Nottingham City Council

Flood Investigation Report:

17th June 2020 Flood Event

Larchdene Avenue and Wollaton Vale, Nottingham

Prepared under Section 19 of the Flood and Water Management Act 2010

Nottingham City Council

DOCUMENT CONTROL

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FLOOD INVESTIGATION REPORT SUMMARY

Nottingham City Council is a Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (2010) (FWMA).

Section 19 of the FWMA states that on becoming aware of a flood the LLFA must, where appropriate, investigate which Risk Management Authorities have relevant flood risk management functions and whether they have, or are proposing to, exercise those functions in response to the flood.

Flooding occurred at Wollaton Vale and Larchdene Avenue, Wollaton on 17th June 2020. It was considered necessary to undertake a formal investigation because Nottingham City Council's thresholds were surpassed, as more than 5 properties reported internal flooding. This Flood Investigation Report has been completed by the City Council under our duties as the LLFA and summarises the formal investigation that has been undertaken.

The flooding occurred as a result of an intense summer storm on the 17th June, resulting in a significant volume of rain falling onto the area of Wollaton. Subsequently, water levels of the Tottle Brook rose sharply, resulting in the watercourse overtopping, particularly at locations where the channel has become restricted. In addition to the flood mechanism caused by the overtopping of the Tottle Brook, the summer storm was significant enough to overwhelm the sewer system and highway infrastructure, causing additional surface water flooding. The Risk Management Authorities with relevant flood risk management functions with regards to this flooding are therefore the Environment Agency (Main River), Severn Trent Water (Water and Sewerage Company), and Nottingham City Council (Highway Authority).

It is recommended that a Flood Risk Modelling study is undertaken to better understand the watercourse and the hydraulic impact of the observed channel restrictions. The modelling can then be used to develop a potential flood risk management scheme and provide an evidence base for future funding opportunities.

1 INTRODUCTION

1.1 What is a Formal Flood Investigation?

Flooding has a devastating impact that affects people, property, business, the environment and transport. There are many different sources of flooding including rivers, sewers, surface water and groundwater and there are a number of Authorities and organisations involved in managing the risk of flooding from these different sources. Flooding can be caused by a complex interaction of different sources that can be difficult to resolve, particularly in urban areas.

Nottingham City Council is a Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (2010) (FWMA). In recognition of the complex nature of flooding and the number of different Authorities that can be involved, Section 19 of the FWMA places a duty on LLFA's to investigate flooding in their area, as appropriate. The legislative requirements of Section 19 are included below.

Flood and Water Management Act (2010) – Section 19

(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.

This report has been prepared in response to this legislative requirement.

1.2 Which Authorities are involved?

The Flood and Water Management Act (2010) identifies organisations that have flood risk management responsibilities as 'Risk Management Authorities'. Table 1 shows the key responsibilities of Risk Management Authorities that operate in the Nottingham City area.

Due to the number of different organisations involved, the City Council is responsible for the leading on flood investigations and works in partnership with relevant Risk Management Authorities. Through leading the investigation, the City Council will identify which Risk Management Authorities have flood risk management functions in relation to the flood event and what actions they propose to take, if any, to reduce flood risk in the future.

Risk Management Authority	Flood Risk Management Functions
Lead Local Flood Authority & Highway Authority: Nottingham City Council	• River (fluvial) flooding from minor watercourses ('Ordinary Watercourses') • Surface water (pluvial) flooding

	• Groundwater flooding • Provision and maintenance of highway drains and road gullies
Water and Sewerage Company: Severn Trent Water	• Providing effectual drainage • Maintaining adopted public sewerage network
Environment Agency	• River (fluvial) flooding from large watercourses ('Main Rivers') • Flooding from the Sea and estuaries • Reservoir flooding

Table 1: Risk Management Authorities in Nottingham City Council's administrative area.

1.3 When are Formal Flood Investigations undertaken?

Nottingham City Council has developed thresholds and triggers for when a formal investigation will be undertaken following a flood event. These thresholds relevant to this Flood Investigation are shown below:

Nottingham City Council Thresholds for Initiating Flood Investigations

For a residential dwelling such as houses or flats, including Nottingham City Homes properties, a Section 19 flood investigation shall be carried out where:

- Internal (over the doorstep) flooding affects five or more properties and the properties are either in close proximity, or the flooding is hydraulically linked.

1.4 Flood Investigation Report

The flood event on the 17th June 2020 caused the internal flooding of 19 properties across Larchdene Avenue and Wollaton Vale. This Flood Investigation Reported has been compiled because the number of properties that experienced internal flooding exceeds the thresholds that been set by the City Council.

2 SITE INFORMATION

2.1 Location of the flooding incident and the local area

Larchdene Avenue and Wollaton Vale are located approximately 5km south-west of Nottingham City centre, within the administrative district of Nottingham City Council (NCC), in the ward of Wollaton West. Wollaton is an urbanised residential area, with a significant area of open recreational and green space such as Wollaton Park and Martin's Pond (see Figure 1). Local topography varies across the area, with several roads falling towards the Tottle Brook "valley", with Wollaton Vale being lower than the surrounding streets e.g. Bramcote Lane, Sheraton Drive and Parkside Rise.

