

Level 2 Cumulative Impact Assessment

1 Background

1.1 Introduction

The cumulative impact of development should be considered at both the Local Plan making stage and the planning application and development design stages.

Paragraph 160 of the National Planning Policy Framework (NPPF, 2021) states:

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

Appropriate mitigation measures should be undertaken to prevent exacerbation of flood risk, and where possible the development should be used to reduce existing flood risk issues, both onsite and offsite of the development.

To understand the impact of future development on flood risk in Wokingham Borough, the previous Level 1 Strategic Flood Risk Assessment (SFRA) identified catchments where development may have the greatest potential effect on flood risk, and where further assessment would be required within a Level 2 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 and fluvial flooding, alongside evidence of historic flooding incidents were considered to identify catchments at the highest risk. Catchments identified as high risk have then been assessed further in this Level 2 SFRA and recommendations have been suggested to help manage the risk.

1.2 Assessment of Cross-Boundary Issues

Wokingham Borough is bordered by the following Local Authority areas, shown in Figure 1-1 of the Level 1 SFRA report:

- Basingstoke and Deane Borough
- Bracknell Forest
- Buckinghamshire
- Hart District
- Reading Borough
- South Oxfordshire District
- West Berkshire

- Royal Borough of Windsor and Maidenhead

The topographic characteristics of Wokingham Borough are dictated by the Thames Basin Heaths, a Special Protection Area atop chalk hills in the south, the southern end of the Chilterns in the northern tip of the Borough, and lowland Thames Valley through the middle reach. The high ground in the south of the borough creates the watershed for a number of tributaries to the River Loddon, which flows northward into the River Thames. The Twyford Brook, Emm Brook, Barkham Brook and the River Blackwater drain the majority of Wokingham Borough from the east into the Loddon, which drains the western portion. Some cross-boundary tributaries also drain small sections in the far west, including the Burghfield Brook and Foudry Brook, and parts of the River Thames catchment.

Future development, both within and outside of Wokingham Borough, as well as climate change, have the potential to affect flood risk to existing development and the surrounding areas, depending on the effectiveness of SuDS and drainage implementation.

Development control should ensure that the impact on receiving watercourses from development in the Borough has been sufficiently considered during the planning stage. The National Planning Policy Framework (NPPF) sets out how developments should demonstrate they will not increase flood risk elsewhere. Therefore, providing developments near watercourses in neighbouring authorities comply with the latest planning policy, guidance and legislation relating to flood risk and sustainable drainage, they should result in no increase in flood risk within or outside 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 Wokingham Borough.

The Wokingham Borough Local Plan Update, which will look up to at least 2039/40, is currently being prepared.

The following Local Plans have been adopted by neighbouring local authorities and include policies relevant to flood risk and drainage, with hyperlinks to the documents provided:

- [Basingstoke and Deane Local Plan 2011 – 2029](#)
- [Bracknell Forest Local Plan \(Currently at Examination stage, due to cover up to 2037\)](#)
- [Buckinghamshire Local Plan \(Currently under review, not yet adopted\)](#)
- [Hart Local Plan 2020 – 2032](#)
- [Reading Local Plan 2019 - 2036](#)
- [South Oxfordshire Local Plan 2020 – 2035](#)
- [West Berkshire Local Plan 2022-2039 \(Currently under review, submitted to Secretary of State for Examination\)](#)
- [Windsor and Maidenhead Local Plan \(2013 – 2033\)](#)

2 Findings from Wokingham Borough Councils' Level 1 SFRA CIA

A broadscale Cumulative Impact Assessment (CIA) was undertaken as part of the Level 1 SFRA. This was undertaken at a similar time to the Level 2 SFRA. For the CIA, Wokingham Borough was assessed at a catchment level, with these catchments shown in Figure 2-1. Figure 2-2 shows the adjoining local authority areas to the Wokingham Borough. The main watercourses across Wokingham Borough are shown in Figure 1-3 in the Level 1 SFRA report.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, and appropriate consideration is given to surface water flow paths and storage proposals should normally not increase flood risk elsewhere.

The CIA is prepared to identify those catchments at highest risk of flooding, where development might have the greatest potential to increase flood risk and where, with appropriate planning policies in place, there is the opportunity for development to contribute towards a reduction in flood risk across the wider area.

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

- Foudry Brook (West End Brook to M4)
- Emm Brook
- Barkham Brook
- Loddon (Swallowfield to River Thames confluence)
- Twyford Brook

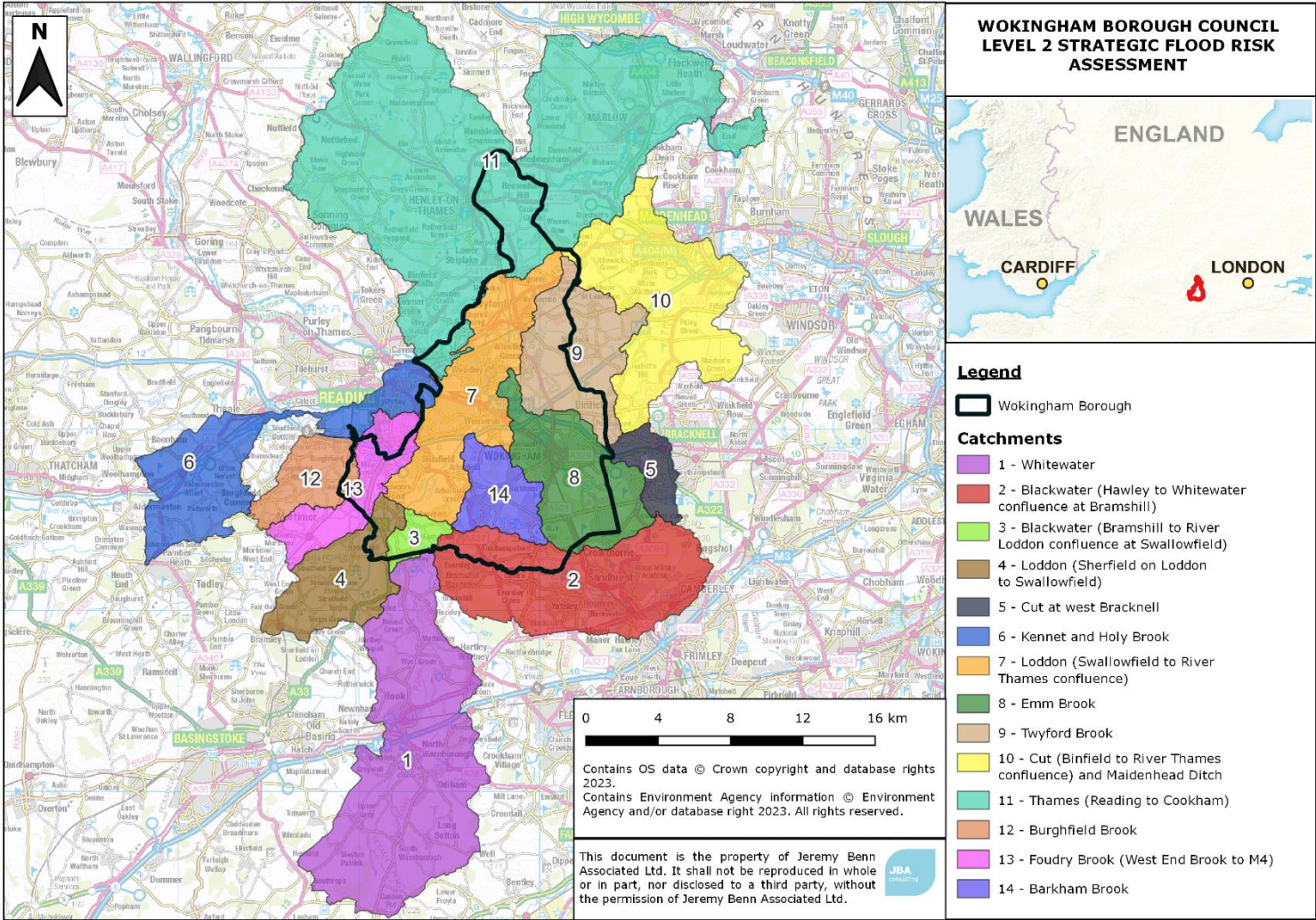


Figure 2-1: Catchments within Wokingham Borough.

