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Buckinghamshire County Council

Flood Investigation Report

Chalfont St Peter

January – March 2014



Photos courtesy of Glynis Chanell, 12/02/14 and 17/02/14.

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Revision Schedule

Buckinghamshire County council Flood Investigation Report

02 January 2015

Rev	Date	Details	Author	Checked and Approved by
1	19/11/14	Draft for review	Anne-Claire Loftus	Karen Fisher
2	02/01/15	Final report	Anne-Claire Loftus	Karen Fisher

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Executive Summary

This report has been produced by Buckinghamshire County Council (BCC) to investigate the flooding that occurred in Chalfont St Peter during January-March 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 Chalfont St Peter 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 Chalfont St Peter occurred after a prolonged period of above average rainfall which, combined with exceptionally high groundwater levels, raised river levels. In addition, a culvert flow restriction in the village caused the River Misbourne to back up, and may have caused a backup of the surface water drainage network. Moreover, a blockage within the sewer network caused an overflow of foul water onto the A413, while groundwater infiltration within the sewer network also caused foul water overflows within the village centre. A list of recommendations is included which, if followed, will reduce the flooding in Chalfont St Peter.

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 Chalfont St Peter because it met the following threshold: internal flooding of two or more business premises within an area of 1km². In addition, the High Street was closed for approximately two weeks.

1.2 Site Location

Chalfont St Peter is a large village of approximately 13,000 inhabitants located at the south of Chiltern District in the south of Buckinghamshire, as shown in Figure 1.

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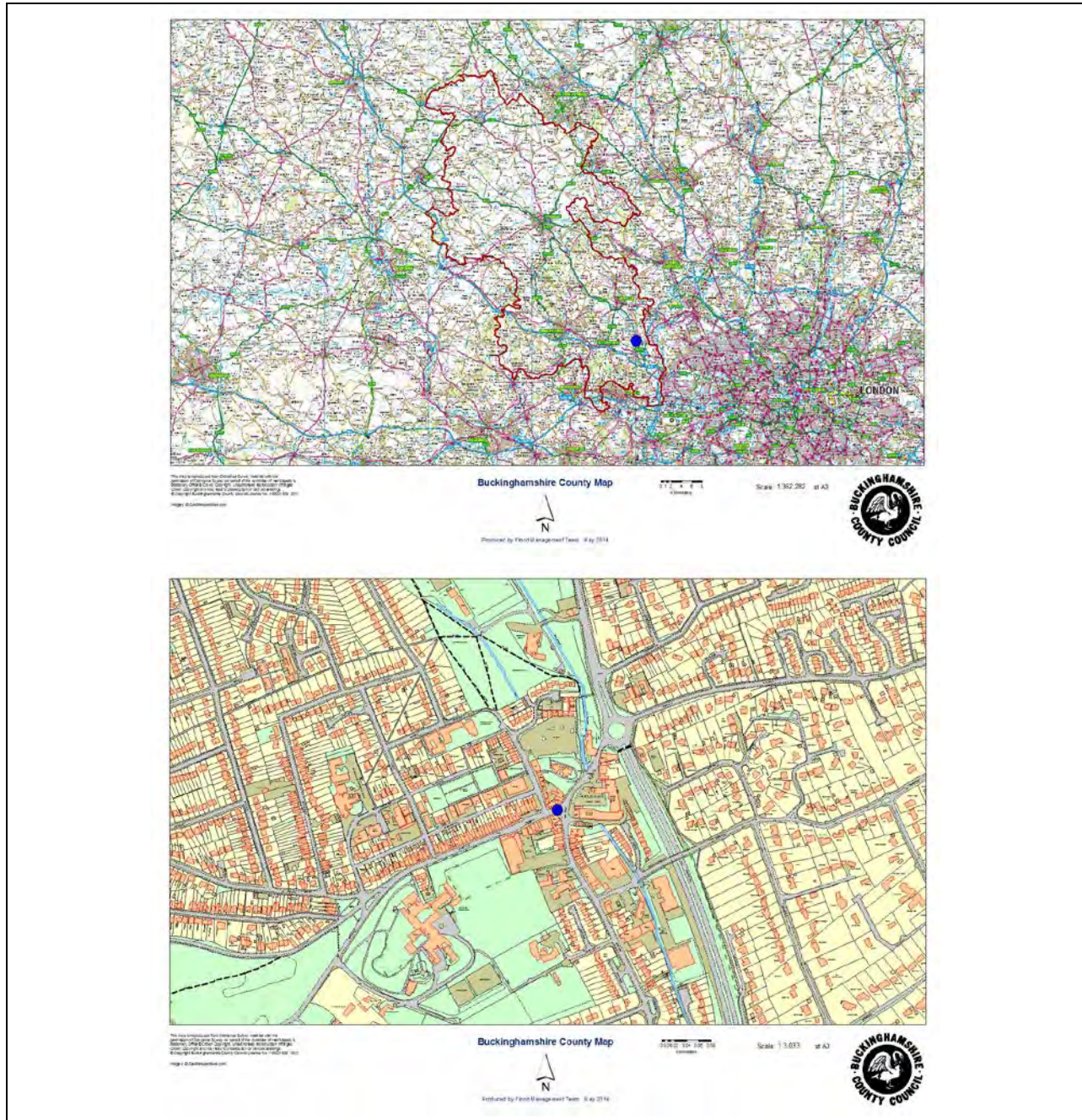


Figure 1: Location maps for Chalfont St Peter at County and local level (Ordnance Survey License 100021529 2014)

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1.3 Drainage system and river network

The River Misbourne is a main river that flows through Chalfont St Peter, as shown in Figure 2. It is a chalk stream that flows for 17 miles (27 km) from Mobwell Pond just north of Great Missenden to its confluence with the River Colne, which itself is a tributary of the River Thames. Apart from a small section in Great Missenden, the River Misbourne is classed as a main river. The Environment Agency (EA) is the RMA for the main river section, as defined in section 4.3. The Environment Agency has powers to work on main rivers and the sea to manage flood risk.

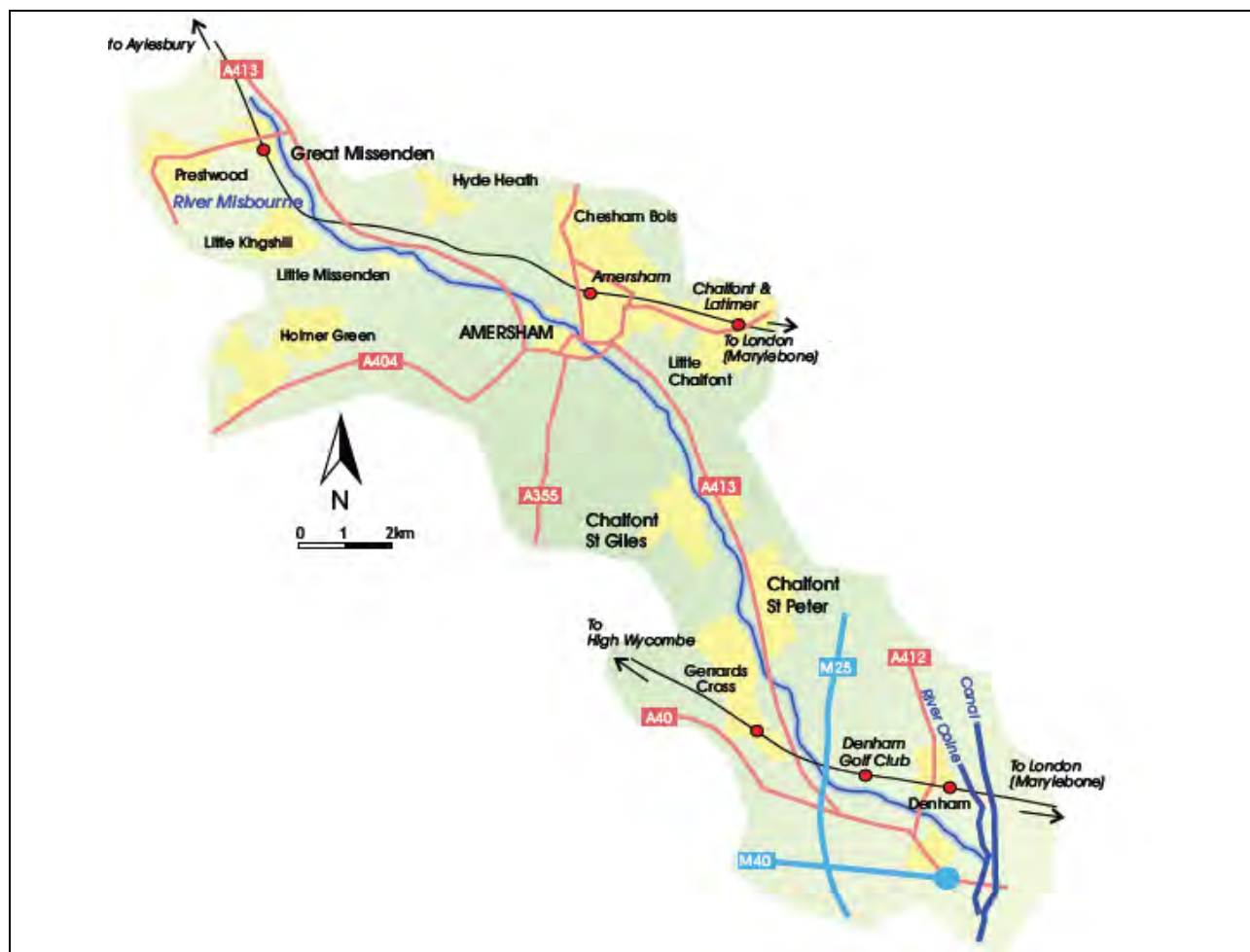


Figure 2: The River Misbourne (Source: Chilterns Chalk Streams Project)

After exiting Chalfont St Giles upstream of Chalfont St Peter, the River Misbourne runs south through open fields to Chalfont St Peter.