Larchdene Avenue and Wollaton Vale are directly adjacent to the Tottle Brook, a main river which is a tributary of the River Leen, eventually leading to the River Trent which runs through Nottingham.

The Tottle Brook originates from agricultural land (outside of Nottingham City Council's administrative area, to the west). From the source, it is classed as an ordinary watercourse and is mostly culverted from Bilborough Road (A6002). It becomes an open watercourse again to the rear of Fernwood Crescent, before becoming culverted and designated as Main River for the remainder of its length until it reaches the River Leen. The Tottle Brook is extremely constrained and hidden through the residential areas, and there is a history of property owners building up to the boundary of the Brook and a number of unconsented alterations to the channel, reducing capacity and conveyance through the channel.

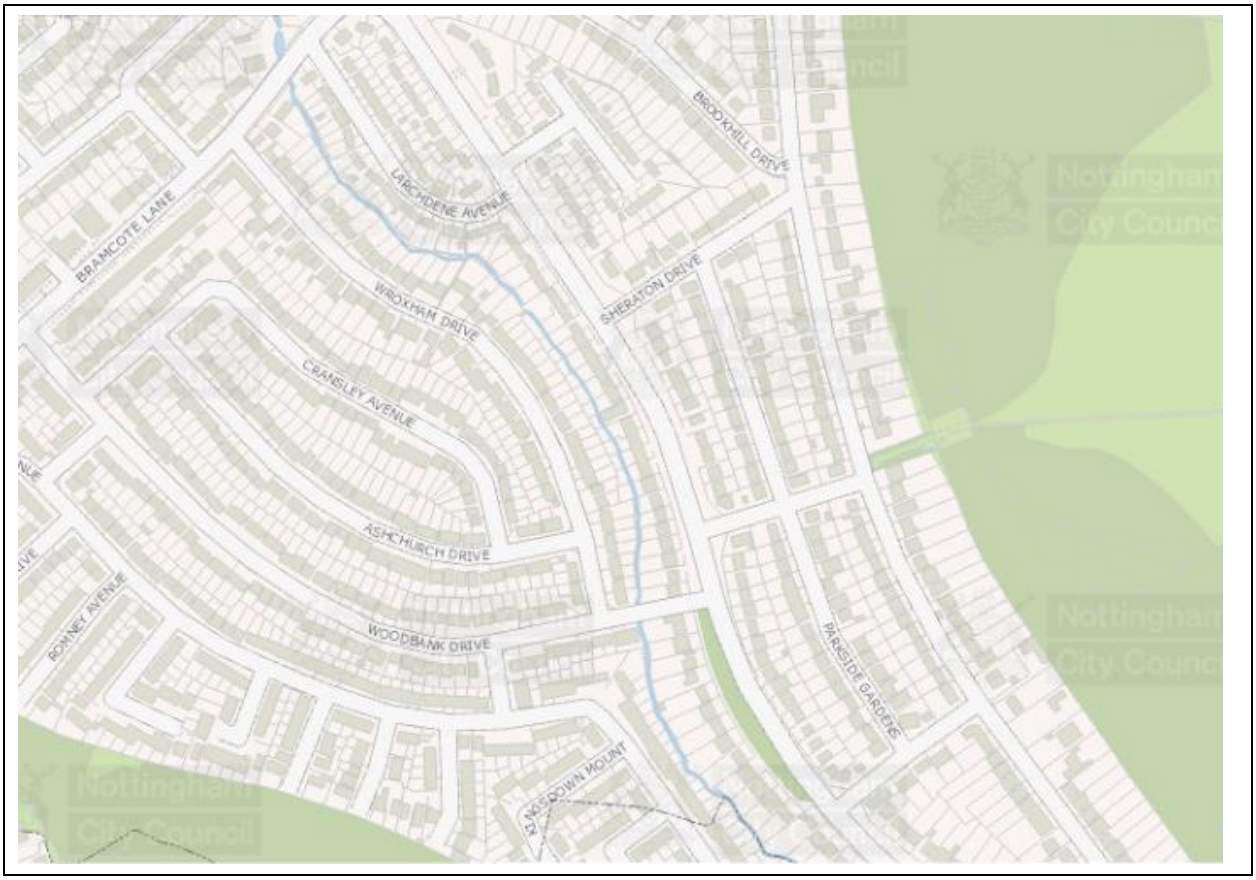


Figure 1: Site location

In addition to the main channel of the Tottle Brook, there is also a by-pass culvert that runs from Woodbank Drive, under Wollaton Vale. This enables additional flows to be taken out of the main channel, aiming to protect lower properties before it re-joins the Tottle Brook at Derby Road.

A separate foul and surface water sewer network serves the area of Larchdene Avenue and Wollaton Vale. Many of the surface water sewers discharge into the Tottle Brook, with a number of connections in the affected area. The watercourse of the Tottle Brook can rise quite sharply due to the number of connections from private properties and from surface water drainage networks.