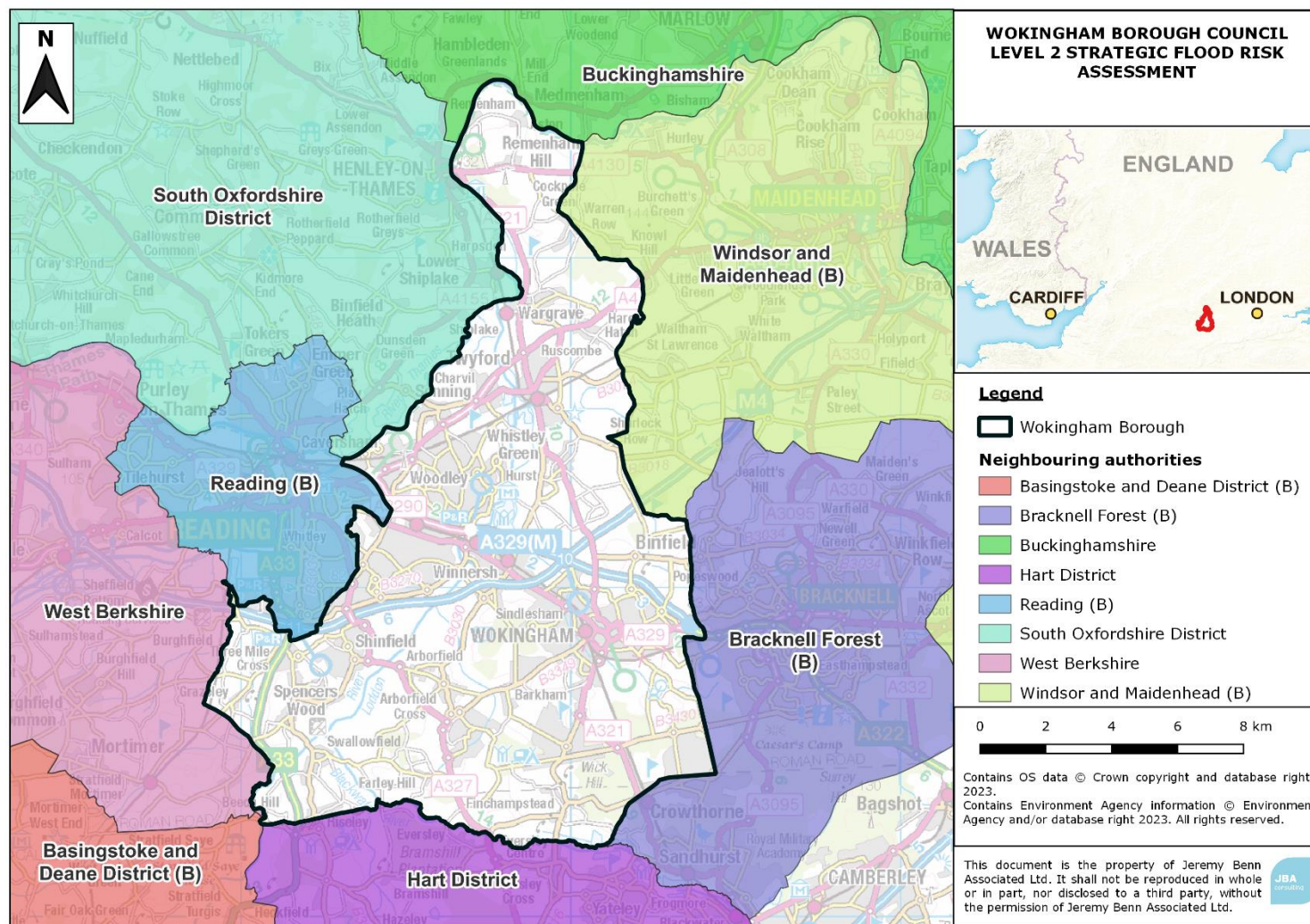


Figure 2-2: Neighbouring local authorities to Wokingham Borough.

3 Broadscale Cumulative Impact Assessment

Wokingham Borough Councils' Level 1 SFRA included a broadscale CIA. Despite this Level 2 CIA being produced directly after the Level 1 CIA, the broadscale CIA has been rerun for this assessment using updated development data for Wokingham Borough following the site screening process. No other changes were made with respect to the previous CIA.

The original Level 1 CIA included all sites which have been promoted to WBC. However, as part of the screening process WBC identified the sites assessed as potentially suitable for development through the latest Housing and Economic Land Availability Assessment (HELAA) including those proposed for allocation in the Revised Growth Strategy (2021) consultation, from all sites promoted as well as newly promoted sites not yet subject to HELAA assessment. These sites identified by WBC were used to update the broadscale CIA. No other changes were made. It is worth emphasising that not all sites assessed through the HELAA as potentially suitable will be proposed for allocation in the emerging Local Plan Update.

As a result of these changes the final risk category has changed for the following catchments and this is reflected in the tables within this CIA:

- Foudry Brook (West End Brook to M4) - downgraded from high to medium risk.
- Loddon (Sherfield on Loddon to Swallowfield) - downgraded from medium to low risk.

For the full methodology, users should refer to the original Level 1 CIA (IDT-JBAU-XX-XX-RP-HM-0003-A1-C01-AppF_CIA). The sections below detail any changes to the results following the change in development sites used within Wokingham Borough.

3.1 Updated results

3.1.1 Ranking the results

The results for each assessment were ranked into high, medium, and low risk as shown in Table 3-1. Ranking delineations were given based on similar characteristics of risk in the results.

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

There is currently no national guidance available for assessing the cumulative impacts of development. These rankings provide a relative assessment of the catchments

within Wokingham Borough and are not comparable across other boroughs/districts. The thresholds used have been based on natural breaks in the data and professional judgement and provide a relative assessment of risk between the catchments within the Borough.

The ranking thresholds for the catchment area covered by new development have changed slightly since the previous Level 1 CIA due to the refined potential development sites compared to the previously larger number of site promotions considered at the Level 1 stage across the Wokingham Borough.

Table 3-1: Ranking assessment criteria

Flood risk ranking	Percentage of properties at increased risk of fluvial flooding	Percentage of properties at increased risk of surface water flooding	Total number of historic flooding incidents	Percentage area of catchment covered by new development
Low risk	<1	<4	<20	<2
Medium risk	1 to 5	4 to 5	20-50	2 to 9
High risk	>5	>5	>50	>9

3.1.2 Area of proposed development

WBC and neighbouring authorities provided shapefiles of promoted development sites and the total area of potential new development in each catchment was measured, as a percentage of the catchment area. Within Wokingham Borough, only the sites proposed for further consideration, following the site screening process, are included within this assessment. As set out above, not all of these sites will be proposed for allocation in the emerging Local Plan Update, and so this represents a conservative approach. Due to the scale of proposed developments in comparison to the catchment areas, catchments with more than 9% of their area earmarked for development were considered high risk. It should be noted that if these sites were to be developed in the future, the entire site area would not necessarily be comprised of built development.

Development sites were not provided for Buckinghamshire which covers part of the Thames (Reading to Cookham) catchment and therefore development in Buckinghamshire could not be taken into account during this assessment. The Buckinghamshire area was removed from the total catchment area so that it did not skew the results. As the Buckinghamshire area is downstream of Wokingham Borough, development in Buckinghamshire should not affect flood risk upstream across Wokingham Borough.

Two of the catchments extend further than the neighbouring authorities: Whitewater extends slightly into East Hampshire District and Blackwater (Hawley to Whitewater confluence at Bramshill). Proposed development data was not available for these authority areas. However, these cover only small areas of the catchments and removing them from the calculations was shown to have no impact on the catchment rankings.

