Section 19 Flood Investigation Report

Date: 8th August 2025

Section 19 Flood Investigation Report: Hanover Gardens

Date of Flood Incident: 23rd September 2024

Revision Schedule

Version	Date	Details	Author	Checked	Approved
1	25/04/2025	Hanover Gardens Draft Flood Investigation Report for OCC comment	N Cain	T Luck	T Byres
2	30/04/2025	Hanover Gardens Draft Flood Investigation Report for RMA comment	N Cain	T Luck	T Byres
3	15/07/2025	Hanover Gardens Draft Flood Investigation Report for OCC / RMA final check	N Cain	T Luck	T Byres
4	08/08/2025	Hanover Gardens Flood Investigation Report Final	J Linnane	T Luck	B Mitchell
5	21/01/2026	Accessibility Review	J Linnane	T Luck	B Mitchell

Executive Summary

This Section 19 (S19) Flood Investigation Report has been issued by Oxfordshire County Council (OCC) in its capacity as Lead Local Flood Authority (LLFA). It is based upon an investigation by OCC and Cherwell District Council (CDC) into the floods that occurred during September 2024 in Hanover Gardens.

September 2024 Flood Event

It was deemed necessary to complete a formal investigation into the flood incidents in Hanover Gardens due to flooding of properties which are classified as critical infrastructure (Hanover Gardens retirement apartments/nursing home) and also because of the number of properties that reported flooding internally. The apartments on Hanover Gardens were confirmed to have been flooded by CDC. As such the flooding that occurred met the OCC threshold for undertaking a formal Section 19 flood investigation.

Flooding was reported to have occurred on the 23rd and 24th of September 2024 within Hanover Gardens due to raised river levels in the Town Brook (also referred to as the Bure Brook), which flows adjacent to the properties through central Bicester. Raised river levels followed a period of unprecedentedly high rainfall in late September 2024. This rainfall peaked on the 22nd September when daily rainfall depths reached its highest ever recorded level of 74mm (since records began in April 1984) at the Bicester rainfall gauge.

The heavy rainfall fell over a relatively short period, leading to increased river levels and surface water runoff. The sheer volume of water caused the channel to reach its capacity and overtop the banks at several locations. The channel exceedance also prevented additional surface water from entering the channel and draining away.

The performance of the Town Brook and Back Brook culverts and trash screens were investigated due to their involvement in the flooding that occurred in 2013, but both culverts were found to have been functioning normally with no blockages.

This report provides a number of recommendations aimed at maintaining current systems, increasing preparedness, and identifying potential solutions to mitigate future risks; these recommendations are summarised below.

Main Recommendations

Recommendation	Lead Stakeholders	Consulting stakeholders
Local residents and Parish Council to set up a flood action group. Through this action group, discuss the issues and recommendations from this S19 report. With support from CDC & OCC develop emergency resilience plans.	Local residents, Parish Council	OCC, CDC, EA
Local residents to sign up for Flood Alerts and Warnings and develop a personal flood plan. Guidance on this can be found at: Oxfordshire County Council – Flood Toolkit	Local residents	Parish Council, CDC, OCC, EA
OCC to identify if there are any flood assets that need to be added to the local flood register.	OCC	OCC Highways, CDC, EA
EA to review the current flood map which looks to exclude properties in Hanover Gardens from areas considered to be at risk of fluvial flooding during extreme events.	EA	
EA to continue with the ongoing annual maintenance of Main River culverts and trash screens on behalf of the riparian owners. This should include the continued maintenance of Town Brook, Back Brook and other culverts and be undertaken according to level of risk present.	EA	OCC, CDC,
Environment Agency to consider using their powers under the Land Drainage Act 1991 to ensure riparian owners carry out required maintenance.	EA,	Landowners
Consider the feasibility of constructing a small bund or wall adjacent to left bank of Town Brook to protect properties from out of bank flooding. The technical feasibility will need to ensure that flood risk would not be transferred elsewhere.	EA, OCC	CDC
Consider working with landowners to discuss willingness for natural flood management (NFM) measures to be implemented on rural land upstream of Bicester to slow and / or attenuate flows.	EA, OCC	Landowners, Parish Council, CDC
Explore the feasibility of implementing upstream flood alleviation measures and / or retrofitting SuDS to slow and / or attenuate flows reaching the Town Brook.	OCC	EA, CDC, Landowners Parish Council

Explore the willingness to implement property flood resilience measures (PFR). Guidance on PFR measures can be viewed through Ciria document (C790F) and a link to this document is provided below: https://www.ciria.org/ItemDetail?iProductCode=C790F&Category=FREEPUBS&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 Funding in the form of grants, may be available to support the property owners in delivering PFR measures – see Section 5.1.	Property owners	OCC, CDC, Parish Council

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1. INTRODUCTION

1.1. Lead Local Flood Authority (LLFA) Investigation

Section 19 of the Flood and Water Management Act (F&WMA) states:

1) On becoming aware of a flood in its area, a LLFA must, to the extent that it considers it necessary or appropriate, investigate: -
   a. which risk management authorities have relevant flood risk management functions, and
   b. whether each of those risk management authorities has exercised, or is
   c. proposing to exercise, those functions in response to the flood.

2) Where an authority carries out an investigation under subsection (1) it must: -
   a. publish the results of its investigation, and
   b. notify any relevant risk management authorities.

The LLFA have a set criteria which determines when a S19 report is required. The criteria are set out below.

LLFA/OCC Criteria

- Internal flooding (excluding to basements) to five or more residential properties or businesses within and area of 1km².

- Internal flooding of a business premises employing more than 10 people within an area of 1km².

- Internal flooding (excluding to basements) of at least one property or business for one week or longer.

- Flooding of one or more items of critical infrastructure, which could include hospitals, health centres, clinics, surgeries, colleges, schools, day nurseries, nursing homes, emergency services (police, fire, ambulance) stations, utilities and substations.

Caused a transport link to be impassable:

- Motorways, trunk roads, Class A and B highway closures shall all be investigated.

- Class C highways – 10 hours or more unless the route is the only means of access or is primary route for critical infrastructure then reduce to 4 hours.

- Class U highways – 24 hours or more unless the route is the only means of access or is primary route for critical infrastructure then reduce to 4 hours.

- All rail link closures shall be investigated.

Any flooding event that a risk management authority deems significant but does not meet the agreed thresholds should be put forward to the Agency flood group meeting for consideration.

1.2. Site Location and context

This report relates to a flood event which occurred in Hanover Gardens, Bicester OX26 (Figure 1) in September 2024. The town of Bicester is located within the Cherwell District of Oxfordshire, approximately 18km northeast of Oxford and 25km northwest of Aylesbury. Hanover Gardens is made up of a range private residential retirement apartments around Hanover Gardens (road) and Manorsfield Road, off the B4100 in central Bicester.

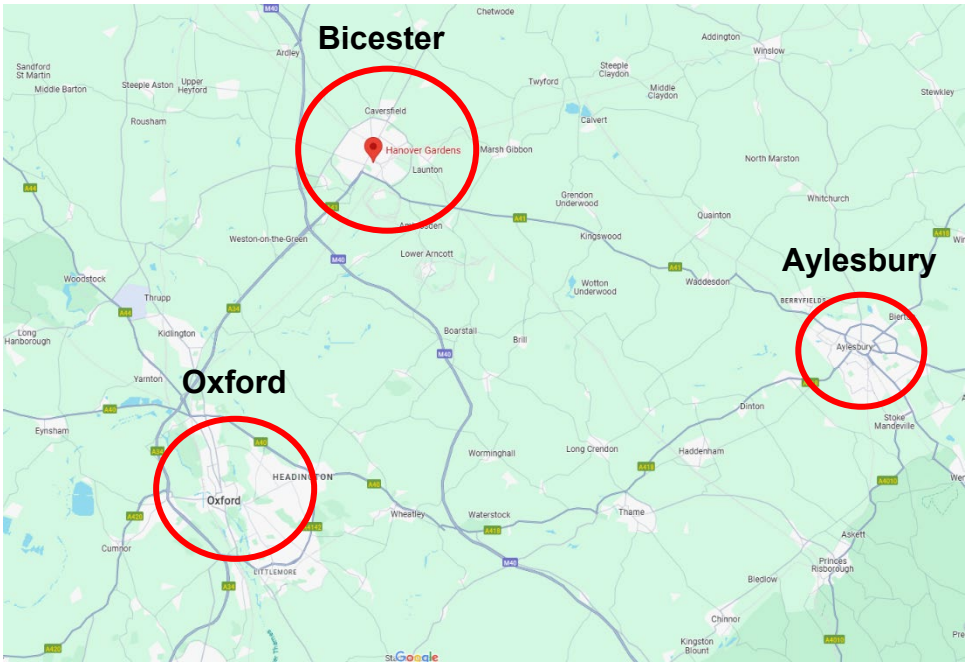

Figure 1 – Hanover Gardens in relation to Oxford and Aylesbury. (Source Google 2025.)

Figure 2 - Hanover Gardens and its position within Bicester. (Source OS Maps 2025.)

