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FLOOD INVESTIGATION REPORT

LAVENDON

23th DECEMBER 2020

Client:	Lead Local Flood Authority Milton Keynes Council 9 Dickens Road Old Wolverton Milton Keynes
Prepared By:	Martin Andrews
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REVISION SCHEDULE

Milton Keynes Council
Flood Investigation Report
Lavendon

David Smith Associates Reference: 21/42983

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01	23/06/21	Draft Report.	Martin Andrews (David Smith Associates)		
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FOREWORD

One of the roles of Milton Keynes Council as the Lead Local Flood Authority (LLFA) is to carry out investigations into flooding incidents if they meet the set thresholds.

The LFFA will:

- Identify and explain the likely cause/s of flooding;
- Identify which authorities, communities and individuals have relevant flood risk management powers and responsibilities;
- Provide recommendations for each of those authorities, communities and individuals; and
- Outline whether those authorities, communities or individuals have or will exercise their powers or responsibilities in response to the flooding incident.

The LLFA cannot:

- Resolve the flooding issues or provide designed solutions; or
- Force Authorities to undertake any of the recommended actions.

CONTENTS

EXECUTIVE SUMMARY

This Flood Investigation Report (FIR) has been completed by David Smith Associates on behalf of Milton Keynes Council (MKC) under its duties as the Lead Local Flood Authority (LLFA) in accordance with Section 19 of the Flood and Water Management Act 2010 (F&WMA).

Statutory Context

Section 19 of the F&WMA states that on becoming aware of a flood which meets certain pre-determined criteria, the LLFA must undertake a formal flood investigation in order to determine the relevant flood risk management authorities involved and which flood risk management functions have been, or should be taken to mitigate future flood risk. Where an authority carries out an investigation it must publish the results.

Within the Milton Keynes Council 'Flood Investigation Protocol', the approved thresholds for undertaking a FIR are:

A formal flood investigation will be carried out if one or more of the following occurs:

- Flooding affecting critical infrastructure* for more than 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; and/or
- Internal flooding of five buildings in close proximity*** has been experienced during a single flood incident.

* Those infrastructure assets (physical or electronic) that are vital to the continued delivery and integrity of essential national services, the loss or compromise of which would lead to severe economic or social consequences, or to loss of life.

** A situation in which a building (commercial or residential) has been flooded internally, i.e. water has crossed the threshold and entered the building. This includes;

- Basements and ground level floors of the building;
- Garages/outbuildings if they are integral to the main occupied building. Garages adjacent or separate from the main occupied building are not included;
- Occupied static caravans and park homes. Tents are not included.

*** Where it is reasonable to assume that the affected properties were flooded from the same source, or interaction of sources, of flooding.

See over for additional notes

Notes:

- The LLFA will not investigate incidents of structural dampness or where basements are affected by groundwater entering through cracks in the basement walls or floor.
- In the event that the cause of, and the responsibility for addressing the flooding is well understood, no formal investigation will be undertaken.
- The LLFA will only undertake a flood investigation if the incident is formally reported within nine months of the flood event occurring.
- In addition to internal flooding of occupied buildings, affected properties shall also include those properties (commercial or residential) where water has entered gardens or surrounding areas which restricts access, or where flooding has disrupted essential services to the property such as sewerage or electricity supply. For businesses, this includes those where the flood waters are directly preventing normal trading practices.

Flooding Incident

It was deemed necessary to complete a formal investigation into the flood incident at Lavendon that occurred on Wednesday 23rd December 2020. Internal flooding of five or more buildings and of the highway occurred during this event.

Cause of Flooding

The flooding was caused by intense heavy rainfall over a relatively short period of time falling on to a near saturated or saturated catchment. Water from the extreme event stayed within the watercourse until it reached a culvert provided for a redundant field access located between Castle Road and the Glebe. At this location the capacity of the watercourse was exceeded and fluvial flooding occurred.

Main Conclusion

Following this report, the local community and relevant authorities must continue to work together, sharing information and reports, and consider implementing the key recommendations set out in Section 9 of this report.

Previous hydraulic modelling assessed by WSP in their 2016 report 'Post Modelling, Option 2 – Baseline Update And Post Alleviation Hydraulic Modelling' which sort to identify any flood alleviation measures that may be required in Lavendon did not identify that any were required for Ditch 2 (see 4.1.1.1, the source of the flooding. The modelling should be revisited in light of the most recent flood event and consideration should be given to removing the culvert.

Flooding on Harrold Road resulted due to a lack of capacity at the point where the watercourse is culverted. The Harrold Road culvert at the time of the site visit would appear to require some maintenance to remove debris from the ditch located around the opening of the culvert.

1. INTRODUCTION

1.1 Lead Local Flood Authority Investigation

1.1.1 Purpose of Investigation

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

(1) On becoming aware of a flood in its area, a Lead Local Flood Authority 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 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.

Within the Milton Keynes Local Flood Risk Management Strategy the thresholds for undertaking a Formal Investigation Report have been determined as:

A formal flood investigation will be carried out if one or more of the following occurs:

- Flooding affecting critical infrastructure* for more than 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; and/or
- Internal flooding of five buildings in close proximity*** has been experienced during a single flood incident.

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Notes:

- The LLFA will not investigate incidents of structural dampness or where basements are affected by groundwater entering through cracks in the basement walls or floor.
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- The LLFA will only undertake a flood investigation if the incident is formally reported within nine months of the flood event occurring.
- In addition to internal flooding of occupied buildings, affected properties shall also include those properties (commercial or residential) where water has entered gardens or surrounding areas which restricts access, or where flooding has disrupted essential services to the property such as sewerage or electricity supply. For businesses, this includes those where the flood waters are directly preventing normal trading practices.

1.1.2 Flood Incident

1.1.2.1 It was deemed necessary to complete a formal investigation into the flood incident at Lavendon that occurred on Wednesday 23rd December 2020. Internal flooding of five or more buildings and of the highway occurred during this event.

1.2 Method of Investigation

1.2.1 Information Provided

1.2.1.1 Milton Keynes Council (MKC) identified that a flood investigation was required in Lavendon. MKC provided details of the appropriate contact, basic details of the incident and details local drainage infrastructure.