Table 3-2: Catchments with the highest percentage cover of proposed development.

Catchment	Area of proposed development (ha)	Area of proposed development as percentage of catchment area	Rank
Barkham Brook	295	16	1
Loddon (Swallowfield to River Thames confluence)	656	13	2
Twyford Brook	382	9	3
Emm Brook	392	9	4

3.1.3 Overall rankings

For each assessment, catchments were given a score of 3 (high), 2 (medium), or 1 (low) risk of impact from increased pressure from development, excluding the historic data assessment where sufficient information was not available. These scores were then averaged across the assessment to give a combined score. Table 3-3 provides a summary of the rankings for each catchment for the individual assessments and the combined scores.

Table 3-3: Catchment rankings and combined scores.

Waterbody name	Area covered by proposed development sites	Historic flooding	Fluvial flooding	Surface water flooding	Average score
Whitewater	1	n/a	1	3	1.67
Blackwater (Hawley to Whitewater confluence at Bramshill)	1	n/a	2	2	1.67
Blackwater (Bramshill to River Loddon confluence)	1	2	2	2	1.75

Waterbody name	Area covered by proposed development sites	Historic flooding	Fluvial flooding	Surface water flooding	Average score
at Swallowfield)					
Loddon (Sherfield on Loddon to Swallowfield)	1	n/a	1	3	1.67
Cut at west Bracknell	1	n/a	1	1	1.00
Kennet and Holy Brook	1	n/a	3	3	2.33
Loddon (Swallowfield to River Thames confluence)	3	3	2	1	2.25
Emm Brook	3	3	2	2	2.50
Twyford Brook	3	n/a	2	1	2.00
Cut (Binfield to River Thames confluence) and Maidenhead Ditch	2	n/a	1	3	2.00
Thames (Reading to Cookham)	1	n/a	3	2	2.00
Burghfield Brook	1	n/a	2	1	1.33
Foudry Brook (West End Brook to M4)	1	n/a	2	3	2.00
Barkham Brook	3	2	1	3	2.25

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 of impact from increased pressure from development. The RAG ratings are shown in Figure 3-1. The catchments with an average score of greater than 2 were deemed high risk and are shown in Table 3-4.

Table 3-4: High risk catchments as shown in Figure 3-1.

Waterbody name	Average score
Emm Brook	2.50
Barkham Brook	2.25
Loddon (Swallowfield to River Thames confluence)	2.25
Twyford Brook	2.00

Despite scoring a combined score of 2, on balance, the Twyford Brook catchment was increased from medium to high risk on the account of ranking high for development increase, medium for surface water risk and had 15 recorded historic flood incidents although these were not included in the overall rankings due to half the catchment lying outside Wokingham Borough. All other high risk catchments named in Table 3-4 above ranked high for at least two parameters.

Despite scoring a combined score of 2.33, the Kennet and Holy Brook catchment has been decreased to medium risk. This catchment lies predominantly upstream of Wokingham Borough. The Kennet and Holy Brook catchment ranked high risk for fluvial and surface water risk but ranked low risk for increase in development area. As this catchment lies predominantly upstream of the Borough, it is the responsibility of neighbouring authorities to put measures in place so flood risk within Wokingham Borough is not increased because of development in this area.

The high risk catchments shown are the same as those in the original broadscale CIA produced for the Level 1 SFRA other than the 'Foudry Brook (West End Brook to M4)' catchment. This was previously considered a high risk catchment but has now been assessed as a medium risk catchment. This is because most development sites promoted within the part of this catchment which lies within Wokingham Borough were not taken forward by WBC during the site screening process so the catchment is ranked as low risk for development area increase, whereas previously it ranked as high risk in this category.

The catchments classified as medium and low risk are shown in Table 3-5 and Table 3-6 respectively.

The limitations and assumptions for the broadscale assessment can be found in Section 1.4.6 of the Level 1 CIA report.

Table 3-5: Medium risk catchments.

Waterbody name	Average score
Kennet and Holy Brook	2.33
Cut (Binfield to River Thames confluence) and Maidenhead Ditch	2.00
Thames (Reading to Cookham)	2.00
Foudry Brook (West End Brook to M4)	2.00

Waterbody name	Average score
Blackwater (Bramshill to River Loddon confluence at Swallowfield)	1.75

Table 3-6: Low risk catchments.

Waterbody name	Average score
Loddon (Sherfield on Loddon to Swallowfield)	1.67
Whitewater	1.67
Blackwater (Hawley to Whitewater confluence at Bramshill)	1.67
Burghfield Brook	1.33
Cut at west Bracknell	1.00

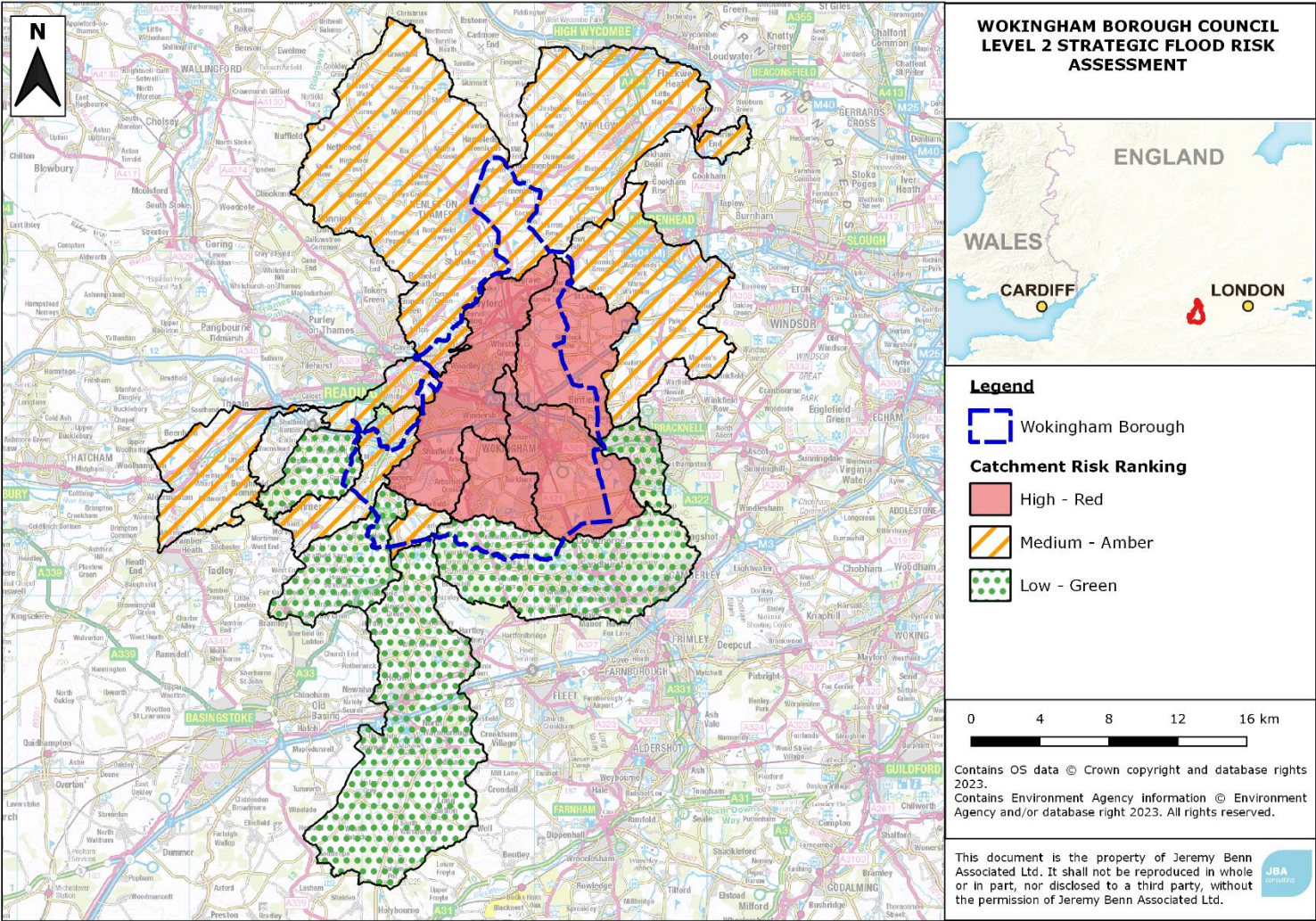


Figure 3-1: Results of the ranking assessment showing high (red), medium (amber) and low (green) risk catchments across Wokingham Borough.