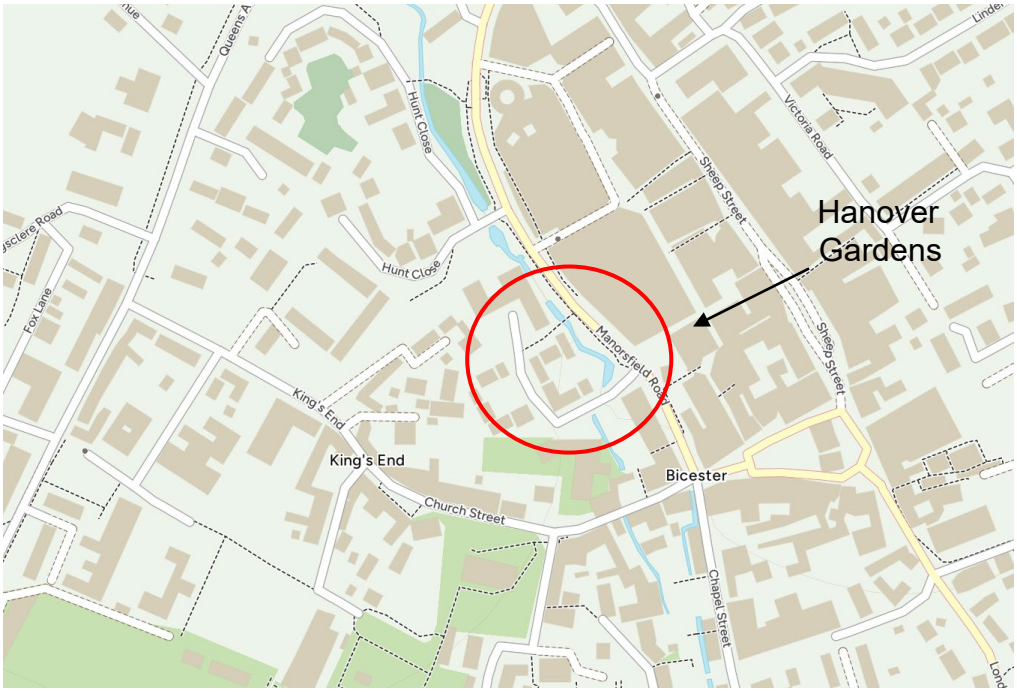

Figure 3 - Hanover Gardens in relation to the local area. (Source OS Maps 2025)

Bicester is a large market town with topography that changes from higher elevation in the northwest towards lower elevation in the southeast (with the exception of Graven Hill to the far southeast). Figure 4 shows a topographical map of the town, generated using 2023 1m Light detection and ranging (LiDAR) data, alongside the statutory Main River and water body catchment extent.

The Bure Brook (known locally as the Town Brook) flows south eastly through Bicester, passing under the A4095 and beneath the railway line, before flowing alongside Manorsfield Road towards Hanover Gardens. At Hanover Gardens there is a small overflow culvert to the west, known as the Back Brook (Figure 5). At this point both channels enter culverts (pipes), where issues surrounding trash screen blockage have caused the area to flood previously[1]. Both channels then continue in a combination of open channel and culvert until they rejoin south of Priory Lane. Town Brook then joins Pingle Brook upstream of the railway near Bicester Village. Town Brook, including the Back Brook, is classified as a Main River, including the point in which it flows past Hanover Gardens.

[1] Hanover Garden Flooding December 2013. Published July 2014. Available at: https://modgov.cherwell.gov.uk/documents/s22704/Appendix%201.pdf

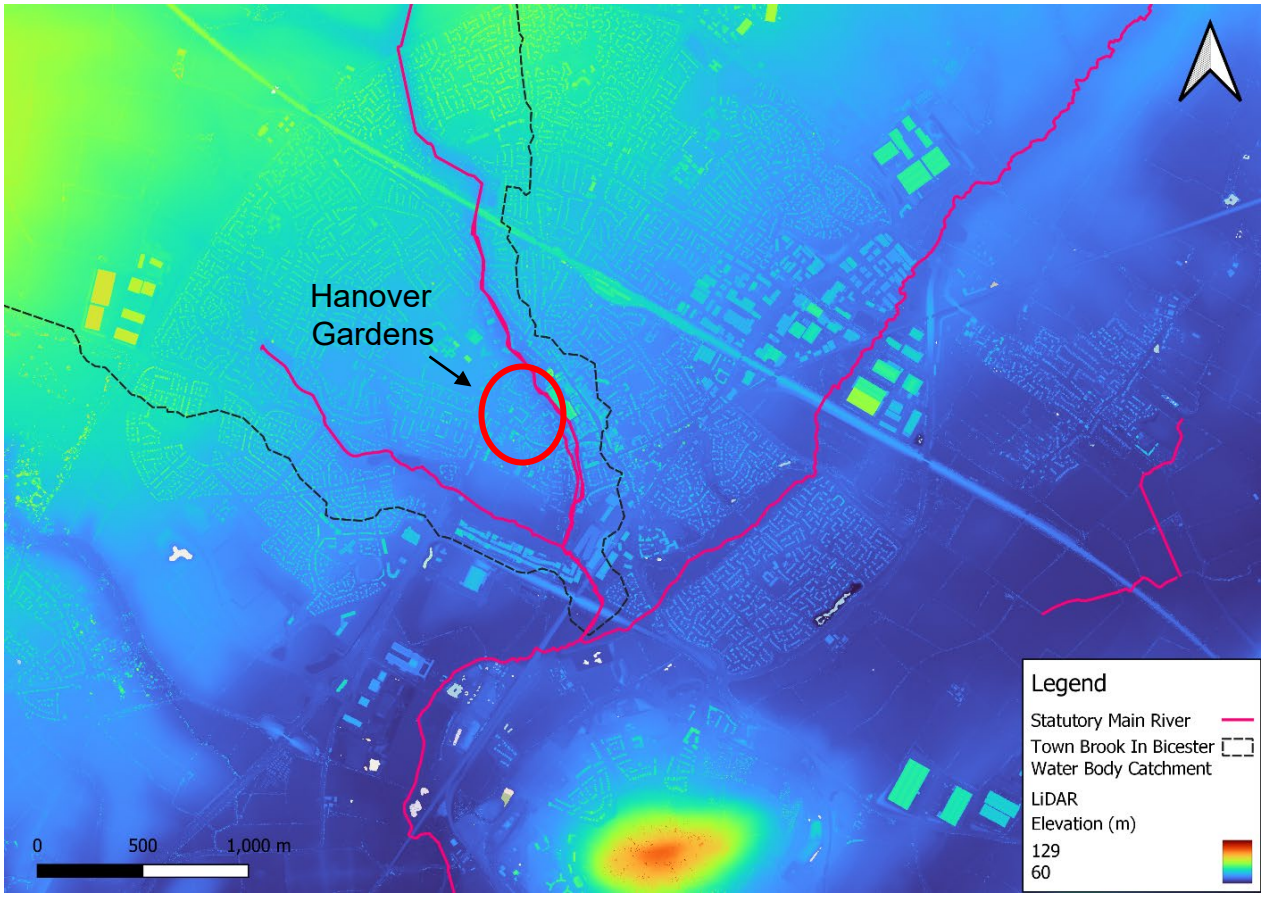

Figure 4 - Bicester elevation overview generated by LiDAR (DEFRA 2025), including Statutory Main River of Town Brook 2025

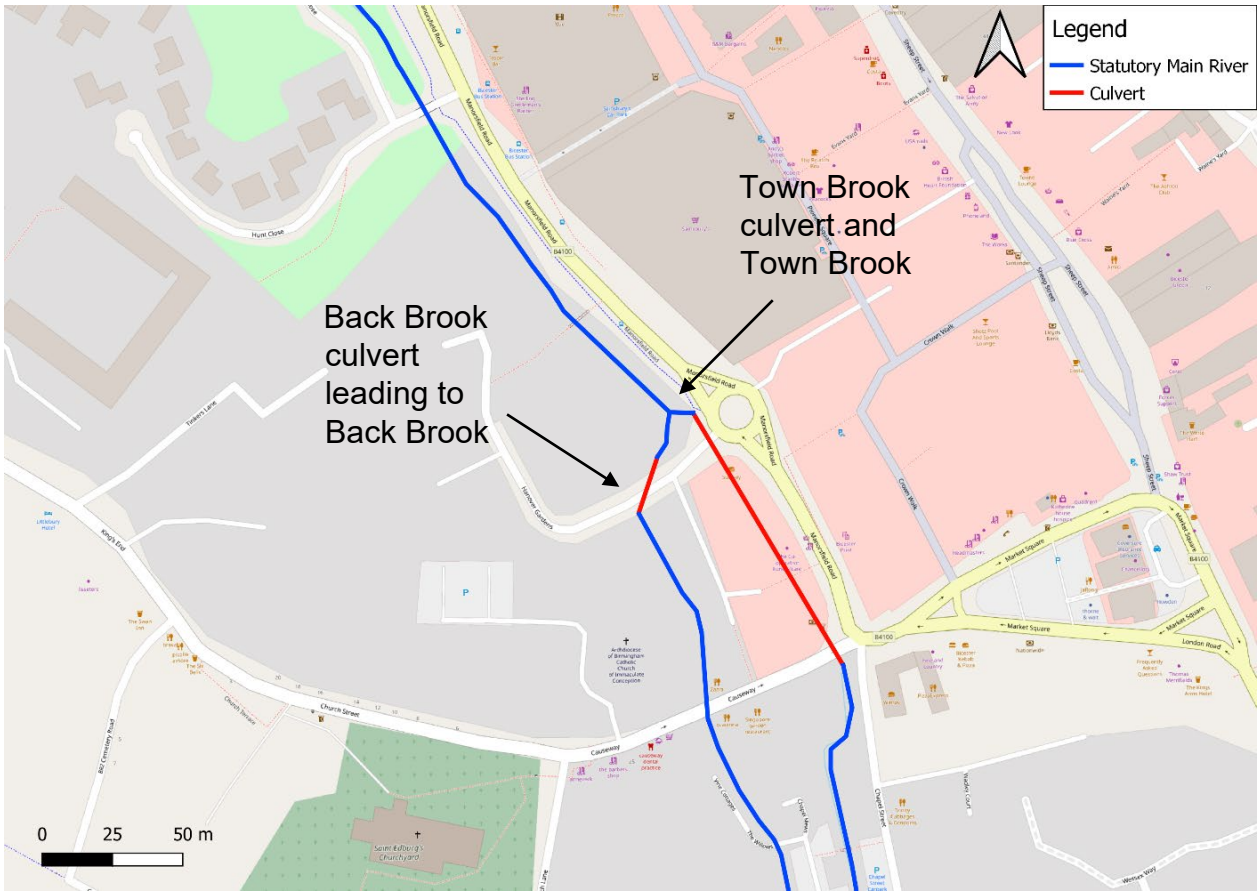

Figure 5 - Main River map showing the location where the Town Brook and Back Brook split into two culverts and continue downstream as separate watercourses. (Source: OS Maps & Statutory Main River Map 2025).

