12th June 2023 Flood Event

Floods and Water Management Act 2010 Section 19 - Investigation

Ettingshall Road/Birmingham New Road, Bilston, Wolverhampton

This report has been prepared by Staffordshire County Council Flood Risk Management Team on behalf of the Lead Local Flood Authority for City of Wolverhampton Council, under Section 19 of the Flood and Water Management Act 2010, with the assistance of Severn Trent Water and City of Wolverhampton Council Highways Department.

This report is based on the information available at the time of preparation. Consequently, there is potential for further information to become available, which may lead to future alterations to the conclusions drawn in this report for which Staffordshire County Council cannot be held responsible.

Document Ref:			12th June 2023 Flood Event Floods and Water Management Act 2010 Section 19 - Investigation Ettingshall Road/Birmingham New Road, Bilston, Wolverhampton		
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1	02/05/2024 Draft for RMA Partners		E Roberts	A J Brett	
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3	09/07/2024 New Draft following comments from RMA Partners		E Roberts	A J Brett	J Cooper
4	16/07/2024 Amended draft following additional comments from RMA Partners		E Roberts	A J Brett	J Cooper
5	08/11/2024 Final Version for publication		J Cooper	J Charles	J Roseblade

Contents

Executive Summary

Parts of the West Midlands experienced periods of isolated heavy rainfall on 12th June 2023 resulting in internal flooding to properties and businesses from surface water. One of the areas affected by this flood event was Ettingshall Road and Birmingham New Road in Bilston. At least 15 properties internally flooded due to surface water. City of Wolverhampton Council have produced this Section 19 reports for this location.

As required by Section 19 of the Flood & Water Management Act 2010, City of Wolverhampton Council as Lead Local Flood Authority (LLFA) has a duty to investigate flooding where the appropriate thresholds have been met. Our thresholds for investigation are outlined in our Local Flood Risk Management Strategy and have triggered the requirement for this report.

In the recovery phase that followed, CWC Flood Risk Management team worked with Severn Trent Water and CWC Highways to identify affected residents, provide help and guidance and undertake remedial works to the drainage infrastructure where required. Whilst CWC were able to confirm 15 properties flooded internally, it is suspected more properties were impacted however no response was received when CWC reached out to such properties.

Introduction

The requirement to undertake this report

Section 19 of the Flood & Water Management Act 2010 (FWMA) requires that the Lead Local Flood Authority (LLFA) undertake an investigation (to the extent that it considers it necessary or appropriate) upon becoming aware of flooding in its area.

The role of the LLFA in City of Wolverhampton Council (CWC) is carried out by the Flood Risk Management team at Staffordshire County Council (SCC) as part of an agreed Service Level Agreement. This report has been produced by SCC and will be published by CWC.

The flood investigation must also determine the risk management authorities (RMAs) that have relevant flood risk management functions and whether each of those authorities have exercised or is proposing to exercise those functions in response to the flood. See Appendix I for the responsibilities of the various RMAs involved in this flood event.

City of Wolverhampton Council Surface Water Management Plan (SWMP) identifies the thresholds that will apply when determining whether an investigation under Section 19 of the FWMA is required. These thresholds are as follows:

1. Five or more residential properties internally flooded
2. Two or more commercial properties internally flooded
3. One or more piece of critical infrastructure affected that impact on the wider area
4. Flooding that places vulnerable individuals or vulnerable communities at risk e.g. hospitals, care and nursing homes, schools, etc.

Scope of this report

This report summarises the completed and ongoing investigations carried out by the identified Risk Management Authorities into the flooding which occurred on 12th June 2023, at Ettingshall Road and Birmingham New Road in Bilston.

This report does not obligate the LLFA or other risk management authorities into resolving the flooding issues investigated herein, nor is it possible for the LLFA to impose others to undertake any of the recommended actions.

Investigation Summary

Following the event of 12th June 2023, CWC in its role as LLFA, has undertaken the steps as outlined below:

Step 1: Initial Investigations

Using call records, social media sweeps, testimonies from residents and site visits, the LLFA identified most of the locations where flooding occurred and then distributed 'Flood Questionnaire Surveys' to all property owners and residents affected by flooding and those within the surrounding area.
Responses were received, providing personal accounts of the flood event including the estimated time, duration, extent and depth with any other information which was felt pertinent.

Step 2: Detailed Investigation and Analysis

The LLFA conducted detailed investigation of the location where a minimum of five properties experienced internal flooding. It should be noted that CWC have defined internal property flooding as:

> 'Flooding that occurs in a habitable room within a single property, excluding detached garages, porches and underfloor ingress of water.'

These investigations typically included a table-top review of known existing infrastructure and topography, identification of predominant flow paths, compared with the survey responses and photos, local-knowledge, and then site visits with individual face to face interviews with residents.

Through this detailed analysis, the LLFA identified the types of flooding that occurred on 12th June 2023.

Step 3: Recommended Actions

Following the analysis of the affected areas, the LLFA have worked in collaboration with other RMAs to identify opportunities and options to mitigate the potential that a similar rainfall event will result in similar outcomes. These have been summarised as 'Recommended Actions' and a lead RMA has been identified to undertake these actions.

The following sections of this report provides an overview of the different types of flooding, which is then followed by the summary of the findings from the works undertaken to date regarding the affected areas.

Standard definitions of types of flooding

The following section explores the various types of flooding that were experienced during 12th June 2023.

Surface Water Flooding – Pluvial Flooding

Surface water is rainwater which is on the surface of the ground and has not soaked into the ground or entered a watercourse, drainage system or sewer. During a storm event, rainfall will land on the ground and depending on the characteristics of the ground it will behave in different ways.

Soft surfaces, known as *permeable surfaces*, allow water to soak (infiltrate) into the ground. These are typically in the form of gardens, parks, fields and green spaces,

Hard surfaces, known as *impermeable surfaces*, do not allow any rainfall to soak into the ground and this rainfall will become (surface water) runoff. Runoff is usually very quick too. These are typically in the form of highways and roads, roofs, car parks and public squares.

Surface water flooding occurs under a number of circumstances, most commonly occurring when:

- There has been a prolonged period of rainfall and the permeable surface becomes saturated therefore no more water can infiltrate into the ground;
- The rainfall intensity is very high, and the rain is falling faster than it can infiltrate into the ground;
- There has been a prolonged warm dry period, the permeable surface may be baked hard and effectively turn the permeable surface into hard impermeable surface;
- It rains on impermeable surfaces, and there is no formal means of managing the rainfall;
- There is heavy rainfall on impermeable surfaces and the surface water cannot enter the drainage system provided to manage rainfall. This could be due to the system running at its maximum capacity, and inlets such as gullies are unable to convey flows into systems quick enough.

During most storm events, the rainfall rate is low enough to allow surface water to soak into the ground or drain into formal drainage systems (e.g. gully pots). However, during an extreme event, where the intensity of the rainfall is high or there is an excessive volume of water, it is unable to soak into the ground or enter formal drainage systems and as such it will flow across a surface in an uncontrolled manner.

Flooding from Sewer Infrastructure

Where rainfall falls on an impermeable surface, it will typically be served by a formal drainage system, most commonly this is a sewer. There are different types of sewer, including:

Surface Water Sewers carry rainfall and surface water away from properties roofs and curtilages to watercourses.

Foul Water Sewer, carries wastewater away from properties to be treated; and,

Combined Sewer, drain both wastewater from properties along with surface water from properties roofs and curtilages. In addition these can also accept runoff from highways, roofs, car parks and other sources, subject to agreement. These systems are not constructed anymore but they are still found in certain areas of villages, towns, and cities.