1.2.2 Site Meetings

1.2.2.1 A site visit to the area of flooding was carried out by the Investigating Officer at DSA on 7th May 2021. The meeting was held with members and the Clerk of the Parish Council, Councillor McLean, and a resident. The site visit was undertaken with the resident, the clerk and one member of the parish council.

1.2.2.2 The visit undertook a visual inspection of the general topography and relevant features within Lavendon. The focus of the discussions and site visit was related to the flooding caused around Ditch 2.

2. RAINFALL ANALYSIS

2.1.1 Environment Agency Report

2.1.1.1 The Environment Agency have prepared a 'December 2020 Flooding Great Ouse Catchment' report which sets out the rainfall data in the lead up to and the subsequent river response. A copy of this document is enclosed in Appendix A.

Long Term Average (LTA) Rainfall

2.1.1.2 The Environment Agency data highlights that whilst November was relatively dry the LTA for the three months from October – December were wet with rainfall reaching 154% of the LTA.

2.1.1.3 The Environment Agency say that:

"Over 2020, rainfall across the area was 115% of the LTA (Figure 1). The consistently above average rainfall in the months ahead of the main flood contributed to the catchment response on the 23rd December."

Soil Moisture Deficit (SMD)

2.1.1.4 On this the Environment Agency say:

"SMD is the difference between the amount of water actually in the soil and the amount of water the soil can hold, expressed in depth of water (mm). This is an indication of how saturated the ground is. A low SMD means heavy rainfall is less likely to infiltrate the ground and more likely to run off into watercourses. The impact of the excess rainfall shown in Figure 1 was an average SMD across the East of 3mm at the end of December. Statistically this is 'below normal' and an indication of how wet the catchment was."

Event Rainfall

2.1.1.5 On this the Environment Agency say:

"Up to 17mm fell across the catchment in the 3 days prior to the flood event, this filled the majority of remaining storage space, effectively saturating the catchment ahead of Storm Bella arriving on Wednesday 23rd December.

Figure 2 indicates the distribution of rainfall which fell across the Great Ouse catchment on December 23rd 2020, along with spot totals. Much of the rainfall was in the afternoon of the 23rd, rather than over the course of the day. This intensity of rainfall contributed to the fast reaction of watercourses. The December LTA of 55mm shows that almost a month's rainfall was seen in certain locations on the 23rd."

Site Specific Analysis

2.1.1.6 The nearest rainfall gauge to the site at Olney recorded 26mm of rainfall on the 23rd December. Based on a catchment average LTA of 55mm this equates to approximately 50% of a month's rain falling within a short period of time on a catchment which was either fully saturated or close to saturation. The rain gauge recorded peak rainfall intensities of nearly 15mm / hour.

2.1.1.7 Local variations in rainfall could mean that actual rainfall intensities at Lavendon could be different.

2.1.1.8 The saturated or near saturated nature of the catchment would mean that there was very limited scope for water to infiltrate into the ground. Hence, the rate at which the water reached the watercourse would be much faster than for an unsaturated catchment.

3. FLOODING HISTORY

3.1 Previous Reports of Flooding

3.1.1.1 Prior to this event flooding has occurred in Lavendon during 2012, 2015 and 2020. Following the 2012 event WSP undertook flood investigation works including hydraulic modelling of the watercourses. In addition, we understand some improvements have been undertaken in the north west of Lavendon which we are advised seem to improved matters.

4. LOCATION OF FLOODING

4.1 Location in Context

4.1.1 Catchment Area

4.1.1.1 Lavendon is located approximately 16.5km north east of Milton Keynes and 3.44km north east of Olney. Lavendon has a principal watercourse which runs from north to south through the village, the watercourse is generally open but culverted in some locations. A secondary watercourse feeds into the principal watercourse from the north east. This secondary watercourse is the principal cause of the fluvial flooding on the 23rd December 2020. This secondary watercourse was called 'Ditch 2' in the modelling undertaken by WSP, for consistency we will use the same name.

4.1.1.2 Ditch 2 upstream of the flooding serves an agricultural catchment of approximately 0.52km^2. Upstream of the flooding the watercourse is open which continues until the watercourse reaches Castle Road at which point the watercourse is culverted through Lavendon.

4.1.1.3 The context of Lavendon within the wider catchment is shown on the drawing enclosed in Appendix B.

4.1.2 Long Term Flood Risk Mapping

4.1.2.1 Long Term Flood Risk Mapping has been obtained from https://flood-map-for-planning.service.gov.uk/ and https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

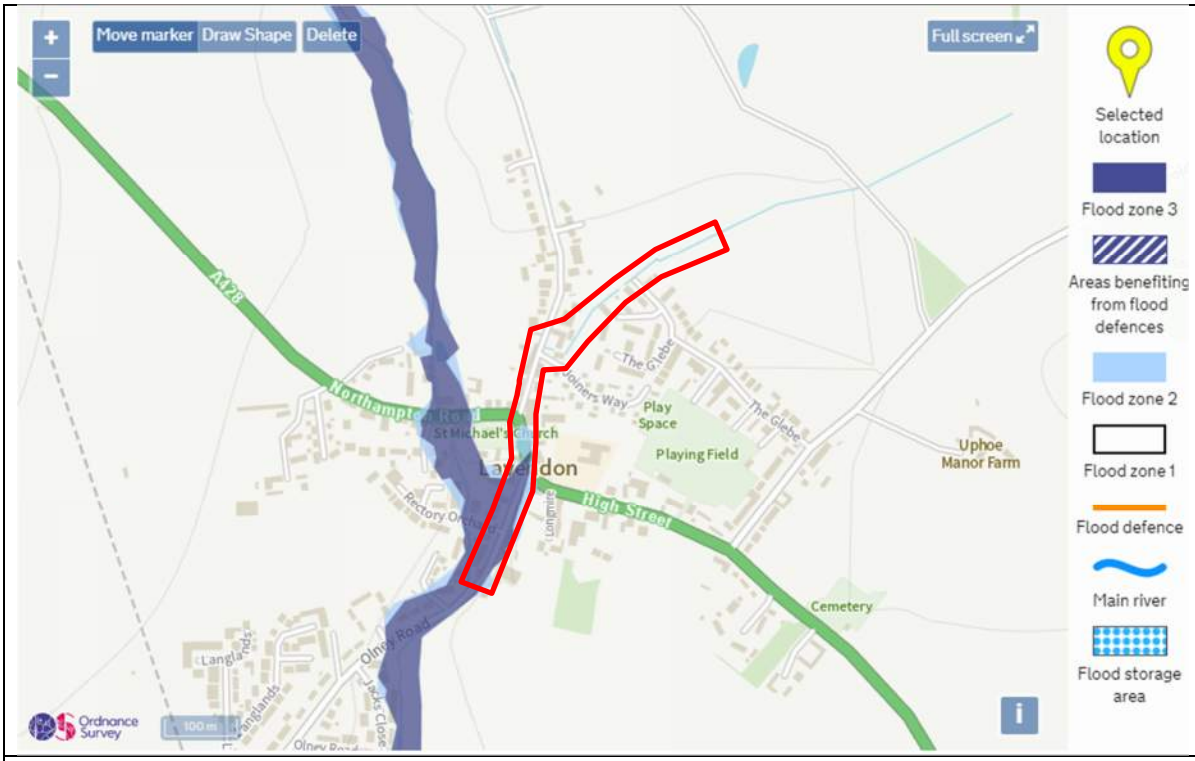
4.1.2.2 The maps are intended for guidance and cannot provide details for individual properties. The maps have been produced by the Environment Agency. Ditch 2 is not identified as having any fluvial flooding on the Environment Agency's flood map as the upstream catchment of the watercourse is too small to be included within this map.

