

Flood Investigation Report

Location:

Bletchley and Fenny Stratford, and
West Bletchley

Flood Event: 18th June 2021

Report Date: August 2022

This report has been prepared to fulfil Milton Keynes Council’s responsibility under the Flood and Water Management Act 2010. 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.

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1.0 Purpose and Scope of Report

As the Lead Local Flood Authority (LLFA) for the Borough of Milton Keynes, it is Milton Keynes Council's duty to investigate flood incidents as detailed within Section 19 of the Flood and Water Management Act 2010.

Milton Keynes Council investigates flood incidents that meet the following threshold:

- Flooding has affected critical infrastructure for a period in excess of three hours from the onset of flooding
- Internal flooding of a building has been experienced on more than one occasion in the last five years
- Internal flooding of five buildings in close proximity has been experienced during one single flood incident

Table 1.0: Scope of investigation

| The investigation will: | The investigation is unable to: |
|---|--|
| <ul style="list-style-type: none">○ Identify and explain the likely cause(s) of flooding○ Identify which authorities, communities and individuals have relevant flood risk management powers and responsibilities in respect of the flooding incident○ Provide recommendations for each of those authorities, communities, and individuals○ Outline whether those authorities, communities or individuals have or will exercise their powers or responsibilities in response to the flooding incident. | <ul style="list-style-type: none">○ Resolve the flooding issues or provide designed solutions○ Force authorities, communities or individuals to undertake any of the recommended actions. |

