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FLOOD INVESTIGATION REPORT

RAVENSTONE

23rd 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
Ravenstone

David Smith Associates Reference: 21/42983/04

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01	24/06/21	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 Ravenstone that occurred on Wednesday 23rd December 2020. Internal flooding of several dwellings and the highway occurred.

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. The drainage infrastructure both natural and manmade with Ravenstone, was unable to accommodate the volume of surface water during this extreme event.

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.

The majority of flooding was fluvial from the watercourse which runs through Ravenstone exceeding the capacity of the watercourse and its structures. Some properties were affected directly from agricultural runoff whilst others were impacted when road drainage had insufficient capacity to accommodate the flows experienced during the event.

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.

* 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;
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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.
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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 Ravenstone that occurred on Wednesday 23rd December 2020. Internal flooding of a habitable garage and of the highway occurred.

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 Ravenstone. MKC provided details of the appropriate contact, details of the incident, and details of drainage assets.

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 13th May 2021. The meeting was held with the Clerk to the Parish Council, and Mr MacGown a resident with knowledge of the flood incident.

1.2.2.2 The visit undertook a visual inspection of the general topography and relevant features within Ravenstone.

1.2.2.3 Significant lengths of the watercourse were not accessible due to being located on private land.

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 Ravenstone 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 We understand that flooding had previously occurred in Ravenstone 18 months prior to this event but was less extensive and affected different houses. Prior to this there had been various small scale flooding events and foul water sewers are reported as flooding often. Ravenstone was also affected by the Easter 1998 flood event.

4. LOCATION OF FLOODING

4.1 Location in Context

4.1.1 Catchment Area

4.1.1.1 Ravenstone is located approximately 12.1km north east of Milton Keynes and 4km west of Olney. Ravenstone is located within a valley with high land on all sides. The watercourse and tributary flow through Ravenstone from north to south.

4.1.1.2 At the southern end of the village alongside Common Street dwellings to the west of Common Street are located adjacent to the watercourse. To the north as Common Street turns east the dwellings and road move away from the watercourse and climb the hill.

4.1.1.3 Dwellings around North End and Weston Road are the high point of the village. As North End heads north it drops back down the hill and towards the watercourse.

4.1.1.4 Upstream of Ravenstone the catchment serves an area of approximately 3.3km^2. The upstream catchment comprises predominately agricultural land.