The Environment Agency are the lead risk management authority for Main Rivers which are typically larger rivers. In contrast, Ordinary Watercourses are generally smaller rivers, streams, or ditches of which LLFA's are the lead management authority. More information on these classifications can be found in Section 4 of this report.

The catchment area of the Town Brook upstream of Hanover Gardens is approximately 15km^2. Upstream of the A4095 ring road, the catchment is predominantly rural and characterised by agricultural fields. Downstream of the A4095 and through Bicester, the catchment is urbanised and much of this flow is managed through walled channels, culverts, drains and other means of flow control.

The Risk of Flooding from Rivers and the Sea (RoFRS) is shown in Figure 6. The region immediately adjacent to the Town Brook is classified as being at high risk of fluvial flooding with a greater than 3.33% Annual Exceedance Probability (AEP) of flooding in within a given year. The properties in Hanover Gardens, however, are currently shown to be in an area of very low fluvial flood risk with a less than 0.1% AEP of flooding. This is not consistent with historical flooding of the site nor the local topography and may need to be reviewed.

While fluvial flooding is an important consideration in this report, it is not the only consideration. Risk of Flooding from Surface Water (RoFSW) is also considered, especially when considering the capacity of the extensive drainage system in the area. Figure 7 shows the Risk of Flooding from Surface Water (RoFSW) classifications defined by the EA throughout Hanover Gardens. Most of Hanover Gardens is considered by the EA to be at low risk (less than 0.1% AEP), with the region alongside the Town Brook being at an increased, medium risk (between 3.33% and 1% AEP). A zone that is considered to be at high risk is also located immediately downstream of the Back Brook culvert. These zones are defined by localised low areas in topography rather than overland flow paths.

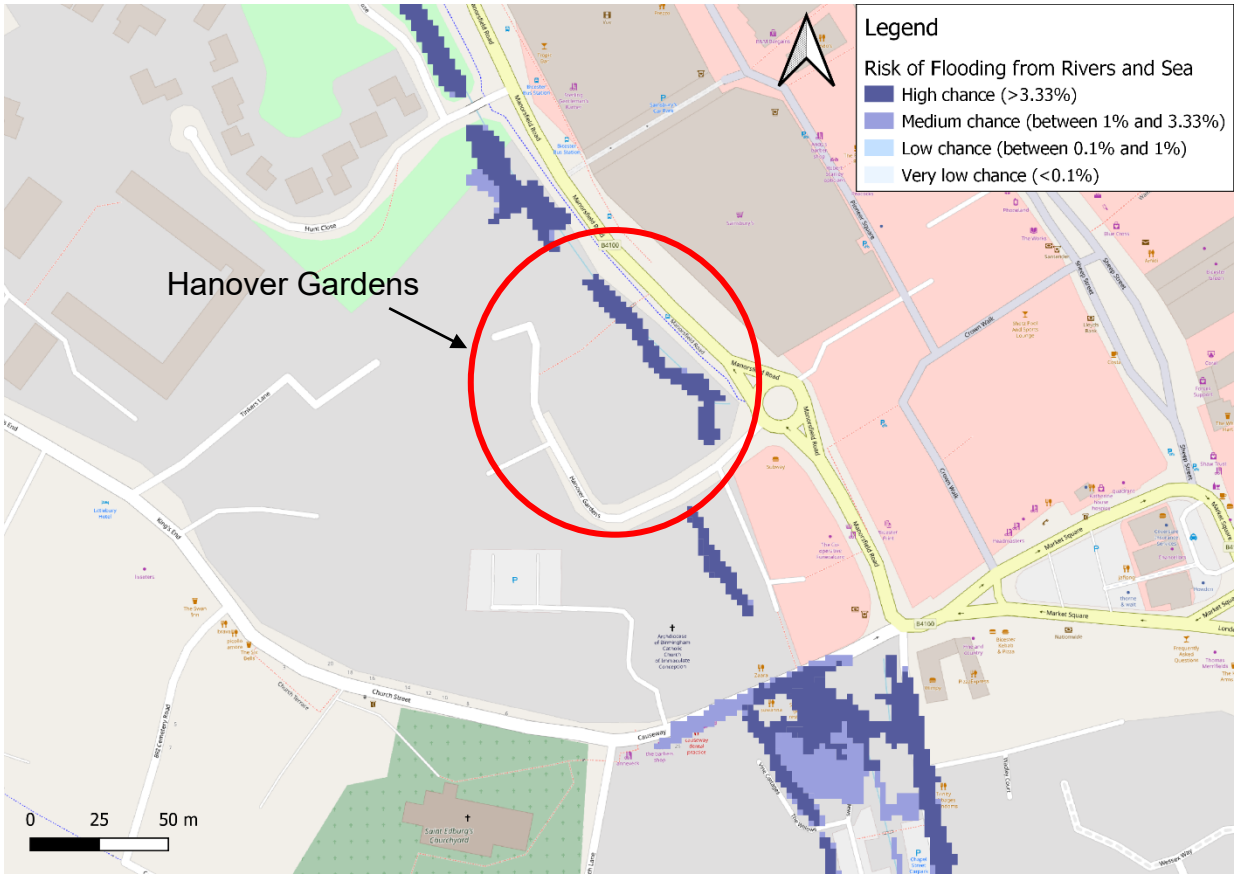

Figure 6 - Main River and Risk of Flooding from Rivers and Sea through Hanover Gardens. (Source: DEFRA Data Services Platform 2025)

Figure 7 - Hanover Gardens Risk of Flooding from Surface Water. (Source: DEFRA Data Services Platform 2025)

The proximity of Hanover Gardens to Town Brook is likely a leading cause of the flooding due to its location adjacent to the brook. However, overland flow pathways towards Town Brook provide some further explanation of surface water contribution to the watercourse from other sources. The combination of both surface water runoff, and increased rates of flow through the brook following the intense rainfall is likely to be the cause of the flooding detailed in this report (see Section 2.2). This is particularly relevant when the watercourse is bank-full, leaving no further capacity for the addition of surface water runoff.

Figure 8 shows the LiDAR-generated elevation data, with maximum and minimum extents constrained to show the localised depressions around Hanover Gardens. Discounting building heights, the site is located at a low point alongside Town Brook. The courtyard in the 'C' shaped building to the south of the site appears to be at the lowest point of the site and is therefore predicted by LiDAR to be at the highest risk of flooding (this is supported by the flood outline shown in Figure 7).

Figure 8 also shows the locations of indicative overland flow pathways derived from LiDAR data in relation to Hanover Gardens. Surface water flooding is difficult to forecast as exact rainfall location and volume are somewhat unpredictable and as such these maps should not be taken as an exact prediction. Flow pathways, represented by pink lines, flow towards Town Brook from either side of the shallow valley, through Hanover Gardens.

