Milton Keynes Council

FLOOD RISK INVESTIGATION

Bletchley Section 19 Report

JULY 2022

PUBLIC

Milton Keynes Council

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1 INTRODUCTION

1.1 BACKGROUND

1.1.1. WSP UK Ltd (WSP) have been commissioned by the Milton Keynes Council (MKC) Flood and Water Management Team to investigate a flooding event in the property affected on Mill Road in Bletchley on the 15th January 2021.

1.1.2. A Section 19 flood investigation under the Flood and Water Management Act (FWMA) 2010 has been completed for Bletchley to investigate the flooding mechanisms, causes and sources of flooding that occurred.

1.2 RISK MANAGEMENT AUTHORITIES

1.2.1. Summary of Risk Management Authorities (RMA) and their responsibilities can be seen in Table 1-1.

Table 1-1 – Risk Management Authorities relevant to this S19

Risk Management Authority	Flood Risk Function
Milton Keynes Council - LLFA	Lead Local Flood Authority (LLFA), responsible for undertaking an investigation of the 15th January 2021 flood event, ensuring co-operation between the Risk Management Authorities in this area and leading the development of emergency planning and recovery after the flood. Can carry out flood risk management works on minor watercourses (outside the IDB District). Works in partnership with other Risk Management Authorities to ensure risks are managed effectively.
Anglian Water Services	Responsible for ensuring the appropriate level of resilience to flooding and maintenance of the foul and surface water sewerage assets within the study area.
Environment Agency	Manage the risk of flooding from main rivers, reservoirs, estuaries and the sea and responsible of developing long-term approaches to FCERM.
Internal Drainage Board (IDB)	Responsible for managing water levels in low-lying areas as well as supervising land drainage and flood defences works on ordinary watercourses inside the Boards district. Act as Agent for Lead Local Flood Authority on Consenting and Enforcement matters.
Buckinghamshire Fire & Rescue Service	Local fire and rescue service responsible for attending to emergency events within Milton Keynes.

1.2.2. It is considered that the above RMAs have exercised or are proposing to exercise those functions in response to the flood. The LLFA have exercised their flood risk management function by

investigating reported incidents of flooding through the commissioning of this S19 Flood Investigation Report.

1.3 DATA COLLECTION

1.3.1. As part of this investigation WSP has undertaken data collection activities with a variety of key stakeholders including the Environment Agency (EA), Anglian Water (AW), the Internal Drainage Board (IDB), Buckinghamshire Fire & Rescue Service and MKC. This is being undertaken to obtain key data regarding the aforementioned flood event on 15th January 2021, including but not limited to pre and post flood recovery actions, maintenance regimes and local flood risk issues associated with assets that may have contributed to the events.

1.3.2. Data obtained to date and further details regarding this can be seen in Table 1 in Appendix A.

1.4 SITE VISIT

1.4.1. A site visit was conducted on 7th June to Bletchley. On the day of the visit the weather was dry, hot and sunny. On the days preceding the site visit the weather was generally dry.

1.4.2. The main aim of the site visit was to:

- Gain an understanding of this part of the catchment of the River Ouzel within this location by identifying structures of the watercourse, flow paths and the setting of the watercourse in its catchment.
- Gain an understanding of the local areas by walking along the street where the property was reported as flooded to understand the scale of flooding experienced during the 15th January 2021 and associated flooding mechanisms.
- Undertake liaison with the local residents regarding the aforementioned flood event.

1.4.3. The following key observations were noted:

Figure 1-1 - Evidence of a low elevation in pathway located to the south of the property which could have been overtopped during the flood event. No evidence was found of a culvert being located beneath the pathway.

Figure 1-2 – Evidence of debris from a high flow event on a bridge downstream of the River Ouzel between the Bletchley Town Cricket Club and Watling Street.

Figure 1-3 - Sandbags located between Bletchley Town Cricket Club and Walting Street, downstream of the River Ouzel.

Figure 1-4 - Evidence of overgrown vegetation blocking one of the Watling Street bridge spans downstream of the River Ouzel. It might reduce the capacity of the bridge to convey river flows during extreme flood events.

Figure 1-5 - Evidence of well-maintained and clean riverbanks in the River Ouzel running along Bletchley due to clearing works undertaken during the month of May, 2021.

1.4.4. Photos have also been obtained from the Environment Agency which show Waterhall Park and the downstream reach of the River Ouzel prior to and following the maintenance work in early 2021.

1.4.5. The following key observations were noted:

Figure 1-6 – Pre and post maintenance photos upstream of Watling Street Bridge

Figure 1-7 – Pre and post maintenance photos of Waterhall Park at the pedestrian bridge on Mill Road

2 CONTEXT AND SETTING

2.1 SUMMARY OF EVENT

2.1.1. As stated by the Environment Agency[1], December 2020 was a very wet month with a total rainfall of 108mm (195% of the Long-Term Average (LTA) rainfall) across East Anglia. December 2020 was the second wettest December in this area since the record started in 1981. The consistently above average rainfall in the River Ouzel catchment during October, November and December 2020 saturated the catchment and contributed to the flooding in Bletchley in January 2021. A combination of surface water runoff and fluvial flooding resulted in the external flooding of a property at the east of Bletchley on Mill Road. The approximate location of the reported flood incident is shown in Appendix B.