2.2 Historical Flooding

Some locations across Larchdene Avenue and Wollaton Vale have been affected by flooding previously. Nottingham City Council have records of external flooding on Larchdene Avenue in 2012, as a result of the Tottle Brook overtopping, affecting rear gardens. Wollaton Vale has been impacted by surface water flooding on a more frequent basis.

2.3 Predicted Flooding

The Environment Agency's Flood Map is a national dataset, which shows the areas in England and Wales predicted to flood from rivers and the sea, reservoirs and surface water. The dataset was made publicly available and is published on the Environment Agency's website(1).

The flood map indicates that Wollaton Vale is affected by fluvial risk, and sits within Flood Zone 3, but does not show Larchdene Avenue to be at risk. However, the flood risk maps for the Tottle Brook are limited to the lower section of the Brook. The flood modelling available more likely shows risk associated with the River Leen and River Trent backing up, and not the risk associated with the Tottle Brook itself. Flood risk modelling is discussed further in Section 3.5.

The flood map for surface water indicates areas of High Risk along both Larchdene Avenue and Wollaton Vale.

High Risk areas are where there is a chance that 1 in 30-year event flooding is likely to occur. Medium Risk areas are where there is a chance flooding will occur between 1 in 30 to 1 in 100-year event. Low Risk areas are where there is a chance of flooding for an event greater than 1 in 100-year.

High Risk areas are estimated to experience flooding of more than 900mm. Medium Risk of flooding are estimated to have sections of flooding with varying depths between 300mm and 900mm. Areas of Low Risk are estimated to have sections of flooding below 300mm.

An extract from the Environment Agency flood maps is included in **Appendix A**.

(1) https://flood-warning-information.service.gov.uk/long-term-flood-risk

3 FLOOD INVESTIGATION

3.1 Weather conditions before and during the event

Conditions in the days prior to the flood event on the 17th June were fairly dry with occasional showers, but there were no significant volumes of rainfall until the thunderstorm event, which started in the late afternoon. Due to the urbanised nature of the catchment, antecedent rainfall will not have contributed to this flood event.

Nottingham City Council own a network of 4 rain gauges across the city. The nearest rain gauge to the location of the storm that passed over the affected areas is at Clifton Leisure Centre, approximately 5.5 km south-east of Wollaton. The rain gauge recorded 33.6mm of rain over a 55 minute period.

The rain gauge also recorded 18mm of rainfall on the 18th June, however this was over a more prolonged period. Rainfall data has been summarised in the Figures 2 and 3 below.

Date	Total rainfall (mm) – Clifton Leisure Centre
15/06/2020	0.4
16/06/2020	1.8
17/06/2020	33.6
18/06/2020	18
19/06/2020	0.6