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

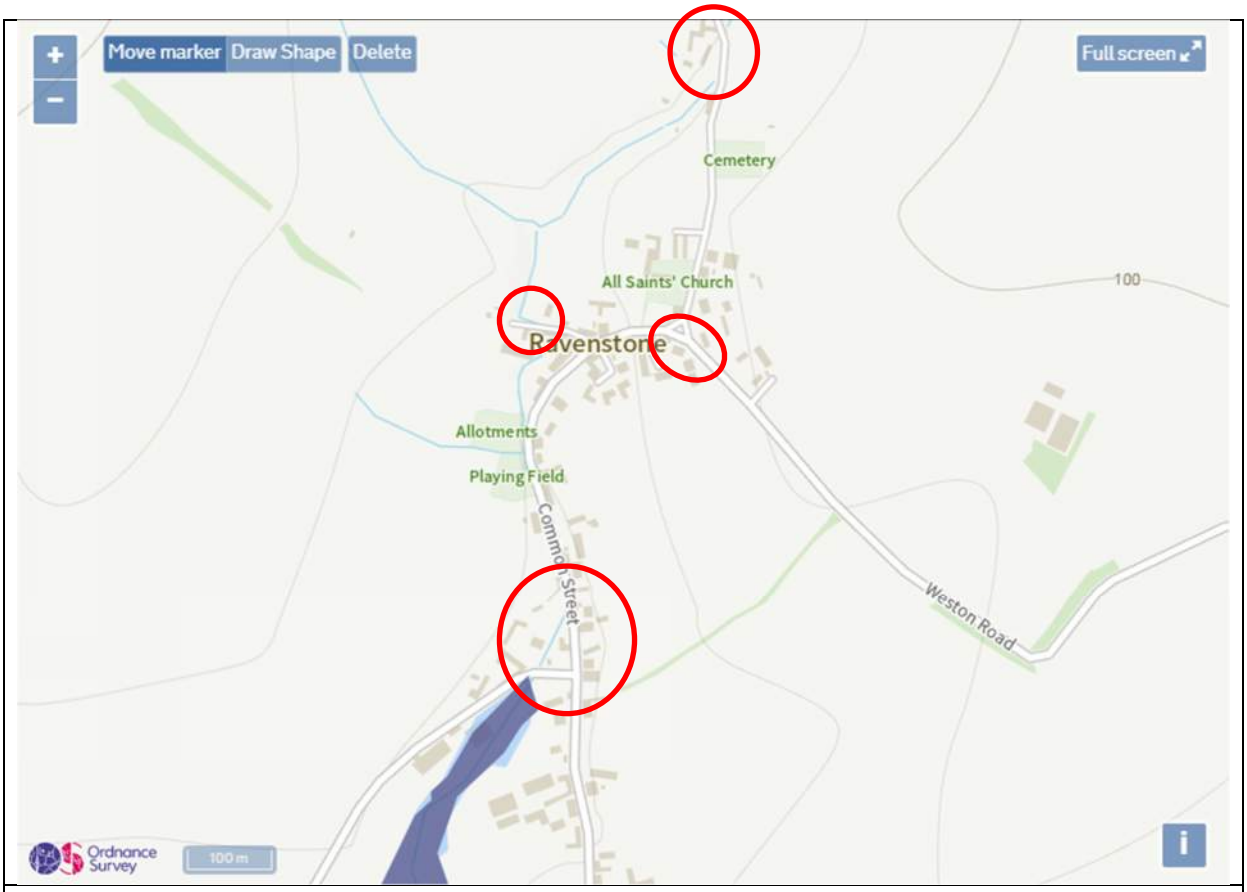
4.1.2 Long Term Flood Risk Mapping

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.

4.1.2.3 No flooding is shown on the fluvial flood map, this may or may not be accurate as the Environment Agency doesn't provide fluvial data for the smallest of watercourses.

4.1.2.5 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

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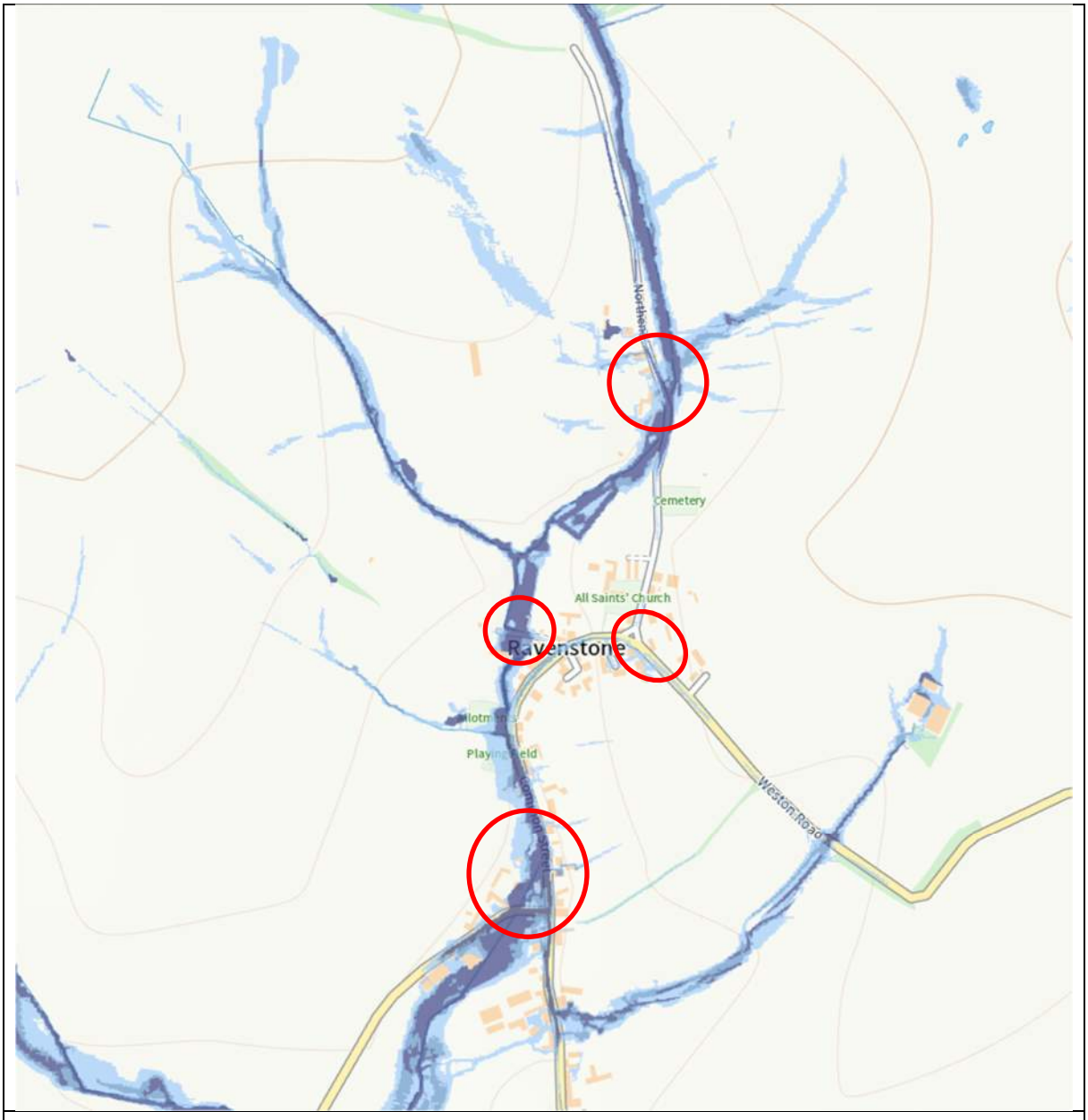
4.1.2.6 Flood Risk from Rivers or the Sea