2.1.2. Data from a nearby river gauge was obtained to determine the river flow rates and levels surrounding the flooding period. The nearest river gauge is located in the River Ouzel at Bletchley, approximately 800m upstream of the flooded property. The Bletchley gauge recorded a maximum daily flow of 31.2m^3/s on the 14th January, followed by a high flow of 25.9m^3/s on 15th January. The Bletchley gauge also recorded a maximum daily river levels for January of 1.785m on 14th January followed by 1.778m on 15th January.

2.1.3. The nearest rain gauges to the flooded property are located at Drayton Parslow (E24763), 6km southwest, and Birchmoor (E22231), 6km east. Both rain gauges recorded errors over the flooding period. Therefore, rainfall data could not be used to assess the flooding mechanisms of the January 2021 event.

2.1.4. Although the river flow and level were higher on 14th January than 15th January, most of the flooding occurred on 15th. As such, it is deduced that high rainfall in combination with the high-water levels from the river stressed highway drains, drainage ditches and the local sewer network exacerbating the flooding issues in this area.

2.1.5. Flood incident data from Anglian Water (AW) hasn't been provided at the time of writing this report.

[1] Environment Agency Fact Sheet December 2020 Flooding.

Figure 2-1 – Footage provided by resident showing flood extent in garden of the flooded property during the January 2021 flood event.

2.2 SITE LOCATION

2.2.1. Bletchley is located within the local authority of Milton Keynes in Buckinghamshire. To the East of Bletchley runs the River Ouzel which flows in a Northerly direction parallel to the Grand Union Canal. The town is situated 16km East from Buckingham, 9km south from Newport Pagnell and 74km Northwest from London.

2.2.2. Flood management schemes on the River Ouzel include two large balancing lakes at Caldecotte and Willen, 1.7km and 6.7km downstream of the site respectively.

2.3 TOPOGRAPHY

2.3.1. Ground levels taken from a desktop LiDAR survey of the site indicate the River Ouzel lies at the lowest point of 65mAOD. The ground rises steadily towards the west reaching a level of 73mAOD at the Grand Union Canal. The flooded area external to the property lies at 68.5mAOD. Beyond the canal the ground levels continue to rise into the town centre.

2.4 GEOLOGY

2.4.1. The majority of the land within the study area is defined by Cranfield Soil and AgriFood Institute (CSAI)[2] as Soilscape 8- “Slightly acid loamy and clayey soils with impeded drainage” and Soilscape 20 defined as “Loamy and clayey floodplain soils with naturally high groundwater”. Only a section

[2] Soil Types – Cranfield University, Source: http://www.landis.org.uk/soilscapes/, Last accessed: 09/09//2021

west of the floodplain is classified as Soilscape 9- “Lime-rich loamy and clayey soils with impeded drainage” while a reduced section to the southeast is classified as Soilscape 10 “Freely draining slightly acid sandy soils”. The area is also moderately urbanised with a proportion of impermeable surfaces such as roads likely to increase runoff volumes.