Figure 2: Recorded Rainfall at Clifton Leisure Centre

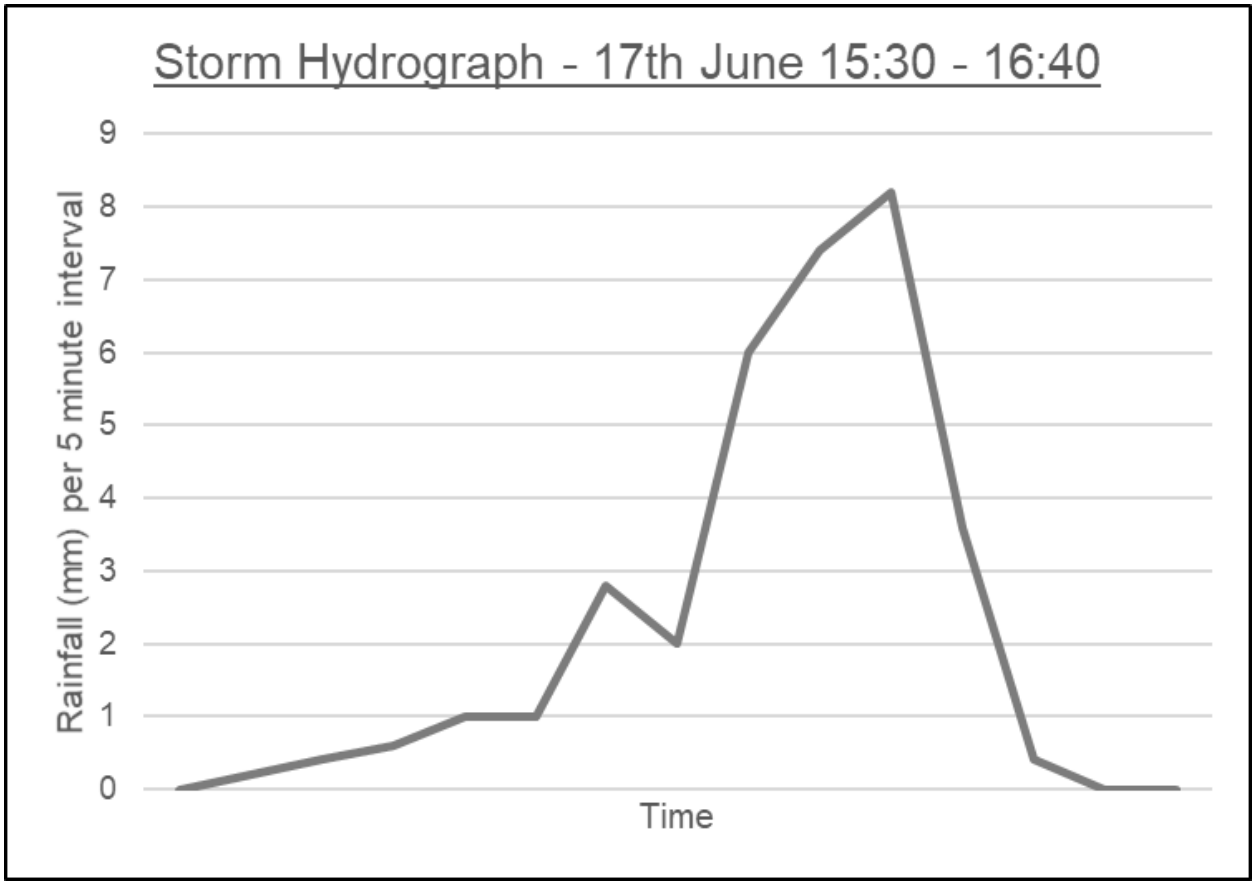


Figure 3: Storm Hydrograph for Recorded Rainfall at Clifton Leisure Centre – 17th June

An analysis of the flood records and rainfall radar data for the event has shown that the thunderstorm was extremely localised to the Wollaton and Clifton area. The storm moved across the City boundary from the south east over Clifton, and moved north west to Wollaton. Due to the localised nature of the storm, Nottingham City's rain gauges may not accurately reflect the volume of water that fell across this catchment. Further information has therefore been obtained through MapRain UK which utilises Met Office rainfall data. This data indicates an estimation of 52mm rain falling between 4.00pm and 6.30pm at Bramcote Lane.

The maximum return period for the rainfall at this location is estimated to be 1 in 70-year event. This highlights that there is a 1.43% chance of an event happening in a year.

The average precipitation for Nottingham in June is 56 mm [(2)]. The date of the flooding incident indicates that almost an average month's rainfall fell over a period of 2 days in Wollaton. As such, the rainfall intensity was extremely high which would have compromised existing drainage systems to deal with the amount of rainfall.

(2) https://en.climate-data.org/europe/united-kingdom/england/nottingham-128/

Whilst this is an extreme event, it must be clarified that this does not mean those affected will not flood again for 70 years, it means the chance of this event occurring in a single year is 1 in 70. This calculation utilises the maximum rainfall intensity recorded and may not represent the return period of the event for the whole of the catchment.

3.2 Flooding Source and Mechanism

Mechanisms for flooding varied across Larchdene Avenue and Wollaton Vale. The flood event occurred rapidly in response to the thunderstorm, with flooding reported within 30 minutes of the storm reaching the area. Length of flooding varied across the affected locations, depending on local topography and thresholds of the properties.

Flooding was predominantly caused by the Tottle Brook overtopping. However, some properties were affected by surface water flooding mechanisms, and some a combination of both fluvial and fluvial flooding.

Whilst the flood event was significant, it is likely to have been exacerbated by the years of modification to the river channel, creating "pinch points" and areas of restriction where water is likely to build up and back up towards properties. These areas will be more susceptible to blockages.

A number of surface water sewers across the catchment discharge directly into the Tottle Brook, leading to a rapid rise in water level. This also meant that during the flood event once the Tottle Brook was high, it was likely that water was unable to discharge freely into the watercourse. This results in backing up of water through the sewer network, and Highway infrastructure that connects into the sewer will effectively "switch off".

For properties solely affected by surface water flooding, the flood source was overland flow from steeper streets to the lower level of Wollaton Vale, exacerbated by the drainage infrastructure being at capacity.

Sewers are typically designed to accommodate a 1 in 30 year event, meaning the capacity of the sewers would've been massively exceeded by the volume of rainfall that fell.

3.3 Preventative Measures

Nottingham City Council's Highway Services team has a gully cleansing regime to ensure all road gullies are cleared on an annual basis. In response to the flooding, the road gullies will be

added to a ‘Hotspot List’ where increased cleansing will be undertaken in response to any weather warnings.

The Environment Agency undertake regular inspections and cleansing of their assets in the area e.g. trash screens and culverts.

There is currently not a flood warning system in place for the Tottle Brook.

Residents should look to invest in sandbags or more permanent flood defences as Nottingham City Council has limited supply and cannot guarantee deployment, particularly during intensity summer storms.