2.0 Roles and Responsibilities

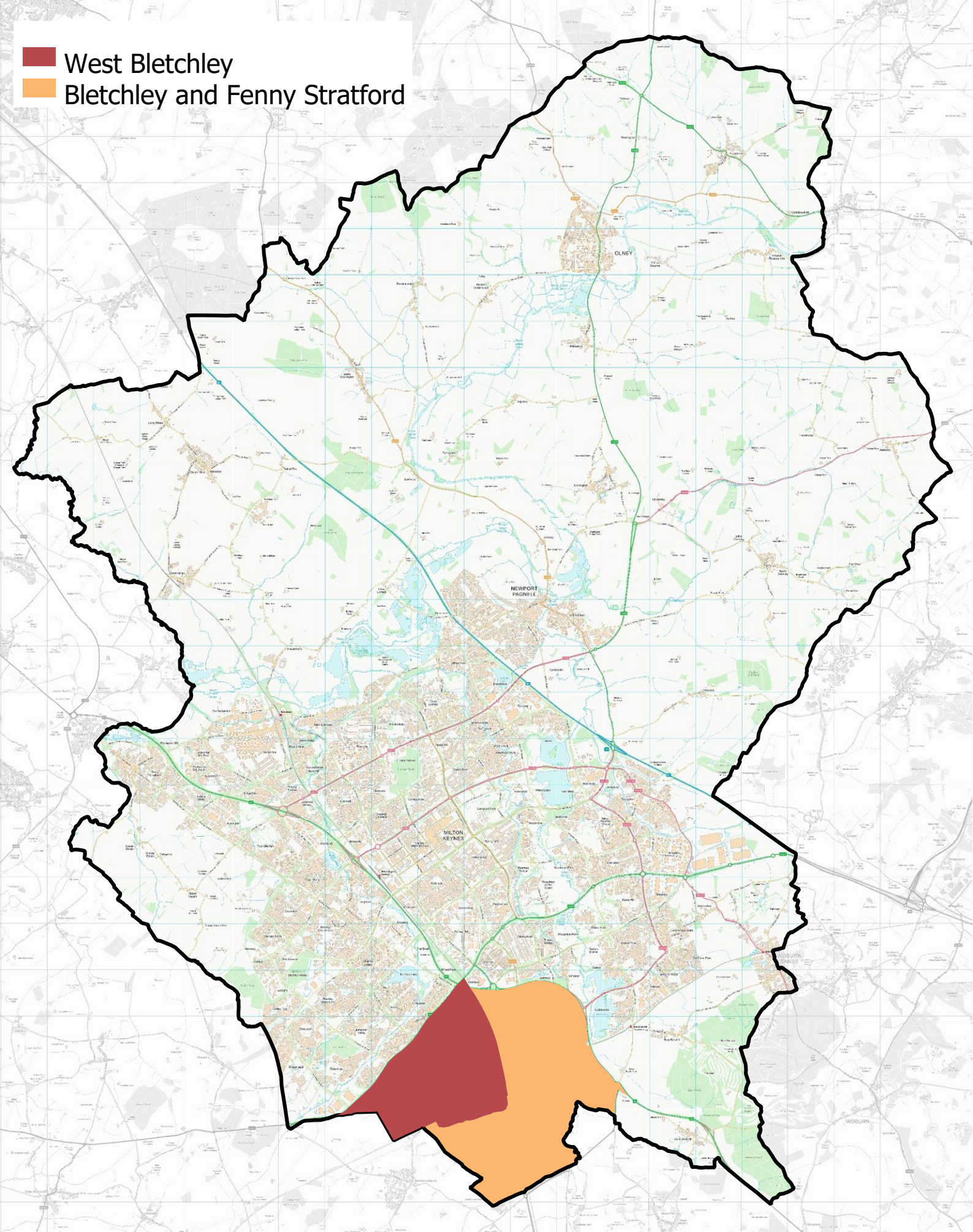
| Flood Risk Management Authority (RMA) | Roles and Responsibilities for Flood Risk Management |
|---|---|
| Lead Local Flood Authority (LLFA) | <p>Under the Civil Contingencies Act 2004, Milton Keynes Council is a Category 1 Responder. As a Lead Local Flood Authority, Milton Keynes Council:</p> <ul style="list-style-type: none"> • Under Section 19 of the Flood and Water Management Act 2010, investigates flood incidents that meet the threshold as set out in the approved Flood Investigation Protocol • Coordinate the management of flood risk from surface water, groundwater and from ordinary watercourses that are not within an Internal Drainage Board district • Issue Land Drainage Consents for any works to ordinary watercourses (i.e. streams, ditches) that may affect the flow or storage of water outside the Internal Drainage Board’s district. This process is administered by the Bedford Group of Internal Drainage Boards as they are responsible for issuing consents on behalf of Milton Keynes Council. • Maintain a register of structures and features that are likely to have a significant effect on flood risk in their area and designate assets if appropriate • Respond as a statutory consultee for planning applications with surface water drainage implications. |
| Highway Authority (Milton Keynes Council) | <p>Under the Civil Contingencies Act 2004, Milton Keynes Council is a Category 1 Responder. Under the Highways Act 1980, the Highway Authority is required to:</p> <ul style="list-style-type: none"> • Ensure that all adopted highways are drained of surface water and where necessary maintain highway drainage systems. Ditches that run alongside a highway generally do not form part of the highway and may remain the responsibility of the landowner or occupier. |
| Anglian Water | <p>Under the Civil Contingencies Act 2004, Anglian Water is a Category 2 Responder. Water and Sewerage Companies have a duty to:</p> <ul style="list-style-type: none"> • Effectually drain areas within their responsibility • Manage the risks of flooding from all types of public sewer (foul, combined and surface water sewers), as well as burst mains. |
| Businesses and householders | <p>It is the responsibility of residents to:</p> <ul style="list-style-type: none"> • Protect their property from flooding and erosion (through property level resilience and resistance measures) provided it does not increase flood risk to other people’s property and land • Let water flow naturally through their land • Identify all the necessary permissions and licences required to maintain, repair, build or remove anything in and around any watercourse. |

3.0 Executive Summary

- This flood investigation report was undertaken following a flood event that occurred in Bletchley during the afternoon of Friday 18th June 2021.
- The likely cause of the flooding was due to an intense rainfall event that subsequently led to the overwhelming of surface water systems. This type of pluvial flooding is normally associated with high intensity summer storm events.
- Flooding on Angus Drive, Moray Place, and Melrose Avenue was further exacerbated by an open channel near Angus Drive.
- Reports of internal flooding to 46 residences, three shops, and three schools in Bletchley were received by Milton Keynes Council. This number may not reflect the true number of properties affected, as some residents may not have reported their flooding.
- Flooding also occurred on multiple streets, including but not limited to Water Eaton Road, Lennox Road, Bettina Grove, Buckingham Road, Caernarvon Crescent, Chester Close, Doon Way, Dorset Close, Melrose Avenue, Newton Road, Santen Grove, Whadden Way, Whalley Drive, and Watling Street.

The impacted parish areas included in this report are shown on the map in Figure 1 on the following page.