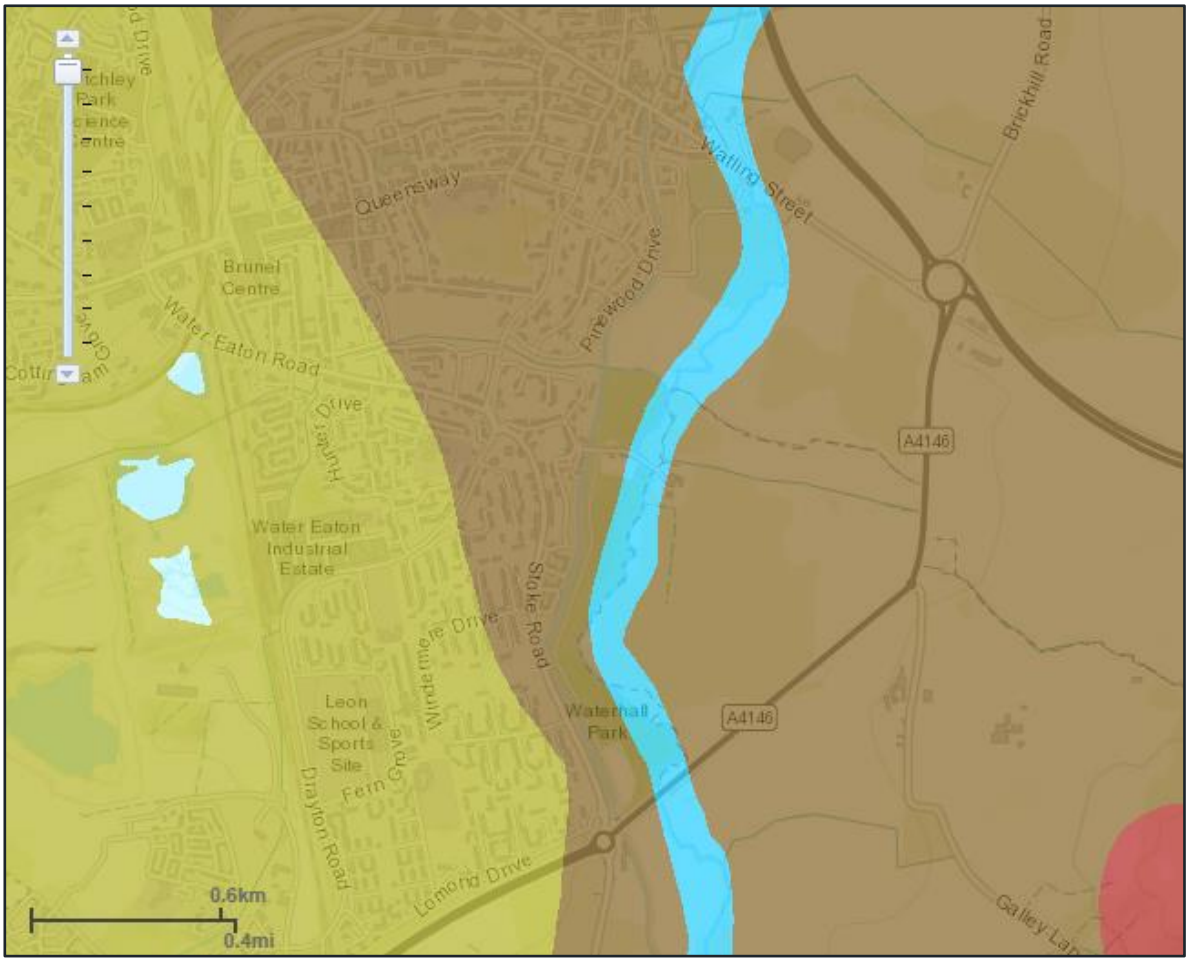

Figure 2-2 – Cranfield Soil and AgriFood map

2.4.2. A review of the British Geological Survey (BGS)[3] maps indicate that the majority of the underlying soils of flood area comprise Oxford Clay Formation while east of the site comprises West Walton Formation. The areas in the proximity of the River Ouzel have resulted in a covering of alluvium and river terrace deposits.

[3] BGS Geology of Britain Viewer, Source: https://mapapps.bgs.ac.uk/geologyofbritain3d/, Last accessed: 09/09//2021

2.5 FLOOD RISK

2.5.1. FLUVIAL FLOOD RISK

2.5.2. Appendix C shows an extract from the Environment Agency Flood Risk Map for Planning[4] which identifies that the area reported as flooded on Mill Road is predominantly within Flood Zone 3 [5]classified as 'High Probability of Fluvial Flooding' with areas in Flood Zone 2 [6]classified as 'Medium Probability of Fluvial Flooding'.

2.5.3. SURFACE WATER FLOOD RISK

2.5.4. The Environment Agency Long term Flood Risk Map[7] within Appendix C identifies the area reported as flooded as being at 'Medium Risk[8]' and 'High Risk[9]' of flooding from surface water, with estimated water depths below 300mm in the external area of the property, and 300-900mm in pond adjacent to the property and the River Ouzel.

2.5.5. GROUNDWATER FLOOD RISK

2.5.6. In regard to groundwater, the BGS Areas Susceptible to Groundwater Flooding map shown in Figure 2-3 identifies the area reported as flooded as having 'Potential for groundwater flooding to occur at surface' and 'Potential for groundwater flooding of property situated below ground level'. This mapping provides an indication as to where there is the potential for groundwater flooding and should be considered alongside other sources of flooding.

2.5.7. High groundwater level conditions may not always lead to widespread groundwater flooding; however, they have the potential to exacerbate the risk of surface water flooding and flooding from rivers by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

2.5.8. Persistent rainfall on the 14th and 15th January served to raise groundwater levels and saturate the catchment. High groundwater levels can cause seepage into the drainage network, therefore reducing its capacity. However, groundwater mapping in this area is uncertain and there may be disturbance to shallow natural soils and geology due to urbanisation in close proximity to the flooded area.