3.4 Flooding Impacts

The LLFA have investigated the impacts of flood event through a door knocking exercise with residents and collating reports which were received by the Risk Management Authorities in the area. The number of properties that reported to have flooded internally (across both Larchdene and Wollaton Vale) was 19. At least 3 more properties were affected externally. This meant a number of residents were displaced as the properties were uninhabitable during repairs to damage. Damage varied between properties, but generally, there was unrepairable damage to furniture, furnishings, floorboards and carpets. Externally, there was damage to gardens e.g. outdoor furniture, decking and planting. The impacts of the flooding were amplified for residents due to the ongoing COVID-19 pandemic.

3.5 Potential Solutions

Whilst the risk of flooding can never be fully mitigated, there are possible measures that could be taken forward to reduce flood risk and to reduce the severity associated with the impacts of flooding.

There is a clear data gap with no flood modelling available for the Tottle Brook catchment. It is recommended that the LLFA works collaboratively with other Risk Management Authorities to develop a Flood Risk Model, looking at both fluvial and surface water risk. This will enable potential options to be explored using the model as an evidence base. Modelling is an essential element to bid for funding to deliver any potential solutions.

To support the modelling, the Tottle Brook and the associated assets should be surveyed, with a particular focus on an areas of constraint and restriction that may impact conveyance.

Once a flood model has been built for the area, solutions such as Property Level Resilience measures (PLR), sustainable drainage systems and upstream flood storage will be explored. Any structures within the channel of the Tottle Brook shown to increase flood risk in the flood model, verified by records provided by residents, should be improved.

In line with the survey work and flood modelling, a flood warning system should be established to better prepare residents. Flood warnings would allow residents to prepare for predicted events and minimise the damage that could occur.

4 RIGHTS AND RESPONSIBILITIES

Which Risk Management Authorities have flood risk management functions in relation to the flood event?

4.1 Lead Local Flood Authority (Nottingham City Council)

The FWMA places a number of responsibilities on LLFAs in relation to flood risk management. As stated in Section 1, LLFAs have a responsibility to investigate flood incidents, as appropriate, under Section 19 of the Act. Whilst we can investigate flood events, work with our professional partners and make recommendations for reducing the risk of future events, LLFAs do not have a responsibility or the funding to solve all flooding issues.

4.2 Highways Authority (Nottingham City Council)

NCC as the Highways Authority have a duty to maintain all highways classed as being "maintainable at public expense" that fall within their area of control. They have the lead responsibility for providing and managing highway drainage and roadside ditches under the Highways Act 1980. The owners of land adjoining a highway also have a common-law duty to maintain ditches to prevent them causing a nuisance to road users.

The Highways Authority are required to ensure that the drainage system is adequate and ensure they are maintained.

4.3 Public Sewer (Severn Trent Water)

Water companies are Risk Management Authorities (RMAs) and play a major role in managing flood and coastal erosion risks. They manage the risk of flooding to water supply and sewerage facilities and flood risks from the failure of their infrastructure.

The main roles of water and sewerage companies in managing flood and coastal erosion risks are to:

- 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. They have a duty under section 94 Water Industry Act 1991 to ensure that the area they serve is “effectually drained”. This includes drainage of surface water from the land around buildings as well as provision of foul sewers.
- Provide advice to LLFAs on how water and sewerage company assets impact on local flood risk
- Work with developers, landowners and LLFAs to understand and manage risks – for example, by working to manage the amount of rainfall that enters sewerage systems.
- Work with the Environment Agency, LLFAs and district councils to coordinate the management of water supply and sewerage systems with other flood risk management work.

4.4 Main River (Environment Agency)

The Environment Agency is a key flood risk management operating authority. It has a strategic overview of all sources of flooding and coastal erosion. It is responsible for flood and coastal erosion risk management activities on both main rivers and the coast, as well as regulating reservoir safety and working in partnership with the Met Office to provide flood forecasts and warnings. It has the power (but not legal obligation) to manage flood risk from designated main

rivers, such as the Day Brook. This means that the Environment Agency is responsible for managing flood risk of Main Rivers by carrying out maintenance, improvement or construction work.

5 RECOMMENDATIONS FOR THE PUBLIC

Recommendations to the public:

- Where available, sign up to the EA's flood warnings (Floodline) by calling 0345 988 1188 or by registering online https://www.gov.uk/sign-up-for-flood-warnings.
- Where available, monitor online river gauge information as well as flood warnings https://flood-warning-information.service.gov.uk/river-and-sea-levels.
- Owners of affected properties should consider preparing a Household Emergency Plan and an emergency kit containing essential items.
- Implement resilience infrastructure inside of the property e.g. tiles instead of carpets, PVC doors instead of wood, water compatible walls, flooring and kitchen fittings, sump and pump systems, and raised electrics/meters.
- With support from Flood Risk Management Authorities, the community should make efforts to form a local resilience/flood group and communicate with their neighbours to help each other during an event. This should including appointing Community Flood Wardens and preparing a Community Emergency Plan.
- Seek support for insuring your property https://www.floodre.co.uk/
- Regularly inspect drainage systems in the area. Report blockages or other issues to the responsible owner and the LLFA.
- Home owners who live adjacent to the watercourse should be aware of their maintenance responsibilities through Riparian Ownership.
- Any works to be undertaken by landowners on or adjacent to the watercourse requires consent and a permit from the Environment Agency.
- For further information, please see the Environment Agency's "What to do before, during and after a flood" document [3].