West Bletchley
Bletchley and Fenny Stratford



Lead Local
Flood Authority

Date: 2/3/2022

@A4P

**Bletchley parish areas within the
Borough of Milton Keynes**

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Scale
1:100,000

4.0 Background and Context

Bletchley is a constituent town of Milton Keynes covering both residential and industrial areas. Based on data from the Office for National Statistics, the average number of people per square kilometre in Bletchley is 3,743 across three lower layer super output areas (LSOAs)¹. This indicates that it is a relatively dense urban area. Plan:MK identifies plans for re-development and urban renewal in Bletchley²; this is worthy to note as a relevant factor for surface water management.

4.1 Geology

The British Geological Society (BGS) provides open data on bedrock geology and superficial deposits for the UK.³ Further information on soil types is available from Cranfield Soil and Agrifood Institute.⁴ Data from these sources suggests that the types of deposits encountered in Bletchley are likely to have low to moderate infiltration potential. West Bletchley is underlain by lime-rich loamy and clayey soils with slightly impeded drainage. Bletchley and Fenny Stratford is underlain by slightly acidic loamy and clayey soils with slightly impeded drainage. Whilst the geological make-up of the area is relevant contextual information, flood risk from surface water is largely created by a high coverage of impermeable surfaces such as roads and roofs.

¹ Open data available at: (Lower layer Super Output Area population estimates (supporting information) - Office for National Statistics (ons.gov.uk))

² Further information can be accessed via: Central Bletchley Prospectus - Milton Keynes Council (milton-keynes.gov.uk) and Central Bletchley Regeneration Strategy - Milton Keynes Council (milton-keynes.gov.uk).

³ Geology of Britain viewer - British Geological Survey (bgs.ac.uk)

⁴ Soilscales soil types viewer - National Soil Resources Institute. Cranfield University (landis.org.uk)

5.0 Flood Risk

Located in the south-west of the borough, the affected parish areas of West Bletchley and Bletchley and Fenny Stratford were identified as 'Critical Drainage Catchments' (CDCs) in the 2016 Surface Water Management Plan for Milton Keynes. A Critical Drainage Catchment is defined as:

'Areas of significant flood risk, characterised by the amount of surface runoff that drains into the area, the topography and hydraulic conditions of the pathway (e.g. sewer, river system), and the receptors (people, properties and infrastructure) that may be affected.' (SWMP, 2016).

The table below summarises the surface water flood risk data for the area outlined in the 2016 Surface Water Management Plan⁵.

Table 3.0: Summary of surface water flood risk in Bletchley

| CDC Number | CDC Name | CDC Area (km ²) | Flooded buildings 1 in 30 AEP event | Flooded buildings 1 in 100 AEP event | Flooded buildings 1 in 1000 AEP event | Critical infrastructure at risk |
|------------|-------------------------------|-----------------------------|-------------------------------------|--------------------------------------|---------------------------------------|---|
| CDC9 | Bletchley and Fenny Stratford | 13.72 | 299 | 717 | 2377 | <ul style="list-style-type: none"> 1 emergency service is at high risk (3.3% AEP) 2 educational facilities are at high risk (3.3% AEP) 1 surgery/healthcare centre is at medium risk (1% AEP) 2 electricity substations are at medium risk (1% AEP) |
| CDC20 | West Bletchley | 3.84 | 20 | 64 | 341 | <ul style="list-style-type: none"> 2 emergency services are shown to be at low risk (0.1% AEP) 8 educational facilities are at high risk (3.3% AEP) 1 surgery/healthcare centre is at high risk (3.3% AEP) 1 sewage treatment works is at medium risk (1% AEP) 1 electricity substation is at medium risk (1% AEP) |

Government data suggests there are over 65,000 people in 12,145 properties living in areas at high risk of surface water flooding across the Anglian River Basin area.⁶ The table above indicates that there are 319 properties in Bletchley at high risk of surface water flooding in a 1 in 30 AEP event.

⁵ 2016 SWMP report produced by AECOM is accessible via the Milton Keynes Council website

⁶ Data accessible via:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/456961/LIT8956_FloodRiskMaps_Anglian_SurfaceWater_v2.pdf

A map showing areas at high risk from surface water flooding can be found on the following page, produced using data from the Environment Agency's flood risk maps for surface water.⁷

The surface water maps on the following page indicate that flooding is expected in Bletchley on Baccara Grove, Beaverbrook Court, Berwick Drive, Cawkwell Way, Chestnut Crescent, Denham Close, Drayton Road, Dumfries Close, Eaton Avenue, Fensham Drive, Findlay Way, Hunter Drive, Larch Grove, Maple Grove, Manor Road, Melrose Avenue, Mersey Way, Morebath Grove, Nottingham Grove, Portbrush Close, Queensway, Severn Way, Sherwood Drive, Stoke Road, Sunningdale Way, Sutherland Grove, Tavistock Street, Tiffany Close, Walnut Drive, Water Eaton Road, Watling Street, Whadden Way and Wolfescote Road in a 1 in 30 year Annual Exceedance Probability (AEP) rainfall event.