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/

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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 Generally, the watercourse, where observable adjacent to Common Street, appeared to be in a good condition. Downstream, where the watercourse is much flatter, near Stoke Goldington Road there was some sign of silting. We understand the parish council is proposing to organise some maintenance of this riparian watercourse in this location.

5.2.1.2 Upstream of Ravenstone where the watercourse passes below North End one of the culverts showed signs of significant silting.

5.2.2 Buried Watercourses

5.2.2.1 There is a short section of buried watercourse to the south of the recreation ground across the frontage of the cottages before becoming an open watercourse south of the cottages. The watercourse is buried for approximately 55m on the upstream end of the buried watercourse there is a trash screen.

5.2.3 Structures

5.2.3.1 There are various culverts for road or access crossings. The majority of those observed appeared to be in good condition although a couple of culverts were showing signs of significant silting. Some examples of this are shown on the photographs included in Appendix C.

5.3 Drainage Systems

5.3.1 Public Sewers

5.3.1.1 There are public sewers located within Ravenstone.

5.3.2 Highway Drainage

5.3.2.1 Highway drainage within Ravenstone generally comprises road gullies although there are some grips. Some highway gullies were observed to be unable to cope with the relatively light rainfall during the site visit.

5.3.2.2 During the site visit we were advised that they felt maintenance of highway drainage within Ravenstone had been an issue over the years within some areas of drainage thought to be blocked. We understand from the highway authority that regular maintenance of road drainage within Revenstone has been completed.

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 principally to watercourses although some dwellings may be relying on infiltration techniques.

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 We are not aware of any property or community level flood resilience measures that have been or are being introduced.

5.4.1.2 During the flood event residents some residents made efforts to prevent water ingress or minimise its impact by making barriers or digging trenches.

6. DESCRIPTION OF FLOOD EVENT

6.1 Resident/Occupier Descriptions

6.1.1 Interview Responses

6.1.1.1 The Parish Council have collated a number of responses from residents who were affected by the flooding, the main elements are summarised below.

Properties were flooded on North End and Common Street. These were mostly caused by watercourse flooding. Whilst the depth of flooding was generally limited to between 50 and 100mm.

Residents 1 & 2 – North End
Narrowly avoided internal flooding but suffered external flooding.

Resident 3 – Common Street
"The extent of our flooding was very limited-an inch or so in the boiler room and part of the kitchen as we were able, by using sandbags, to divert the water away from the house and down the driveway."

Resident 4 – Stoke Goldington

"The French drains surrounding our home were no help to prevent the water from rushing into our home through a wall. Even with three storm drains completely open from their manhole covers, was no help. And two extra dirt moats had to be dug to divert the water onto Stoke Goldington road, where the water struggled to drain through the regular street drains. Without the support of our neighbours our entire bottom floor of our home would have been flooded."

