Flood Investigation Report

Locations: Various across Bedford Borough

Flood Event: October 2022

Date of Report: June 2025

Version: 1.0

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Environment Directorate

Contents

EXECUTIVE SUMMARY

This report has been produced in accordance with the duties placed upon Bedford Borough Council as a Lead Local Flood Authority, under Section 19 of the Flood and Water Management Act 2010 to investigate a flood event. The purpose of the flood investigation is to identify the reported impacts and likely causes of flooding, develop informed actions to reduce the risk of flooding in affected locations and/or increase the preparedness and resilience of communities for future flood events.

On the 20th October 2022 Bedford Borough suffered an intense rainfall event with over 31.4mm of rainfall falling within one hour. This intense rainfall led to surface water flooding across various locations with a total of 17 areas with properties flooding internally.

The River Great Ouse remained within its 'normal range' with no properties suffering from fluvial flooding.

Many roads and infrastructures including schools flooded through damaged roofs as a result of the rainfall, until the drainage systems were able to reestablish control of the volume of water being transferred.

The Resilience Team coordinated the response with Highways to enable officers to attend reports of flooding being received. A Bedfordshire Tactical Coordinating Group was convened with partners across the County through the Bedfordshire Local Resilience Forum (BLRF) as well as an Internal Silver Meeting with key staff within the Council. The impact of the flooding was primarily felt across Bedford and Kempston.

Reports of flooding were primarily received by the Council, Bedfordshire Fire and Rescue Service and Anglian Water. The Council did not request any properties to be evacuated and as such no assistance centres were required and/or set up. Several properties self-evacuated.

The Resilience Team along with officers from Highways Teams and Anglian Water carried out inspections on all properties located that flooded to help fully understand the flooding that occurred as well as to identify any issues within the drainage system or assets that required attention and to establish whether other mitigation options could be explored as a result.

Assistance was provided by the Council in the removal of damaged items as well as used sandbags/aqua sacs. The Resilience Team continues to work closely with Highways, to identify where blockages and defects are apparent and develop better working practices and maintenance regimes that can ensure flood risk is better managed across the Borough. The recovery for homeowners continued for a significant period of time after dealing with the serious impact that flooding had on properties.

The flooding that occurred highlighted just how quickly surface water flooding can affect properties and our road network and the impact it can have. It highlighted the importance of homeowners and businesses ensuring they fully understand the flood risk associated with their properties either from surface water or fluvial risk.

Current drainage systems across the UK are not designed to cope with such intense rainfall events therefore, residents, communities, the Council and its partners need to be as resilient as possible to react and respond to future events.

1. INTRODUCTION

1.1. Background to investigation

As a Lead Local Flood Authority (LLFA) Bedford Borough Council, under Section 19 of the Flood and Water Management Act has a duty to investigate a flood event when considered appropriate and to the extent it deems necessary. The LLFA will identify the relevant Risk Management Authorities (RMAs) and record any actions which have been taken or they are proposing to action in response to the flood event. When an investigation is carried out under section 19 of the Act, the LLFA will publish the results of the investigation and notify any relevant risk management authorities.

The purpose of the flood investigation is to identify the reported impacts and likely causes of flooding, develop actions to mitigate the risk of flooding in affected locations and/or increase the preparedness of communities for future flood events.

The flooding reported across the Borough was from pluvial (surface water) only, affecting residential, commercial, communities, roads and educational properties. The Resilience Team commissioned a specialist consultant, AECOM, to support the investigation of reported internal flooding instances on the 20th of October 2022.

To investigate possible flooding mechanisms at each of the locations that reported flooding in October 2022, AECOM undertook site visits with Bedford Borough Council and Anglian Water representatives to the impacted areas. The resulting observations from this visit and supporting evidence obtained by the Council and Anglian Water of the event and post-event works have been collated into interactive PDFs which should be read in conjunction with this briefing note (Appendix C).