Flooding from sewer infrastructure occurs under a number of circumstances, most commonly occurring when:

- There is a blockage, or the sewer itself collapses, which restricts or prevents flow within the sewer network. This causes water to back-up through the network and find its way to the surface, typically through a manhole or associated drainage structure.
- There is a period of heavy and/or prolonged rainfall, which results in significant flows that exceed the capacity of the sewer network. This prevents water from entering the sewer network and may result in surface flooding.

Severn Trent Water, as the sewerage company, is responsible for the operation and maintenance of the public sewers within the City of Wolverhampton area.
New surface water and foul water sewers are currently designed in accordance with the Design and Construction Guidance approved documents published by Water UK in April 2023. This guidance is typically for new development sites. Though these design standards are not necessarily used when determining designs for reduce flood risk to achieve higher standards of protection.

At the time of construction of the sewer network across Wolverhampton, the guidance may have been to accommodate smaller storm event magnitudes. Designs will have been calculated and modelled to determine the appropriate sizes of the network for the catchment at that time, with set tolerances to allow for future expansion of the network. The entire drainage network is complex with some infrastructure able to accommodate storms well above current design standards and other sewers much lower. Thus, when an extreme storm event occurs, the existing drainage network (combined or surface water sewers) may become significantly overwhelmed.

Flooding from Highway Drainage

Highway drainage consists of gullies, drainage channels and other features which collect and drain rainfall away from the highway. These features are typically located on one, or both, side(s) of the highway where they connect to an underground highway drainage system. In a lot of cases these systems discharge into the public sewer infrastructure, but can sometimes connect directly to other pipes, drains, culverts or watercourses.

Where rainfall falls onto the highway, this will enter the highway drainage system or flow within the highway channel until a point where it enters the system or ponds on the surface.
In new development, it is common practice to use highways to contain and convey heavy rainfall events away from properties, however historically this practice has not happened.

Across Wolverhampton, properties can be seen at or below the level of the adjacent road. This means that should a carriageway not be able to contain the water flowing within it, flow will overtop the kerbs on the highway and spill over adjacent land into properties.
Flooding from highway infrastructure occurs under a number of circumstances, most commonly occurring when:

- There is a blockage or build-up of surface debris in the vicinity of a gully, typically trash, leaves and twigs, which prevents, or restricts, the highway runoff from entering the gullies and subsequent highway infrastructure.
- There is a period of heavy and/or prolonged rainfall, whereby the volume of rainfall falling onto the highway overwhelms the highway drainage features and is unable to be captured. The resulting flows are then conveyed or contained within the highway, until such times as the water level overtops the kerbs and flows overland into properties.
- The sewer, culvert or watercourse to which the highway drainage is connected is at full capacity and therefore the highway run-off has no-where to drain to.

City of Wolverhampton Council, in their role as the local highway authority, is responsible for the highway drainage and gullies. This work includes maintenance of the adopted highway drainage infrastructure including roadside gully pots.

Background to Flood Risk Mapping

Flooding is traditionally very difficult to predict, and while there are many local factors that influence flooding, there are a number of publicly available, national information tools which can enhance our understanding of the potential flood risks within a local area, more specifically risk of flooding from surface water and from rivers.

Surface Water Flood risk

In 2013, the Environment Agency, working with LLFAs, produced the Risk of Flooding from Surface Water map.

This is the third national surface water map produced by the Environment Agency under their Strategic Overview role and is the first publicly available surface water flood risk map.

Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when.

This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.

This mapping assesses surface water flood risk as a result of the chance of rainfall occurring in any given year, and is categorised into the following three scenarios:

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk : Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

It should be noted that this mapping has been produced at national scale with a number of assumptions and therefore there are some limitations at a local scale and is not appropriate for identifying individual property level flood risk. This mapping is publicly available for use and is available online.

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

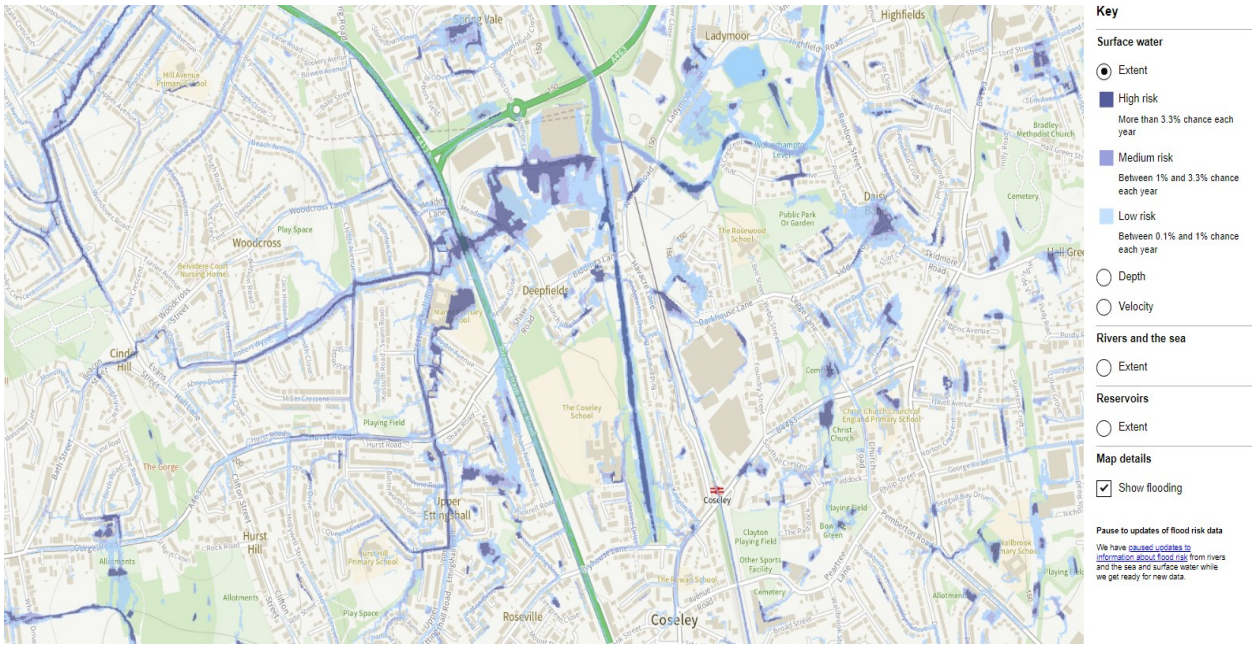


Figure 1 Extent of Surface Water Flooding, Source Environment Agency

River flood risk

With regards to river flooding the Environment Agency publish the Flood Risk from Rivers or the Sea map. This shows the flood risk from Environment Agency Main Rivers and from the sea, taking into account any flood defences that may be present.

Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when. This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.
This mapping assesses flood risk from rivers or the sea as a result of the chance of rainfall occurring in any given year, and is categorised into the following four scenarios:

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk: Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

This modelling is publicly available as the Environment Agency's Flood Risk from Rivers or the Sea map and is available online.

