Section 19 Investigation Report

Stockport Metropolitan Borough Council

September 2016 Flood Events

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ZZP264145

Section 19 Investigation Report

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D03	07/04/2017	Final Report for Executive Approval	T Diesner	C Isherwood	C Isherwood

Executive Summary

According to the Met Office, September 2016 was exceptionally warm, and for the UK, the month as a whole was the equal-second warmest on record since 1910. This was driven by hot southerly airflow from France and Spain, which resulted in a short heatwave over the period of four days from the 12th to 15th September. This hot and humid air then led to thunderstorms and intense downpours in parts of south west England and the south Pennines, which resulted in significant flooding across Greater Manchester, Cheshire, Staffordshire, and in parts of west Cornwall.

Whilst data collected suggest that September was a typical month for rainfall in Stockport, with the district receiving approximately 100% of the long-term average rainfall, it received the majority of the monthly total on the 13th September 2016 after two periods of heavy and intense rainfall. One local rain gauge recorded a peak rainfall intensity of 45mm/hour, which is well above the 32mm/hour indicative of torrential downpours. As a result, the exceptional weather (in both rainfall intensity and volume) received in Stockport exceeded the capacity of the urban drainage network and caused public sewer and private drain flooding to occur, which included the backing up of public combined sewers causing foul flooding.

Stockport Council, the Environment Agency and United Utilities recorded 660 properties to have been affected by flooding on the 13th September 2016; with the communities of Heatons and Reddish, worst affected recording 25% of the reported property flooding. The worst hit Ward areas included Davenport and Cale Green, Stepping Hill and Heatons North.

365 more properties were affected by flooding in September, when compared to the flood event that hit Stockport in June 2016. However, during this event 82% of the total properties flooded by public combined sewers. Unlike the June 2016 event, no significant infrastructure damage was recorded.

Following the flood events, and in addition to supporting this investigation, each authority has been undertaking surveys, investigations and providing further community support. This has included the provision of flooding grant funding, the freezing of council taxes for those affected, and culvert and sewer surveys, repairs and blockage removal.

This report documents the investigation into the flood event in Stockport, undertaken on behalf of Stockport Council under Section 19 of the Flood and Water Management Act 2010. The aim of the investigation is to identify those communities affected, to determine why they were flooded and review responses during and post event. It is not the purpose of this investigation to assess flooding mechanisms in detail.

Where appropriate, this report recommends further actions for each relevant authority to consider going forward. Based on this event, the report recommends 15 general and 4 community specific actions to help reduce or mitigate the impacts of future flooding within the borough. Due to the primary source of flooding (exceptional rainfall, which overwhelmed the public combined sewers), the majority of these actions are strategic in nature, which offers ways in which each authority can help improve the resilience of the communities to flooding. The delivery of some of these actions will be dependent on the authorities securing funding and other internal priorities.

In addition to the recommendations presented in this report, the Council, as LLFA, are continuing to work proactively together with United Utilities and other Risk Management Authorities to engage with the communities affected and to ensure that flood mitigation is a key part of their present and future programme of works.

Contents

1. Introduction

1.1 Flood Event Overview

On the 13th September 2016, extreme rainfall events hit parts of south west England and the south Pennines, with significant flooding observed across Greater Manchester, Cheshire, Staffordshire, and also in parts of west Cornwall.

The rainfall event significantly affected Stockport, with the borough receiving approximately 44% of its total monthly rainfall in just one day. Leading up to this day, Stockport had experienced a period of warm dry weather and as a result ground conditions were not saturated and water levels within the local watercourses were quite low. Therefore, the primary cause of flooding was due to the volume and intensity of rainfall, which overloaded the local drainage systems and caused public sewer and private drain flooding throughout large parts of the borough.

660 properties were recorded to have suffered mainly public combined sewer flooding, with the communities of Heatons and Reddish worst affected, and Davenport and Cale Green, Stepping Hill and Heatons North the worst affected Wards areas. A number of these properties were also flooded during the June 2016 event. Whilst the Council did not record any major infrastructure damage, a number of roads became impassable causing local traffic disruption.

In response to the events, the Council, United Utilities, and the Environment Agency as Risk Management Authorities (RMAs) have been working together to support affected communities and understand what happened. This included responding to the incidents both during and after the event and undertaking flood investigation and management works.

1.2 Section 19 Investigation Requirements

The Flood and Water Management Act 2010 (the Act)[1] places a number of duties on Lead Local Flood Authority (LLFAs) in relation to local flood risk management. One of the principal duties of the LLFA, as laid out in the Act, is the responsibility to record and investigate flooding incidents within their area (the latter is known as a Section 19 Investigation).

Section 19 – 'Local authorities: investigations' of the Act states:

1) *On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate –*
   a) *Which risk management authorities have relevant flood risk management functions, and*
   b) *Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*
2) *Where an authority carries out an investigation under subsection (1) it must -*
   a) *Publish the results of its investigation, and*
   b) *Notify any relevant risk management authorities.*

The Act defines flooding as any case where land not normally covered by water becomes covered by water. Flood risk is a combination of two components: the chance (or probability/ likelihood) that a location will flood from any source or type of flooding, and the impact (or consequence) that the flooding would cause if it occurred.

[1] Flood and Water Management Act 2010. http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf

1.3 Purpose

The aim of this independent investigation is to provide a factual record of the flooding to meet the requirements of Section 19 of the Act. The report will provide an overview of the event and list the communities affected and the total number of properties affected (Section 2.3).

Based on technical evidence and flood incident data recorded by the Council, the Environment Agency and United Utilities during and after the event, it may also be possible to determine the source, cause and impact of these events in those communities affected. The main body of this report provides an overview of the flooding impacts, including commentary of properties and infrastructure affected.

It is not the intention of the investigation to provide options and actions to reduce flood risk for every location that flooded. It does however include, where relevant, high-level recommendations (Section 4.1) to manage future flood risk in Stockport, which will require involvement from the Council, as LLFA, and the other RMAs within the borough.

In many locations there is ongoing investigations and engagement with the affected communities and stakeholders to identify the full range of options available to manage risk going forward. This investigation is an important first step to help the Council and other RMAs manage flood risk, inform future schemes and continue to work together proactively and effectively across Stockport.

1.3.1 Scope

The Stockport Local Flood Risk Management Strategy (LFRMS)[2] states that the Council must record and investigate flood events within Stockport according to the procedures set out in the Association of Greater Manchester Authorities (AGMA) policy document "Recording and Investigation of Flood Events". This policy requires that the Council, as LLFA, carry out a full investigation if a flood event is deemed a 'significant' incident.

This policy defines a 'significant' incident as one that meets the following 'significance' thresholds:

- Five or more residential properties flooded internally, and/or;
- Economic disruption from commercial property flooding , and/or;
- Flooding to critical services such as hospitals, care homes, schools and emergency services.

Given that the September 2016 flood event in Stockport affected a large number of residential properties and some commercial properties, critical services and infrastructure, the event meets the above 'significance' thresholds and therefore a full investigation is required.

[2] Stockport MBC (2016) Stockport Local Flood Risk Management Strategy. https://www.stockport.gov.uk/stockport-local-flood-risk-management-strategy

1.4 Relevant Risk Management Authorities

The responsibilities for managing flooding in the UK is divided between different RMAs as defined in the Act. RMAs have powers and duties to manage the different forms for flooding that can occur, as listed in Table 1.1. Although each RMA has their own responsibilities, managing local flood risks often requires RMAs to work together.

Table 1.1 : RMAs within Stockport and their areas of responsibility

Flood Source	Environment Agency	Lead Local Flood Authority (the Council)	Water Companies (United Utilities)	Highway Authority (the Council & Highways England)
Main River[1]	✓			
Ordinary Watercourse[2]		✓		
Surface water (pluvial runoff)		✓		
Public sewer flooding			✓	
Highway drainage flooding				✓
Groundwater flooding		✓		
Water supply infrastructure			✓	
Reservoirs[3]	✓	✓	✓	✓

[1]Main Rivers have been designated as such by the Environment Agency. These tend to be major rivers or rivers with a high flood risk.

[2]Ordinary Watercourses are all other rivers and streams not classified as Main Rivers.

[3]RMAs have varying responsibilities for reservoirs, including asset management, regulation and emergency planning.

The Act and the Stockport LFRMS provide a full description of RMA responsibilities. The section below outlines relevant RMAs to this investigation.

1.4.1 Environment Agency

The Environment Agency has a strategic overview of all sources of flooding and coastal erosion. They are also responsible for flood and erosion risk management activities on Main Rivers and the coast, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings.

1.4.2 Stockport Metropolitan Borough Council

The Council has a joint risk management role in its capacity as district council, highway authority and LLFA. As a highway authority, the Council has a duty under the Highways Act 1980 to maintain highways that are maintainable at public expense. This requires attention to the drainage requirements of the public highway.

As LLFA, the Council has a number of duties and powers as laid out under the Act, in addition to the duty to investigate flooding set out above. These include, but are not limited to, a duty to develop and apply a LFRMS for its area, a duty to develop a register of structures or features that might affect flood risk, the power to undertake works for manging flood risk and power to take enforcement action where there is an obstruction to an Ordinary Watercourse. The Council also takes an overseeing role to ensure that RMAs and landowners are fulfilling their responsibilities adequately.

1.4.3 Highways England

Highways England has responsibility as the highway authority for the motorways in Stockport, namely: the M56 motorway between junction 1 and 4, and the M60 motorway between junction 5 and 25 travelling anticlockwise. It shares the same flood risk management duties as the Council as a highway authority.

1.4.4 Water Companies

Water companies have a duty under Section 94 of the Water Industry Act 1991 to provide and maintain sewers for the drainage of buildings and associated paved areas within property boundaries. They are also now responsible for transferred sewers under the 'Transfer of Private Sewer Regulations 2011' and lateral drains, which communicate with the public sewers.

United Utilities are the local water company within the borough of Stockport. With regards to local flood risk management, they are responsible for any flooding which is directly caused by its assets – i.e. water or sewerage pipes, and must maintain a register of properties that have flooded due to hydraulic incapacity of the sewerage network, and have a duty to cooperate with other relevant authorities.

1.4.5 Riparian Landowners and Residents

Riparian landowners are those who own land adjoining or containing a watercourse. They have certain rights and responsibilities, including the maintenance of watercourses and assets within their ownership to ensure flood risks are not increased upstream or downstream of their land. Private drains are also the responsibility of property or landowner to maintain.

Residents who are concerned they may be at risk of flooding should take appropriate action to protect themselves and their property. These actions include registering to receive flood warnings, obtaining a personal supply of sandbags, and moving valuable items to higher ground. They also include more resilient and permanent property protection measures including water resistant doors, airbrick covers, floodgates, raised electrical sockets and the fitting of non-return valves on pipes.

2. Overview of Flooding Event

2.1 Data Collection

This section of the investigation provides an overview of the hydrological conditions to help provide an overall picture of the conditions that led to the flooding event in Stockport. In order to do so, the following key datasets were reviewed:

1) **Met Office Data** – provided in the form of an article[3] reviewing the exceptional conditions during September 2016.
2) **Environment Agency Water Situation Reports**[4] - the Environment Agency issues monthly water situation reports for England that provide an overview of various hydrological information for that month, including rainfall, soil moisture and river flows. The reports provide a measure of Soil Moisture Deficit at a very high level across the UK (40 x 40 km grid resolution), which is a measure of how saturated the ground is; low values reflect more saturated ground conditions, high values reflect less saturated ground conditions.
3) **Centre for Ecology and Hydrology Hydrological Summary Reports**[5] - the Centre for Ecology and Hydrology issues reports for the UK, which, similar to the Water Situation Reports, provide analysis of various hydrological records for the month.
4) **Environment Agency Rainfall Radar Imaging** - the Environment Agency provided rainfall radar imaging covering the period 11 September to 15 September. These images provide snapshots at regular intervals of the rainfall over Stockport and help provide a detailed understanding of the 13th September rainfall event, in addition to the conditions preceding and following the event.
5) **Environment Agency Rain Gauge Records** – the Environment Agency provided the record from their rain gauge within Stockport, covering the month of September. Similar to the radar imaging, this data provides an understanding of conditions through September and relating specifically to the 13th September; however, depending on the distribution of rainfall over Stockport, the data may be most applicable to the locality of the gauge.
6) **Environment Agency River Gauge Records** – the Environment Agency provided water level records at their river gauging stations within Stockport. This data provides an understanding of how the local watercourses responded to the 13th September rainfall event.