1.2. Individual Reports

The individual reports have been prepared providing details on each location where flooding occurred internally. The reports have been produced into an Interactive PDF which contain a map of the flooding locations and their immediate surroundings at a scale of 1:1000. There are a total of five layers that can be turned on with six buttons, with the sixth button used to display multiple layers at once. The layers obtained from Open Access sources are:

1. Light Detection and Ranging (LiDAR), outlining the local topography.

2. Environment Agency Flood Zones, outlining the risk of flooding from main rivers; and,

3. Risk of Flooding from Surface Water, outlining the risk of flooding from surface waters.

Two layers have been created by AECOM, these are:

4. Direction of Flow, outlining predicted surface water flow pathways based on local topography and the flow paths predicted on the Risk of Flooding from Surface Water dataset; and,

5. Annotations, outlining key site visit observations and information received from BBC and AW.

Each layer can be viewed by clicking the respective button. The 'Combined Layers' button displays the LiDAR, Risk of Flooding from Surface Water, Direction of Flow and Annotations layers simultaneously. It should be noted that not all sites will have Flood Zone or Direction of Flow data due to their location siting beyond the Flood Zone extents and negligible influence of surface water flow pathways.

1.3. Risk Management Authority Responsibilities

Table 1 shows RMAs responsible for managing the flood risk from different sources that the Council's investigation procedure applies to.

Flood Sources	Environment Agency	Lead Local Flood Authority (LLFA)	Drainage Authority	Water Company	Highway Authority
		Bedford BC	Bedford IDB	Anglian Water	Bedford BC
Main River	□				
Surface Water		□			
Surface Water (originating from the highway)					□
Sewer flooding				□	
Ordinary Watercourses		□	□		
Groundwater		□			
Reservoirs	□				

Owners of land adjoining, above or with a watercourse running through it are termed 'riparian owners' and have responsibilities to maintain and allow the free flow of water through their land.

1.4. Scale of Flood Event

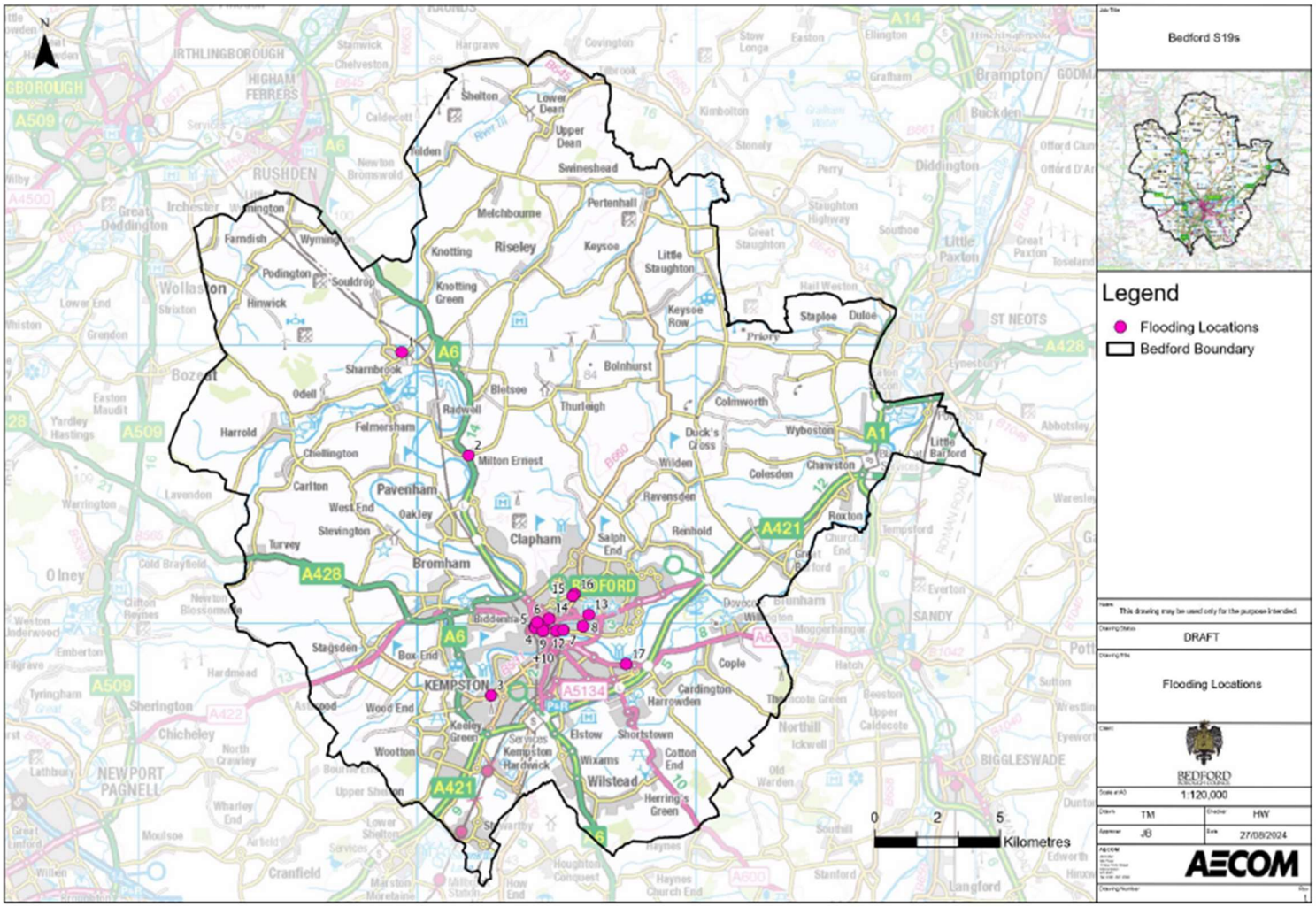
The Borough experienced flooding on the 20th of October 2022, with reports of internal property flooding at 17 locations. This only includes those reports that were provided to the Council. Figure 1.0 shows the extent of the flooding that occurred across the Borough.