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[4] EA Flood Risk Map for Planning. Source: https://flood-map-for-planning.service.gov.uk/confirm-location?easting=487583&northing=243709&placeOrPostcode=MK16%200EN; Last accessed: 09/09//2021
[5] Flood Zone 2: Land having between a 1% and 0.1% annual probability of river (fluvial) flooding (between 1 in 100 return period and 1 in 1000 return period) in any given year; or land having between a 0.5% and 0.1% annual probability (between 1 in 200 return period and 1 in 1000 return period) of sea (tidal) flooding.
[6] Flood Zone 3: land assessed as having a 1% or greater annual probability of fluvial flooding (1 in 100 return period or greater) in any given year or 0.5% or greater annual probability of sea flooding (1 in 200 return period or greater) in any year, not taking into consideration flood defences.
[7] EA Long term Flood Risk Map. Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=535641&northing=178954&map=SurfaceWater; Last accessed: 09/09//2021
[8] Medium Risk: each year this area has a chance of flooding between 1% and 3.33%.
[9] High Risk: each year this area has a chance of flooding of greater than 3.33%.

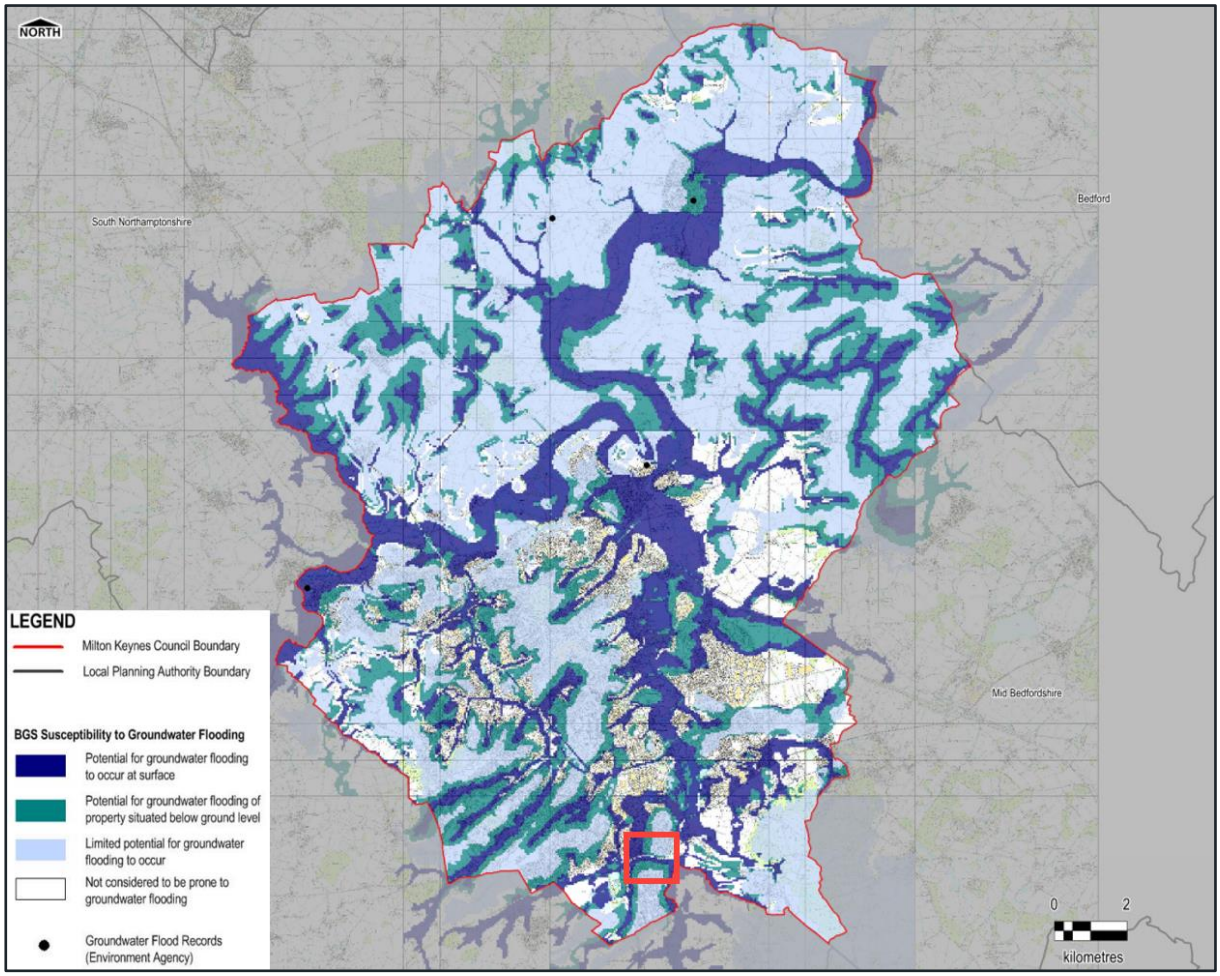

Figure 2-3 – Susceptibility to groundwater flooding. Source: Milton Keynes Council Local Flood Risk Management Strategy, AECOM 2016

2.5.9. DRAINAGE

2.5.10. The surface water drainage system within Bletchley is a separate system of public surface water and foul sewers owned and maintained by AW. Highway drainage, owned and maintained by MKC as the Highway Authority, generally consists of gullies connected to the public surface water sewers.

