - Risk of Flooding from Rivers and Sea	Environment Agency (via Warwickshire County Council)

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future
Fluvial	Greater than 1 in 100 year (FZ3)	Between 1 in 100 and 1 in 1000 year (FZ2)	Less than 1 in 1000 year	EA's Flood Zones 1, 2 and 3 use a risk-based approach. Functional Floodplain (FZ3b) is displayed using the best available model data: 2015 Anker, 2010 Sowe, 2023 WCC Nuneaton model. Where model data is not available, Fluvial Floodzone 3a 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 sites area's are shown to be at risk in the 1000 year (0.1% AEP), 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. Climate Change uplifts use the best available data: - where climate change datasets are not avaiable 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. - No climate change datasets are available to define Low Risk 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.
Surface Water	A chance of flooding of greater than 3.3% each year	A chance of flooding of between 1% and 3.3% **each year**	A chance of flooding of between 0.1% and 1% each year	Different assumptions are used to derive surface water risk than is the case for fluvial and tidal flood 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 and sea flooding. Therefore, a precautionary approach should be taken so development is located in areas of low flood risk.	Different assumptions are used to derive surface water risk than is the case for fluvial and tidal flood 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 and sea flooding. Therefore, a precautionary approach should be taken so development is located in areas of low flood risk. This approach will require that sites where proposed development is located in a high risk surface water zone are assessed in more detail in the Level 2 SFRA. Climate Change datasets exist for the following events and scenarios 3.3% AEP CC+25%; 3.3%AEP CC+35%; 1% AEP CC+25%; and 1% AEP CC+40%. Surface water flood risk into the future should be sequentially assessed using the maximum extent of either the existing 0.1% AEP dataset of the 1% AEP extent including 40% uplift for Climate Change.

Source of Flooding	High Risk	Medium Risk	Low Risk	Present Day	Future
Groundwater	All sites assumed to be potentially susceptible to grondwater flooding			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 groundwater. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for groundwater flood risk in the Level 2 SFRA and the implications for sequential selection of alternative locations considered at this 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 groundwater. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for groundwater flood risk in the Level 2 SFRA and the implications for sequential selection of alternative locations considered at this stage.
Sewer	All sites assumed to be at high risk of sewer flooding. Additional information required via the Level 2 assessment			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, a precautionary approach should be taken and all potential allocation sites will be assessed for sewer flood risk via the Level 2 SFRA where data is available and the implications for sequential selection of alternative locations considered at this 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 sewers. Therefore, a precautionary approach should be taken and all potential allocation sites will be assessed for sewer flood risk via the Level 2 SFRA where data is available and the implications for sequential selection of alternative locations considered at this stage.
Reservoir	Sites where reservoir flooding is predicted to make fluvial flooding worse for development in high hazard zone 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 or where development is proposed in a high hazard zone 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 or where development is proposed in a high hazard zone will be assessed in Level 2 SFRA and the implications for sequential selection of alternative locations considered at that stage.

Appendix D - Flood Alert and Flood Warnings

1.1 Flood Alert Areas

Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
033WAF202	River Sowe, River Sherbourne, Canley Brook and Finham Brook	River Sowe, River Sherbourne, Canley Brook	Low-lying land and roads between Bedworth and Baginton on the River Sowe, between Allesley and Whitley on the River Sherbourne, between Tile Hill and Canley on the Canley Brook and the Finham Brook and its tributaries
033WAF307	River Anker and River Sence	River Anker, River Sence	Low-lying land and roads between Nuneaton and Tamworth on the River Anker and between Temple Mill and Ratcliffe Culey on the River Sence

1.2 Flood Warning Areas

Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
033WAF307	River Anker at Nuneaton Town Centre	River Anker	River Anker at Nuneaton Town Centre
033WAF307	River Anker at Horeston Grange and Attleborough, Nuneaton	River Anker	River Anker at Horeston Grange and Attleborough including Launceston Drive area, Kingfisher Court, Liberty Way, Pembroke Way, Attleborough Road, Seymour Road, Caarnarfon Drive, Ribbonbrook, Lister Street, Ribbonfields and Pingle Court
033WAF307	River Anker at Weddington	River Anker	River Anker at Weddington including Church Lane, Cleaver Gardens, Cleaver Park Sports Ground, Brook Lane and parts of Weddington Road
033WAF202	River Sowe at Bedworth	Sowe	River Sowe at Bedworth including Heather Drive, Brooklea, Croft Pool and Delamere Road areas
033WAF202	River Sowe at Longford	Sowe	River Sowe at Longford including Rowley's Green Lane, Oakley Close, Basford Brook Drive, Bungalow Estate Lady Lane and Longford Bridge areas

Appendix E – Summary of flood risk in Nuneaton and Bedworth Borough

The table below summarises the areas where there are notable flood risks within the Borough.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
Bedworth Heath and west Bedworth	There are two unnamed watercourses in the north of this area which flow east and south respectively to their confluence south of Newtown Road. South of Dalton Road this watercourse becomes the River Sowe and flows in a southerly direction through the area before leaving the study area by Rowley's Green. A tributary of the River Sowe, Breach Brook, enters the area in the west by the Lorry Park off Smorrall Lane and flows in an easterly direction until it joins the River Sowe by Exhall Interchange. Along the unnamed watercourse flowing east through the area the floodplain mainly consists of woodland, fields and greenspace however there is flood risk to some local roads, including Astley Lane where the watercourse enters the area in the east and Newtown Road and Heath Road in the west just before the watercourse passes under Bedworth Bypass. There are a couple of properties located in Flood Zone 3 along Newtown Road and Heather Drive, with a further property at risk where Flood Zone 2 encroaches slightly further north. Along the east side of Bedworth Bypass, Flood Zone 2 extends along the side of the raised road from Newtown Road in the north to Bedworth Crown Green Bowls Club in the south. Several properties along Brooklea, Croft Pool and Delamere Road are located in Flood Zone 2. Where the unnamed watercourse flows east through the residential area there are a couple of properties between Brooklea and Croft Pool located in Flood Zone 3. At the confluence of the two unnamed watercourses they then flow in a southerly direction through a culvert between Croft Pool and Dalton Road and the Flood Zones remain confined to the channel. South of Dalton Road where the watercourse becomes the River Sowe, the flood extents for Flood Zones 2 and 3 show similar extents and remain confined to a narrow floodplain, with limited flood risk to local roads and a couple of properties. The flood zones extend away from the channel to the north by Daffern Road however this area of land is unoccupied.	The EA AIMS dataset shows the following defences: • High ground along both sides of the unnamed watercourse from the east side of The Nook in the west through to the Bedworth Bypass in the east. • High ground along both sides of the unnamed watercourse on the east side of the Bedworth Bypass to Croft Pool in the east, with a flood wall along the south side of this stretch of watercourse. • High ground along both sides of the unnamed watercourse flowing in a southerly direction between Newtown Road in the north and Croft Pool in the south. • High ground along both sides of the River Sowe from where it starts to the south of Dalton Road until it leaves the study area by Rowley's Green.	Surface water in the area follows the topography, predominantly flowing downhill from the higher areas along the west of the area mainly following the path of the main watercourses and their tributaries and the roads in the area. There are also many small isolated areas of surface water ponding throughout the residential areas, which may present a localised flood risk to properties. The north west of the area is relatively rural. The surface water risk in the area mainly follows the paths of the unnamed watercourses with flood risk limited to local roads and a small number of properties, particularly around Bedworth Woodlands where there are a couple of larger areas of surface water ponding. There is a large area of low to high risk surface water ponding along the west side of the Bedworth Bypass but this does not appear to affect any roads or properties. To the south there is a low to high risk surface water flow path following the course of another unnamed watercourse which flows in an easterly direction towards the Bedworth Bypass. The flood risk is mainly confined to woodland and park areas, with some risk to local roads and a few properties, particularly along the Willows. Between The Nook and Bedworth Bypass the flood extent increases and there are a considerable number of properties at high risk of surface water flooding along Heather Drive, Heath Road, Newtown Road and Croft Road with many more properties at medium and low risk. South of this unnamed watercourse there is a low to high risk surface water flow path which flows east through the centre of Bedworth Heath. This flow path follows the roads through the area, however, there are a number of properties at risk, particularly in the low risk extent, particularly between Anderton Road and Smorrall Lane and along Smorrall lane, Bryony Close, Alice Close, Beechcroft and Holly Hurst. To the northeast of the area, east of Bedworth Bypass, there are several low to high risk flow paths through Mount Pleasant, with flood risk to a number of properties particularly along Wessex Close, Chalfont Close, Ashford Drive, Bede Road and Mount Pleasant Road. To the south of Mount Pleasant there is a large area of low to high surface water flood risk at the	✓	✓	✓	✓	None	**From the EA's Recorded Flood Outlines Shapefile:** • December 2008 – fluvial flooding due to channel capacity exceedance along both sides of the unnamed watercourse through The Nook, to the north of The Willows, and along the east of Bedworth Bypass from Newtown Road in the north to Bedworth Crown Green Bowls Club in the south.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
	The River Sowe then passes under the Bedworth Bypass and flows in a southerly direction. Both Flood Zones 2 and 3 extend across a wider floodplain but no properties or roads are shown to be at risk. There is an isolated property at risk between School Lane and the M6. To the south of the M6 Breach Brook flows in an easterly direction to join the River Sowe. Flood Zones 2 and 3 show similar extents and remain confined to a relatively narrow floodplain. There is some flood risk to local roads, and a few properties located in Flood Zones 2 and 3 to the south of Bell Drive. Around the confluence of Breach Brook and the River Sowe Flood Zone 2 shows a greater extent than Flood Zone 3, particularly along the east side of the River Sowe. After its confluence with Breach Brook, the River Sowe continues in a southerly direction and passes under Phoenix Way. The flood extents extend over a wider floodplain to the east of Phoenix Way but no properties are shown to be at risk within the study area.	• High ground along both sides of Breach Brook from Royal Oak Road in the west until it joins the River Sowe in the east.	confluence of the two unnamed watercourses where they then become the River Sowe. Several properties are at a high risk of surface water flooding along both sides of the watercourse, along Dalton Road, Delamere Road and Croft Pool and smaller side roads. Many more properties are at a medium and low risk of surface water flooding. There is a low to high risk surface water flow path which follows the River Sowe as it flows south through the area. There are a number of properties at a low risk of surface water flooding either side of Bedworth Bypass, along River Close, Hayes Green Road and Silk Weavers Way, where the River Sowe passes under it, with a couple of properties also at medium risk. Heading south the flood risk is mainly confined to fields, with a couple of properties and roads at risk at School Lane and Bowling Green Lane. However, there is a low to high risk surface water flow path along the Bedworth Bypass from the crossing of the River Sowe in the north to the M6 roundabout in the south. To the south of the M6 roundabout Breach Brook and its tributaries flow in an easterly direction through the area to join the River Sowe. The surface water flow paths follow the watercourse, with flood risk predominantly affecting the surrounding fields. However, there are also a number of areas of flood risk to roads and properties. Surface water flood risk through Keresley Newlands mainly follows the roads but there are also properties at risk, particularly along Howat Road. There are a number of properties at risk in Ash Green, with a flow path which flows in an easterly direction through the area to join Breach Brook. There are also areas of low to high risk along the M6. Downstream of its confluence with Breach Brook, the River Sowe continues in a southerly direction, with small areas of flood risk around the industrial buildings situated to the east of Phoenix Way. Bedworth Heath.						
East Bedworth and Bulkington	Coventry Canal runs through this area in a south-north direction. Wem Brook enters the area in the east and flows in a north-westerly direction through the area towards Marston Lane. The southeast of the area is relatively rural and the flood risk from Wem Brook is confined to local roads. As the Brook flows along the east side of Bedworth there are a few properties located in Flood Zone 3 along	The EA AIMS dataset has no record of flood defences in this area.	In the 30-year surface water event the flow paths mainly follow the paths of the watercourses in the area with flood risk following the fluvial flood extents. However, there are numerous small areas of ponding affecting roads and properties across the area. There are also some notably larger areas of surface water ponding and flow paths affecting properties in the following areas: • There is a flow path heading south through the west side of Bulkington towards Wem Brook affecting several properties along Weston	✓	✓	✓		None	