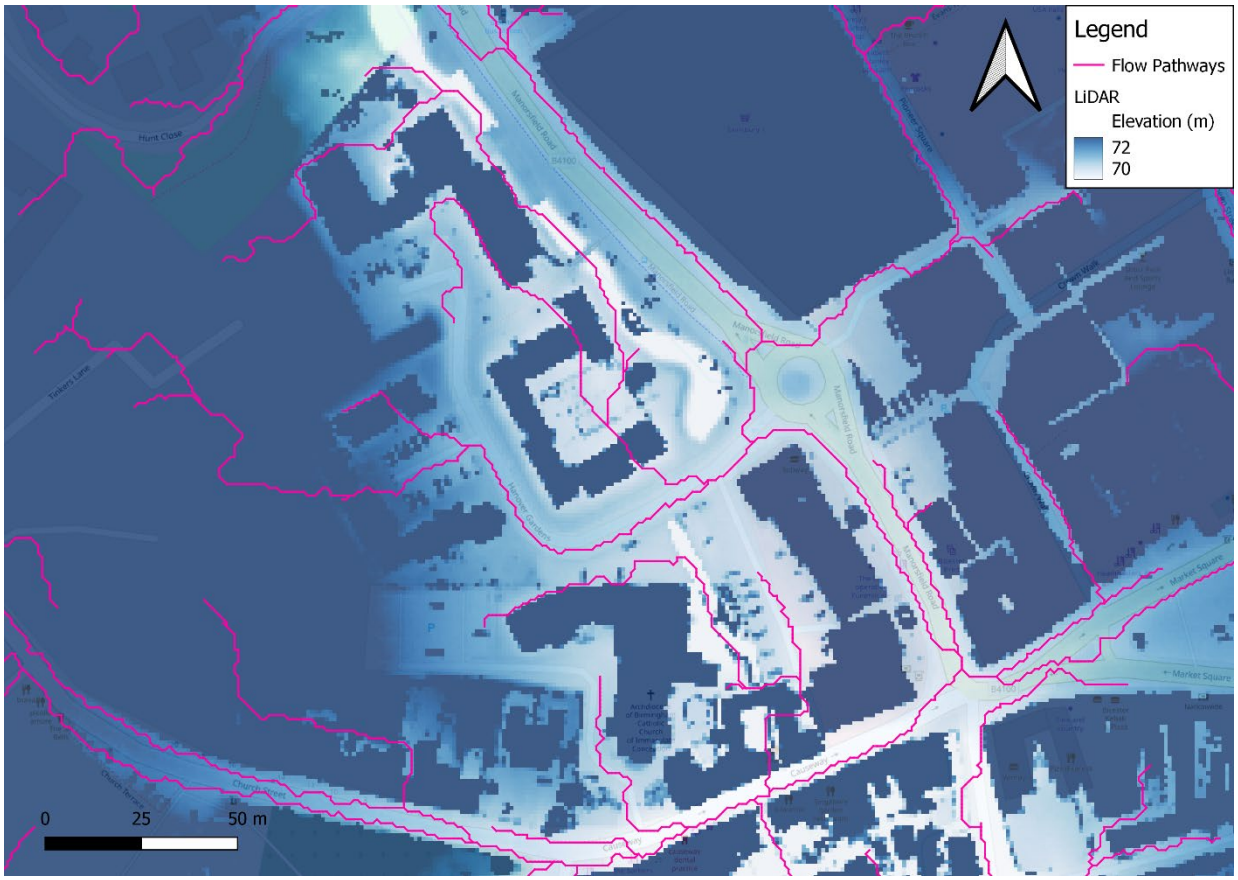

Figure 8 - Indicative overland flow pathways surrounding Hanover Gardens. (Source LiDAR 2025)

A cross section has also been taken of the region (Figure 9) which shows an approximate 400mm depression across Hanover Gardens followed by Town Brook when compared to the higher land to the west. Once water overtops the Town Brook, it

is likely to pond in the localised depression within Hanover Gardens, with the only outlet being the Town Brook or Back Brook culverts.

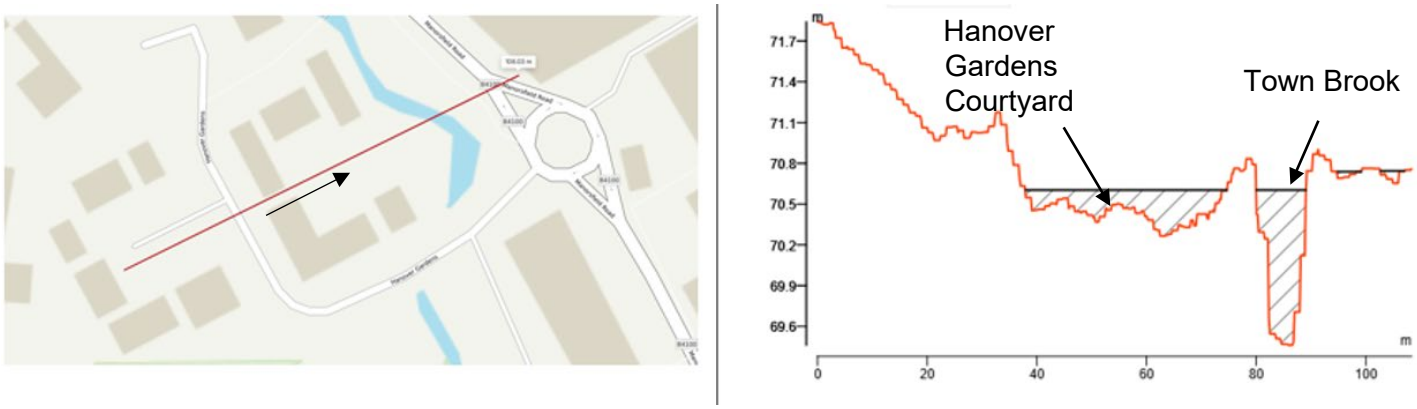

Figure 9 - Cross section through Hanover Gardens. (Source: LiDAR 2025.)

1.3. Realignment of the Town Brook

In the 1970's the Town Brook was diverted from its original natural alignment to the east of Manorsfield Road to the west of the road. Since then, a further series of drainage works took place in the region as part of the re-development and regeneration of Bicester Town Centre in 2009. These works included the construction of a new diverted watercourse including channel lining and bank stabilisation/reinforcement and was supported by additional works to manage changes in the towns drainage systems. This included new overflow channels, culverts, diversions of existing foul sewers, diversions of existing surface water drainage (towards the new watercourse) and the removal of foul and surface water sewers that had been abandoned[2]. The watercourse diversion was designed to ensure that the channel and culverts had capacity to convey a 1% AEP including an allowance for climate change[2].

A full flood risk assessment was issued and approved by the EA alongside a report describing hydrologic and hydraulic modelling of the Town Brook system. Furthermore, a strategic surface water design for the Bicester Town Centre Development was approved by the EA. These reports, as well as the Town Brook River Diversion report[2], were prepared to ensure there was no increased risk of flooding during construction of the new channel and supported the application for formal consents from the EA.

1.4. Previous flood events

Whilst there are no recorded flood events on the EA's historic flood map or recorded flood outlines, there have been recorded instances of flood events in Hanover Gardens and Bicester more widely, including Dunkins Close approximately 250m upstream of Hanover Gardens.

According to the Cherwell Level 1 Strategic Flood Risk Assessment (SFRA)[3] and an individual report on Hanover Gardens[3], flooding has previously been experienced in:

[2] Bicester Town Centre Redevelopment, Town Brook River Diversion, July 2007. Bettridge Turner & Partners – a division of Hyder Consulting (UK) Limited. Prepared for Town Centre (Bicester) Ltd.
[3] Cherwell District Council Level 1 Strategic Flood Risk Assessment (November 2022) updated October 2024. Available at: https://www.cherwell.gov.uk/info/33/planning-policy/1259/strategic-flood-risk-assessment-november-2022

- December 2013 – Fluvial – Significant flooding of Hanover Gardens. Following elevated levels of rainfall in the region, and reports from OCC of flooding at Hanover Gardens, an EA operations management team was deployed. Following inspections throughout the morning of 24th Dec 2013, a significant amount of debris was observed and removed from the Back Brook culvert (see Figure 10) which led to an observed drop in water level around Hanover Gardens, with water retreating below banks. Following recommendations from the report produced after this incident, regular trash screen maintenance is now carried out by the EA to assist OCC who are the asset owner. The EA has since installed a remote camera to allow frequent monitoring and targeted field team attendance to clear the screen.
- Two reports of flooding in Hanover Gardens were also reported to OCC in 2020 (23/12/2020), in which at least 2 properties were affected.

Figure 10 - Blocked Back Brook Culvert during the Hanover Gardens flooding on 24 Dec 2013. (Source: EA 2013)

2. RECENT FLOOD ISSUES AND INVESTIGATION

2.1. Summary of September 2024 Floods

The Met Office's report into the September 2024 flooding describes severe weather impacts across the UK[4]. Seven counties, including Oxfordshire, recorded more than 300% of their average September rainfall (Oxfordshire received 185mm), with September 2024 being the wettest calendar month in a series dating back to 1836 in Oxfordshire. The largest proportion of this rain fell between the 21st and 30th of September, with rainfall between the 21st and 23rd of September attributed to the flooding detailed in this report.

The sheer amount of rainfall from the 21st to the 23rd of September led to increased surface water runoff in several locations across Bicester, overwhelming the existing drainage systems, and consequently the conveyance capacity of the Town Brook and Back Book. This led to the overtopping of the Town Brook banks into the surrounding floodplain, which contains many of the Hanover Gardens properties. OCC flood reports suggest that five retirement flats were flooded during the event, however specific details of the properties effected are unknown. It is understood that some of those impacted were vulnerable residents which had to move to temporary accommodation.

Met Office data showed that the amount of rainfall was the highest recorded in almost 200-years[4] and it is likely that flooding was primarily caused by the capacity of channel and culverts being unable to deal with this unprecedented amount of rainfall. However, due to previous flooding being attributed to blocked culverts and debris screens, the performance of these assets has been investigated. Following reports from the EA on the day of the flooding, and through checking the camera that was installed following the flooding in 2013, it has been confirmed that the trash screens on the Town Book and Back Brook culverts were kept clear during the September 2024 event. As such, this report can confirm that the blockage of the trash screens and culverts were not the cause of flooding in September 2024.

2.2. Rainfall and River data analysis

Rainfall data has been obtained from the Department for Environment Food & Rural Affairs' (DEFRA) Hydrology Data Explorer[5]. A rain gauge and river level gauge for which data can be obtained are both located in the immediate vicinity of the site (Figure 11).

[4] Record-breaking rainfall for some this September, Met Office. 1 Oct 2024. Accessed 15/03/25. Available at: https://www.metoffice.gov.uk/about-us/news-and-media/media-centre/weather-and-climate-news/2024/record-breaking-rainfall-for-some-this-september

[5] Hydrology Data Explorer, 2025. Department for Environment Food & Rural Affairs. https://environment.data.gov.uk/hydrology/station/5466e4ec-fcb6-47f5-bb1f-fd1a54e108da [Accessed 20/03/2025].

Figure 11 - Rainfall and river level gauges around Hanover Garden and Bicester. (Source: DEFRA 2025).

Three low pressure systems passed over the Oxfordshire region between the 21st and the 30th of September. Rainfall charts for this period, taken from the 2024 September rainfall report[6] are presented in Figure 12. The most extreme of the low pressure systems was the first between the 21st and 23rd of September, and the system that caused the flooding documented by this report.