4 Catchment Level Assessment

4.1 Methodology

In the catchment level assessment, a detailed analysis of the high risk catchments, as identified in the broadscale assessment, is undertaken. Other factors, such as the catchments' existing urban extent, topography, location within the wider river drainage network, and presence of EA Flood Warning Areas (FWAs) are also considered to determine policy recommendations to address the specific risks within the catchment. Sites promoted to the Level 2 assessment by WBC have been categorised into brownfield or greenfield developments based on available online mapping.

Historic flooding incidents are also considered and presented as a hotspot 250m grid across the catchments to indicate areas potentially sensitive to flooding. This dataset includes records from WBC and Thames Water.

4.1.1 Emm Brook

Catchment overview

Figure 4-1 shows the catchment boundary, main watercourses, historic flooding incident hotspots, and proposed development sites for the Emm Brook catchment.

Emm Brook catchment lies mostly within the southeast end of Wokingham Borough with its upstream end extending into Bracknell Forest Borough to the east. The catchment is predominantly urbanised. In the upstream reaches of the catchment lie the settlement of Crowthorne and the southwest end of Bracknell. The main urban area is the town of Wokingham which lies in the centre of the catchment. To the north the catchment covers the eastern side of Winnersh.

Emm Brook originates as a series of drainage channels in the southeast of the catchment to the east of Crowthorne. The watercourse then flows in a north-westerly direction through the catchment where it is joined by several further unnamed drainage channels. It is designated a Main River to the south of Wokingham. It then continues to flow in a north-westerly direction through the west side of Wokingham and to the east of Winnersh before its confluence with the River Loddon by the village of Hurst.

Fluvial flood risk

The fluvial flood risk within the catchment follows the path of Emm Brook from its source, through Wokingham and Winnersh, and then widens at its confluence with the River Loddon. There is also fluvial risk along the main tributaries of Emm Brook, to the north and south of Wokingham and in the southwest of the catchment. The broadscale CIA showed that fluvial flood risk in the catchment is generally low with only a small

percentage of properties shown to be sensitive to increases in fluvial flood risk. Table 4-1 details the sites within this catchment that are shown to be at fluvial risk.

Table 4-1: Sites at fluvial flood risk within Emm Brook catchment.

Site	Location	Description of fluvial flood risk
5WK006	Land south of Gipsy Lane, south of Wokingham	West side of the site affected by flood risk from Emm Brook
5WK045	Land at Bridge Retail Park, south of Wokingham	East side of the site affected by flood risk from Emm Brook
5WI004, 006 and 010	Land off Poplar Land and Watmore Lane, east of Winnersh	Centre of the site affected by flood risk from Emm Brook which bisects the site
5HU009 and combined sites	Oak View Farm, Forest Road	Small area of flood risk on the site from a tributary of Emm Brook which flows in a westerly direction through the northeast of the catchment
5WK051	Land east of Toutley Depot, Wokingham	Small area of flood risk on the site from a tributary of Emm Brook which flows in a westerly direction through the northeast of the catchment
5WW030, 017 and 026	South Wokingham Master Planning Area	Flood risk along the southern boundary from a tributary of Emm Brook
5WW009	Ravenswood Village, west of Crowthorne	Flood risk in the north and west of the site from two tributaries of Emm Brook, which flow through the north and west sides of the site.

Three sites within the Emm Brook catchment (5WI004, 006 and 010; 5WK006; and 5WK045) lie partially within EA FWAs. The EA should be consulted on any proposed development within existing FWAs to ensure that adequate flood warning procedures and evacuation processes are in place and that Risk Management Authorities (RMAs) are not put under any additional burden.

Historic flooding

There are historic flooding incidents recorded across the catchment. Several of these correlate with the fluvial flood risk from Emm Brook and its tributaries although some are also more widespread, particularly across the settlements of Wokingham and Winnersh. There are widespread records of fluvial and surface water flooding across the catchment during the July 2007 floods, with additional incidences in December 2000, 2008, 2013 and 2015. There are seven sewer flooding incidents located in Winnersh and the northwest of Wokingham.

The following sites are within, or partially within a 250m historic flooding hotspot:

- 5WK006
- 5WK015
- 5WK028 and combined sites
- 5WK042
- 5WK045
- 5WK047
- 5WI009 and 019

Surface water flood risk

Surface water flood risk across the catchment is distributed widely along roads through the urban areas as well as natural topographic depressions and channels. The broadscale CIA assessment shows there are a large number of receptors across the catchment shown to be at risk of surface water flooding and the catchment is sensitive to increases in surface water flooding in future. It is therefore particularly important that development does not increase runoff and contribute to the existing known surface water issues and that careful consideration is given to proposals that affect the natural storage and flow of surface water.

Recommendations

As the main areas of risk are distributed across the catchment, particularly in the downstream areas in the centre and north of the catchment, there is the potential for upstream measures, such as SuDS implementation and preservation and enhancement of natural surface water storage mechanisms, to reduce the risk to these areas.

The majority of potential future development within the catchment appears to be predominantly at greenfield locations, therefore there are unlikely to be many potential opportunities to provide additional betterment for SuDS and surface water attenuation beyond the existing runoff rate although there are some smaller sites of proposed development at brownfield locations, particularly within the centre of Wokingham, where betterment could be achieved.

However, developers should consider options for oversized SuDS, particularly on the upstream greenfield sites, to contribute to a reduction in flood risk downstream. As the upstream end of the catchment lies within Bracknell Forest Borough, WBC should work in partnership with the neighbouring authority to identify any opportunities for development within Bracknell Forest Borough to reduce flood risk downstream in Wokingham. There are currently a number of greenfield promoted sites within the catchment in Bracknell Forest Borough where there may be potential to implement oversized SuDS and NFM features to reduce flood risk downstream in Wokingham Borough.