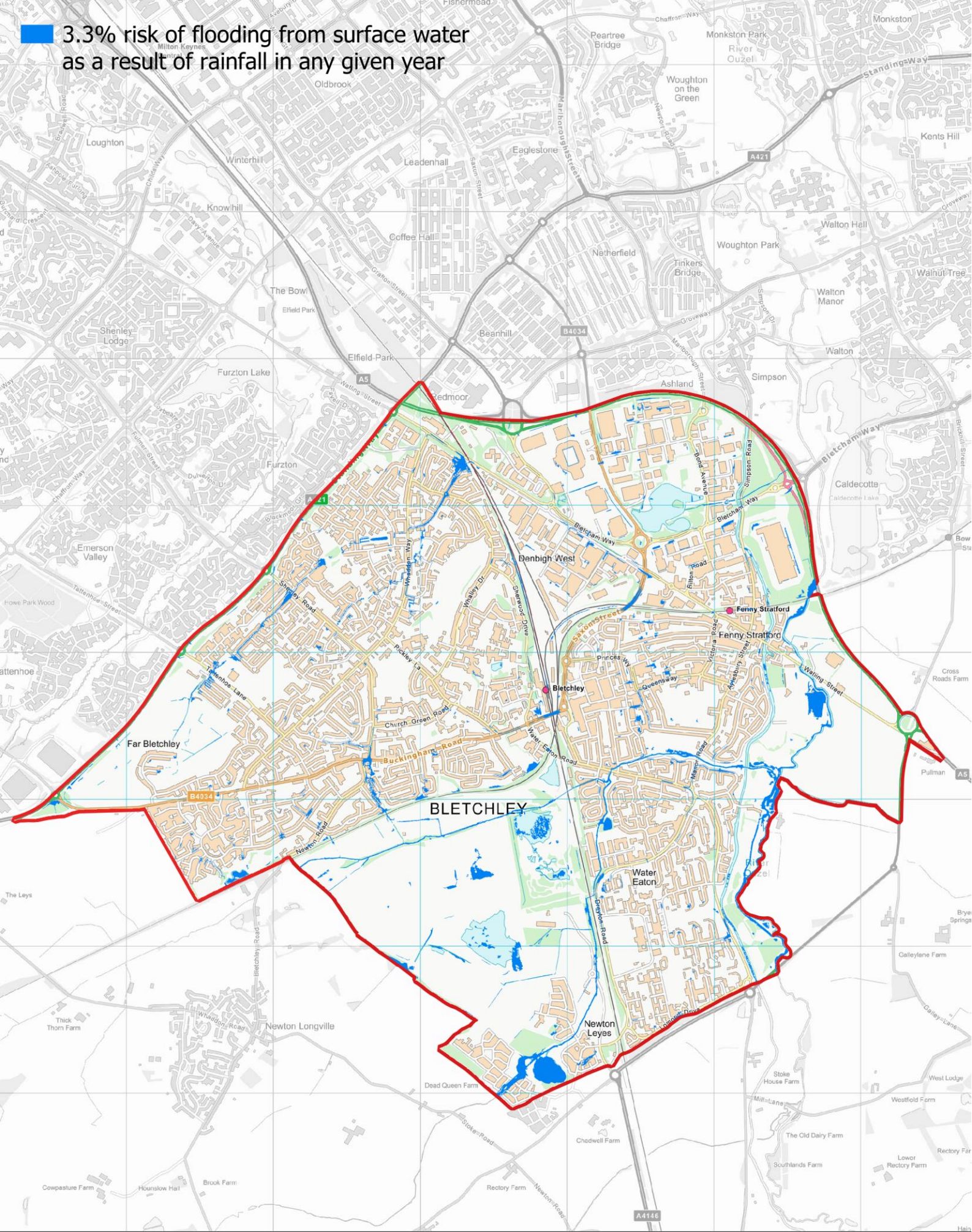
The BGS groundwater dataset also suggests that there is potential for groundwater flooding in some areas of Bletchley.