4.1.2.3 Flood Risk from Surface Water

	This is in an area that has a HIGH chance of flooding from surface water. This means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%).
	This is an area that has a MEDIUM chance of flooding from surface water. This means that each year, this area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
	This is an area that has a LOW chance of flooding from surface water. This means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).
	This is an area that has a VERY LOW chance of flooding from surface water. This means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%).

Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

4.1.2.4 Flood Risk from Rivers or the Sea



Flood zone 3	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Flood zone 2	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Flood zone 1	Land having a less than 1 in 1,000 annual probability of river or sea flooding.

Source: https://flood-map-for-planning.service.gov.uk/

5. DRAINAGE SYSTEMS & WATERCOURSES

5.1 Drainage Systems General

5.1.1.1 This section describes drainage systems and watercourses in direct proximity to the flood incident. The wider catchment is drained by numerous systems, all of which have some impact on the effective management of surface water flowing to and from the area of the flood incident.

5.1.1.2 If drainage systems are exceeded higher in the catchment, this would result in overland surface water flow which would follow the overall topography of the settlement's catchment. This leads to an increasing cumulative quantity of surface water flowing to areas lower in the catchment, which is beyond the capacity of drainage systems in that area.

5.2 Natural Watercourses

5.2.1 Open Watercourses

5.2.1.1 Ditch 2 is an open watercourse upstream on the flooding incident and 110m to the south of what is understood to be the primary cause of the flooding. Ditch 2 becomes a culverted watercourse where it meets Castle Road. Through Lavendon Ditch 2 is culverted until it meets Lavendon's principal watercourse

5.2.1.2 The principal watercourse (Ditch 1) is open throughout Lavendon except where it is culverted under highways etc. Ditch 1 is a tributary of the River Great Ouse an Environment Agency main river located to the south of Lavendon.

5.2.1.3 On the northern side of Harrold Road there is a ditch which is culverted with a 150mm dia. pipe at the field edge near the junction with The Glebe. The culvert was shown to be partially blocked with leaves and other detritus possibly washed down during the extreme event.

5.2.2 Buried Watercourses

5.2.2.1 Ditch 2 and the Harrold Road ditch is culverted through Lavendon, as described above.

5.2.3 Structures

5.2.3.1 The flooding occurred at a culvert below an historical and now redundant field access. The location of the culvert is shown in Appendix B and seen in Appendix C. The culvert is a box culvert approximately 500mm square.

5.2.3.2 To the south of the culvert, downstream of the cause of the flooding, a resident has bridged across the watercourse with decking to extend their garden. The decking extends from bank to bank and partially extends into the channel. We understand that the Parish Council are seeking to get this removed as it is partially located on their land.

5.3 Drainage Systems

5.3.1 Public Sewers

5.3.1.1 More modern areas of Lavendon around The Glebe are served by a separate foul and surface water sewer network. The surface water sewers associated with The Glebe discharge directly into Ditch 2.

5.3.1.2 Older areas of Lavendon such as dwellings on Castle Road are served by a foul water sewer only.

5.3.2 Highway Drainage

5.3.2.1 The highway is drained by gullies the outfall of these gullies is not known but they are expected to discharge directly into the culverted watercourse.

5.3.2.2 Road gullies were seen to be generally clear during the site visit. There was no suggestion that road drainage had resulted in any significant flooding during this event.

5.3.2.3 Collection systems such as road gullies are normally provided to drain surface water from the public highway close to the system only, with no allowance for additional flow from private property or cumulative exceedance flows from higher areas of the catchment.

5.3.2.4 Modern highway drainage systems are designed to have capacity for the 1 in 5 annual exceedance probability event. Historic highway drainage systems that have become the responsibility of the Highway Authority due to dedication, as opposed to adoption, may not have been designed to any standard.

5.3.2.5 Highway drainage is required to remove water in normal wet weather conditions so that the carriageway is safe for vehicular traffic, and to reduce structural damage to pavements caused by water.

5.3.3 Private Drainage

5.3.3.1 Private residential properties have their own drainage systems to collect surface water and convey this to an outfall. These comprise roof gutters and downpipes, and gullies/channels for external areas.

5.3.3.2 The private drainage is expected to outfall to a variety of methods depending on their location within Lavendon.

5.3.3.3 Individual property owners are responsible for their drainage systems.

5.4 Flood Resilience

5.4.1 Community or Property Level Resilience Measures

5.4.1.1 WSP identified that flood alleviation measures could be provided within Lavendon to reduce the risk of further flood events. We understand that some of the measures have been implemented but none were identified as being required for Ditch 2.