A total of 17 individual investigations have been undertaken at each of the locations. Other areas are likely to have suffered external flooding to gardens and outbuildings etc. However, efforts have been focused on those reporting internal flooding.

This report provides an overview of the flooding experienced across the Borough, the findings of the flood investigations, and next steps.

It is acknowledged that the extent and scale of the locality flooding that occurred in October 2022 goes beyond the remit of the section 19 report, which focusses on locations where properties were internally flooded as a result of surface water flooding; however, there are many other communities, villages and Wards that were impacted across the Borough.

Figure 1.0 Flooding locations across the Borough October 2022



1.5. Information sources

Information was gratefully received to aid in the flood investigations from the following:

- Bedford Borough Council Highways
- Bedfordshire Fire and Rescue Service (BFRS)
- Bedfordshire Local Resilience Forum (BLRF)
- Anglian Water
- Members of the Public

2. RISK MANAGEMENT AUTHORITY RESPONSE

Following the first call the Council received at 05:56am reporting flooding, the Resilience Team and Highways Team co-located to coordinate the response and direct officers from both teams to the calls coming in.

Officers from both teams assisted by distributing aqua sacs, clearing gullies and pumping flood water away from properties where possible and offering reassurance and advice to properties that were affected.

An internal Silver Meeting was convened at 13:00 following the numbers of calls being received from the Council and the number of properties and infrastructure impacted by the flooding.

Following the internal Silver meeting a multi-agency Tactical Command Group (TCG) meeting was held with partners across Bedfordshire through the Bedfordshire Local Resilience Forum (BLRF).

The BLRF TCG for the flooding was convened at 14:30 to establish the extent and impact of the flooding across Bedfordshire. Partners including Bedfordshire Police, Bedfordshire Fire Service, Environment Agency and the Met Office attended.

The impact of the flooding seemed primarily over Bedford and Kempston.

Bedfordshire Fire received 70 calls on the morning of the 20th of October, the majority of which was focused in Bedford area. They attended 40 of these calls pumping water out where able and assisting vulnerable people.

The Environment Agency confirmed they would not be expecting to see any issues on ordinary watercourses or main rivers including the River Great Ouse following the rainfall as there was plenty of capacity within the system. As a result, no further TCG were scheduled after this.

Reports of flooding were primarily received by the Council, Bedfordshire Fire and Rescue Service and Anglian Water. Table 2 identifies the areas with reports of internal flooding, with a total of 17 locations being affected by internal flooding. These were concentrated across the north-west of Bedford, in the areas of Sharnbrook and Milton Ernest and within Bedford town centre itself.

The Council did not request any properties to be evacuated and as such no assistance centres were required and or set up. Several properties self-evacuated.