2.2 September 2016

The Met Office reports that September 2016 was exceptionally warm; the highest September temperature since 1911 was recorded on the 13th September in Gravesend, Kent (34.4 C), and for the UK the month as whole was the equal-second warmest since 1910.

Based on the data provided, Stockport received in the region of 100% of the 1971 to 2000 long-term average rainfall in September 2016. As a result, the total rainfall experienced across the month was typical and ground conditions were moderately saturated, but not much more saturated than on average for a typical September.

However, a short heatwave occurred over the period of four days, from the 12th to 15th September, caused by hot southerly airflow from France and Spain. The Met Office issued a Yellow Warning of rain for North West England at 02:10 on the 13th September.[6] This hot and humid air then led to thunderstorms and intense downpours in parts of south west England and the south Pennines.

Information from the Met Office and Centre for Ecology and Hydrology suggests that Stockport experienced intense convective downpours and received a significant proportion of its monthly total rainfall over a short

[3] Met Office (2016) Exceptional Warmth, September 2016. http://www.metoffice.gov.uk/climate/uk/interesting/september2016_temperature
[4] Environment agency (2016) Water Situation Report for England: September 2016 (https://www.gov.uk/government/collections/water-situation-reports-for-england
[5] National River Flow Archive (2016) Hydrological Summary for the United Kingdom September 2016. http://nrfa.ceh.ac.uk/monthly-hydrological-summary-uk
[6] @metofficeUK https://twitter.com/metofficeUK/status/775622631571660801

period. The sections below provide an overview of rainfall radar and rain gauge data collected to provide a local analysis of the rainfall event in Stockport.

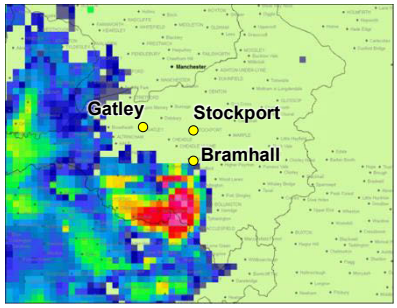
2.2.1 Rainfall Radar Records

The rainfall radar data received from the Met Office, and illustrated in Figure 2.1 and Figure 2.2, provides images of rainfall intensities over the entire borough at 15-minute intervals. It is useful in providing an overview of the spatial variation of rainfall across a much larger area. This can then be supported by local rain gauge data discussed in Section 2.2.2.

The rainfall radar data shows that two torrential downpours took place on the 13th September 2016 across Stockport: the first shortly after 15:00, lasting around half an hour, and the second shortly before 17:00, lasting around an hour and a half. The images reveal that both downpours hit the western half of the borough, with the eastern half only affected by the second downpour; however, every part of Stockport is likely to have received torrential downpours for a period during the day. The distribution of rainfall across the borough will have had an impact on the areas worst affected.

Figure 2.1 : Rainfall radar images for the first downpour – 13 September 2016[7]

First Downpour 15:15 to 15:45



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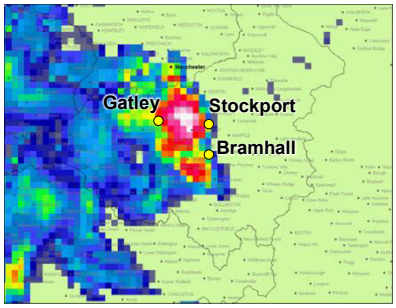
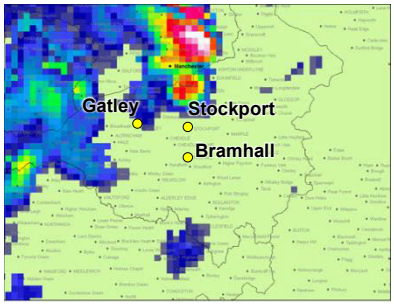


15:30 GMT 13 Sep 2016



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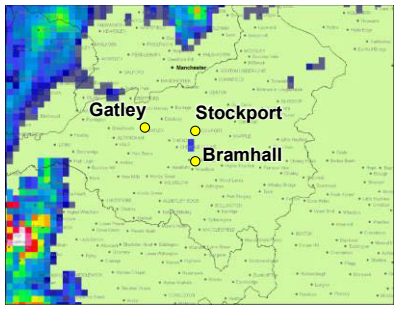
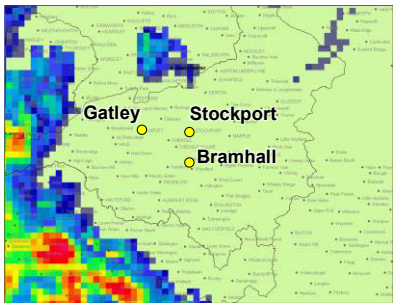


16:00 GMT 13 Sep 2016



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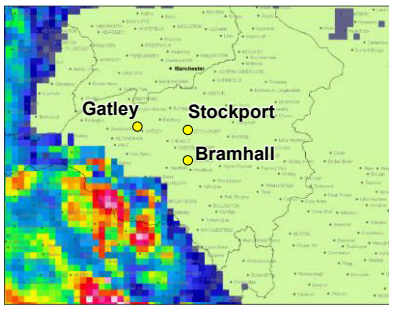

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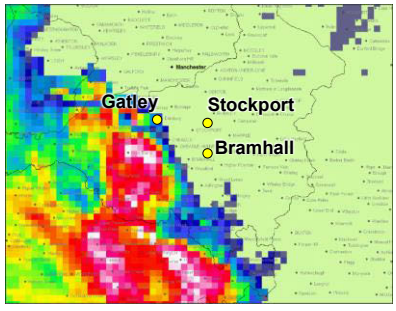

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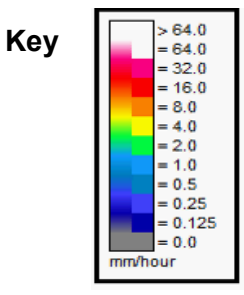
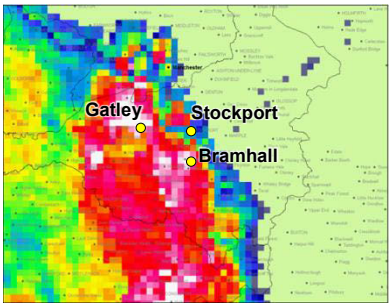


[7] Contains public sector information licensed under the Open Government Licence V3.0

Figure 2.2 : Rainfall radar images for the second downpour – 13 September 2016[8]

Second Downpour 17:00 to 18:15



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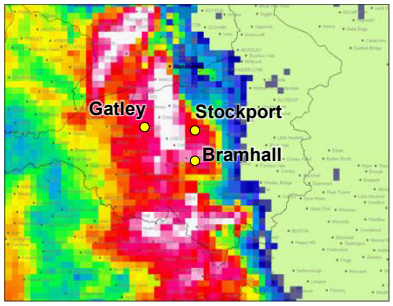

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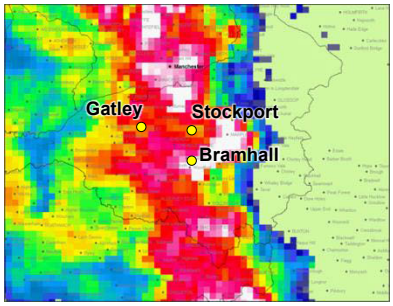

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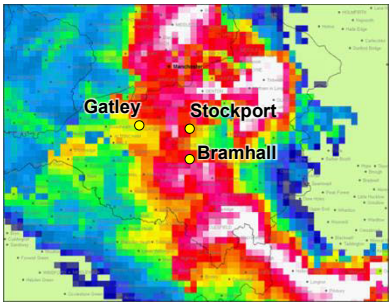

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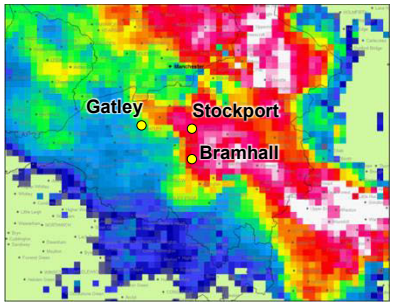

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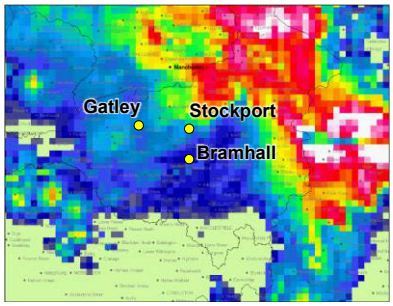

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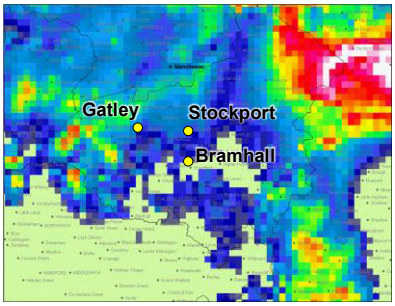
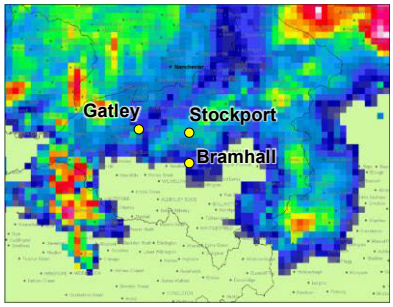


18:30 GMT 13 Sep 2016



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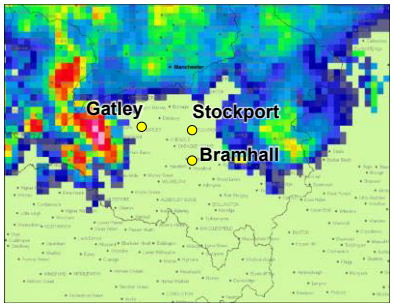

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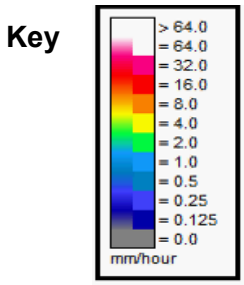


[8] Contains public sector information licensed under the Open Government Licence V3.0

2.2.2 Rain Gauge Records

One Environment Agency rain gauge is located within Stockport at Meadowbank School in Cheadle. The rain gauge is a tipping bucket rain gauge recording at 15-minute intervals. It is noted that the gauge data has not yet been verified and should be used with some caution.

Figure 2.3 illustrates the daily rainfall totals recorded every day during the month of September 2016. The 13th September is immediately identifiable as an isolated event and a standout day of rainfall with over three times the amount of rainfall on this day compared with any other day in the month.

Analysis of the rain gauge data reveals that 85mm of rainfall was recorded during the whole September, of which 37mm was recorded on the 13th September, which is equivalent to 44% of the total rainfall for September. This correlates with the Hydrological Summary report's statement that some parts of the UK received most of their monthly rainfall during downpours mid-month.