6.0 Flood History

Milton Keynes Council hold records of flooding in Bletchley during flood events in May 2018 and June 2016. Comparison of flood data from 2016, 2018 and 2021 indicates that localised flooding occurred in different locations across the three flood events, with eight areas identified as having flooded in at least two of the three events. These past events were taken into consideration when developing area-specific recommendations as part of this 2021 flood investigation.

⁷ Search the risk of flooding from surface water map on the Environment Agency website (www.environment-agency.gov.uk/flood) by postcode or town name.

3.3% risk of flooding from surface water as a result of rainfall in any given year



**Lead Local
Flood Authority**

Date: 3/3/2022

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**Flood Risk Map
for Surface Water**

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Scale
1:31,500

7.0 Rainfall Event (June 2021)

Long term average monthly rain records published by the MET office indicate that the estimated Long Term Average (LTA) rainfall for the region in March, April and May are 55 mm, 53 mm, and 59 mm respectively. The 2021 regional data shows rainfall of 45.1 mm, 13.5 mm, and 119.6 mm for these months, indicating that rainfall totals fluctuated in the preceding months, with much drier than average conditions during April 2021 and much wetter than average conditions during May 2021. The regional LTA for June is 53 mm. Monthly rainfall totals are particularly relevant for indicating ground saturation prior to fluvial flood events. For this report, these figures are intended to provide contextual information for understanding the localised rainfall totals for the specific pluvial event under investigation.

A variety of organisations and agencies measure and analyse rainfall data to understand surface water flood events. As heavy rainfall events are often highly localised, rainfall gauges in varied locations may show different rainfall totals for the same rainfall event. Similarly, the aggregate rainfall across a day may be taken from differing start and end points, which can also explain a variation in rainfall totals across any given day. The below information was collected from three different data sources to indicate the rainfall on the 18th June 2021.

Data from the Environment Agency's two nearest tipping-gauge rainfall sensors show rainfall totals of 50.6 mm and 66.2 mm on this day.⁸ This data demonstrates that the rainfall total on the day of the flooding event was higher than the average rainfall total for the month.

Rainfall data received from a Milton Keynes Council Highways rain gauge in Bow Brickhill shows a rainfall total of 70.9 mm within 24 hours between the 17th and 18th June, with 60 mm falling within an 8 hour period.

Data provided by Meniscus, an analytics platform that uses real time rainfall and flood monitoring data, indicates that the most intense period of rainfall occurred in the early afternoon. A peak rainfall intensity of 40 mm/h observed between 12:30 – 15:00. This represents a 1 in 50 year, or 2% Annual Exceedance Probability (AEP) event.

⁸ Map showing EA rainfall gauges is shown in Appendix A.

8.0 Flood Response

| Organisation/Team | Action |
|---|---|
| Buckinghamshire Fire and Rescue Service | <ul style="list-style-type: none"> • Attended 33 call-outs for internal flooding • Activation of a Partner Area Teleconference (PAT) • Forwarded log to LLFA for data collation |
| Milton Keynes Council Customer Services | <ul style="list-style-type: none"> • Received phone calls from residents experiencing flooding, relayed information to operational team • Logged information and later passed this to LLFA |
| Milton Keynes Council Housing | <ul style="list-style-type: none"> • Relocated some residents to temporary accommodation |
| Milton Keynes Council Highways | <ul style="list-style-type: none"> • Activated flood desk to log and capture required actions • Received over 100 phone calls • Updated media communications informing public of road closures • Operations team attended flooding locations, closed roads and attended with tanker • Forwarded log to LLFA for data collation |
| Milton Keynes Council Lead Local Flood Authority (LLFA) | <ul style="list-style-type: none"> • Received phone calls from local councils and ward members, liaised with operational response team • Requested activation of PAT conference from Buckinghamshire Fire and Rescue service • Monitored social media for real-time local information updates |

Table 4.0: Milton Keynes Council teams and Emergency Service response during the flood event

9.0 Flood Investigation

Following the flood event, data was collected and collated from multiple sources to create a summary of the flood impacts. Buckinghamshire Fire and Rescue Service, Milton Keynes Council Highways, Milton Keynes Council Housing, Milton Keynes Council Customer Services, and the Lead Local Flood Authority flood logs were collated. Areas which experienced internal flooding to properties are shown on the map on the following page.⁹

Key actions stemming from investigation works include remedial works undertaken on the open channel near Angus Drive and a resolved blockage caused by tree roots in the surface water drainage network by the junction between Shenley Road and Whaddon Way.