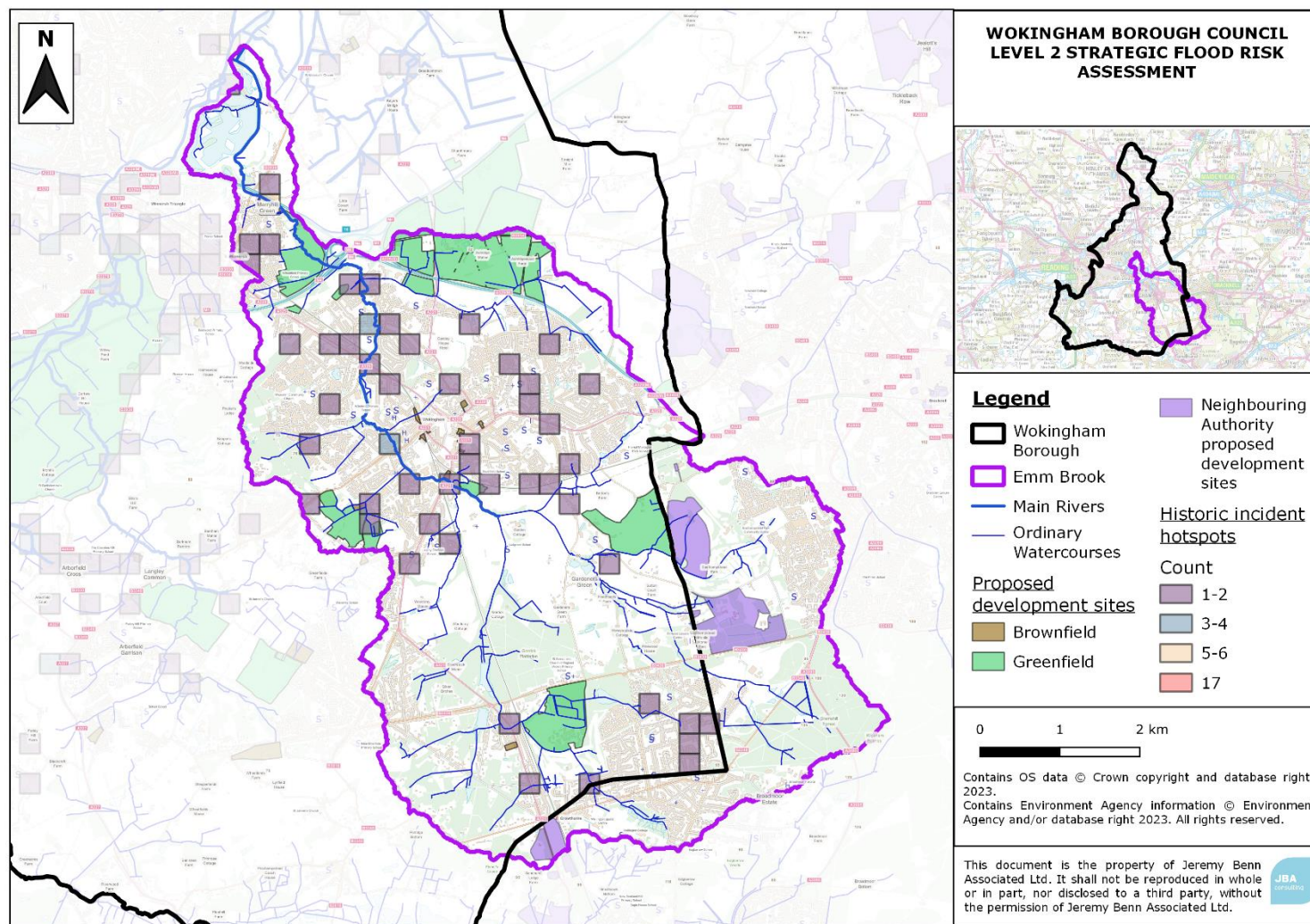


Figure 4-1: Watercourses, proposed development sites, and historic flooding hotspots within the Emm Brook catchment.

4.1.2 Barkham Brook

Catchment overview

Figure 4-2 shows the catchment boundary, main watercourses, historic flooding incident hotspots, and proposed development sites for Barkham Brook.

Barkham Brook catchment lies fully within the south end of Wokingham Borough. The catchment is predominantly rural but includes three main settlements: Barkham in the northeast, Finchampstead North in the southeast, and Arborfield Garrison Strategic Development Location (SDL) in the south of the catchment.

Barkham Brook rises to the east and west of Finchampstead North as a series of drainage channels. It is designated a Main River downstream of Barkham Street which it crosses to the south of the village of Barkham. The path of Barkham Brook is predominantly rural downstream of where it flows through Arborfield Garrison SDL. Barkham Brook continues to flow in a north westerly direction through the catchment towards its confluence with the River Loddon.

Fluvial flood risk

The fluvial flood risk within the catchment follows the path of Barkham Brook, along the main upstream drainage channels and then along the main channel through the catchment. The broadscale CIA showed that fluvial flood risk in the catchment is generally low and the catchment is not sensitive to increases in fluvial flood risk. Two development sites in the catchment are proposed in areas of fluvial flood risk. Barkham Brook flows in a northerly direction and bisects a proposed development site (5BA010) to the north of Arborfield Garrison SDL. Barkham Brook then flows in a north westerly direction where it flows through the large Hall Farm / Loddon Valley proposed strategic site (5AR011 and combined sites) to join the River Loddon, which also flows through this site.

One site within the Barkham Brook catchment (5AR011 and combined sites) lies partially within an EA FWA. The EA should be consulted on any proposed development within existing FWAs to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.

Historic flooding

There are a couple of historic flood hotspots which correlate with the flood risk from Barkham Brook within 5AR011 and combined sites.

Other sites within, or partially within a 250m historic flooding hotspot include:

- 5BA010
- 5WK028 and combined sites
- 5FI032

- 5BA013
- 5WK028 and combined sites (although most of this site lies outside this catchment)

There are six sewer flooding incidents recorded around the settlements of Arborfield Garrison SDL and Barkham. There are fluvial flooding incidences located along the path of Barkham Brook and its tributaries from the Summer 2007 floods and further surface water flooding incident records around Arborfield Garrison SDL.

Surface water flood risk

Given the suburban/rural mixed nature of the catchment, surface water flood risk is distributed widely across natural topographic depressions and channels as well as urban areas. The broadscale CIA assessment shows that although the rural nature of the catchment limits the number of receptors at risk of surface water flooding, the catchment is highly sensitive to increases in surface water flooding in future. It is therefore particularly important that development does not increase runoff and contribute to the existing known surface water issues and that careful consideration is given to proposals that affect the natural storage and flow of surface water.

Recommendations

As the main areas of risk are distributed across the catchment, there is the potential for upstream measures, such as SuDS implementation and preservation and enhancement of natural surface water storage mechanisms, to reduce the risk to these areas.

The majority of potential future development within the catchment appears to be predominantly at greenfield locations, therefore there are unlikely to be many potential opportunities to provide additional betterment for SuDS and surface water attenuation beyond the existing runoff rate although there are some smaller sites of proposed development at brownfield locations where betterment could be achieved. However, given the large amount of development proposed in this catchment and its rural nature, there are likely to be good opportunities to use oversized SuDS and natural flood management features across the larger development sites (particularly 5BA010 and 5BA033, 032 and 034) to reduce flood risk downstream.

The Hall Farm / Loddon Valley strategic site (5AR011 and combined sites) proposed in the downstream end of the catchment at the confluence of Barkham Brook and the River Loddon has good potential to use oversized SuDS and NFM features to reduce downstream flood risk outside the catchment along the River Loddon. The LLFA should work closely with the EA to identify any areas of land at this watercourse confluence that should be safeguarded for any future flood alleviation and NFM features.