Figure 2.3 : Daily rainfall totals – Meadowbank School Rain Gauge September 2016

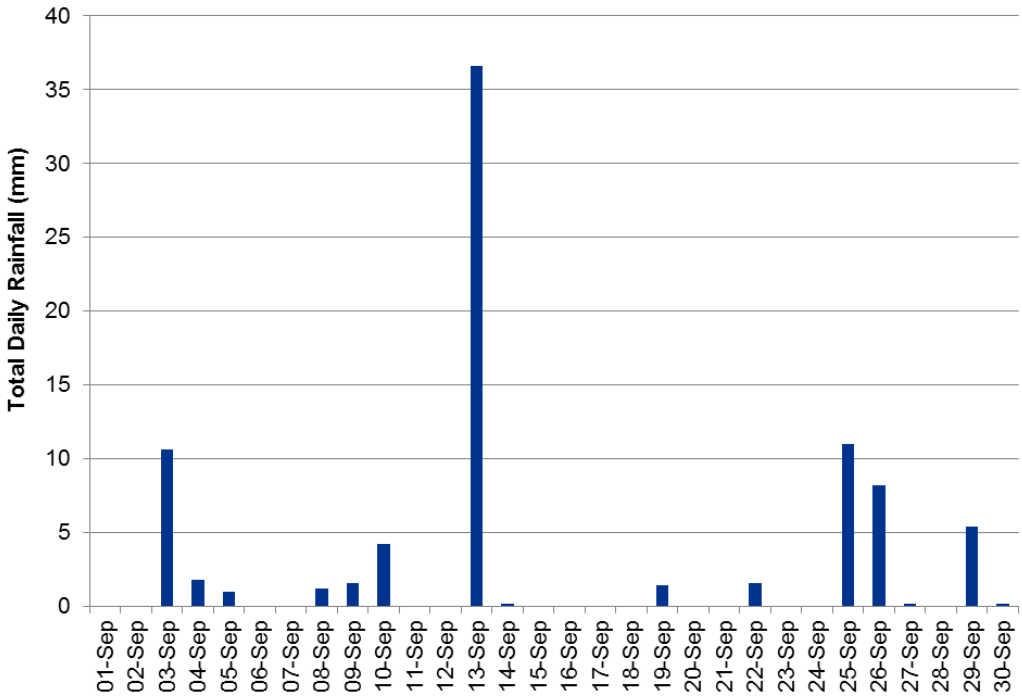


Figure 2.4 provides a breakdown of the hourly rainfall totals across 24 hours on the 13th September 2016. The data shows that rainfall (over Cheadle) was confined to the late afternoon / early evening on the day of the flooding, with the greatest amount of rain falling between 17:00 and 18:00. The gauge did not record any rainfall on this day before 15:00 and again after 20:00.

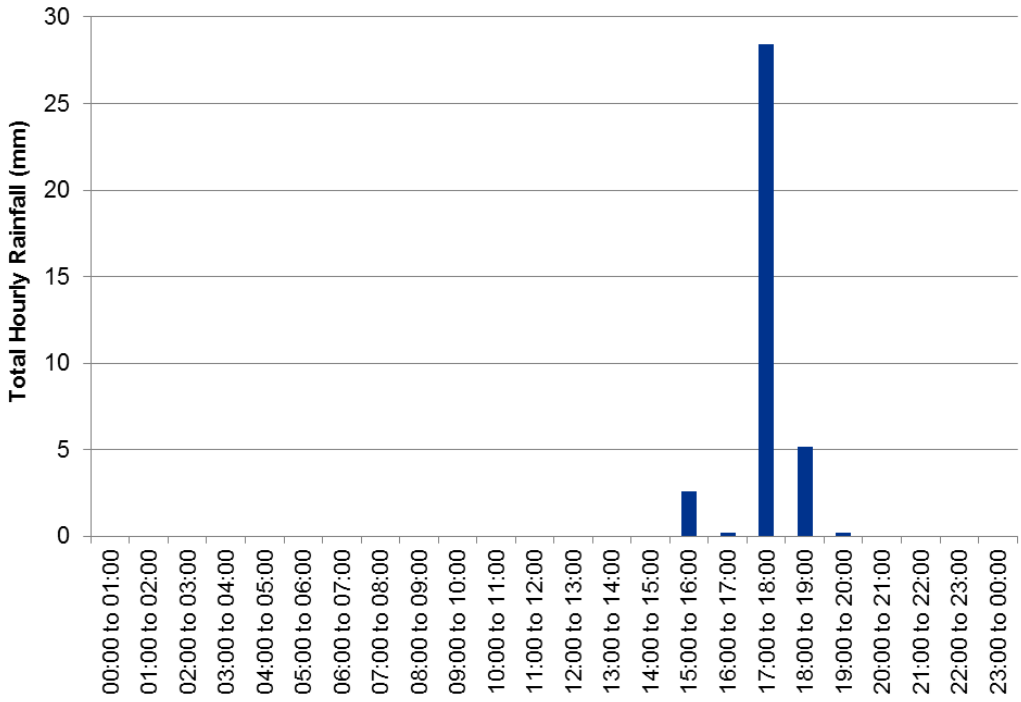
On closer inspection, the data shows that:

- 3mm of rain fell over half an hour between 15:15 and 15:45, followed generally by a break in rainfall,
- 34mm of rain fell over an 1.5 hours between 17:00 and 18:30, followed (by and large) by no further rainfall during the rest of the day; and
- Between 17:00 and 18:30, the peak rainfall intensity reached 45 mm/hour. The Met Office considers that rainfall intensities exceeding 32mm/hour are indicative of torrential downpours.

When comparing the rainfall radar and rain gauge data, it can be seen that the Cheadle rain gauge does not fully capture the intensity of the first downpour, which highlights the spatial variability of the rainfall events. Therefore, even across one borough, one location may receive significant rainfall, whilst other areas may not

have. Prior to analysis of the source of flooding reported and solely considering the nature of the rainfall event (short duration and high intensity), it would be expected that surface water (pluvial runoff) flooding and public sewer/ private drain flooding would be the primary sources of flooding as the urban drainage system would have been overwhelmed. Fluvial flooding would not have been expected, as this is more typically the result of rain falling over a longer period that causes river levels to build.

Figure 2.4 : Hourly rainfall totals – Meadowbank School Rain Gauge 13th September 2016



2.2.3 River Level Records

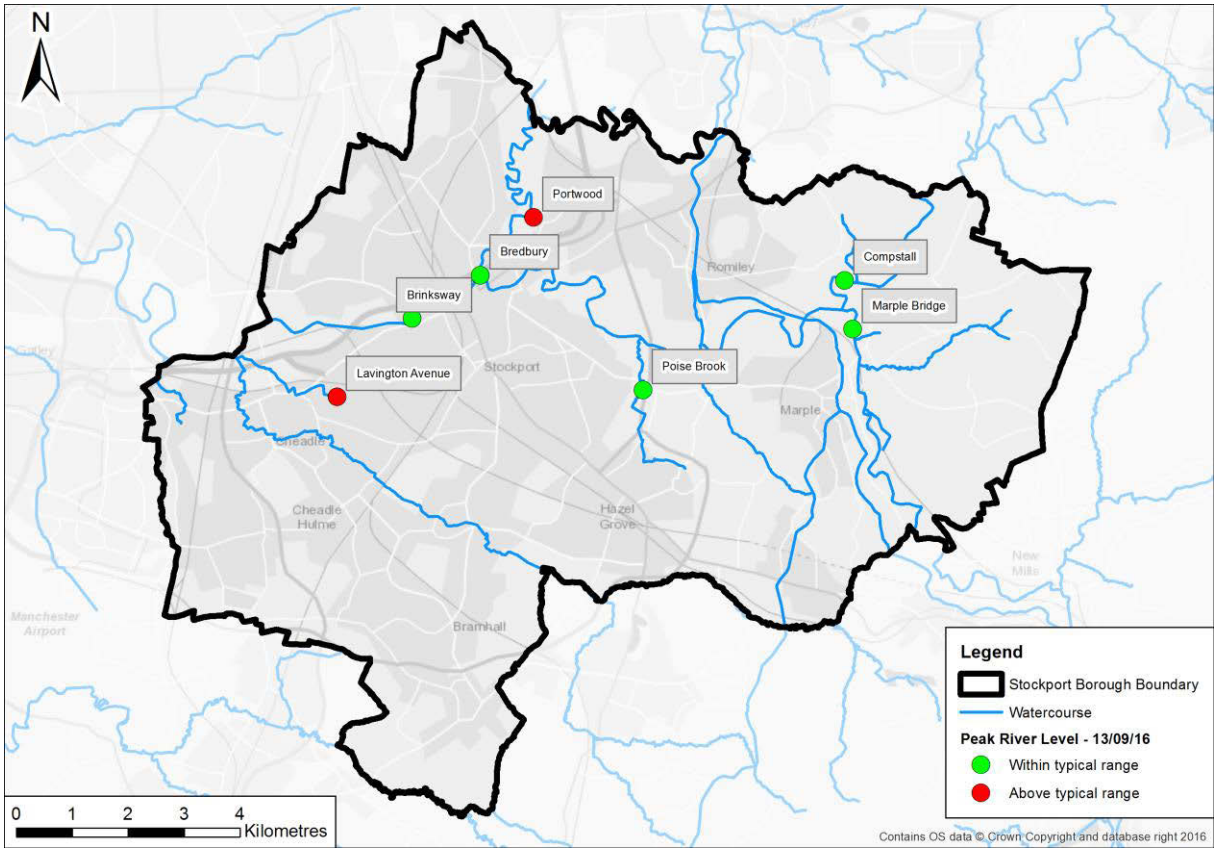
There are seven gauged watercourses within the borough of Stockport, used by the Environment Agency to provide Flood Warnings to properties located in vulnerable areas along these watercourses and to undertake various long-term watercourse analyses.

Figure 2.5 illustrates the location of each of the gauging stations within Stockport and whether the peak water level recorded at each station on the 13th September 2016 was within or above the historic typical range for that station. The data shows that only two stations recorded levels above the historic typical range:

1) Portwood River Gauge Station, River Tame - River levels peaked at 0.7m, with typical river levels ranging between 0.1m and 0.4m, however no flooding from the River Tame in Stockport was reported. The highest level recorded in the station's 47-year history is 4.0m. This would suggest levels were not significantly elevated on the 13th September 2016.
2) Lavington Avenue River Gauge Station, Chorlton Brook - River levels peaked at 1.51m and were the highest in the station's history. However, no flooding was recorded to properties from Chorlton Brook. The station has only been open for approximately 3 years, which may account for the river levels being the highest recorded, but no flooding experienced.

The remaining stations generally recorded typical river levels on 13th September, in the context of the entire month of September; this day was shown to be higher except for Marple Bridge station, which recorded higher levels later in the month. The available gauge data shows that the rainfall event did not result in fluvial flooding from these Main Rivers. This is primarily the result of the nature of the rainfall, which was extreme in terms of intensity, but short in duration, which did not last long enough to allow river levels to keep rising.

Figure 2.5 : River gauge recordings – 13th September 2016



2.3 Property Impacts

According to flood records provided by the Council, the Environment Agency and United Utilities, 660 properties suffered some form of flooding on the 13th September 2016. This was considerably more than the number of properties flooded across the three flood events in June 2016 combined (295).

Due to the nature of flooding, as detailed later in Section 2.3.3, United Utilities recorded the majority of incidents. Caution must be taken then quoting the figures in this report, as there will be a number of outlining reasons why a property may or may not have reported flooding. For example, there may be cases residents were unavailable when contacted by each authority or where residents did not want to report that their property flooded.

This report does not identify the locations of individual properties reported to have flooded during September event for reasons of confidentiality. Instead, the analysis of incidents is made at a Committee Area, based on aggregating the number and type of incidents across individual Council Ward areas. Appendix A contains a full property county per Committee Area and Council Ward. Appendix B provides a further breakdown of incidents per Council Ward area for each Committee Area affected.

2.3.1 Distribution of Flood Incidents

Properties affected by flooding were recorded across all areas Stockport on the 13th September 2016, with Figure 2.6 illustrating the total number of properties affected by Committee Area. Seventeen Council Wards areas were affected by this event with more than five properties flooded, with the major of properties affected located in the more urbanised western half of the borough.

The greatest numbers of properties affected were located in the Committee Areas of Heatons and Reddish with 25% of the total number of reported incidents. There were six Council Ward areas, which recorded 50 or more properties affected as listed in Table 2.1 along with the key roads flooded. Davenport and Cale Green,

Stepping Hill and Heatons North, and Heaton Moor, were the worst hit Council Wards areas with 12% of the reported property flood incidents.