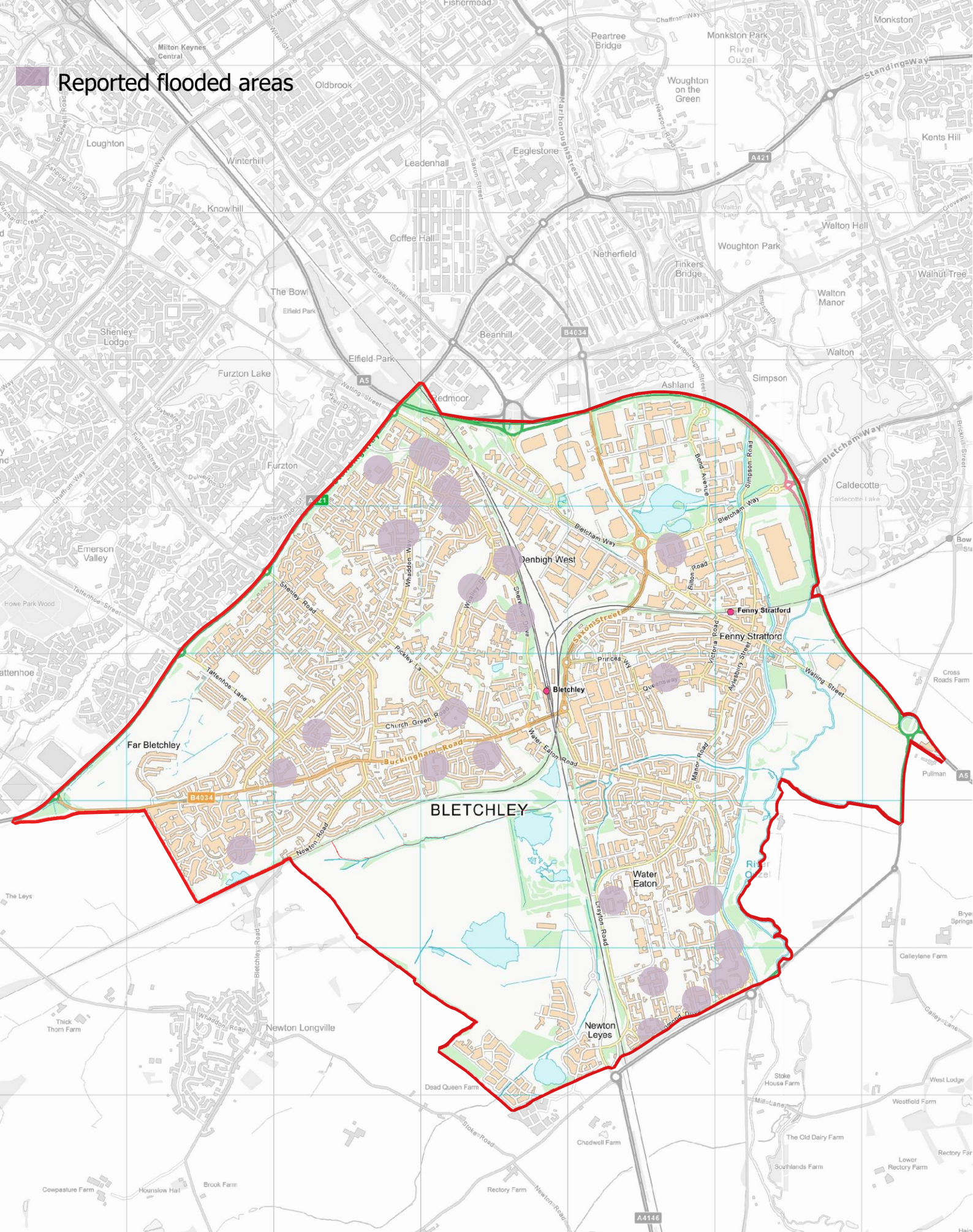
Site visits were conducted on 13th October 2021, 29th October 2021, and 10th November 2021 to collect information on the affected areas. Site photographs were taken and flow paths were identified.

During the site visits, the LLFA engaged with residents affected by flooding to gather descriptive information on the flood event, including flow directions and extent of impact.

This flood investigation report was then written to summarise the flood event.

⁹ Precise location data has been buffered to a 100m radius due to GDPR compliance.