Resident 5 – Common Street
"In the last flooding in December the rain was torrential and I would class us as a near miss, but would have most certainly flooded if it had not been for the help and quick intervention of neighbours digging trenches to let the water drain away into the torrent running down the street."

"We escaped with a few damp floor boards at the edge of the door, but could have been so much worse."

Resident 6 – Common Street
"Flood water entered five of our ground floor rooms and rose to a depth of just a couple of inches. The house was completely surrounded by water which was pouring over the access to The Old Forge, from Common Street.

The water level in Common Street, outside of The Old Forge, rose quickly. It overwhelmed the stream and started flooding the road. The flood water came over the boundary into our property about 90 minutes later. A large quantity of water flowed off the driveway and in to the adjacent orchard. At this stage, the road was flooded but there was still room beneath the bridge to The Old Forge to take more water in the stream".

Resident 7 – Weston Road

"On 23rd December it was so serious our garage flooded to a depth of approximately 3 to 4 inches due to excess water flooding down our driveway, it was only stopped from rising further by sand bagging the front of our drive, see photo 1. The excess rainwater in the gully flooded driveways of houses further down the road, properties were only stopped from flooding by volunteers digging trenches to divert the rainwater and building sand bag defence barriers."

Resident 8 – Common Street

"The water enters through our drive and then spreads around outside the house and then rose until we knocked the top off the rear wall and allowed it to escape to stream."

Resident 9 – Common Street

"Fortunately no water went into the house but it would have if we had not filled plastic feed bags with gravel to act as sand bags."

6.1.1.2 Not all properties have provided details of the flooding, we understand that in total the following properties suffered internal flooding:

- Stoke Goldington Road – 1 dwelling
- Common Street – 4dwellings
- Weston Road – 1 dwelling
- North End – 2 dwellings

6.1.1.3 A number of other dwellings suffered near misses and were saved by the actions from further flooding by actions of the residents.

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 flooding occurring during the afternoon.

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.

Common Street / Stoke Goldington Road

7.1.2.2 Dwellings affected by the flooding at the southern end of the village were primarily flooded by the watercourse. Upstream of the recreation ground the watercourse was within the bank, however, it left the watercourse and started flooding overland at the culvert for the recreation ground and the start of a 55m buried section of watercourse.

7.1.2.3 This culvert has a trash screen and appeared to be reasonably well maintained, it can be seen if Figure 7 in Appendix C. It was reported that residents removed debris from the trash screen on a number of occasions during the flood event. The debris was caused by the flood event.

7.1.2.4 Water flowed overland and within the watercourse affecting a number of properties downstream.

7.1.2.5 Further downstream where the watercourse passes underneath the Stoke Goldington Road, we understand that this also acted as a flow control with it being reported that water levels had risen to approximately 300mm above the top of the culvert.

7.1.2.6 Two properties one on Common Street and one on Stoke Goldington Road was caused by agricultural runoff from fields located upstream of the dwelling causing internal flooding.

7.1.2.7 Externally the water depth was estimated at around 300mm.

Bay Lane

7.1.2.8 Flooding also occurred around Bay Lane, this is understood to have caused external flooding only with depths of around 400mm affecting the stables. This was caused by the watercourse and located where the watercourse passes under the highway.

Weston Road / Common Street

7.1.2.9 In this area properties were affected by overland flow which primarily appear to have started with agricultural runoff from the south east draining on to the carriageway. However, once on the highway road gullies were unable to accommodate the flow of water. The water followed the local topography flowing into one house on Weston Road but also flowing down the carriageway on towards Common Street and almost affecting another property.

North End

7.1.2.10 The dwellings on North End affected by the flooding are located within the valley near the watercourse. Agricultural runoff overloaded the drainage infrastructure both natural and highway. Water followed the natural topography generally along the line of the watercourse to the south east flooding properties located on low spots. The properties were affected by a mix of overloaded watercourses and agricultural runoff.

7.1.3 Standing Water

7.1.3.1 There were areas of standing water on low spots but generally the water was flowing southwards.

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 Observable watercourses generally seemed to be in a well-maintained condition, however, there were some signs of maintenance being required to the watercourse and culverts in a couple of locations.

7.1.5.3 The majority of flooding was related to agricultural runoff overloading the watercourse, however, in some locations road gullies were noted to have not been working efficiently. Whether this was due to overloading from additional runoff or because they require additional maintenance is not certain.