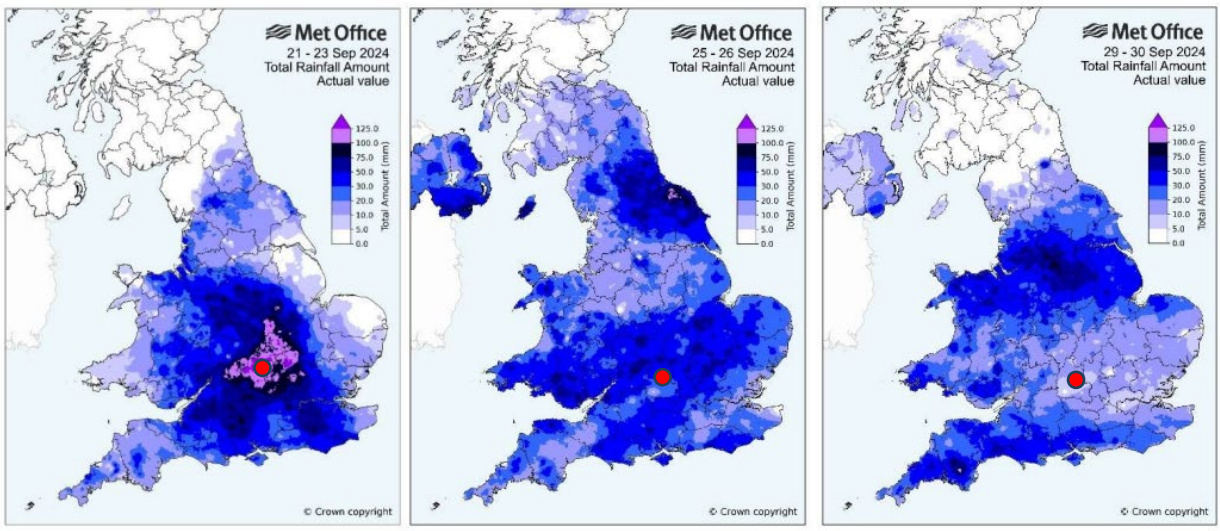

Figure 12 – Succession of rainfall in the last third of September 2024. The red dot indicates the location of Hanover Gardens (Source: Met Office, 2024).

[6] Met Office, 2024. Exceptionally wet month for parts of the Midlands, September 2024. Accessed March 25. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2024/2024_07_september_rain.pdf

At the Bicester rain gauge (1km to the south of Hanover Gardens) 10.6mm, 74.1mm and 38.7 of rain fell on the 21st, 22nd and 23rd of September, respectively (Figure 13). A15-minute maximum of 6.3mm falling at 16:30 on the 22nd of September (Figure 14). The daily rainfall total of 74.1mm on the 22nd of September is the highest since records began at Bicester gauge in April 1984. The rainfall total for this day is 14.1mm higher than the second highest daily value of 60mm in July 2006.

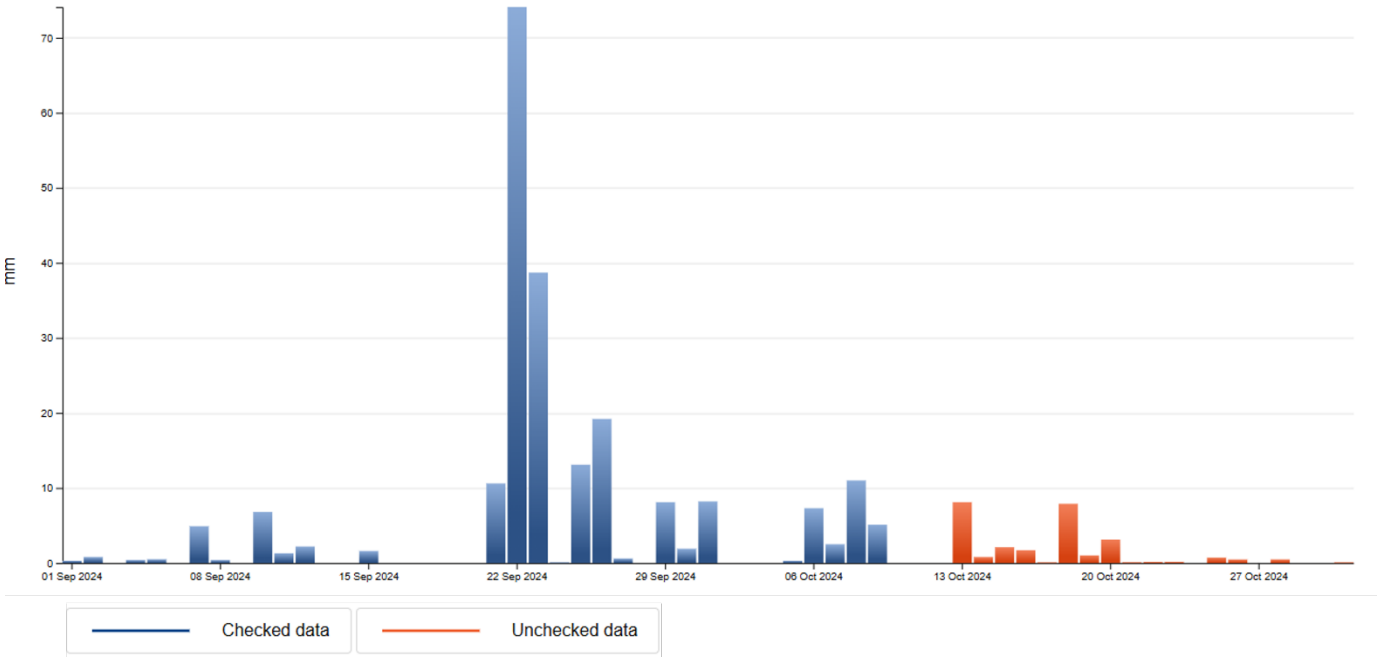

Figure 13 - Daily rainfall at the Bicester Gauge throughout September and October 2024 (Source: DEFRA 2025).

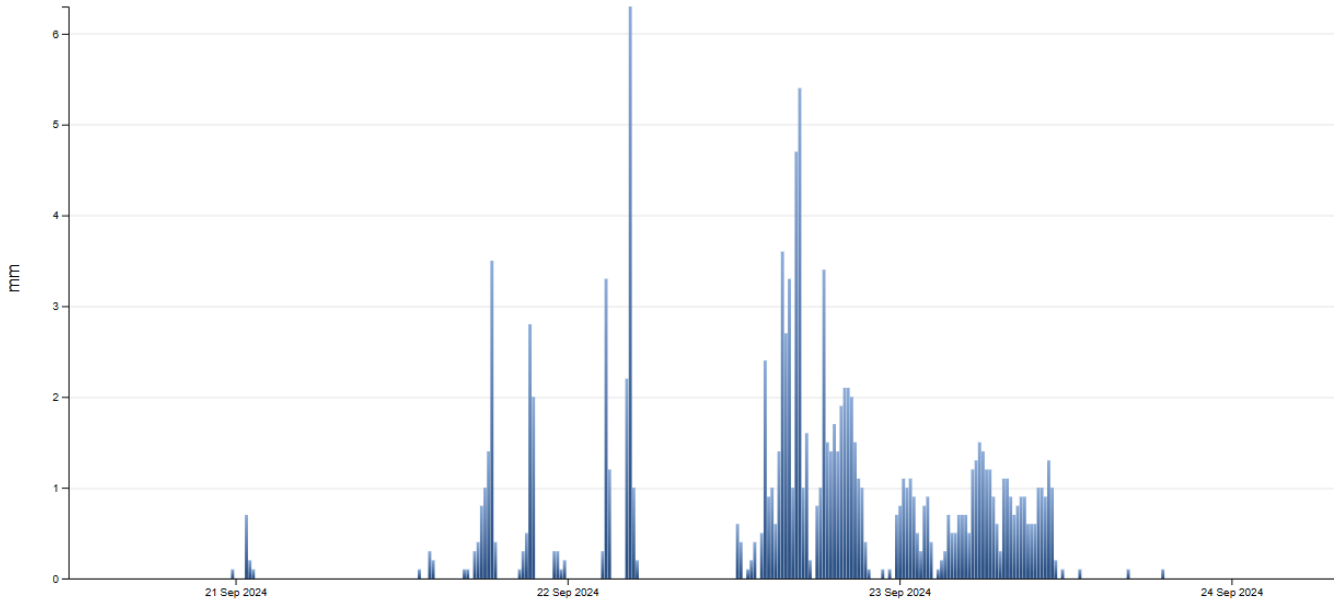

Figure 14 - Rainfall over 15-minute intervals at the Bicester Rainfall Gauge between 21-24 Sep 2024 (Source: DEFRA 2025).

The river level gauge at Hunt Close Bridge is immediately upstream of Hanover Gardens. The response in river level following the rainfall events seen in late September 2024 is shown in Figure 15. Flow in Town Brook spiked dramatically, mirroring the rainfall in Figure 13 and Figure 14. It should be noted that the anomalous spikes in Figure 15 are the result of errors at various points in the gauge reading, the

flow peak on the 24th September 2024 is still correct, though. A more rapid response in river levels following rainfall is indicative of quick runoff rates associated with impermeable surfaces like roads and car parks accelerating surface water flow towards the watercourse. Land use though Bicester and upstream of Town Brook at Hanover Gardens is predominantly classed as “discontinuous urban fabric” by the Coordination of Information of the Environment (CORRINE) Land Cover (CLC) mapping service developed using Copernicus Satellites. This supports the contention that rapid runoff rates though the town and towards Town Brook and Back Brook contributed to the overwhelming of the channel capacity and culverts. The rainfall was also prolonged at an extent that didn’t allow the river levels to recede, despite the culvert being clear of debris.