Reported flooded areas



Lead Local
Flood Authority

Date: 3/3/2022

@A4P

**Flood impacted locations
reported to Milton Keynes
Council**

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Scale
1:31,500

10.0 Flood Vulnerability

This section provides an overview of factors that could influence surface water flood risk. These factors are generally applicable across all urban regions, though local examples are also included at the end of this section.

10.1 Roof and Building Design

Some properties are impacted due to household scale flood mechanisms, such as the roof style, guttering, drainage infrastructure and driveway or garden topography. These factors can impact whether a property will flood during heavy rainfall. Some properties in the Bletchley area have flat roofing with shallow guttering. During intense rainfall, rainwater from these roofs can overtop guttering and spill directly onto the ground immediately outside the front or back of properties. If this area is also hardstanding with limited drainage infrastructure, water can build up and enter the threshold of the property. Household level infrastructure can also become overwhelmed more quickly if multiple houses share a drainage downpipe, as the impermeable roof area being drained is too great for the pipe to accommodate. Guttering can also become blocked with leaf fall or litter, impeding its drainage performance.

10.2 Estate Characteristics

The topographic characteristics of housing estates can also cause flooding in certain areas, most often when sewer flooding causes surface flows to drain via gravity to the lowest point on an estate. Homes at the bottom of sloped cul-de-sacs or terraces that are positioned below the street level are therefore more vulnerable to flooding. In the past when urban areas were first built, impermeable surfacing was used to build roads, footpaths, and carparks as well as the roofs of buildings. Impermeable surfacing creates large volumes of water during heavy rainfall events, as water cannot infiltrate as it would on permeable surfaces such as soil. Therefore, the proportion of impermeable surfacing across an estate is also a relevant factor when considering vulnerability to flooding.

10.3 Conveyance Infrastructure

At a catchment scale, surface water drainage is dependent on a range of conveyance infrastructures such as rills, gullies, drains, pipes and culverted or open ditches. These infrastructures accommodate flows of water and transfer it to ponds, lakes, and rivers. The networks of conveyance infrastructures across Milton Keynes are managed by multiple authorities as well as individual land holders. Conveyance infrastructures can become obstructed, silted, blocked, or over-vegetated, which affects the extent to which they can carry flows. Conveyance infrastructures can also face capacity issues when intense or

prolonged rainfall produces a larger volume of water than infrastructures were originally designed to accommodate.



Figure 1: Impermeable sloped topography in areas typically impacted.

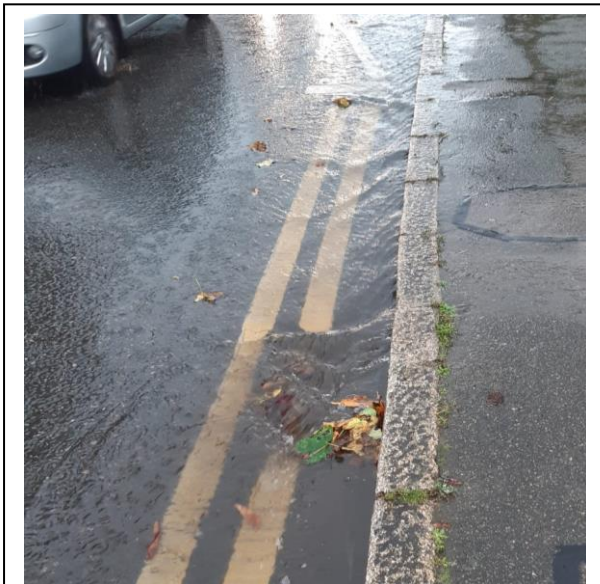


Figure 2: Surface water beginning to build in heavy rain with leaf debris



Figure 3: Conveyance infrastructure near Angus Drive

11.0 Recommendations

| Organisation/Stakeholder | Recommended Actions |
|----------------------------------|--|
| MKC – Lead Local Flood Authority | <ul style="list-style-type: none"> • Ensure the Flood Investigation Report is forwarded to each Risk Management Authority identified in the context of the specific flood event under investigation. • Ensure that flood investigation reports are published online, and all partners are notified. • Continue to support other teams within Milton Keynes Council to further develop internal procedures for flood preparation, flood response and flood recovery. • Work with local councils and communities to support flood resilience. Flood resilience involves being better prepared for emergencies, having a flood plan in place to respond, and adapting to enable a faster recovery after flooding. • Identify opportunities for project works to reduce flood risk by retrofitting SuDS. SuDS help to intercept and store surface water, and can reduce pressure on the public surface water sewer network. • To consider opportunities for soft landscaping changes and property flood resilience measures in locations where land and property is owned by Milton Keynes Council • Work to improve understanding of surface water flood risk in Bletchley by integrating local knowledge. |
| MKC - Housing | <ul style="list-style-type: none"> • Consider the viability of replacing guttering, increasing the number of downpipes, or installing ground level drainage for high risk sites under Council ownership. • Identify conveyance infrastructures on housing land and review maintenance arrangements for vegetation clearance and general inspections. |
| MKC – Highways | <ul style="list-style-type: none"> • Continue to perform maintenance of gullies and drains. • Assess whether areas at high risk from surface water flooding could be given added priority when moving to an asset-led maintenance programme for gully cleansing. |
| Anglian Water | <ul style="list-style-type: none"> • Continue to identify and resolve problems that arise in the public surface water sewer network. |