2.5.11. Video footage taken on 15th January by a resident shows a flooded gully on Mill Road, outside the flooded property. Further study is required to understand if the condition and current capacity of the sewer network were key factors in the flooding mechanisms at this location. Milton Keynes Highways reported that gullies were last cleaned in October 2017 and further maintenance was due in October 2021 based on the current cleasing cycle.

2.6 RECORDED FLOOD INCIDENTS

2.6.1. The River Ouzel lies in the Great Ouse catchment which has a history of flooding. The most extensive fluvial flood that has occurred in the catchment was in March 1947. Most records on flooding in this catchment relate to the River Great Ouse, which lies in an area of greater vulnerability. The only found record of flooding in Bletchley prior to the 15th January flood is on 17th June 2020 at the south of Bletchley.

3 RAINFALL ANALYSIS

3.1 RAIN GAUGE ANALYSIS

3.1.1. The nearest rain gauges to the flooded property are located at Drayton Parslow, 6km southwest, and Birchmoor, 6km east. Both rain gauges recorded errors over the flooding period. The tipping bucket gauge at Drayton Parslow reported the error as “12mm blocked water”.

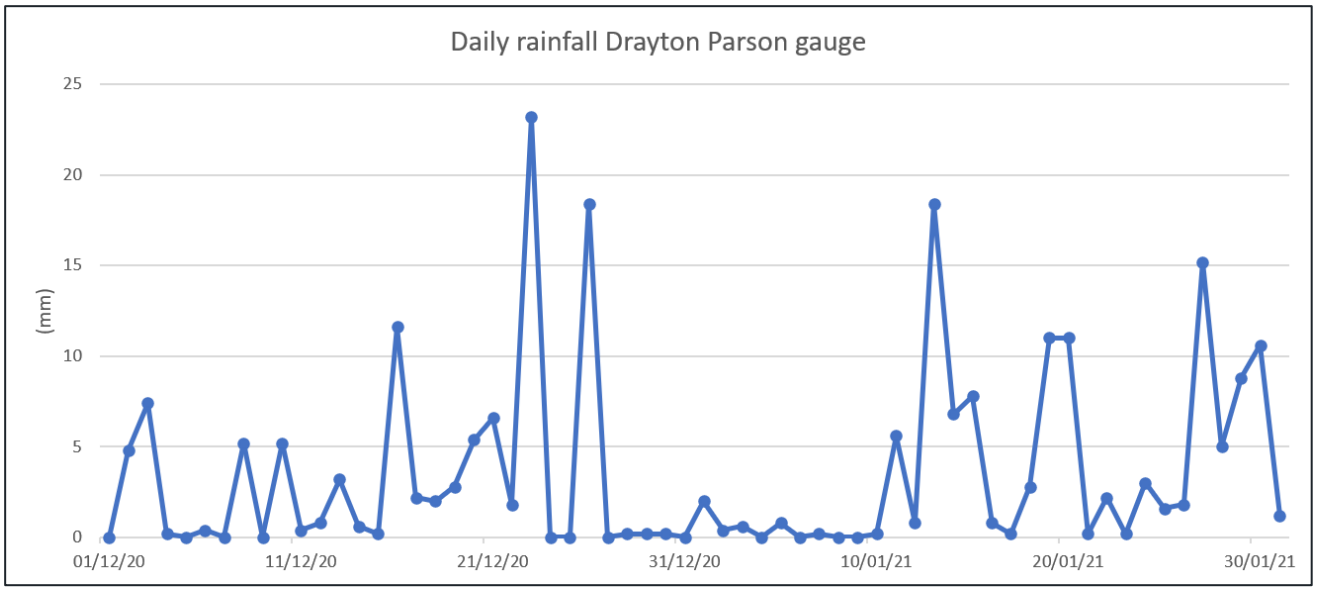

Figure 3-1shows the results at Drayton Parslow from December 2020 to January 2021. Rainfall over the period of flooding from 14th to 15th January is shown to be less than 10mm, which is unlikely given the increase in surface water over the period. Additionally, reports by Flood Assist Insurance[10] on 14th and 15th January, state that “river levels are rising at the Bletchley river gauge as a result of persistent rainfall. Consequently, flooding of property is expected over Thursday night and into Friday, 15/01/2021. We expect flooding to affect Mill Road, Watling Street and Belvedere Lane in Bletchley.”