7.2 Response to Flooding

7.2.1 Immediate Response

7.2.1.1 It is understood residents acted to clear debris from the trash screen near the recreation ground culvert and divert water away from individual properties. There was

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.

8. CONCLUSION

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

8.1.1.2 The majority of flooding was fluvial from the watercourse which runs through Ravenstone exceeding the capacity of the watercourse and its structures. Some properties were affected directly from agricultural runoff whilst others were impacted when road drainage had insufficient capacity to accommodate the flows experienced during the event.

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

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

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

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.

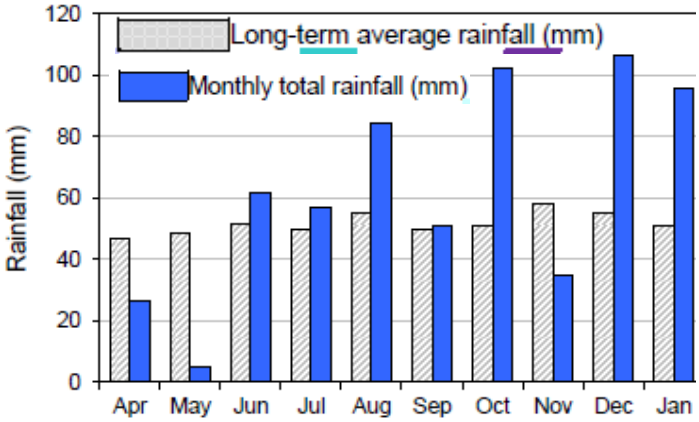


Figure 1: LTA vs 2020 observed rainfall

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

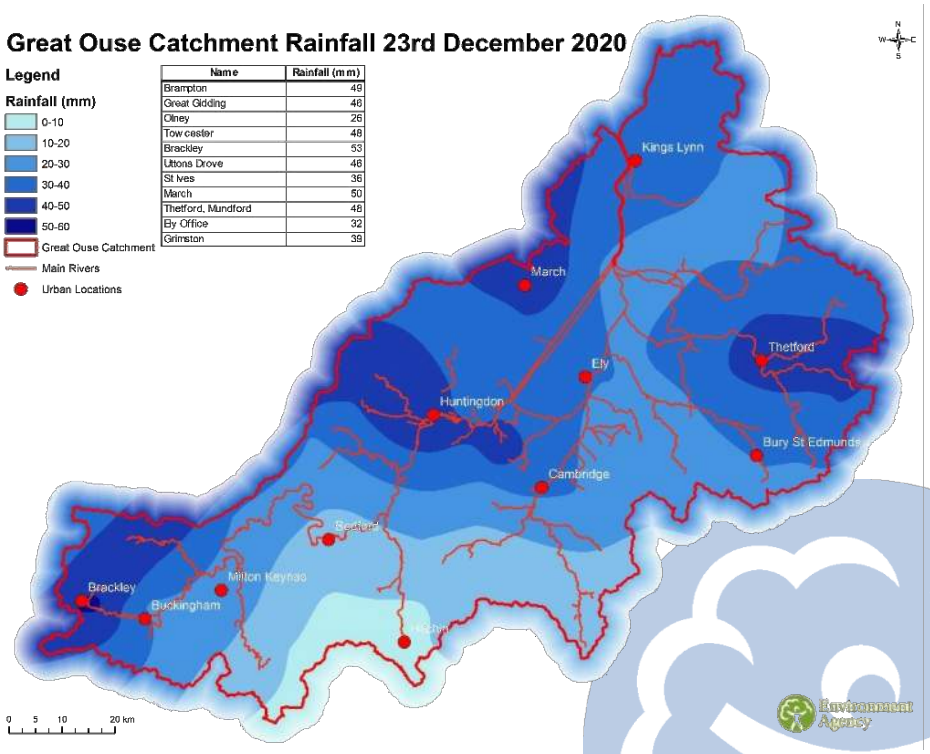


Figure 2: Rainfall distribution on 23rd December 2020

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.