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/403213/LIT_5216.pdf

6 CONCLUSIONS & AGREED ACTIONS

A total of 11 residential properties were flooded internally on Larchdene Avenue, with a further 8 flooded internally on Wollaton Vale. This was caused by a short high intensity rainfall event occurring over 55 minutes on the 17th June, which meant the capacity of the Tottle Brook and drainage systems were exceeded.

The Environment Agency, Severn Trent Water and Nottingham City Council (Highways Authority) are the Risk Management Authorities that have flood risk management functions in relation to the flood event. The Environment Agency are responsible for overseeing activities on the main river, including enforcement, and undertake maintenance necessary to reduce flood risk. Severn Trent Water is responsible for managing and maintaining the public sewer network and Nottingham City Council is responsible for managing highway drainage and for investigating the flood event.

A number of recommendations have been made for residents to improve their resilience. Residents should report any future flooding issues associated with the watercourse (Tottle Brook) to the Environment Agency and any flooding issues associated with the Highway to Nottingham City Council. If flooding occurs and foul sewage is present or manholes visibly blow, this should be reported to Severn Trent Water.

Nottingham City Council as the Lead Local Flood Authority are working with the Environment Agency to improve the understanding of the flood hydrology and will publish the flood risk modelling for the catchment. The flood risk model will also be used to test potential options to reduce flood risk and will provide an evidence base to support any funding opportunities.

6.1 Agreed Action Plan

There have been a number of actions undertaken in response to the flood event, as well as further actions planned.

Nottingham City Council (LLFA) Actions	**Status**
Undertake channel survey of the Tottle Brook.	Complete.
Undertake CCTV survey of the Tottle Brook and relevant connections.	Complete.
Obtain funding to build flood model of Tottle Brook.	Complete.
Build flood model of Tottle Brook to better understand and predict flood risk and test potential options to reduce flood risk across the catchment.	Ongoing.
Look for funding opportunities to assist residents on Property Level Resilience measures (PLR) delivery.	Ongoing.
Advise residents on resilience measures e.g. PLR, Sandbags, Riparian Ownership and maintenance.	Ongoing.
Nottingham City Council (Highway Services) Actions	
Continue to maintain drainage infrastructure on the adopted highway and ensure they are clear for floodwater to drain away.	Ongoing maintenance. Gullies are to be placed on

Target cleansing of road gullies in receipt of weather warnings.	targeted 'Hotspot List'.
Severn Trent Water Actions	
Investigate sewer network for any defects.	Complete. No defects found, storm event exceeded design capacity of network.
Ensure sewer network is maintained.	Ongoing maintenance.
Share asset data for flood modelling.	Ongoing.
Environment Agency	
Undertake emergency maintenance and culvert cleansing post-flood event.	Complete.
Develop flood warning system for the Tottle Brook catchment.	Ongoing.
Work with the LLFA to provide advice on Riparian Ownership and maintenance responsibilities, as well as the consent process.	Ongoing.
Support the LLFA in delivering flood model and making data publicly available on the Environment Agency's Flood Mapping website.	Ongoing.

7 DISCLAIMER

This report has been prepared by the Council solely for the purpose of complying with its duties under Section 19 of the Flood and Water Management Act 2010 to establish:-

1. Which risk management authorities have relevant flood risk management functions, and
2. Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

Nottingham City Council does not accept any liability arising from reliance on or the use of this report or its contents by any third party 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 should not be considered as a definitive statement of all factors that may have triggered or contributed to the flood event.

Nottingham City Council expressly disclaim responsibility for any error in, or omission from, this report and the supporting technical assessment Report and for any error in, or omission from, this report arising from or in connection with any opinion, conclusion and recommendations expressed.

Although the Council may have commented upon contextual issues related to the flood event, it is not the purpose of this report to determine any private rights arising from the flood event. Nor is the purpose of this report to reach conclusions as to whether any Risk Management Authority or other stakeholder (e.g. private land owners, public bodies or government agencies) has breached any duty of care (whether statutory or common law) that they may have held.

Any party wishing to assert any rights or cause of action related to the flooding event or in the process of buying/selling or insuring property should not place reliance on this report but should conduct and rely on their own investigations.