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The River Misbourne runs approximately parallel to the A413/Amersham Road/Gravel Hill on its west side. It runs alongside the east side of the football fields (SU 99915 91267). A small ordinary watercourse, marked in light blue in Figure 3, flows into the River Misbourne from the northwest, partly flowing through a culvert under properties and a parking lot.

The two main areas of concern are shown in Figure 3 below: A is the location of the sewer overflow onto Gravel Hill (TQ 00088 91109), while B shows the location of the road and property flooding (around TQ 00102 90885). The explanation of these areas of concern is given below in Section 3.4.

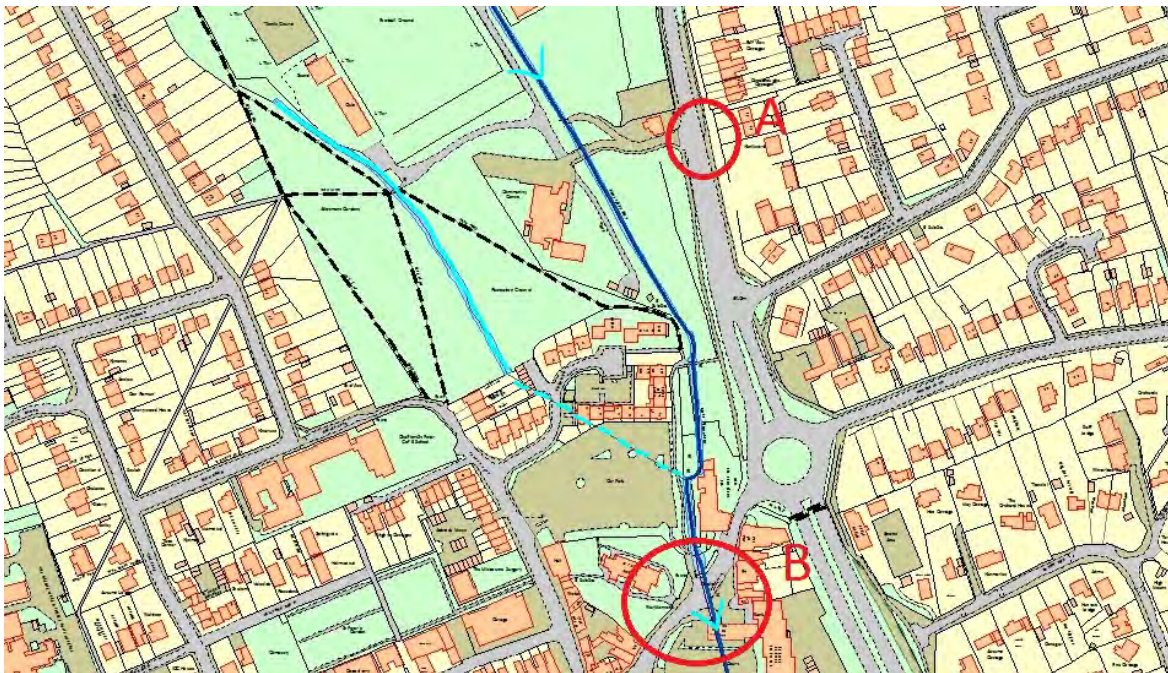


Figure 3: Sewer overflow (A) and main road and property flooding (B) locations in Chalfont St Peter (Ordnance Survey License 100021529 2014)

Figure 4 overlays current maps of Chalfont St Peter with the historic county map (1:2500 First Edition, 1876-1885), showing the historical route of the River Misbourne and also illustrating the culverting of the river in the village centre.

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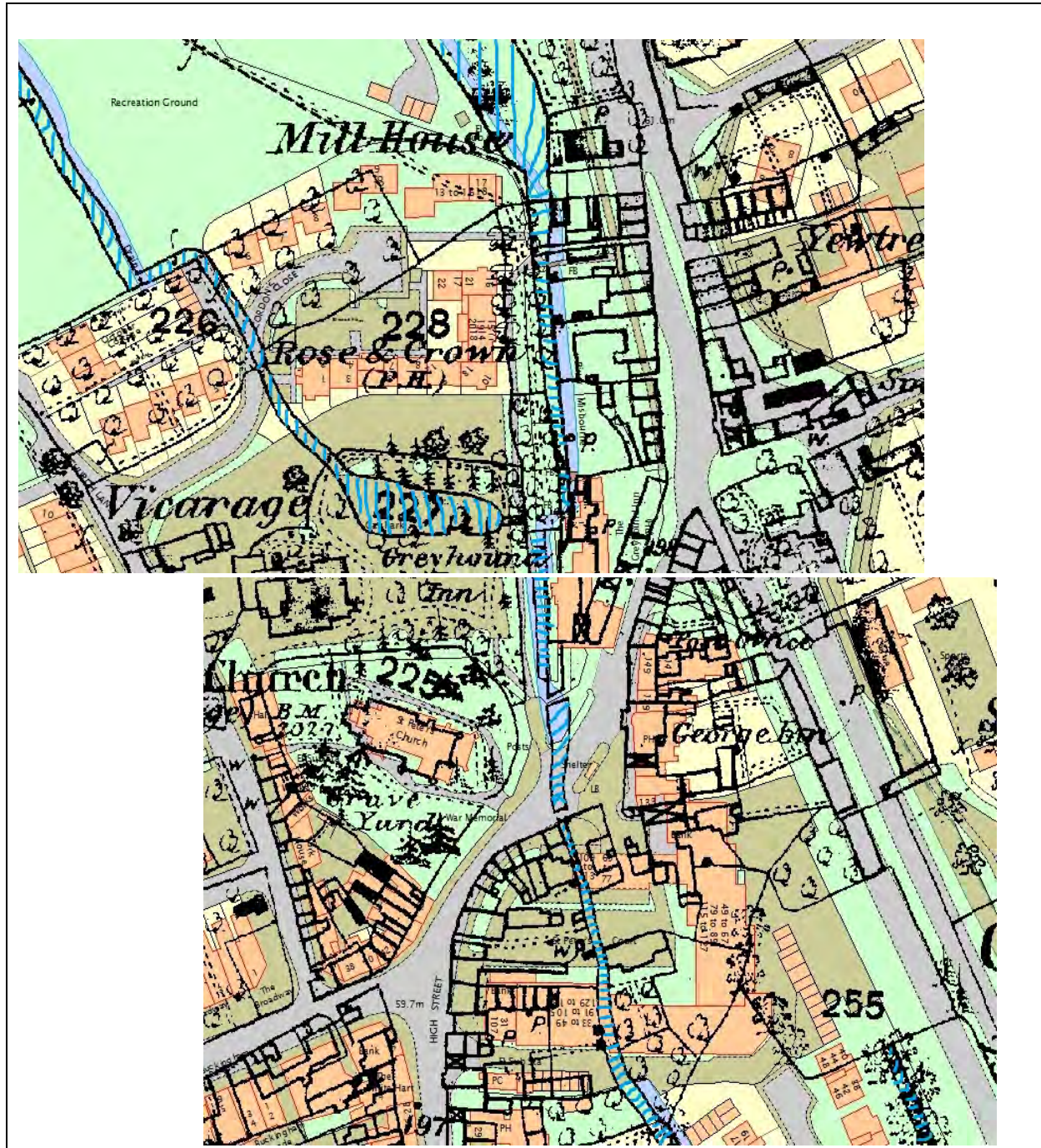


Figure 4: Current (solid blue) and historic (blue hashed line) map of watercourses in Chalfont St Peter (Ordnance Survey License 100021529 2014)

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Figure 5 shows Chalfont St Peter’s surface water drainage system which is owned and maintained by Transport for Buckinghamshire (TfB). The road drainage system along the A413 flows east to west into the River Misbourne. The culvert that takes the River Misbourne underneath St Peter’s Court is marked with an orange line; the culvert is split into two separate pipes, with the one on the east being referred to as the left-side culvert (looking downstream) and one on the west being referred to as the right-hand culvert.