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
	Acacia Crescent with a couple of further properties located in Flood Zone 2. There is also a sewage treatment works located partially within the Flood Zones.		Lane, Tamar Road and its smaller side roads and Bedworth Road. • Ponding around a number of commercial buildings along Bayton Road between Martindale Road and Bayton Way. • A flow path following Chapel Street/Johnson Road/Furnace Road through the northeast of Bedworth with flood risk to a couple of properties off Furnace Road and Acacia Crescent. In the 100-year surface water event there are increases in extent in many of the areas of ponding and increases in the length and extent of the flow paths. There are particular increases in flow paths along a number of roads across the area, but the flood risk mostly remains confined to the roads and there are no key areas of new risk. In the 1000-year surface water event there are large increases in flood risk across the area. The greatest increases affecting properties in the area are seen: • In the northeast of Bedworth where the flow path increases considerably with further properties at risk particularly along Acacia Crescent, Furnace Road, Wootton Street and Pine Tree Road. • In the east of Bedworth along Bulkington Road, West Avenue, Columbia Gardens and Shakespeare Avenue. • In the south of Bedworth along Tresillian Road and Rosemullion Crescent and throughout the Bayton Road industrial estate. • Along the flow path in the west side of Bulkington with further properties at risk particularly along Mersey Road, Wye Close and Bedworth Road. • In the north east of Bulkington with properties at risk along Kingsley Crescent, Cleveland Road, Nuneaton Road, Amberley Avenue and Oakham Crescent.						
Nuneaton – east of Wem Brook/the River Anker	Wem Brook flows in a northerly direction through the area, until it joins the River Anker to the west of Attleborough. The flood risk from Wem Brook is confined to local roads and greenspaces until it reaches Attleborough, where there is flood risk to several properties, particularly along Donnithorne Avenue and Wembrook Close. Flood Zone 2 extends further than Flood Zone 3 in this area with several further properties at risk. There is further flood risk to some properties along Avenue Road and those closest to the watercourse on Simon Close and Pingle Court, with only a couple of	The EA AIMS dataset shows the following defences: • High ground along both sides of Wem Brook from Gipsy Lane in the south until its confluence with the River Anker in the north.	In the 30-year surface water event the flow paths mainly follow the watercourses in the area with flood risk following the fluvial flood extents. However, there are numerous small areas of ponding affecting roads and properties across the area. There are also some notably larger areas of surface water ponding in the following areas: • In the northwest of Weddington building up to the south of the raised land with flood risk to a large number of properties, particularly to the south of Weddington Road along Adderley Avenue, Red Cross Way and Watitune Avenue.	✓	✓	✓		Makin Fisheries Lake, located to the east of the study area – the extent is shown to follow the path of the River Anker to just north of where it crosses Eastboro Way. In the wet day scenario the flood extent extends further from the watercourse, with flood risk to a number of properties around Eastboro Way.	**From the EA's Recorded Flood Outlines Shapefile:** • May 1932 – fluvial flooding due to channel capacity exceedance along the River Anker through Nuneaton from Riversley Park in the south through to just north of where it crosses the railway line.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
	properties located in Flood Zone 3 but considerably more in Flood Zone 2. The River Anker enters the study area in the east and flows in a westerly direction until its confluence with Wem Brook. The floodplain is rural until it reaches Eastboro Road where the Rugby Club is located in Flood Zone 3. There are also a couple of properties along Hemdale and Liberty Way at flood risk. Downstream Flood Zone 2 shows a much greater extent than Flood Zone 3, encroaching on a couple of industrial buildings off Lister Street. At the confluence of the River Anker and Wem Brook Flood Zone 3 remains confined to a narrow floodplain but Flood Zone 2 extends across a wide floodplain with many roads and properties at risk, including along Seymour Road, Ribbonfields and Pembroke Way. The River Anker then flows in a northerly direction until it leaves the study area. Through the centre of Nuneaton the Flood Zones extend over a wide floodplain, with Flood Zone 2 showing a much greater extent, and there a number of roads and properties at risk, including along Vicarage Street, Church Street, Wheat Street, Back Street and Newtown Road. The Flood Zones are then confined to a narrower floodplain until the confluence with Channel Brook. Downstream of this confluence the floodplain is more rural, with no further flood risk to roads or properties within the study area. There is an unnamed watercourse which leaves the River Anker to the north of the Rugby Club before re-joining it by Cleaver Park. Flood Zone 3 remains confined to the channel, but Flood Zone 2 extends north away from the channel to the north of the railway line. This causes flood risk to a number of properties and roads, including along Launceston Drive, Crantock Way, Newlyn Close, Wadebridge Drive and Pentire Close. There is also flood risk further downstream by Horeston Grange Park with a few properties at risk along the south side of Hinckley Road. There are also a number of tributaries of the River Anker which run through the area, including Harrow Brook, which flows in a southerly direction along the eastern boundary of the study area to join the River Anker to the northeast of Whitestone, an	• High ground along both sides of the River Anker from where it enters the study area in the east to where it leaves the study area in the north. • High ground along both sides of the unnamed watercourse which leaves the River Anker to the north of the Rugby Club and re-joins the River Anker by Cleaver Park, with the exception of the stretch where it is culverted beneath Hinckley Road. There is also a section of flood wall rather than high ground to the east of Weddington Road. • High ground along both sides of Change Brook from its culvert outlet from Higham Lane in the east to its confluence with the River Anker in the west. • High ground along both sides of Harrow Brook where it flows along the eastern boundary of the study area until its confluence	• In the centre of St Nicholas Park at the end of Greendale Road affecting a few properties on Greendale Road and Pallett Drive. • In the east of St Nicholas Park along the west of The Long Shoot affecting properties along The Long Shoot and Edgedale Road. • In the east of Marston Jabbett affecting a small number of properties off Marston Lane. In the 100-year surface water event there are considerable increases in the size of flow paths and areas of ponding across the area, alongside numerous new small flows paths and areas of ponding along roads and around buildings. A key area of increased risk is in the south of St Nicholas Park with increased risk to properties along Grasmere Crescent, Windermere Avenue, St Nicholas Park Drive and Ullswater Avenue. There is also a notable risk in Horeston Grange with properties at risk along Axminster Close, Dawlish Close and Salcombe Close. In the 1000-year surface water event, there are further increases in the size of flow paths and areas of ponding across the area, alongside further new flows paths and areas of ponding along roads and around buildings. The key areas showing increased risk to properties within the 1000-year event are: • In the north of Weddington building up to the south of the embankment and further south around Church Lane, Grove Fields and Bramdene Avenue. • Across the centre of St Nicholas Park particularly affecting properties on St Nicholas Park Drive, Grasmere Crescent, Windemere Avenue, Ullswater Avenue, Clay Avenue, Coniston Way and Pallett Drive. • In the east of St Nicholas Park particularly affecting properties along The Long Shoot, Leghorn Road, Baskerville Road, Edgedale Road and Russett Avenue. • Through the east side of Whitestone where there is a flow path affecting properties along Copeswood Avenue, Whitestone Road, Stonewell Crescent, Lutterworth Road, Fairway, Meadowside, St Andrews Drive and Hillfarm Avenue. • In the south of Whitestone with flood risk to properties along Purcell Avenue, Elgar Close, Bulkington Lane, Hoarestone Avenue and Whitestone Road. • In the north of Whitestone with a flow path affecting several properties along Grassinton Drive and its smaller side roads, Hebden Way, Shakespeare Drive, Hamlet Close, Verona Close and Hathaway Drive.					Seeswood Pool, located in the study area to the south of Stokingford (west of Wem Brook/the River Anker) - the flood extent is shown to head east along an unnamed watercourse, impacting the south side of Bermuda and then flows north following the path of Wem Brook and into the River Anker until it leaves the study area. At the confluence of Wem Brook and the River Anker, the reservoir flood extent is also shown to extend upstream along the River Anker, until the footbridge by Liberty Way. In the wet day scenario the reservoir flood extent reaches upstream as far as Eastboro Way and also extends further from the channel impacting a number of properties and roads particularly in the centre of Nuneaton.	• December 1992 – small areas of flooding along the River Anker to the west of Weddington, along the River Anker/Wem Brook in Riversley Park, south of the River Anker by Gadsby Street, along the River Anker between Seymour Road and Ribbonfields and north of the River Anker by Eastboro Way. The cause of flooding is unknown.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
	unnamed watercourse which flows in a northerly direction from north of Bulkington and Change Brook which flows in a westerly direction from Higham Lane to join the River Anker in the north of the area. The floodplain of Harrow Brook is rural and shows no flood risk to roads or properties. The floodplain of the unnamed watercourse is also relatively rural and flood risk is confined to a small section of Lutterworth Road (B4114) where it crosses it and Nuneaton Golf Club. Change Brook flows through Weddington where there are a small number of properties located in Flood Zone 3 along Cleaver Gardens, Brook Lane and Glenfield Avenue to the north and Ventnor Street and Weddington Road to the south with further properties located in Flood Zone 2.	with the River Anker. • A section of flood wall/embankment at Longshoot pumping station.	• Through the centre of Horestone Grange particularly affecting properties along Axminster Close, Tiverton Drive, Dawlish Close and Salcombe Close.						
Nuneaton – west of Wem Brook/the River Anker	Wem Brook flows in a northerly direction through the area, until it joins the River Anker to the west of Attleborough. Its floodplain is relatively rural in the south. As it flows through Caldwell the Flood Zones encroach slightly on the roads and properties nearest the watercourse. Where Wem Brook joins the River Anker, Flood Zone 2 extends much further than Flood Zone 3, which remains confined to the channel. This mainly affects Riversley Park, however properties along Ribbonbrook are located in Flood Zone 2. As the River Anker flows north through Nuneaton, Flood Zone 2 extends across a large area to the west of the channel, with large parts of the centre of Nuneaton located at flood risk. To the north of Nuneaton, the flood risk is confined to parks and greenspaces. There are also several tributaries of Wem Brook/the River Anker which present a flood risk within the area. There is an unnamed tributary of Wem Brook which flows in an easterly direction from Seeswood Pool to join Wem Brook just upstream of Marston Lane. This presents a risk of flooding to a few properties at the north end of Collycroft, along Willow Close and Brook Street. Where the watercourse crosses Coventry Canal, around Marston Junction, the flood extent increases with a couple of isolated buildings at flood risk.	The EA AIMS dataset shows the following defences: • High ground along both sides of Wem Brook from Gipsy Lane in the south until its confluence with the River Anker in the north. • High ground along both sides of the River Anker from its confluence with Wem Brook in the south until it leaves the study area in the north.	In the 30-year surface water event the flow paths mainly follow the watercourses in the area, with flood risk following the fluvial flood extents. There are also clear flow paths along Queens Road and the railway line. There are numerous small areas of ponding affecting roads and properties across the area, with the largest areas notably within the centre of Nuneaton. Here there are large areas of flood risk along Coton Road and around roads and properties to the north of Market Place. There are also considerable areas of flood risk around the Bus Depot and other commercial buildings to the north of Newtown Road. In the 100-year surface water event there are considerable increases in the size of flow paths and areas of ponding across the area, alongside numerous new flows paths and areas of ponding along roads and around buildings. Some key areas include: • West of Jubilee Park with increased risk along the roads and around properties, particularly along Silver Walk and Far Isle Drive, and also east of Jubilee Park with an increase in the area of ponding on Greenmoor road affecting a number of properties. • Through the centre of Nuneaton, with increased extent in the existing flow paths and areas of ponding along with several new areas of risk, particularly along roads in the south and west, although there is limited risk to properties in these areas as most of the risk remains confined to the roads. • Within the Bermuda Business Park in the south of the area where there are a number of new areas of ponding around the buildings.	✓	✓	✓		Seeswood Pool, located in the study area to the south of Stokingford - the flood extent is shown to head east along an unnamed watercourse, impacting the south side of Bermuda and then extend north following the path of Wem Brook and into the River Anker until it leaves the study area. Two reservoirs at Oldbury (No.1 and No.2) located to the north of the study area – the extent from the Oldbury reservoirs is shown to enter the study area at Chapel End and follow the path of Bar Pool Brook in a south-easterly direction until it joins the Coventry Canal. The canal is shown to overtop in a couple of locations, affecting properties along Beaumont Place to the south and causing flooding around Ballin Road and Corrib Road to the north of the railway. The extent from the reservoir is also shown to reach Nuneaton affecting several roads and properties in the centre	**From the EA's Recorded Flood Outlines Shapefile:** • May 1932 – fluvial flooding due to channel capacity exceedance along the River Anker through Nuneaton from Riversley Park in the south through to just north of where it crosses the railway line. • December 1992 – small areas of flooding along the River Anker from Cleaver Park in the south to where it leaves the study area in the north. The cause of flooding is unknown.