[10] Flood Assist Insurance. Source:https://floodassist.co.uk/flood-warnings/flood-area-info/buckinghamshire/052fwfozbc/river-ouzel-at-bletchley-and-caldecotte; Last accessed: 23/09//2021

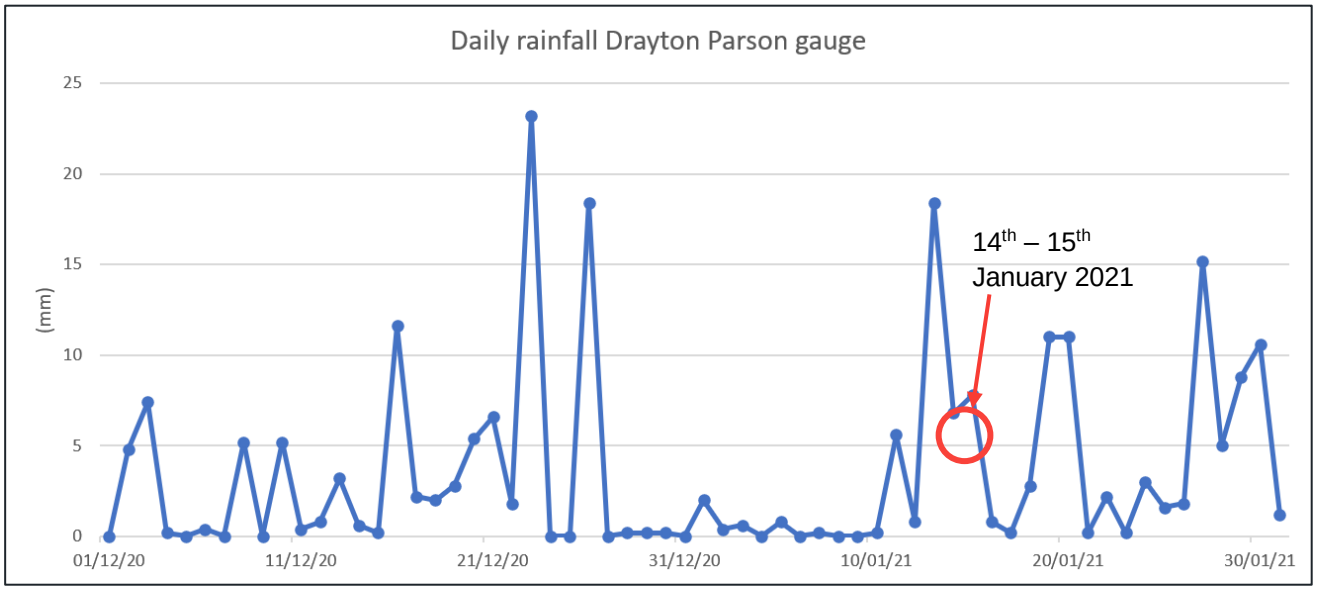

Figure 3-1 - 15 min rainfall (mm) recorded at Drayton Parslow

3.2 RIVER GAUGE ANALYSIS

3.2.1. There are several river gauges along the River Ouzel. Bletchley gauge is located at the south of Bletchley, 700m upstream of the flooded area (See Figure 3-2). The Environment Agency owns and maintains this gauge.

Figure 3-2 - Location of river gauges in Milton Keynes, including Bletchley

3.2.2. River gauge analysis has been based on gauging station data that has not been validated yet, which means that the outcomes from this analysis may change in future assessments.

3.2.3. Data obtained from the National River Flow Archive (NRFA)[11] and the Environment Agency for the 15th January 2020 at the Bletchley River gauge at River Ouzel is shown in Figure 3-3. This figure clearly displays a sharp rise in river flows, peaking at 31.2 m^3/s on the 14th January, resulting from the heavy rainfall during the 14th and 15th January.

[11] NRFA data are quality controlled before archival and release. Near real-time data are from the Environment Agency's Hydrology API and consist of checked and un-checked data. More information, including on quality flags for near real-time data is available in the API documentation.