The Werneth Area and Marple Area were the least impacted Committee Areas; only one incident of property flooding was recorded in the Werneth Area, whilst none were recorded in the Marple Area, making this the only Committee Area where no flooding incidents were reported. Owing to the limited extent of flooding in these two Committee Areas the flood impacts in these locations are not analysed in detail within the following sections of the report; please refer to Appendix B for further detail.

Figure 2.6 : Distribution of properties affect by Committee Area – 13th September 2016

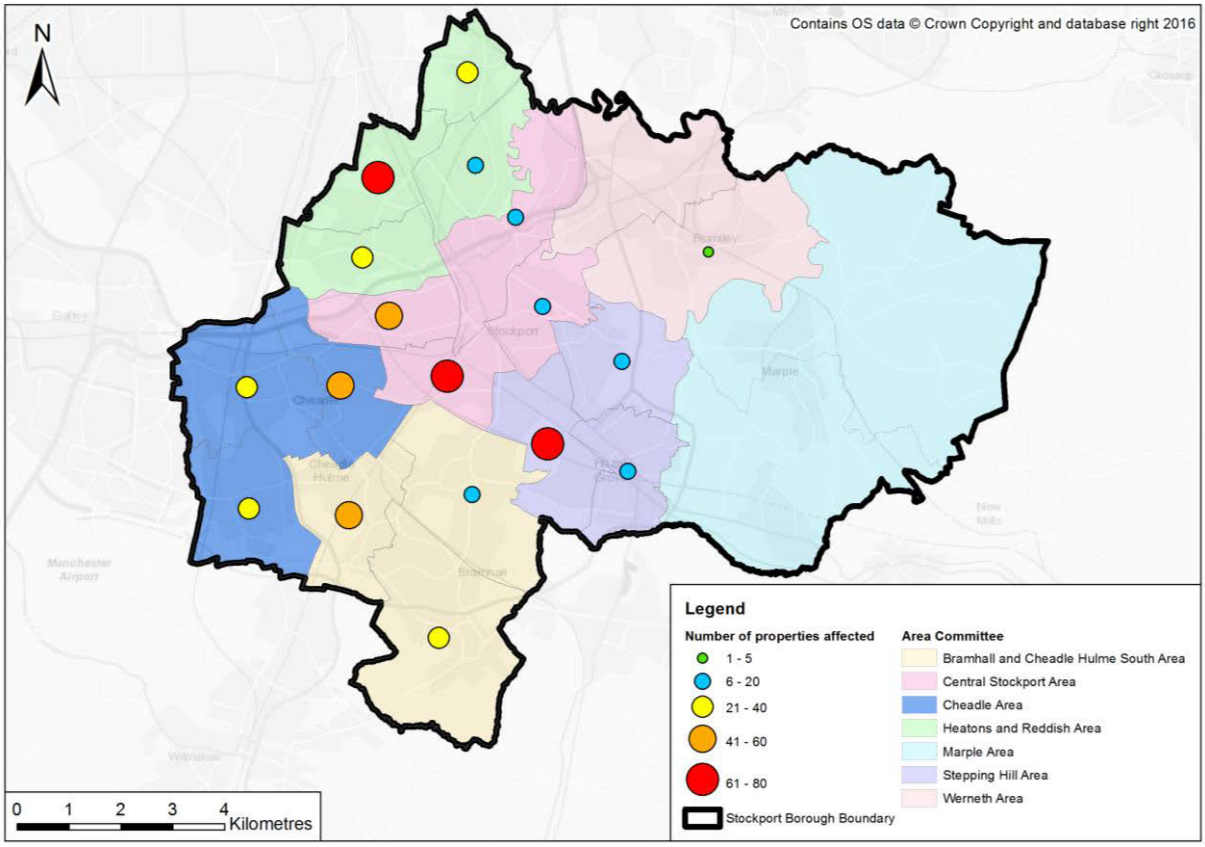


Table 2.1 : Council Ward areas with 50 or more properties affected

Council Ward	Key Roads Flooded
Davenport and Cale Green	Countess Street (21), Clover Avenue (13), Culver Road (8), Kennerley Road (8) and Adswood Road (7)
Heatons North	Buckingham Road West (30), Lynton Road (12), Clifton Road (8) and Buckingham Road (8)
Stepping Hill	Linden Grove (24), St. Saviours Road (15), Belgrave Crescent (9), Dial Road (7), Cherry Tree Lane (6) and Gower Avenue (6)
Cheadle Hulme North	Ellesmere Drive (18), Madison Avenue (14), Victoria Avenue (8) and Queens Road (5)
Edgeley and Cheadle Heath	Edgeley Road (32) and St. Lesmo Road (6)
Cheadle Hulme South	Hill Top Avenue (31), Nursery Road (5) and Hulme Hall Road (5)

2.3.2 Flood Incidents by Property Type

The flood incident data shows that out of the 660 reported incidents, 92% were residential properties of which 78% reported flooded internally. One of the key facts taken from the incident data is that of the residential properties who reported internal flooding, 80% were associated with basement flooding only, which is also an indicator of the cause of flooding as highlighted in Section 2.3.3.

Figure 2.7 and Figure 2.8 illustrate the number of flood incidents by impact and property type affected across the Committee Areas heavily affected.

Figure 2.7 : Flood incidents by impact

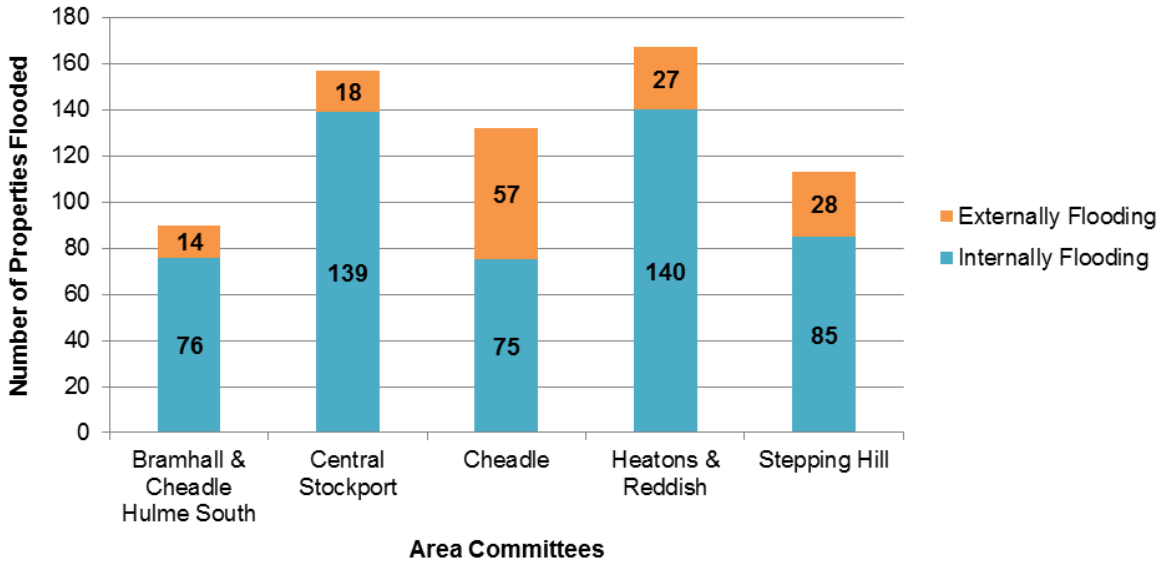
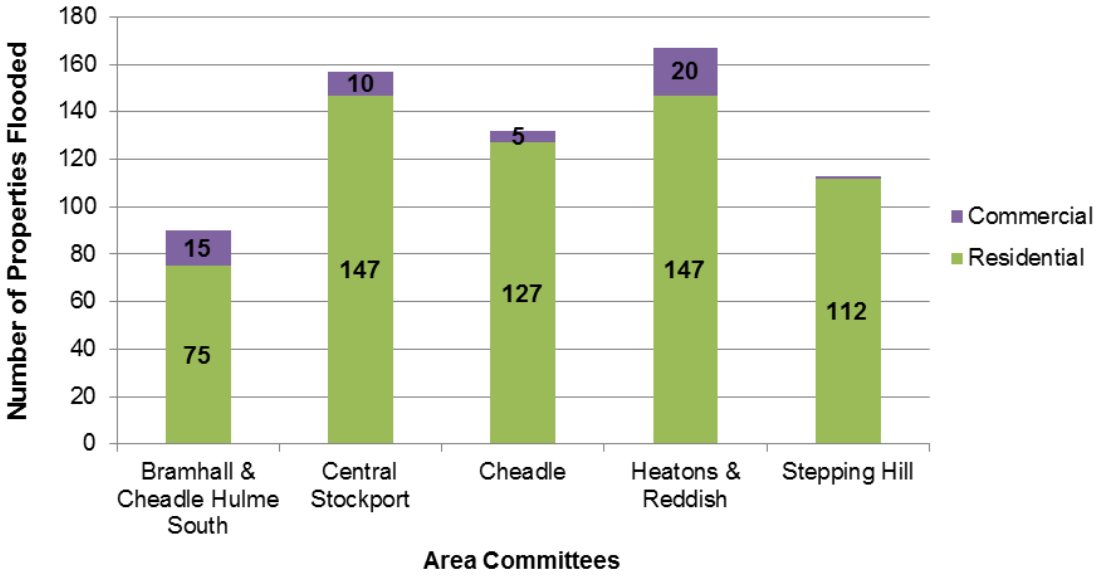


Figure 2.8 : Flood incidents by property type



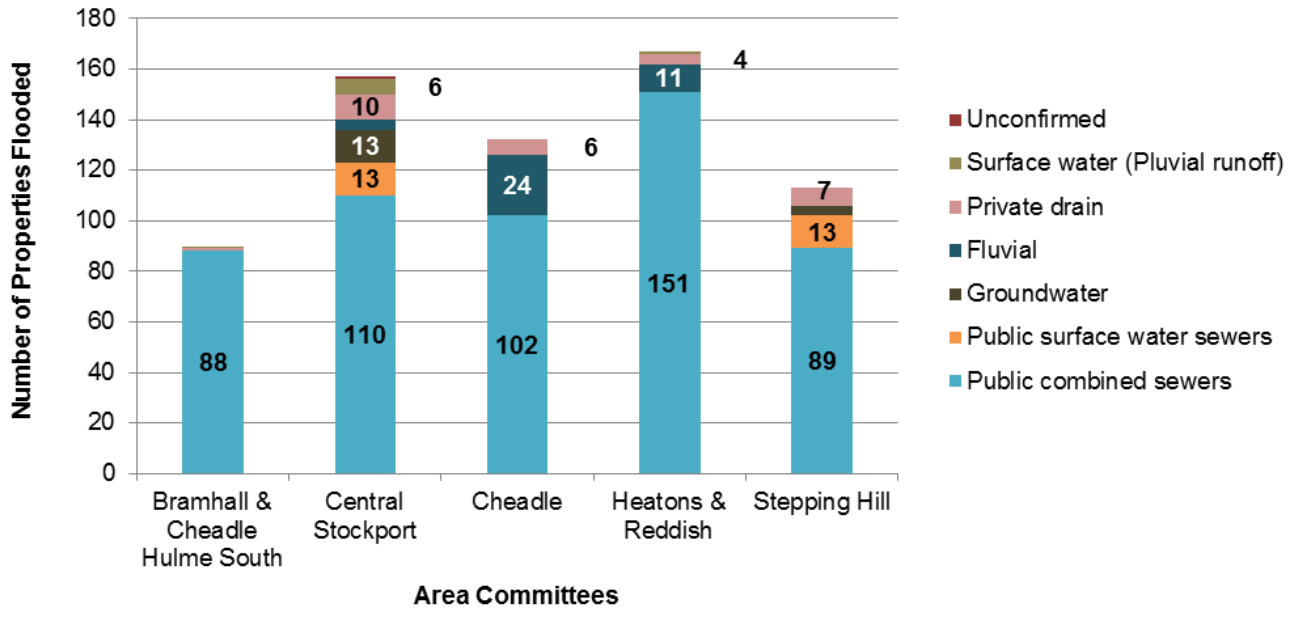
2.3.3 Flood Incidents by Source of Flooding

Each incident recorded has been allocated a source of flooding based on information collected by the authority in which it was reported to or following subsequent investigations. Table 2.2 provides a general description of the different sources of flooding. Not all sources of flooding listed will have been observed during the event. Figure 2.9 illustrates the number of incidents by source across the Committee Areas heavily affected.