Area	Fluvial flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
				<25%	>=25% <50%	>=50% <75%	>=75%		
	There is an unnamed watercourse which flows downhill from North Wood where it crosses under Walsingham Drive and enters Bermuda Lake, where there are a couple of local roads shown to be at flood risk. From Bermuda Lake the watercourse continues in an easterly direction along the Coventry Canal Griff Arm, with a few roads and properties at flood risk, particularly along Burlington Way to the south of the watercourse. The watercourse then flows through Griff Hollow and crosses the canal where it becomes Griff Brook, which continues in an easterly direction to its confluence with Wem Brook. Flood Zone 2 extends much further than Flood Zone 3 along Griff Brook, particularly to the north where there are several properties at flood risk along Red Deeps and Bradestone Road. There is an unnamed tributary of Bar Pool Brook, which flows in an easterly direction to join Bar Pool Brook to the northeast of Whittleford. As the unnamed watercourse flows through Whittleford there are many properties located in Flood Zones 2 and 3 on both sides of the watercourse. Upstream of its confluence with the unnamed watercourse, flood risk from Bar Pool Brook is limited to local roads. Downstream of the confluence, Bar Pool Brook flows east through Camp Hill where there are several roads and properties at flood risk, including along Maple Road, Hilary Road, Pool Road and Corrib Road. Where Bar Pool Brook joins the Coventry Canal the flood risk extends in both directions along the path of the canal. To the north there are a number of properties along Sheelin Crescent and Carra Close located in Flood Zone 2. To the south the flood risk extends a short way along the canal before following the downhill slope of the land east into Nuneaton. There are many properties and roads on the west side of Nuneaton that are at a risk of flooding.		In the 1000-year surface water event, there are further increases in the size of flow paths and areas of ponding across the area, alongside further new flows paths and areas of ponding along roads and around buildings. In large parts of the area the flood risk remains mostly confined to the roads, however there are areas with considerable increases in flood risk to properties. Key areas include: • East of The Dingle with numerous properties at risk along roads, including Elderberry Drive, Mount Pleasant Terrace, Hawthorne Terrace and Willow Road. • The flow path through the centre of Stockingford affecting properties along roads including Kingswood Road, Berwyn Way, Wiclif Way, Arbury Garth and Ansley Road. • The flow path from Stockingford Recreation grounds in the west heading east towards Greenwood Road with numerous properties at risk, including along Greenmoor Road, Silver Walk, The Raywood's, Far Isle Drive, Croft Road, Marsdale Drive, Montana Walk and Westbury Road. • South of Jubilee Road in Nuneaton with numerous properties at rick, including along Prince's Street, Dugdale Street and Riversley Road. • In the north of Bermuda to the south of the junction of Bermuda Road and The Bridleway where several properties are at flood risk. • In Collycroft, with several properties at risk along the west side of Nuneaton Road and Joseph Luckman Road.					before reaching the River Anker and following this watercourse north until around Church Lane. In the wet day scenario the reservoir flood extent extends further from the channel impacting a number of properties and roads particularly in the centre of Nuneaton.	

Appendix F – Cumulative Impact Assessment

This section provides a summary of the catchments where the level of flood risk and development pressures mean they could be affected by cumulative impacts and identifies recommendations for local planning policy for Nuneaton and Bedworth Borough Council so the impacts are addressed.

1 Background

1.1 Introduction

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 implemented so 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 Warwickshire and Coventry, catchments were identified where cumulative 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). The potential change in developed area within each catchment and communities sensitive to increased risk of surface water flooding, alongside evidence of historic flooding incidents have been considered to identify catchments at the highest risk. Where catchments have been identified as sensitive to the cumulative impact of development, the assessment concludes with recommended strategic planning policy suggestions to manage the risk.

1.2 Strategic flood risk solutions

Nuneaton and Bedworth Borough Council (NBBC) have a vision set forth in their Local Plan for the future management of flood risk and drainage in the region. The plans consider flood risk management, alongside wider environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ Flood Risk Management (FRM) schemes, new defences, and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems. **The Warwickshire Local Flood Risk Management Strategy** (as LLFA), **Humber River Basin District Flood Risk Management Plan**, **Severn River Basin District Flood Risk Management Plan** (RBMP) and **River Trent Catchment Flood Management Plan** (CFMP) set out specific actions for the authority region.

Section 2 sets out the strategic plans that exist for the authority region. The following list summarises the key outcomes these strategies are seeking to achieve. It is anticipated that this vision will be delivered by new development

alongside retrofitting and enhancing green infrastructure and flood defence schemes in the existing developed area.

The strategic policy vision from the Catchment Flood Management Plans (CFMPs) and the River Basin Management Plans (RBMPs) focus on community engagement and seeking opportunities to fund and deliver flood alleviation schemes in areas deemed high-risk; re-naturalising watercourses, safeguarding the floodplains and encouraging collaboration and creating new partnerships to reduce the risk of flooding and to enhance the natural environment. Within the Nuneaton and Bedworth Borough, strategic solutions encourage development that:

- Prevents deterioration of the status of surface water and groundwater;
- Aims to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological status and good surface water chemical status;
- Works to minimise the cost of flood damage in Nuneaton and Bedworth, taking into account future climate change and urban growth;
- Reverses any significant and sustained upward trends in pollutant concentrations in groundwater;
- Reduces discharges, emissions and losses of priority hazardous substances into surface waters;
- Progressively reduces the pollution of groundwater and prevent or limit the entry of pollutants;
- Reduces the risk to people, economic damage and community disruption;
- Uses sustainable flood storage and mitigation schemes to store water and manage surface water runoff in locations that provide overall flood risk reduction as well as environmental benefits;
- Engages with a variety of stakeholders across the region to develop plans and seize opportunities for collaborative partnership working;
- Provides a greater role for communities in managing flood risk;
- Improves knowledge and understanding of flood risk and management responsibilities, and of watercourse networks and drainage infrastructure;
- Promotes sustainable and appropriate development;
- Delivers flood risk management measures that have social, economic and environmental benefits;
- Identifies opportunities to use areas of the floodplain to store water during high flows and reduce long term dependence on engineered flood defences;
- Uses SFRAs to inform future development and minimise flood risk from all sources;
- Implements upstream catchment management e.g. slow the flow and flood storage schemes could be implemented in upper catchments to reduce flooding downstream and across neighbouring authority boundaries; and

- Promotes and considers Sustainable Drainage Systems (SuDS) at the earliest stage of site development.

In some locations, the Environment Agency (EA) have committed to assist Local Planning Authorities (LPAs) in identifying areas which may be most affected by increased flood risk due to development and/or climate change. However, this work is stated to likely fall short of extensive hydraulic modelling and detailed mapping of theoretical flood extents. The headline message is therefore:

Flood risk is increasing, perhaps substantially, so Planners, Emergency Planners, Asset Managers and others will need to mitigate this through a mix of collaborative working, planning policies, use of 'worst case' scenarios, development of contingency plans and some detailed analysis.

1.2.1 Opportunities and projects in/ affecting the Nuneaton and Bedworth Borough

There are currently no known plans for future flood defence or alleviation within Nuneaton and Bedworth Borough. Severn Trent Water recently announced its intention to improve 500km of Rivers across Warwickshire as part of their **Green Recovery Plan**, and there are likely to be opportunities to reduce flood risk alongside these plans.

Despite limited large scale plans, there are likely to be many smaller opportunities to deliver benefits through the retrofitting of SUDS in urban areas and natural flood management in upper catchment areas. Additionally, development presents opportunity to provide benefits beyond the site boundaries, for example through the provision of oversized SUDS or post-development reductions in runoff rates.

Specific recommendations and areas likely to benefit are included as part of the policy recommendations in Section 2 of this assessment.

The Nuneaton and Bedworth Borough is already included within the **Warwickshire, Coventry and Solihull Local Nature Partnership (LNP)**. The following are other stakeholders and project delivery schemes affecting the Borough.

Tame, Anker and Mease Catchment Based Approach:

The **Tame, Anker and Mease (TAM)** is the associated Catchment Based Approach (CaBA) catchment partnership for the 'Tame, Anker and Mease' catchment. It is a collaboration between relevant partners to deliver projects that will improve the health of the area's rivers and wetland environments.

Their key principles are:

- Engage and work with local stakeholders and communities
- Create a more sustainable and diverse water environment
- Increase the natural capacity of rivers, streams, and wetlands to alleviate the impacts of flooding and pollution
- Enhance the quality of the natural environment for the benefit of people's health and wellbeing

Warwickshire Avon Catchment Partnership:

The **Warwickshire Avon Catchment Partnership** is the associated Catchment Based Approach (CaBA) catchment partnership for the 'Warwickshire Avon' catchment. The partnership focuses on 7 priority areas:

1. Coventry Brooks and Rivers
2. River Stour catchment including tributaries
3. River Alne Source to Confluence with Preston Bagot Brook
4. River Arrow
5. Upper River Avon, Rains Brook and Upper River Leam
6. Forest of Feckenham
7. Carrant Brook

The Warwickshire Avon Partnership is a collaboration between relevant partners to deliver projects that will improve the health of the area's rivers and wetland environments.

Their key priorities are:

- To co-ordinate action through liaison with a range of partners;
- To endorse priority projects identified in the Delivery Action Chart which are delivering multiple benefits including enhancing ecological condition, addressing flood issues, and promoting involvement and education on catchment priorities;
- To communicate the Catchment Plan and projects to key audiences e.g. liaise with landowners to engage their active support with practical projects, and to facilitate the creation of more feasibility studies for larger scale flood risk reduction or river enhancement schemes;
- To inform stakeholders and the public of priorities, planned actions and achievements;
- To deliver practical improvements at a minimum of two priority sites per year across the catchment and priority areas and use these as demonstration sites to encourage further action;
- To secure funds and resources to deliver projects on the ground;
- To engage with major stakeholders and developers to deliver enhancements; and
- To monitor and report on results achieved and progress across the catchment.

Warwickshire, Coventry and Solihull Sub-Regional Green Infrastructure Strategy

The Warwickshire, Coventry and Solihull Sub-Regional Green Infrastructure Strategy is a Strategy that aims to provide evidence for the preparation of plans, policies and strategies relating to Green Infrastructure (GI) at a sub-regional level and local level. The strategy also details how landholders and partners can help with the delivery of GI. The desired outcome is a comprehensive, interactive and highly flexible evidence base, which can be used for a range of purposes:

- A framework for the sustainable land management of the area;
- A tool for predicting the implications of change on the natural environment;
- Informing the sustainable management of the historic environment and the
- conservation and enhancement of heritage assets;
- An accurate picture of the green infrastructure of an area – essential in making
- planning decisions, informing developments and strategies;
- A tool for delivering the natural environmental contribution to identified priorities in the
- fields of health, economy and quality of life;
- A structured plan for delivering environmental change;
- Attracting funding by demonstrating researched needs and outcomes;
- Attracting inward investment; and
- Assisting priority setting for neighbouring authorities in areas of common interest.

Habitat Biodiversity Audit (HBA)

The Habitat Biodiversity Audit (HBA) is a partnership project was established in 1995. It is managed by Warwickshire Wildlife Trust and funded by local authorities. The project is based in Warwickshire County Council's Ecological Services offices in Warwick and provides both up to date accurate records of habitats and a record of changes in land use over time. The European Committee of Regions (2006) described the HBA as the "only recognised best practice model for monitoring and auditing biodiversity". The HBA is updated annually with surveying ongoing.

The **Wildlife Sites Project** is part of the HBA Partnership. This project began in 1999 and aims to develop and maintain a formal local wildlife sites system for Warwickshire as part of a wider initiative with Coventry and Solihull. The Warwickshire Wildlife Sites data can be found **here**.

Warwickshire Wildlife Trust Nature Reserves

Warwickshire Wildlife Trust manage two nature reserves just outside the Nuneaton and Bedworth Borough boundary.

These are:

- Wyken Slough, Coventry
- Daffern's Wood, Coventry

These sites are home to various important and protected habitats and species, including:

- Grassland
- Wetland
- Woodland
- Snipe
- Reed Bunting
- Mute Swans
- Meadow Pipit
- Jack Snipe

Natural Flood Management techniques could be encouraged at some of the reserves to aid flood storage and improve natural habitats.

1.3 Assessment of Cross-Boundary Issues

This assessment has been undertaken covering six Local Authority areas; Rugby, Warwick, Stratford-on-Avon, Nuneaton and Bedworth, Coventry, and North Warwickshire Districts (referred to collectively as the Warwickshire Authorities in this report). Additionally, catchments covering Nuneaton and Bedworth Borough also cross into the following neighbouring Authorities (see Figure 1.1 in the main report for the Local Authority boundaries):

- City of Coventry
- Hinckley and Bosworth Borough
- North Warwickshire Borough
- Rugby Borough

The Nuneaton and Bedworth Borough area is predominantly lowland with the main River Anker and Wem Brook flowing through the central and eastern parts of the Borough. The topography around Nuneaton is around 80m AOD. In Bedworth the topography is slightly higher around 110m AOD. In the west of the Borough the topography is generally higher at around 110-160m AOD.

The River Anker leaves the Nuneaton and Bedworth Borough, entering the North Warwickshire Borough to the north. The River Sowe flows south into the City of Coventry. The Harrow Brook follows the border of the Rugby Borough and Nuneaton and Bedworth Borough, joining the River Anker near Attleborough Fields Industrial Estate. See Section 1.5 of the main report for further details on the study area.

As such, future development, both within and outside of Nuneaton and Bedworth Borough can have the potential to affect flood risk to existing development and surrounding areas, depending on the effectiveness of SuDS and drainage implementation.

Development control should address the potential impact on receiving watercourses from development in the Borough has been considered appropriately during the planning stage and appropriate development management decisions put in place so there are no adverse impacts on flood risk or water quality. All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments near watercourses in neighbouring authorities comply with the latest guidance and legislation relating to flood risk and sustainable

drainage, they should not normally result in an increase in flood risk within the Borough. The neighbouring authorities were contacted for information on their site allocations, to determine where development in neighbouring authorities may have an impact on.

Nuneaton and Bedworth Borough Council Borough Plan (2011 – 2031) was completed and adopted in 2019. Nuneaton and Bedworth Borough Council began conducting a Borough Plan Review in June 2021. In June 2022 the Council released their **Borough Plan Review: Preferred Options 2024-2039** document along with the accompanying **Sustainability Appraisal** and **Habitats Regulations Assessment** which are all currently undergoing consultation. Therefore, the evidence base and the flood risk and sustainable drainage policies in the adopted plan (2015 - 2030) have not yet been updated to ensure compliance with the NPPF.

The following Local Plans have been adopted by neighbouring local authorities and include policies relevant to flood risk and drainage:

- **Solihull Metropolitan Borough Council's Local Plan** (2011 – 2028)
- **Rugby Borough Council's Local Plan** (2011 – 2031)
- **Coventry City Council's Local Plan** (2011 – 2031)
- **Hinckley and Bosworth Borough Council's Local Plan** (currently under review, due end unknown)
- **North Warwickshire Borough Council's Local Plan** (2021 – 2033)

For the CIA, Nuneaton was assessed at a sub-catchment level (see Figure F-1).

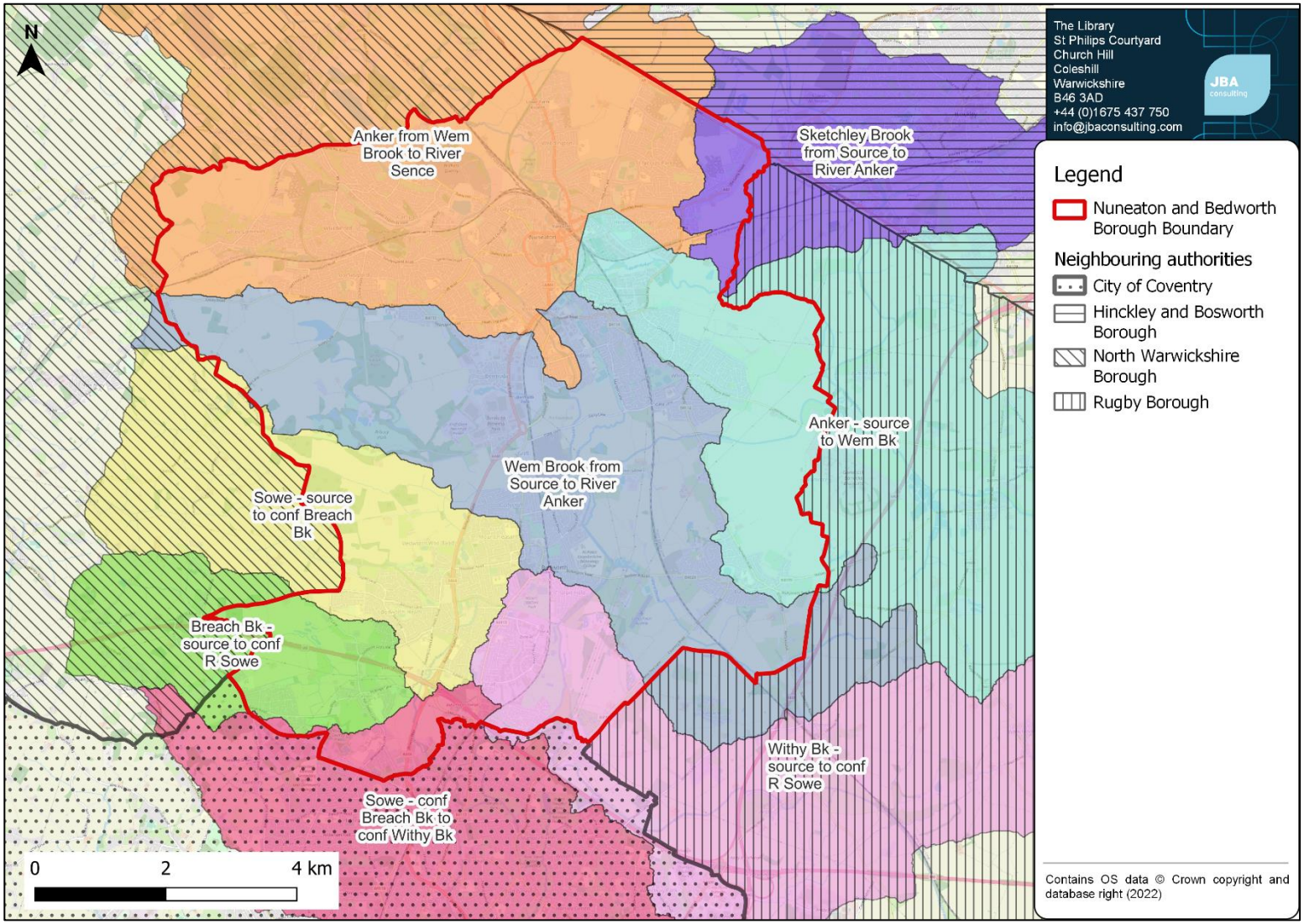

Figure F-1: Catchments within Nuneaton and Bedworth Borough.

1.4 Cumulative Impact Assessment Methodology

This broadscale assessment determines where the potential cumulative impact of developments may have the greatest effect on flood risk across the study area. Catchments at the highest risk are taken forward to a catchment-level analysis. Potential change in developed areas within each catchment from neighbouring authorities was also considered. In this instance, historic records of flooding events were not available, however some baseline records were derived from recent Section 19 reports and a supplied asset register. The recorded incidents from these provide a general overview but were included in the assessment. Analysis of this data facilitated the identification of catchments at the greatest risk of cumulative impacts of an increase in impermeable area within the catchment.

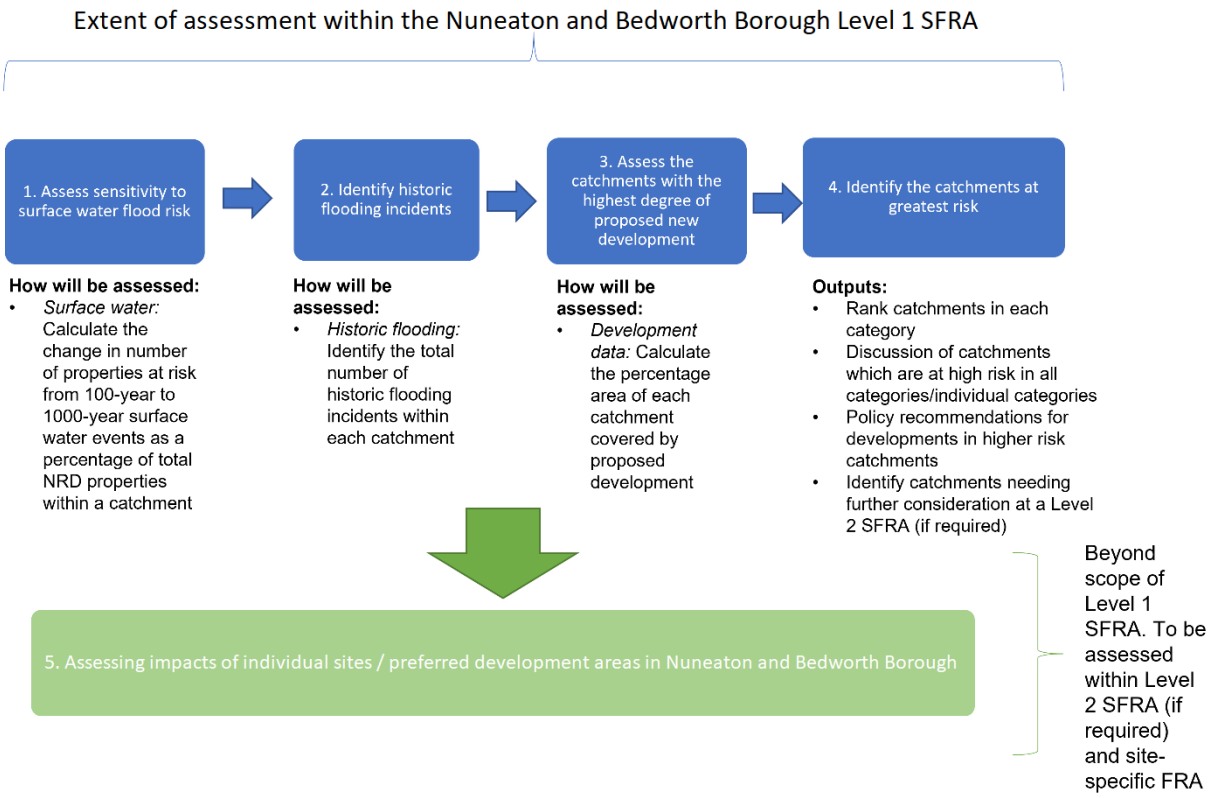

Figure F-2: Overview of the method used within the Cumulative Impact Assessment

Figure F-2 shows the methodology used and Table F-1-1 summarises the datasets used within the Warwickshire cumulative development scenario.

Future development sites within the study area were provided by the Warwickshire Authorities. Catchments within the study area were initially ranked using the following five metrics: sensitivity to increased fluvial flood risk; prevalence of recorded historic flood incidents (limited by the data available); prevalence of historic sewer flooding instances; sensitivity to increased risk of surface water flooding; and area of new development proposed within the catchment.

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

1.4.1 Sensitivity to increases in surface water flooding

For the purpose of the CIA this is the measure of the increase in the number of properties at risk of surface water flooding from a 1 in 100-year event to a 1 in 1,000-year 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, but rather an indicator of the sensitivity of receptors to cumulative effects.

The National Receptor Database (NRD) dataset 2021 was used to identify all properties within the study area.

This data was analysed for the 1,000-year and 100-year surface water flood extents respectively to determine the number of properties in each catchment, in each surface water 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.

1.4.2 Sensitivity to increases in fluvial flooding

For the purpose of the CIA this is the measure of the increase in the number of properties at risk of fluvial flooding from a 1 in 100-year event to a 1 in 1,000-year 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, but rather an indicator of the sensitivity of receptors to cumulative effects.

The National Receptor Database (NRD) dataset 2021 was used to identify all properties within the study area.

This data was analysed using Flood Zone 2 (1,000-year event) and Flood Zone 3 (100-year event) to determine the number of properties in each catchment, in each Flood Zone. 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.

1.4.3 Growth in the area

Development within authorities has the potential to affect flood risk in neighbouring authorities, especially if there are existing flood risk issues. The River Anker enters the Nuneaton and Bedworth Borough from the North Warwickshire Borough. The Anker flows through the centre of Nuneaton and into Rugby Borough. It is joined by a small number of tributaries draining the south of Nuneaton and Bedworth Borough, including the Wem Brook and the Change Brook. The River Sowe originates in Bedworth and leaves the Borough, entering the City of Coventry.