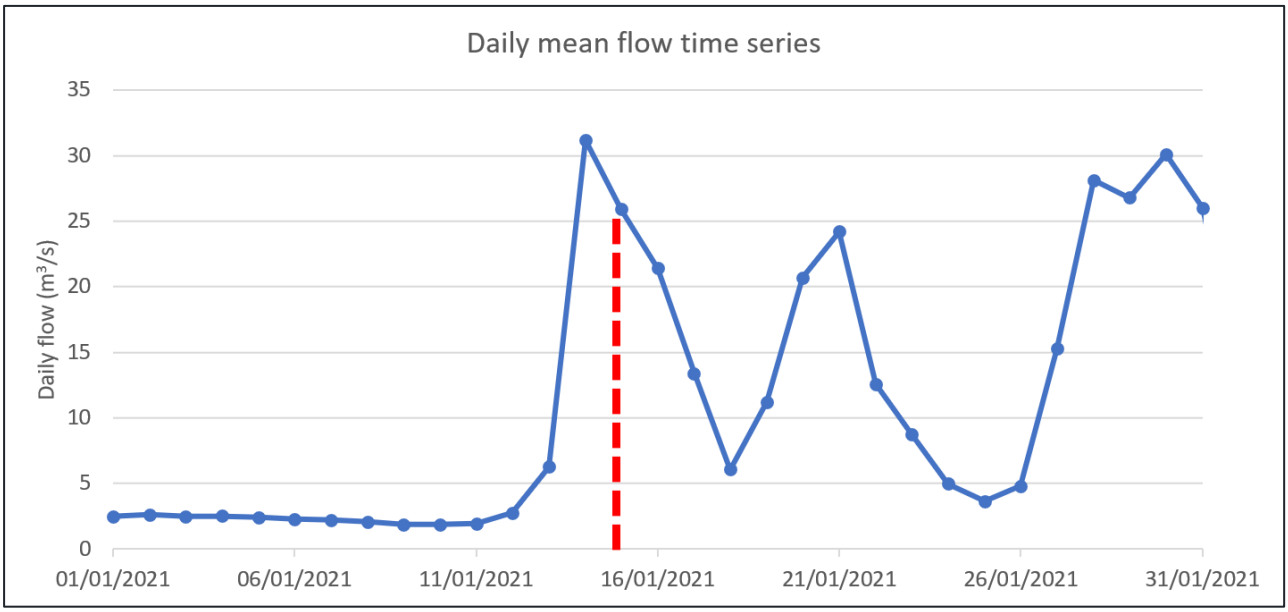

Figure 3-3 – Gauged daily flow at Bletchley gauge at River Ouzel. Source: National River Flow Archive (NRFA)

3.2.4. Figure 3-4 shows the river levels at the Bletchley gauge for January 2021. The water levels peaked at 1.79m at this gauge on 14th January and 15th January. This compares to an average daily water level of 0.46m between 1st to 12th January.

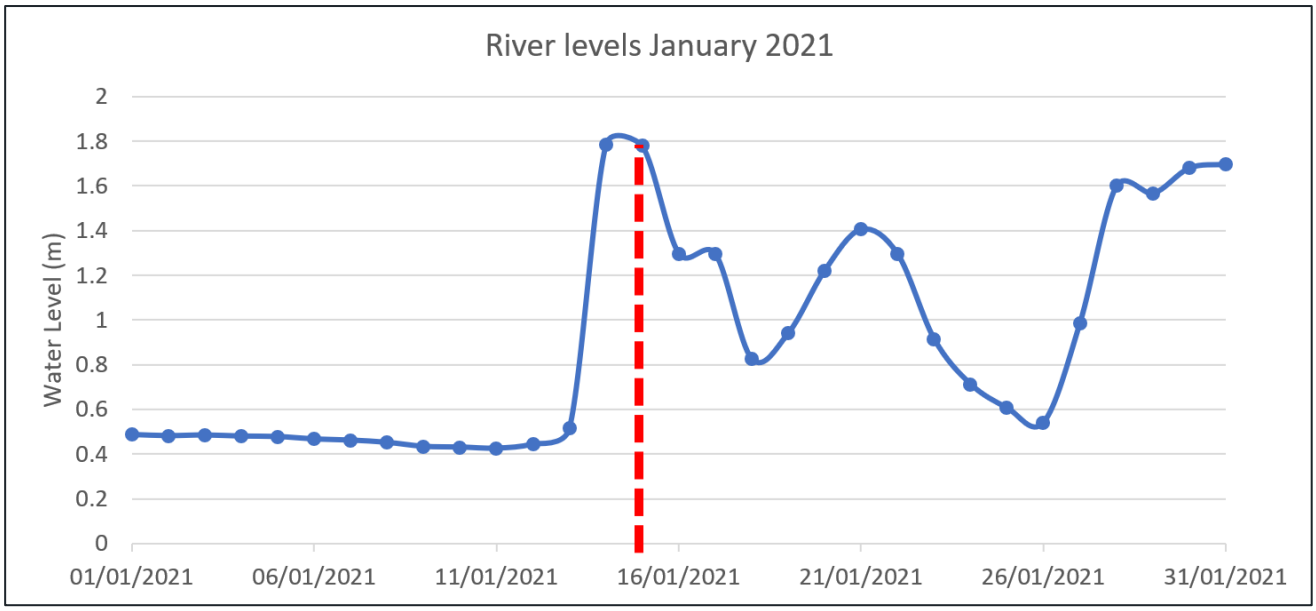

Figure 3-4 - River levels at Bletchley gauge

4 FLOODING DESCRIPTION AND MECHANISM

4.1.1. The flood event that occurred on the 15th January was the result of a combination of river and surface water flooding due to the intense rainfall in the River Ouzel catchment during the 14th and 15th January over an already saturated catchment due to a wet month of December. This led to a quick response of the watercourses and high-water levels within the River Ouzel. As stated by the Environment Agency, the Soil Moisture Deficit (SMD), which is the difference between the amount of water present in the soil and the amount of water the soil has the capacity to hold, was on average at 3mm across the East of England at the end of December. This was 'below normal', whereby a low SMD means heavy rainfall is less likely to infiltrate the ground and more likely to run off into watercourses, explaining the significant impact of the intense rainfall experienced.