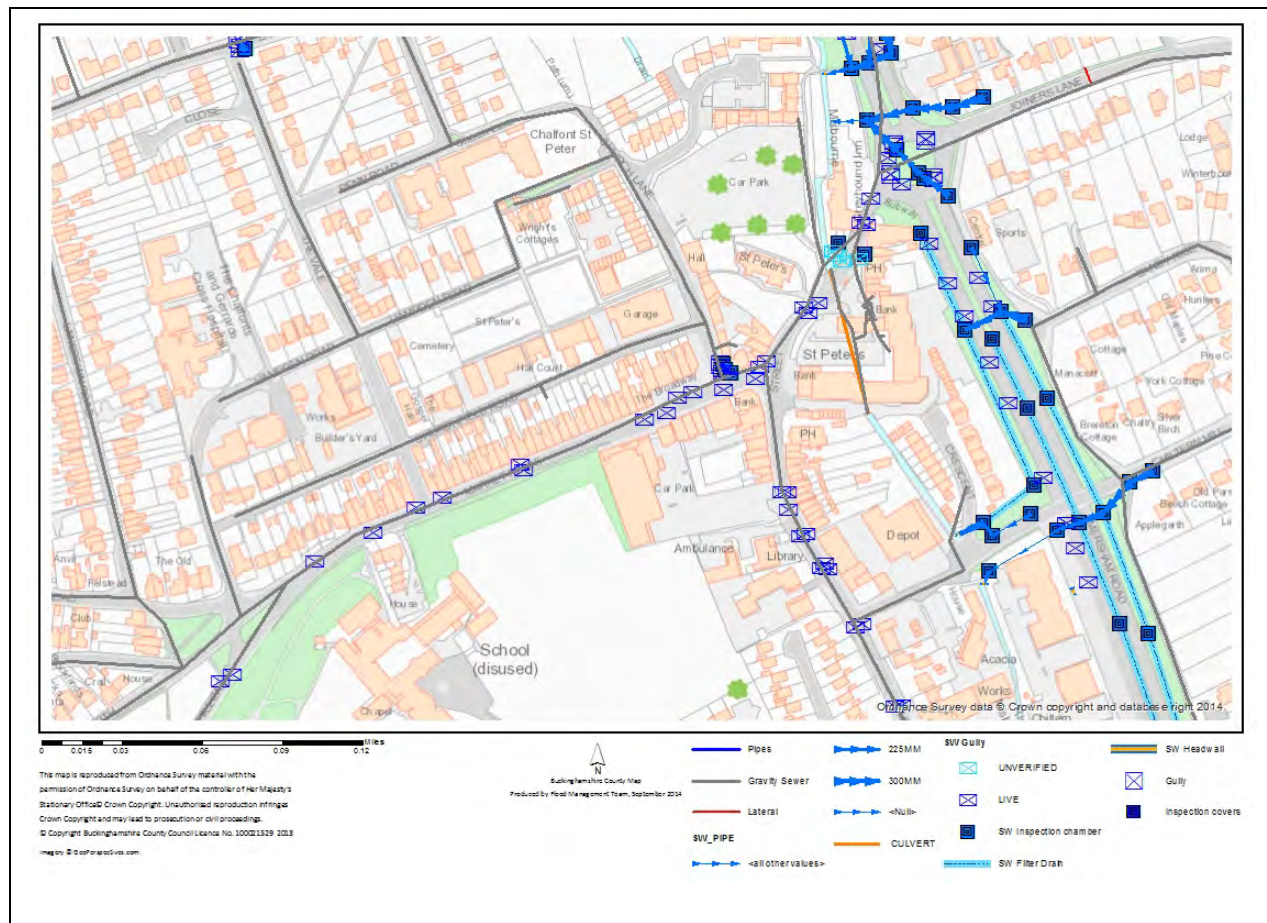


Figure 5: Maps showing highway drainage in Chalfont St Peter (Ordnance Survey License 100021529 2014)

Figure 6 shows the connections into the east culvert underneath the High Street and St Peter’s Court. Only the east culvert connections are marked because the Environment Agency was unable to survey the west culvert.

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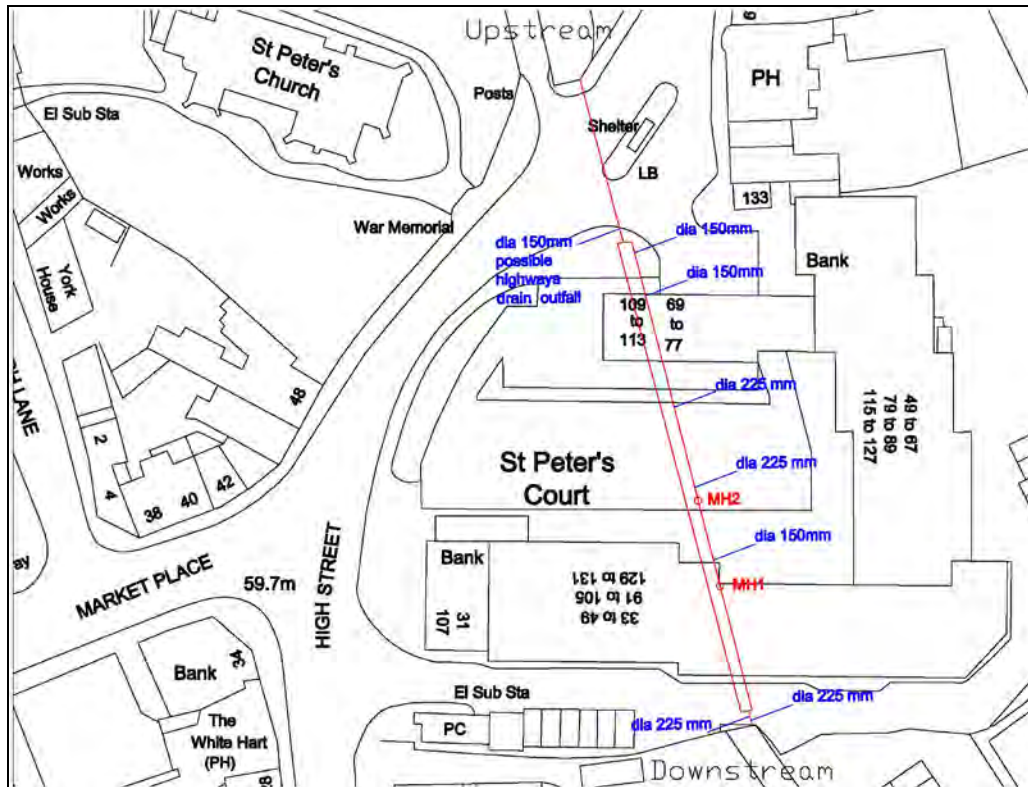


Figure 6: Pipe connections into the east culvert underneath St Peter's Court (Source: Environment Agency, 2010)

Figures 7 and 8 show the water company assets in Chalfont St Peter. Figure 7 is a map of the Affinity Water assets relating to drinking water in the village, while figure 8 maps the foul water assets owned by Thames Water.

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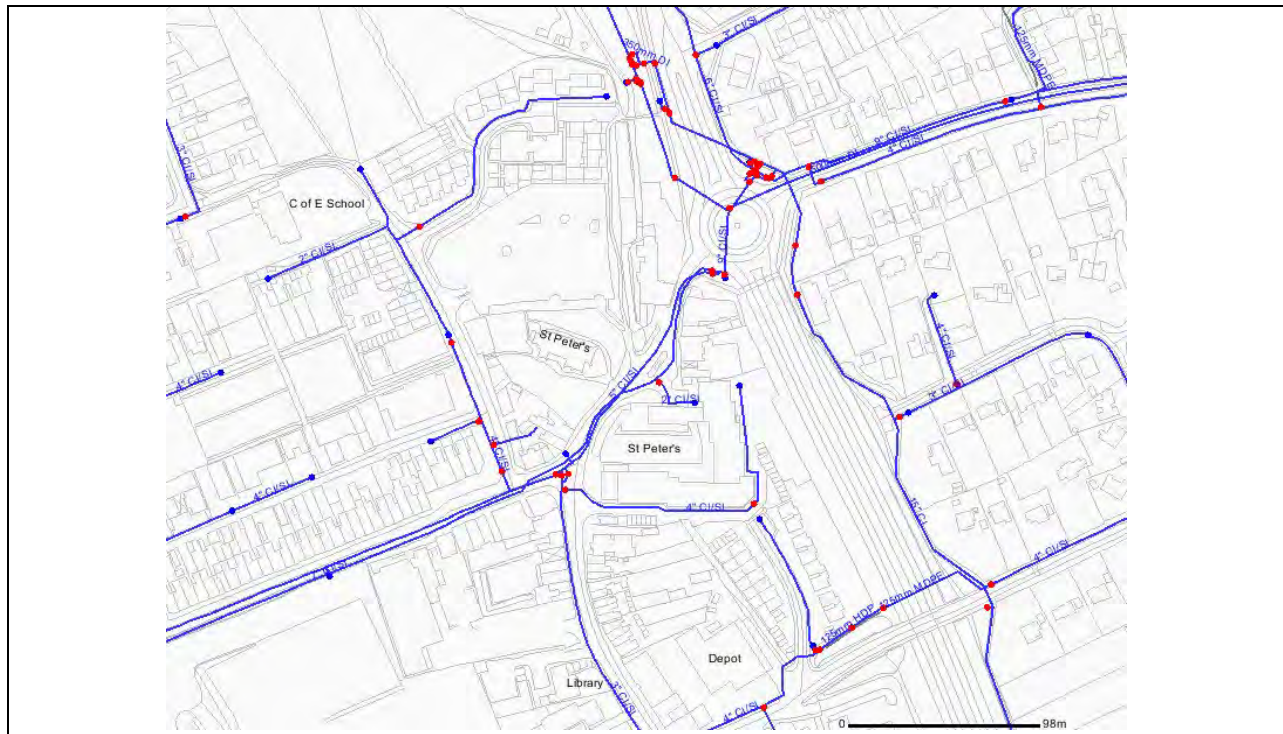


Figure 7: Map showing Affinity Water assets in Chalfont St Peter (Source: Affinity Water)

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2. Background

2.1 Catchment characteristics

The River Misbourne is a main river, as designated on the main river map produced by the EA. The Misbourne is culverted in some sections through Chalfont St Peter, allowing for access to properties and the passage of flow under the highway. In several cases, properties have been built above the culverted river. Figures 9 and 10 below show the fluvial and surface water flood maps for the village.