Areas for future proposed development were received from the Warwickshire Authorities and were assessed as part of this CIA. The area of potential new development within each catchment was expressed as a percentage of the total catchment area to determine the potential for increase in flood risk as a result of new development.

1.4.4 Historic flood risk

Recorded flooding events data for fluvial or surface water flooding within the study area was provided by Warwickshire County Council and Coventry City Councils as LLFAs. Data was filtered to only include incidences where properties were affected. Details of historic flood events can be found in Section 5.1 of the main SFRA report. Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

A count of each historical flood incident was conducted for each catchment to determine the historic flood risk of the catchments.

1.4.5 Historic sewer flooding incidences

Recorded sewer flooding events data was provided by Severn Trent Water. Data was filtered to only include incidences where property was affected (as opposed to highways flooding). Each point represents a location where it is known there has been at least one flood event (however, the nature and scale of these flood events varies significantly).

A count of each historical flood incident was conducted for each catchment to determine the historic flood risk of the catchments.

A summary of the datasets used to calculate the historic flood risk and the sensitivity to increases in flood flows for each catchment is shown in Table F-1-1.

Table F-1-1 Summary of datasets used within the Broadscale Cumulative Impact Assessment

Dataset	Coverage	Source of Data	Use of Data
Catchment Boundaries	Warwickshire Study Area	Water Framework Directive Catchments	Assessment of susceptibility to cumulative impacts of development by catchment.
National Receptor Dataset (2021)	Warwickshire Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.
Risk of Flooding from Surface Water	Warwickshire Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment.
Fluvial Flood Zones 2 and 3	Warwickshire Study Are	Environment Agency	Assessing the number of properties at risk of fluvial flooding within each catchment

Dataset	Coverage	Source of Data	Use of Data
Future development areas (recently built out sites/sites under construction/sites with planning permission/previously allocated sites/currently allocated sites)	Warwickshire Study Area	Rugby Borough Council, Warwick District Council, Stratford-on-Avon District Council, Nuneaton and Bedworth Borough Council, Coventry City Council, and North Warwickshire District Council.	Assessing the impact of proposed future development on risk of flooding.
Historic Flooding Incidents and Sewer Flooding Incidents	Warwickshire Study Area	Warwickshire County Council, Coventry City Council, Severn Trent Water	Assessing incidences of historic flooding within the study area.

1.4.6 Ranking the results

The ranking results were combined from all five metrics to give an overall High, Medium and Low ranking for all catchments within the study area. The results for each assessment were ranked into High, Medium and Low risk as shown in Table F-1-2. Ranking delineations were given at natural breaks in the results.

Table F-1-2: Ranking assessment criteria

Flood risk ranking	% of properties at increased risk of fluvial flooding	% of properties at increased risk of SW flooding	No. of Recorded Historic Flooding Incidents	No. of Recorded Sewer Flooding Incidents	% Area of Catchment Covered by new development
Low	<3%	<3%	0	<5	<4%
Medium	3 to 5 %	3 to 5 %	1-5	6-10	4 to 10%
High	>5%	>5%	>5	>10	>10

1.4.7 Assumptions

The assumptions made when conducting the cumulative impact assessment are shown in

Table F-1-3.

Policy recommendations with regards to managing the cumulative impact of development are described in Section 2.2 of the CIA. Appropriate policies will address the issue of incremental increase due to cumulative effects in flood risk both within and downstream of Nuneaton and Bedworth Borough.

Table F-1-3: Assumptions of the cumulative impact assessment

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk; Flood Zone 2 and 3	Total number of properties flooded	Assumption that all properties have been included in the 2021 NRD dataset. It may not include all new build properties.	This was the most up to date and best data available.

Historic Flooding incidents	Total number of historic events and severity of flooding	Only flooding incidents recorded that could be georeferenced with XY coordinates to produce GIS files. Each point represents a location where it is known there has been at least one flood incident. The severity of the historic flooding event relating to the point has not been considered, just the total number of points within each catchment where there has been a flood incident.	GIS data sourced provided the best available results for the location of historic flooding incidents in the study area.

1.5 Cumulative Impact Assessment

1.5.1 Sensitivity to fluvial flooding

The number of properties within Flood Zone 2 not presently within Flood Zone 3 was taken, as a percentage of the total properties in the catchment. These properties are considered sensitive to increased flood risk as a result of climate change.

Catchments with greater than 5% properties at increased risk were considered high risk.

Table F-1-4 Warwickshire and Coventry catchments considered highly sensitive to increased fluvial flood risk in future

Catchment	% properties sensitive to increased fluvial flood risk	Rank
Arrow - Spernall Hall Farm, Studley to confluence with River Alne	11.9%	1
Alne– confluence with Preston Bagot Brook to confluence with Claverdon Brook	7.9%	2
Alne - source to confluence with Preston Bagot Brook	7.8%	3
Arrow – confluence with River Alne to confluence with River Avon	7.7%	4
Knee Brook - source to confluence with Blockley Brook	7.6%	5
Leam – confluence with River Itchen to confluence with River Avon	6.2%	6
Avon (Warks) – confluence with River Sowe to confluence with River Leam	5.9%	7

1.5.2 Sensitivity to surface water flooding

The number of properties within the 1000-year surface water extent not presently within the 100-year extent was taken, as a percentage of the total properties in the catchment. These properties are considered sensitive to increased flood risk as a result of climate change.

Catchments with greater than 5% properties at increased risk were considered high risk.

Table F-1-5 Warwickshire and Coventry catchments considered highly sensitive to increased surface water flood risk in future

Catchment	% properties sensitive to increased surface water flood risk	Rank
Marchfont Bk - source to conf R Avon	11.7%	1
Knee Bk - source to conf Blockley Bk	8.3%	2
Knee Bk - conf Blockley Bk to conf R Stour	6.4%	3
Dene - Butlers Marston to conf R Avon	6.0%	4
Itchen - source to conf with R Stowe	5.9%	5
Tadmarton Stream (Source to Sor Brook)	5.9%	6
Dene - source to Butlers Marston	5.5%	7
Alne conf Preston Bagot Bk to conf Claverdon Bk	5.4%	8
Leam - source to conf Rains Bk	5.4%	9
Stour (Warks) - source to conf Nethercote Bk	5.2%	10
Nethercote Bk - source to conf R Stour	5.1%	11
Alne - conf Claverdon Bk to conf R Arrow	5.1%	12

1.5.3 Prevalence of historic flooding incidents

Historic flood incidents data for fluvial or surface water was available for this assessment from Warwickshire County Council and Coventry City Council. Data was filtered to include only flooding that affected properties. While this will not provide a detailed scope of historic flooding incidents across the region, the number of flood incidents in each catchment from the data available were identified to provide a broadscale understanding of flood risk. Catchments with more than 5 recorded incidents were considered high risk.

Table F-1-6 Warwickshire and Coventry catchments with the highest number of recorded historic flood incidents

Catchment	Number of recorded incidents	Rank
Avon (Wark) conf R Leam to Tramway Br, Stratford	20	1
Leam - conf R Itchen to conf R Avon	16	2
Arrow - Spernall Hall Fm, Studley to conf R Alne	16	2
Avon- Tramway Br Stratford to Workman Br Evesham	7	4
Preston Bagot Bk - source to conf R Alne	7	4

Catchment	Number of recorded incidents	Rank
Leam - conf Rains Bk to conf R Itchen	6	6
Tame from R Blythe to River Anker	6	6

1.5.4 Prevalence of sewer flooding incidents

Records of sewer flooding incidents were available for this assessment from Severn Trent Water. Data was filtered to include only flooding that affected properties. Catchments with more than 10 recorded incidents were considered high risk.

Table F-1-7 Warwickshire and Coventry catchments with the highest number of recorded historic flood incidents

Catchment	Number of recorded incidents	Rank
Leam - conf R Itchen to conf R Avon	49	1
Avon (Wark) conf R Leam to Tramway Br, Stratford	39	2
Anker from Wem Brook to River Sence	32	3
Stour - conf Nethercote Bk to conf Back Bk	30	4
Avon – Claycoton-Yelvertoft Bk to conf R Sowe	29	5
Avon- Tramway Br Stratford to Workman Br Evesham	28	6
Anker from River Sence to River Tame	28	6
Finham Bk - source to conf Canley Bk	25	8
Sow Bk - source to conf R Avon	25	8
Avon (Warks) - conf R Sowe to conf R Leam	21	10
Stowe - source to conf R Itchen	21	10
Clifton Bk - source to conf R Avon	21	10
Tame from R Blythe to River Anker	20	13
Sherbourne - source to conf R Sowe	20	13
Cole from Hatchford-Kingshurst Brook to R Blythe	20	13
Wem Brook from Source to River Anker	16	16
Canley Bk - source to conf with Finham Bk	14	17
Withy Bk - source to conf R Sowe	13	18
Dene - source to Butlers Marston	13	18
Sowe - conf Withy Bk to conf R Avon	13	18

1.5.5 Area of proposed development

The Warwickshire authorities provided a list of likely new development sites and the total area of new development in each catchment was measured, as

a percentage of catchment area. Catchments with more than 10% of their area earmarked for development were considered high risk.

Table F-1-8 Warwickshire and Coventry catchments with the highest percentage cover of proposed development

Catchment	Area of proposed development (ha)	Area of proposed development (%)	Rank
Finham Bk - conf Canley Bk to conf R Sowe	266.6	40.9%	1
Tach Bk - source to conf R Avon	441.8	16.6%	2
Radford Bk - source to conf R Leam	190.2	12.1%	3
Sowe - conf Breach Bk to conf Withy Bk	303.4	11.5%	4
Marchfont Bk - source to conf R Avon	373.0	11.3%	5
Clifton Bk - source to conf R Avon	330.5	10.11%	6

1.6 Overall rankings

As can be seen from the above tables and Figure F-2, there are catchments that are at high risk in multiple categories. Rankings from each assessment have been combined to give an overall ranking. A Red-Amber-Green (RAG) rating was then applied to the catchments, with red being high risk, amber being medium risk and green being low risk (Figure F-3). The catchments with a combined ranking score of less than 30 were deemed high risk.

The catchments rated as high-risk in the broadscale assessment, that lie within Nuneaton and Bedworth Borough, are shown in Table F-1-9.

Table F-1-9: High Risk catchments as shown in Figure F-3

Waterbody Name
Sowe - conf Breach Bk to conf Withy Bk

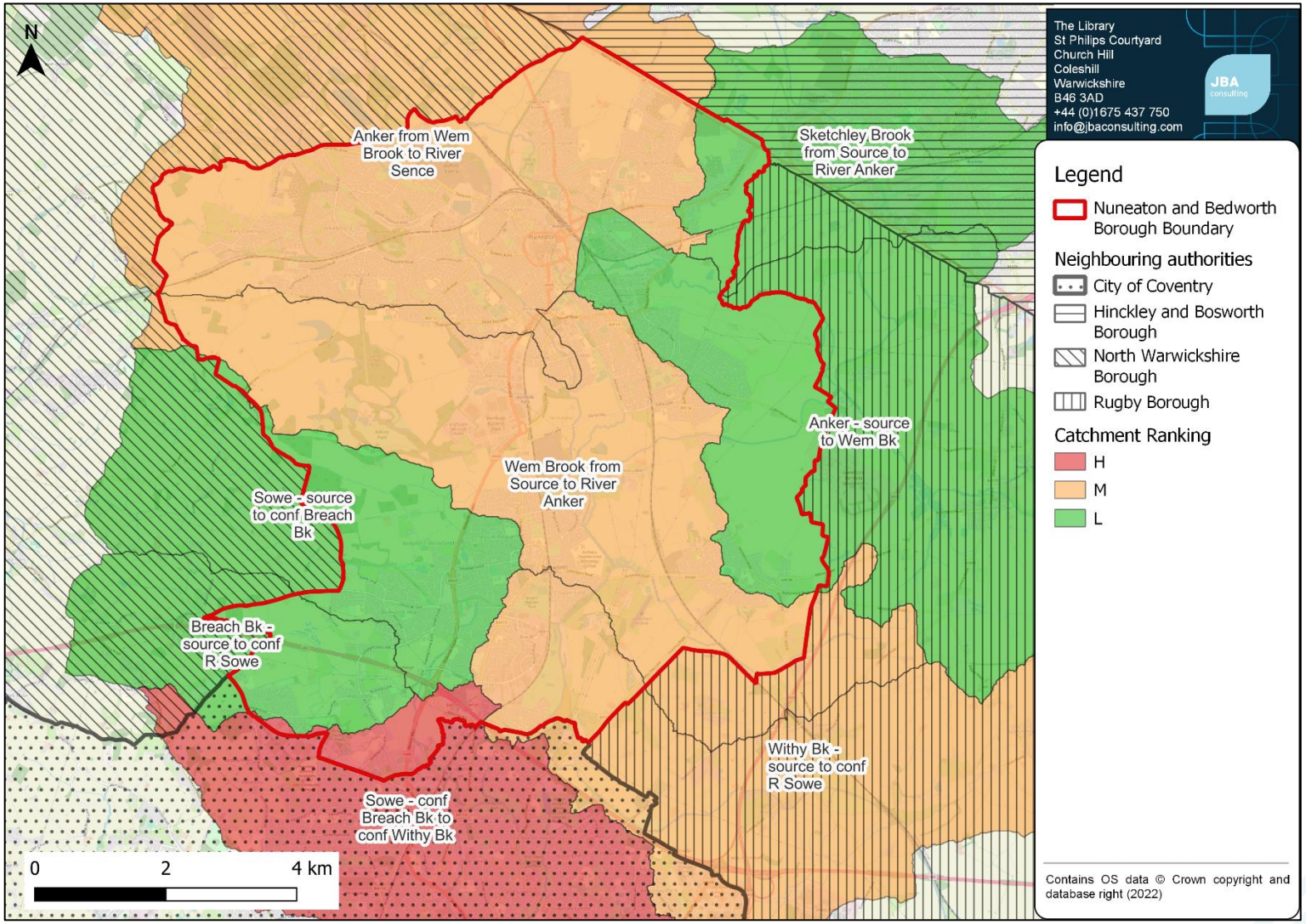

Figure F-3: Final catchment rankings of susceptibility to the impacts of cumulative impacts within Nuneaton and Bedworth Borough.

