Flood Investigation Report

REDMILE

16TH FEBRUARY 2020

To discuss this report, please contact the Flood Risk Management Team by email flooding@leics.gov.uk or by phone 0116 305 0001

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1 EXECUTIVE SUMMARY

In the early hours of 16th February 2020, five residential properties in Redmile village were internally flooded at two locations. The flooding was predominantly caused by a heavy[1] rainfall event on the 15th February (approximately 28.2mm of rain fell within a 12-hour period, source: Langar Rain Station located approximately 7km south-west of Redmile). The sheer volume of rain fell onto an already saturated catchment resulting in significant overland surface water flows following the topography of the land from the agricultural fields towards two areas of the village.

In addition to the surface water runoff, one area was impacted due to an ordinary watercourse becoming overwhelmed resulting in flood water flowing onto the highway. The volume of flood water on the highway was further exacerbated by the STW surface water system surcharging. The water on the highway breached the low thresholds resulting in internal flooding to two residential properties.

Three residential properties were affected in the second area due to the combination of overland surface water and an overwhelmed ordinary watercourse (which added to the sheer volume of overland flood water) which impacted the residential properties to the rear.

Due to the flood event occurring in the early hours of the morning, detailed information on the sources and nature of flooding at both locations is limited.

1.1 SUMMARY OF FLOOD SOURCES

Ordinary Watercourse	☑	**Public Sewer**	☑
Main River	☐	**Canal**	☐
Surface Water	☑	**Land Drainage**	☑
Groundwater	☑	**Highway Drainage**	☐

1.2 RECEPTORS IMPACTED (NUMBER)

Residential	Business	Other Buildings	Roads	Critical Infrastructure
5				

[1] https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet_3-wter-in-the-atmosphere.pdf

2 INTRODUCTION

2.1 SECTION 19 INVESTIGATIONS – DUTY TO INVESTIGATE

Section 19 of the Flood and Water Management Act (FWMA) states:

(1) On becoming aware of a flood in its area, a Lead Local Flood Authority (LLFA) must, to the extent that it considers it necessary or appropriate, investigate:

a. *which Risk Management Authorities (RMAs) have relevant flood risk management functions, and*
b. *whether each of those RMAs has exercised, or is proposing to exercise, those functions in response to a flood event.*

(2) Where an authority carries out an investigation under section 1 (above) it must:

- *publish the results of its investigation, and*
- *notify any relevant RMAs."*

2.2 FORMAL FLOOD INVESTIGATIONS CRITERIA

Leicestershire County Council, from herein referred to as *"The Council",* identified local thresholds for formally investigating flood incidents across Leicestershire within the Local Flood Risk Management Strategy published in August 2015. This policy advises when a formal flood investigation should be undertaken, including where one or more of the thresholds in table 1 occurs as a result of a flooding incident.

A formal investigation into the flood incident in Redmile on the 16th February 2020 has been undertaken as the event triggered the locally agreed flooding characteristics or discretionary items as indicated below:

Table 1: Locally Agreed Criteria for Formal Flood Investigations

Mandatory Investigation	
Loss of life or serious injury	☐
Critical infrastructure flooded or nearly flooded from unknown or multiple sources	☐
Internal property flooding from unknown or multiple sources	☑
Discretionary Investigation	
A number of properties have been flooded or nearly flooded	☐
Other infrastructure flooded	☐
Repeated instances	☐
Investigation requested	☐
Risk to health (foul water)	☐
Environmental or ecologically important site affected	☐
Depth/area/velocity of flooding a cause for concern	☐

2.3 RISK MANAGEMENT AUTHORITIES (RMAS)

The following RMAs were identified as relevant to the flooding in Redmile:

- Leicestershire County Council – LLFA
- Leicestershire County Council – Local Highways Authority
- Melton Borough Council (MBC) - Local Planning Authority and Land Drainage Authority who can carry out flood risk management works on minor watercourses
- Severn Trent Water Ltd (STW) - Statutory undertaker for public wastewater and water supply assets in Redmile.

3 FLOOD INVESTIGATION

3.1 LOCATION AND SETTING

Redmile is situated along the northern border of Leicestershire County and is approximately 22km south-east of Nottingham in Melton district (Figure 1). Redmile village is surrounded by grassland and farmed agricultural land which falls towards the residential properties. The area is predominantly limestone and mudstone which is associated with a high-water table and groundwater flooding.

Figure 1 illustrates the two areas (sections ‘a’ and ‘b’) that were affected on the 16th February 2020.

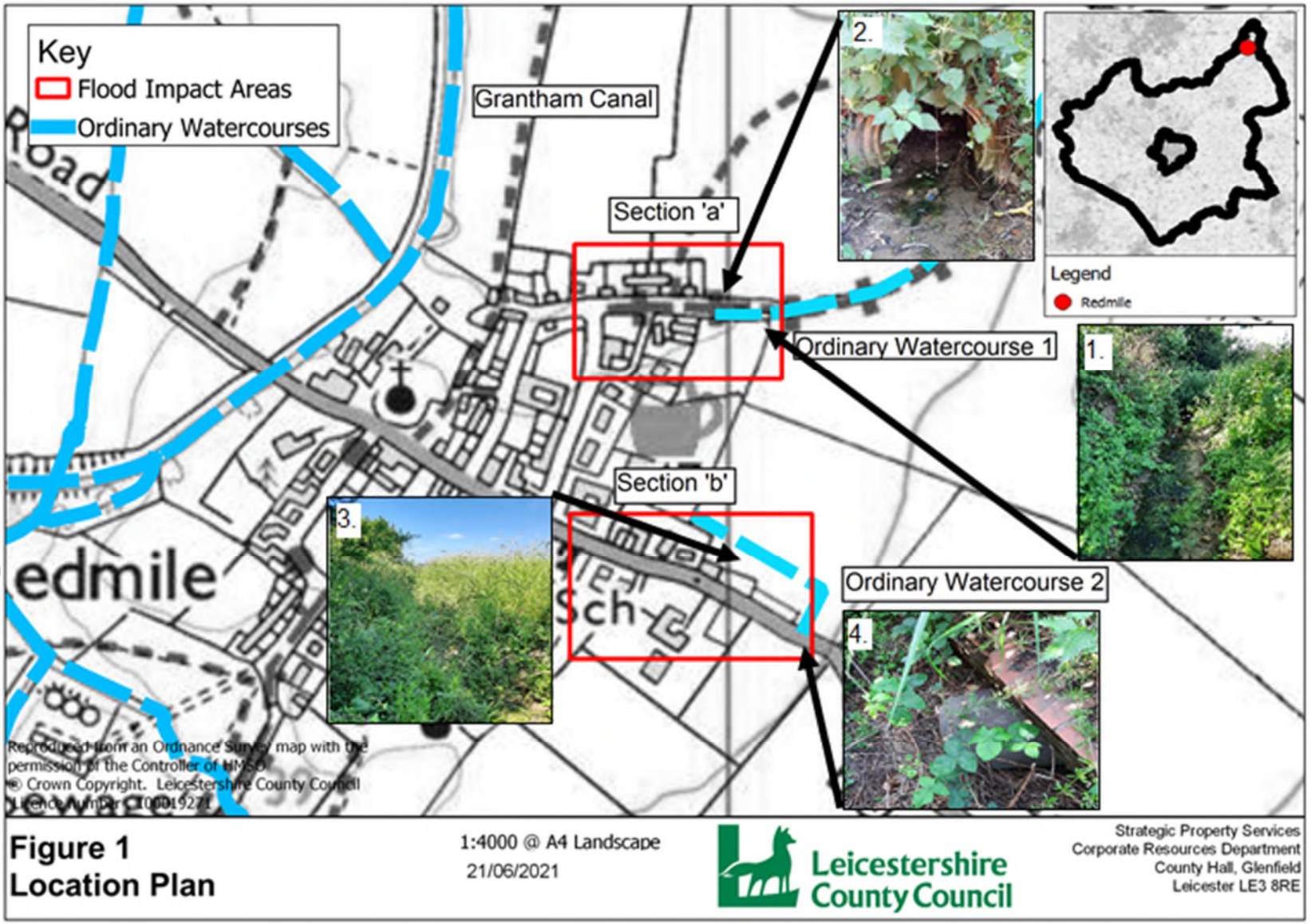

Figure 1
Location Plan

1:4000 @ A4 Landscape
21/06/2021

Leicestershire County Council

Strategic Property Services
Corporate Resources Department
County Hall, Glenfield
Leicester LE3 8RE

3.2 LOCAL DRAINAGE

The two focus areas of the report are Post Office Lane and Belvoir Road (Figure 1, sections ‘a’ and ‘b’ respectively) as these were the two locations which reported internal flooding during the flood event. Figure 1 presents the network of ordinary watercourses around Redmile including the Grantham Canal which flows along the western edge of the village and is the responsibility of the Canal and River Trust. The village is categorised as Flood Zone 1 and is served by foul and surface water sewer networks which are owned and maintained by STW.

Section ‘a’

Ordinary Watercourse 1 (Figure 1) flows in a south westerly direction towards the village centre through agricultural fields (Photo 1 in Figure 1) before it is culverted into a 600mm diameter pipe at approximately ordnance survey National Grid Reference (OSNGR) Easting: 480061; Northing: 335612 (Photo 2 in Figure 1). Highway gullies along Easthorpe Lane connect into this 600mm diameter highway drainage system, which then connects into a 450mm diameter STW surface water at approximately OSNGR Easting: 479887; Northing: 335598. The STW system flows in a westerly direction and then downsizes into a 300mm diameter pipe which passes under the Grantham Canal before outfalling into an ordinary watercourse at approximately OSNGR Easting: 479699; Northing: 335656. Pipe sizes mentioned above are based on asset records, to confirm pipe sizes a survey would be required.

Section ‘b’

Ordinary Watercourse 2 (Figure 1) is an unmarked ordinary watercourse (not available on the mapping available to the Council and anecdotally reported by residents) located to the north of the impacted residential properties (Photo 3 in Figure 1). Ordinary Watercourse 2 flows in an easterly direction before being culverted into a 300mm diameter pipe under Belvoir Road (Photo 4 in Figure 1). Ordinary Watercourse 2 then becomes open channel on the south side of Belvoir Road and flows west before being culverted again under private land. The condition of the culverted sections of Ordinary Watercourse 2 and where it eventually outfalls are unknown to the Council. Notably, in this section, there are depressions within the farmland to the north of section ‘b’ which fall towards Belvoir Road (Photo 5). There is also a 150mm combined STW system that flows in a westerly direction along Belvoir Road away from the village towards the local pumping station.

Photo 5: The farmed land between section ‘a’ and ‘b’ which has depressions along the land towards Belvoir Road. The blue arrow indicates the identified depression and direction of surface water flow.

4 FLOODING INCIDENT ON 16TH FEBRUARY 2020

The majority of the information supporting the description of the flooding incident is based on first-hand accounts and flood survey information provided by affected residents.

4.1 PRIOR TO THE EVENT

Prior to 2019, the Council held no records of internal flood reports within either of the flood impact areas. In 2019, the Council was made aware by MBC that several historic flood reports in section 'b' had been made incorrectly to Nottinghamshire County Council. Following receipt of this information, the Council distributed flood report forms to those who had reported the flooding. The flood source was believed to be due to a known source of obstructions with Ordinary Watercourse 2. The previous flooding events therefore did not reach the Council's threshold to conduct a formal flood investigation. The Council engaged with the riparian landowner of Ordinary Watercourse 2 and maintenance works were conducted. Following reports to the Council of internal flooding on 16th February 2020 from unknown sources in sections 'a' and 'b', the trigger was met to conduct this formal flood investigation.

On the weekend of the 15th and 16th February 2020 the UK was hit by Storm Dennis which bought strong winds and heavy rain to the whole of the UK, just a week after Storm Ciara bought similar weather. These storms followed six months of heavy and persistent rainfall across the UK, with February 2020 being recorded as the wettest February on record[2]. Based on available rainfall data, the rainfall incident on 16th February 2020 was not considered to be extreme in terms of the rainfall, however the already saturated catchment resulted in significant surface water runoff from adjacent land.

Prior to the event there was no flood warden or local flood plan in place for Redmile and as the village is located within Flood Zone 1 there was also no flood warning therefore, there was limited preparedness by the residents.

4.2 FLOOD EVENT

Due to the flood event occurring in the early hours of the morning (approximately 4am), reports are limited on the sources and direction of flood water.

Section 'a'

It was anecdotally reported that the sheer volume of rainwater and overland surface water runoff from agricultural land overwhelmed Ordinary Watercourse 1 and the drainage network in section 'a'. Ordinary Watercourse 1 subsequently over-topped and flood water flowed onto the highway. The volume of flood water on the highway was anecdotally reported to be exacerbated by the STW surface water system surcharging. Water built up within the highway and subsequently breached the highway thresholds and resulted in internal flooding through the front of two residential properties.

[2] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2020/2020-winter-february-stats

Section 'b'

It was anecdotally reported that significant overland surface water flowed across agricultural fields in a southerly direction, this volume of flood water overwhelmed Ordinary Watercourse 2 and caused the watercourse to breach its banks (Figure 1). This added to the volume of flood water flowing south towards the residential properties. The flood water exceeded the residential property thresholds and entered the rear of three residential properties. One residential property also reported that groundwater flooding worsened the impacts of the flood event.

4.3 POST FLOOD EVENT

Following the flood event, the Council conducted a review of all available data and various site visits to gather further information. The Council also spoke directly with the affected residents and flood report forms were issued to help understand the sources of flood water. Numerous site meetings with relevant RMAs and the local Parish Council were held to share available information.

The Risk of Flooding from Surface Water Map (Figure 2) has been produced by the Environment Agency (EA) and is created using high level modelling which represents where water could flow and accumulate during certain rainfall events[3].

[3] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

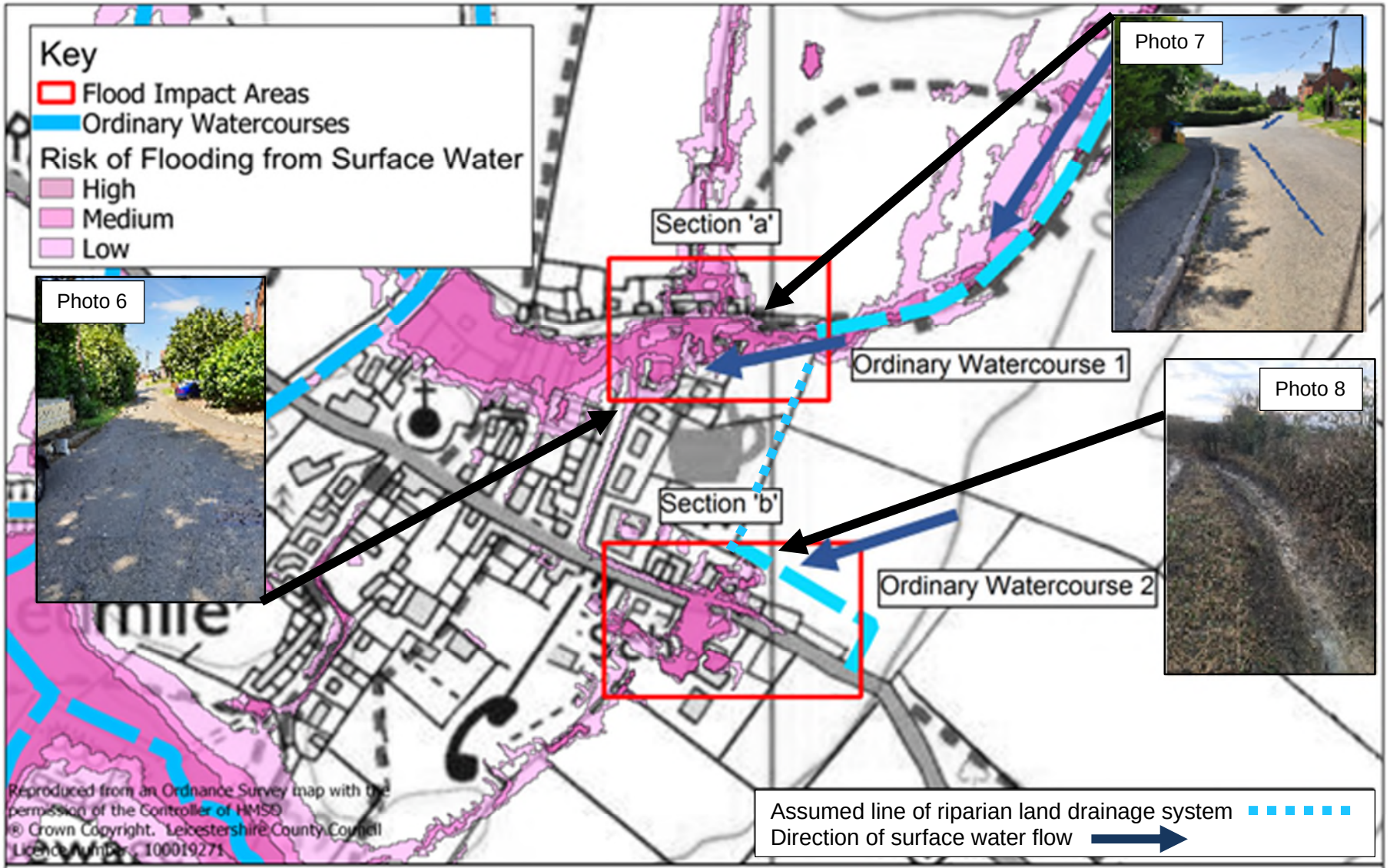

Figure 2
Risk of Flooding from Surface Water

1:4000 @ A4 Landscape
21/06/2021

Leicestershire County Council
Strategic Property Services
Corporate Resources Department
County Hall, Glenfield
Leicester LE3 8RE

Section ‘a’

Figure 2 indicates a high-risk surface water flow path along Ordinary Watercourse 1 and within section ‘a’. The surface water flow path closely mimics what was anecdotally reported by the residents. This includes overland surface water flows following the topography of the adjacent agricultural land in a southerly direction towards Easthorpe Lane, as well as along Ordinary Watercourse 1 which breached its banks. Ariel photography available to the Council indicates potential depressions along the agricultural land which may be linked to historical ploughing of the land and could have exacerbated the overland surface water flows. Figure 2 also indicates that the impacted residential properties are located within a low point of the catchment; site visits and land height data available to the Council supports this analysis. Easthorpe Lane and Drift Hill (located opposite Easthorpe Lane) both fall towards section ‘b’ (Photo 6 in Figure 2), with Post Office Lane increasing in land height to the south of section ‘b’ (Photo 7 in Figure 2). This subsequently creates a ‘bowl’ effect around the impacted residential properties resulting in overland surface water flows from Ordinary Watercourse 1 and adjacent agricultural fields collecting in the natural low point.

Figure 2 also presents a high surface water risk flow path from the north of section ‘a’. There is a known open ordinary watercourse which flows south before being culverted to the north of the residential properties and so this flow path may illustrate the culverted watercourse’s path. It is believed that this culverted system connects into the highway drainage system along Easthorpe Lane. Although no water ingress through the rear of residential properties was reported, this extra volume of flood water in the highway drainage system may have overwhelmed the storm system and exacerbated the volume of flood water within Ordinary Watercourse 1. However, the extent that this may have influenced the flood event is unknown.

The residential property thresholds within this flood impact area are lower that the highway, therefore the flood water which pooled in section ‘b’ would have quickly breached the front of the residential properties.

Following the flood event, the Council and STW conducted investigation works into the local drainage network. It was found that there was an intrusion of a STW foul pipe through the 450mm diameter STW surface water system on Post Office Lane. At this intrusion 3rd party debris was found lodged which subsequently reduced the capacity of the system by approximately 40%. The debris was believed to have entered the system from Ordinary Watercourse 1. This supports the anecdotal reports of STW inspection chambers within section ‘a’ surcharging during the flood event and increasing the volume of flood water on the highway. It was also anecdotally reported that highway gullies required maintenance at the time of the flood event.

Anecdotal reports indicate that there was historically a trash screen at the inlet of Ordinary Watercourse 1 into the 600mm diameter highway drainage system, however prior to the flood event (timeframe unknown by the Council) this structure was removed. The lack of trash screen at the inlet indicates how the debris entered the local drainage network.

As previously mentioned, the 600mm diameter highway drainage system along Easthorpe Lane reduces into a 450mm diameter STW surface water system. Further west, this 450mm diameter pipe reduces again into a 300mm diameter system. These

reductions in pipe diameters would have acted as a throttle during the rainfall event and further exacerbated the volume of flood water in Ordinary Watercourse 1 due to a decreased discharge rate.

Section 'b'

Figure 2 presents a high surface water flood risk within section 'b', indicating that the residential properties are located at a natural low point. The main source of flooding was anecdotally reported to be the overland surface water flows from the agricultural fields to the north of section 'b' flowing in a southerly direction and causing flood water ingress through the back of the residential properties. The sheer volume of overland surface water run-off would have quickly overwhelmed Ordinary Watercourse 2 and added to the volume of flood water flowing south towards the impacted residential properties (Photo 8 in Figure 2). Figure 2 does not illustrate this anecdotally reported surface water flow path. However, the surface water modelling data is not always accurate at a local level. Site visits and land height data available to the Council indicates that a large area of the catchment to the east of section 'b' falls in a westerly direction towards the flood impact area (Photo 9).

According to local reports, an inspection chamber to an old 100mm diameter land drainage system exists in private land to the north of the affected residential properties (Photo 10). It is unknown what connects into this system however local investigations have identified a discharge point into Ordinary Watercourse 1 (section 'a', Figure 3). During the flood event, the water level of Ordinary Watercourse 1 would have been high and therefore would have reduced the discharge rate of this land drain. Due to the unknown age and extents of the land drain, it is unclear to what degree the land drain would have influenced the volume of flood water impacting section 'a' and 'b'.

Photo 9: Facing east from the agricultural field between section 'a' and 'b' indicating how the falls in a westerly direction towards the field (photo taken in June 2021).

Photo 10: The inspection chamber which connects into the 100mm land drain and then Ordinary Watercourse 1.

During site visits conducted by the Council, it was identified that the residential properties impacted during the flood event have low thresholds compared to the agricultural fields. The thresholds would therefore have been easily compromised by the volume of flood water.

One residential property anecdotally reported that groundwater flooding exacerbated the impacts of the flood event. The limestone element of section ‘b’s geology can be highly permeable if the limestone has been dissolved due to the groundwater or there are fractures or bedding planes within the rock which creates openings. Therefore, depending on the porosity of the limestone, this may have exacerbated the groundwater flooding. The extent of this is however unknown.

4.4 SUMMARY OF IMPACTS AND FINDINGS

The combination of factors described below resulted in the ingress of flood water to five residential properties in Redmile on 16th February 2020:

- The catchment area had experienced higher than average rainfall in the months prior to the flood event resulting in the catchment being heavily saturated.

Section 'a'

- The sheer volume of rainfall quickly overwhelmed the already saturated catchment and caused significant overland surface water run-off from the agricultural fields to overwhelm Ordinary Watercourse 1 and cause flood water to flow onto the highway.
- An intrusion of a 150mm STW foul pipe into the 450mm STW surface water system which Ordinary Watercourse 1 outfalls into had reduced the capacity of the local drainage network. This along with debris within the STW surface water system had caused a blockage restricting approximately 40% of the system's capacity, resulting in the local drainage network surcharging and adding to the volume of flood water on the highway.
- Two reductions in pipe size in the STW surface water system further exacerbated the volume of flood water in Ordinary Watercourse 1.
- The threshold levels of the residential properties were lower than the highway in section 'a' and so flood water breached the thresholds and resulting in internal flooding.

Section'b'

- The significant overland surface water flows from agricultural fields to the north of section 'b' overwhelmed Ordinary Watercourse 2 and resulted in flood water ingress through the back of residential properties in section 'b'.
- The low threshold levels of the residential properties compared to the adjacent agricultural land were quickly compromised and resulted in water ingress through the rear of the properties.

Other more localised and specific factors are likely to have influenced the severity and impact of the flood water. Whilst these factors may have made a difference to the volume and peak flood levels, at the time of writing this report, there is no firm evidence that these factors would have independently caused any of the internal flooding experienced by this event. These factors include:

Section 'a'

- Siltation in the highway gullies along Easthorpe Lane was reported during the flood event which would have exacerbated the volume of flood water along the highway and impacting section 'b'. However, considering the sheer volume of flood water during the event the systems would have unlikely been able to cope and so the impact of this is considered negligible.
- The private land drain system may have added to the volume of flood water within Ordinary Watercourse 1, further exacerbating the volume of flood water

which impacted section ‘a’. However, due to the unknown age and extents of the land drain it is unclear to what degree this may have influenced the volume of flood water.

Section ‘b’

- The discharge rate of the old unmaintained private land drainage system in section ‘b’ would have been reduced due to the high volume of flood water in Ordinary Watercourse 1. This would have contributed towards the system being overwhelmed and subsequently reducing its capacity and increasing the volume of flood water on the agricultural fields. However, given the volume of flood water during the event, the impact of this is considered negligible.
- The local geology of limestone may have resulted in ground water flooding which would have exacerbated the volume of flood water impacting one of the residential properties.

5 RESPONSIBILITIES

5.1 LEAD LOCAL FLOOD AUTHORITY (LCC)

As the LLFA, the Council has the responsibility to co-ordinate the management of flood risk and the interaction of RMAs across Leicestershire. For more information please refer to the Local Flood Risk Management Strategy.

5.2 MELTON BOROUGH COUNCIL

Melton Borough Council has powers under Section 14 of the Land Drainage Act 1991 (LDA) to undertake flood risk management works on ordinary watercourses (excluding Main Rivers), where deemed necessary. Under Section 20 of the LDA, Borough/District Councils have the power (by agreement of any person and at their expense) to undertake drainage work which that person is entitled to carry out and maintain.

5.3 HIGHWAY AUTHORITY (LCC)

The Local Highway Authority has a duty to maintain the Highway under Section 41 of the Highways Act (1980). Section 100 states that the Council also has the responsibility and power to prevent water running onto the highway from adjoining land.

5.4 WATER COMPANY

Water and sewerage companies are responsible for managing flood risk related to surface water, foul water and combined sewer systems. Public sewers are designed to protect properties from flood risk in normal wet weather conditions. In extreme weather conditions however, there is a risk of these public sewers being overwhelmed resulting in sewer flooding.

5.5 RIPARIAN LANDOWNERS OF WATERCOURSES AND HOMEOWNERS

Riparian landowners have certain rights and responsibilities including:

- They must maintain the bed and banks of their watercourse, including the trees and shrubs growing on the banks;
- They must clear any debris, even if it did not originate from their land. This debris may be natural or man-made;
- They must keep any structures that they own clear of debris. These structures include (but are not limited to) culverts, trash screens, weirs and mill gates.

A full explanation of the rights and responsibilities of riparian ownership are given on the ‘Owning a Watercourse’ government webpage found at;
https://www.gov.uk/guidance/owning-a-watercourse

Local residents and tenants who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected.

Community resilience is important in providing information and support to each other if flooding is anticipated. Actions taken can include; signing up to Flood Warning Direct (if available), nominating a community flood warden, producing a community flood

plan, implementing property level protection and moving valuable items to higher ground. More permanent measures are also possible such as; installing floodgates, raising electrical sockets, and fitting non-return valves on pipes.

6 RECOMMENDATIONS/ACTIONS

6.1 LEICESTERSHIRE COUNTY COUNCIL

Leicestershire County Council (LLFA) has agreed/completed the following actions:

ACTION	PROPOSED TIMESCALE
To coordinate the formal flooding investigation and the actions of all RMAs, and feedback to the community.	Completed
To work with residents and RMAs to ensure that riparian landowners are fully aware of their maintenance responsibilities for ordinary watercourses. The Council has issued Guidance Notes to assist with this as well as attended site visits with homeowners.	Completed
To investigate the appropriateness of a bid for national funding to help fund resilience work where possible	9 months from publication date
To investigate the connectivity and condition of Ordinary Watercourse 2 to help understand its influence on the flood event.	12 months from publication date
Engaged with the riparian landowners of the 100mm diameter land drain system regarding their riparian responsibilities.	Completed

Leicestershire County Council (Highways Authority) has agreed/completed the following actions:

ACTION	PROPOSED TIMESCALE
Conducted investigation works into the outfall of the private land drainage system in section ‘b’.	Completed
Conducted investigations and maintenance works on the 600mm diameter highway drainage system along Easthorpe Lane following the flood event.	Completed
To work with the LLFA to obtain Ordinary Watercourse consent under Section 23 of the Land Drainage Act (1991) to install a trash screen on the 600mm diameter highway drainage system inlet to prevent debris entering the system.	6 months from publication date*

6.2 SEVERN TRENT WATER

Severn Trent Water has agreed/undertaken the following actions:

ACTION	PROPOSED TIMESCALE
To conduct an inspection into the combined STW sewer system to identify any defects, blockages, or intrusions.	6 months from publication date
To install a catch pit and inspection chamber along the 450mm diameter STW surface water system at the intersection of the STW foul sewer. This will reduce the flow impact of the foul sewer crossing, reduce the likelihood of future blockages at this location and improve access to the surface water system for regular maintenance activities.	6 months from publication date*

**Reliant on delievery timescales of third-party supliers of raw materials*

STATUS OF REPORT AND DISCLAIMER

This report has been prepared as part of the Council's responsibilities under the FWMA.

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.

The opinions, conclusions and any recommendations in this report are based on assumptions made by the Council when preparing this report, including, but not limited to those key assumptions noted in the report, including reliance on information provided by others.

The Council expressly disclaims responsibility for any error in, or omission from this report arising from or in connection with any of the assumptions being incorrect.

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