The fluvial flood map (figure 9) shows the flooding which would occur from the main river in a 1 in 100 year and 1 in 1000 year event. The flood water in these situations would come from the river and flow out onto the impacted areas shown on the map.



Figure 9: EA flood map showing the River Misbourne 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 10) shows the extent of flooding in the 1 in 30, 1 in 100 and 1 in 1000 year events for the area surrounding Chalfont St Peter. 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.

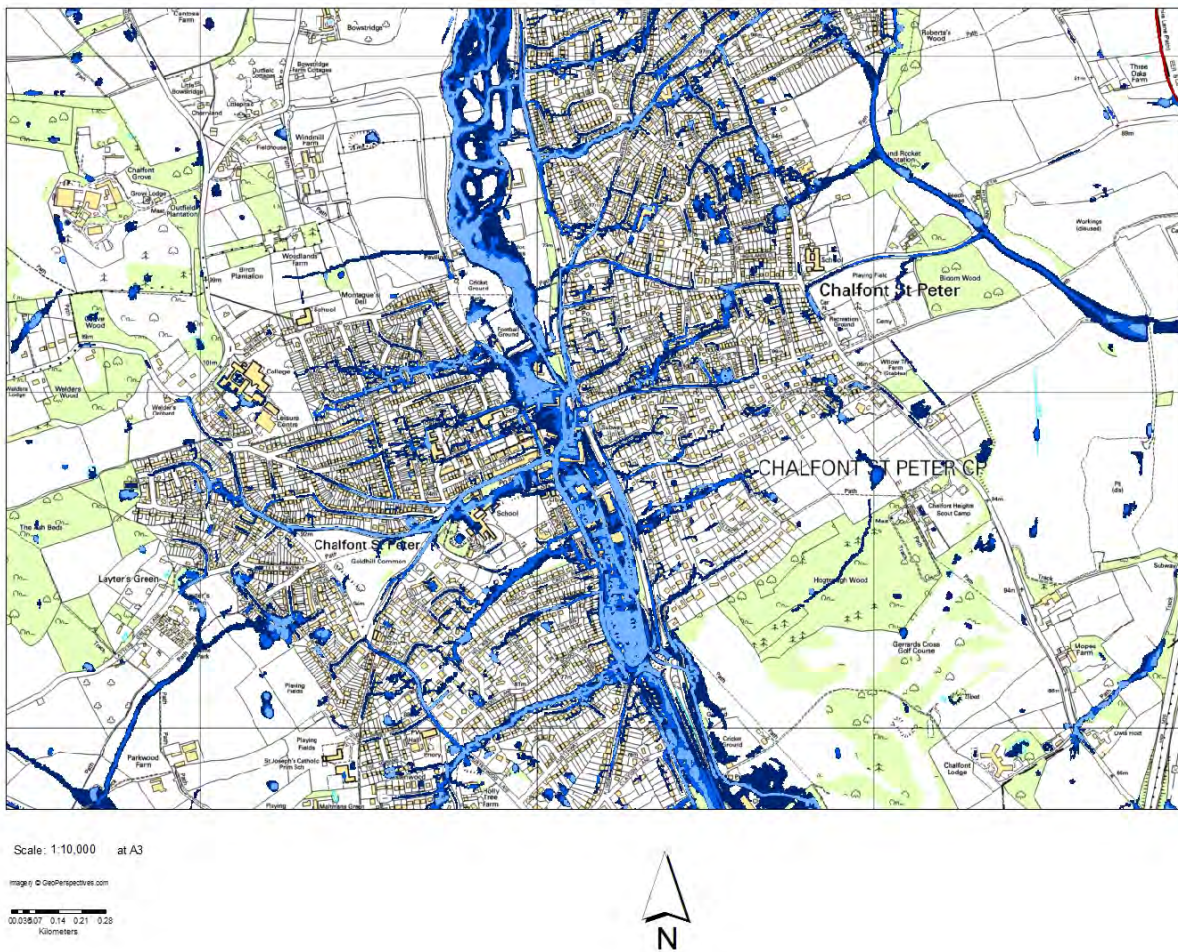


Figure 10: Surface water flood map showing predicted extent of flooding in Chalfont St Peter for the 1:30 (light blue), 1:100 (medium blue) and 1:1000 (dark blue) year events (EA, 2013) (Ordnance Survey License 100021529 2014)

Figures 9 and 10 show that although there is a band of fluvial flood risk running along the valley bottom parallel to the A413, a more extensive area within the village is at risk of flooding from surface water.

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Chalfont St Peter is situated on alluvium (clay, silt, sand and gravel) along the line of the Misbourne, with sand and gravel superficial deposits on the more hilly parts of the village. The solid geology is chalk along the A413 and the line of the River Misbourne, but is Lambeth group (clay, silt and sand) on the more hilly parts of the village either side of the river, as shown in figure 11. Low lying areas underlain by permeable strata such as chalk, such as Chalfont St Peter along the line of the River Misbourne, are particularly susceptible to groundwater flooding. In terms of the event described in this report, groundwater played a role because of its incursion into the foul sewer network. The valley of the River Misbourne at Chalfont St Peter slopes from 90-95mAOD either side of the village down to 65mAOD where the river flows through Chalfont St Peter towards the south.

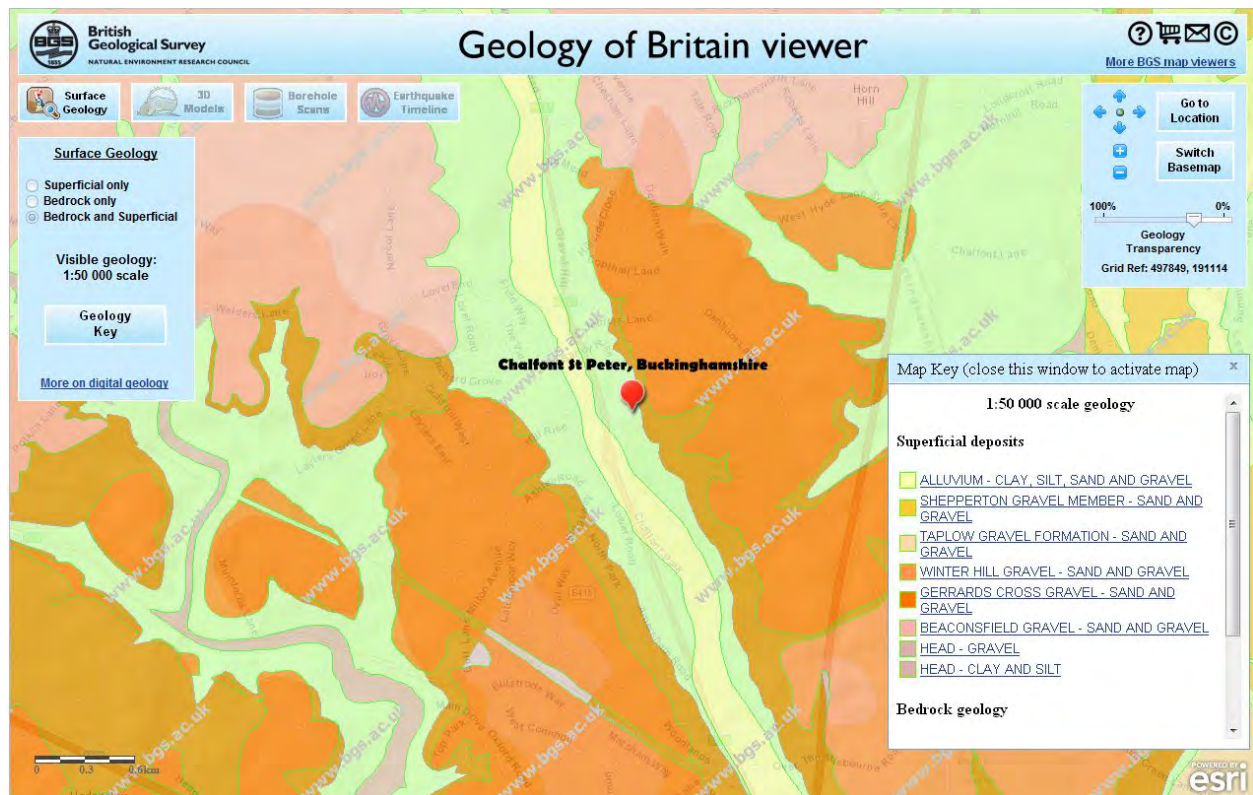


Figure 11: Geology of Chalfont St Peter (BGS online map, 2014)

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2.2 Previous flood events

A Chiltern Society report into the 2000/1 flooding recorded a number of details about the flooding in and around Chalfont St Peter (Chiltern Society, 2001).

- A pinch point at and flooding of “Irishman’s bridge” (a footpath crossing the River Misbourne near the Greyhound Inn - TQ 00083 90986), causing flooding to the car park and village centre.
- Flooding to the Greyhound Inn, which closed regularly starting from October 2000 (the business closed permanently from February until at least December 2001). Other businesses were impacted either directly (by water ingress) or indirectly (because of access difficulties for customers).
- Repeated flooding to the village center between November 2000 and February 2001, with sewage often combining with floodwater, leading to multiple road closures (once for a week in February 2001). The village center was flooded to a depth of 45 cm in February 2001.
- Extended flooding to the south of the village center following the storm of 12/13 February 2001, with fluvial flooding augmented by surface water flooding coming from the west.

The Environment Agency commissioned a CCTV survey of the culvert through which the River Misbourne passes under the High Street and several buildings located on St Peter’s Court in November 2010. The CCTV survey was done to meet a Defra target for flood defence assets inspections on a risk-based frequency. The survey revealed a flow restriction in the culvert. The Environment Agency initiated contact with the riparian owner of the culvert, who is responsible for maintaining it, in November 2010. More information about this culvert is provided later in this section and in section 3.

A number of instances of flooding in Chalfont St Peter were recorded for the Buckinghamshire Preliminary Flood Risk Assessment (BCC, 2011). Transport for Buckinghamshire reported a number of drain flooding incidents: November 2006 (Kingsway, Lower Road, The Rowans), December 2006 (Leachcroft, Gold Hill West, Gold Hill North, Foxdell Way), January 2007 (Rickmansworth Lane, Welders Lane), February 2007 (Gravel Hill, Amersham Road, Bull Lane), March 2007 (Chiltern Hill, Joiners Lane, Layters Green Lane, Nicol End, North Park) and May 2007 (Pennington Road, Grassingham End). Transport for Buckinghamshire also reported a number of

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road flooding incidents in October 2010 (West Hyde Lane, Denham Lane and Amersham Road at the Greyhound roundabout) (BCC, 2011). Chiltern District Council pointed out High Street/Lower Road as a recurring problem area for road flooding and sewage discharges (BCC, 2011). BCC has not been provided with any records of flooding in this area from Thames Water.

The Chalfont St Peter Parish Council (CSPPC) has highlighted certain areas as suffering from recurring flooding or ponding: the junction of Church Lane and Market Place, and the High Street foul sewer manholes near the churchyard and river. CSPPC also noted that there was a flood in Lower Road in 2005.

On 16 March 2013, the High Street in Chalfont St Peter flooded. The road was closed for unrelated bridge works (which took place from March to May 2013) so traffic was not affected, but the sewage-laden water caused an inconvenience and health hazard to pedestrians. Manholes were reported to be overflowing, and gullies on the road were reported to not be draining the water away (Chalfont St Peter Parish Council, 2013). The Environment Agency conducted a site visit on Saturday 16 March 2013, accompanied by a Thames Water contractor, to investigate manholes overflowing with sewage (location not known). No blockage was found, and although the water levels in the chambers were high the water was running freely; meter readings in the watercourse revealed that oxygen levels and other parameters were within the normal range. Towards the end of the day, manholes were no longer overflowing (Environment Agency, 04 April 2013). Referring to this particular incident, Chalfont St Peter Parish Council reported that overflowing manholes were a regular occurrence in the village (Chalfont St Peter Parish Council, 04 April 2013). Residents reported flooding of the underpass under the A413 from 16 to 20 March 2013 and again on 25 March 2013. Multiple instances of road flooding were reported from 16 to 26 March 2013 (at Denham Lane and Kingsway among others). The High Street road gullies were cleaned around that time in conjunction with the bridge works.

The Environment Agency attempted to undertake a CCTV of the culvert in April 2013; this was not possible because of the silt blocking the culvert. The Environment Agency contacted the riparian owner again in May and September 2013 requesting for the culvert clearance work to be undertaken.

On 05 August 2013 the High Street was flooded once again, seemingly without the



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presence of sewage. The road gullies on Market Place had been cleaned out the week prior to the flooding, in conjunction with road resurfacing done by Transport for Buckinghamshire. A multi-agency site visit involving the Environment Agency and Buckinghamshire County Council was held on 19 August 2013, at which the Environment Agency committed to follow up with the riparian owner of the blocked culvert.

In September 2013, the riparian owner informed the Environment Agency that they had been in touch with several contractors regarding the culvert clearance work. The Environment Agency contacted the riparian owner further in September and October 2013. In October 2013, the riparian owner advised the Environment Agency that they had chosen a contractor and requested the EA to serve a formal notice. This formal notice was sent by the Environment Agency on 25 November 2013, allowing for 90 days for the work to be done. Further details about the work and about contact between the Environment Agency and the riparian owner is detailed in section 3.4.

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3. Analysis of January-March 2014 flood event

3.1 Conditions at the time

The EA provided rainfall data for the period of 01 December 2013 to 30 March 2014. The nearest EA rain gauge is at Maple Lodge Sewage Treatment Works. Figure 12 gives the daily rainfall totals from the Maple Lodge gauge for the period from December 2013 to March 2014. From this data it can be seen that there were constant high levels of rainfall from mid-December 2013 to early March 2014, with peaks on 23 December 2013, 31 January and 06 February 2014. There was almost daily rainfall from mid-December 2013 until early March 2014, and the gauge registered a maximum (for the period) of 27 mm of rainfall on 06 February 2014.

To put this rainfall in context, from 01 October 2013 to 28 February 2014, the Colne catchment received 166% of the long-term average, while for the month of February itself the Colne catchment received 240% of the monthly rainfall average (EA, February 2014). This was the third wettest February in the EA's North East Thames Area since records started in 1910 (EA, February 2014).

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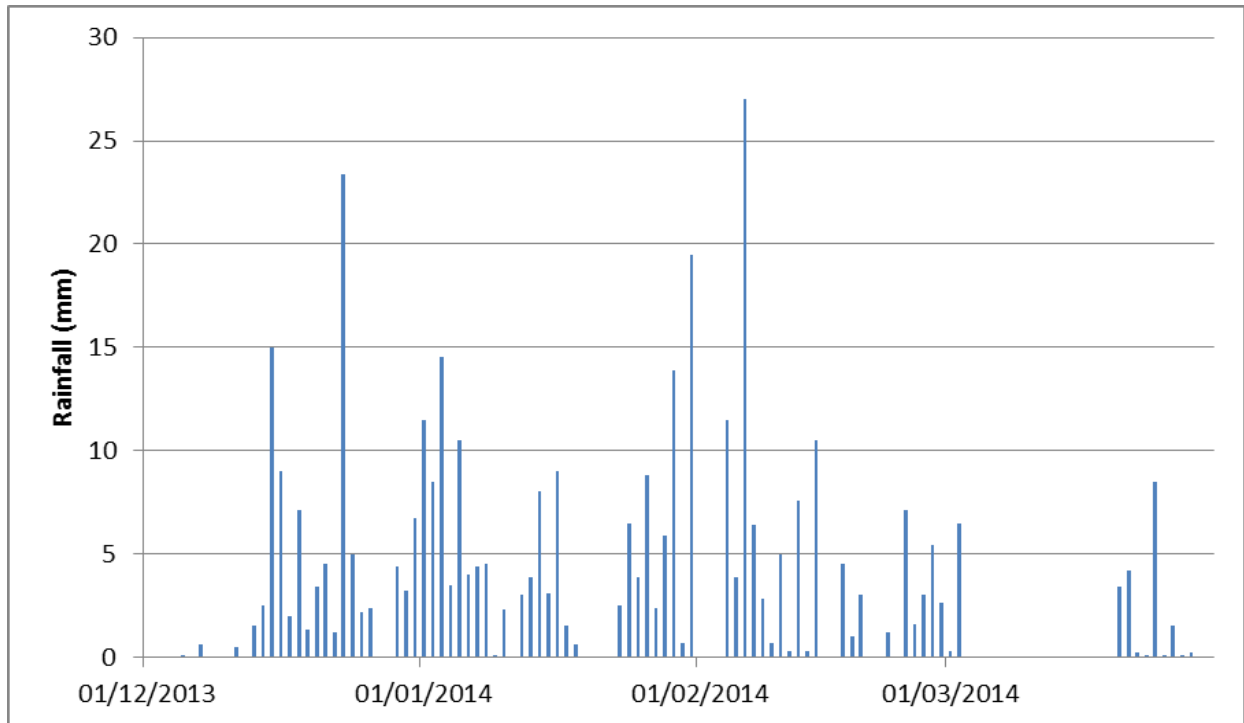


Figure 12: Daily total rainfall for rain gauge at Maple Lodge from 01 December 2013 to 30 March 2014 (EA, 2014)

The EA's nearest telemetered river level gauge is at Little Missenden (SU 9342198458, approximately 11 km upstream of the centre of Chalfont St Peter). Figure 13 shows the river levels for December 2013 to April 2014.

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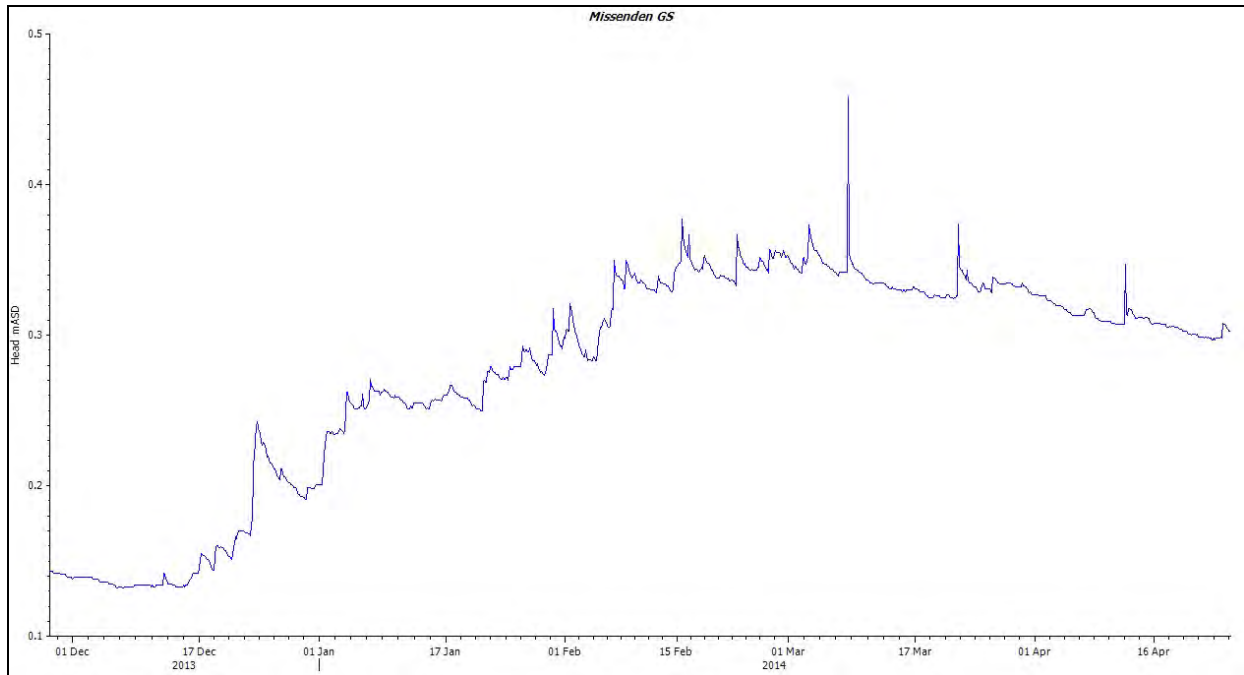


Figure 13: River Misbourne hydrograph, as per Little Missenden gauge measurements, December 2013 to April 2014 (EA, 2014)

The Little Missenden gauge has been in operation since October 1993. The EA's records for the gauge show that the entire event (the three months leading up to March 2014) is listed as number 1 of the top 10 levels ever recorded at this site. The peak level of the event was on 08 March 2014, at 459mm, although there were other peaks in river levels during the event in question, for example on 07 and 08 February 2014.

The measurements from the Little Missenden gauge can only give an indication of levels in Chalfont St Peter. Indeed, it is too far upstream from the village to accurately reflect the local river levels in Chalfont St Peter, which are primarily affected by the presence of culverts, natural restrictions to flow, blockages and other things. However, Figure 14 – the hydrograph for the past three years – can give an indication of levels in the area. It shows the high levels of February/March 2014, with similar levels recorded in March/April 2013. As a note, river levels in the area vary in the period analysed by 443mm (the difference between the lowest and the highest recorded levels).

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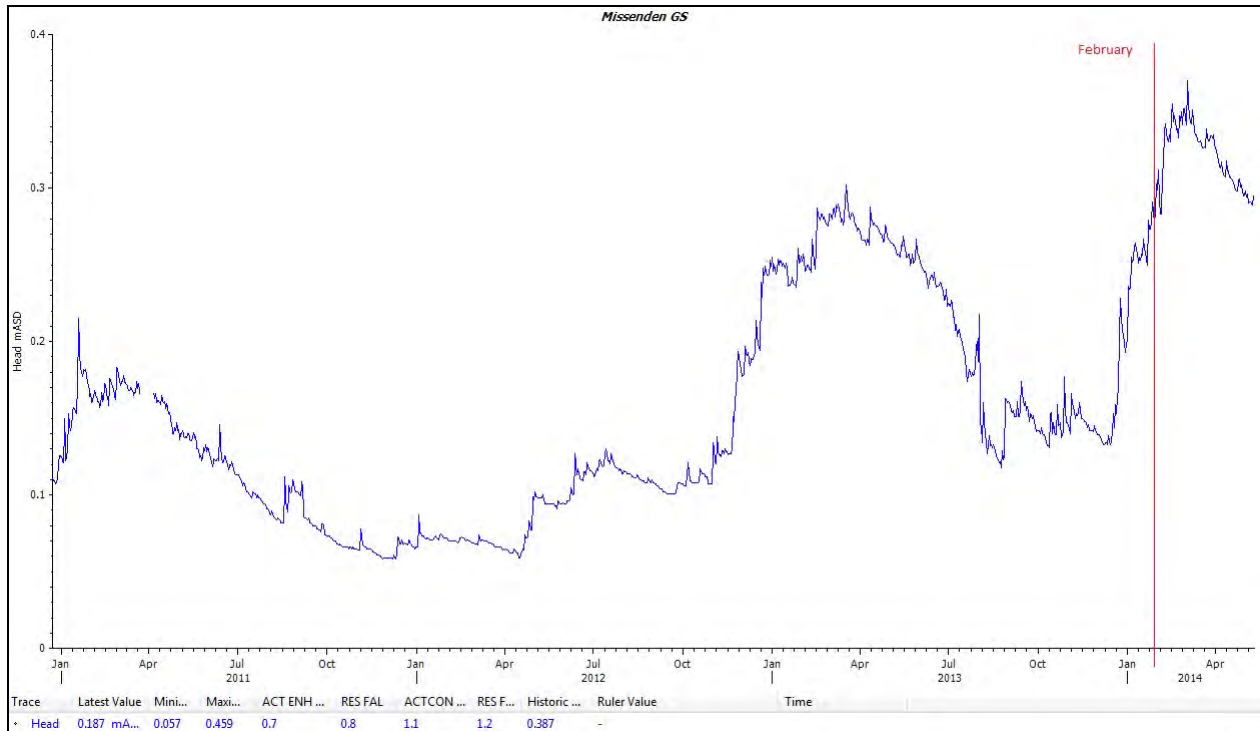


Figure 14: River Misbourne hydrograph, as per Little Missenden gauge measurements, January 2011 to April 2014 (EA, 2014)

Groundwater was ‘exceptionally high’ throughout the Colne catchment during the period of flooding under investigation; ‘exceptionally high’ is the maximum category for groundwater levels, meaning levels are likely to fall within this band 5% of the time (EA, February 2014). The EA, using the river gauge data at Little Missenden, treated the three-month period leading up to 08 March 2014 as one event, because of the heavy influence of groundwater. The situation was much the same across the whole River Colne catchment, with the soil moisture deficit (SMD) being zero in February 2014, indicating that the soil was completely saturated (EA, February 2014). This would have had important implications for the flooding, as the soil would have been unable to absorb the continuing rainfall.

3.2 Condition of features

The flow in the culvert located under St Peter’s Court (see B, figure 3) was partly restricted, as evidenced by the CCTV survey attempt of 2010 (see Section 2.2). The

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gullies on the High Street, which are designed to discharge to the Misbourne, were seemingly unable to discharge at full capacity due to the high water levels in the Misbourne and due to the flow restriction within the culvert. This idea was supported by the rapid clearing of surface water once the culvert had been cleared and the gullies jetted, though it will not be fully confirmed until a CCTV survey of the culvert is performed.

Groundwater had infiltrated into the sewer network, not because of any cracks or collapses, but rather because the sewer network is not sealed to prevent ingress of water. In addition, it was reported to BCC that Thames Water found a blockage within the sewer network next to the A413 (see A, figure 3).

3.3 Condition of watercourse

A visual survey (18-19 February 2014) of the River Misbourne from the High Street to Kingsway did not find any obstructions to flow within the watercourse (see section 3.4).

The EA do not undertake maintenance on the River Misbourne 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 some of the problems experienced by Chalfont St Peter in 2014 have been experienced in previous instances, this report covers the flood incident of January to March 2014 only (see Section 2.2 for more details of previous flood events).

Chalfont St Peter Parish Council reported manholes overflowing with sewage-laden water to Thames Water, copying in the Environment Agency, on the weekend of 05/06 January 2014 (reported on 08 January 2014) and on 07 February 2014. Both instances caused sewage-laden water to enter the George pub on the High Street, and the 07 February instance also caused internal flooding in the Greyhound Inn as well as a road closure for at least 10 hours. BCC has not been able to obtain information from Thames Water about the response to the flooding reports on these dates.

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On 10 February 2014, residents reported the sewage overflow next to the A413 zebra crossing to Chiltern District Council, who attended onsite and reported the problem to Thames Water, who informed they would attend within 24 hours.

On 11 February 2014, Thames Water was onsite to attend to a further instance of sewage overflow from a manhole; Thames Valley Police assisted with a road closure to enable the clean-up of sewage from the road and pavement around the A413 zebra crossing to proceed. The same day, as reported by the Environment Agency, the Affinity Water pumping station in the upstream village of Chalfont St Giles ceased pumping because it was flooded.

On 12 February, The George pub suffered from internal flooding with sewage-laden water again. The EA and other agencies (Thames Water and BCC) attended onsite to determine whether pumping arrangements might alleviate flooding on the High Street, but it was decided not to do this given the increased risk of flooding to residential properties downstream.

On 13 February 2014, Transport for Buckinghamshire sent a tanker onsite; it left with a full load, but given the return of water to the same levels within 15 minutes, the tanker was instructed not to return after having removed a full load (1800 gallons) as it was clearly not effective enough for the volume of water to be removed. From November 2013 to 13 February 2014, the Environment Agency contacted the riparian owner three times to ask for an update on the culvert clearance work.

On 14 February 2014, the Environment Agency arranged for a contractor to clear the blocked culvert (see section 2.2) under its emergency works remit. The decision was made to undertake the work – despite the enforcement notice on the riparian landowner not yet having expired – given the significant disruption caused by the flooding in the village. The contractor was instructed to start onsite on 16 February 2014 for an initial assessment, with jetting to commence on 17 February. Because the Environment Agency undertook the emergency works before the expiry of the notice on the riparian owner, it was not able to recover the costs of the work or take further enforcement action on the riparian owner.

Due to high water levels, the contractor was unable to deploy silt nets downstream of the culvert to catch debris, as is usually done. Observation downstream of the culvert

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during the jetting found that large amounts of silt, several pieces of plywood, branches and general refuse were being removed. The jetting continued until 21 February 2014, with the assumption that any remaining silt would be flushed out gradually over the following weeks thanks to the natural flow of the river. River levels fell slowly during the week the jetting process was undertaken.

Buckinghamshire County Council's Flood Management Team organised a multi-agency meeting on 18 February 2014, inviting representatives from the Environment Agency, Thames Water, Chiltern District Council, Transport for Buckinghamshire and the Parish Council. The actions from the meeting were as follows:

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Table 1: Actions from the multi-agency meeting of 18 February 2014

Agency	Actions, as per the meeting minutes	Current status
Environment Agency	Survey, and where possible clear, the river bed and banks for 1000m downstream of the culvert to ensure there are no preventable constrictions to flow.	Reported on 20/02: EA walked the length of the river downstream of High Street to the Kingsway/A413 roundabout and found: <ul style="list-style-type: none"> - No obstructions to flow - All culverts have ample capacity - No channel realignment is required - The channel is conveying water as efficiently as it can - Bank height is adequate along the majority of this stretch
Environment Agency	Check upstream as it was believed there has been work to the river course (Misbourne Farm, upstream of Chalfont St Giles).	Reported on 20/02: The EA enforcement officer is aware of the development on this site and has regular contact with the owner. The recent constructions do not increase flood risk downstream.
BCC (TfB)	When the culvert was clear, TfB would ensure the road gully in the flooded area was cleared.	Culvert clearing finished on 21/02 and gullies jetted on 22/02. Further jetting planned in November 2014.
BCC (TfB)	BCC and TfB will also survey other areas of the village where roads are liable to flooding, including the A413 which is TfB's priority. All blocked gullies identified will be cleared.	Action done, with blocked gullies identified and cleared either as part of reactive orders or routine maintenance.
BCC (TfB)	BCC and TfB will identify all areas which regularly flood due to blocked boreholes. TfB will bore/re-bore soakaways.	Although there are no soakaways in the village centre, all blocked soakaways are identified using the "supersucker" and are put on the programme for re-boring if needed.

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Thames Water	Look again at the possibility of sealing a manhole next to the George Inn and either carry out the work or report why not.	Status unknown
Thames Water	Consider reinstating pumping from Thames Water sewers into the Misbourne, with EA approval, and consider obtaining additional pumping capacity.	Status unknown
Thames Water	Send a clean-up team and gulley sucker to the zebra crossing on the A413 on 18/02/2014, de-block gulley and cleanse area from site of discharge to the roundabout and continue this every day until problem rectified. Regarding the manhole on Gravel Hill, it was felt there may be a blockage downstream from here and this was to be checked out.	Status unknown
Thames Water	There was a suggestion that holding tanks could help relieve flash floods, Thames Water to look into this.	Status unknown
Thames Water	Thames Water said there had been a full study of the catchment on-going until the water levels got too high. TW were asked by DM that funding was made available to ensure this was completed as soon as possible when levels reduced.	Reported on 14/05: Thames Water undertaking an information-gathering exercise in 20 catchments severely affected by infiltration and groundwater problems, to prioritise them for more detailed investigations
Thames Water	There had also at one time been proposals to line the main sewers. Can this be re-examined? Also the possibility of foul flows being screened in tanks and excess flow discharged into the Misbourne during storm flows.	Status unknown

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On 20 February 2014, the Affinity Water pumping station at Chalfont St Giles resumed pumping, which may have had a small and very localised but positive impact on groundwater levels and hence on water levels in the River Misbourne. Also on 20 February 2014, the Environment Agency conducted a site visit in Chalfont St Peter to review the impact of Thames Water sewage discharges into the River Misbourne. Water quality was found not to have been overly adversely impacted, and the Environment Agency continued to allow discharges into the river provided dissolved oxygen levels (a measure of water quality) were monitored daily by Thames Water and reported to the Environment Agency. The date at which discharges of sewage-laden water into the River Misbourne stopped is not known.

On 14 May 2014, Thames Water informed Buckinghamshire County Council that they were undertaking an information-gathering exercise in 20 catchments severely affected by infiltration and groundwater problems (including the Misbourne catchment, covering Chalfont St Peter), with the exercise intended to help prioritise those catchments for further more detailed investigations.

In total, the flooding caused at least 2 business premises to flood internally. These numbers are based on instances of internal flooding as reported to the RMAs; more properties may have been affected. In addition, business activities were indirectly affected by the flooding in the village centre which affected parking and pavement usage by customers.

3.5 Possible causes

The weather conditions

- Continued high levels of rainfall throughout December 2013, January and February 2014 (see figure 12).
- Saturated soils due to exceptionally high groundwater levels.

The condition of the main river

- The water levels in the River Misbourne were high due to above-average rainfall and exceptionally high groundwater levels.
- The culvert under St Peter's Court was partially restricted and caused water to back up.



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The condition of highway ditches and drainage

- It is presumed that the flow obstruction in the St Peter's Court culvert prevented surface water from draining into the River Misbourne through the highway drainage connections into it, hence causing a backup of surface water at ground level.

The condition of the foul water network

- Unlined sewer pipes allowed for infiltration of groundwater into the foul water network, contributing to overflows of foul water in the village.
- A blockage in the sewer network caused an overflow of foul water onto the carriageway of the A413.

3.6 Incident response

Table 2 below summarises the main incident response activities that took place in relation to this event. The information provided in Table 2 reflects the input we have had from the risk management agencies and the public, but it may be that other actions were taken which we have not been made aware of. Thames Water have not provided details of their response activities.

Following the event, those businesses that reported experiencing internal flooding of their property to CDC were advised to apply for support under the Repair and Renew Grant funded by Central Government. They were also advised to take advantage of business rate rebates and of the support scheme available to businesses.

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Table 2: Incident response

Date and time	Activity/event	Agency
08 January 2014	CSP Parish Council reports sewage overflow event of 05/06 January 2014 to Thames Water	CSPPC
15 January 2014	CDC ask BCC to organise a multi-agency meeting to resolve the flooding situation	CDC
16 January 2014	BCC begins organising the multi-agency meeting	BCC
03 February 2014	CDC reports road flooding to Transport for Buckinghamshire at the junction between Narcot Lane and Welders Lane, causing pedestrians to be splashed with water from passing vehicles	CDC
06 February 2014	Hatfield Area Incident Room opened to respond to widespread flooding in the EA Hertfordshire & North London area.	EA
07 February 2014	CSP Parish Council reports sewage overflow event to Thames Water	CSPPC
07 February 2014	CDC site visit: witness sewage overflow and speak to flooded businesses	CDC
07 February 2014	It was reported to BCC that Thames Water attend onsite with a small tanker but reprioritise the incident with the intention of sending a larger tanker	Thames Water
08 February 2014	CDC contact Thames Water regarding sewage overflows	CDC
08 February 2014	CDC distribute FloodSax® to two properties suffering from flooding	CDC
10 February 2014	Residents report sewage overflow to CDC at A413 zebra crossing	Residents
10 February 2014	CDC attend A413 zebra crossing overflow and report the problem to Thames Water	CDC
10 February 2014	It was reported to BCC that Thames Water reported the High Street sewage overflow incident as closed to CDC, blaming the overflow on bad weather	Thames Water

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11 February 2014	Thames Water cleanup of sewage from road and pavements following sewage overflow	Thames Water
11 February 2014	CDC, BCC and Thames Valley Police assist Thames Water cleanup with road closure	CDC / BCC / TVP
12 February 2014	CDC visit and distribute FloodSax® to the scout hut and community centre	CDC
12 February 2014	Site visit to determine extent of flooding and possible solutions	EA / CDC / BCC / Thames Water
12 February 2014	CDC contact Thames Water again regarding the A413 zebra crossing overflow	CDC
13 February 2014	EA contact riparian landowner of St Peter's Court culvert	EA
13 February 2014	Transport for Buckinghamshire tanker sent onsite	BCC
13 February 2014	It was reported to BCC that Transport for Buckinghamshire closed the High Street, moved sandbags to protect High Street properties and closed the footpath from High Street to the Church Lane parking lot	BCC
14 February 2014	Site visit to determine possible solutions	EA / BCC
14 February 2014	EA authorise and commission emergency clearance of the blocked riparian-owned culvert	EA
14 February 2014	CDC advise Paradigm Housing on properties at risk and vulnerable residents	CDC
15 February 2014	EA site visit to determine extent of flooding	EA
15 February 2014	EA distribute briefing note about culvert clearance to neighbouring properties and inform the riparian owner of the emergency culvert works	EA
15 February 2014	EA delivers and installs 20 sandbags to protect a property in Hither Meadow	EA

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15 February 2014	CDC request BCC assistance for emergency response	CDC
16 February 2014	It was reported to BCC that an Armed forces site visit determines that situation is under control and no military input is needed	Armed forces
17 February 2014	EA builds a sandbag wall of approximately 500 sandbags to protect properties Hiljon Crescent and the industrial area during the jetting of the culvert	EA
17 February 2014	EA contractor begins jetting of the blocked culvert	EA
18 February 2014	BCC organises multi-agency meeting in CSP	BCC
18 February 2014	BCC, the EA, Thames Water, CDC and CSP Parish Council attend the BCC-organised multi-agency meeting.	BCC / EA / Thames Water / CDC / CSPPC
20 February 2014	EA monitoring and evaluation of water quality in River Misbourne	EA
20 February 2014	CDC contact Thames Water again regarding the A413 zebra crossing overflow	CDC
21 February 2014	EA contractor ends jetting of the blocked culvert	EA
Multiple occasions	TfB distribute and install sandbags on several occasions, including two tonnes in one night	TfB
Date unknown	Thames Water remove blockage, ending the sewage overflow at the A413 zebra crossing	Thames Water
Date unknown	Thames Water install temporary pumping and filtration system next to the George pub to discharge water into the River Misbourne	Thames Water

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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.