2 Policy Recommendations

2.1 Broadscale Recommendations

The broadscale cumulative impact assessment for Nuneaton and Bedworth Borough has highlighted that the potential for development to have a cumulative impact on flood risk is moderately low across the area. Catchments have been identified as high, medium or low risk.

New development can potentially increase flood risk and thus the need for incremental action and betterment in flood risk terms across all of Nuneaton and Bedworth Borough is appropriate.

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

- The Warwickshire Authorities should work closely with each other and neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the City to other local authorities in order to minimise cross boundary issues of cumulative impacts of development.
- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the districts where practicable. Developers should refer to the relevant LLFA guidance (Warwickshire County Council) for the requirements for SuDS in Nuneaton and Bedworth Borough, including Technical and Development Type-specific Guidance for Developers.
    - **Warwickshire Flood Risk & Sustainable Drainage Local Guidance for Developers**

Further guidance on SuDS can be found in Section 9 of the main SFRA report.

- Warwickshire County Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should take into account all sources of flooding so that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Where appropriate, that the opportunity for Natural Flood Management in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should be opposed, and day-lighting existing culverts promoted through new developments.
- Runoff rates from all development sites must be limited to greenfield rates (including brownfield sites) for all 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. Developers should refer to the relevant LLFA guidance for the requirements for SuDS in Nuneaton and Bedworth Borough.

- Nuneaton and Bedworth Borough Council should consider requiring developers to contribute to community flood defences outside of their red line boundary to provide wider benefit and help offset the cumulative impact of development. There are proposed and ongoing Flood Alleviation Schemes which may help to reduce fluvial risk in the town centre, and there may be opportunities for development to support the funding/delivery of these schemes.

Section 8.3 of the main SFRA report details the local requirements for mitigation measures. Catchment-specific recommendations are made for high-risk catchments below.

2.2 Recommendations for medium and high-risk catchments

Medium Risk catchments are detailed in Table 2-1 below. High risk catchments are detailed in Table F-1-9. From analysing the results produced above, high-level recommendations to manage the risks of the cumulative impacts of development have been proposed for the medium and high-risk catchments. These recommendations include policy recommendations for the Local Authority and considerations for developers as part of site-specific proposals.

Table 2-1 Medium Risk Catchments with the Nuneaton and Bedworth Borough Study Area

Medium Risk catchments within Nuneaton and Bedworth Borough
Anker from Wem Brook to River Sence
Wem Brook from Source to River Anker
Withy Bk - source to conf R Sowe

- Nuneaton and Bedworth Borough Council 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 natural flood management features, including land which may lie outside their boundaries.
- Nuneaton and Bedworth Borough Council should explore the potential for development in High-Risk catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.
- Nuneaton and Bedworth Borough Council, in discussion with Warwickshire County Council as LLFA should consider requiring additional betterment for runoff rates from brownfield sites, beyond those currently set. Currently, the Warwickshire Local Guidance for Developers states that greenfield sites should limit runoff to greenfield rates whilst brownfield sites should reduce runoff to greenfield rates or achieve a minimum 50% reduction in runoff where it can be proved greenfield rates are not possible. 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.

- For any sites where an FRA is required, developers should explore, through the site-specific FRA, opportunities to provide wider community flood risk & water resource benefits as part of new development and justify where such measures are not included. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered, with a focus on slowing the flow of water downstream, particularly in the upper catchment. This could include the provision of additional storage e.g. oversized SuDS and/or Partnership Funding contributions towards wider community schemes.
- Nuneaton and Bedworth Borough Council should consult with Local Non-For-Profit organisations such as wildlife trusts, rivers trusts and catchment partnerships 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.

2.2.1 Recommendations for Developments in High-Risk Catchments

Catchments that have been scored an overall ranking of high, should also consider the following recommendations:

- That a Level 2 SFRA or detailed local area Strategic Drainage Study considers further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.
- All development proposals should undertake a site-specific Flood Risk Assessment. Site-specific FRAs should explore opportunities to provide wider community flood risk benefit 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 be by provision of additional storage on site e.g. through oversized SuDS, natural flood management techniques, green infrastructure and green-blue corridors, and/ or by providing a Partnership Funding contribution towards any flood alleviation schemes.
- That a Surface Water Drainage Strategy be required for all developments, regardless of development size. Developers should also 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 LPA regarding the proposed management approach during the construction phase to address surface water management during storm events.
- That Nuneaton and Bedworth Borough Council consider requiring developers to contribute to community flood defences both within and

outside of their red line boundary in these catchments to provide wider benefits and help offset the cumulative impact of development.

Appendix G - Modelling Technical Notes

JBA Project Code	2022s0447
Contract	NBBC Level 1 SFRA
Client	Nuneaton and Bedworth Borough council
Day, Date and Time	August 2023
Author	Arran Bright
Reviewer / Sign-off	Louise Goode/Paul Redbourne
Subject	Updated Modelling

1 Introduction

1.1 Updating the SFRA modelling

The Coventry and Warwickshire Level 2 Strategic Flood Risk Assessment (SFRA) provides a comprehensive and robust evidence base on flood risk issues to investigate 22 proposed development sites which have been identified by Nuneaton and Bedworth Borough Council (NBBC). The use of comprehensive and robust evidence will support the replacement of the current Nuneaton and Bedworth Borough Plan. This will cover a period between 2024 - 2039. The Environment Agency's 'Flood Map for Planning' is used to represent the flood zones and levels of flood risk and incorporates updates modelled data where available.

The Planning Practice Guidance on Flood Risk and Coastal Change was updated on the 25th August 2022 which resulted in the need to update the SFRA. These updates include the requirement for:

- Updated climate change modelling for all sources of flood risk
- Definition of the functional floodplain (Flood Zone (3b)) based around the 3.3% AEP event, rather than the 5% AEP event under previous guidance.

2 The River Sowe

The hydraulic modelling of the River Sowe has been updated to simulate the 3.3% AEP, 1% AEP and 0.1% AEP with updated Central, Higher and Upper end climate change allowances for the management catchment (as quoted in Table 2-1).

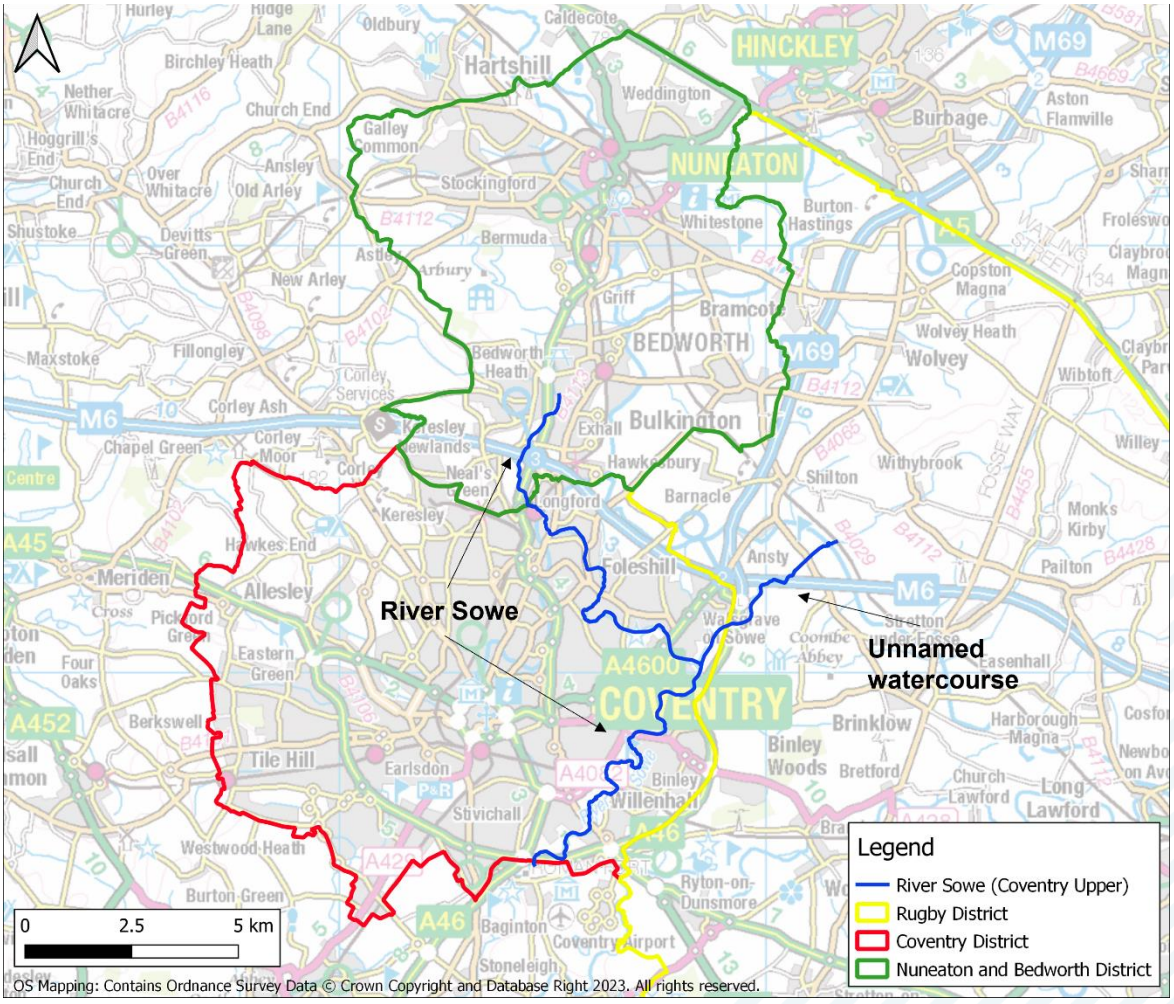

Figure 2-1: River Sowe (Coventry Upper) model extent

The Coventry Upper is a modelled as a 1D-2D FM-TUFLOW model which covers the River Sowe and a smaller, unnamed watercourse. The River Sowe flows from the north-west from the Nuneaton and Bedworth District through the Coventry District. The smaller, unnamed tributary flows from the north-east through the Rugby District and joins the River Sowe within the Coventry District.