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

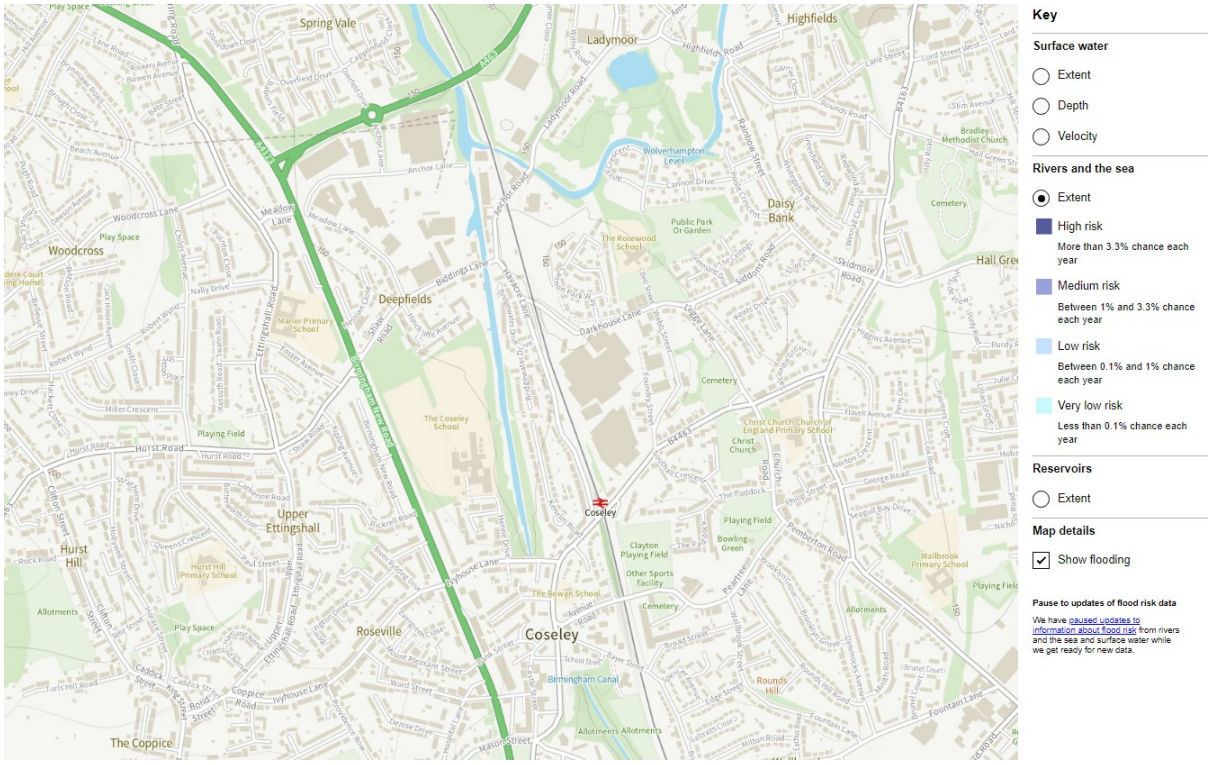


Figure 2 Extent of River Flooding , Source Environment Agency

What actually happened? Weather and flood warnings

In the days preceding the flood event in question, commencing from 8th June 2023, the Met Office issued several national Yellow and Amber Thunderstorm warnings, in addition to Yellow Rain warnings. Thunderstorm warnings issued on 12th June listed the West Midlands Authorities and neighbouring authorities as potential areas that may be affected.

Due to high temperatures seen across the days preceding, heavy rain and thunderstorms were expected for a number of days. Thunderstorms in the UK are often associated with breakdown following hot and humid weather with torrential downpours accompanied by hail and lightning strikes. The thunderstorms were caused by hot humid air resulting from the hot spell being experienced.

Warnings were issued for isolated surface water flooding by the Flood Forecasting Centre, characterised as having the potential for significant impacts and a low likelihood of occurrence.

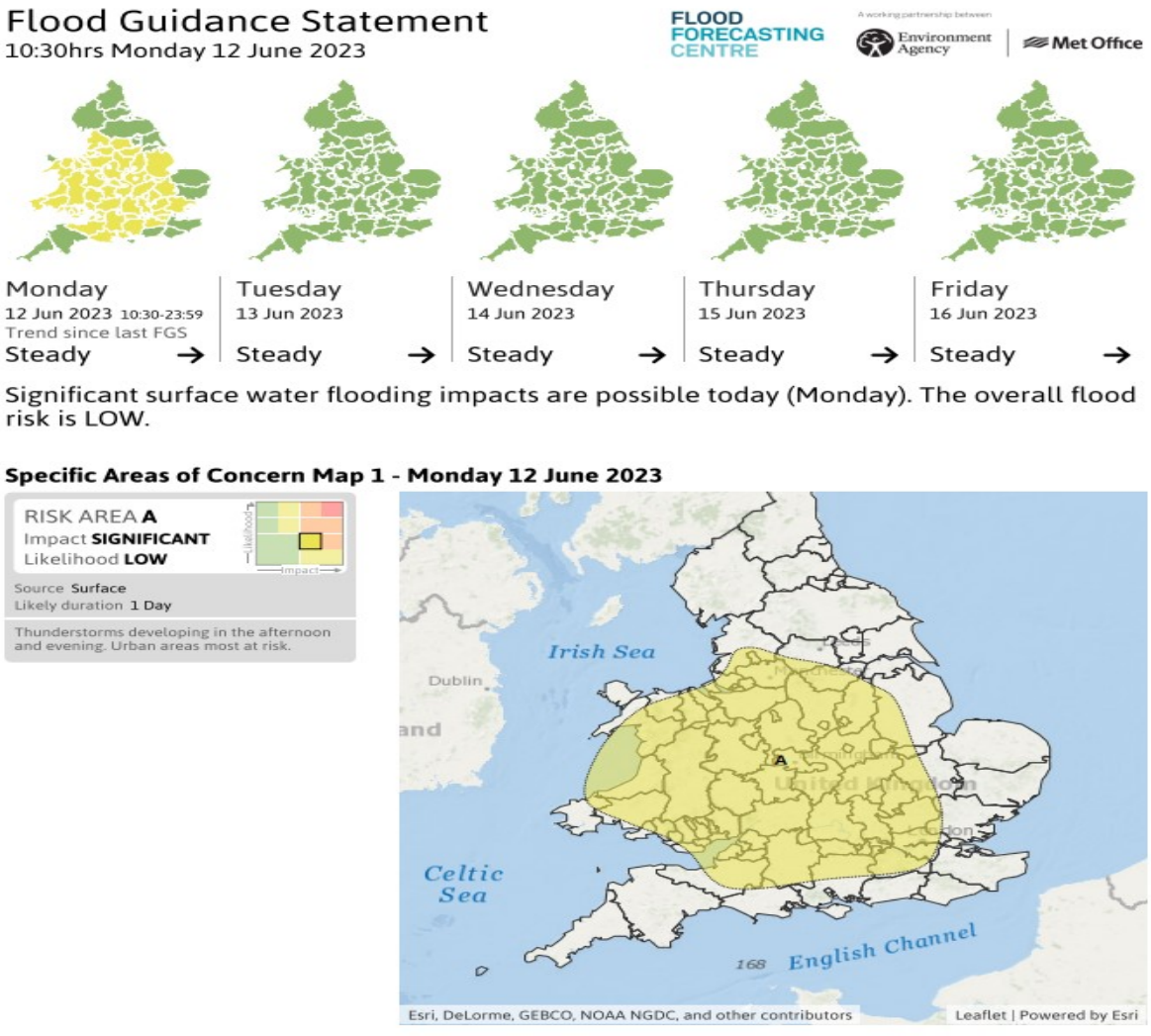


Figure 3 Extract from Flood Guidance Statement 12th June 2023

From rainfall radar data obtained through Hydromaster, precipitation software which SCC utilises that provides real time and historic estimated rainfall data from the Met Office, an evident belt of heavy rain can be seen travelling North West across the West Midlands Authorities between 17:00-20:00hrs on 12th June. The epicentre of the band of high rainfall intensity is seen to pass directly over Bilston at around 18:00hrs. With reference to the images below taken from Hydromaster between the hours of 18:00-18:20 hours, the higher rainfall intensities are denoted through shades or red, purple and pink. Lower intensities are represented through colours of blue and green.