River levels in Town Brook spiked from 0.08m on the 20th of September at midnight (00:00), to a maximum level of 1.5m at 02:00 on the 24th of September. River levels then receded towards the end of the month, with the exception of some less dramatic and brief rises in level following the rain associated with the remaining 2 low pressure systems in September (Figure 12).

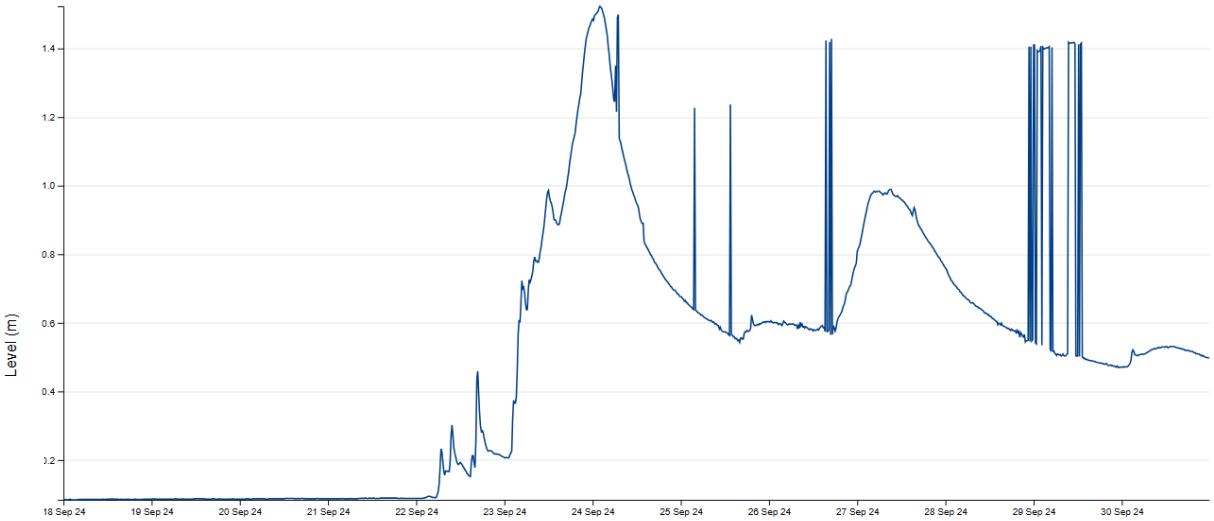

Figure 15 – River levels in Town Brook at Hunt Close Bridge prior to, during and following the flood event – maximum level peaking at 1.5m (Source: DEFRA 2025).

The data presented here supports the conclusion that county-wide intense rainfall beginning on the 21st of September and continuing through the month was the primary cause of flooding in Hanover Gardens. The heavy rainfall likely followed the indicative drainage pathways towards the low point of Hanover Gardens and Town Brook shown in Figure 8. Rainfall had already collected from further upstream in the catchment, with rates accelerated by mostly impermeable land cover. As such, river levels exceeded channel capacity and spilled into the surrounding floodplain where Hanover Gardens is located.

2.3. Site Visit and Observations

A site visit was conducted on the 21st of January 2025 with representatives from OCC, during which the team visited multiple locations throughout the village, taking photos and discussing the areas that were understood to have experienced the most flooding. The observations and discussions on site informed the investigation and the recommendations detailed in this report.

The areas that the site team noted required the most attention were: the Back Brook culvert and trash screens (which was the cause of flooding in the past (Figure 10)); and potential low points in the river bank that could be susceptible to overtopping.

During the site visit, the Back Brook Trash screen was noted by representatives from OCC as requiring maintenance. On the day of the visit, very little vegetation and debris was seen caught up in the screens, despite the surrounding vegetation appearing to be very low or recently cut (Figure 16).

Figure 16 - Culverts and trash screens upstream of Hanover Gardens. (Source: Site visit Jan 2025)

Whilst it's acknowledged that the Town Brook and Back Brook culverts require regular maintenance and clearance, the camera evidence and EA reports of the culvert condition during the flood event (Section 2.1) confirms that blockage of the culverts was not a contributing factor to the cause of the flooding in September 2024.

As part of the series of developments that took place in the region following the redevelopment and regeneration of Bicester Town Centre in 2009 (see Section 1.3),

additional overflow channels were constructed to account for the additional drainage needs of the redevelopment (Figure 17). As with any overflow drains leading to a stream or river, additional surface water runoff will have contributed to the Town Brook during the flood event. To support the Planning Application for the town centre redevelopment project, a flood risk assessment was submitted and approved by the EA concluding that the Town Brook would have sufficient capacity to convey 1% AEP flow (including an allowance for climate change)[2].

Figure 17 – Back Brook overflow channel downstream of Hanover Gardens. (Source: Site visit Jan 2025)

During the site walkover, the team assessed whether any low points or damaged areas in the bank could have led to the river overtopping at a level that is lower than the anticipated capacity of the channel. It should be noted that the management and maintenance of the riparian zone falls under the jurisdiction of the landowner (See Section 4.7).

The site team identified no sections of damaged or poorly managed bank, in fact, the bank and riparian zone was found to be well managed, with vegetation maintained well in the entire region surrounding Town Brook as well as on the grounds of Hanover Gardens (Figure 18). While some vegetation was present in the channel, it was not considered to be contributing to issues with channel capacity and culverts with trash screens were visibly clear (Figure 19). It is worth noting that the EA undertakes annual watercourse maintenance through this area.

Figure 18 – Town Brook adjacent to Hanover Gardens looking upstream. (Source: Site visit Jan 2025)

Figure 19 - Town Brook channel clear of vegetation. (Source: Site visit Jan 2025)

The site visit also confirmed observations from the desk-based study that the Hanover Gardens courtyard is set at a low elevation. Figure 20 shows the buildings within Hanover Gardens being set visibly lower than the overtopping point of the right bank. This means that if the bank is overtopped during a heavy rainfall or flooding event, there is no additional flood protection for the residences.

Figure 20 - Low set buildings in Hanover Gardens compared to the bank of Town Brook. (Source: Site visit Jan 2025)

These observations lead to recommendations from this report that the Parish Council, landowners, local residents and other stakeholders establish a flood action group with support from CDC and OCC to provide guidance where necessary, this is covered in Section 5.

3. CONCLUSIONS

This investigation has reviewed the events and conditions that occurred primarily between the 21st and 23rd of September 2024 which led to flooding within the Hanover Gardens retirement properties.

The unprecedented rainfall that was seen in late September 2024 was the highest ever recorded in almost 200-years (Met Office[4]). The daily rainfall total of 74.1mm on the 22nd of September is the highest since records began at Bicester gauge in April 1984. Over 14.1mm higher than the second highest daily value of 60mm in July 2006.

Anecdotal evidence suggests surface water flow from the urban areas may also have contributed to the flooding experienced in Hanover Gardens. The low point in the floodplain in which the properties are located meant that the properties have little to no additional protection from flooding once the banks of the Town Brook are overtopped during extreme events.

Flooding in Hanover Gardens primarily occurred due to heavy rainfall over a short period, leading to increased river levels and surface water runoff. The sheer volume of water caused the channel to reach its capacity and overflow, whilst also preventing additional surface water from entering the channel and being drained away. This created issues at key locations where surface water and fluvial waters interact throughout Hanover Gardens, including the multiple culverts that flow through the area. The high fluvial flows placed stress on key structures, like the Town Brook and Back Brook culvert, causing the channel to overflow. Unlike the December 2013 floods, it is not believed that debris accumulating around trash screens caused significant flow restrictions as EA reports and camera footage from the region indicate the culverts were clear of obstructions. It is possible that the culverts themselves did not have capacity to convey the volume of flow in the river.

Whilst the primary source of flooding is fluvial, there are significant contributions of flow from urban runoff. It is therefore recommended that options for upstream flow attenuation and storage within the rural catchment and options to attenuate surface water flows through retrofitting of Sustainable Drainage Systems (SuDS) are explored. The river and catchment upstream of Bicester offer potential opportunities for Natural Flood Management (NFM). By slowing key inflows, whether from upstream, throughout the town, or from key surface water routes, waters would enter the river slower, reducing the overall strain on channel capacity and allowing flood waters to drain more effectively through the town.

Additionally, continuing to ensure that highway drainage functions freely and outfalls to appropriate locations will limit stress on channel capacity. Maintaining the channels and ensuring that existing drainage and defences are functioning properly would also minimise the risk of flooding.

Due to the unpredictable nature of rainfall, it may not be entirely possible to eliminate the risk of future flooding to these properties. Recommendations have therefore been suggested that could reduce the likelihood and detrimental impact of flooding through resilience planning.

Establishing a flood action group to deploy emergency resilience support would be beneficial. It is also recommended to explore the feasibility of property flood resilience measures. Section 5 details the recommendations resulting from this investigation.

4. RIGHTS AND RESPONSIBILITIES

4.1. Communities and Residents

Communities may consist of the Town or Parish Council, Flood Forum, Community Group and affected residents, amongst others.

Communities and residents who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected.

Community resilience is important in providing information and support to each other if flooding is anticipated. Actions taken can include subscribing to MET Office email alerts for weather warnings and the EA's Flood Warning Service, nominating a Community Flood Warden, producing a community flood plan, implementing property level protection and moving valuable items to higher ground. Finally, individual households can create their own personal flood plans, such as collating important documents for quick removal from the property, torches, waterproof clothing etc.