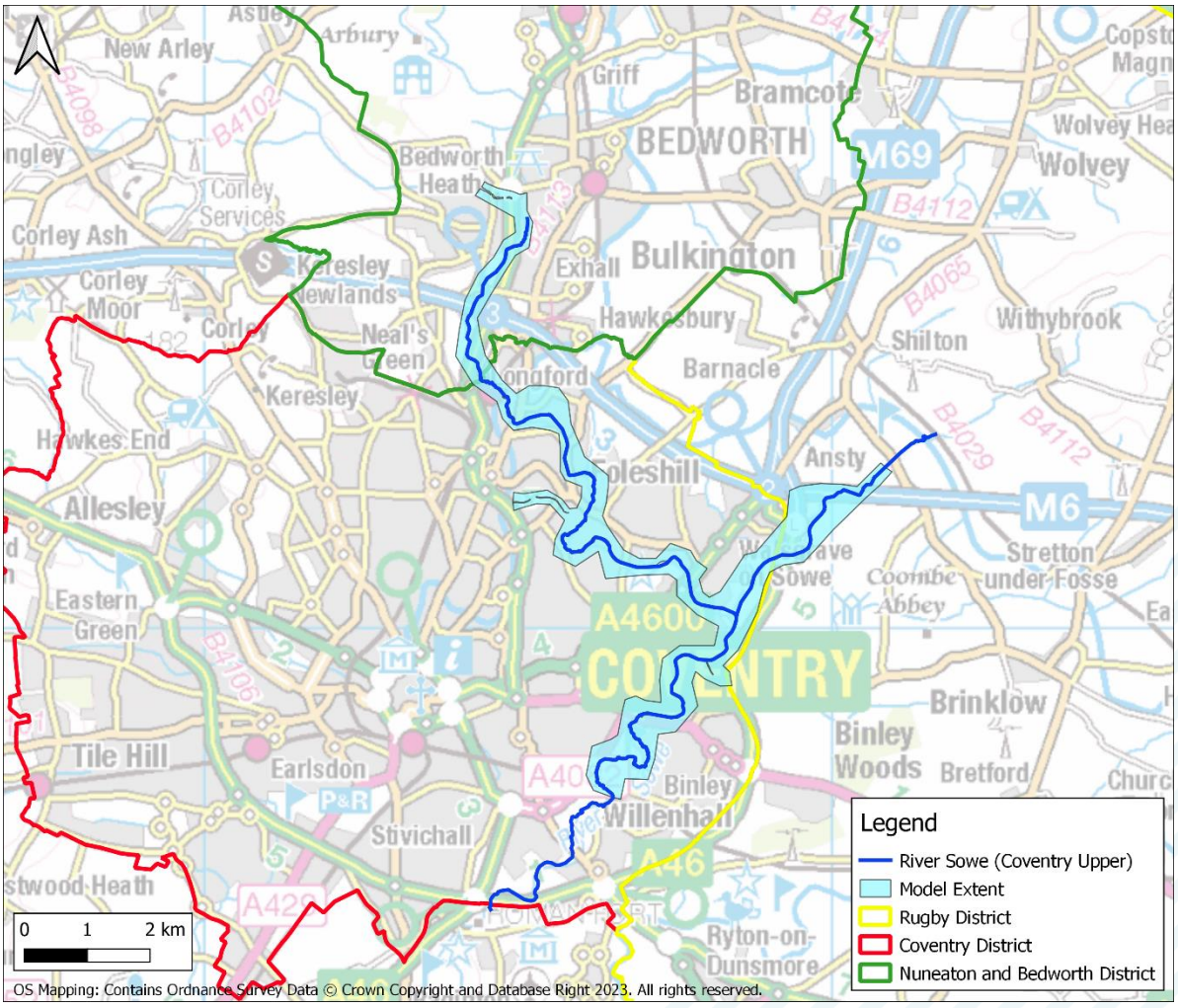

Figure 2-2: Extents of 1D-2D linked model

The following events were simulated for the model:

- 3.3% AEP
- 3.3% AEP + CC - Central, Higher and Upper end allowances
- 1% AEP
- 1% AEP + CC - Central, Higher and Upper end allowances
- 0.1% AEP
- 0.1% AEP + CC - Central, Higher and Upper end allowances

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Subject	Updated Modelling

2.1 Method

2.1.1 Estimating the 3.3% AEP flood flow

Flows for the 3.3% AEP event were not available with the existing model files and had not been derived in the existing hydrological study. The model though is schematised with FEH Boundaries as inflows, meaning appropriate flows can be derived by adjusting the Flood Return Period in the boundary unit to 30 years.

From the FEH Rainfall data a flow hydrograph for each inflow point is then calculated by Flood Modeller and applied to the hydraulic model. The flow hydrographs produced for each inflow point are consistent with the shape of the respective 20 and 50 year flow hydrographs. Checks for consistency have shown that the 30-year hydrographs are reasonable and fit between the 20 and 50 year hydrographs.

A more comprehensive updating of the hydrology for the River Sowe is considered to be beyond scope of the project as this modelling is strategic and in nature and aims to derive datasets that can be used consistently with existing flood risk datasets. Furthermore, there are complexities in re-running the model and the age of the model which means updating the model hydrology may become a more complex and expensive undertaking.

2.1.2 Applying the climate change guidance

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances which were released in July 2021.

Table 2-1 shows the updated peak river flow allowances that apply in Nuneaton/Coventry for fluvial flood risk for the River Sowe within the Avon Warwickshire Management Catchment (last updated in July 2021). Table 2-1 shows the updated Central, Higher and Upper end climate allowances for the 2020s, 2050 and 2080 epochs. The red highlighted box shows the relevant climate change allowances used in the SFRA and model.

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Table 2-1: Peak river flow allowances for the Avon Warwickshire Management Catchment

Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Central	7%	8%	21%
Higher	12%	14%	32%
Upper	22%	31%	59%

3 Nuneaton Model (River Anker and Tributaries)

The hydraulic modelling of the River Anker and its tributaries (Figure 3-1), which form the WCC (Warwickshire County Council) Nuneaton model, have been updated to simulate the 3.3% AEP and 0.1% AEP with updated Central, Higher and Upper end climate change allowances for the management catchment.

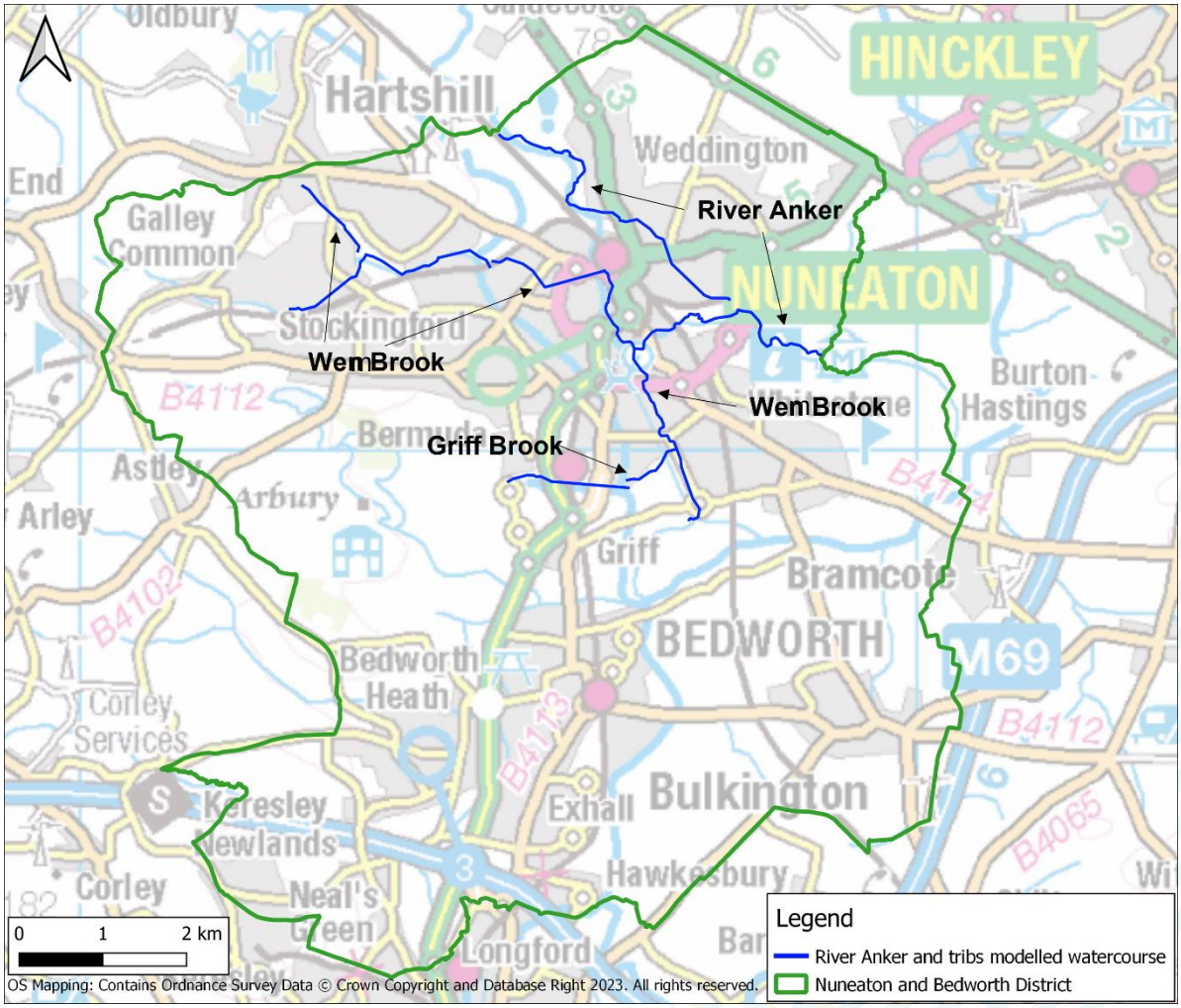

Figure 3-1: Extent of Nuneaton modelled watercourse

The WCC Nuneaton model is a 1D-2D FM-TUFLOW model which covers the River Anker and a number of tributaries which flow through the Nuneaton and Bedworth District. Modelled watercourses include The River Anker, which flows from the east through the

centre of Nuneaton and the Wem and Griff brooks flow from the south-east (Figure 3-2).

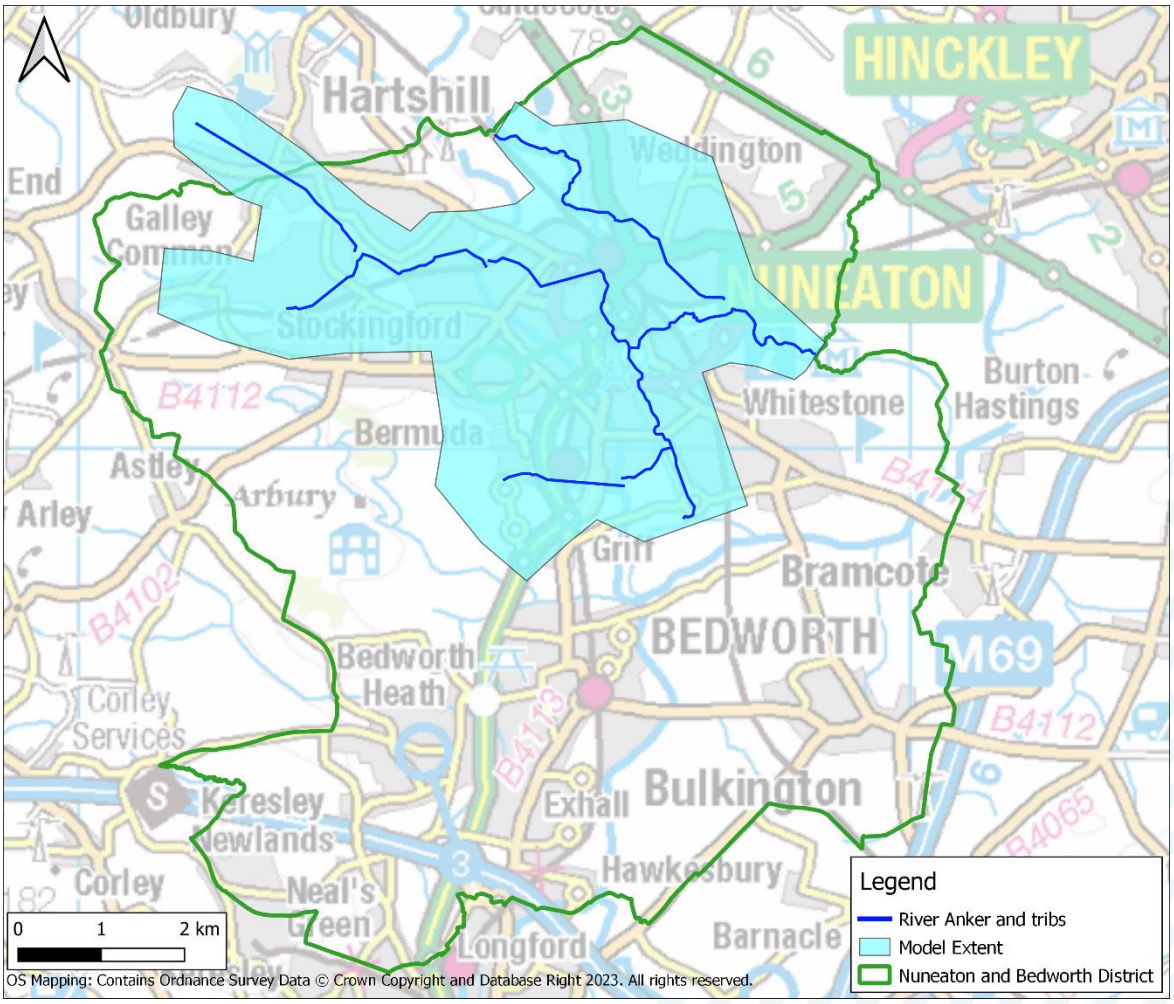

Figure 3-2: Extents of 1D-2D linked model

The following events were simulated for the model:

- 3.3% AEP
- 3.3% AEP + CC - Central, Higher and Upper end allowances
- 1% AEP
- 1% AEP + CC - Central, Higher and Upper end allowances
- 0.1% AEP

- 0.1% AEP + CC - Central, Higher and Upper end allowances

3.1 Method

3.1.1 Estimating the 3.3% AEP flood flow

Flows for the 3.3% AEP event were not available with the existing model files and had not been derived in the existing hydrological study. The model though is schematised with FEH Boundaries as inflows, meaning appropriate flows can be derived by adjusting the Flood Return Period in the boundary unit to 30 years.