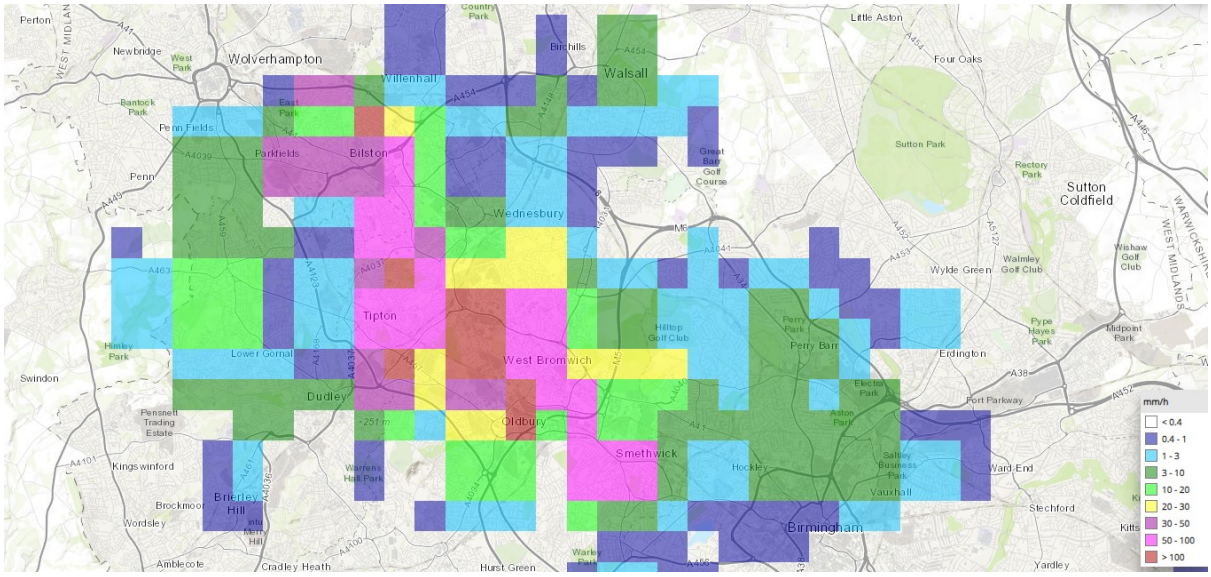


Figure 4 12th June 2023 at 18.00

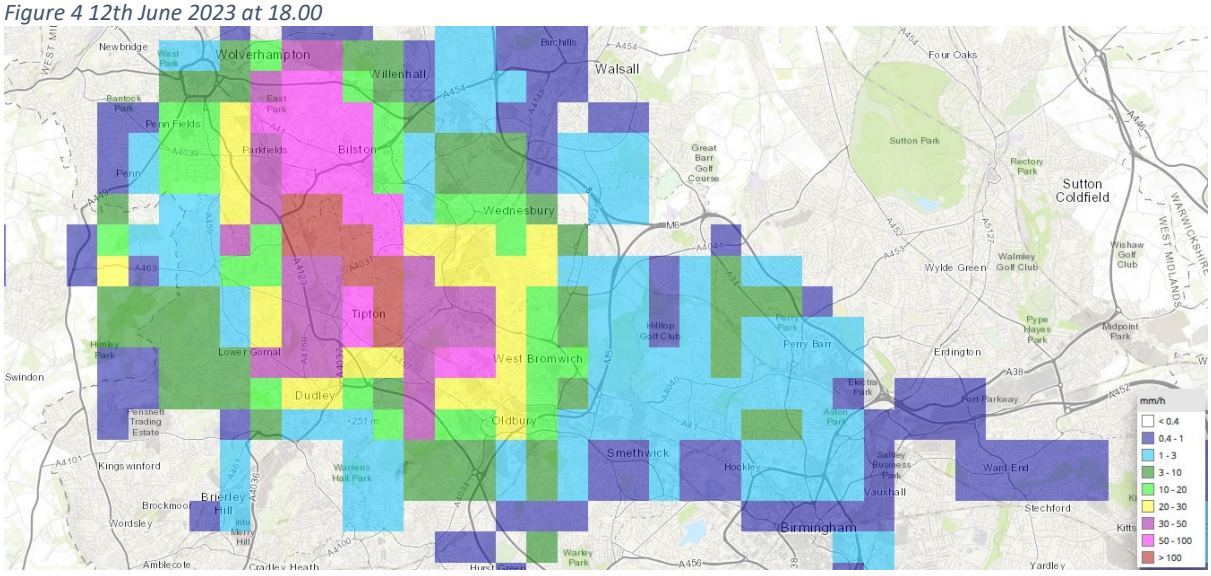


Figure 5 12th June 2023 at 18.05

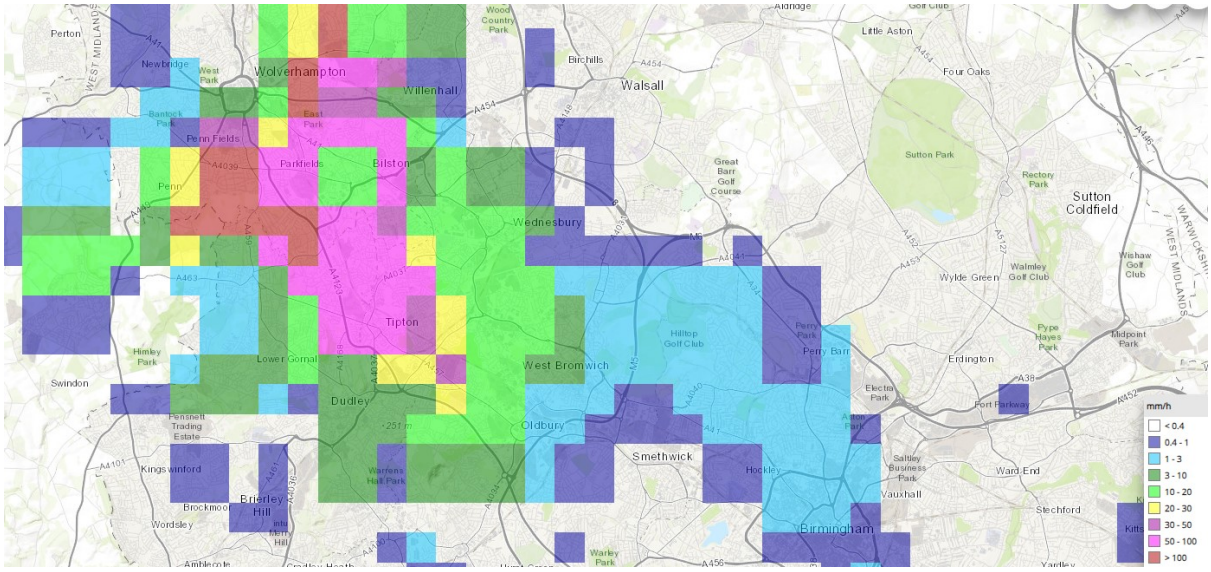


Figure 6 12th June 2023 at 18:10

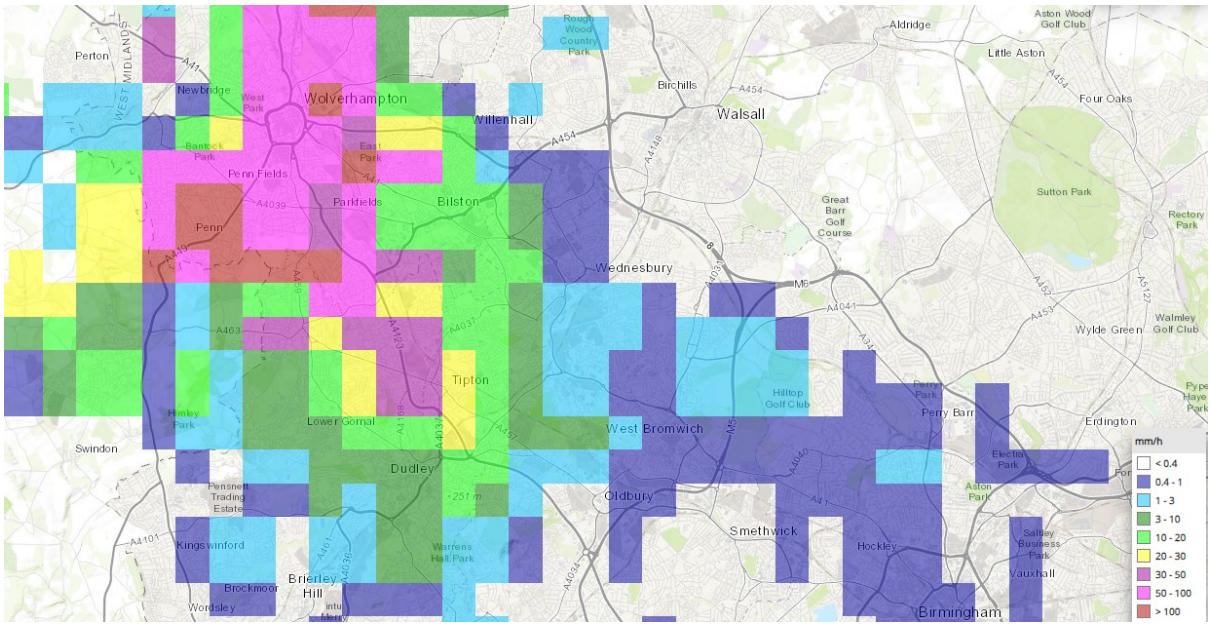


Figure 7 12th June 2023 at 18:15

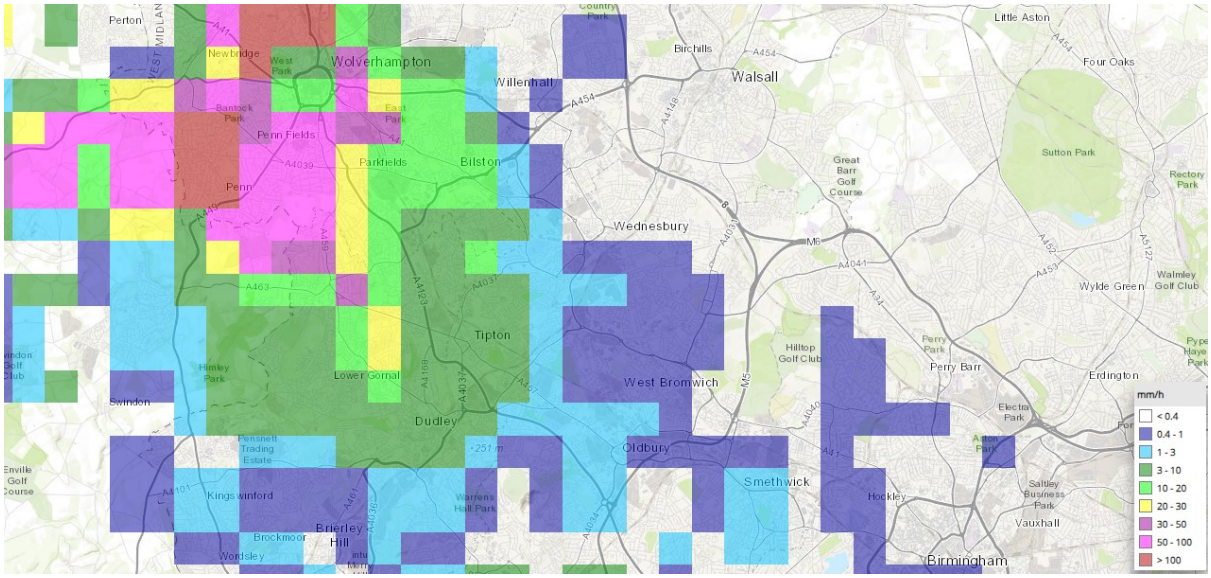


Figure 8 12th June 2023 at 18:20

By using Hydromaster, estimated rainfall data of both real time and historical can also be analysed at a localised catchment level. The graph below shows the capture of estimated rainfall data for the 24-hour period of 12th June 2023. This shows the spike of rainfall at around 18.15pm.