Table 2: Areas where properties suffered from internal flooding (October 2022)

Location Reference	Area	Source of Flooding	Affected Properties
1	High Street, Sharnbrook	Surface Water	1 x Residential
2	Rushden Road, Milton Ernest	Surface Water	1 x Commercial
3	High Street, Kempston	Surface Water	1 x Residential
4	Ashburnham Road, Bedford	Surface Water	1 x Residential
5	Ashburnham Road, Bedford	Surface Water	1 x Residential
6	Conduit Rd, Bedford	Surface Water	1 x Commercial
7	Castle Lane, Bedford	Surface Water	1 x Commercial
8	Bower Street, Bedford	Surface Water	1 x Commercial
9	Alexandra Road, Bedford	Surface Water	1 x Residential
10	Alexandra Road, Bedford	Surface Water	1 x Residential
11	Alexandra Place, Bedford	Surface Water	1 x Residential
12	St Paul's Square, Bedford	Surface Water/ Foul Flooding	1 x Commercial
13	Caves Lane, Bedford	Surface Water/ Foul Flooding	3 x Residential
14	Adelaide Square	Surface Water	1 x Residential
15	St Augustine's Road, Bedford	Surface Water	1 x Residential
16	Park Avenue, Bedford	Surface Water	1 x Commercial
17	Cardington Road, Bedford	Surface Water	1 x Residential

3. IMPACT OF THE FLOODING

The Council received 118 reports of flooding over the morning of 20th October from internal property flooding to road flooding and flooding of schools through roofs. The Council received its first call at 05:56am.

By the afternoon of 20th, the majority of the flooding had receded as drainage systems caught up and officers from both the Council and Fire Service worked non-stop to mitigate its impact as much as possible.

Due to the rainfall event falling within rush hour, disruption was caused to road networks across the Borough following the surface water flooding.

Many Roads across the Borough were flooded and closed as a result including Lovell Road, Oakley, Embankment, Brickhill Drive, Larke Way, Kimbolton Road, De Pary's Avenue, High Street, Risley, Dudley Street, Avon Drive, Highbury Grove, Clapham, Chaucer Road, Mile Road, Broad Avenue, Book Street and Waveney Green. One Nursing home was flooding which is included in the individual reports and several schools were flooded including Castle Newnham Primary, Castle Newnham Secondary, Kings Oak Primary, Goldington Academy, Lincroft Academy, St Thomas Moore Secondary and Westfield Primary. The majority from water damage through the roof.

Figure 2.0 Surface water flooding in Brickhill

No properties required evacuation by Bedford Borough Council. Once receded, flood water left debris, pollution from sewage flooding and siltation in the affected areas including properties, gardens, garages, roads, footways and the local drainage system, both Highways systems and Anglian Water Surface Water network and foul system.

Property and asset owners have subsequently needed to undertake cleansing and additional maintenance works. Figures 2.0 to 3.0 highlight some of the impact caused by the flooding across the Borough.

Figure 3.0 Anglian Waters Foul system surcharging

3.1. Cause of Flooding

The week leading up to the 20th October 2022 was typically unsettled for autumn. An Atlantic weather system brought areas of rain at times and gusts around 25 to 30mph during this time. Many of the leaf fall that occurred during this period covered the top grating of many of the gullies, particularly within Bedford town, exacerbating flooding issues on many of the roads affected.

Following thunderstorms on the morning Thursday 20th October a total of 31.4mm of rainfall fell between 07:00 and 07:59 am and a total of. 44mm of rainfall over the 12-hour period. According to the Met Office Rain Gauge in Bedford. Average October rainfall between 1991-2020 is noted as 65.27 mm at the nearby Bedford Aerodrome. This suggests that approximately 50% of the total October average rainfall fell over the Borough in one hour, resulting in widespread surface water flooding.