8 CONTACTS & USEFUL LINKS

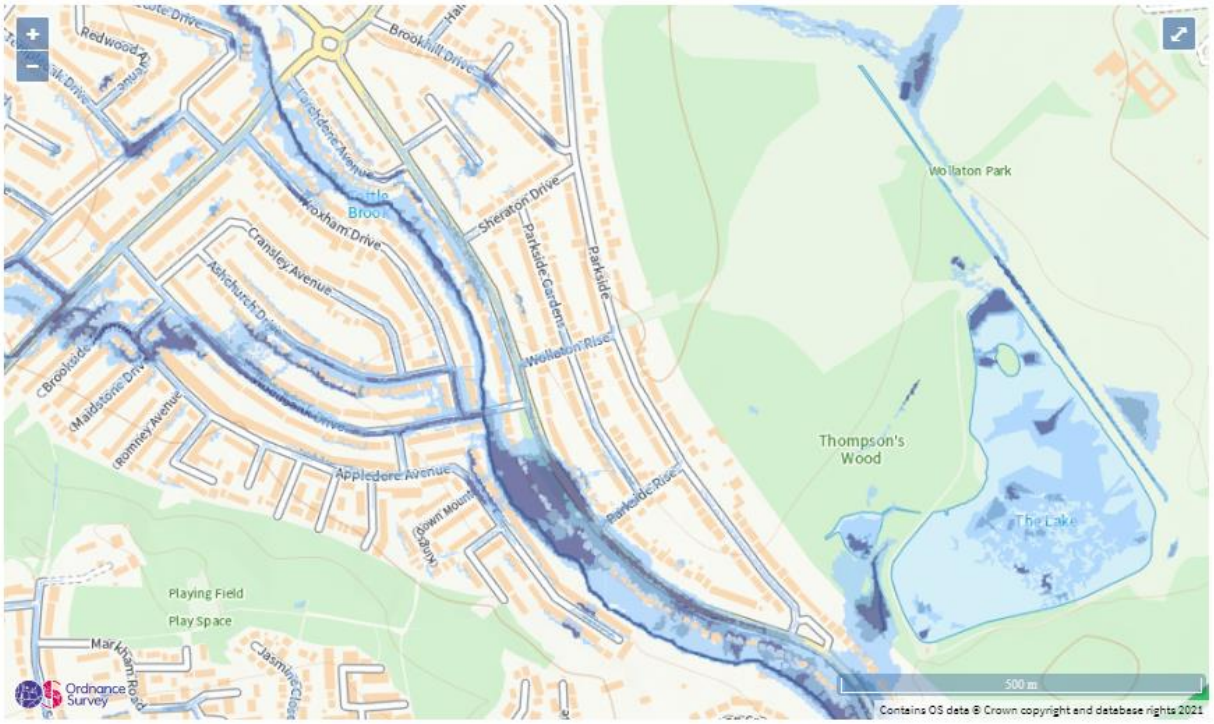
Nottingham City Council Contacts & Links		
Nottingham City Council	0115 915 5555	https://www.nottinghamcity.gov.uk/reportit
Flood Risk Management Team	0115 876 5275 Monday to Friday 9:00-16:30	Advice on improving the level of protection to your property
Highway Services Team	0115 915 2000	https://myaccount.nottinghamcity.gov.uk/service/report_it___report_a_blocked_gully
Bulky Waste Collection	0115 915 5555	Free of charge bulky waste collection http://www.nottinghamcity.gov.uk/bulkywaste
Useful Web Pages	https://www.nottinghamcity.gov.uk/information-for-business/environmental-health-and-safer-housing/flooding/flood-document-library/	
Environment Agency Contact & Links		
Environment Agency	https://www.gov.uk/report-flood-cause	Reporting a flood
	0800 80 70 60	Environment Agency incident hotline (24 hours)
	0345 988 1188	Floodline
Severn Trent Water Contacts & Links		
Severn Trent Water	https://www.stwater.co.uk/in-my-area/report-a-problem/	Report a drainage problem (non-emergent)
	0800 783 4444	Emergencies (24 hours) e.g. leaking water main causing flooding

9 APPENDICES

Appendix A: Predicted Flood Risk Maps (Source: https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode)