Table 2.2 : Source of flooding

Source of Flooding	Description
Fluvial	Exceedance of the flow capacity of river channels (from either a Main River or Ordinary Watercourse), leading to overtopping of riverbanks and inundation of floodplain.
Surface Water (Pluvial Runoff)	Intense or prolonged rainfall exceeding the available infiltration capacity and / or drainage capacity leading to overland flows and surface water flooding where it becomes obstructed or collects in low-lying areas prior to entering a drainage network.
Public Surface Water Sewers	Exceedance of capacity and / or blockage of public or transferred surface water sewers leading to water discharging from manholes or backing up and entering buildings directly.
Public Combined / Foul Sewers	Exceedance of capacity and / or blockage of public or transferred foul or combined sewer leading to contaminated water discharging from manholes or backing up and entering buildings directly.
Private Drain	Exceedance of privately maintained sewers leading to water discharging from manholes or backing up and entering buildings directly.
Highway Flooding	Exceedance of highway drainage network or sewers (in which they discharge into) leading to surface water flooding along the highway or to nearby grounds and buildings.
Groundwater	Where water held underground rises to a level where it breaks the surface (ground level) in areas away from watercourses and drainage pathways. It may also stay underground but reach a level where it seeps into basements or cellars.
Water Retaining Infrastructure	Flooding from canals and reservoirs can occur when the structure is overtopped or breached.

Figure 2.9 : Flood incidents by source of flooding



According to the flood incident data, the main source of the property flooding on the 13th September 2016 was from the public combined sewers, with 82% of all incidents attributed to this source. In these instances the volume of surface water (pluvial runoff) drained into the combined sewer systems caused the network to back up and flood properties directly. This flooding would have mainly affected properties with basements, as previously mentioned above. Flood water from the combined sewer system would also have contained foul water. The Committee Areas of Central Stockport, and Heatons and Reddish both recorded a large number of properties flooded by public combined sewers, the majority of which were residential and flooded internally.

The remaining incidents were split between fluvial flooding (6%), public surface water sewer flooding (4%), private drain flooding (4%), groundwater flooding (3%) and flooding from surface water (pluvial runoff) (1%). It is also worth noting that 24 properties in Cheadle were flooded from fluvial sources.

This data supports the hydrological analysis of the event, which states that the high intensity, short duration rainfall event would have overloaded the urban drainage network, causing this to be the primary source of flooding. Public sewer flooding was observed across large areas of the borough, however although the rainfall event may have resulted in localised ponding of surface water (pluvial runoff) along the highway network, this was generally not to depths significant enough to flood into properties. Very little fluvial flooding to properties was reported, which supports the analysis of the river gauge data.

2.3.4 Flood Incidents by Cause of Flooding

Each incident recorded has been allocated a principal cause of flooding based on information collected by the authority in which it was reported to or following subsequent investigations. Table 2.3 provides a general description of the different causes of flooding. Not all causes of flooding listed will have been observed during the event. The different causes of flooding will also be linked to the sources of flooding discussed above.

Table 2.3 : Principal causes of flooding

Cause of Flooding	Description
Exceptional Weather	Natural weather conditions such as short duration heavy rainfall and thunderstorms or prolonged, extensive rainfall. Storm events are likely to result in large amounts of sheet runoff from adjacent land (urban or rural) and are likely to be larger than design standards.
Hydraulic Inadequacy	Storm water flow is unable to pass through the network due to a permanent problem (e.g. flat gradient, small diameter) with network likely to be below national design standards (weather not classified as exceptional and no blockages or defects present)
Blockages	Temporary problems such as blockages of channels, culverts and sewers caused by debris or siltation
Asset Failure	Structural failure of assets such as culverts, flood defences, canals and reservoirs or failure of equipment failure such as pumping stations

United Utilities recorded the majority of the flood incidents and their post event investigations found that 84% of the incidents were due to the exceptional weather experienced, which would have been greater than the national design standards of their public sewer network. Furthermore, 70% of the incidents relating to exceptional weather also resulted in basement flooding, which supports the mechanism that foul floodwater would have entered properties directly due to the backing up of the public combined sewers.

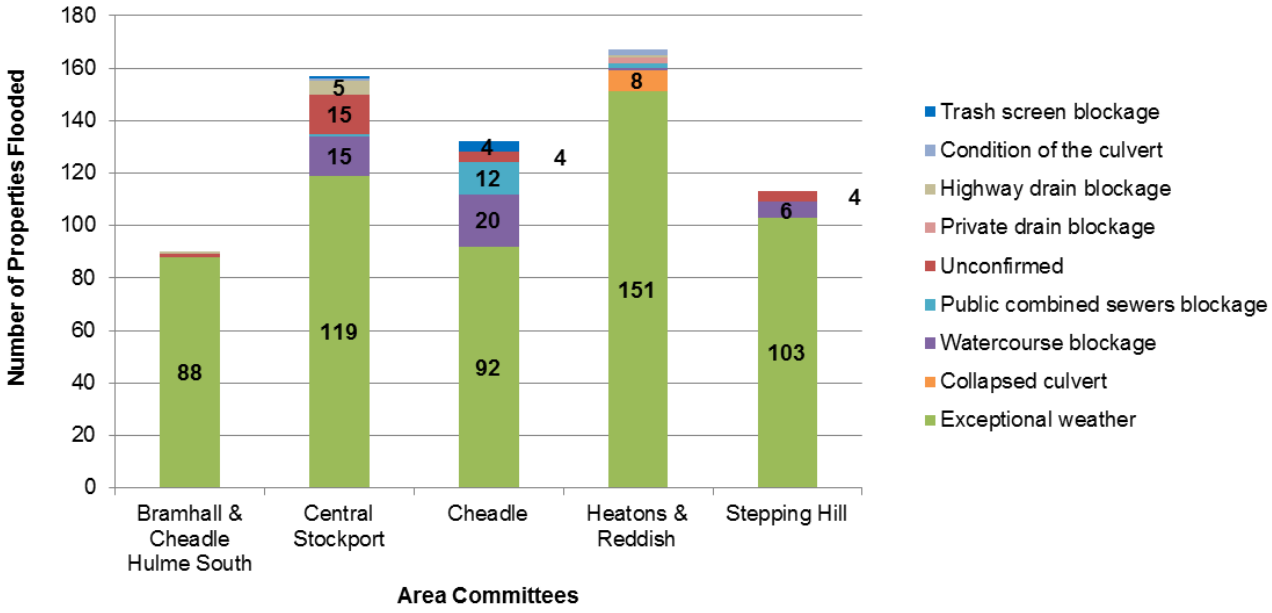
In addition to general overloading of public sewers, incidents were also attributed to local blockages of public sewers, private drains and highway drains and collapsed culverts. Two areas recorded fluvial flooding including:

1) Cheadle West, Cheadle and Gatley: 23 residential properties flooded due to fluvial floodwater overtopping Park House Culvert due to partial blockage of the debris screen. Fluvial flooding was also attributed to surface water (pluvial runoff) flooding along Wilmslow Road, which caused a brick wall to collapse into the watercourse.

2) Heaton Moor and Heatons North: Ten residential properties flooded including eight basements on Clifton Road due to a collapse of the culverted watercourse. A further two basements flooded in Stanley Road from the Heaton Moor culvert, which was recorded to have been in poor condition.

Figure 2.10 illustrates all the flood incidents by cause across the Committee Areas heavily affected.

Figure 2.10 : Flood incidents by cause of flooding



2.4 Other Impacts

In contrast to the June 2016 flood events, according to the Council the high intensity rainfall event that affected Stockport on the 13th September 2016 did not cause significant damage to highway structures, parks, greenspaces nor Public Rights of Ways.

However, the September event did result in local disruption to road users as surface water (pluvial runoff) flooding caused certain roads to become impassable, but there were no road closures as a result. There were also no reported incidents of motorway flooding.

According to newspaper reports[9], both Stockport Station (pedestrian walkway) and Gatley Station flooded during the height of the event, the connecting line to Manchester Airport was affected, and there were circuit failures at Cheadle Hulme track during the night.

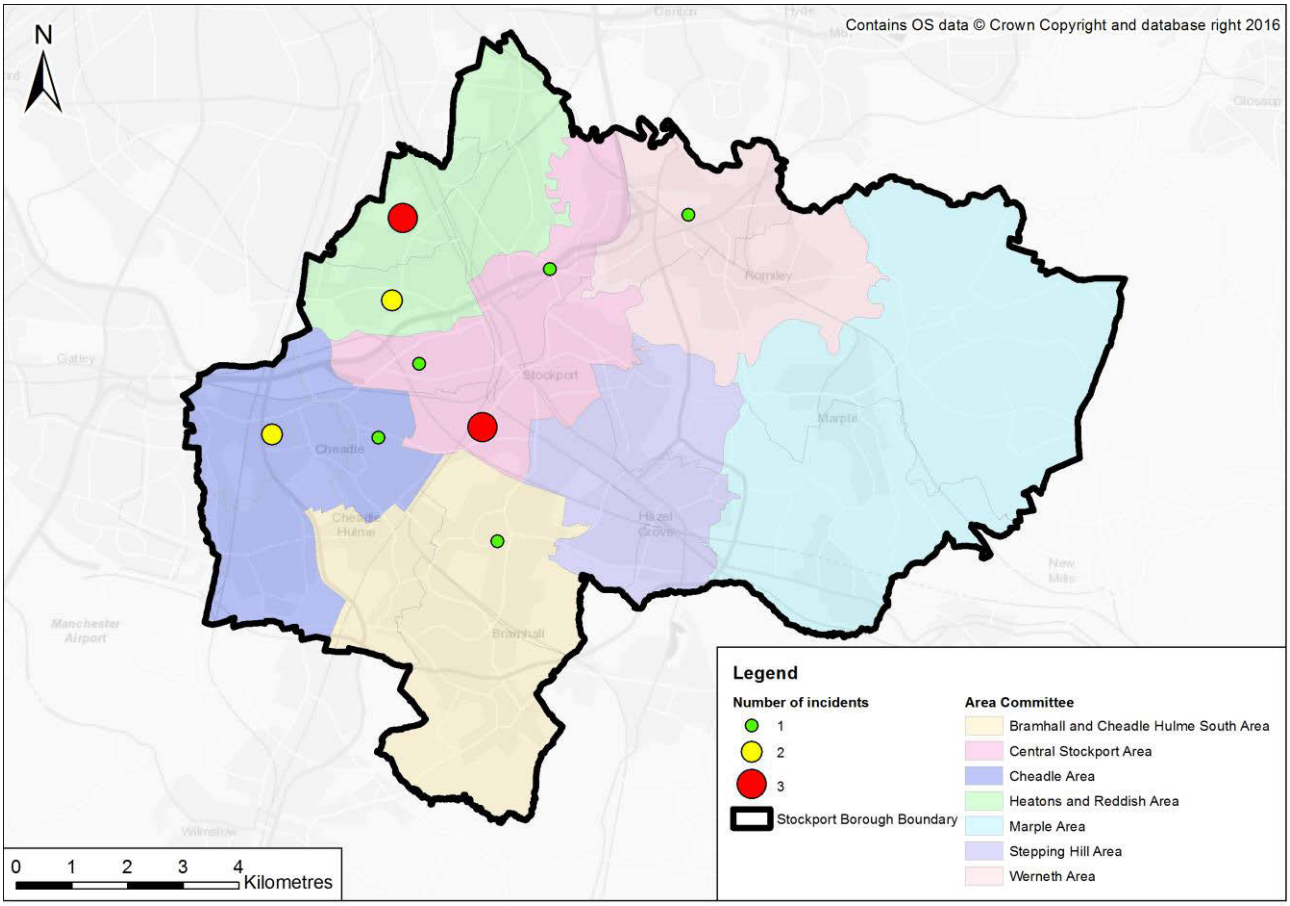
Beyond Stockport, sections of the Metrolink network were subject to flooding during the rainfall event. This affected services on the Rochdale line, where the flooding caused a points issue, and the Manchester Airport and East Didsbury lines where tracks were flooded. Flooding of the tracks at the Market Street tram stop in Manchester City Centre was heavily reported in the media, but is not reported to have affected this service. Full services on the affected lines were able to resume later in the evening when most of the track flooding had subsided.