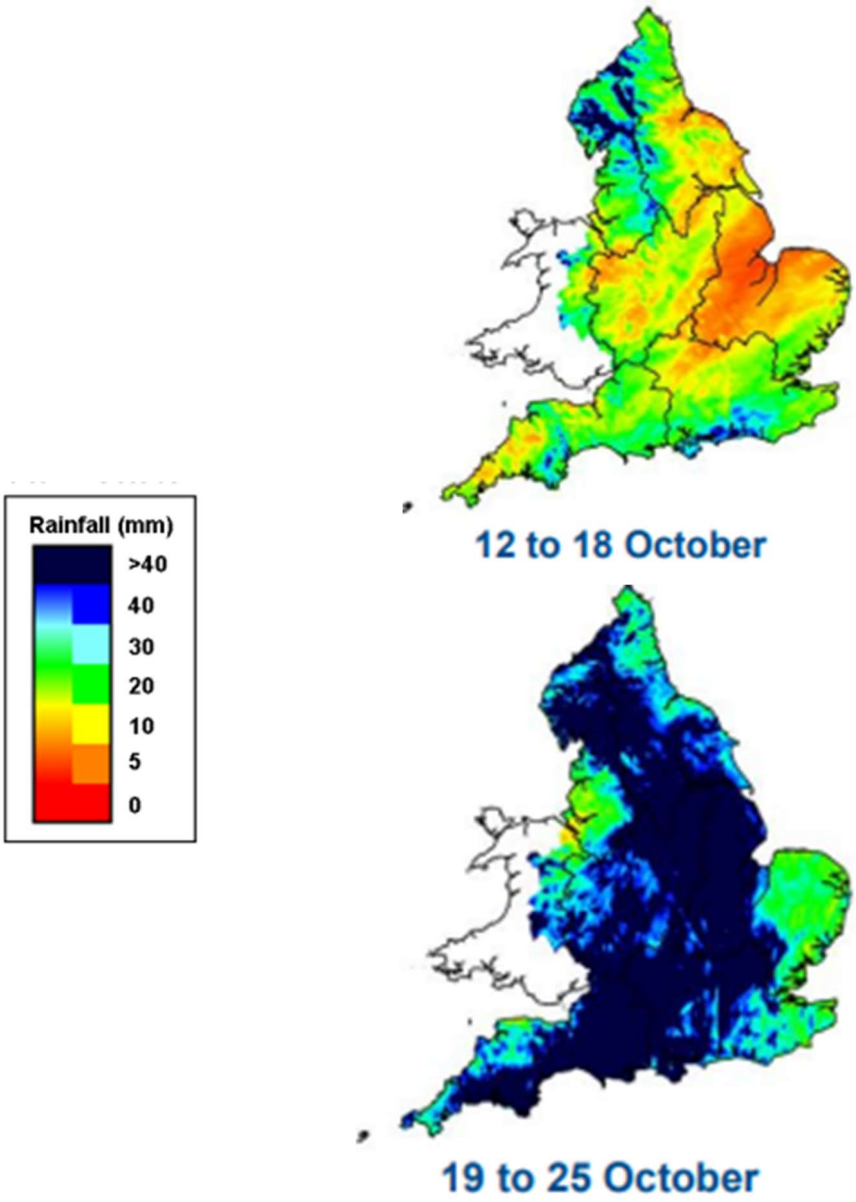
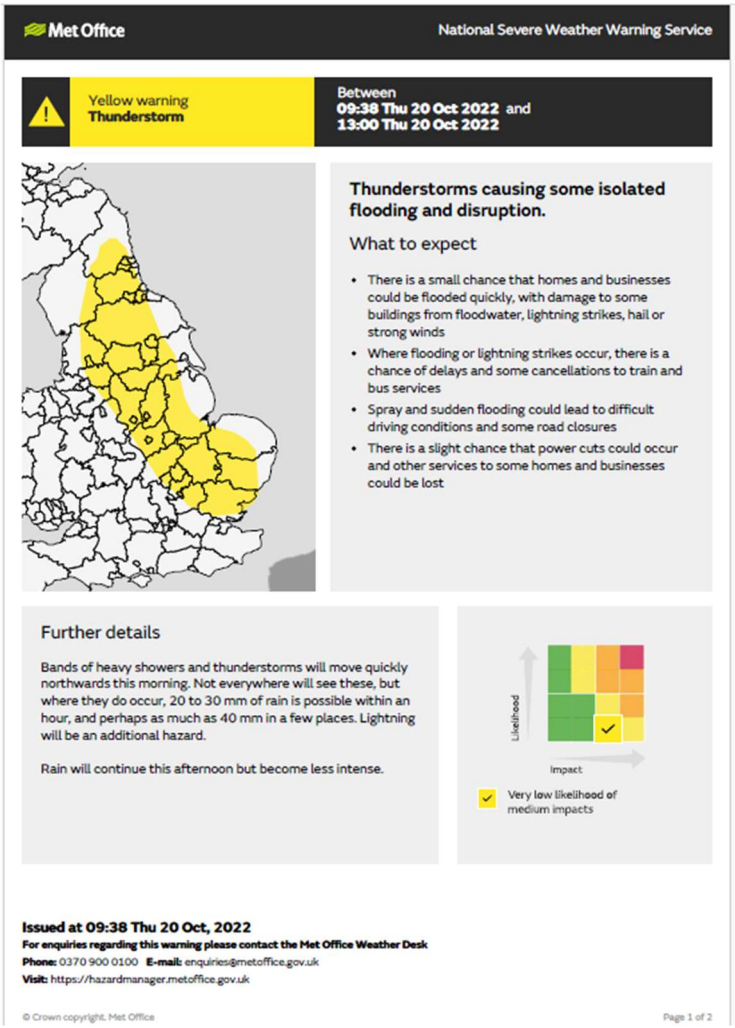