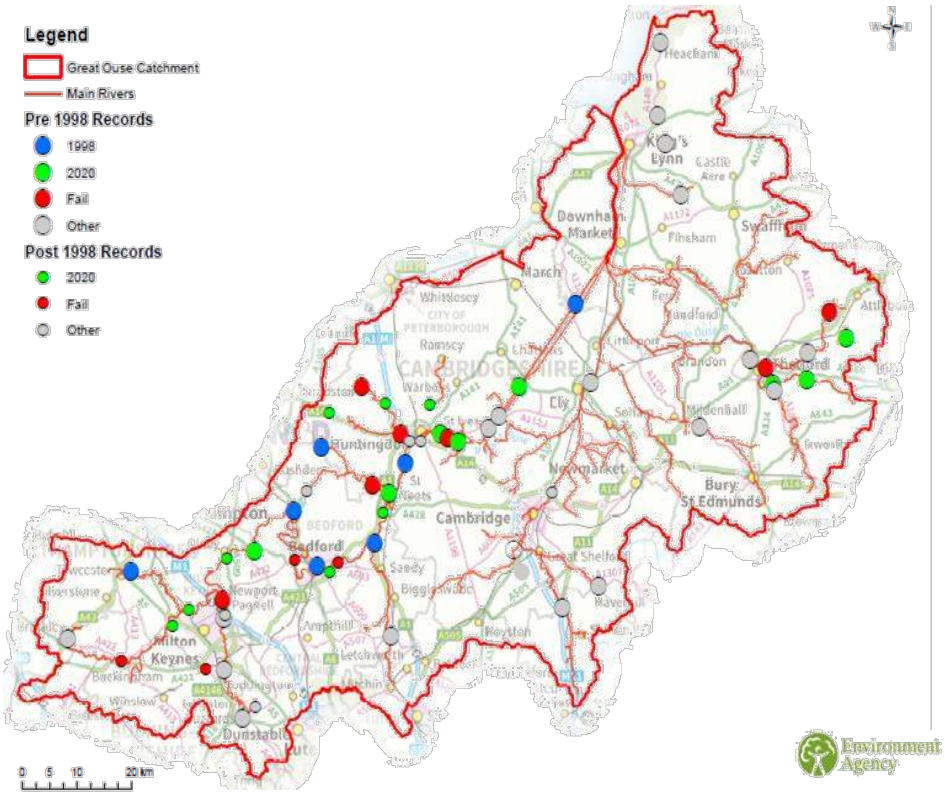


Figure 3: Year of highest recorded gauge level. 'Fail' indicates the gauge did not record an accurate level during the December 2020

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.

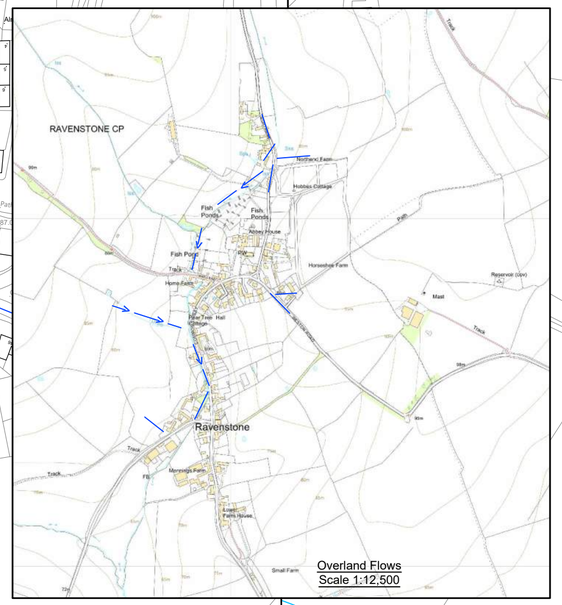
The Environment Agency are continuing to collect and process data related to the December flooding and subsequent impacts. Asset inspections are underway and any subsequent work being scoped. The performance of the flood warning service is being reviewed and we are working with a number of communities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



Overland Flows
Scale 1:12,500

Flood Details
Scale 1:2000

Flood Details
Scale 1:2000

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:

Key:

Schematic area of flooding

Main route of overland flow during flood incident.