4.1.2. The flooding affected the garden of the property on Mill Road, owing to combined river and surface water flooding during the January flood event. Video evidence provided by a resident indicated that surface water runoff on Mill Road was unable to enter the sewer system due to flooding and therefore joined the River Ouzel near Mill Road bridge. The flow of the River Ouzel quickly increased, overtopping its banks and inundating the back garden of the property, merging with the ponds. Some flow was held back by a sluice gate and several pumping devices at the walled section at the eastern boundary of garden.

4.1.3. At a site visit undertaken on 7th June, debris was found on the parapet of a bridge spanning the River Ouzel approximately 1km downstream of the flooded property. The debris were likely captured by the bridge during a high flow event. The structure may have constricted the flow of water downstream of the property leading to a backwater curve with heightened river levels at the property. In addition, vegetation on the banks of the Ouzel downstream of the flood event was unmaintained at the time of the flood, as shown in Figures 1-6 and 1-7, leading to reduced channel capacity. A side span of the bridge was partially blocked by vegetation which may have reduced the capacity of the bridge to convey river flows during extreme flood events. High water levels at the bridge are supported by the placement of sandbags adjacent to the river immediately upstream of the bridge, shown in Figure 1-3. Clearing works were undertaken during the month of May 2021 resulting in well-maintained and clean riverbanks in the River Ouzel running along Bletchley, depicted in Figures 1-5 to 1-7.

5 FLOOD RESPONSE

5.1.1. Buckinghamshire Fire and Rescue Service (BFRS) were not dispatched to Bletchley for the flooding event on 15th January due to the limited severity and extent of damage to property.

5.1.2. Flood warnings were issued by Flood Assist Insurance on 14th and 15th January, stating “River levels are rising at the Bletchley river gauge as a result of persistent rainfall. Consequently, flooding of property is expected over Thursday night and into Friday, 15/01/2021. We expect flooding to affect Mill Road, Watling Street and Belvedere Lane in Bletchley.”

6 CONCLUSIONS AND FURTHER WORK

6.1 MAIN FINDINGS

6.1.1. The flood incident that occurred during the 15th January was the result of intense rainfall in the catchment of the River Ouzel during the 14th January. The rain fell on to an unusually saturated catchment, as reported by the Environment Agency, which likely lead to more surface water runoff than would be expected if the catchment was dry and groundwater was at normal levels. The quick response of the watercourses and high-water levels in the River Ouzel increased the vulnerability of this area historically at high risk of fluvial flooding.

6.1.2. Although persistent rainfall between 14th to 15th January was reported in the area by Assist Flood Insurance, the nearest rainfall gauges from Bletchley reported errors over the flooding period which means that return periods cannot be ascertained.

6.1.3. High flows of the River Ouzel overtopped the banks and inundated the back garden of a property on Mill Road. Some of the flow was obstructed by sluice gates and pumping devices. It is possible that a bridge downstream of the site constricted the flow and produced a backwater curve, contributing to heightened water levels.

6.1.4. Video recordings from the resident show the highway gully to be flooded which indicates that the surface water network was at capacity or was experiencing a blockage. As such, potential failure or inability to undertake maintenance of Highway Authority or AWS assets may have increased the extent of surface water ponding in the street and resulted in increased flows in the River Ouzel. However, it cannot be confirmed at this stage and further analysis is required to understand current capacity of surface water sewer network.

6.1.5. Evidence of high flows overtopping a bridge downstream of the flood has been found which may indicate flow constriction leading to a backwater curve. This theory is further supported by vegetation partially blocking a span of the bridge.

6.2 RECOMMENDATIONS AND FURTHER WORK

6.2.1. Recommendations and further work are suggested for the following key stakeholders.

- The *Lead Local Flood Authority* should support the community in the preparation of a Community Flood Plan, alongside the Environment Agency and other flood risk management authorities. The LLFA should also facilitate collaboration between key stakeholders to enhance current understanding of flood risk and flood mitigation measures at Bletchley to determine any potential improvement opportunities and constraints as well as investigate the flow capacity of the downstream bridge.
- The *Environment Agency* should investigate and consider further improvements to maintenance of floodplains and riverbanks around Mill Road and downstream at the bridge to increase discharge capacity of River Ouzel. The Environment Agency should also consider the improvement of maintenance of rainfall gauges located at Drayton Parslow and Birchmoor as well as support the community in the preparation of a Community Flood Plan, alongside MKC and other flood risk management authorities.

- *Anglian Water* should investigate where funding and resources are available, the development of a proactive maintenance plan for this catchment instead of reactive maintenance activities. Also, AW should consider the investigation of further hydraulic studies to determine any potential capacity issues within the surface sewer system and undertake CCTV surveys in critical areas to identify potential blockages or defects in the surface sewer network.

Appendix A

APPENDIX A

Appendix B

APPENDIX B

Appendix C

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