Figure 4.0 Weekly precipitation acroros Engladn and Wales.
Weekly Rainfall and Riverflow Reports for England.UKPP Radar Data

Figure 4.0 Highlights the weekly precipitation across England and Wales and shows very clearly the rainfall that was receieved the week of the 20th of October 2022.



At 09:38 on the 20th October the Met Office Issued a Yellow Weather Warning for Thunderstorms causing isolated flooding and disruption from 09:38 – 13:00 on the 20th October 2022.

The River Great Ouse remained within its 'normal range' and as such no Flood Alerts or Flood Warnings were issued by the Environment Agency. Equally no properties suffered from fluvial flooding.

The reported flood mechanisms in many of the affected areas are consistent with the Environment Agency Flood Risk from Surface Water mapping, which identifies the potential areas of ponding and flood flow routes that are expected to occur during rainfall events.

The mapping is a useful visual tool to identify areas at risk, although this is produced nationally so does not always correctly represent the local nuances in topography and drainage systems. This can be obtained through the following link: Technical map - Check your long term flood risk - GOV.UK

3.2. Recovery

Following the impact of the flooding and using the call logs and visits already completed, the Resilience Team along with officers from Highways Teams and Anglian Water carried out inspections on all flooded properties to fully understand the flooding that occurred as well as to identify any issues within the drainage system or assets that required attention and to establish whether other mitigation measures could be explored as a result. In the majority of cases the flooding that occurred was due to a hydraulic overload of the system. Which was evidence in the majority of locations where the flooding drained away fairly quickly after the intense rainfall had passed. This showed the drainage system was working when it had a chance to catch up and drain away effectively.

Assistance was provided by the Council in the removal of damaged items and used sandbags/aqua sacs. Additional gully cleaning occurred at all the vulnerable spots where had seen flooding and street cleansing also worked around these priority areas to ensure debris was swept away.

The Resilience Team continues to work closely with Highways, to identify where blockages and defects are apparent and develop better working practices and maintenance regimes that can ensure flood risk is better managed across the Borough. Including improving the joined up and collaborative approach across agencies particularly Anglian Water.

Including improved joint investigation and information sharing to ensure both parties are aware of specific areas and remedial actions to ensure the future resilience of the drainage network that is inherently linked and requires such transparency and good working relations.

Alongside Highways and Anglian Water better working relations have bene made with Street Cleansing again to ensure the joined-up approach to maintenance focusing on those at-risk locations

Anglian Water carried out both joint visits with the Council and prioritised other jobs based on their environmental impact and foul flooding entering properties.

The recovery for homeowners carried on for a long time after dealing with the devastating impact flooding causes to property.

4. NEXT STEPS/RECOMMENDATIONS

The flooding over the 20th October 2022 highlighted just how quickly surface water flooding can occur and the impact it can have. It highlighted the importance of homeowners and businesses to fully understand their own flood risk associated with their properties either from surface water or fluvial risk. By understanding the risk associated to communities, properties and businesses individuals, communities and the Borough can become better prepared and more resilient when dealing with future events.

Current drainage systems across the UK are designed to cope with such intense rainfall events therefore, residents, communities and the Council and its partners need to be as resilience as possible to react and respond to future events.

Mitigation measures will be explored such as water butts, raingardens and tree pits in areas at high risk of surface water flooding. These flood mitigation measures provide additional capacity during heavy rainfall events by storing rainwater that would otherwise flow into the surface water system and potentially overwhelm the drainage system causing flooding to properties and infrastructure.