The most significant impact to the Metrolink network and services was caused by lightning strikes from the storm, causing communications losses to electrical substations and trips on overhead power lines. This disrupted mainly the Bury and Altrincham lines, where the service was affected from 18:00 on the 13th September until the following morning. Where lightning strikes disrupted other lines, this was more temporary and Metrolink were able to quickly re-open the lines.

[9] http://www.manchestereveningnews.co.uk/news/greater-manchester-news/greater-manchester-plunged-darkness-great-11883098 /

According to Greater Manchester Fire and Rescue Service (GMFRS), North West Fire Control operators (which handle emergency calls from Cumbria, Lancashire, Greater Manchester and Cheshire) received nearly 200 emergency calls about flooding incidents on the 13th September 2016[10], with over a hundred calls being received in 90 minutes during the height of the storm. According to the GMFRS, they were called out to 15 incidents across Stockport to ensure the safety of occupants where electricity supplies were affected by flooding. Figure 2.11 illustrates the distribution of the incidents in Stockport in which GMRFS responded to during the flood event.

Figure 2.11 : GMFRS call out responses – 13th September 2016



[10] Greater Manchester Fire and Rescue Service (2016) "Firefighters battle to protect communities after GMFRS receives 200 calls about flooding in one night". http://www.manchesterfire.gov.uk/updates/incidents/14sep2016_gmfrsreceives200floodingcallsinonenight/

3. Response and Recovery

The Council, the Environment Agency and United Utilities as Risk Management Authorities (RMAs) along with other authorities responded to the September flood event, by issuing weather and flood warnings, providing immediate assistance to those flooded and carrying out post event investigations, repairs and support.

3.1 Pre-Event Warnings

3.1.1 Weather Warnings

The Met Office issue warnings to the public and emergency responders through the National Severe Weather Warning Service of severe or hazardous weather (rain, snow, wind, fog and ice), which has the potential to cause damage, widespread disruption and/or danger to life. These warnings are given a colour (Table 3.1) relating to a combination of both the likelihood of the event happening and the impact the conditions may have.

The Met Office issued a Yellow Warning of rain for North West England at 02:10 on the 13th September, around 13 hours before the first downpour and 15 hours before the second, heavier downpour, which warned against localised flooding of homes and businesses and susceptible roads.

Table 3.1 : Met Office Weather Warning Codes[11]

Weather Warning Code	Likelihood of Severe Weather	What it means
No Severe Weather	Very Low	A very small risk of severe weather is possible.
Be Aware	Low	Severe weather is possible over the next few days and could affect you. Keep an eye on the latest forecast and be aware that the weather may change or worsen, leading to disruption of your plans in the next few days.
Be Prepared	Medium	There is an increased likelihood of bad weather affecting you, which could potentially disrupt your plans and possibly cause travel delays, road and rail closures, interruption to power and the potential risk to life and property.
Take Action	High	Extreme weather is expected. You should take action to keep yourself and others safe from the impact of the weather. Widespread damage, travel and power disruption and risk to life is likely. You must avoid dangerous areas and follow the advice of the emergency services and local authorities.

3.1.2 Flood Warnings

The Environment Agency issue flood warnings to allow communities to prepare for fluvial flooding from Main Rivers. Three different Flood Warning codes are used depending on the severity of flooding expected (Table 3.2); these are also issued at different intervals in advance of flooding.

Flood Alert areas generally cover a large area, whilst Flood Warning areas are usually more detailed and broken down into specific locations. Locations within a Flood Alert area are also not necessarily within a Flood Warning area.

[11] Met Office (2015) Weather Warning Guide. http://www.metoffice.gov.uk/guide/weather/warnings

Table 3.2 : Environment Agency Flood Warning Codes

Flood Warning Code		What it means	When it's used	What to do
	**Flood Alert**	Flooding is possible, be prepared	Two hours to two days in advance of flooding	• Be prepared to act on your flood plan • Prepare a flood kit of essential items • Monitor local water levels and the flood forecast on the Met Office website
	**Flood Warning**	Flooding is expected, immediate action required	Half an hour to one day in advance of flooding	• Move family, pets and valuables to a safe place • Turn off gas, electricity and water supplies if safe to do so • Put flood protection equipment in place
	**Severe Flood Warning**	Severe flooding, danger to life	When flooding poses a significant threat to life	• Stay in a safe place with a means of escape • Be ready should you need to evacuate from your home • Co-operate with the emergency services. • Call 999 if you are in immediate danger

According to the Environment Agency, one Flood Alert and three Flood Warnings were issued during the September 2016 flood event in Stockport. A Flood Alert was issued for the Middle River Mersey catchment, covering Stockport with Gatley, Cheadle Hulme and Cheadle, late in the evening on the 13 September 2016. The Flood Alert occurred two hours after the end of the rainfall. There was fluvial flooding at the surroundings of Wilmslow Road close to Micker Brook in the Cheadle Area Committee, which affected 23 properties.

Table 3.3 : Flood Alerts issued

Flood Alert Area	Alert Issued	Alert Withdrawn
Middle River Mersey catchment including areas near Bramhall, Stockport, Sale, Altrincham and Urmston	21:07 on 13 Sept 2016	09:29 on 14 Sep 2016

Chorlton Brook was the only watercourse within Stockport to receive Flood Warnings on the 13 September 2016. These flood warnings occurred around at the end of the storm, one hour later than Chorlton Brook peaked at Lavington Avenue gauge station. There were flooded properties in the flood warning area but the reason was not Chorlton Brook, it was a combination of different sources, mainly sewer flooding.

Table 3.4 : Flood Warnings issued

Flood Warning Area	Warning Issued	Warning Withdrawn
Chorlton Brook at Cheadle, Sports Field, Palmer Avenue and Cuthbert Road Areas	19:04 on 13 Sep 2016	09:15 on 14 Sep 2016
Chorlton Brook at Cheadle, Boundary, Bangor Road, Shakespeare Drive and Ashbourne avenue areas	19:54 on 13 Sep 2016	09:12 on 14 Sep 2016
Chorlton Brook at Cheadle, Carrs and Stockport Road, Cranleigh Drive, Jackson Street Areas	19:04 on 13 Sep 2016	09:21 on 14 Sep 2016

3.2 Immediate Responses

Table 3.5 outlines the responses undertaken across the borough from both RMAs and other Authorities. Table 3.6 outlines community specific responses.

Table 3.5 : Immediate responses – Stockport wide

Lead RMA	Response
Council as LLFA	Major emergency response staff available 24 hours a day (and all year round)
	Coordination with emergency services
United Utilities	Customer support and incident logging
Environment Agency	Flood support provided via incident hotline
	On-site response to provide support to residents and investigate flooding incident

Table 3.6 : Immediate responses – community specific

Non-RMA	Response	Council Ward
Network Rail	Closed and cleaned Gatley Station.	Cheadle and Gatley
Greater Manchester Fire and Rescue Service	Pumped out six properties, four properties made safe from flood impacts, gave advice and stood by without action where needed	Davenport and Cale Green, Heatons North, Heatons South, Bredbury and Woodley, Edgeley and Cheadle Heath, Cheadle and Gatley, Cheadle Hulme North, Bramhall North, Brinnington and Central

3.3 Post-Event Responses

Following the flood event, United Utilities investigated each flood incident recorded and where possible determined the source and cause of flooding; blockages were also cleared if found. In some cases, United Utilities recorded the incident to be associated with non-United Utilities assets, such as private drains (which are the responsibility of the homeowner) and surface water (pluvial runoff) and groundwater sources. United Utilities then reported these to the Council as LLFA.

The Council have provided financial assistance to those properties impacted by the September 2016 flood event in the form of grant funding and council tax freezes, where it can be demonstrated that a property was flooded internally. Over 80 flooding grants have been approved to householders during the period from the start of July to the beginning of January 2017. The applications rolled over from the June flooding events to the September flood, therefore some householders may have applied in October for a grant from the June flood, or in November for the September flood. In some cases, the properties have been flooded during both the June and September events and have been eligible for grant funding for both.

Table 3.7 outlines responses undertaken post event across the borough. Table 3.8 outlines community specific responses immediately after and in the days following the September 2016 flooding events.

Table 3.7 : Post-Event response – Stockport wide

Lead RMA	Response
Council Highways Department	Debris clearance from roads and highway structure inspections.
	All highway drainage gullies in flooded areas cleaned and known hotspots prioritised for inspection.
Council as LLFA	Recovery Coordination Group set up to manage the ongoing response to the flooding incidents, supporting local residents and businesses.
	Flood grants made available and publicised on the Council website.
	Inspection of parks, greenspaces and Public Rights of Way to identify damage and repairs required.
	Carried out extensive clean up after flooding.
	Contacted the businesses affected and site inspections carried out at the flooded properties.
	Independent review into the flooding commissioned (this report).
	Meetings with other RMAs to establish a coordinated response for the recovery and support of local residents.
	An extra phone line has been installed into the Control Room to provide additional capacity for receiving calls during periods of high traffic.
	The accessibility and usefulness of information held on the Council website has been improved.
	Data collection methods to record flooded properties have been improved.
	Maintenance programme for the drains, gullies and debris screens across the borough to be reviewed to help prevent blockages.
	Capacity of the Council's out of hour's response capability to be reviewed.
	Policy on sandbags to be reviewed.
United Utilities	Carried out extensive cleaning and investigation works on the drainage system.
	Assisted with clean-up operations and provided support to affected customers.
	All reported flooding incidents investigated.
	All blockages found on United Utilities maintained sewers cleared.
	Contacted customers eligible for discretionary payment system.
Environment Agency	Door-to-door survey and support in areas affected by fluvial flooding.
	Data gathering and follow-up investigations into fluvial flooding.