5.4.1.2 We are not aware of any property level flood resilience measures being introduced.

6. DESCRIPTION OF FLOOD EVENT

6.1 Resident/Occupier Descriptions

6.1.1 Interview Responses

6.1.1.1 The following properties are understood to have suffered internal flooding:

- Property 1 (Castle Road) – remained in property – internal flooding to conservatory and kitchen
- Property 2 (Castle Road) - remained in property – internal flooding to ground floor particularly affected carpeted areas
- Property 3 (Castle Road) – left property and remedial works had not been completed at the time of the site visit. Extensive flood damage to ground floor and external areas
- Property 4 (Castle Road) - remained in property – Some minor internal flooding to conservatory
- Property 5 (Olney Road) – flood water went under the floor with depths for 1/2" across the parts of the ground floor
- Property 6 (Olney Road) – approximately 4” across whole ground floor.

6.1.1.2 Water flowed through the garden of Property 1 Castle Road, into Property 2 through their garden and causing internal flooding to their property. The water continued on towards Property 3 which is located approximately 750m lower than Property 2. Water flooded this property internally which was the most significantly affected with the residents still not able to occupy the property at the time of the visit. Water predominately flowed down the side of Property 3 between the dwelling and the retaining wall onto Castle Road but also made use of other routes towards Castle Road.

6.1.1.3 At the Castle Road culvert water was described as spraying 8ft into the air.

6.1.1.4 The flow of water overland at Castle Road was described as being minimal to 150-200mm deep in a matter of minutes.

6.1.1.5 Generally, water depths were through to reach no more than 300mm to 400mm but deeper in some locations such as between Property 2 and 3 Castle Road where Property 3 Castle Road is located approximately 750mm lower than Property 2.

6.1.1.6 Following the onsite visit further information was provided regarding Property 6 (Harrold Road). It is understood that overland flows from the playing field ponds in the playing field and runs through their garden. We understand that the residents divert this away from their property using sandbags.

7. DESCRIPTION OF FLOOD EVENT

7.1 Rainfall and Flood Water

7.1.1 Rainfall

7.1.1.1 The rainfall described in Section 2 fell on the catchment from early afternoon with rain around 12:00/13:00 with flooding occurring around 14:00. By 16:00 the flooding had reduced to areas of ponding.

7.1.2 Direction of Surface Water Flow

7.1.2.1 A plan showing our understanding of the main flow routes during this event are enclosed in Appendix B.

7.1.2.2 The main flow of water was from north east along Ditch 2 to the south, water generally remained within the watercourse until it reached the Culvert on Ditch 2 located near Castle Road, see Appendix B. At this point the watercourse breached its banks and flowed through the gardens of Property 1, 2 and 3 Castle Road. Water followed topographical low routes with significant proportion of flow between properties 2 and 3.

7.1.2.3 Once on Castle Road water flowed down the hill towards the High Street / Northampton Road and Olney Road. On Olney Road two dwellings Properties 5 and 6 are located at a low spot and these were partially flooded internally.

7.1.2.4 On Olney Road the flood water was able to re-enter the watercourse.

7.1.2.5 Highway flooding was also recorded on Harrold Road. At the culvert the flow of water exceeded the capacity of the watercourse. This resulted in predominately highway flooding. The water flow south west on Harrold Road before turning north west on the A428 and onto Olney Road.

7.1.2.6 It is understood that there was also some localised flooding on Northampton Road.

7.1.3 Standing Water

7.1.3.1 There were no significant areas of standing water, the water generally flowed through Lavendon. Some of the water within the rear gardens on Castle Road ponded against the dwellings which are generally set lower than rear gardens.

7.1.4 Drainage Systems

7.1.4.1 Sewers were not thought to have contributed to this flood event.

7.1.5 Specific Features That May Have Affected Water Flow

7.1.5.1 The upstream catchment is predominately rural, which as discussed above was saturated or nearly saturated as a result of higher than average rainfall from October. An intense rainfall event on the 23rd December result in significant rainfall on a catchment with limited or no capacity for infiltration.

7.1.5.2 The culvert on Ditch 2 lacked adequate capacity to accommodate the flood water during this extreme event. Further the culvert on Harrold Road also lacked capacity to accommodate the surface water flows during this event.

7.2 Response to Flooding

7.2.1 Immediate Response

7.2.1.1 The fire service were also in attendance, these arrived around 2pm with 3 to 4 appliances. They provided sandbags and may have undertook some pumping activities.

7.2.1.2 Sandbags were requested by the Parish Council and left by MKC within Lavendon. Due to the rapid nature of the flood these arrived after the event occurred.

7.2.2 Follow Up Response

7.2.2.1 MKC Flood and Water Management Team processed formal reports of flooding and instigated the Section 19 Flood Incident Investigation. Individual reports of the flood incident continued to be received by the LLFA over the following weeks.

7.2.2.2 The Local Highway Authority cleared drainage in Northampton Road, Castle Road, High Street and Olney Road on 24th December 2020. The clearance exercise noted high volumes of shingle within the gully pots from resident's driveways.

8. CONCLUSION

8.1.1.1 The flooding of Lavendon was caused by intense heavy rainfall over a relatively short period of time on a near saturated or saturated watercourse.

8.1.1.2 Flooding in the Castle Road area resulted as a lack of capacity on a culvert which serves a redundant field access.

8.1.1.3 Previous hydraulic modelling by WSP to identify any flood alleviation measures that may be required in Lavendon did not identify that any were required for Ditch 2 the source of the flooding. The modelling should be revisited in light of the most recent flood event.

8.1.1.4 Flooding on Harrold Road resulted due to a lack of capacity at the point where the watercourse is culverted. During the site visit the Harrold Road culvert would appear to require some maintenance to improve capacity.

8.1.1.5 Flooding downstream of these two locations resulted due to the above two causes.

8.1.1.6 The affected areas are shown to be at high risk of surface water flooding on published Long Term Flood Risk Mapping.

8.1.1.7 Residents affected by the flooding might consider implementing property level flood protection to limit the impact of future flood events.

8.1.1.8 The following are the Key Recommendations resulting from the flood incident:

- Owners and/or occupiers of affected properties should consider preparing an Emergency Plan or Business Continuity Plan, and implementing Property Level Resilience.
- With support from Flood Risk Management Authorities, the community should make efforts to:
    - Appoint Community Flood Wardens,
    - Prepare a Community Emergency Plan,
    - Explore options for funding and contributions for schemes to manage surface water and flood risk.