To find out about flood risk associated to your property please use the following link
Where do you want to check? - Check your long-term flood risk - GOV.UK

Setting up Flood Groups across the Borough can also bring resilience to these at risk communities by the communities and residents being more aware of the flood risk associated in particular area along with plans detailing steps that will be taken during flood events.

Due to the limited number of properties affected in different locations the setting up of community flood groups can often be different to gather enough interest in one specific area. However, for more information on setting up a flood Group please contact floodrisk@bedford.gov.uk

The flooding that affected the majority of properties was from surface water flow paths which influenced flooding at 9 locations.

The small numbers of properties affected in each location makes mitigation options difficult to attract funding to be able to put forward schemes to complete, so Property Level Resilience measures have been recommended for many locations. However, those areas affected and at risk are constantly being reviewed and assessed both by the Resilience Team and in collaboration with other RMA's and partners as future funding and partnership opportunities arise.

5. APPENDICES

A – Key Terms

B - Summary of Recommendations as a result of the Flood Investigation reports

C - Individual Section 19 Reports

Appendix A - Key Terms

Within the 'Annotations' layer, tables have been produced outlining 'Key Comments', 'Source Theme' and 'Mitigation Theme' **Key Comments:** Outlines observations from the site visit conducted by AECOM, BBC and AW. Also notes key information (e.g. flood depths and post-event improvements) of the event received from BBC and AW

Source Theme: Due to the similar nature of the sources and causes of flooding between the individual locations, the sources of flooding have been classified into 8 No. Themes': Capacity issues; Gully clearance issues; Low threshold; Rainfall and downpipe flooding; Seepage; Surface water flow paths; and, Topographic influence.

Mitigation Themes: Due to the similar nature of the mitigation that could be employed across the Borough, potential mitigations have been categorised into 4 No. 'Themes'.
Capacity improvements; Flow path diversion; Leaky water butt; and Property Flood Resilience.

Key Term	Definition
Bow waves	Disturbance of flood water created by the movement of vehicles.
Capacity improvements^{-}	Measures that will increase the capacity of the drainage system. This can include measures above ground such as attenuation basins or below ground such as wet wells and storage tanks
Capacity issues^{+}	Borough wide constraints and development over time have led to reduced capacity of the drainage system across the Borough.
Downpipe	Vertical pipe that conveys water from roof guttering down the side of a building.
Flow path diversion^{-}	Measures that will change the conveyance route of surface waters on the ground surface. This can include altering local topography through measures such as kerb reprofiling and installing speed humps.
Gully clearance issues^{+}	Areas where problems with clearing drainage gullies are known to exist. Problems include tree route ingress, cars parked over manholes and other access issues.
Leaky water butt^{-}	Water butts that are attached to the base of gutter downpipes that release captured storm water through additional taps, thereby increasing the lag time between rainfall and entry to the drainage network.
Low threshold^{+}	Properties with thresholds that are lower than 150 mm (residential) or 50 mm (commercial).

Property Flood Resilience[-]	Measures at the property level that can reduce vulnerability and impact of flooding. Measures can reduce flood damage and help with recovery after a flood. Measures can include installing flood gates across doorways, raising property thresholds and installing pumps. Measures reduce likelihood of water getting into a property but do not prevent it.
Rainfall and downpipe flooding[+]	Flooding as a result of issues with waters drained off property roofs via guttering.
Seepage[+]	Slow movement of water through a solid surface (e.g. bricks) leading to internal flooding.
Surcharge[+]	As a result of the sewer entrance and exit being submerged, the pipe is flowing full which can result in the flow of water from the sewer or drainage system being conveyed out of manholes and to the surrounding area. Blockages and capacity constraints are likely to enhance the likelihood of surcharge. This can be within the foul, surface water or combined network.
Surface water flow path[+]	Natural overland flow route of surface water, usually follows local ground profile.
Threshold	Level that property entryways are set at.
Topographic influence[+]	Local ground level has a strong influence over flooding, for example, conveying surface water towards a property due to a fall in gradient or a property being situated within a depression.