Oxfordshire County Council has produced a number of flood guides covering various subjects, some of which relate to this type of flood incident. The relevant guides have been identified and are available at: www.oxfordshirefloodtoolkit.com

4.2. Lead Local Flood Authority (LLFA)

As stated within the introduction section, OCC as the LLFA has a responsibility to investigate flood incidents under Section 19 of the F&WMA.

The LLFA also has a responsibility to maintain a register of assets which have a significant effect on flooding from surface runoff, groundwater or ordinary watercourses (non-Main River) as detailed within Section 21 of the F&WMA. The register must contain a record about each structure or feature, including the ownership and state of repair. OCC is also required to keep a record of flooding hotspots across the county.

OCC's practices relating to third party assets is to notify third party owners of their asset forming part of a flood risk system and assist by advising those third party owners on the condition of their assets and their maintenance responsibilities.

As LLFA, OCC will be looking for support from other risk management authorities, communities and individual homeowners to ensure flood incidents are reported, and any assets which have a significant effect on flood risk are recorded on the asset register.

While OCC can suggest possible causes of flooding and make recommendations to ensure flood risk is mitigated as far as possible, the F&WMA does not provide OCC with the mandate or funding to act on identified causes of flooding or force risk management authorities to undertake any recommended actions.

4.3. Highway Authority (Oxfordshire Highways)

Oxfordshire Highways have a duty to maintain the highway under Section 41 of the Highway Act 1980 but subject to the special defence in Section 58.

New highway drainage systems are designed to Highways England's Design Manual for Roads and Bridges (Volume 4, Section 2). They are only required to be constructed to drain surface water runoff from within the highway catchment rather than from the wider catchment.

There are historic drainage systems in historic highways which can become the responsibility of the Highway Authority due to dedication, as opposed to adoption. These drainage systems may not have been designed to any standard.

Oxfordshire Highways undertake regular highway drainage cleansing. Identify and develop a detailed plan of their assets.

If flooding occurs OCC will assess the capacity of the highway assets and identify any areas with insufficient capacity for draining runoff from the highway. Where this leads to flood risk to properties improvement works should be considered.

Oxfordshire highways should assess the suitability of third party drainage systems accepting discharge from Highway Drainage systems and report any unsatisfactory areas to the relevant Risk Management Authorities.

4.4. Water Authority - Thames Water Utilities (TW)

Water and sewerage companies are responsible for managing the risks of flooding from surface water, foul water or combined sewer systems. Public sewers are designed to protect properties from the risk of flooding in normal wet weather conditions. However, in extreme weather conditions there is a risk that sewer systems can become overwhelmed and result in sewer flooding.

Sewerage undertakers have a duty, under Section 94 of the Water Industry Act 1991, to provide sewers for the drainage of buildings and associated paved areas within property boundaries. Since the 1st October 2011 the majority of private sewers and lateral drains in England and Wales were transferred into public ownership, meaning they are now the responsibility of the relevant sewerage undertaker.

A public sewer is a conduit, normally a pipe that is vested in a Water and Sewerage Company or predecessor, that drains two or more properties and conveys foul, surface water or combined sewage from one point to another, and discharges via a positive outfall.

There is no automatic right of connection for other sources of drainage to the public sewer network. Connection is therefore discretionary following an application to connect.

4.5. Cherwell District Council (CDC)

District Councils have powers under Section 14 of the Land Drainage Act 1991 (LDA) to undertake flood risk management works on ordinary watercourses (non-Main River) where deemed necessary.

Under Section 20 of the LDA, District Councils have the powers to (by agreement of any person and at that person's expense) carry out any drainage work which that

person is entitled to carry out. Agreement may not be required in certain emergency or legally upheld situations.

CDC also has delegated authority from OCC LLFA to serve notice on persons requiring them to carry out necessary works to maintain the flow of ordinary watercourses under Section 25 of the LDA and receives funding from the LLFA to do this.

The District Council is the Planning Authority and has a role in Building Control and the Building Regulations.

4.6. Environment Agency (EA)

The EA is responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion. This includes setting the direction for managing the risks through national and strategic plans; providing evidence and advice to inform Government policy and support others; working collaboratively to support the development of risk management skills and capacity; and providing a framework to support local delivery.

The EA also has operational responsibility for managing the risk of flooding from main rivers. Main rivers are usually larger river and streams and include all watercourses defined on the main river map which can be accessed at https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/StatutoryMainRiverMap&Mode=spatial

The responsibility for maintenance and repair of rivers lies with the riparian owner, but the EA have permissive powers to carry out maintenance work on main rivers under Section 165 of the Water Resources Act 1991 (WRA).

The EA encourage third party asset owners to maintain their property in appropriate condition and may take enforcement action on a prioritised basis where it is appropriate. They may also consider undertaking maintenance or repair of third party assets only where it can be justified in order to safeguard the public interest and where other options are not appropriate.

Further remit of the EA includes;

- preparing preliminary flood risk assessments and flood risk management plans for flooding from main rivers, reservoirs and the sea (Flood Risk Regulations 2009)

- warning and informing (Ministerial Direction to the National Rivers Authority, 1996)

- regulating activities that may affect the risk of flooding from main rivers (Environmental Permitting Regulations (England and Wales) Regulations 2016)

- Carrying out surveys and mapping (Flood Risk Regulations 2009, Water Resources Act 1991)

- reporting to the minister on flood and coastal erosion risk and how the national and local strategies are being applied by all of the authorities involved (FWMA, 2010)

- acting as a statutory consultee for planning authorities providing advice on planning applications, local plans and environmental assessments regarding flood risk from main rivers and the sea (Town and Country Planning (Development Management Procedure) (England) Order 2015)

4.7. Landowners and Developers

Landowners are responsible for the drainage of their land and controlling any movement of sediment from their land. Legally, owners of lower-level ground have to accept natural land drainage from adjacent land at a higher level. The exception to this is where the owner of the higher level land has carried out “improvements” such that the runoff from the land cannot be considered “natural”.

Agricultural practices by landowners can be considered as “improvements” to the land, so that cultivation of crops or other land uses can take place. Mitigation works are required on improved land to account for the change in natural land drainage and changes to surface water runoff this can create.

Landowners and developers are responsible for working with the Local Planning Authority to ensure that their development is completed in accordance with the planning permission and all conditions that have been imposed.

Advice for developers is available on the Oxfordshire Flood Toolkit.
www.oxfordshirefloodtoolkit.com/planning/developers/

5. RECOMMENDATIONS

5.1. General

Listed below are the recommendations arising from this formal Section 19 Flood Investigation Report. All the actions are initial recommendations that require discussion with relevant stakeholders to determine their feasibility.

It is important to note that it is for the relevant responsible body or persons to assess each recommendation in terms of the legal obligation, funding, resource implications, priority and cost/benefit analysis of undertaking such action.

The recommendations may be included within the action plan linked to the Local Flood Risk Management Strategy or in the relevant risk management authority’s future work programmes, as appropriate.

Authorities should work together Look into funding opportunities to carry out the listed actions. There are multiple funding sources which could contribute to schemes and improvement works going forward. The majority schemes will require elements of partnership working and contributions to be successfully funded. They are likely to need to provide multiple benefits such as improving flood resilience whilst also managing water levels, reducing drought risks, helping nature recovery as well as climate adaptation.

There are several funding options available which can be explored through multi agency working groups such as,

- Flood & Coastal Erosion Risk Management (FCERM)
    - Flood Defence Grant in Aid (FDGiA)
    - Local Levy Regional Flood and Coastal Committee (RFCC)
- DEFRA Natural Flood Management Funding

- Woodland Creation Grants
- Agricultural & Environmental Schemes (Countryside Stewardship)
- Funding sources relating to development and regeneration, such as section 106 agreements, Community Infrastructure Levy (CIL) and New homes bonus
- Non-government organisations and charitable trusts
- Community fundraising and events
- Lotteries (Heritage Lottery Fund, Big Lottery, Arts Council
- Volunteering
- Nature for Climate Fund
- Grants from other government departments, such as BEIS, MHCLG, DfT, DfE (for example, Flood Resilient Schools)
- UKRI – the research councils funding
- Business in the community
- Green recovery challenge fund
- Partnership funding (for example, contributions from partners, local authorities, businesses and communities etc.

5.2. Main Recommendations

Recommendation	Lead Stakeholders	Consulting stakeholders
Local residents and Parish Council to set up a flood action group. Through this action group, discuss the issues and recommendations from this S19 report. With support from CDC & OCC develop emergency resilience plans.	Local residents, Parish Council	OCC, CDC, EA
Local residents to sign up for Flood Alerts and Warnings and develop a personal flood plan. Guidance on this can be found at: Oxfordshire County Council – Flood Toolkit	Local residents	Parish Council, CDC, OCC, EA
OCC to identify if there are any flood assets that need to be added to the local flood register.	OCC	OCC Highways, CDC, EA
EA to review the current flood map which looks to exclude properties in Hanover Gardens from areas considered to be at risk of fluvial flooding during extreme events.	EA	
EA to continue with the ongoing and regular maintenance of Main River culverts and trash screens. This should include the continued maintenance of Town Brook, Back Brook and other culverts.	EA	OCC, CDC,
Environment Agency to consider using their powers under the Land Drainage Act 1991 to ensure riparian owners carry out required maintenance.	EA,	Landowners

Consider the technical feasibility of constructing a small bund or wall adjacent to left bank of Town Brook to protect properties from out of bank flooding. The technical feasibility will need to ensure that flood risk would not be transferred elsewhere.	EA, OCC	CDC
Consider working with landowners to discuss willingness for natural flood management (NFM) measures to be implemented on rural land upstream of Bicester to slow and / or attenuate flows.	EA, OCC	Landowners, Parish Council, CDC
Explore the feasibility of implementing upstream flood alleviation measures and / or retrofitting SuDS to slow and / or attenuate flows reaching the Town Brook.	OCC	EA, CDC, Landowners Parish Council
Explore the willingness to implement property flood resilience measures (PFR). Guidance on PFR measures can be viewed through Ciria document (C790F) and a link to this document is provided below: https://www.ciria.org/ItemDetail?iProductCode=C790F&Category=FREEPUBS&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 Funding in the form of grants, may be available to support the property owners in delivering PFR measures – see Section 5.1.	Property owners	OCC, CDC, Parish Council

5.3. Communities and Residents

These include Town/Parish Council, Flood Forum, Community Group, landowners and affected residents.