Figure 9 Graph showing 5 minute rainfall totals

The graph below shows the accumulated estimated rainfall for the 24-hour period of 12th June 2023. This shows the estimated rainfall amount at 18.15pm was at least 23mm in a 15-minute period. In simple terms 1 inch depth of rain fell directly on the whole catchment in 15 minutes.

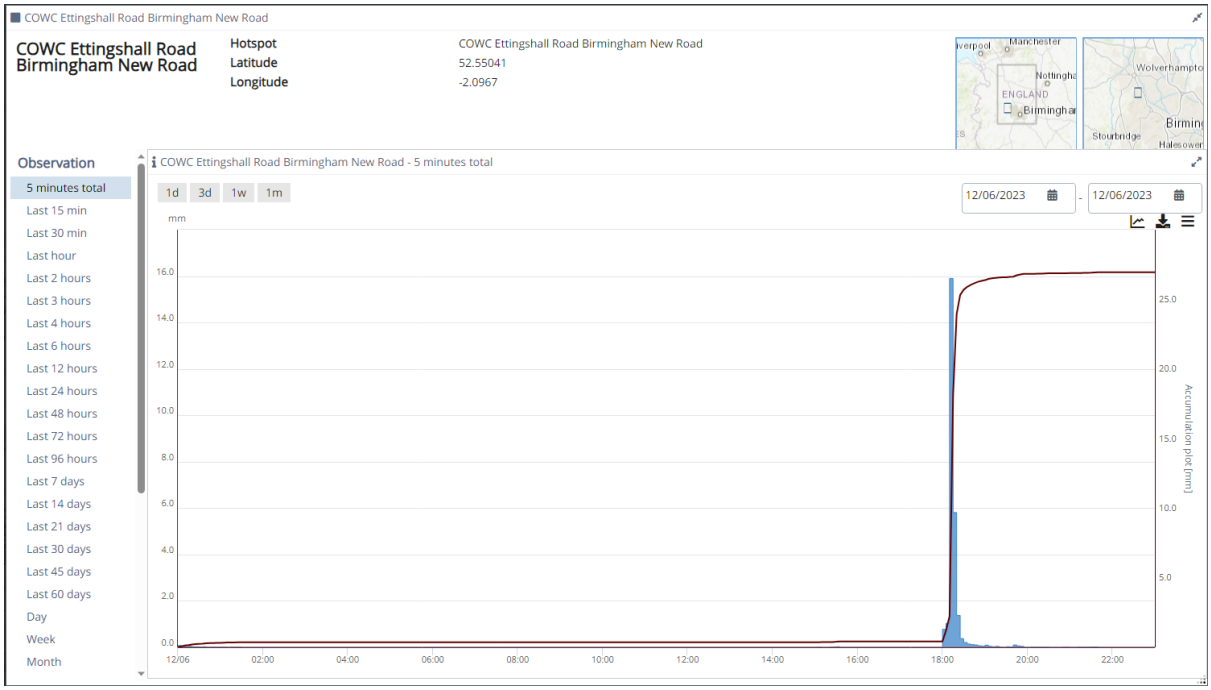


Figure 10 Graph showing 24hour rainfall totals for 12th June 2023

The storm was moving northwest but slowly, the rainfall rate of 23 mm (1 inch) in 15 minutes created huge volumes very quickly. These volumes are extremely significant and are the primary reason for the flooding that has occurred to infrastructure and properties.