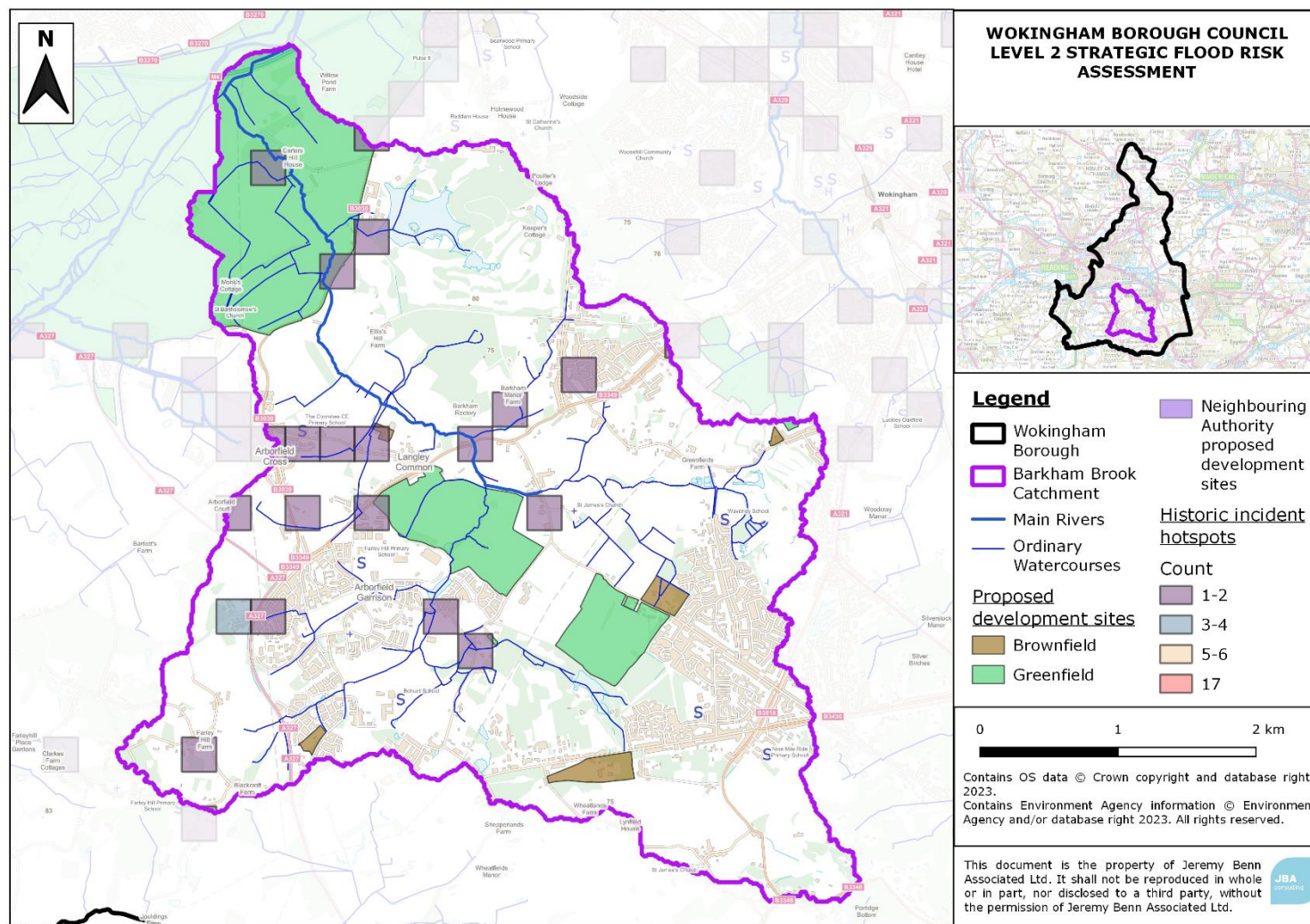


Figure 4-2: Watercourses, proposed development sites, and historic flooding hotspots within the Barkham Brook catchment.

4.1.3 Loddon (Swallowfield to River Thames confluence)

Catchment overview

Figure 4-4 shows the catchment boundary, main watercourses, historic flooding incident hotspots, and proposed development sites for the Loddon (Swallowfield to River Thames confluence) catchment.

The Loddon (Swallowfield to River Thames confluence) catchment covers large parts of the west and centre of Wokingham Borough. The catchment lies predominantly within Wokingham Borough, extending slightly into Reading Borough in the west. The catchment is predominantly urban, covering the eastern side of Reading, with some more rural areas in the upstream and downstream ends of the catchment.

The River Loddon enters the catchment in the south at Swallowfield and then flows in a northerly direction around the east side of Reading and to the west of Winnersh, Twyford and Ruscombe to join the River Thames west of Wargrave. The River Thames flows in a north easterly direction along the northern boundary of the catchment between Sonning and Wargrave.

Fluvial flood risk

The fluvial flood risk within the catchment follows the paths of the River Loddon and the River Thames. The broadscale CIA showed that fluvial flood risk to receptors across the catchment is relatively low and not particularly sensitive to increases in fluvial flood risk. There are six sites across the catchment which are proposed in areas of flood risk. In the south of the catchment, the River Loddon flows in a northerly direction impacting the east side of the combined site 5SH023 and 027 and site 5SH025. The Loddon then flows through the centre of the Hall Farm / Loddon Valley strategic site (5AR011 and combined sites) bisecting the site. Sites 5WI008, located to the north of 5AR011 and combined sites, and 5WO004, in the east of Woodley, are also impacted by the River Loddon. In the north of the catchment, 5CV001 is located to the south of the confluence of the River Thames and River Loddon and is impacted by flood risk from the Loddon along the east side of the site.

There are EA FWAs which follow the path of the River Loddon through this catchment. The following sites lie partially within an EA FWA:

- 5EA002
- 5WI004, 006 and 010
- 5WK006
- 5WK045
- 5SH025
- 5AR011 and combined sites
- 5SW005
- 5SH023 and 027

- 5CV001
- 5WI008
- 5WO004

The EA should be consulted on any proposed development within existing FWAs to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.

Historic flooding

The broadscale CIA ranked this catchment as high risk for historic flooding, with 49 historic incidents recorded by WBC and 34 sewer flooding incidents recorded by Thames Water. The flooding incidents recorded by WBC are widely distributed across the catchment. Some incidents correlate with the flood risk along the River Loddon and River Thames but are also distributed across the urban areas further from the watercourses. The main flooding incidents recorded are in July 2007, with widespread fluvial flooding particularly across Lower Earley and Winnersh, and in January 2013, with widespread fluvial and surface water flooding distributed across the catchment. The sewer flooding incidents are distributed across the catchment, particularly at Shinfield, in the east side of Woodley, and around Winnersh.

The following sites are within, or partially within a 250m historic flooding hotspot:

- 5BA010
- Combined site 5RU001-006
- 5RU007
- 5WI008
- 5WK006
- 5WK015
- 5WK028 and combined sites
- 5WK042
- 5WK045
- 5WK047
- 5WO004
- 5HU019
- 5HU030
- 5FI032
- 5BA013
- 5SH025
- 5WI009 and 019
- 5AR011 and combined sites

Surface water flood risk

Surface water flood risk across the catchment is distributed widely along roads through the urban areas as well as natural topographic depressions and channels.

The broadscale CIA assessment shows the catchment is sensitive to increases in surface water flooding in future. It is therefore particularly important that development does not increase runoff and contribute to the existing known surface water issues and that careful consideration is given to proposals that affect the natural storage and flow of surface water.

Recommendations

As the main areas of risk are distributed across the catchment, there is the potential for upstream measures, such as SuDS implementation and preservation and enhancement of natural surface water storage mechanisms, to reduce the risk to these areas. The Hall Farm / Loddon Valley strategic development site is located upstream along the River Loddon which has good potential to provide options for upstream measures, such as storage, NFM measures and oversized SuDS, to reduce the flood risk along the River Loddon downstream.

The majority of potential future development within the catchment appears to be predominantly at greenfield locations, therefore there are unlikely to be many potential opportunities to provide additional betterment for SuDS and surface water attenuation beyond the existing runoff rate although there are some smaller sites of proposed development at brownfield locations within the urban settlements where betterment could be achieved.