| | |
|--|---|
| | <ul style="list-style-type: none"> • Continue to work with the LLFA to develop partnership projects for SuDS retrofits. |
| West Bletchley Town Council | <ul style="list-style-type: none"> • Consider raising awareness and knowledge on flood risk through public communications. • Work to establish a flood response group. This group could provide early warnings, develop a flood plan, liaise with MKC, and support residents in the event of future flooding. • Review the role of the Town Council in supporting flood preparation, response and recovery. • Draw upon the LLFA for resourcing and technical support when working towards these goals. |
| Bletchley and Fenny Stratford Town Council | <ul style="list-style-type: none"> • Consider raising awareness and knowledge on flood risk through public communications. • Work to establish a flood response group. This group could provide early warnings, develop a flood plan, liaise with MKC, and support residents in the event of future flooding. • Review the role of the Town Council in supporting flood preparation, response and recovery. • Draw upon the LLFA for resourcing and technical support when working towards these goals. |
| Local residents and communities | <ul style="list-style-type: none"> • Sign up for MET Office weather warnings. • Check your flood risk on the Gov.uk website. • If your property is at high or medium risk from flooding, complete a household flood plan to prepare for future flooding. • Consider any landscaping changes or property level protection measures you could add to your property. • If you have a garden, consider installing a water butt to your property. • If you notice a blocked drain, report it on the MKC website. • If you notice heavy rain is predicted, check the drain tops nearby your house are clear of litter and leaves. • If your property has flooded but you didn't report it, or if you have flooded two or more times since 2016, please contact LLFA@milton-keynes.gov.uk to ensure our records are complete. • Consider volunteering as a local flood warden. Email LLFA@milton-keynes.gov.uk for further information. |

| Location | Recommended Action |
|---|---|
| Angus Drive/Moray Place | <ul style="list-style-type: none"> • Milton Keynes Council to review maintenance arrangements for vegetation works around the open channel, consider working with West Bletchley Town Council for future maintenance • Anglian Water to inform LLFA and West Bletchley Town Council of the frequency of outfall checks on this infrastructure |
| Nevis Grove | <ul style="list-style-type: none"> • LLFA to consider whether volunteer emergency response team (VERTs) could aid in a future flood event in this area |
| Brora Close, Torridon Court, Rimsdale Court, Laggan Court | <ul style="list-style-type: none"> • LLFA and Milton Keynes Council Housing to review property level drainage for any council owned properties in the area and consider works to make them less susceptible to flooding |
| Gairloch Avenue | <ul style="list-style-type: none"> • Milton Keynes Council Highways to check the drain at the lowest point on this road is clear and functioning effectively • Consideration could be given by householders to install flood barriers on the outer front gates of the two lowest lying properties on this street |
| Cold Harbour Rimary Schools, Holne Chase Primary School | <ul style="list-style-type: none"> • LLFA to assess the viability of SuDS retrofit projects in these schools • Anglian Water to consider partnership funding for SuDS retrofits in these schools |

Table 5.0 Recommended actions

12.0 Appendix A

Station E24763

- label: Rainfall station
- Station ID: E24763
- Lat, long: 51.95, -0.77
- Grid ref: SP848286
- EA region: Anglian

Station E22231

- label: Rainfall station
- Station ID: E22231
- Lat, long: 52.00, -0.63
- Grid ref: SP941343
- EA region: Anglian

Information on the two nearest Environment Agency rainfall gauging stations to Bletchley. All EA rain gauging station locations can be seen on a map using the Environment Agency's Rainfall API Demonstrator.ⁱ

ⁱ Accessible via: <https://environment.data.gov.uk/flood-monitoring/assets/demo/index.html>