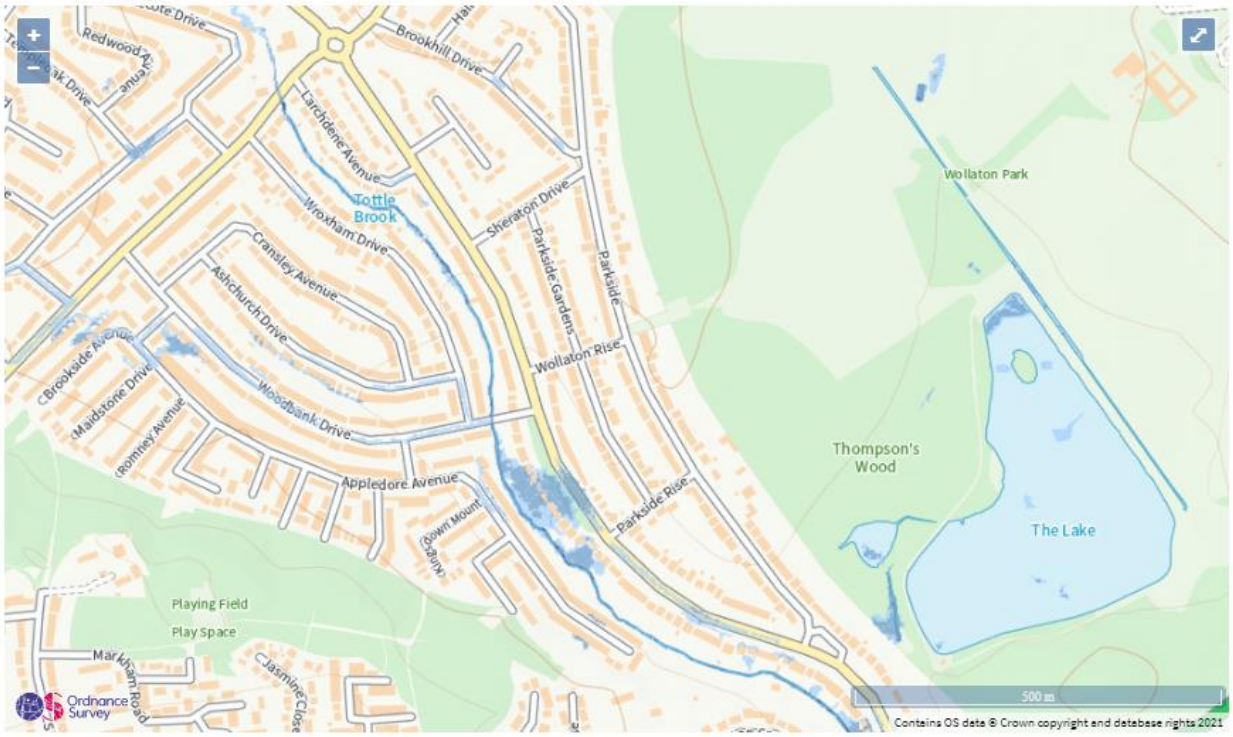
Extent of flooding from rivers or the sea

High Medium Low Very low



Extent of flooding from surface water

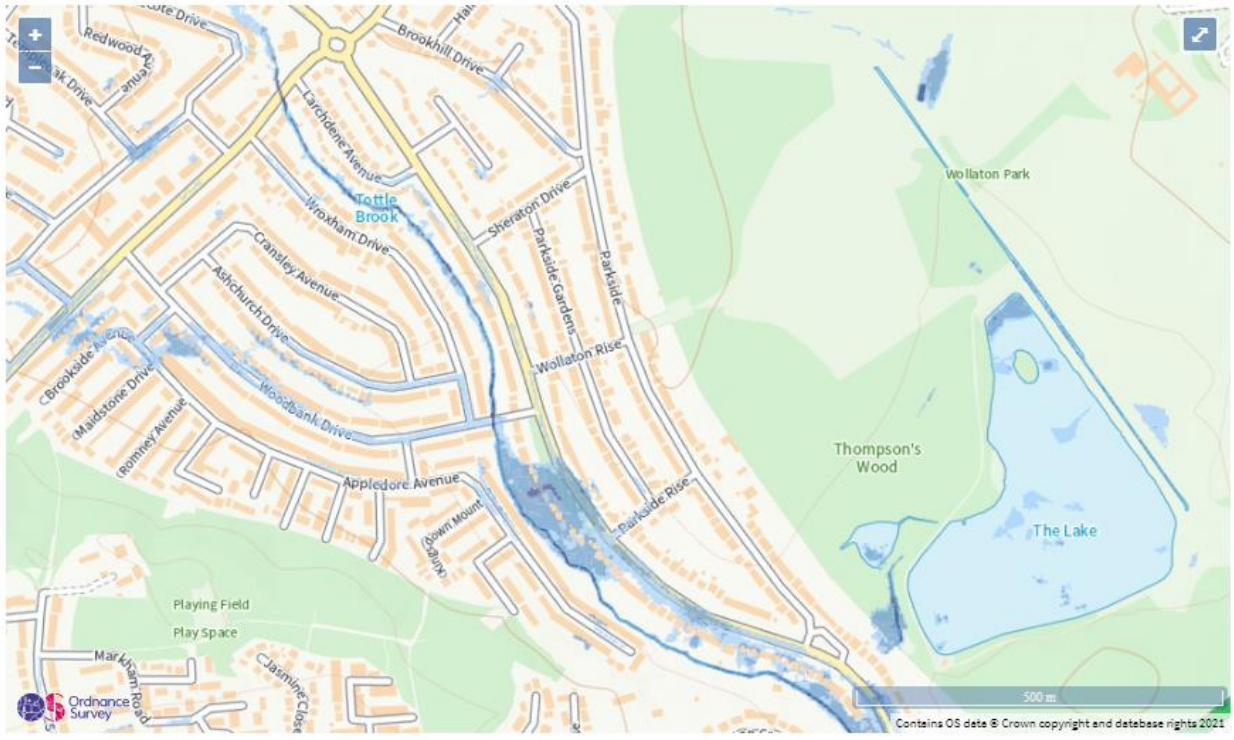
High Medium Low Very low



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm



Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm

Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm