

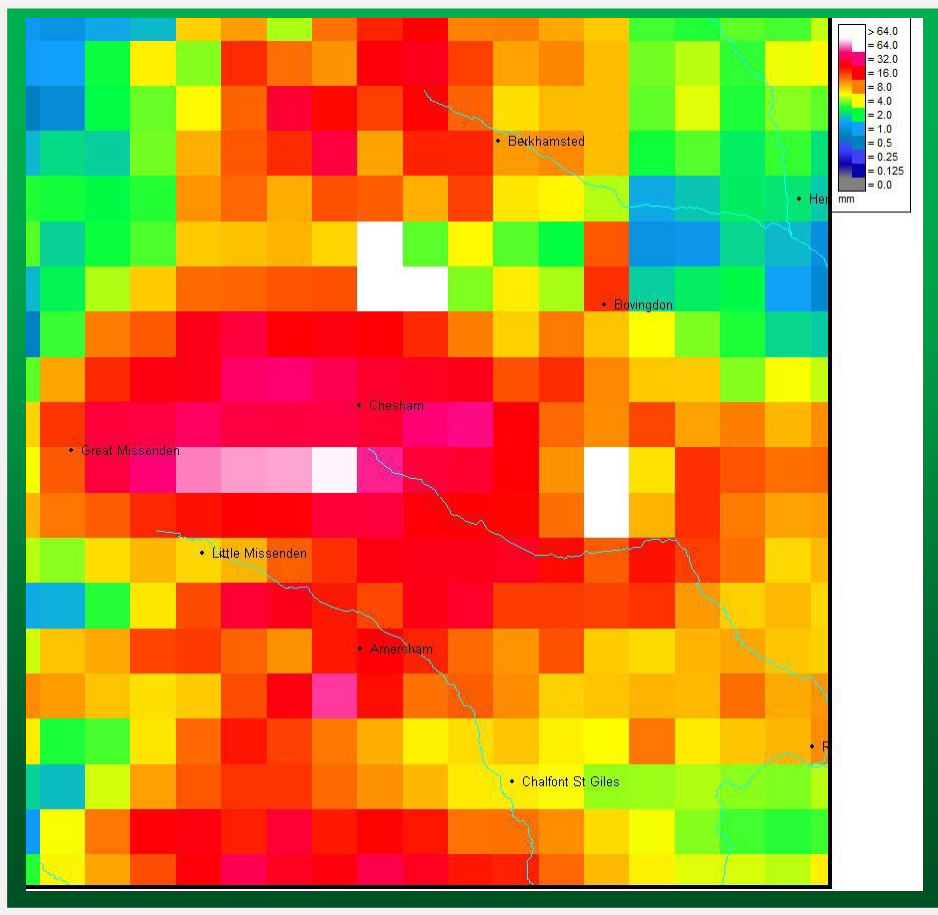
29 June 2015

Buckinghamshire County Council

Flood Investigation Report

Chesham

20 September 2014



Rainfall accumulation radar data for 20/09/2014 courtesy of the Environment Agency (2014).

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Revision Schedule

Buckinghamshire County council Flood Investigation Report

29 June 2015

Rev	Date	Details	Author	Checked and Approved by
1	27/04/15	Draft for review	Anne-Claire Loftus	Karen Fisher
2	29/05/15	Final report	Anne-Claire Loftus	

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Executive Summary

This report has been produced by Buckinghamshire County Council (BCC) to investigate the flooding that occurred in Chesham on 20 September 2014. The report provides details of the event and makes recommendations for Risk Management Agencies (RMAs) to undertake to prevent a repeat in the future.

A Section 19 Investigation is a statutory requirement for Lead Local Flood Authorities (LLFA) under the Flood and Water Management Act (FWMA) 2010. On becoming aware of a flood in its area, the LLFA must, to the extent that it considers it necessary or appropriate, investigate:

- Which RMA have relevant flood risk management functions; and
- Whether each of those RMAs has exercised, or is proposing to exercise, those functions in response to the flood.

It was deemed necessary to produce this report as the flood event in Chesham exceeded BCC's criteria for carrying out a Section 19 Investigation.

The aim of the Section 19 Investigation is to give an explanation of what happened in the flood event and what were the RMAs' responsibilities during the event. The recommendations are there to help the RMAs learn lessons from the event and to move forward with management of the flood risk in the future.

The flood event in Chesham on 20 September 2014 was caused by an intense rainfall event which caused surface water runoff as well as increased flow in the River Chess and its tributary the Vale Brook. In some parts of town, this increased flow exceeded the capacity of infrastructure such as the Vale Brook culvert. A list of recommendations has been included in the report; if followed, they will contribute to reducing risk of and vulnerability to flooding in Chesham.

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1. Introduction

1.1 Background to investigation

BCC as the LLFA has a responsibility to record and report flood incidents as detailed within Section 19 of the Flood and Water Management Act (FWMA) 2010:

Section 19

- (1) On becoming aware of a flood in its areas, 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.

BCC has established criteria for section 19 flood investigations which can be found in the appendix.

It was deemed necessary to complete an investigation into the flood incident in Chesham because it met the following thresholds:

- Internal flooding (including to basements) to five or more residential properties within an area of 1km²
- Internal flooding of two or more business premises within an area of 1km²

1.2 Site Location

Chesham is a town of approximately 21,000 inhabitants located at the south of Chiltern District in the south of Buckinghamshire, as shown in Figure 1.



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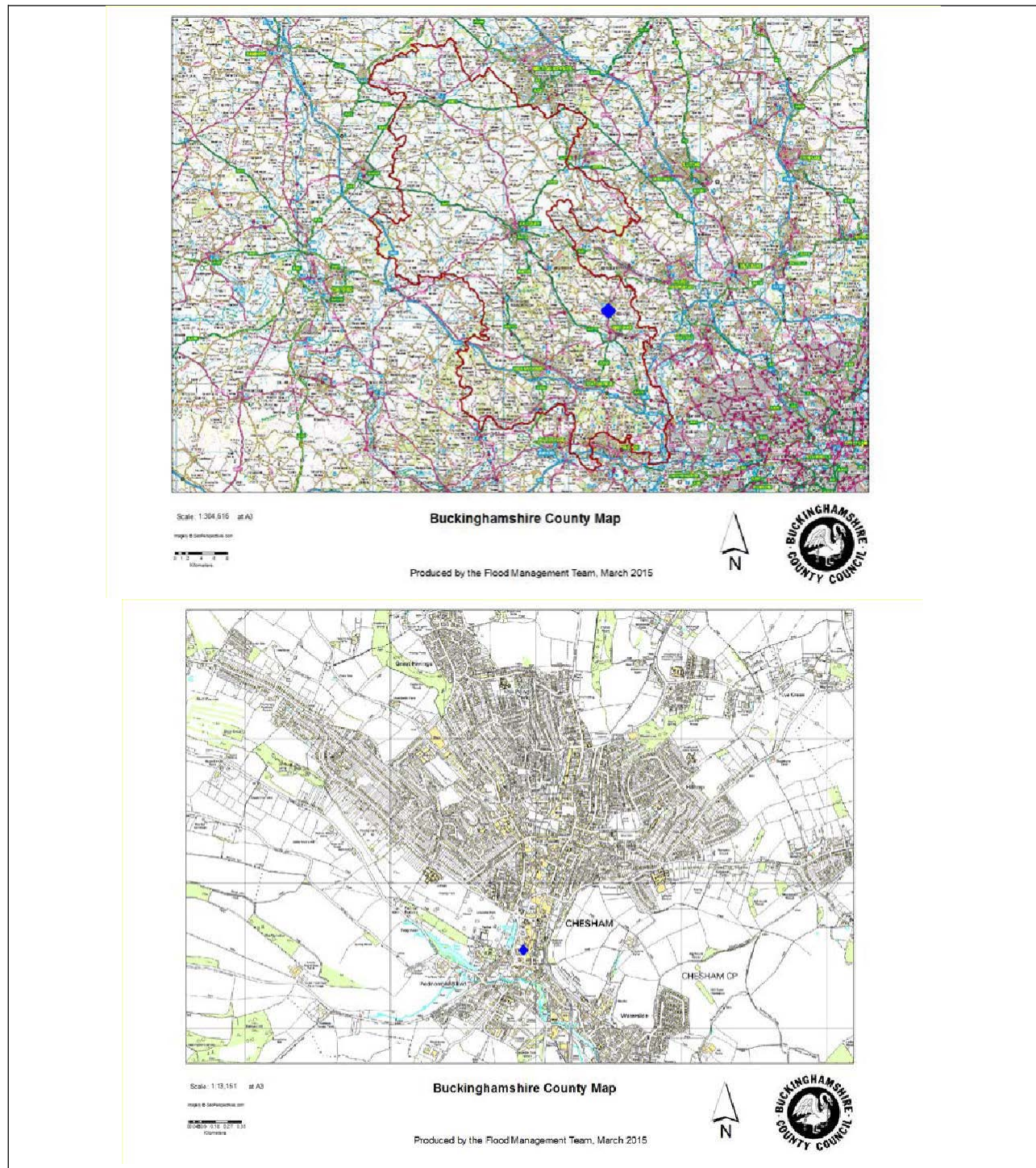


Figure 1: Location maps for Chesham at County and local level (Ordnance Survey License 100021529 2014)

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1.3 Drainage system and river network

The River Chess is a main river that flows through Chesham, as shown in Figure 2. It is a chalk stream that flows for 11 miles (18 km) from Pednormead End in Chesham to its confluence with the River Colne, which itself is a tributary of the River Thames. Apart from some small sections near Pednormead End, the River Chess is classed as a main river. An important tributary of the River Chess is the Vale Brook, which joins the Chess east of Germain Street (SP 95919 01327). The Vale Brook is classed as a 'main river' from Townsend Road (SP 96073 02090) to its confluence with the River Chess, and is classed as an 'ordinary watercourse' north of Townsend Road. The Environment Agency (EA) is the Risk Management Agency (RMA) for the main river sections, as defined in section 4.3. The Environment Agency has powers to work on main rivers and the sea to manage flood risk. Buckinghamshire County Council, as Lead Local Flood Authority for Buckinghamshire, is the RMA for the ordinary watercourse sections.

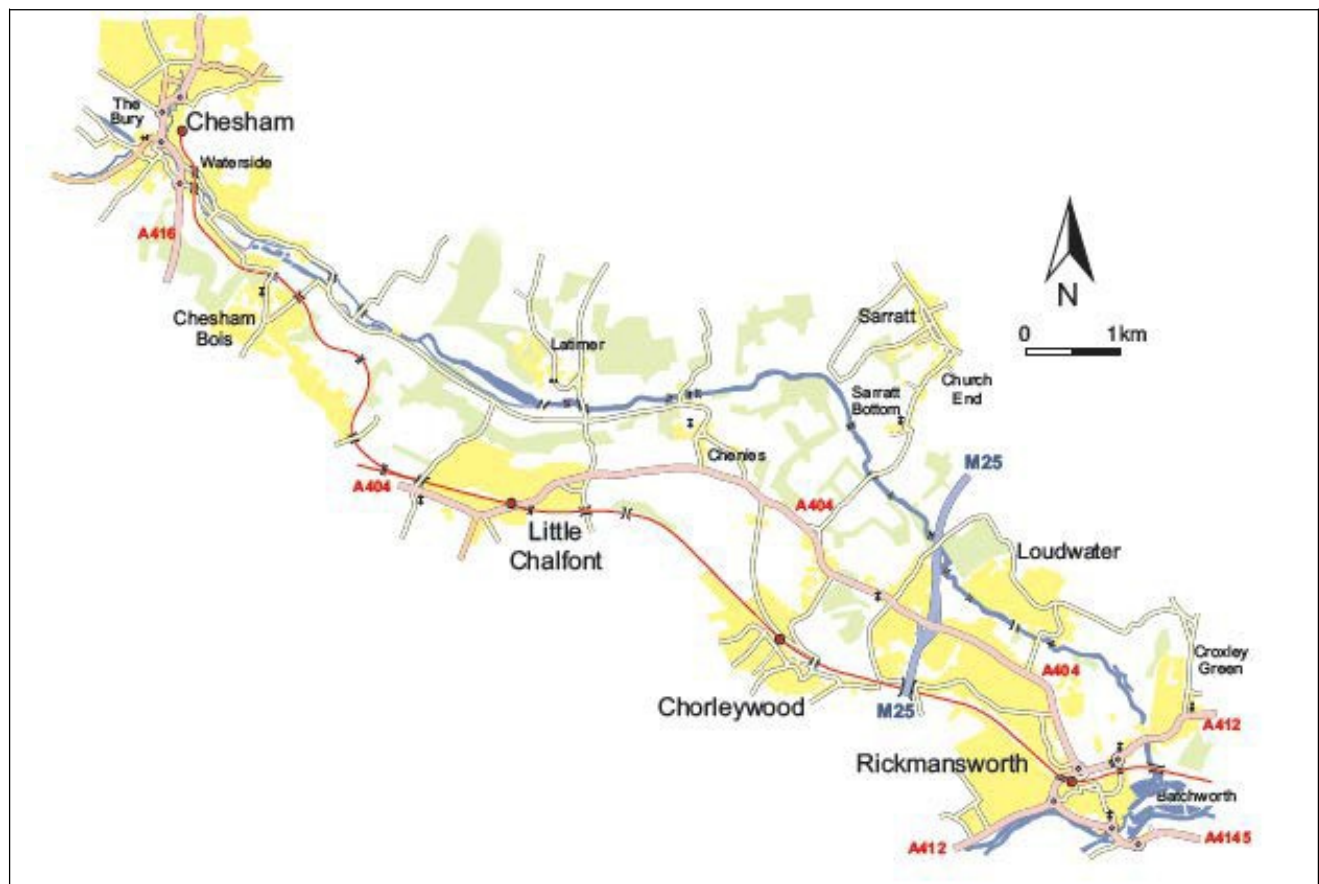


Figure 2: The River Chess (Source: Chilterns Chalk Streams Project)

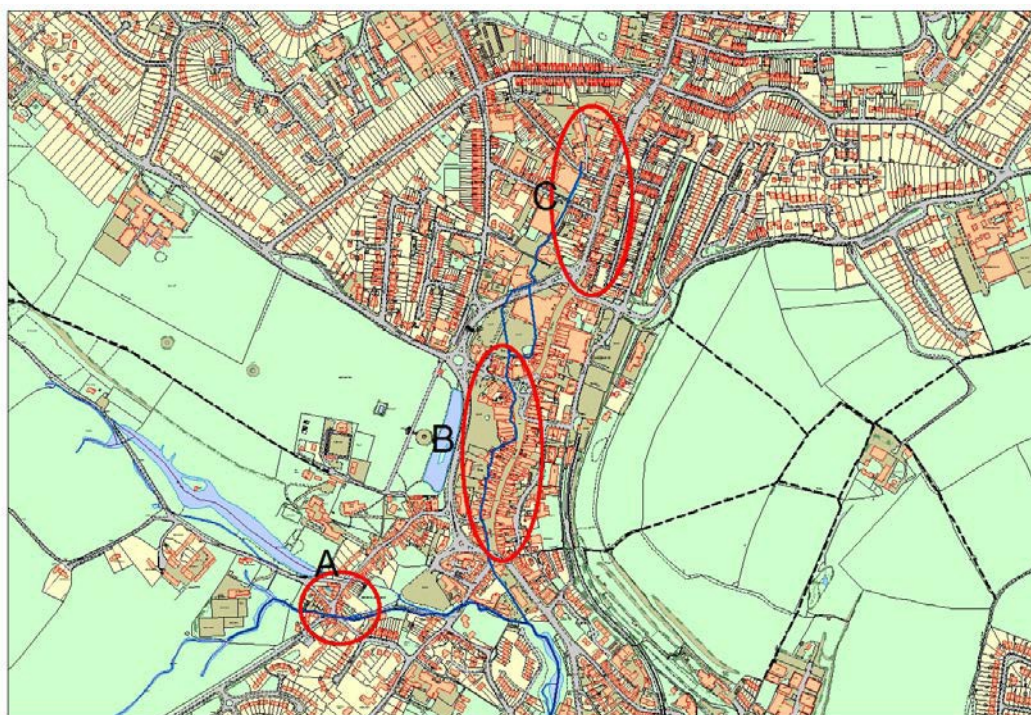
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The Vale Brook is in a culvert for most of its length through Chesham, with a few small open sections remaining. The River Chess is generally not culverted, except under roads, for example under the B485 (Missenden Road) in Pednormead End (SP 95631 01321).

The three main areas of concern during the flood incident covered in this report are shown in Figure 3 below:

- A is Pednormead End (around SP 95633 01339), where several residential properties flooded;
- B shows the location of the mainly business property flooding from Market Square (SP 95934 01440) along the High Street north to The Broadway (SP 95962 01760);
- C indicates Broad Street (SP 96104 01962 to SP 96175 02224), where property flooding occurred as well.

The explanation of these areas of concern is given below in Section 3.4.



Scale: 1:5,473 at A3
Image © Ordnance Survey
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kilometres

Chesham flooding locations

Produced by the Flood Management Team, March 2015



Figure 3: Main locations of property and road flooding in Chesham (Ordnance Survey License 100021529 2014)



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Figure 4 shows the surface water drainage system in Chesham's town centre, which is owned and maintained by Transport for Buckinghamshire (TfB).

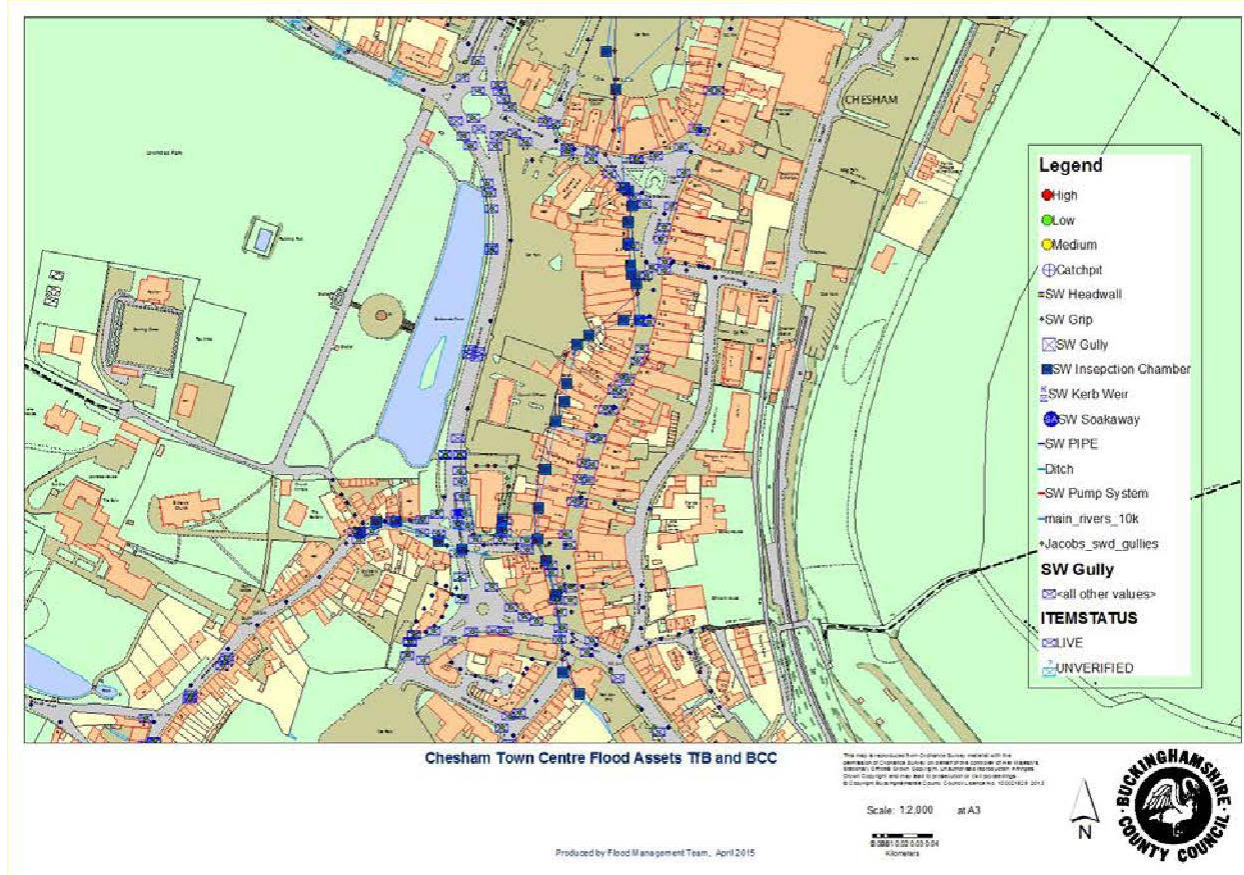


Figure 4: Map showing highway drainage in Chesham's town centre (Ordnance Survey License 100021529 2014)

Figure 5 shows Thames Water's main assets through Chesham's town centre.

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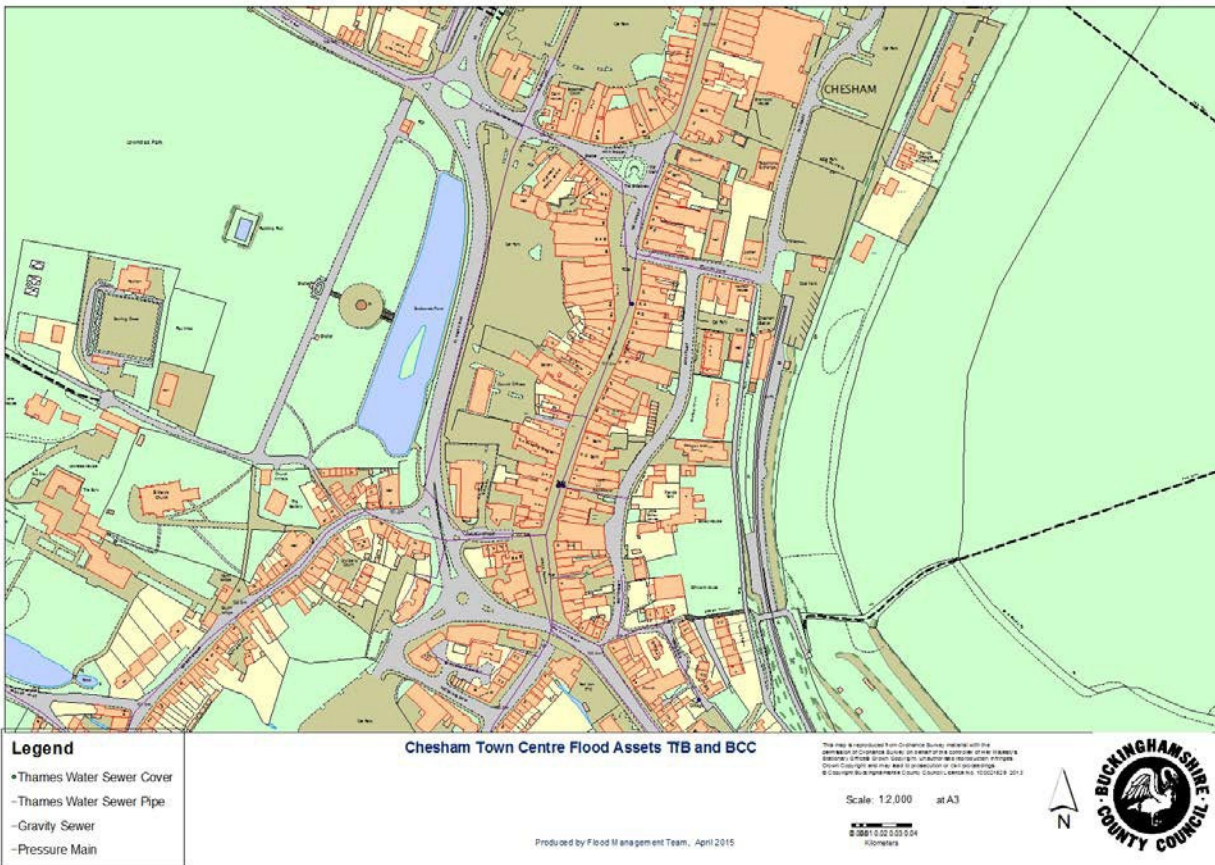


Figure 5: Map showing Thames Water assets in Chesham (Source: Thames Water)

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2. Background

2.1 Catchment characteristics

The River Chess is a main river, as designated on the [main river map](#) produced by the Environment Agency. Its tributary the Vale Brook is an ordinary watercourse from its source to Townsend Road, then a main river from Townsend Road to its confluence with the River Chess. The Vale Brook is particularly important in relation to flooding in the town, since it receives surface water from a majority of Chesham's urban area yet is limited in terms of its capacity. Figures 6 & 7 show the fluvial and surface water flood maps for the town.

The fluvial flood map (figure 6) shows the flooding which would occur from the main river in a 1 in 100 year (flood zone 3) and 1 in 1000 year (flood zone 2) event. The flood water in these situations would come from the river and flow out onto the impacted areas shown on the map.

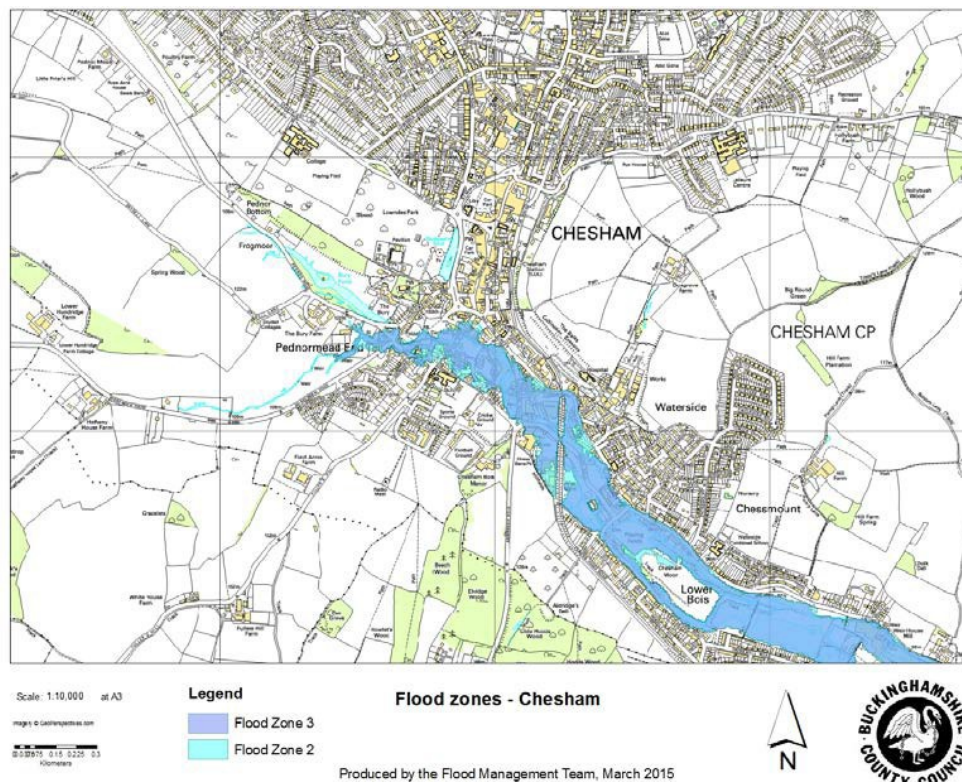


Figure 6: EA flood map showing the River Chess 1:100 year event (flood zone 3) in dark blue and 1:1000 year (flood zone 2) in light blue (EA, 2014) (Ordnance Survey License 100021529 2014)

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The surface water flood map (see figure 7) shows the extent of flooding in the 1 in 30, 1 in 100 and 1 in 1000 year events for the area surrounding Chesham. Surface water flooding occurs when extreme or prolonged rainfall cannot infiltrate into saturated ground, or flow into the rivers and/or highways drainage due to high volumes of water.

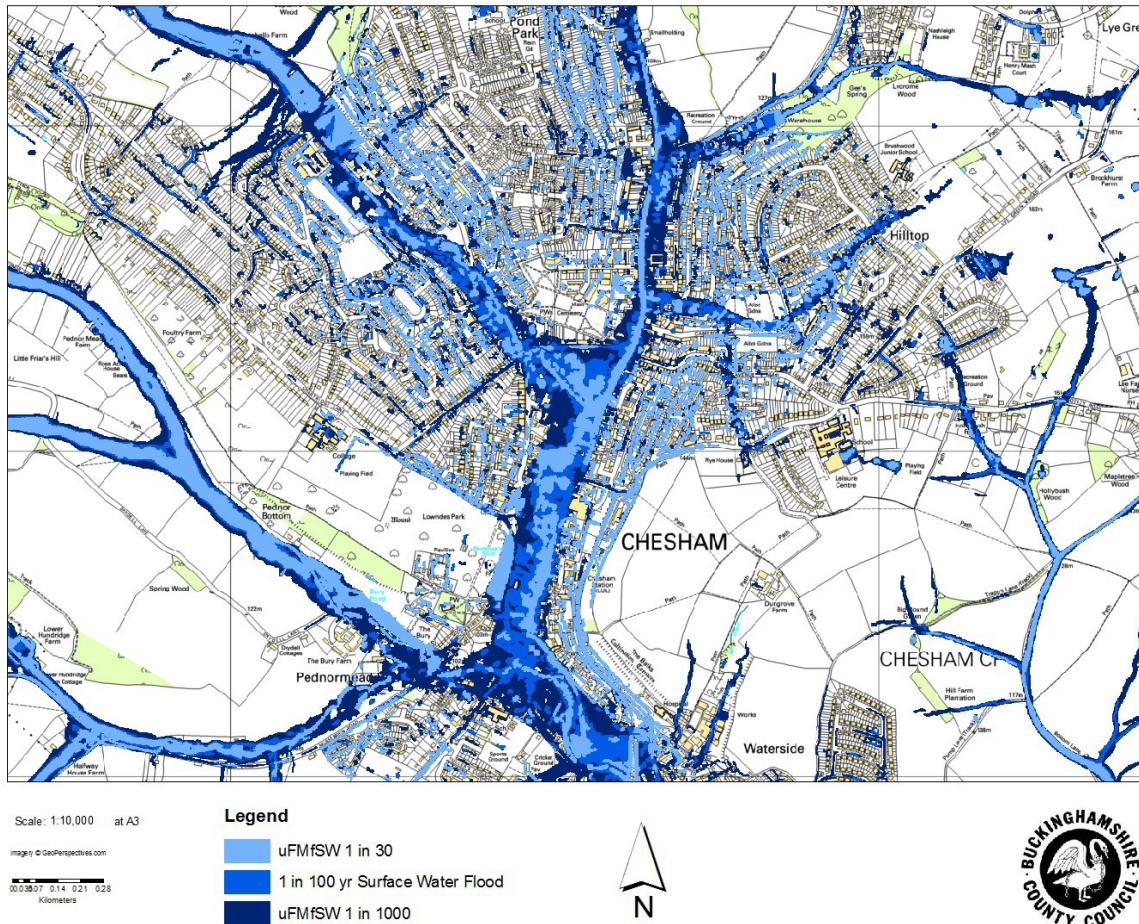


Figure 7: Surface water flood map showing predicted extent of flooding in Chesham for the 1:30 (light blue), 1:100 (medium blue) and 1:1000 (dark blue) year events (EA, 2013) (Ordnance Survey License 100021529 2014)

Figures 6 and 7 show that although there is a band of fluvial flood risk – running along the Chess in the south of town – a more extensive area within Chesham is at risk of flooding from surface water.

Chesham is situated on alluvium (clay, silt, sand and gravel) along the route of the River Chess, with superficial head (clay, silt, sand and gravel) in other parts of town. The solid

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geology is chalk, as shown in Figure 8. Low lying areas underlain by permeable strata such as chalk (as is the case with Chesham) are particularly susceptible to groundwater flooding. In terms of the event described in this report, groundwater did not play a role (as mentioned in Section 3.1), but it has been a source of flooding in Chesham in the past. The valley of the Vale Brook slopes quite steeply from 160mAOD either side of the town down to 115mAOD where the river flows through Chesham towards the south, funneling surface water towards the Vale Brook and ultimately the River Chess.

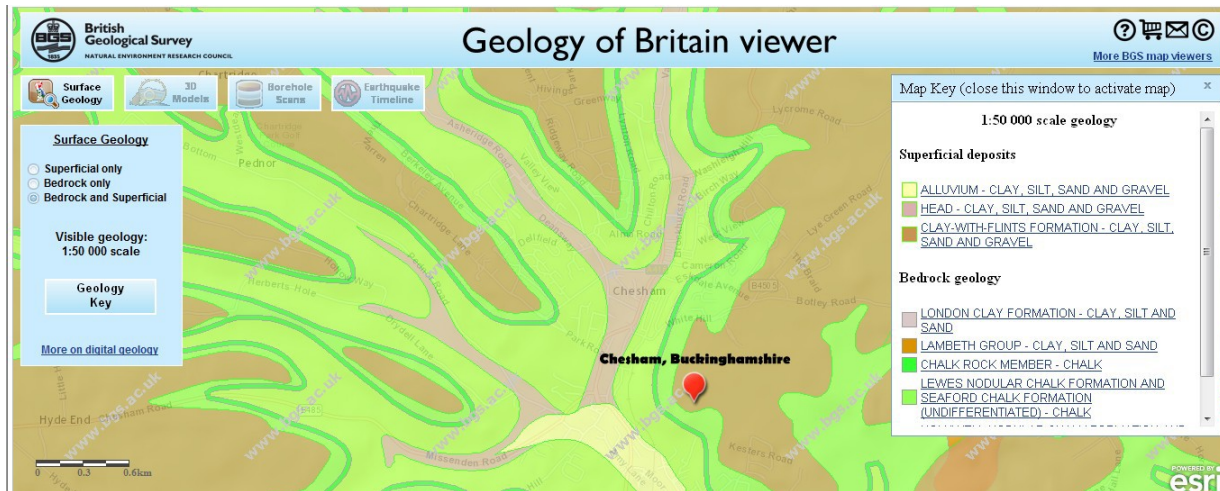


Figure 8: Geology of Chesham (BGS online map, 2015)

2.2 Previous flood events

There are numerous records of flooding in Chesham throughout the years. As part of a photography exhibition organised by the Buckinghamshire County Council-managed FloodSmart project in 2013, photographs and written records of flooding were found for the following years:

- 1903, 1912 and 1915, Vale Road and Berkhamstead Road
- 1916, along Vale Road and Berkhamstead Road.
- 1918, major flooding around Pednormead End and Church Street, written about as the “Great Flood”
- 1950s, Broad Street
- 2001, Vale Road
- 2006, Broad Street

A Chiltern Society report into the winter 2000/1 flooding recorded a number of details about the flooding in and around Chesham (Chiltern Society, 2001):

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- Flooding of the road alongside Bury Pond.
- Five artesian wells flowing on Chesham Moor.
- Extensive and prolonged road flooding along Vale Road.

Other examples of flooding in Chesham are given in Chiltern District Council's 2013 Strategic Flood Risk Assessment (SFRA):

- "The River Chess has contributed to flooding in Pednormead End and Lower Bois.
- The Vale Brook has contributed to flooding in the Higham Mead area of Chesham. Upstream, a highways drainage ditch on the east side of Vale Road has been created to alleviate the drainage issues in the area. On occasion this ditch has reached capacity and overtopped onto the road. When this occurs the road provides a direct route for the flood water into the centre of Chesham. This has resulted in the flooding of several properties. This problem becomes more susceptible during periods of high groundwater level.
- The fishing lakes off Cresswell Road overflowed [...] during a 2007 event.
- The ordinary watercourse adjacent to Missenden Road has caused flooding of properties in Pednormead End.
- Flooding from surface water has occurred across Chesham, with particularly notable flooding of properties in 2006 along Broad Street/Berkhampstead Road and in Pednormead End and in 2008 in The Spinney and commercial properties along the High Street. Other roads regularly affected by surface water flooding include Germain Street and Hivings Hill.
- Rising groundwater levels have directly caused, or exacerbated, flooding to a number of properties in Chesham. Rising groundwater levels have affected Bury Pond, which has subsequently overspilled and flooded properties in the Pednormead End area, Chesham."

Finally, Chesham was affected during the winter of 2013/4; there are records of six properties being flooded internally, along Pednormead End, Brushwood Road and Harding Road. Berkhampstead Road and Broad Street were also affected by flooding during this period.

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3. Analysis of the 20 September 2014 flood event

3.1 Conditions at the time

The Environment Agency (EA) provided rainfall data in relation to this event. The nearest EA rain gauge is at Chenies (TL0168600016). Figure 9 gives the daily rainfall totals from the Chenies gauge for the period from 01 to 30 September 2014.

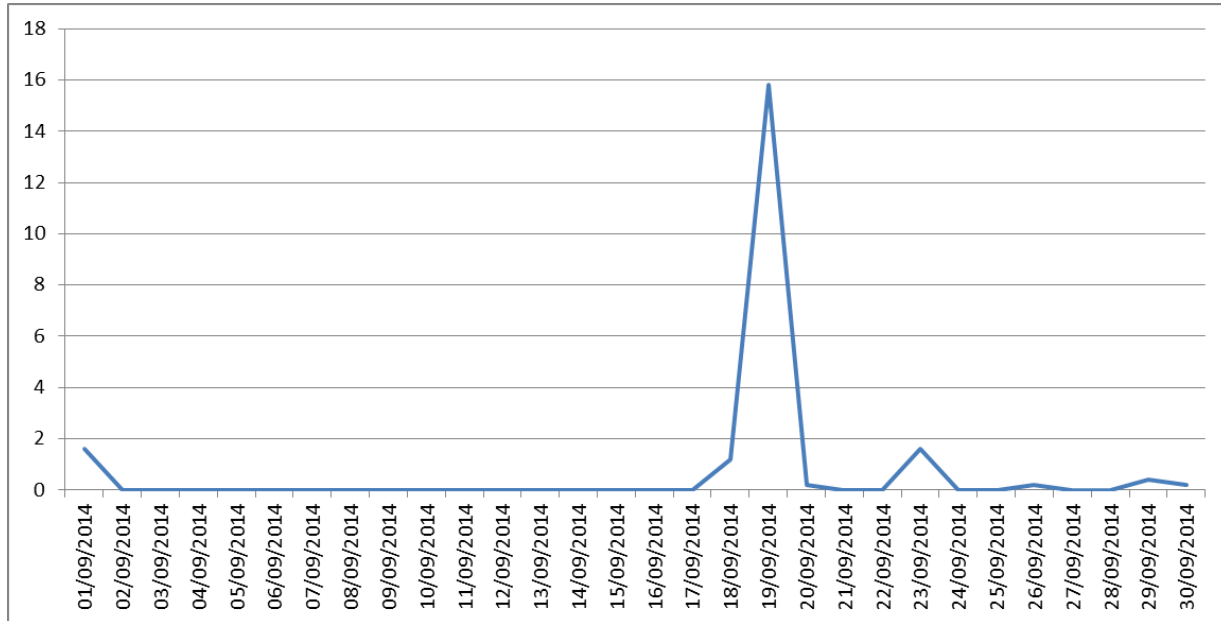


Figure 9: Daily rainfall totals from the Chenies gauge for the period from 01 to 30 September 2014 (Environment Agency, 2014)

In Figure 9, each day of data starts and ends at 09:00; the rainfall from this event, because it fell in the early hours of the morning, was therefore counted under the 19th of September. From this data it can be seen that rainfall peaked on 19 (effectively 20) September 2014 at 15.8mm. The gauge is located approximately 6km away from Chesham's town centre, so the gauge measurements do not reflect the intense and localised nature of the storm. Radar data showing the rainfall accumulation overnight between 19 and 20 September 2014, in Figure 10, indicates that rainfall around the High Street was probably around 30-40mm, while around Pednormead End it is likely that more than 50mm of rain fell, as shown in the radar data. The town names indicated on the map are not accurate: on the map, what is marked as the source of the River Chess near Chesham is near its confluence with the Vale Brook (SP 95919 01327), so the white square is on or near Pednormead End.

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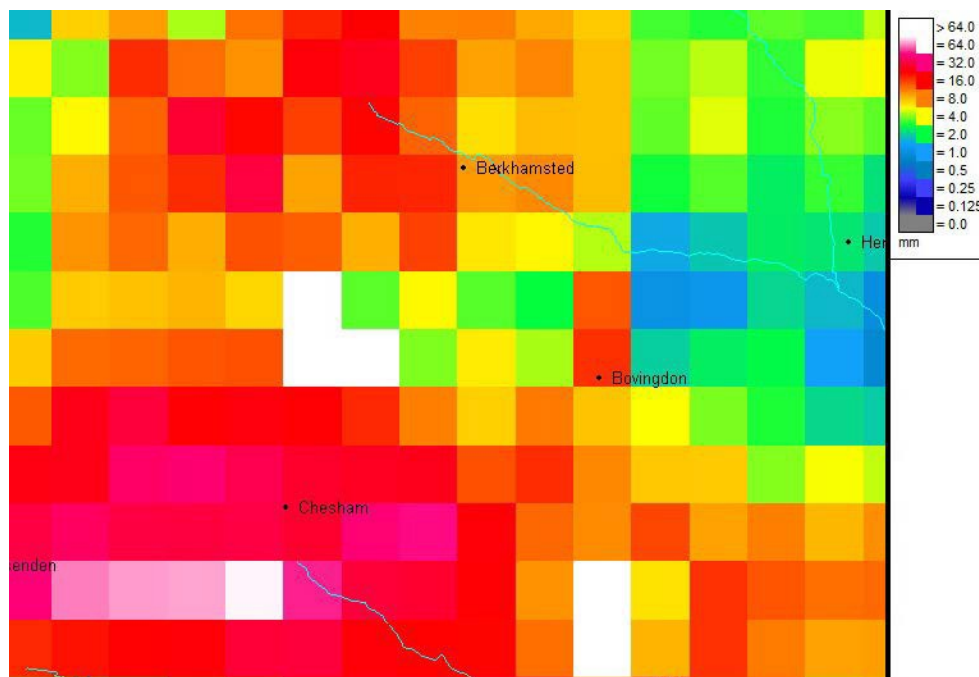


Figure 10: Radar data showing the rainfall accumulation overnight between 19 and 20 September 2014 (Environment Agency, 2014)

To put this rainfall in context, for the month of September 2014 the Colne catchment only received 35% of the long-term monthly rainfall average, most of it being intense rainfall events such as the one described here. For the period from 01 April to 30 September 2014, rainfall in the Colne catchment was classified as “below normal” (EA, September 2014).

The nearest river level gauge, monitored by the EA, on the River Chess is on Missenden Road west of Chesham (SP9477001065). Unfortunately, measurements from this gauge are only available monthly, which does not allow for conclusions to be drawn regarding the specific flood event in question. However, a temporary logger placed at the entrance of the Vale Brook culvert on Townsend Road (SP9607502088) showed the variations in water levels in response to the rainfall (Figures 11 and 12). The logger has been in place since 2011, and during the 20 September 2014 event it recorded the highest water levels since records started. The Vale Brook at this point was around 500mm high, a substantial depth given that the watercourse usually runs dry. Figures 11 and 12 also show how quickly the water levels rose and fell at this point.

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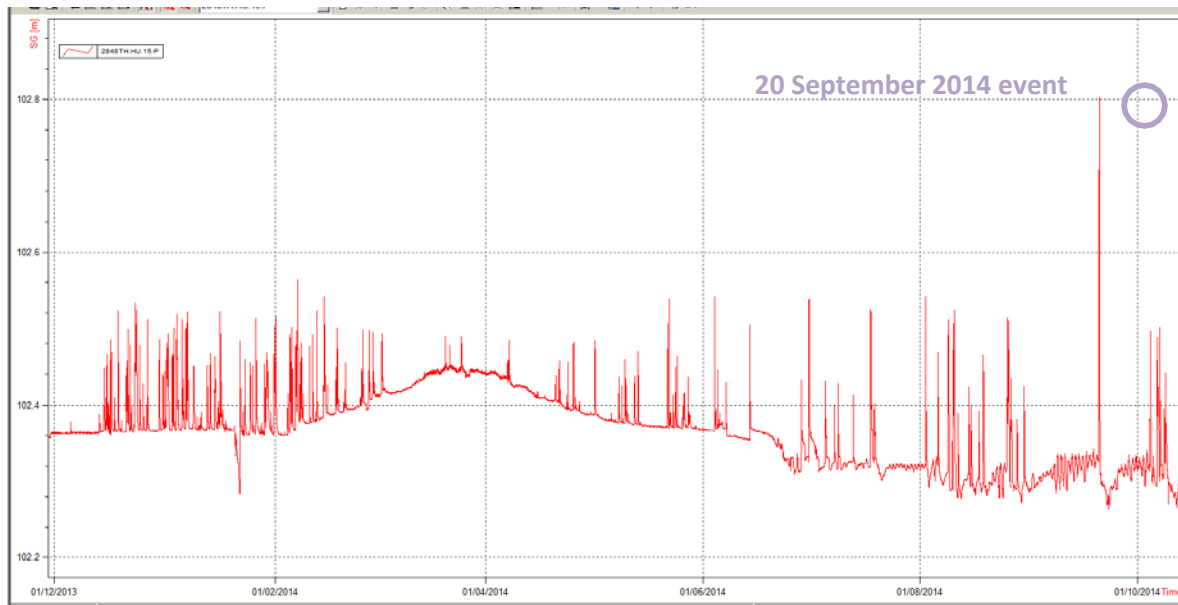


Figure 11: Water level readings taken every 15 min at the Townsend Road logger, December 2013 to October 2014 (Environment Agency, 2014)

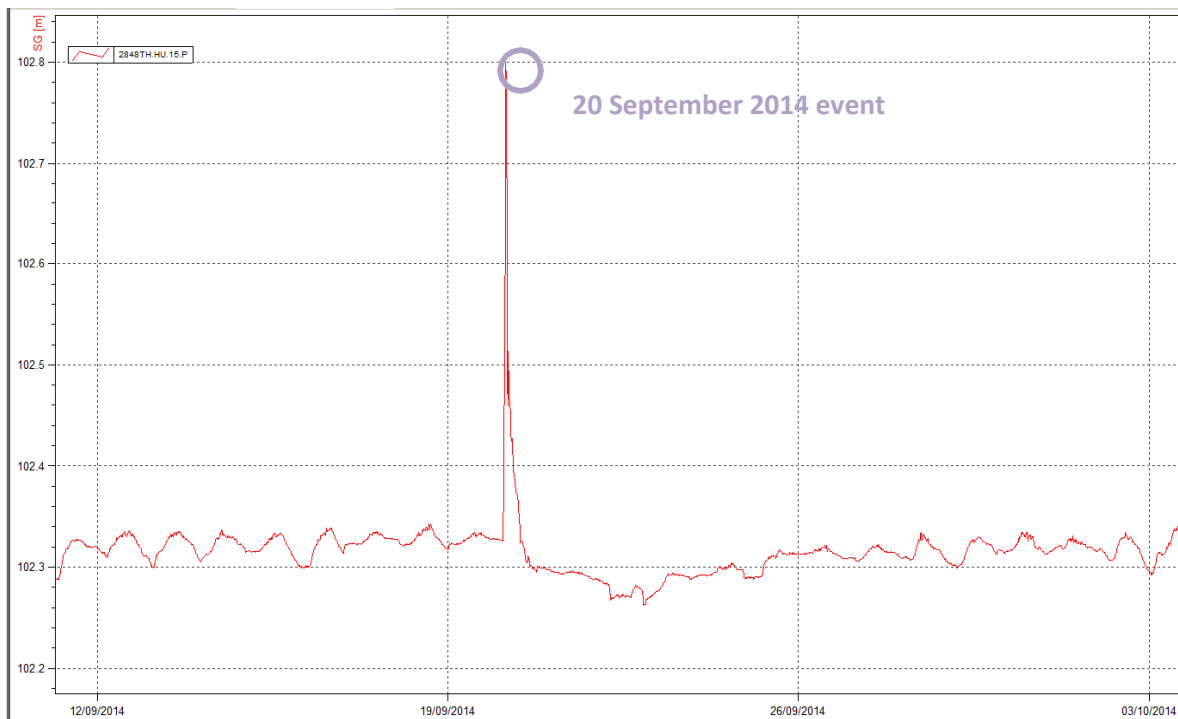


Figure 12: Water level readings taken every 15 min at the Townsend Road logger, 12 September to 03 October 2014 (Environment Agency, 2014)

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Groundwater levels were 'normal' in the area during the period of flooding under investigation; 'normal' is the middle category for groundwater levels, meaning levels are likely to fall within this band 44% of the time (EA, September 2014). The soil moisture deficit (SMD) was 127mm in September 2014 (EA, September 2014), indicating that the soil was not saturated and would have had the capacity to absorb more rainfall, had it been less intense.

3.2 Condition of features

The fact that the flooding occurred in the very early hours of the morning meant that no detailed personal observation of the functioning of infrastructure could take place.

However, the following was observed:

- Building occupiers reported that Vale Brook culvert manholes located within at least 3 shops along the High Street and Broadway surcharged during the event, indicating that the capacity of the culvert was exceeded. Investigation commissioned by one of these shops revealed that their manhole cover might not have been properly shut prior to the event, but the other 2 manholes were shut.
- CCTV footage of the southern end of the High Street showed surface water flooding exceeding the capacity of the slot drains running on either side of the High Street and flowing overland southward for a period of about an hour.
- CCTV footage of Market Square showed surface water flooding exceeding the capacity of the slot drain running along the eastern edge of the square and the gullies located along the western edge. Given that the peak of ponding within the square was around 5:00AM and had fully dissipated by 6:00AM, and given the extreme nature of the rainfall event, it is unlikely that there were any blockages within Market Square's surface water drainage assets.
- The Environment Agency, in partnership with local councils, undertook a replacement of the Market Square section of the Vale Brook culvert, completed in 2014. The rainfall event described in this report caused compaction of the sand surrounding the new culvert and subsequent collapse of the brick pavers at the surface. This did not affect the performance of that section of the culvert. However, it has been noted that the works have slightly changed the drainage system in the area. Prior to the works, the area included 4 gullies and 3 gullies connections. As part of the works, 2 nearby gullies were combined into a single, larger gully. As a result, although the number of gullies and gully connections decreased, the surface area of said gullies was actually increased through the installation of larger gratings.
- A shop owner on The Broadway reported arriving around 6:00AM and although

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he noticed the “tidemark” of water and dirt, the water had dissipated via the surface water drainage system.

The River Chess culvert located under Missenden Road (SP9563101321) is known to be of insufficient capacity during extreme events. Flooding to some properties on Pednormead End may have been caused by water backing up upstream of the culvert, although this has not been confirmed.

3.3 Condition of watercourse

No obstructions to flow within the main rivers were reported around the event.

The EA do not undertake maintenance on the River Chess under their routine maintenance schedule. Therefore the maintenance should be undertaken by the respective Riparian Owner. The EA’s ‘Living on the Edge’ booklet provides guidance on riparian owner responsibilities.

3.4 What happened?

Although the CCTV footage of Market Square and the High Street doesn’t enable precise estimates, it appears as though the rain started around 03:20AM, with the most intense rain appearing to fall between 03:50AM and 05:00AM.

CCTV footage of the southern half of the High Street showed that the slot drains’ capacity was exceeded starting around 04:23AM, with the largest extent of flooding (covering the width of the High Street) happening between 04:54 and 05:13AM; the surface water there had dissipated fully by 05:33AM.

CCTV footage of Market Square showed that the slot drains’ capacity was exceeded starting around 03:54AM, with the largest extent of flooding (covering the width of Market Square) happening between 04:43 and 05:33AM; the surface water ponding there had dissipated fully by 06:03AM.

Although the most intense rainfall was relatively short-lived, at least 34 properties were flooded internally in Chesham. The following numbers have been confirmed by the property owners or occupiers (5 residential properties and 29 businesses):

- 3 properties flooded around PednormeadEnd.
- 1 property on Germain Street.
- 1 property on Church Street.

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- 5 properties in Market Square.
- 18 properties along the High Street.
- 2 properties on The Broadway.
- 4 properties on Broad Street.

Because of the timing of the flooding, and the fact that most were businesses, few property owners or occupiers were able to witness the flooding in person. However, many were able to provide helpful information about how far water ingressed into the property and in some cases how deep it was. For the majority of properties, particularly those around Market Square and the High Street, the flooding does not appear to have entered more than a few metres into shops, to a depth of approximately 2 to 5 cm. Anecdotal evidence from the Chesham Museum appears to confirm the shallow depth of the flooding: a small sand-filled draught excluder had been placed across the front door upon closing the evening before and prevented water entering the Museum.

Most of the properties along Market Square, the High Street, The Broadway and Broad Street were flooded by water entering from the front (street-facing) of their shops. In addition, approximately 4 properties along the east side of the High Street were flooded by water coming in from the back of the property (east side), via East Street. Also, 2 properties along the east side of Broad Street (at the St Mary's Way roundabout) were flooded by water coming in from the back (east side).

Some businesses noticed that they were internally flooded, but did not feel that this had a big impact, for example if stock was shelved at a sufficient height, if the flooring was not carpet, or if a minimal carpet area was wet and subsequently dried easily. Other properties were more adversely impacted, with some businesses reporting having lost floor-level stock through water damage, having to replace damaged carpets or suffered from reduced trading hours because of the need to clean up.

3.5 Possible causes

The weather conditions

- Intense and highly localised rainfall event over Chesham, lasting approximately 2 hours, from around 03:00 to 05:00.
- Up to approximately 50mm of rainfall overnight around the Pednornead End part of town, and 30 to 40mm of rainfall over the town centre.

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The capacity of the Vale Brook

- The capacity of the culverted Vale Brook within the town centre appears to have been exceeded, causing backing up of water through manholes in several instances, as well as preventing the rapid draining away of surface water.

The capacity and design of highways and highway drainage

- The levels and camber of the High Street channelled surface water to either side of the High Street.
- The state of repair of a possible 300mm pipe running under the High Street is not known; if it suffered from blockages at the time of the event, this would have reduced its capacity to drain away surface water. As a note, information about this pipe is currently insufficient to ascertain its state of repair.
- Although no obstructions to flow were noticed, the capacity of the surface water drainage was exceeded, causing a backup of surface water at ground level. However, given the extreme nature of the rainfall event, and the dispersal of surface water within less than 2 hours, the highway drainage can be said to have functioned effectively.
- The capacity of the highway drainage located on East street was exceeded, causing surface water to flow downhill to the back of some properties located on the east side of the High Street.

3.6 Incident response

Because of the timing of the event, and the fact that surface water had drained away by approximately 06:00AM, Risk Management Agencies were not made aware of the flooding until Monday 22 September 2014. As a result, there was no immediate incident response to the flooding. Property owners dealt with the impacts of the flooding themselves, for example by cleaning floors, removing damaged carpet tiles and operating dehumidifiers.

Buckinghamshire County Council went door-to-door in the town centre to find out which properties were affected by the flooding on 24 September 2014 as well as 08 and 10 October 2014. Properties affected by the flooding were invited to an event focused on businesses and flooding held on 15 October 2014 in Chesham's Town Hall. The event was organised as part of the Buckinghamshire County Council-managed FloodSmart project; although such an event had been planned to take place, the 20 September 2014 event provided additional impetus for its organisation. Four businesses attended the event.

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4. Responsible Authorities and landowners

There are different responsibilities for flood management depending on the type of flooding. Organisations responsible for flooding are known as Risk Management Authorities (RMAs) and their responsibilities are detailed below. Riparian landowners also have responsibilities for watercourses across their land and these are also detailed below. These are summaries of the details included in the Buckinghamshire County Councils Local Flood Risk Management Strategy (2013-2018).

4.1 Lead Local Flood Authority

The Lead Local Flood Authority in this area is Buckinghamshire County Council. Buckinghamshire County Council has a role as a RMA in coordinating management of local flood risk from surface water, ground water and ordinary watercourses in the county.

4.2 Chiltern District Council

Chiltern District Council have responsibilities to inspect and maintain watercourses on District Council land, respond to requests for assistance during flood events and have the power, if instructed by Buckinghamshire County Council, to carry out flood risk management work which will benefit management of surface runoff, groundwater and ordinary water courses.

4.3 Environment Agency

The Environment Agency is one of the RMAs as defined by the Flood and Water Management Act 2010. Protecting the river environment and managing flood risk is part of their job. The EA is the RMA for flooding from main rivers.

4.4 Highways Authority – Transport for Buckinghamshire

Any flooding from highways is managed by the Highways Authority which is BCC and the highways function is managed by TfB.

4.5 Water Utility Company – Thames Water

Thames Water is responsible for flooding from foul sewers and surface water sewers which they own. Whilst undertaking this they must manage flood risk from sewers.

4.6 Landowners and riparian owners

Landowners and riparian owners must maintain any culvert, or the bed and banks of



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any adjacent watercourse. They should clear away any debris from the watercourse or culvert even if it did not originate from their land.

Riparian owners can find further guidance on their responsibilities as landowners in the Environment Agency document 'Living on the Edge' which can be found online

4.7 Residents

Residents have a responsibility to take measures to protect themselves and their property when flooding is imminent.

4.8 Emergency Responsibilities

The emergency responsibilities are outlined in table 1 below. Please note that Parish and Town Councils do not have a legal obligation to respond to emergencies. Whatever service they provide is voluntary and unique to each Parish or Town Council.

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Table 1: Roles and responsibilities in an emergency, during and after a flood event

Local (County and District) Authorities <ul style="list-style-type: none"> • Coordinate emergency support within their own functions • Deal with emergencies on 'non main rivers' • Coordinate emergency support from the voluntary sector • Liaise with central and regional government departments • Liaise with essential service providers • Open rest centres • Manage the local transport and traffic networks • Mobilise trained emergency social workers • Provide emergency assistance • Deal with environmental health issues, such as contamination and pollution • Coordinate the recovery process • Manage public health issues • Provide advice and management of public health • Provide support and advice to individuals • Assist with business continuity 	
Police Force <ul style="list-style-type: none"> • Save life • Coordination and communication between emergency services and organisations providing support • Coordinate the preparation and dissemination Fire and Rescue Service <ul style="list-style-type: none"> • Save life rescuing people and animals • Carry out other specialist work, including flood rescue services • Where appropriate, assist people where the use of fire service personnel and equipment is relevant Ambulance Service <ul style="list-style-type: none"> • Save life • Provide treatment, stabilisation and care at the scene 	Utility Providers <ul style="list-style-type: none"> • Attend emergencies relating to their services putting life at risk • Assess and manage risk of service failure • Assist with recovery process, that is, water utilities manage public health considerations Internal Drainage Board <ul style="list-style-type: none"> • Operate strategic assets to reduce flood risk in partnership with RMAs and public Town and Parish Councils <ul style="list-style-type: none"> • Support emergency responders • Increase community resilience through support of community emergency plan development Voluntary services <ul style="list-style-type: none"> • Support rest centres • Provide practical and emotional support to those affected • Support transport and communications • Provide administration • Provide telephone helpline support
Environment Agency <ul style="list-style-type: none"> • Issue Flood Warnings and ensure systems display current flooding information • Provide information to the public on what they can do before, during and after a flood event • Monitor river levels and flows • Work with professional Partners and stakeholders and respond to requests for flooding information and updates • Receive and record details of flooding and related information • Operate water level control structures within its jurisdiction and in line with permissive powers • Flood event data collection • Arrange and take part in flood event exercises • Respond to pollution incidents and advise on disposal • Assist with the recovery process, for example, by advising on the disposal of silt, attending flood surgeries 	

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5. Conclusions and recommendations

5.1 Conclusions

A number of issues contributed to the flooding that occurred in Chesham on 20 September 2014, and can be summarised as follows:

- Rainfall accumulation maps show that 30-40mm of rain appear to have fallen over Chesham's town centre overnight (primarily over the space of a few hours), and over 50mm of rain fell over Pednormead End.
- The capacity of the culverted Vale Brook appears to have been exceeded in some instances, causing a backup of water through manholes but also impeding the drainage of surface water.
- The High Street is primarily drained by slot drains to either side of the "vehicle lane" – the capacity of these drains is limited, particularly during intense rainfall events. Furthermore, there is uncertainty about the type, location and state of repair of some town centre highway drainage assets.
- The levels and design of the High Street guide water to either side of the vehicle "lane" of this pedestrian area.
- Many properties within the town centre have no or low thresholds, allowing for ingress of even shallow water depths.
- The incident occurred in the early hours of the morning and the period of rainfall and flooding was very short. As a result there was no reporting of the flooding during the event and no incident response until after the event.

5.2 Recommendations

The recommendations are summarised in table 2 below. Many of the actions are already planned to be taken as part of ongoing projects in Chesham, and speak to the existing high levels of commitment of agencies and the community to reducing flood risk in the town.