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4.6 Landowners and riparian owners

Landowners and riparian owners must maintain any culvert, or the bed and banks of 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 at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297423/LIT_7114_c70612.pdf.

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 2 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 3: 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 prolonged flooding and repeated sewer overflows that occurred in Chalfont St Peter, and can be summarised as follows:

- The culvert under St Peter's Court was partially restricted and caused water to back up.
- High river levels and the flow restriction in the St Peter's Court culvert prevented surface water from draining away via the surface water drainage infrastructure.
- A blockage in the sewer network caused foul water to back up out of a manhole adjacent to the A413.
- High groundwater levels and the lack of lining of the foul water network caused groundwater ingress into the network and subsequent overflows of foul water from manholes.
- The water levels in the River Misbourne were high due to above-average prolonged rainfall and exceptionally high groundwater levels.

5.2 Recommendations

The recommendations are summarised in table 4 below. Many of the actions cover the maintenance of watercourses and highway drainage. The table also includes some more strategic actions, for example encouraging RMAs to work closely on the potential EA-led Misbourne scheme. The recommendations are not only for the RMAs but also for riparian owners and Chalfont St Peter residents.

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Table 4: Recommendations

Authority / Stakeholder	Recommended Actions
All RMAs	<ul style="list-style-type: none"> • Make improvements to the emergency response and coordination from all RMAs. • In the event of a future culvert flow restriction, all RMAs to consider what remediation options are available. • Work in partnership on the EA-led Misbourne project from 2015 onwards, if this is successfully funded. If it is not, work in partnership to come up with alternative funding and/or solutions.
EA	<ul style="list-style-type: none"> • Undertake the already-planned CCTV survey of the St Peters Court culvert to ascertain the condition of the culvert. • Distribute ‘Living on the Edge’ booklets to residents and landowners adjacent to the River Misbourne in Chalfont St Peter and in impacting/impacted areas. • If required, and as has already been done, use enforcement action under Section 25 of the Land Drainage Act where land owners have failed to maintain/remove obstructions from the Misbourne. • Provide training on culvert flow restriction detection and reporting to relevant stakeholders. • Look at flood management options on the Misbourne and/or land management practices upstream of Chalfont St Peter with appropriate RMAs and landowners. • Consider installing a telemetered river level gauge closer to Chalfont St Peter to improve the accuracy of the flood warning service. • Consider increasing the frequency of CCTV surveys of the St Peter’s Court culvert and other high risk culverts within Chalfont St Peter.

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TfB	<ul style="list-style-type: none"> • If the EA's planned CCTV survey of the St Peter's Court culvert reveals any problems with the surface water outfalls into the culvert, the repair and/or maintenance of these should be prioritised in the schedule. • If further surface water flooding in the High Street occurs despite the St Peter's Court culvert having been cleared and the gully connections into it jetted, investigate other potential problems. • For TfB culverts within the Chalfont St Peter 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. • 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. • To ensure the open sections of the River Misbourne located on Highways-owned land are maintained in agreement with the EA. • CDC street cleaning teams and TfB to consider coordinating their work on autumn leaves removal and gully emptying, in partnership with the community regarding potential road closures.
BCC	<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. • To discuss setting up a Chalfont St Peter Flood Action Group with residents, landowners and relevant RMAs. • Review the temporary flood defence options in Chalfont St Peter as part of the ongoing flood defence feasibility study.

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CDC	<ul style="list-style-type: none"> • Consider a targeted promotional campaign to encourage use of garden waste bins and/or waste recycling centres (with an emphasis on flood alleviation). • CDC street cleaning teams and TfB to consider coordinating their work on autumn leaves removal and gully emptying, in partnership with the community regarding potential road closures. • Take account of sewer capacity constraints when making planning decisions. • Consult Thames Water on planning applications for more than 10 dwellings.
Thames Water	<ul style="list-style-type: none"> • Share the outcomes of their information gathering exercise for catchments affected by infiltration problems with other RMAs. • Work with other RMAs to address potential infiltration problem. • Until infiltration issues have been resolved/lessened, prioritise Chalfont St Peter as a known problem area for rapid incident response. • Check if there is a pipe capacity issue on the foul sewer network in Chalfont St Peter • Work with the Local Planning Authority (CDC) to take into account the implications of planning decisions on the foul sewer network.
Affinity Water	<ul style="list-style-type: none"> • Work with other RMAs to understand the potential flood risk implications of any abstraction reduction plans.
Chalfont St Peter Parish Council	<ul style="list-style-type: none"> • Work with the BCC Resilience team and TfB regarding the level of response to emergencies CSPPC is willing to provide and what support is available to them (including the possibility of storing and deploying flood signs locally during flood events).

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Riparian Landowners	<ul style="list-style-type: none"> • Ensure that the River Misbourne 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 'Managing the River Misbourne' booklet also provides useful guidance and is available here: http://www.chilternsaonb.org/uploads/files/CCSP/misbourne_awareness_web.pdf • Undertake clearance of vegetation and debris on the Misbourne with guidance from relevant RMAs. • Riparian landowners not to dump waste (including garden waste, tree cuttings and woody debris) into the river or on the riverbanks. • Riparian owners of relevant culverts to undertake maintenance of culverts while following guidance from the EA. • Owners of footbridges to ensure structures are firmly fastened to the bank and do not include elements at risk of being washed downstream in the event of a flood (e.g. semi-rotten sleepers). • Seek permission from the EA prior to installation any new footbridges and any other structure in, under, over or within eight metres of the top of the riverbank as required by law.
Residents	<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. • Consider forming a Flood Action Group. • Residents not to dump waste (including garden waste, tree cuttings and woody debris) into the river or on the riverbanks. The Chilterns Chalk Streams Project's 'Managing the River Misbourne' booklet provides useful guidance and is available here: http://www.chilternsaonb.org/uploads/files/CCSP/misbourne_awareness_web.pdf

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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
CSPPC	Chalfont St Peter Parish Council

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.
Chalfont St Peter Parish Council, 04 April 2013)	Chalfont St Peter Parish Council, 04 April 2013). Email from John Hatton, Chalfont St Peter Parish Council, to the Environment Agency on 04 April 2013.
Chalfont St Peter Parish Council, 2013	Chalfont St Peter Parish Council (18 March 2013). Email correspondence.
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 http://www.ufmfsw.com
EA, February 2014	Environment Agency (February 2014). <i>Monthly Water Situation Report, South East Region, North East Thames Area</i> .
Environment Agency, 04 April 2013	Environment Agency (2013). Email from Usha Amaranathan, Environment Agency, to John Hatton, Chalfont St Peter Parish Council, on 04 April 2013.
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

Email: enquiries@environment-agency.gov.uk

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

District Council



**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



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Telephone: Transport and roads – 0845 2302882
Out of hours emergencies (Highways) – 01296 486630
Email: tfb@buckscc.gov.uk
Website: <http://www.transportforbucks.net/Transport-and-roads.aspx>

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://www.bucksfire.gov.uk/BucksFire/Contact+Us/>

Thames Valley Police

Telephone: 101 in non-emergency, 999 in emergency
Website: <http://www.thamesvalley.police.uk/contactus-phone.htm>

Buckinghamshire Ambulance Service

Telephone: 111 in non-emergency, 999 in emergency
Website: <http://www.southcentralambulance.nhs.uk/content/press-release/buckinghamshire/flooding-advice.ashx>

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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.

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Appendix B: Photos taken by RMAs



Surcharging manhole, High Street. Photo courtesy of CSP Parish Council, 16/03/14



Road flooding, High Street. Photo courtesy of CSP Parish Council, 16/03/14



Surcharging manhole, High Street. Photo courtesy of CSP Parish Council, 16/03/14



Surcharging manhole, High Street. Photo courtesy of CSP Parish Council, 16/03/14

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Flooded footpath to parking lot. Photo courtesy of CSP Parish Council, February 2014



Road flooding, A413. Photo courtesy of CSP Parish Council, February 2014



Flooded entrance to the George Inn. Photo courtesy of CSP Parish Council, February 2014



TfB tanker, High Street. Photo courtesy of CSP Parish Council, 13/02/14

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EA sandbag wall protecting industrial area and Hiljon Crescent. Photo courtesy of EA, 14/02/17



Flooding outside of the scout hut. Photo courtesy of EA, 14/02/17