Table 3.8 : Post-event responses – community specific

Lead RMA	Response	Ward
Council Highways Department	The Highway drain in Brinnington Road has been mapped and the removal of the tree roots has been scheduled for March 2017.	Brinnington and Central
	Further investigation of possible tree root problem.	Edgeley and Cheadle Heath
	Drain cleaning and CCTV surveys.	Cheadle Hulme South
	Arranged to clean up the mud and sludge from the highway drainage manhole chamber.	Bredbury Green and Romiley
	Provide additional drainage assets also kerbline need to be increased, which is part of the TCAP scheme.	Brinnington and Central
	Arranged for 10 gullies to be replaced.	Bramhall North
Council as LLFA	Sandbags issued to householders on Brydon Avenue.	Heald Green
	Clean up after flooding of Gower Avenue, silt has now been removed.	Stepping Hill
	Investigated the section of culverted watercourse between Appleby Close and open brook downstream. Partial blockage within culvert identified and remedial works ongoing to remove blockage and restore culvert capacity. Excavation works undertaken to re-establish the watercourse channel. Site clearance works undertaken to prevent further debris entering the watercourse. Internal condition survey of culvert is ongoing. The results will be passed to Network Rail in order that a comprehensive investigation of the culvert watercourse network can be progressed and any issues that could have been a factor in the recent flooding are identified. Remedial works to address any defects, if required, will then be programmed to restore the capacity of the culvert and minimise the risk of future flooding.	Davenport and Cale Green
	Advised the residents that non-return valves or closing off the drain can be used to prevent flooding in the cellar.	Edgeley and Cheadle Heath
	Visited Branksome Drive and spoke to affected residents.	Heald Green
	CCTV of the culverted watercourse along Clifton Road was carried out and a collapse identified. The collapse has been subsequently repaired. The riparian owners of the culvert have been notified of the structural issues found and issued with a notice to remedy the condition of the culvert. Further investigation has been programmed for the culvert at Clifton Road as one of the manholes is holding water. Cleaning of gullies and the road at another watercourse has also been carried out.	Heatons North
	CCTV survey was carried out of an unmapped existing drain in Epsom Close.	Hazel Grove
	Visited residents to assess extent of flooding and flooding mechanism, after the section of wall within brook has been removed.	Cheadle and Gatley
	Debris screen cleared at Gorsey Mount Street.	Manor

4. Recommended & Ongoing Actions

4.1 Recommended & Ongoing Actions across Stockport

The purpose of this report is to document the investigations carried out into the flood events that affected the communities of Stockport in September 2016 and for RMAs to consider and prioritise actions relevant to each authority. In this way, communities can be clearer on what has happened since the floods, and what each authority is planning to do to reduce or mitigate the impacts of future flooding within the borough.

As highlighted earlier in the report, the majority of flooding incidents on 13th September 2016 were caused by the exceptional rainfall event, which overwhelmed the public combined sewers. On the day of the event, the majority of the combined sewers performed as designed, draining surface water and providing a valuable function in protecting against surface water flooding up to a point. However, the public combined sewers affected were designed and built to national sewer standards, and would not be expected to deal with such an extreme rainfall event exceeding these standards.

Due to the cause and widespread nature of flooding experienced, it is not possible to identify detailed actions for each community affected. This section of the report therefore contains more general action recommendations, which apply across the whole borough of Stockport (Table 4.1) to improve the resilience of the community to flooding. Where possible, ongoing or planned actions are recommended to be taken in specific locations (Table 4.2).

Table 4.1 : Recommended and ongoing actions – Stockport wide

Lead RMA	Recommended Action	
The Council Highways Department	1.1	Maintain efficient operation of highway drains.
	1.2	Ensure necessary maintenance is carried out to local highway drains following flood events.
	1.3	Consider ways to raise awareness of damage caused by driving through floods.
The Council as LLFA	2.1	Consider provision of Property Level Protection for properties at risk.
	2.2	Ensure property owners are aware of their responsibilities as riparian owners of watercourses (whether open or culverted watercourses).
	2.3	Investigate and address issues identified as relating to private drains.
The Council as LLFA and the Environment Agency	3.1	Continue to manage flood risk from new development. Seek flood risk benefits from new development where possible.
United Utilities	4.1	Maintain efficient operation of separate surface water and combined sewers.
	4.2	Ensure effective communication with the Council regarding flooding events/ potential flood issues.
Environment Agency	5.1	Review borough-wide flood management.
	5.2	Ensure watercourses are suitably maintained.
	5.3	Review trigger levels for Flood Alerts in this area.
	5.4	Ensure effective communication with the Council regarding flooding events/ potential flood issues.
Property Owners	6.1	Consider installation of Property Level Protection.
	6.2	Check weather forecast and flood warnings regularly.

Table 4.2 : Recommended and ongoing actions – local specific

Lead RMA	Recommended Action		Where
The Council Highways Department	7.1	Review a possible tree root problem at Saint Lesmo Road.	Edgeley and Cheadle Heath
The Council as LLFA	8.1	Review Heaton Moor culvert.	Heatons North
	8.2	Review Park House culvert.	Cheadle and Gatley
	8.3	Consider options to reduce fluvial flood risk on Micker Brook Tributary.	Cheadle and Gatley

4.2 Next Steps

At this stage, the actions listed are recommendations only and their delivery is likely to depend on the RMA securing funding and on other commitments and priorities within each authority. Any major works requiring capital investment, the Council will consider through the Defra funding programme. That said, the Council, as LLFA, will continue to work proactively with the Environment Agency, United Utilities and other RMAs to engage with the communities affected to ensure that flood mitigation is a key part of their present and future programme of works.

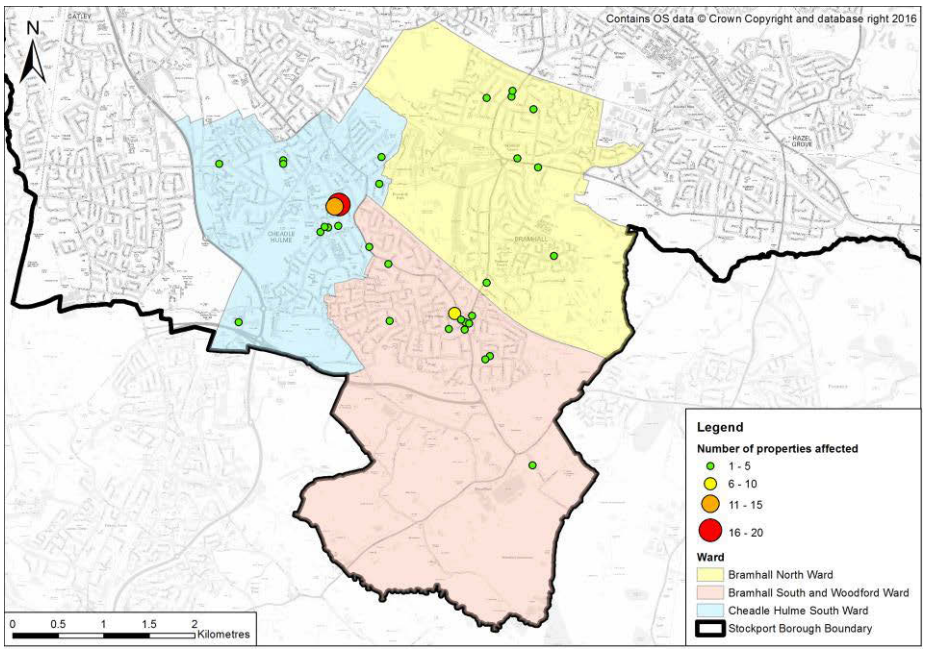
Meanwhile, the communities need to be prepared for more similar extreme weather events in the future, such as heavy and intense downpour after a quite dry period. These kinds of event can be more common due to climate change, and their impacts can be reduced with paying attention to the weather forecast and flood warnings, and regular maintenance of the drains and watercourses.

Appendix A. Flood Incident Register Summary

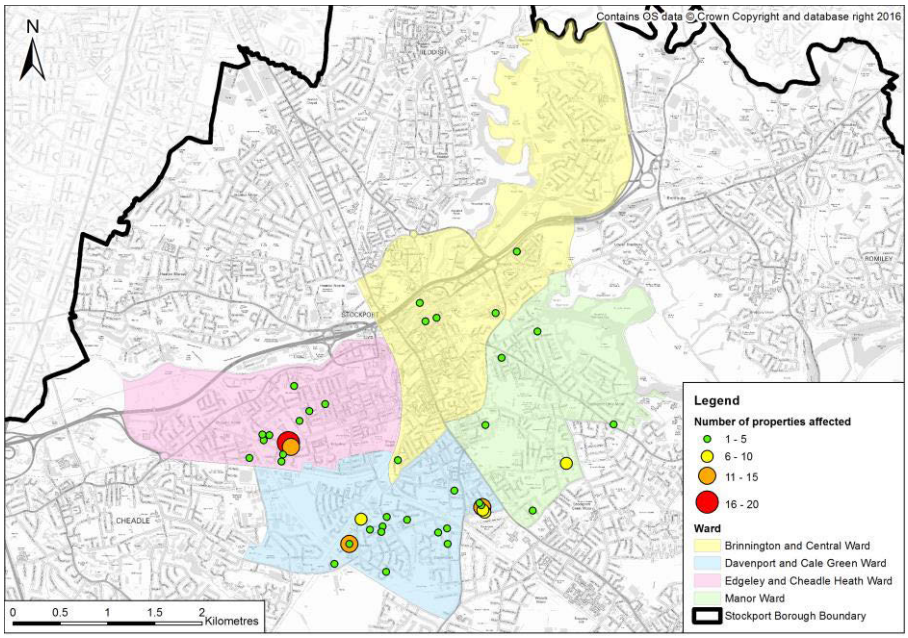
Table A.1 : Number of properties affected across Area Committees

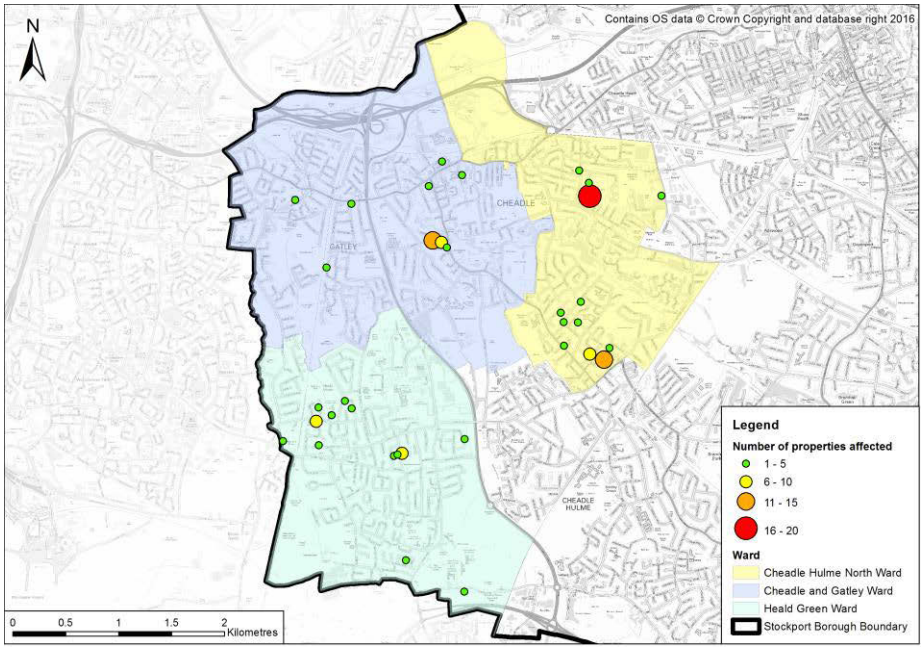
Area Committee	Ward	Internally Flooded	Externally Flooded Only	Total
Bramhall and Cheadle Hulme South Area Committees	Bramhall North	9	5	14
	Bramhall South and Woodford	19	4	23
	Cheadle Hulme South	48	5	53
	Total	**76**	**14**	**90**
Central Stockport Area Committee	Brinnington and Central	6	1	7
	Davenport and Cale Green	67	13	80
	Edgeley and Cheadle Heath	52	2	54
	Manor	14	2	16
	Total	**139**	**18**	**157**
Cheadle Area Committee	Cheadle and Gatley	22	13	35
	Cheadle Hulme North	32	26	58
	Heald Green	21	18	39
	Total	**104**	**74**	**132**
Marple Area Committee	Marple North	-	-	-
	Marple South	-	-	-
	Total	**-**	**-**	**-**
Heatons and Reddish Area Committees	Heatons North	60	18	78
	Heatons South	34	5	39
	Reddish North	31	3	34
	Reddish South	15	1	16
	Total	**140**	**27**	**167**
Stepping Hill Area Committee	Hazel Grove	5	10	15
	Offerton	7	13	20
	Stepping Hill	73	5	78
	Total	**85**	**28**	**113**
Werneth Area Committee	Bredbury and Woodley	-	-	-
	Bredbury Green and Romiley	1	-	1
	Total	**1**	**-**	**1**