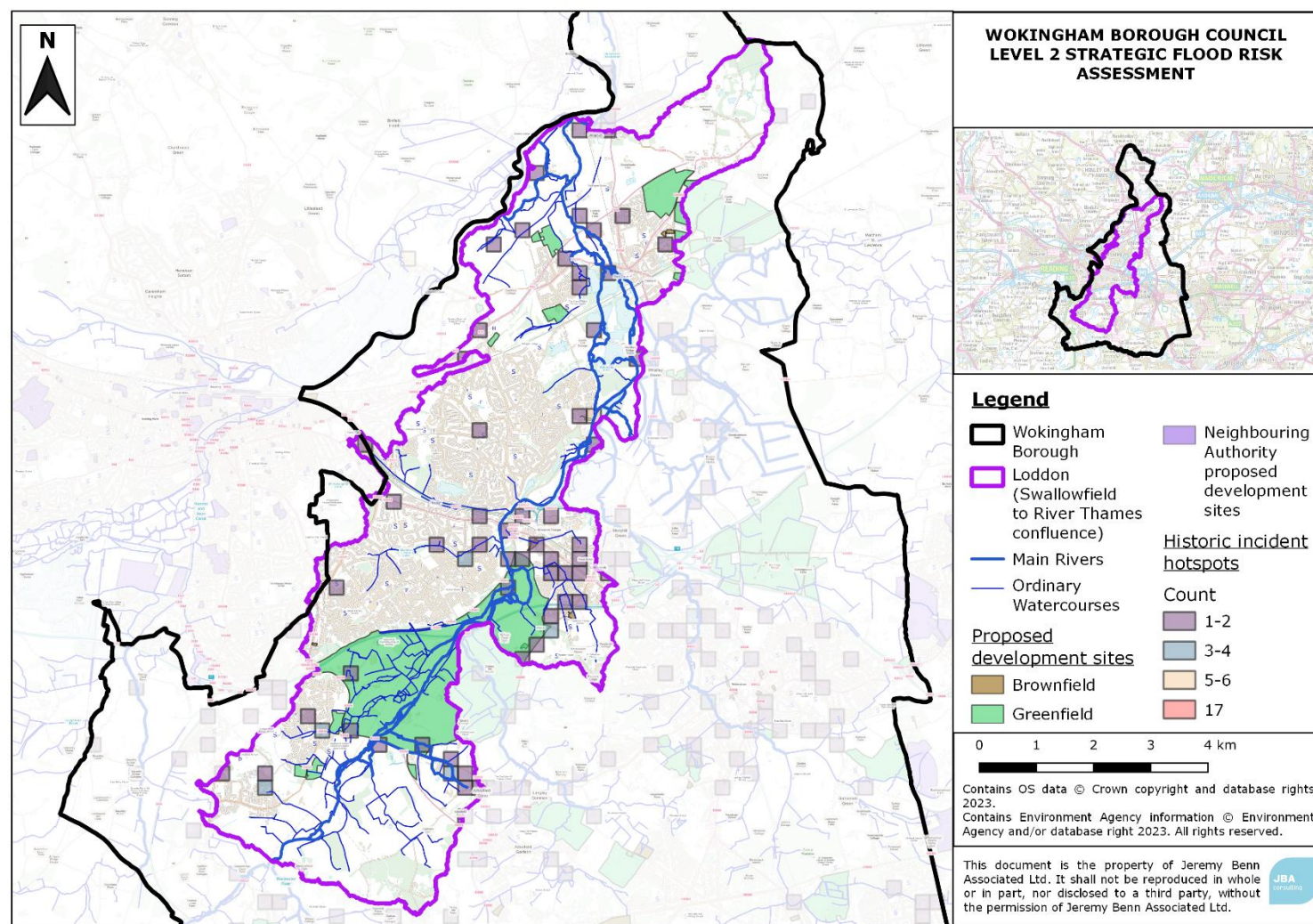


Figure 4-3: Watercourses, proposed development sites, and historic flooding hotspots within the Loddon (Swallowfield to River Thames confluence) catchment

4.1.4 Twyford Brook

Catchment overview

Figure 4-4 shows the catchment boundary, main watercourses, historic flooding incident hotspots, and proposed development sites for the Twyford Brook catchment.

Twyford Brook catchment lies along the eastern side of Wokingham Borough. The downstream western half of the catchment lies within Wokingham Borough whilst the upstream eastern half of the catchment lies mostly within the Royal Borough of Windsor and Maidenhead with a small southeast section of the catchment falling within Bracknell Forest Borough. The catchment is predominantly rural with a small number of settlements: Waltham St Lawrence in the north, part of Binfield in the southeast, part of Twyford in the west and Hurst in the west.

Twyford Brook rises in the northeast of the catchment with a northern branch forming to the south of Waltham St Lawrence and a southern branch forming to the north of Hungerford. These are fed by a number of small unnamed drainage channels. These two branches of Twyford Brook converge by Stanlake Park and then flow in a clockwise direction around the south end of Twyford, where it is joined by several tributaries which drain the south and west of the catchment. The Brook then continues in a northerly direction to the west of Twyford to its confluence with the River Loddon.

Fluvial flood risk

The fluvial flood risk within the catchment follows the path of the River Twyford, along the main channel and its main tributaries downstream of Waltham St Lawrence. The flood risk from the River Loddon is also shown to encroach on the western boundary of the catchment. The broadscale CIA showed that fluvial flood risk in the catchment is generally low although there are some areas which are sensitive to increases in fluvial flood risk. Three development sites in the catchment are proposed in areas of fluvial flood risk, which all fall within Wokingham Borough. Two sites are proposed along a southern tributary of Twyford Brook: site 5HU055, adjacent to Cartref Farm, is surrounded by Flood Zone 2 whilst the northeast end of site 5HU030, to the northwest of Hogmoor Lane, is affected by Flood Zones 3b, 3a and 2. In the north of the catchment, Twyford Brook flows in a westerly direction to the south of the combined site 5RU001-006, and the southeast of the site is at fluvial flood risk.

Historic flooding

Historic flooding information is not available across the east of the catchment which falls outside of Wokingham Borough. Most of the historic flooding hotspots lie along Twyford Brook and its main tributary from the south.

Sites within, or partially within a 250m historic flooding hotspot include:

- Combined site 5RU001-006
- 5HU030

- 5HU019

There is one sewer flooding incident recorded within the catchment. There are fluvial flooding incidences located along the path of Twyford Brook, to the south of Twyford, and its tributaries from the south, across several flooding events. There are also further surface water flooding incident records in the north of the catchment along the A4, along the B3024 east of Twyford, and along the B3030 south of Twyford.

Surface water flood risk

Given the suburban/rural mixed nature of the catchment, surface water flood risk is distributed widely across natural topographic depressions and channels as well as urban areas. The broadscale CIA assessment shows the catchment is not particularly sensitive to increases in surface water flooding in future. However, it is still important that development does not increase runoff and contribute to the existing known surface water issues and that careful consideration is given to proposals that affect the natural storage and flow of surface water.

Recommendations

As the main areas of risk are distributed across the catchment, there is the potential for upstream measures, such as SuDS implementation and preservation and enhancement of natural surface water storage mechanisms, to reduce the risk to these areas. The upstream area of this catchment falls across the Royal Borough of Windsor and Maidenhead and Bracknell Forest Borough so there may be opportunities for partnership working to enhance upstream storage within these Boroughs to reduce the flood risk within Wokingham Borough downstream. There are currently nine proposed sites within the southeast upstream end of the catchment within Bracknell Forest Borough.

The majority of potential future development within the catchment appears to be predominantly at greenfield locations, therefore there are unlikely to be many potential opportunities to provide additional betterment for SuDS and surface water attenuation beyond the existing runoff rate although there are some smaller sites of proposed development at brownfield locations where betterment could be achieved. The use of oversized SuDS and NFM features, particularly at site 5HU009, a large proposed housing development upstream in the catchment, could also help reduce flood risk downstream.