Nominate a Community Flood Warden to help coordinate the following:

- Preparing Household Emergency Plans for vulnerable properties in this area.
- Regularly inspecting ditches and pipework in the area of flood risk. Report blockages or other issues to the landowner and the LLFA.
- Explore options for property level protection and implement any recommendations. This could include additional drainage at the rear of properties, self-sealing air bricks and flood barriers.

Information on Flood Prevention measures for Home Owners, Communities and Businesses can be found on the Flood Toolkit: www.oxfordshirefloodtoolkit.com/risk/prevention

Residents should check whether they are at risk of flooding by using the long term flood risk service www.gov.uk/check-long-term-flood-risk.If they are at risk of flooding they should sign up for the EA's flood warnings by visiting Flood alerts and warnings - GOV.UK. The Met Office also offer a weather warning alert service.

Permanent measures such as installing floodgates, raising electrical sockets and using flood resistant material when doing building work should be considered. Cherwell District Council, Oxfordshire County Council and the Environment Agency can provide advice on these matters and more information can be found at:
www.oxfordshirefloodtoolkit.com/emergency/preparation
https://nationalfloodforum.org.uk/

Explore community wide solutions (e.g. attenuation areas, overflow routes, tree planting). Use the Flood Toolkit Funding Tool to find sponsors who may be willing to help fund improvement projects: www.oxfordshirefloodtoolkit.com/risk/funding

Continue to report flood incidents to the Lead Local Flood Authority at: www.oxfordshirefloodtoolkit.com/emergency/report-flood. Endeavour to obtain as much evidence of flood events as possible, such as photographic and video evidence.

Residents to explore obtaining Government subsidised flood insurance via Can Flood Re help me? https://www.floodre.co.uk/

5.4. Lead Local Flood Authority (LLFA)

LLFA team to work with the Joint Oxfordshire Resilience Team (JORT) and the EA to set up and support a community based Flood Warden Network.

Assist the JORT, the EA and other flood management authorities to support the community in the production of a Community Flood Plan and provide advice to residents on how to explore options for property level protection.

Inform owners of the drainage systems and watercourses within the overall surface water catchment area of their legal responsibilities.

Re-establish the Agency flood group meetings to discuss problems and to look at strategies to combat flooding due to Climate Change. Have periodic meetings with the local flood group to discuss the issues and recommendations with representatives from key authorities.

Work with CDC in looking at opportunities for partnership working to explore schemes to manage flows upstream such as nature-based solutions and through the retrofitting of SuDS in the urban area.

5.5. Highway Authority (Oxfordshire Highways)

Regularly check and maintain highway assets through Bicester in line with their current maintenance regimes. Add detailed information of the assets to the OCC Asset Register.

Assess the capacity of the highway assets with support from the LLFA and CDC to identify any areas with insufficient capacity for draining runoff from the highway. Where this leads to flood risk to properties improvement works must be considered.

Assess the suitability of third party drainage systems accepting discharge from Highway Drainage systems and report any unsatisfactory areas to the relevant Risk

Management Authorities. Work with the community and LLFA to clarify ownership and maintenance responsibilities for watercourses, particularly where these are located within or near to the highway.

5.6. Cherwell District Council

Continue to consult with the Environment Agency and Lead Local Flood Authority as required in respect of planning applications for new developments to reduce flood risk. Aim to ensure that all works are carried out in accordance with the approved plans and documents.

Review the planning policies relating to developments in the vicinity of the flooding incident, together with any flood risk assessments and drainage designs. Consider contacting the developers to take action in the event that any items relating to surface water drainage and flood risk are not evident or ineffective in the final developments or in the construction period.

Utilise their enforcement powers under Section 25 of the Land Drainage Act 1991 where it is considered that riparian owners are failing to maintain ordinary watercourses in their ownership to the approval of the LLFA.

Continue regular maintenance of their Ordinary watercourse Assets, in line with current maintenance regimes.

Endeavour to assist other flood risk management authorities and landowners in the preparation of a detailed plan of assets relating to drainage and flood risk, to share with the LLFA and the community.

Support landowners to investigate private drainage and check for blockages and defects with remedial works to be carried out where necessary.

Continue to support homeowners and businesses in providing individual property level protection.

5.7. Landowners and Developers

Developers should work with local authorities to ensure all development is completed in accordance with approved plans and documents, and planning policy.

Landowners should undertake regular inspection and maintenance of their drainage systems in accordance with a defined maintenance regime. Further, they should identify and develop a detailed plan of their assets to share with the LLFA, other flood risk management authorities and the community.

Landowners should assess the capacity of their drainage systems and identify any areas with insufficient capacity for the collection, conveyance, storage and disposal of surface water. Where this could lead to runoff to the public highway or nuisance to third party private property, improvement works should be considered.

Landowners who are riparian owners are responsible for carrying out work to maintain the natural flow of water in the relevant watercourse. Such work will include the removal of significant blockages and the removal of vegetation if it is causing premature flooding to third party land and or property.

Review the library of flood guides on the Oxfordshire Flood Toolkit.

Agricultural landowners should carry out works to their land to reduce surface water runoff. These include following principles of good soil husbandry and providing land drainage systems such as ditches (https://www.gov.uk/guidance/create-and-use-a-soil-management-plan).

These works help to retain the natural land drainage regime and provide the best soil conditions for the continued agricultural use of the land. Examples of good practice for reducing surface water runoff from agricultural land are:

- Ploughing fields in a perpendicular direction to the slope of the land, reducing the effect of channelling of water over the land when it rains
- Using techniques and machinery to limit compaction of soils
- Growing crops that match the capability of the land, particularly in relation to the timings of activities and not overworking soils through the year
- Providing new ditches, sub-soil drainage and outfalls, and reinstating and regularly maintaining existing ditches. Old existing ditches may be completely filled and difficult to see. The type of soil make-up, type of flora and overall lie of the land can help to determine the routes of filled in historic ditches
- Preventing changes to the levels of the land that would cause channelling of surface water to a single point where this would not naturally occur.

It should be noted that following good practice for managing surface water runoff cannot completely remove the risks of natural land drainage and the associated quantities and flow routes of runoff that can cause flooding.

6. DISCLAIMER

The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

Any recommended actions outlined in this FIR will be for the relevant responsible body or persons to assess in terms of resource implications, priority and cost/benefit analysis of the proposal. Moving forward, these may be included in the Action Plan linked to the Local Flood Risk Management Strategy or in the relevant risk management authority's future work programme as appropriate.

The opinions, conclusions and any recommendations in this Report are based on information provided to CDC and Oxfordshire County Council.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation and CDC and Oxfordshire County Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and any recommendations.

The implications for producing Flood Investigation Reports and any consequences of blight have been considered. The process of gaining insurance for a property and/or purchasing/selling a property and any flooding issues identified are considered a separate and legally binding process placed upon property owners and this is independent of and does not relate to the information in this report highlighting flooding to properties at a street level.

Cherwell District Council or Oxfordshire County Council do not accept any liability for the use of this report or its contents by any third party.

ACRONYMS

AEP Annual Exceedance Probability
CDC Cherwell District Council
OCC Oxfordshire County Council
EA Environment Agency
TW Thames Water
FIR Flood Investigation Report
F&WMA Flood and Water Management Act 2010
LDA Land Drainage Act 1991
LLFA Lead Local Flood Authority
SuDS Sustainable Drainage Systems
WRA Water Resources Act 1991

USEFUL LINKS

Highways Act 1980:
www.legislation.gov.uk/ukpga/1980/66/contents
Water Resources Act 1991:
www.legislation.gov.uk/ukpga/1991/57/contents

Land Drainage Act 1991:
www.legislation.gov.uk/ukpga/1991/59/contents
EA - Prepare your Property for Flooding:
How to reduce flood damage Flood protection products and services
www.gov.uk/government/publications/prepare-your-property-for-flooding
EA - Long term flood risk service:
https://www.gov.uk/check-long-term-flood-risk
EA - Sign up for flood warnings:
Sign up for flood warnings - GOV.UK
EA - Up to date information on flood alerts & warnings:
Flood alerts and warnings - GOV.UK
Oxfordshire County Council Flood and Water Management Web Pages:
www.oxfordshirefloodtoolkit.com
https://www.oxfordshire.gov.uk/residents/fire-and-public-safety/emergency-planning/community-resilience

Flood and Water Management Act 2010
http://www.legislation.gov.uk/ukpga/2010/29/contents

USEFUL CONTACTS
Oxfordshire County Council Highways:
Tel: 0345 310 1111
Website: www.fixmystreet.oxfordshire.gov.uk

Environment Agency:
General Tel: 08708 506 506 (Mon-Fri 8-6) Call charges apply. Incident Hotline: 0800 807060 (24 hrs)
Floodline: 0345 988 1188
Email: enquiries@environment-agency.gov.uk

Thames Water
Emergency Tel: 0800 316 9800 (select option 1)
Website: www.thameswater.co.uk/help-and-advice/bursts-and-leaks/report-a-leak- orburst-pipe