The Chesham Flood Alleviation Scheme (Chesham FAS) referred to in the table is an Environment Agency-led partnership project running from 2013 to 2020 (TBC). The overall strategy agreed between the partners is to provide a standard of protection of 1 in 30 years return period for the Vale Brook culvert from all sources of flooding. Additional reduction in flood risk and improvements to water quality can be achieved through a town-wide approach to reducing runoff into the watercourses, by diverting highway drainage, reducing runoff from impermeable driveways, and promoting the

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disconnection of roof drainage and creation of householder rain gardens and grey water harvesting for re-use.

The Chesham Water Group referred to has recently been formed and is being organised by Buckinghamshire County Council and the Environment Agency. The Group plans to include relevant organisations and cover all the ongoing and planned work in Chesham around overlapping issues of low flows, water quality and flooding.

The Chesham Flood Action Group referred to was formed in 2013 as part of the Buckinghamshire County Council-managed FloodSmart project mentioned in Section 3.6. Flood action groups act as a representative voice for their community on flood-related issues. They work with local authorities and agencies to find ways to help reduce flood risk and the impact of flooding on local communities. The Chesham Flood Action Group (CFLAG) meets on a regular basis, and has been formally constituted with an elected Chair and Secretary. CFLAG has created an action plan which lists their areas of concern and forms the basis of discussions during meetings between the group and relevant agencies. CFLAG is very active, and has led and participated in a number of activities around Chesham. These have included: site visits to review drainage or watercourses in particular neighbourhoods, helping agencies liaise with residents and businesses and organising a number of awareness-raising events.

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Table 2: Recommendations

Authority / Stakeholder	Recommended Actions
All RMAs	<ul style="list-style-type: none"> • Make improvements to the emergency response and coordination from all RMAs. • Continue to work in partnership on the EA-led Chesham Flood Alleviation Scheme and ensure flood risk in Chesham is considered and managed holistically. • Continue to coordinate water-related activities (regarding flooding, water quality and low flows) in Chesham through the Chesham Water Group. • Continue to work closely with the Chesham Flood Action Group (CFLAG).
Environment Agency	<ul style="list-style-type: none"> • Identify any possible improvements that would help surface water drainage in Market Square, in connection with the works completed in 2014, and that could be implemented for instance as part of the Chesham Flood Alleviation Scheme • Continue to work with riparian owners along the Vale Brook main river section to address any structural issues or blockages within the culvert. • Continue to lead and deliver the Chesham Flood Alleviation Scheme.
Transport for Buckinghamshire	<ul style="list-style-type: none"> • For TfB culverts within the Chesham area: <ul style="list-style-type: none"> ○ Continue inspecting culverts above 900mm in diameter in line with current codes of practice, which entail general inspection every two years and principal inspection every 6 years. ○ For culverts below 900mm in diameter, TfB to continue using the expertise of local area-based teams who look at all road infrastructure aspects in their area. Upon noticing issues, these will be raised as concerns or as work orders. ○ Take appropriate action to address any problems identified on BCC-owned sections by the EA's CCTV survey of the Vale Brook culvert. • Continue to carry out cleansing of all gullies and highway drainage as part of the ongoing maintenance schedule. If flow restrictions or other problems are detected as part of the maintenance exercises, repair of these should be prioritised in the schedule. • Consider design for exceedance principles in the design of new highway drainage. • Improve understanding of the location, capacity and state of repair of highway drainage in Chesham's town centre, particularly along the High Street and in Market Square.

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Buckinghamshire County Council	<ul style="list-style-type: none"> • Ensure the owners of culverts and watercourses/ditches within the area are aware of their responsibilities. • Facilitate sharing of information between RMAs and the community. • Review the temporary flood defence options in Chesham as part of the ongoing feasibility study. • Continue to deliver the Pednormead End project looking at upstream flood alleviation, which should reduce flood risk upstream of the restricted culvert under Missenden Road, during 2015 to 2018. • Deliver the Chesham-related elements of the groundwater flood risk mapping project in 2015.
Affinity Water	<ul style="list-style-type: none"> • Work with other RMAs to understand the potential flood risk implications of any abstraction reduction plans.
Chesham Town Council	<ul style="list-style-type: none"> • Work with the BCC Resilience team and TfB regarding the level of response to emergencies CTC is willing to provide and what support is available to them.
Chesham Flood Action Group	<ul style="list-style-type: none"> • Work with the EA, the BCC Resilience team and TfB regarding the level of response to emergencies CFLAG is willing to provide and what support is available to them.
Riparian Landowners	<ul style="list-style-type: none"> • Ensure that the River Chess banks are maintained in a suitable manner. The guidance given in the EA's 'Living on the Edge' booklet regarding riparian owner responsibilities should be followed. The Chilterns Chalk Streams Project's 'Cherishing the Chess' booklet also provides useful guidance and is available here: http://www.chilternsaonb.org/uploads/files/CCSP/chess_advice_web.pdf • Riparian owners of relevant culverts to undertake maintenance of culverts while following guidance from the EA.
Residents and businesses	<ul style="list-style-type: none"> • Sign up for the Environment Agency's Floodline Warnings Direct, where available. • Take measures to protect themselves and their property against flooding. • Continue to document and photograph flood incidents where possible and report flooding to CDC and/or BCC and EA. • Support the Chesham Flood Action Group's activities.

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Explanation of Acronyms

Acronym	Definition
CDC	Chiltern District Council
BCC	Buckinghamshire County Council
BGS	British Geological Survey
EA	Environment Agency
FWMA	Flood and Water Management Act
LLFA	Lead Local Flood Authority
RMA	Risk Management Authority
TfB	Transport for Buckinghamshire
CFLAG	Chesham Flood Action Group

References

Reference in document	Refers to:
BGS online map, 2014	http://mapapps.bgs.ac.uk/geologyofbritain/home.html
BCC, 2011	Buckinghamshire County Council (2011). <i>Preliminary Flood Risk Assessment</i> . BCC, Aylesbury.
Chiltern Society, 2001	Chiltern Society (2001). <i>The Great Deluge</i> (unpublished report). The Chiltern Society, Chesham.
EA, 2013	Updated flood maps for surface water
EA, September 2014	Environment Agency (September 2014). <i>Monthly Water Situation Report, South East Region, North East Thames Area</i> .
EA, 2014	Environment Agency flood map http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=floodmap&utm_source=Poster&utm_medium=FloodRisk&utm_campaign=FloodMonth13
	Contains Environment Agency information © Environment Agency and database right

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Contacts

Lead Local Flood Authority



Flood Management Team
Buckinghamshire County Council
County Hall, Walton Street
Aylesbury
Bucks HP20 1UY

Telephone: 084537 08090

Email: FloodManagement@buckscc.gov.uk

Website: www.buckscc.gov.uk/flooding

Environment Agency



**Environment
Agency**

National Customer Contact Centre
PO Box 544
Rotherham S60 1BY

Telephone: 03708 506506

Website: <https://www.gov.uk/government/organisations/environment-agency>



Chiltern
District Council

Chiltern District Council
King George V House, King George V Road
Amersham HP6 5AW

Telephone: 01494 729000

Email: info@chiltern.gov.uk

Website: <http://www.chiltern.gov.uk/flooding>

Highways Authority

Transport for Buckinghamshire

Telephone: Transport and roads – 0845 2302882

Out of hours emergencies (Highways) – 01296 486630



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Website www.buckscc.gov.uk

Email: ffb@buckscc.gov.uk

Water Utility



Thames Water
PO Box 286
Swindon
SN38 2RA

Telephone: 0845 9200 800

Website: <http://www.thameswater.co.uk/help-and-advice/16739.htm>

Emergency Response

Buckinghamshire Fire and Rescue Service

Address: Buckinghamshire Fire & Rescue Service, Brigade HQ,
Stocklake, Aylesbury, Bucks, HP20 1BD

Telephone: 01296 744400

Website: <http://bucksfire.gov.uk/contact-us>

Thames Valley Police

Telephone: 101 in non-emergency, 999 in emergency

Website: <https://www.thamesvalley.police.uk/>

Buckinghamshire Ambulance Service

Telephone: 111 in non-emergency, 999 in emergency

Website: <https://www.scas.nhs.uk/>

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Appendices

Appendix A: BCC criteria for a Section 19 Investigation

- Internal flooding (including to basements) to five or more residential properties within an area of 1km²
- Internal flooding of two or more business premises within an area of 1km²
- Internal flooding (including to basement) of at least one property for one week or longer
- Flooding of one or more items of critical infrastructure, which could include hospitals, health centres, clinics, surgeries, colleges, schools, day nurseries, nursing homes, emergency services (police, fire, ambulance) stations, utilities and substations.

- Caused a transport link to be impassable for the following periods:
 - Motorways, trunk roads and major rail links – 2 hours or more
 - Class A and B highways and other railway links – 4 hours or more
 - Class C highways – 10 hours or more unless the route is the only means of access, or is primary route for critical infrastructure then reduce to 4 hours
 - Class U highways – 24 hours or more unless the route is the only means of access, or is primary route for critical infrastructure then reduce to 4 hours

- Any flooding event that a risk management authority deems significant does not meet the agreed thresholds should be brought to the next strategic flood management committee for consideration.