- The LLFA should continue to work with the community and Flood Risk Management Authorities. The work should:
    - Aim to manage surface water to provide a better standard of protection to Highway infrastructure, and the community.
    - Identify further surveys, investigations and studies required to locate and record existing drainage systems in the area of the flood incident and the wider catchment.
    - Identify all legal responsibilities for drainage and watercourse maintenance in the area of the flood incident and the wider catchment, reminding relevant parties of these responsibilities and the benefits of doing it.
    - Identify further surveys, investigations and studies required to fully understand how the flooding occurred and the likelihood of it occurring again.
    - Assess the requirement and viability of engineering schemes to ensure the existing infrastructure operates as intended, and to provide a better standard of protection if required. This might include community level flood resilience measures, improving drainage to accommodate extreme rainfall events, providing attenuation storage areas and creating formal overland flood flow routes.
- Local Authorities, Emergency Services and other relevant response groups should continue to work together, and review their immediate and follow up response to the emergency.

9. RECOMMENDATIONS

9.1 General

9.1.1.1 Listed below are the recommended course of actions emanating from this formal Flood Investigation Report.

9.1.1.2 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, resource implications, priority and cost/benefit analysis of undertaking such action.

9.1.1.3 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.

9.2 Communities

(e.g. Town/Parish Council, Flood Forum, Community Groups, Resident and Business Associations, land owners and affected residents)

9.2.1.1 Recruit Community Flood Wardens to help coordinate the production of a Community Emergency and Flood Plan.

This can include:

- a plan of the community showing areas at risk of flooding, especially vulnerable properties and particularly vulnerable people (e.g. elderly, medical conditions, young families);
- a plan of the community outlining the ownership and maintenance regimes of drainage systems, with contact details to report any issues;
- a list of any improvements to existing drainage systems that are required.

This information should be used to inform the basis of preparing Household Emergency Plans for vulnerable properties in this area.

9.2.1.2 Regularly inspecting drainage systems in the area. Report blockages or other issues to the responsible owner and the LLFA.

Explore options for Property Level Resilience.

These measures can apply to single properties or larger systems that can be applied to protect multiple properties and communities.

9.2.1.3 Explore catchment wide solutions such as attenuation areas (balancing ponds), rain gardens, overflow routes and tree planting.

9.2.1.4 Continue to report flood incidents to the LLFA. Endeavour to obtain as much evidence of flood events as possible, such as photographic and video evidence.

9.2.1.5 Property owners should undertake regular inspection and maintenance of their drainage systems in accordance with a defined maintenance regime. Property owners should assess the capacity of their drainage systems and identify any areas with insufficient capacity. Where this could lead to runoff to the public highway or nuisance to third party private property, improvement works should be considered.

9.3 Lead Local Flood Authority (LLFA)

9.3.1.1 Work with Flood Risk Management Authorities, riparian/property owners, the community and those affected by flooding. The work should:

- Aim to manage surface water to provide a better standard of protection to Highway infrastructure, and the community.
- Identify further surveys, investigations and studies required to locate and record existing drainage systems in the area of the flood incident and the wider catchment.
- Identify all legal responsibilities for drainage and watercourse maintenance in the area of the flood incident and the wider catchment, reminding relevant parties of these responsibilities and the benefits of doing it.
- Identify further surveys, investigations and studies required to fully understand how the flooding occurred and the likelihood of it occurring again.
- Assess the requirement and viability of engineering schemes to ensure the existing infrastructure operates as intended, and to provide a better standard of protection if required. This might include community level flood resilience measures, improving drainage to accommodate extreme rainfall events, providing attenuation storage areas and creating formal overland flood flow routes.

9.3.1.2 Work with the MKC Emergency Planning Team and the EA to support community based Flood Wardens, should they be recruited.

9.3.1.3 Work with the MKC Emergency Planning Team, the EA and other flood management authorities to support the community in the production of a Community/Household Emergency and Flood Plan and provide advice to residents and occupiers on how to explore options for property level resilience.

9.4 Highway Authority – Milton Keynes Highways

9.4.1.1 Undertake regular highway drainage cleansing throughout the catchment. Identify and develop a detailed plan of their assets to share with the LLFA and the community.

9.4.1.2 Consider more regular inspection and maintenance of highway drainage systems in areas identified as being at risk on the Surface Water Flood Risk Mapping, and where flooding has occurred.

9.4.1.3 Assess the capacity of their assets and identify any areas with insufficient capacity for draining normal runoff from the highway. Where this leads to flood risk to properties improvement works should be considered.

9.4.1.4 Assess the suitability of third-party drainage systems accepting discharge from Highway Drainage systems and report any unsatisfactory areas to the LLFA.

9.4.1.5 Assess the viability of works to provide overland flood flow routes from the highway to safe areas, to reduce reliance on drainage systems in extreme rainfall events.

9.4.1.6 Work with the LLFA and other parties with the work detailed in 9.3.1.1.

9.4.1.7 Assist the LLFA in publicising the Flood Toolkit information resource.

9.5 Developers

9.5.1.1 Developers should work with local authorities to ensure all development does not increase flood risk (from any source) to the site or adjacent land and is completed in accordance with approved plans, documents, and planning policy.

9.6 Environment Agency (EA)

9.6.1.1 Work with the MKC Emergency Planning Team and the LLFA to support the community and, should one be recruited, a community based Flood Warden.

9.6.1.2 Work with the LLFA and other parties with the work detailed in 9.3.1.1.

9.6.1.3 Assist the LLFA in publicising the Flood Toolkit information resource.

10. RIGHTS AND RESPONSIBILITIES

10.1 Communities

10.1.1.1 Communities may consist of the Town or Parish Council, a Flood Forum, Community Action Group, Resident and Business Associations, affected residents and land owners, amongst others.

10.1.1.2 Property owners who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected.

10.1.1.3 Communities and residents, as property owners, have responsibility for their private drainage systems. They may have riparian responsibilities if their land boundary is next to a watercourse, a watercourse runs alongside their garden wall or hedge, and / or a watercourse runs through or underneath their land.

10.1.1.4 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, signing up to the Flood Warning Direct service for river flood warnings, supporting a Community Flood Warden, producing a Community Emergency and Flood Plan, implementing property level resilience and moving valuable items to higher ground.

10.2 Lead Local Flood Authority (LLFA)

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

10.2.1.2 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.

10.2.1.3 The register must contain a record about each structure or feature, including the ownership and state of repair. The LLFA is also required to keep a record of flooding hotspots across the county.