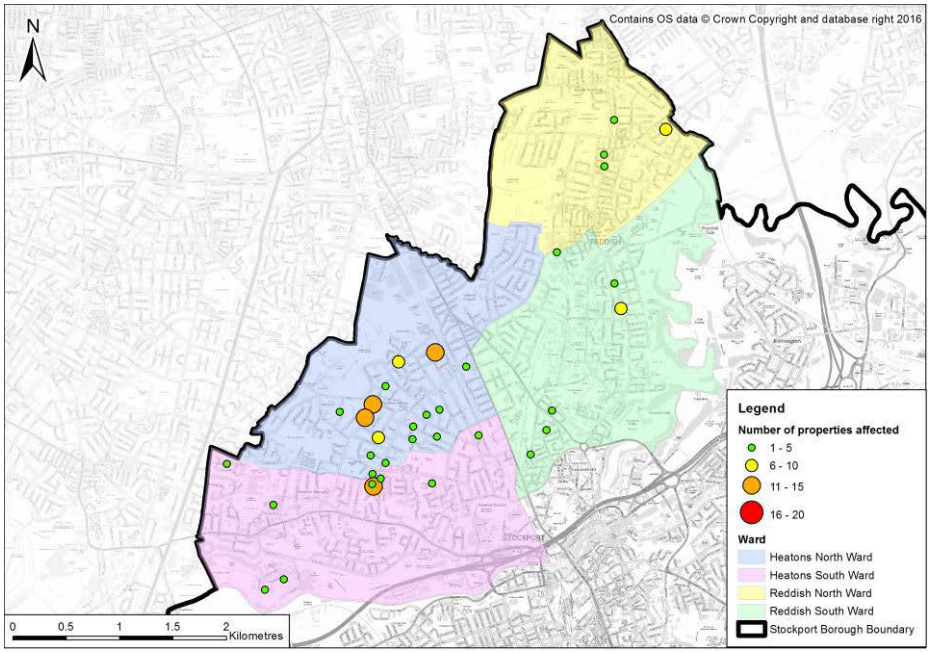
Appendix B. Area Committee Flood Incident Factsheets

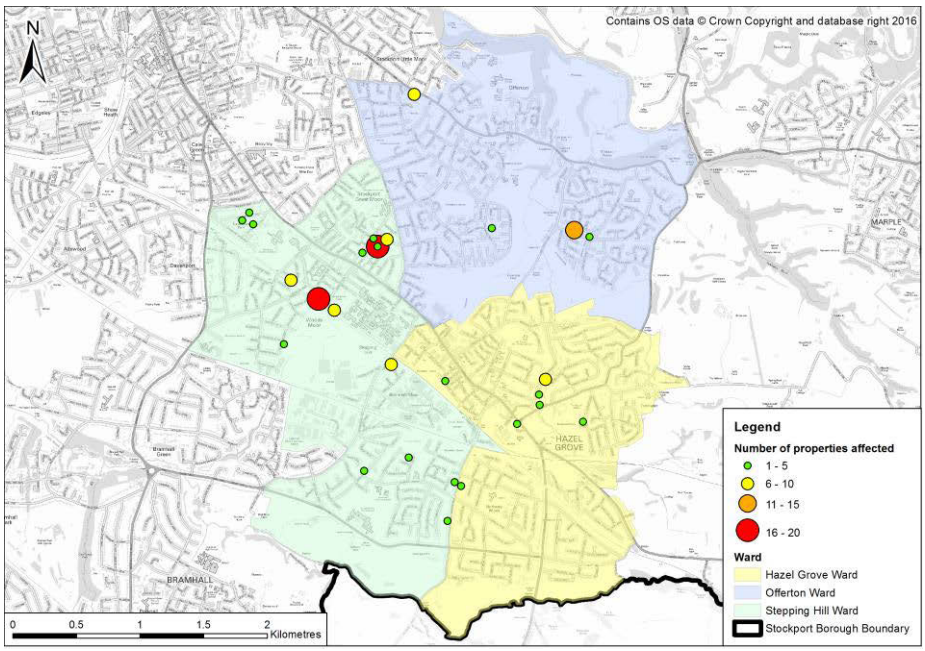
Area Committee Flood Incident Factsheet B1 - Bramhall and Cheadle Hulme South	
Location and magnitude of property flooding by post code	

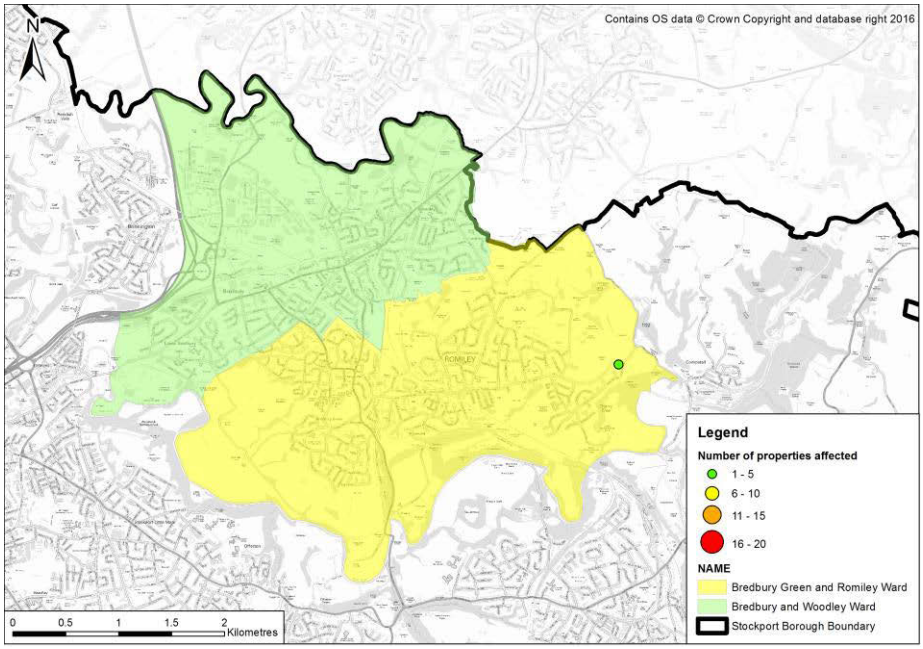
Wards in Area Committee	Bramhall North	Bramhall South and Woodford	Cheadle Hulme South
Number of properties flooded	14	23	53
Property Flooding (some internally flooded properties may also have flooded externally)			
Internal	9	19	48
External only	5	4	5
Source of Property Flooding			
Public combined sewers	14	23	51
Public surface water sewers	-	-	-
Private drain	-	-	1
Surface water (Pluvial runoff)	-	-	1
Fluvial	-	-	-
Groundwater	-	-	-
Unconfirmed	-	-	-
Cause of Property Flooding			
Exceptional weather	14	23	51
Public combined sewers blockage	-	-	-
Private drain blockage	-	-	-
Highway drain blockage	-	-	1
Watercourse blockage	-	-	-
Collapsed culvert	-	-	-
Condition of the culvert	-	-	-
Debris screen blockage	-	-	-
Unconfirmed	-	-	1

Area Committee Flood Incident Factsheet B2 - Central Stockport				
Location and magnitude of property flooding by post code				
Wards in Area Committee	**Brinnington and Central**	**Davenport and Cale Green**	**Edgeley and Cheadle Heath**	**Manor**
Number of properties flooded	7	80	54	16
Property Flooding (some internally flooded properties may also have flooded externally)				
Internal	6	67	52	14
External only	1	13	2	2
Source of Property Flooding				
Public combined sewers	1	49	46	14
Public surface water sewers	-	13	-	-
Private drain	-	8	2	-
Surface water (Pluvial runoff)	2	-	4	-
Fluvial	2	-	-	2
Groundwater	1	10	2	-
Unconfirmed	1	-	-	-
Cause of Property Flooding				
Exceptional weather	2	56	48	13
Public combined sewers blockage	-	-	-	1
Private drain blockage	-	-	-	-
Highway drain blockage	1	-	4	-
Watercourse blockage	2	13	-	-
Collapsed culvert	-	-	-	-
Condition of the culvert	-	-	-	1
Debris screen blockage	0	0	0	1
Unconfirmed	2	11	2	0

Area Committee Flood Incident Factsheet B3 – Cheadle			
Location and magnitude of property flooding by post code			
Wards in Area Committee	**Cheadle and Gatley**	**Cheadle Hulme North**	**Heald Green**
Number of properties flooded	35	58	39
Property Flooding (some internally flooded properties may also have flooded externally)			
Internal	22	32	21
External only	13	26	18
Source of Property Flooding			
Public combined sewers	6	58	38
Public surface water sewers	-	-	-
Private drain	6	-	-
Surface water (Pluvial runoff)	-	-	-
Fluvial	23	-	1
Groundwater	-	-	-
Unconfirmed	-	-	-
Cause of Property Flooding			
Exceptional weather	8	58	26
Public combined sewers blockage	-	-	12
Private drain blockage	-	-	-
Highway drain blockage	-	-	-
Watercourse blockage	19	-	1
Collapsed culvert	-	-	-
Condition of the culvert	-	-	-
Debris screen blockage	4	-	-
Unconfirmed	4	-	-

Area Committee Flood Incident Factsheet B4 – Heatons and Reddish				
Location and magnitude of property flooding by post code				
Wards in Area Committee	**Heatons North**	**Heatons South**	**Reddish North**	**Reddish South**
Number of properties flooded	78	39	34	16
Property Flooding (some internally flooded properties may also have flooded externally)				
Internal	60	34	31	15
External only	18	5	3	1
Source of Property Flooding				
Public combined sewers	67	38	32	14
Public surface water sewers	-	-	-	-
Private drain	-	1	1	2
Surface water (Pluvial runoff)	-	-	1	-
Fluvial	11	-	-	-
Groundwater	-	-	-	-
Unconfirmed	-	-	-	-
Cause of Property Flooding				
Exceptional weather	67	37	32	15
Public combined sewers blockage	-	2	-	-
Private drain blockage	-	-	1	1
Highway drain blockage	-	-	1	-
Watercourse blockage	1	-	-	-
Collapsed culvert	8	-	-	-
Condition of the culvert	2	-	-	-
Debris screen blockage	-	-	-	-
Unconfirmed	-	-	-	-

Area Committee Flood Incident Factsheet B5 – Stepping Hill			
Location and magnitude of property flooding by post code			
Wards in Area Committee	**Hazel Grove**	**Offerton**	**Stepping Hill**
Number of properties flooded	15	20	78
Property Flooding (some internally flooded properties may also have flooded externally)			
Internal	5	7	73
External only	10	13	5
Source of Property Flooding			
Public combined sewers	12	7	70
Public surface water sewers	-	13	-
Private drain	1	-	6
Surface water (Pluvial runoff)	-	-	-
Fluvial	-	-	-
Groundwater	2	-	2
Unconfirmed	-	-	-
Cause of Property Flooding			
Exceptional weather	13	20	70
Public combined sewers blockage	-	-	-
Private drain blockage	-	-	-
Highway drain blockage	-	-	-
Watercourse blockage	-	-	6
Collapsed culvert	-	-	-
Condition of the culvert	-	-	-
Debris screen blockage	-	-	-
Unconfirmed	2	-	2

Area Committee Flood Incident Factsheet B6 – Wenweth		
Location and magnitude of property flooding by post code		
Wards in Area Committee	**Bredbury and Woodley**	**Bredbury Green and Romiley**
Number of properties flooded	-	1
Property Flooding (some internally flooded properties may also have flooded externally)		
Internal	-	1
External only	-	-
Source of Property Flooding		
Public combined sewers	-	-
Public surface water sewers	-	-
Private drain	-	-
Surface water (Pluvial runoff)	-	1
Fluvial	-	-
Groundwater	-	-
Unconfirmed	-	-
Cause of Property Flooding		
Exceptional weather	-	-
Public combined sewers blockage	-	-
Private drain blockage	-	-
Highway drain blockage	-	1
Watercourse blockage	-	-
Collapsed culvert	-	-
Condition of the culvert	-	-
Debris screen blockage	-	-
Unconfirmed	-	-