In Figure 9, the extract from Scalgo uses Lidar and mapping to show where floods flow to when rainfall totals accumulate. This demonstrates what happens when the rainfall depth total of 23mm (1 Inch) falls directly on an uninterrupted catchment and then shows where it wants to flow to. This clearly shows all the properties that may have been affected. It does not take into account the threshold levels of each property, so this is depicting the effect of the storm pictorially, so is subjective.

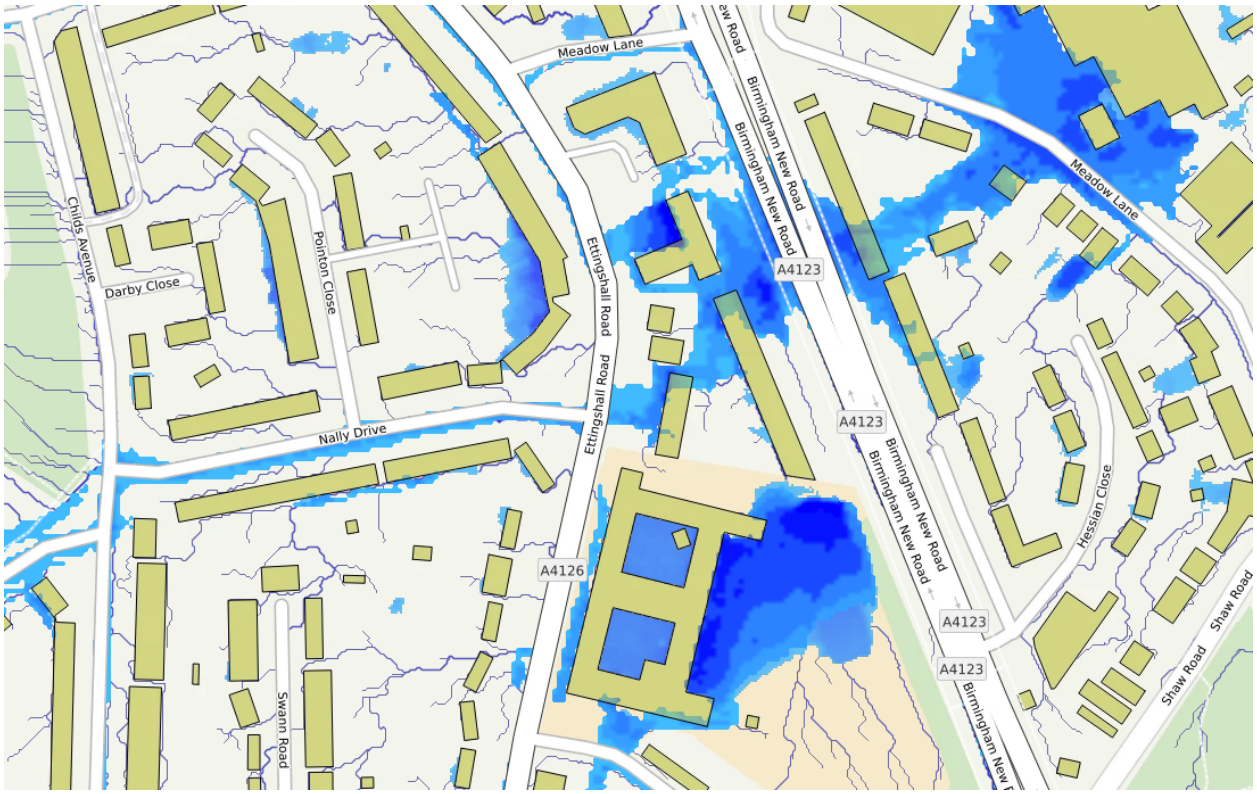


Figure 11 - Extract from Scalgo using rainfall totals

Further rainfall modelling using Flood Estimation Handbook can be used to give details of the type of event that has caused the flooding. The following 4 figures show the calculated periods for 23mm depth of rainfall falling in 15 mins. This calculation was captured data from a nearby location in the region occurring at the same time in the same event.