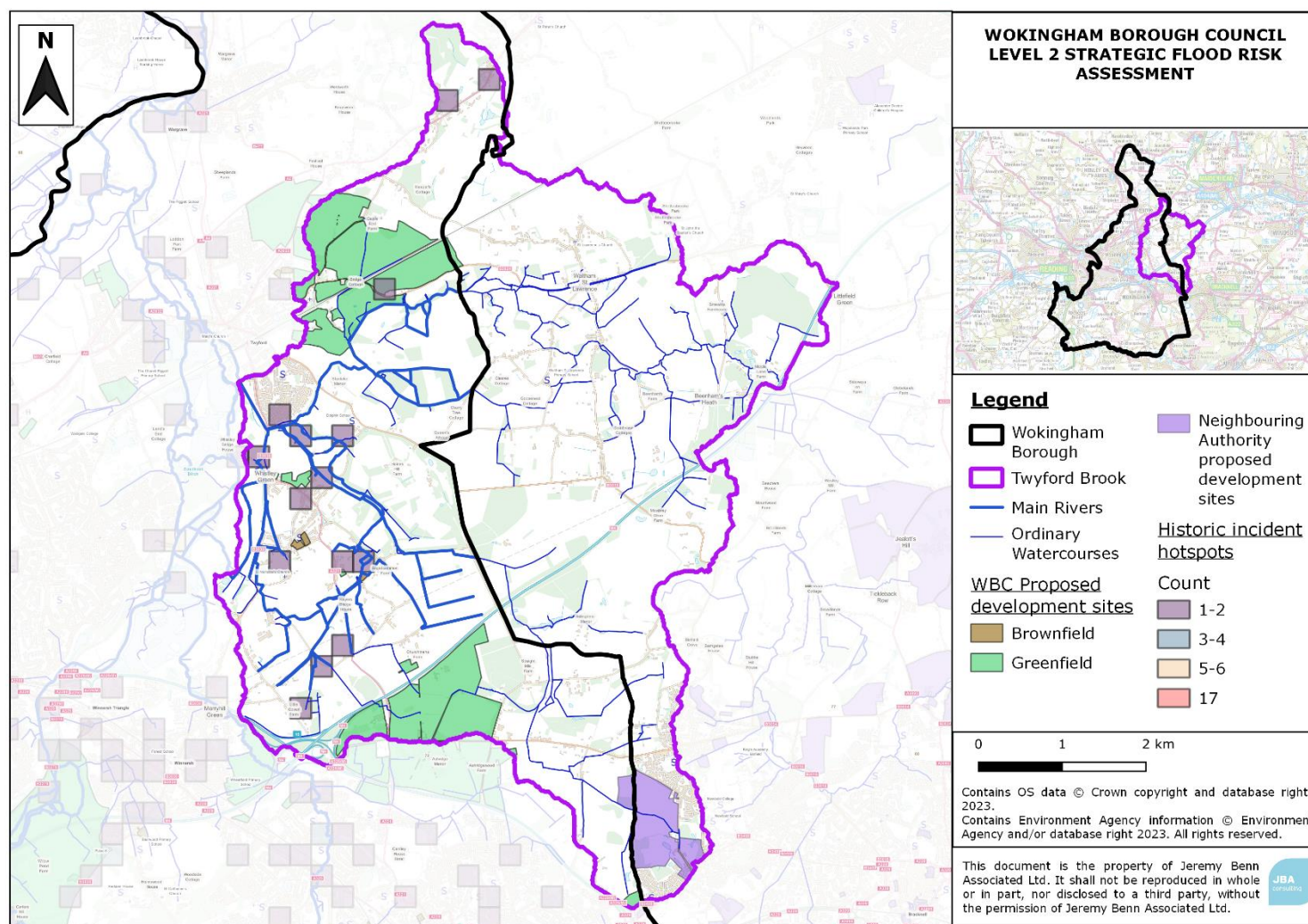


Figure 4-4: Watercourses, proposed development sites, and historic flooding hotspots within the Twyford Brook catchment

5 Recommendations

5.1 Broadscale recommendations

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, and appropriate consideration is given to surface water flow paths and storage proposals, then development should normally not increase flood risk downstream.

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

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

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

- WBC should work closely with neighbouring local authorities to develop complementary Local Planning Policies for catchments that drain into and out of the area to other local authorities in order to minimise any cross-boundary issues of cumulative impacts of development.
- Developers should incorporate SuDS and provide details of adoption, ongoing maintenance, and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure where practicable. Developers should refer to the relevant Lead Local Flood Authority (LLFA) guidance for the requirements for SuDS in Wokingham Borough. Further guidance on SuDS can be found in Section 9 of the Level 1 main report.
- WBC as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should consider all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.
- Where appropriate, the opportunity for NFM in rural areas, SuDS retrofit in urban areas and river restoration should be maximised. Culverting should not be supported, and day-lighting existing culverts should be promoted through new developments.

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

Catchment-specific recommendations are made for the high-risk catchments below.

5.2 Recommendations for high-risk catchments

High risk catchments are detailed in Table 3-4. From analysing the results produced above, high-level recommendations for flood storage and betterment have been proposed for sites in each of the high risk catchments. These recommendations should be considered by developers as part of a site-specific assessment, but more detailed modelling must be undertaken by the developer to ascertain the true storage needs and potential at each site at the planning application stage. The FRA should consider the potential cumulative effects of all proposed development and how this affects sensitive receptors.

- Development should not exceed existing greenfield rates and adequate sewer systems should be provided to ensure the development does not increase runoff and contribute to the existing known surface water issues.
- Developers should include a construction surface water management plan to support the Construction Drainage Phasing Plan. This should provide information to the EA, the LLFA and the LPA regarding the proposed approach to surface water management in storm events during the construction phase.
- For developments in high risk catchments, the LLFA and LPA should consult with Local Not-For-Profit organisations such as wildlife trusts, rivers trusts and catchment partnerships. This will help to understand ongoing and upcoming projects where NFM, flood storage and attenuation, and environmental betterment may be possible alongside developments and aid in reducing flood risk.

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

5.2.1 Emm Brook

The following recommendations are specific to the Emm Brook catchment:

- For proposed development within existing EA FWAs, developers should consult the EA to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.
- Developers should consider options for oversized SuDS, particularly on the upstream greenfield sites, to contribute to a reduction in flood risk downstream.
- WBC should work in partnership with the Bracknell Forest Borough Council to identify any opportunities for implementation of oversized SuDS or NFM features within Bracknell Forest Borough to reduce the downstream flood risk within Wokingham Borough.
- As the catchment drains through Wokingham and Winnersh, the LPA should work closely with the EA and LLFA to identify any areas of land that should be safeguarded for future flood alleviation schemes and NFM features to reduce flood risk to these settlements.

5.2.2 Barkham Brook

The following recommendations are specific to the Barkham Brook catchment:

- For proposed development within existing EA FWAs, developers should consult the EA to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.
- Developers should consider options for oversized SuDS, particularly on the larger greenfield sites, to contribute to a reduction in flood risk downstream both in the catchment and outside of the catchment.
- The Hall Farm / Loddon Valley strategic site (5AR011 and combined sites) proposed in the downstream end of the catchment may provide opportunities to utilise oversized SuDS and NFM features to reduce downstream flood risk outside the catchment along the River Loddon. The LLFA should work closely with the EA to identify any areas of land at this watercourse confluence that should be safeguarded for any future flood alleviation and NFM features.

5.2.3 Loddon (Swallowfield to River Thames confluence)

The following recommendations are specific to the Loddon (Swallowfield to River Thames confluence) catchment:

- For proposed development within existing EA FWAs, developers should consult the EA to ensure that adequate flood warning procedures and evacuation processes are in place and that RMAs are not put under any additional burden.
- The proposed Hall Farm / Loddon Valley strategic development site (5AR011 and combined sites) is located upstream along the River Loddon which may provide options for upstream measures, such as storage, NFM measures and oversized SuDS, to reduce the flood risk along the River Loddon downstream.
- As the catchment drains through Reading, the LPA should work closely with the EA and LLFA to identify any areas of land that should be safeguarded for future flood alleviation schemes and NFM features to reduce flood risk to this settlement.

5.2.4 Twyford Brook

The following recommendations are specific to the Twyford Brook catchment:

- WBC should work in partnership with the Royal Borough of Windsor and Maidenhead Council and Bracknell Forest Borough Council to identify any opportunities for implementation of oversized SuDS or NFM features within these neighbouring authorities to reduce the downstream flood risk.
- Developers should consider the use of oversized SuDS and NFM features to reduce downstream flood risk. In this catchment a key site for this is 5HU009 and combined sites, a large housing development located upstream in the catchment.

5.3 Development within medium risk catchments

Medium risk catchments are detailed in Table 3-5. Catchments that have been scored an overall ranking of medium, but where development proposals are present should also consider the following recommendations:

- Development should not exceed existing greenfield rates and adequate sewer systems should be provided to ensure the development does not increase runoff and contribute to existing surface water issues.
- LPAs should work closely with the EA and the LLFA to identify any areas of land that should be safeguarded for any future flood alleviation schemes and NFM features.
- There is the potential for development in these catchments to contribute towards works to reduce flood risk and enable regeneration as well as contributing to the wider provision of green infrastructure.