10.2.1.4 As the responsible LLFA for the affected properties in Milton Keynes, MKC will be looking for support from other risk management authorities, communities and individual home owners to ensure flood incidents are reported, and any assets which have a significant effect on flood risk are recorded on the asset register.

10.2.1.5 While MKC 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 MKC with the mandate or funding to act on identified causes of flooding or force risk management authorities to undertake any recommended actions.

10.3 Highway Authority – Milton Keynes Council

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

10.3.1.2 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 run-off from within the highway catchment rather than from the wider catchment.

10.3.1.3 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.

10.4 Water Company (Anglian Water) (AW)

10.4.1.1 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.

10.4.1.2 Since October 2011, under the 'Private Sewer Transfer', AWS adopted piped systems on private land that serve more than one curtilage and were connected to a public sewer on 1st July 2011. 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.

10.4.1.3 Sewerage Undertakers are responsible for public sewers and lateral drains. 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.

10.4.1.4 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.

10.5 Land Owners and Developers

10.5.1.1 Land owners must let water flow through their land without any obstruction, pollution or diversion which affects the rights of others. Others also have the right to receive water in its natural quantity and quality. All riparian owners have the same rights and responsibilities.

10.5.1.2 Land owners must accept flood flows through their land, even if these are caused by inadequate capacity downstream. 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 run-off from the land cannot be considered "natural".

10.5.1.3 Land owners must keep any structures, such as culverts, trash screens, weirs, dams and mill gates, clear of debris.

These rights and responsibilities are summarised in the Government guidance – Owning a Watercourse:
https://www.gov.uk/guidance/owning-a-watercourse

10.5.1.4 Land owners 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.

10.6 Environment Agency (EA)

10.6.1.1 The EA has a strategic overview responsibility of all sources of flooding and coastal erosion under the F&WMA.

10.6.1.2 The responsibility for maintenance and repair of Main 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).

10.6.1.3 Main River means all watercourses shown as such on the statutory Main River maps held by the EA and the Department of Environment, Food and Rural Affairs, and can include any structure or appliance for controlling or regulating the flow of water into, in or out of the channel.

10.6.1.4 The nearest Main River is Great Ouse. This was not a factor in the flood incident.

10.6.1.5 The EA will encourage third party asset owners to maintain their property in appropriate condition and take enforcement action where it is appropriate. They may 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.

10.6.1.6 Other work carried out by the EA includes:

- Working in partnership with the Met Office to provide flood forecasts and warnings.
- Developing long-term approaches to Flood and Coastal Erosion Risk Management (FCERM). This includes working with others to prepare and carry out sustainable Flood Risk Management Plans (FRMPs). FRMPs address flood risk in each river catchment. The EA also collates and reviews assessments, maps and plans for local flood risk management (normally undertaken by LLFAs).
- Providing evidence and advice to support others. This includes national flood and coastal erosion risk information, data and tools to help other risk management authorities and inform Government policy, and advice on planning and development issues. The EA are statutory consultees of the Local Planning Authority.
- Working with others to share knowledge and the best ways of working. This includes work to develop FCERM skills and resources.
- Monitoring and reporting on FCERM. This includes reporting on how the national FCERM strategy is having an impact across the country.

DISCLAIMER

This report has been prepared as part of Milton Keynes Council's responsibilities under the Flood and Water Management Act 2010. It is intended to provide context and information to support the delivery of the Local Flood Risk Management Strategy and should not be used for any other purpose.

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 assumptions made by David Smith Associates and Milton Keynes County Council when preparing this report, including, but not limited to those key assumptions noted in the report, including reliance on information provided by others.

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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 County Council highlighting flooding to properties at a street level.

David Smith Associates and Milton Keynes Council do not accept any liability for the use of this report or its contents by any third party.

ACRONYMS

LLFA	Lead Local Flood Authority
EA	Environment Agency
MKC	Milton Keynes Council
AW	Anglian Water
FIR	Flood Investigation Report
F&WMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991

USEFUL LINKS

Highways Act 1980:
http://www.legislation.gov.uk/ukpga/1980/66/contents

Water Resources Act 1991:
http://www.legislation.gov.uk/ukpga/1991/57/contents

Land Drainage Act 1991:
http://www.legislation.gov.uk/ukpga/1991/59/contents

Gov.UK Guidance – Owning a Watercourse:
Your responsibilities and rules to follow for watercourses on or near your property, and permissions you need to do work around them.
https://www.gov.uk/guidance/owning-a-watercourse

EA - Prepare your Property for Flooding:
How to reduce flood damage Flood protection products and services
https://www.gov.uk/government/publications/prepare-your-property-for-flooding

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

USEFUL CONTACTS

Milton Keynes Council

Highways:

Tel: 01908 252353

Website: https://www.milton-keynes.gov.uk/highways-and-transport-hub/report-it-highways-and-transport/report-problems-on-roads-footways-and-redways

Email: customerservices@milton-keynes.gov.uk

Emergency Planning:

Tel: 01908 311773

Website: https://www.milton-keynes.gov.uk/environmental-health-and-trading-standards/emergency-planning

Email: emergencyplanning@milton-keynes.gov.uk

Flood and Water Management Team:

Tel: 01908 691691 (Mon-Fri, 9am - 5pm)

Email: llfa@milton-keynes.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

Website: https://www.gov.uk/government/organisations/environment-agency

Email: enquiries@environment-agency.gov.uk

Anglian Water

Emergency Tel: 03457 145145 (select option 1)

Website:

http://www.anglianwater.co.uk/household/water-recycling-services/sewers-and-drains.aspx

APPENDIX A

Environment Agency Rainfall Catchment Analysis

December 2020 Flooding

Great Ouse catchment

This factsheet presents rainfall data in the lead up to and on 23rd December 2020 and the subsequent river response.

Long Term Average (LTA) rainfall

The LTA is the arithmetic mean calculated from historic records. December was a very wet month with a total average rainfall of 108 mm (195% of the LTA) across East Anglia. December 2020 was the second wettest December in this area since the record started in 1981.

Even with a relatively dry November, the 3 months from October - December rainfall was 154% of the LTA. Figure 1 shows the surplus of rainfall seen in October, December and then January.

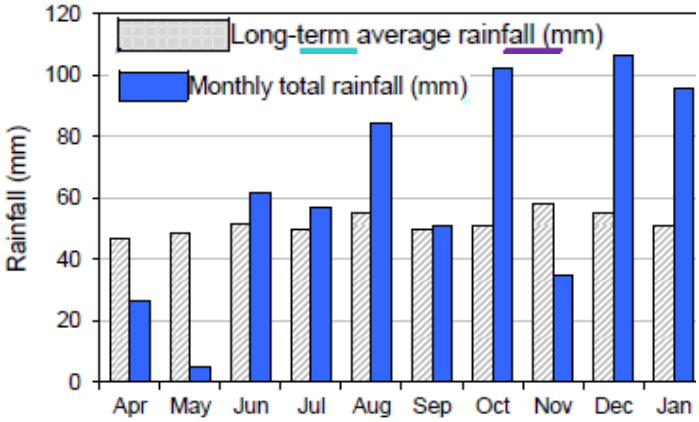


Figure 1: LTA vs 2020 observed rainfall

Over 2020, rainfall across the area was 115% of the LTA (Figure 1). The consistently above average rainfall in the months ahead of the main flood contributed to the catchment response on the 23rd December.

Soil Moisture Deficit (SMD)

SMD is the difference between the amount of water actually in the soil and the amount of water the soil can hold, expressed in depth of water (mm). This is an indication of how saturated the ground is. A low SMD means heavy rainfall is less likely to infiltrate the ground and more likely to run off into watercourses. The impact of the excess rainfall shown in Figure 1 was an average SMD across the East of 3mm at the end of December. Statistically this is 'below normal' and an indication of how wet the catchment was.

Event Rainfall

Up to 17mm fell across the catchment in the 3 days prior to the flood event, this filled the majority of remaining storage space, effectively saturating the catchment ahead of Storm Bella arriving on Wednesday 23rd December.

Figure 2 indicates the distribution of rainfall which fell across the Great Ouse catchment on December 23rd 2020, along with spot totals. Much of the rainfall was in the afternoon of the 23rd, rather

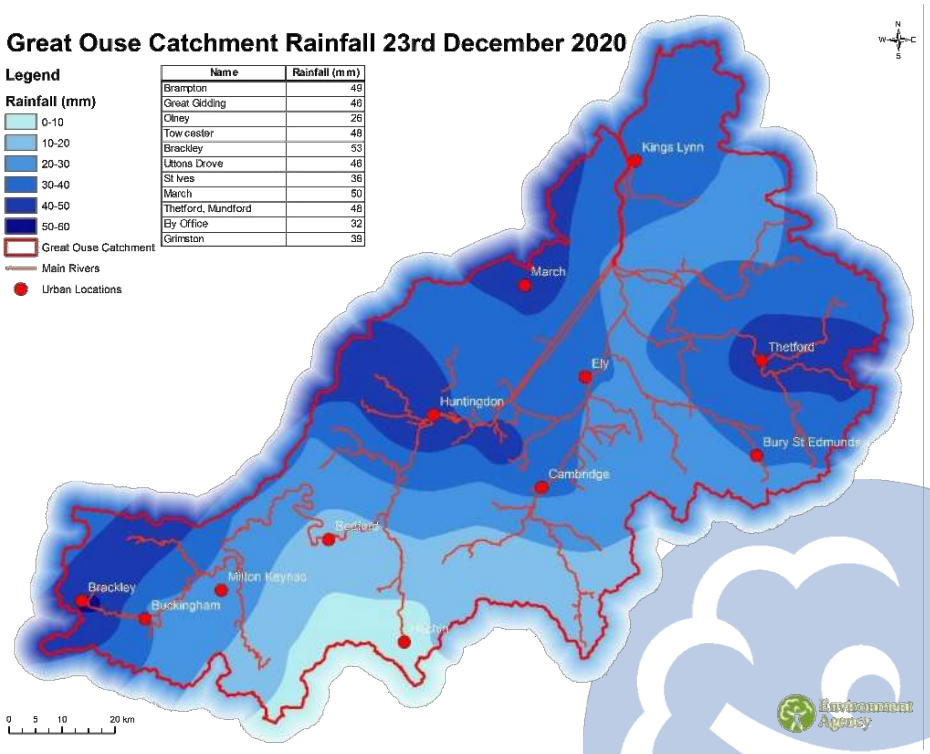


Figure 2: Rainfall distribution on 23rd December 2020

than over the course of the day. This intensity of rainfall contributed to the fast reaction of watercourses. The December LTA of 55mm shows that almost a month's rainfall was seen in certain locations on the 23rd.

River Levels

The most significant river levels were seen on the River Great Ouse, the Tove, Kym, Alconbury Brook and Bury Brook.

The high degree of saturation within the catchment and the rainfall in the days preceding the 23rd December contributed to higher in-channel levels, taking up any spare storage within the system. This culminated in a very high runoff from the 23rd December rainfall and significant flooding from fluvial, surface water and groundwater sources.

The most significant flood event of this scale prior to December 2020 was the 1998 flood event. For the Great Ouse, this is often the benchmark by which other floods are measured and compared.

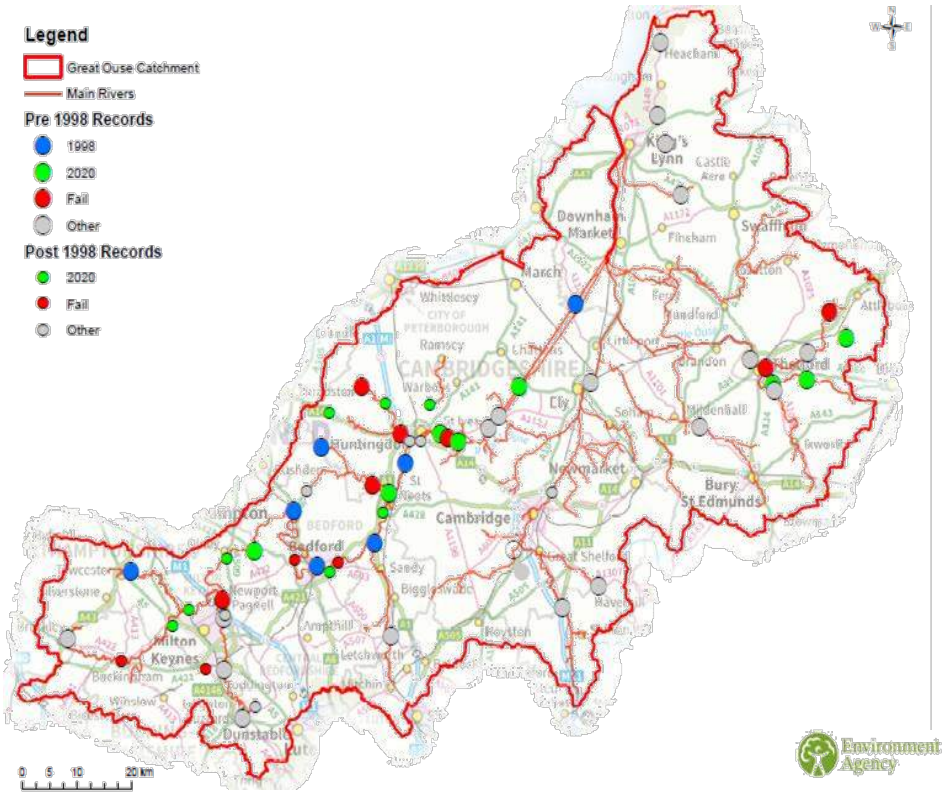


Figure 3: Year of highest recorded gauge level. 'Fail' indicates the gauge did not record an accurate level during the December 2020

Figure 3 shows a number of river level gauges in the Great Ouse catchment. The map shows that following the 23rd December rainfall, several gauges recorded river levels exceeding those of 1998 and are the highest level on record. The river response reflects the severity of rainfall.

Flood Frequency Analysis

The likelihood of flood events are often expressed in terms 'Annual Exceedance Probability' (AEP), i.e. an event of X size has Y% probability of being exceeded each year, although this figure will vary from location to location. It is possible to calculate the AEP of December's flooding, determining how often you would expect to see this size event based on the historic record. The work to calculate this is ongoing.

Summary

The widespread flooding impacts seen on and after 23rd December 2020 were as a consequence of heavy rainfall on December 23rd, falling on an already wet catchment which was especially sensitive to intense rainfall. The LTA shows that the rainfall experienced was exceptionally high in December. The rainfall in the 3 days preceding the 23rd December also contributed to the severity of the event.

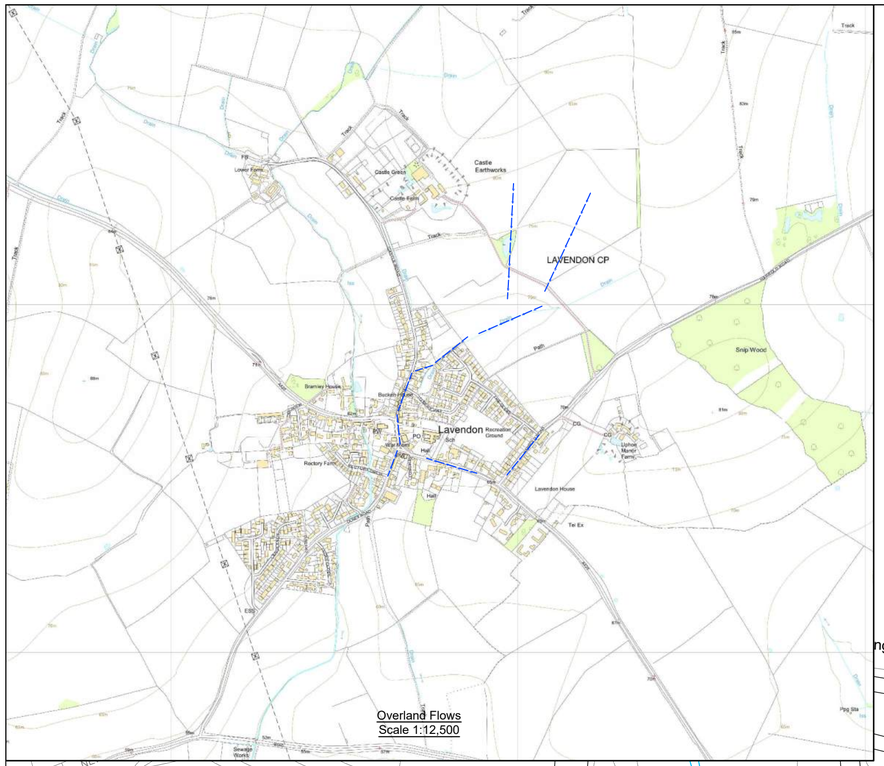
The Environment Agency are continuing to collect and process data related to the December flooding and subsequent impacts. Asset inspections are underway and any subsequent work being scoped. The performance of the flood warning service is being reviewed and we are working with a number of communities to help them increase their resilience to flooding.

Our monthly water situation reports and weekly rainfall and river flow reports are published online at:

https://www.gov.uk/government/collections/water-situation-reports-for-england

APPENDIX B

Flood Incident Plan



Notes:

1. Based on Ordnance Survey mapping. ©Crown Copyright and database rights 2021 OS Licence no. 100019980
2. Extent of flooding and direction of flows based on evidence provided during site observations.
3. Extent of flooding is approximate and shows the broad area of flooding only and should not be used to accurately determine the extent of flooding during the event. All items shown on this drawing are approximate only and should not be relied upon for accuracy.
4. David Smith Associates and Milton Keynes Council expressly disclaim responsibility for any error in, or omission from, this drawing arising from or in connection with any of the assumptions being incorrect.

Key:

Schematic area of flooding

Main route of overland flow during flood incident.

ISSUE	REVISION	BY	DATE

CLIENT
MILTON KEYNES COUNCIL

CONTRACT
SECTION 19
FLOOD INCIDENT INVESTIGATION

TITLE
LAVENDON
INCIDENT PLAN

FLOOD INCIDENT DATE
23 DECEMBER 2020

DRAWN	CH,KD	DATE	SCALE
MA	RJ	AUG'21	AS SHOWN @ A2

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DRAWING NUMBER	21	42983/60	REVISION P1

APPENDIX C

Photographs

Various photographs of the flood incident area taken by the Investigating Officer

Figure 1: Ditch 2: Culvert which restricted flow

Figure 2 Ditch 2: Area built over by resident

Figure 3: Harrold Road Culvert

APPENDIX C

Environment Agency Standard Notice

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