ISSUE	REVISION	BY	DATE

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CLIENT
MILTON KEYNES COUNCIL

CONTRACT
SECTION 19
FLOOD INCIDENT INVESTIGATION

TITLE
RAVENSTONE
INCIDENT PLAN

FLOOD INCIDENT DATE
23 DECEMBER 2020

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

David Smith Associates
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Fax: (01604)782629
Email: northampton@dsagroup.co.uk

DRAWING NUMBER	21	42983/54	REVISION P2

30/08/21

APPENDIX C

Photographs

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

Figure 1: Watercourse downstream of Stoke Goldington Road

Figure 2 Culvert under Stoke Goldington Road

Figure 3: Watercourse upstream of Stoke Goldington Road

Figure 4: Culvert on Common Street

Figure 5: Watercourse on Common Street

Figure 6: Watercourse on Common Street

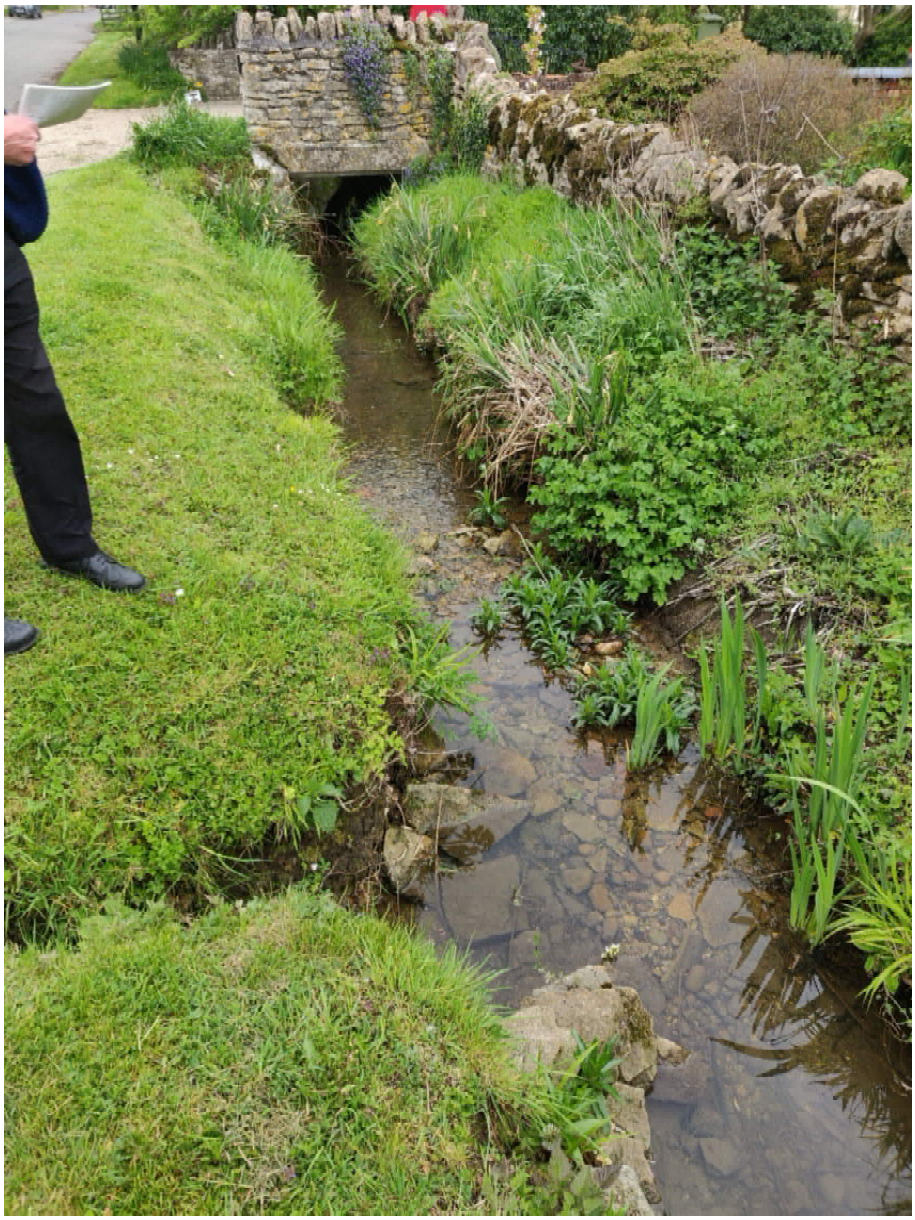

Figure 7: Culvert at recreation ground – start of buried watercourse

Figure 8: Watercourse upstream of recreation ground

Figure 9: North End during site visit

Figure 10: Road gully on North End during site visit

APPENDIX D

Environment Agency Standard Notice

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