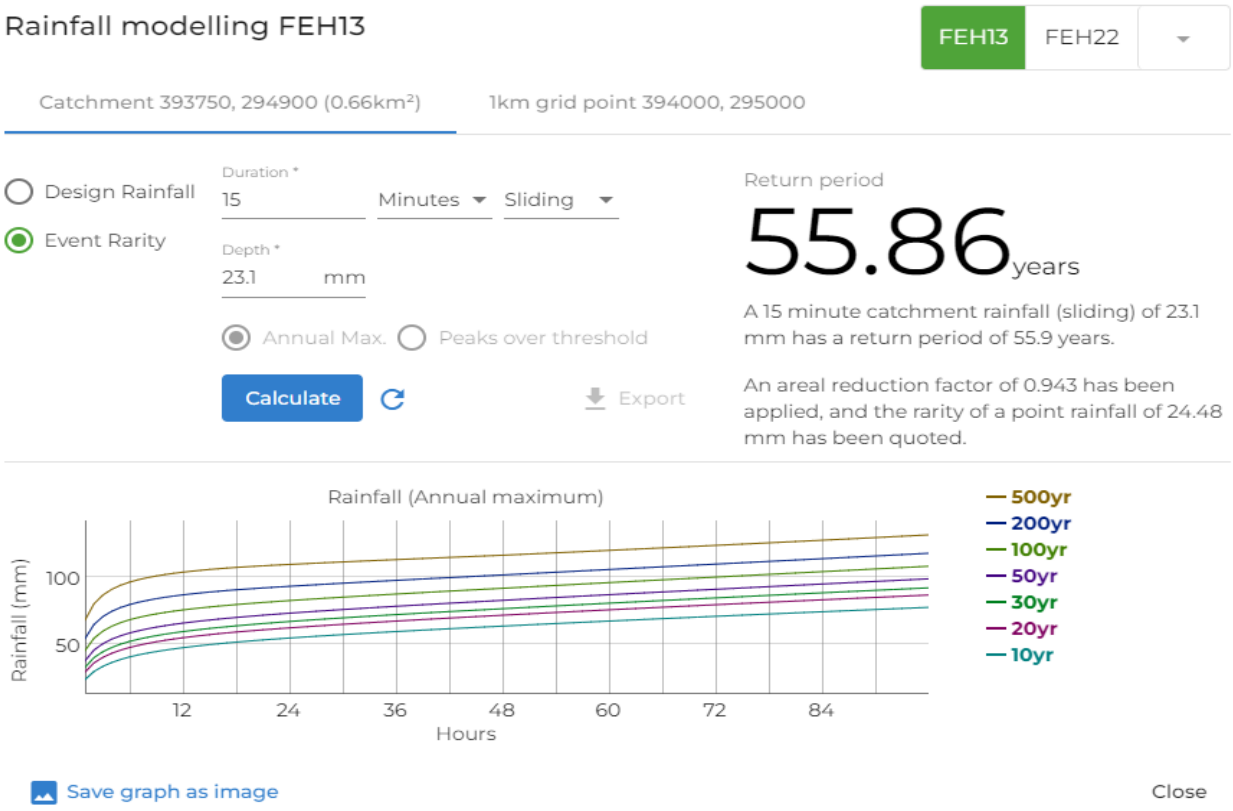


Figure 12 FEH13 Return Period Calculation

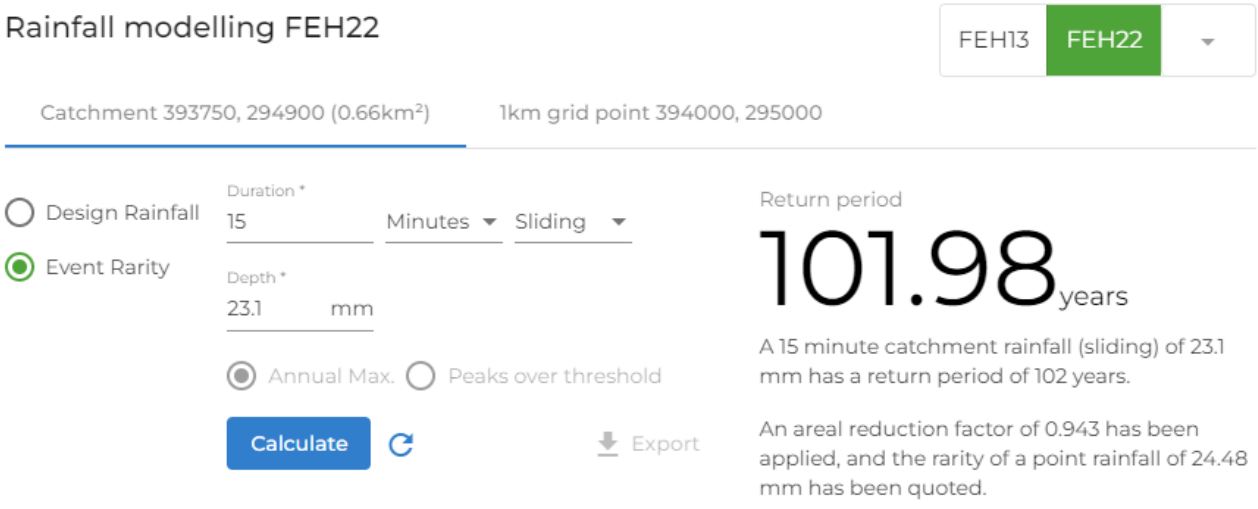


Figure 13 FEH22 Return Period Calculation

A return period is the average time period between rainfall events of the same magnitude or intensity The event that occurred on 12th June 2023 has an estimated rarity of between 1 in 56 and 1 in 102 years

Anecdotal reports made from some of the residents interviewed suggests the intensity of rainfall volumes that fell, flowed with such high velocity over impermeable surfaces such as building roofs, driveways, footpaths and roads in a steep catchment.

The combination of

- Extremely high intensity of rainfall for well over 15 minutes, creating huge volumes very quickly,
- A near total surface impermeability without interruption diversion or obstruction,
- the high velocity of flows in the steep catchment
- and the defined limits of sub-surface drainage infrastructure,

lead to surface water flooding on highways and footways. As the conditions continued, some properties began experiencing external flooding to their driveways and gardens, but a significant number of properties experienced internal flooding through thresholds or communal areas of residential complexes.

Other testimonies suggested that building materials stored further up the catchment was washed down onto Ettingshall Road, blinding highway drainage infrastructure. Given the highly localised rainfall associated with an event of this nature, it is therefore conceivable that in the absence of a local rain gauge that would accurately measure the rates and volumes, the true intensities may have been much higher than estimated or modelled.

To give context, a rainfall depth of greater than 100mm in 24 hours is considered an extreme event. The event on 12th June 2023 was at least 23mm in 15 minutes.

Summary - Flooding Location on 12th June 2023

Ettingshall Road and Birmingham New Road, Bilston Wolverhampton

Event Background

On the 12th June 2023, Ettingshall Road and Birmingham New Road were affected by surface water flooding, affecting the Sewer Infrastructure, Highway Drainage Infrastructure, driveways and residential properties.

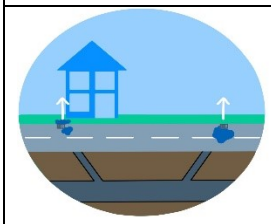
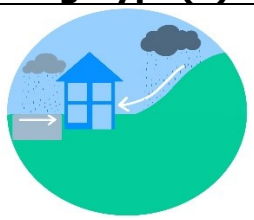
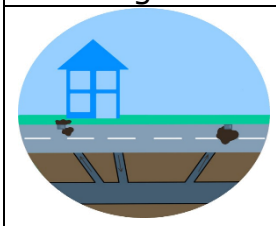
Identified Flooding Type(s)	
 Highway Flooding	 Surface Water/ Pluvial Flooding
 Sewer Flooding	

Figure 14 Location depicting flow routes

Investigations

Following reports by residents to CWC, flood questionnaires were issued to the properties at the location and surrounding areas to help understand the extent of the flooding impacts. As a very low number of questionnaire responses were returned, the extent of the impacts was not fully realized initially until officers representing the LLFA carried out door to door visits to residents to obtain testimonies in person.

Following the collation of information from residents, it was identified that up to 15 residential properties were affected by internal flooding. The properties varied from detached dwellings, semi-detached dwellings, ground floor flats, and private individual dwellings in a communal residential development. The affects and damage varied from property to property. Some properties needed complete renovations lasting many months, whilst others managed to get cleaned up and returned to use quite quickly.

During this time, SCC (LLFA) met and collaborated with CWC Highways and Severn Trent Water to request that all infrastructure assets were inspected and any findings be shared. Information was later presented by CWC Highways and Severn Trent Water, which described all actions and activities undertaken to date. CWC undertook inspection and cleansing operations to ensure that highway gullies were clean, and functioning as designed. Severn Trent Water undertook inspections and CCTV surveys , which lead on to an analysis of their network by way of a modelling exercise to demonstrate how the network would respond to the rainfall event. At first this did not fully replicate the actual real world effects on the properties that were described in some of the 'in person' testimonies of those affected, so further model assessment of the network continues and the results are expected imminently.

Conclusion of Analysis

Following the storm event on 12th June 2023, incidents of flooding were reported which included internal property flooding, external flooding to driveways frontages or gardens, and flooding to highways.

Three types of flooding have been identified as causes for the instances of reported flooding. These include surface water flooding, flooding of sewer infrastructure and flooding of highway drainage.

The capacity of all drainage infrastructure was overwhelmed by the extremely high magnitude of the storm event. Surface water runoff was channelled by impermeable surfaces and followed the gradient and contours of the location. It was noted that all the affected properties were at or below the level of the highway. Therefore, surface water runoff would flow to the lowest points of the highway and when the sub surface drainage infrastructure could not convey any more surface water volumes, it would spill from the highway into properties downhill.

The flows, velocities and volumes experienced in other drains would have also led it escape out of the sewer manholes and highway gullies. There may have been further exacerbation due to highway gullies being unable to adequately capture the surface water runoff, particularly where the intensity of the rainfall, and volume of runoff was such that it flowed over or around a gully. Careful consideration is needed in terms of the design capacity of drainage infrastructure, which is finite. Once those capacities are overwhelmed, overflowing is inevitable and this happening this event.

Recommendations and Actions

The following table briefly outlines what actions have been undertaken so far and lists any further actions that need to be undertaken by the appropriately identified RMA.

Recommendations	**Identified Party/ RMA**	**What has happened so far and what will happen next?**
Severn Trent Water to assess capacity and inspect for blockages in local sewer systems, manholes and local property causes.	STW	The local public drainage network has been inspected and surveyed. Some modelling of the rainfall event has been undertaken to demonstrate the effects the storm had on the network. Further assessment of the sewer hydraulic model was needed to understand system capacity. This will then lead to the exploration of opportunities for investment to achieve higher standards of protection.
City of Wolverhampton Highways to ensure gullies are maintained and kept clear. Important to ensure existing gully infrastructure is regularly maintained.	Highways (CWC)	This is ongoing in line with policy parameters. Inspections and gully cleaning had already taken place earlier in the day, during the morning of 12th June 2023, and all gullies were fully operational a few hours prior to the storm event. Sensors have been placed inside the gullies on Ettingshall Road which monitor the water levels in the gullies and report warnings to operational staff that can respond with the appropriate resources.
City of Wolverhampton Council Lead Local Flood Authority to continue to explore feasibility to introduce additional property resilience measures or any other catchment/community-based approach to hold back flows at source.	CWC LLFA	This can be assessed but will likely require further collaboration with other RMA's working in partnership. The location could be added to a Regional Flood and Coastal Committee programme for potential schemes in 2027 – 2033. But care is needed when protecting properties with resilience products that the problems are not pushed onto others.

Next Steps – Looking Ahead

During the compilation of this report, the relevant Risk Management Authorities have already undertaken many of the identified recommendations, plus other additional works have been carried out.

City of Wolverhampton Council Highways had already undertaken cleaning operations around 6-8 hours before the storm event and all gullies were verified as fully operational prior to the onset of the storm.
Prior to this storm, there have been previous schemes implemented by City of Wolverhampton Council Highways to alter the profile of the road and footpath on Ettingshall Road and install additional gullies and drains. Whilst this work would have increased the capacity of the infrastructure in some way; the huge volumes velocities or flow rates encountered during this storm would have not been contained.
Sensors have also been installed inside the gully chambers which constantly record water levels and will send alerts to responders when they are triggered by rising water. Operational resources can be made available at all times and have set parameters to respond to alarms that are triggered.

Severn Trent Water has taken steps to contact affected properties to build up an accurate picture of what happened and where. Severn Trent Water also undertaken asset condition surveys to ensure that their network was free from obstruction. Some hydraulic modelling has been undertaken to understand how the network reacted to the storm event. It is anticipated that further model assessments being undertaken by Severn Trent Water will be provided in due course. This is looking at the existing surface water sewer infrastructure within the Birmingham New Road environs and its connections and interactions with the network further downstream. If there are any viable opportunities to create or increase capacities to achieve higher standards of protection, further exploration may be required, working with other RMA's to identify viable options and funding sources.

Following on from the publication of this report City of Wolverhampton Council, in their role as Lead Local Flood Authority, will continue to work in partnership with all other relevant Risk Management Authorities, such as Severn Trent Water and City of Wolverhampton Highways.

The findings of this report will be a key part of any evidence for future resilience or flood prevention schemes. Any future flood prevention or resilience scheme, must not increase the flood risk of others, so the scoping of solutions and shortlisting of viable options must bear this in mind.

APPENDIX 1 – Definitions of Risk Management Authorities and Other Parties

A summary of each of the RMAs, with regard to their role in flood risk management, is provided below:

City of Wolverhampton Council (LLFA)
LLFAs are county councils or unitary authorities which are required to prepare and maintain a strategy for local flood risk management in their areas, investigate significant local flooding incidents and publish the results of such investigations and play a lead role in emergency planning and recovery after a flood event.

City of Wolverhampton Council (Highways)
Highway's authorities have the lead responsibility for providing and managing highway drainage infrastructure.

Environment Agency
https://www.gov.uk/government/organisations/environment-agency
The Environment Agency has a strategic overview of all sources of flooding and hold responsibility for flood risk management activities on Main Rivers.

Severn Trent Water
https://www.stwater.co.uk/help-and-contact/customer-information/guide-to-sewer-flooding/
https://www.stwater.co.uk/in-my-area/flooding/
As a water and sewerage company, Severn Trent Water manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They ensure their systems have the appropriate level of resilience to flooding, and maintain essential services during emergencies, maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment and they provide advice to LLFAs on how water and sewerage company assets impact on local flood risk.

Riparian Owners
https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities
A riparian owner is any party or individual who has a watercourse within or adjacent to any boundary of their property. They are responsible for maintaining the riverbed and banks within their section of the watercourse to preventing obstruction to the water flow and mitigate flood risk.

APPENDIX 2 - General Recommendations

Summary of general actions and recommendations suggested in most flooding investigations

While many of actions and recommendations are tailored specifically to a specific flood event, or the location where the flooding occurred, there are some actions and recommendations that are generally applicable in most investigations.

The following sections provide a summary of what these actions may entail:-

Public Sewer Infrastructure:

- Assess the condition and capacity of the sewer network
- Review of existing maintenance schedule of the sewer network

These actions may incorporate multiple tasks which may include:

- An assessment of the sewer network, ensuring that the existing infrastructure can drain the catchment effectively to a prescribed
- Investigation and survey of existing assets, for example using CCTV and in-person inspections, to ensure blockages and flow restrictions (e.g., silt accumulation) are removed
- Feasibility assessment and optioneering of means to increase capacity of sewer network using attenuation or techniques to slow the flow
- Explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks
- Hydraulic modelling and performance analysis.

Highway Drainage:

- Assess the condition and capacity of the highway drainage network
- Review of maintenance schedule of highway assets (e.g., gullies)

These actions may incorporate multiple tasks which may include:

- Review of the location and condition of existing highway drainage assets, to ensure flows are not impeded and that sufficient gullies are in place to collect flows.
- Assessment of the capacity of the local highway drainage network to explore opportunities to increase capacity
- Explore opportunities to increase frequency of maintenance and/or incorporation of additional maintenance tasks

Lead Local Flood Authority (Property Level Resilience):

- Identify and assess if properties would be better protected using resilience measures or solution that are already marketed and available.
- Explore the potential for additional flood mitigation in additional to any resilience measures already in situ in some properties ensuring that any solutions tabled do not increase the flood risk of others.
- Identify potential funding sources such as FDGIA or Local Levy as well as partnering with other RMA's and establish whether any appropriate solutions are actually viable.

The above recommended action may incorporate multiple tasks which may include:

- Site visits and property surveys to identify potential flood resilience/mitigation
- Exploration of property level resilience products and vendors to establish if potential resilience measures may be appropriate and achieve the level of protection needed
- Investigation into previously installed or existing property level resilience measures to assess the effectiveness of the installed measures
- Explore community and catchment wide solutions including, property flood walls and gates, flood defence walls/banks, offline flood storage areas.
- Engage with the relevant Regional Flood and Coastal Committees to understand and clearly establish the limitations to funding sources, and explore enhanced partnerships with RMA's to bridge any identified funding gaps.