From the FEH Rainfall data a flow hydrograph for each inflow point is then calculated by Flood Modeller and applied to the hydraulic model. The flow hydrographs produced for each inflow point are consistent with the shape of the respective 20 and 50 year flow hydrographs. Checks for consistency have shown that the 30 year hydrographs are reasonable and fit between the 20 and 50 year hydrographs.

A more comprehensive updating of the hydrology for the Rivers in the model is considered to be beyond scope of the project as this modelling is strategic and in nature and aims to derive datasets that can be used consistently with existing flood risk datasets. Furthermore, there are complexities in re-running the model and the age of the model which means updating the model hydrology may become a more complex and expensive undertaking.

3.1.2 Applying the climate change guidance

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances which were released in July 2021.

Table 3-1 shows the updated peak river flow allowances that apply in Nuneaton/Coventry for fluvial flood risk for the Rivers in the model are within the Tame, Anker and Mease Management Catchment (last updated in July 2021). Table 3-1 shows the updated Central, Higher and Upper end climate allowances for the 2020s, 2050 and 2080 epochs. The red highlighted box shows the relevant climate change allowances used in the SFRA and model.

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Subject	Updated Modelling

Table 3-1: Peak river flow allowances for the management catchment in Nuneaton (Tame, Anker and Mease)

Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Central	10%	15%	22%
Higher	11%	17%	30%
Upper	22%	30%	51%

4 The River Anker

The hydraulic modelling of the River Anker has been updated to simulate the 3.3% AEP, 1% AEP and 0.1% AEP with updated Central, Higher and Upper End climate change allowances for the management catchment.

Figure 4-1 shows the location of the modelled watercourses for the River Anker study in relation to the wider Nuneaton and Bedworth Borough Council boundary.

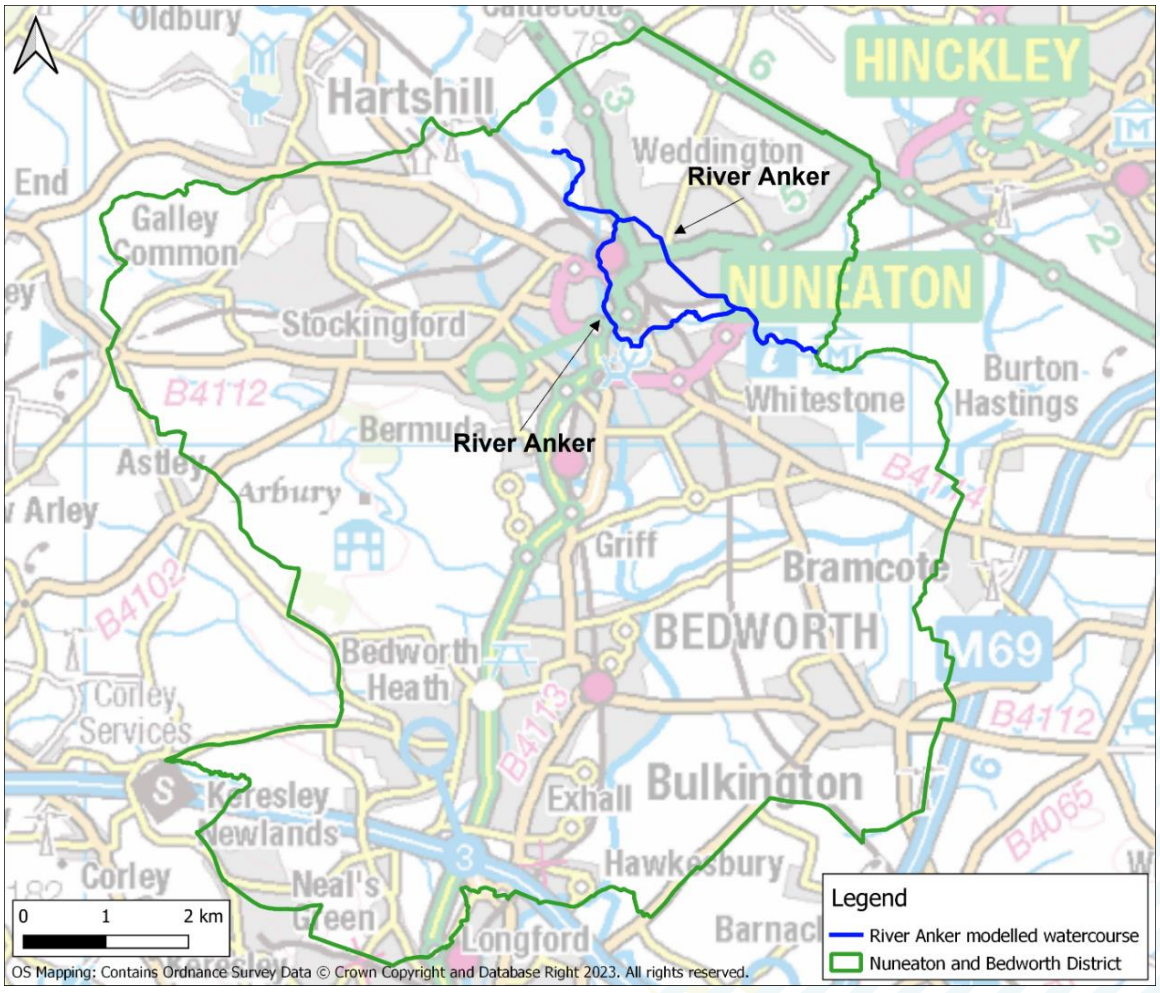

Figure 4-1: Extent of River Anker modelled watercourse

The River Anker is modelled as a 1D-2D linked Flood Modeller (FM) - TUFLOW model covering the River Anker watercourse which flows from the south-east through the Nuneaton and Bedworth District.

The model was originally developed by Capita Aecom in 2015 for the Nuneaton Hazard Mapping study for the Environment Agency as part of the Water and Environmental

Management (WEM) Lot 1 package of works. Figure 4-2 shows the location of the model extent that has been simulated for this study.

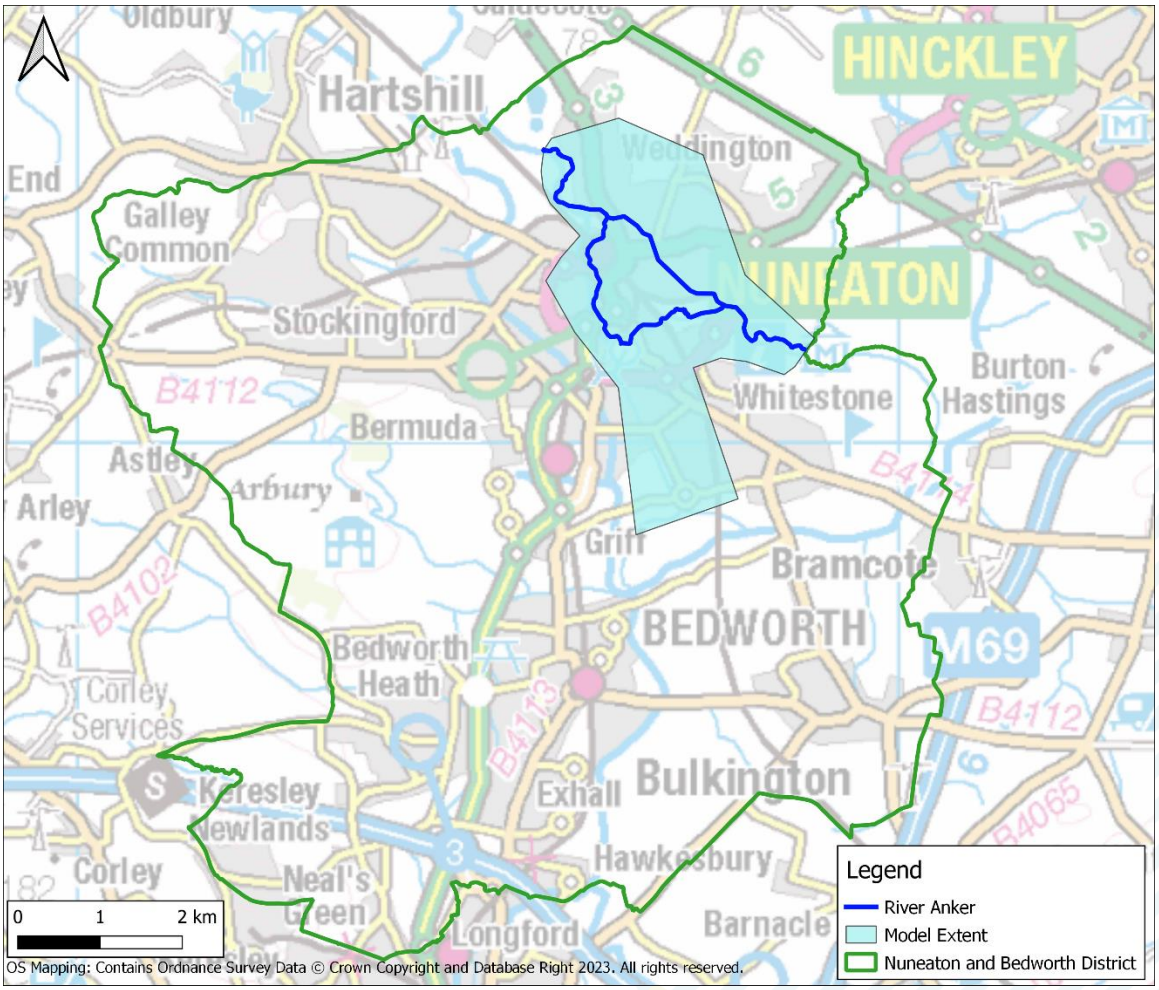

Figure 4-2: Extents of 1D-2D linked model

The following events were simulated for the model:

- 3.3% AEP + CC - Central, Higher and Upper End allowances
- 1% AEP + CC - Central, Higher and Upper End allowances
- 0.1% AEP
- 0.1% AEP + CC - Central, Higher and Upper End allowances

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Subject	Updated Modelling

4.1 Method

There have been no significant changes to the Environment Agencies River Anker model. The scope of works has focused on the simulation of new climate change uplifts, but some minor updates have been undertaken including the use of an updated TUFLOW version (202-10-AD) and an updated version of Flood Modeller (v5.0). Both of software executables have received further updates since the completion of these model runs but the changes are not expected to have any significant impact on the results and importantly represent an improvement compared to the 2015 model.

The following section summarise the updates applied to the model inflows to represent the changes to the climate change allowances.

4.1.1 Applying the climate change guidance

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency used these projections to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances which were released in July 2021.

Table 3-1 shows the updated peak river flow allowances that apply in Nuneaton/Coventry for fluvial flood risk for the River Anker within the Tame, Anker and Mease catchment (last updated in July 2021). Table 3-1 shows the updated Central, Higher and Upper end climate allowances for the 2020s, 2050 and 2080 epochs. The red highlighted box shows the relevant climate change allowances used in the SFRA and model.