BEDFORD BOROUGH COUNCIL

Appendix 1

Appendix B - Summary of Recommendations as a result of the Flood Investigation reports

	Area	Key Comments	Source	Recommendations
1	Sharnbrook	• Low Threshold Property • Ingress through front of property and bricks • Gullies maintained and additional drainage installed prior to the event – however limited effectiveness prior to the event. • Currently no property Flood Resilience available	• Surface Water flow paths • Low threshold	• Property owner to explore Property Flood resilience and BBC to support where possible
2	Milton Ernest	• Topographic low point leading to localised pooling of water • Low threshold along the side of the building adjacent to the car park	• Surface Water flow paths • Low threshold • Topographic influence	• Property owner to explore Property Flood resilience and BBC to support where possible
3	Kempston	• Low Threshold Property • Drop kerbs and multiple entry point and mechanisms	• Surface Water flow paths • Low threshold	• Flow path diversion • Property owner to explore Property Flood resilience and BBC to support where possible
4	Ashburnham Road, Bedford	• Basement Flats • Roof runoff and downpipe outfalls at basement level • Combine foul flooding Anglian Water fitted Non-Return Valves and monitors	• Rainfall and downpipe flooding	• To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding • Non-return valves fitted to foul system
5	Conduit Road, Bedford	• Road cambers directs surface waters downslope • Downpipes outfalls adjacent to main entrance of the building • No downpipe connection to drains potentially leading to water ponding • Combine foul flooding Anglian Water fitted Non-	• Surface Water flow paths • Low threshold	• Property owner to explore Property Flood resilience and BBC to support where possible • To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding

		Return Valves and monitors		
6	Castle Lane, Bedford	• Existing flood gates too low however the protection level provided limited • Sufficient gullies and drains on the road • Potential downstream blockage and capacity constraints • Roof Angle direct water to courtyard	• Surface Water flow paths	• Property owner to explore Property Flood resilience and BBC to support where possible
7	Bower Street, Bedford	• Low Threshold Property • Slight topographic influence • Downpipe outfalls to a drain next to the front door	• Low threshold • Rainfall and downpipe flooding	• Property Owner to explore Property Flood resilience and BBC to support where possible
8	Alexandra Road, Bedford	• Downpipe outfalls to basement entrance way	• Rainfall and downpipe flooding	• To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding
9	Alexandra Road, Bedford	• Downpipe outfalls to basement entrance way	• Rainfall and downpipe flooding	• To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding
10	Alexandra Place, Bedford	• Damaged downpipes • Downpipe outfalls into Highway	• Rainfall and downpipe flooding	• To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding
11	St Paul's Square, Bedford	• Surface water conveyed along steps to the basement • Surface water entry to foul system led to foul sewer surcharging in basement • Lateral seepage through external bricks	• Foul surcharging • Seepage	• Property Owner to explore Property Flood resilience and BBC to support where possible
12	Caves Lane, Bedford	• Tree lined avenue • Multiple slopes directing surface water flows towards properties	• Surface Water flow paths • Foul surcharging • Topographic influence	• Property owner to explore Property Flood resilience and BBC to support where possible
13	Adelaide Square,	• Downpipe outfalls to basement entrance way	• Rainfall and downpipe flooding	• Homeowner to explore Property Flood resilience and BBC

	Bedford			to support where possible • To investigate the effectiveness of a water butt project to mitigate the effect of surface water flooding
15	St Augustine's Road, Bedford	• Road camber directs surface water towards property • Potential surcharge from surface water sewer	• Surface Water flow paths • Topographic influence	• Property Owner to explore Property Flood resilience and BBC to support where possible
16	Park Avenue, Bedford	• Topographic low point • Multiple surface water flow routes • Reports of groundwater flooding in basements • Surface water drainage surcharge • Existing Anglian Water Surface Water Sewer is fed by water from an open ditch across Park Avenue. Ditch has flooded gardens of adjacent properties due to capacity issues Low Threshold Property	• Surface Water flow paths	• Flow path diversions
17	Carding ton Road, Bedford	• Low Threshold Property • Very low risk of flooding from surface water on flood maps • Bow waves from Cardington Road • Adjacent ditch to property unknown influence but likely to provide greater drainage abilities in smaller rainfall event. • Slight topographic influence Downpipe outfalls to a drain next to the front door	• Surface Water flow paths	• Flow path diversions

Appendix C - Individual Section 19 Reports