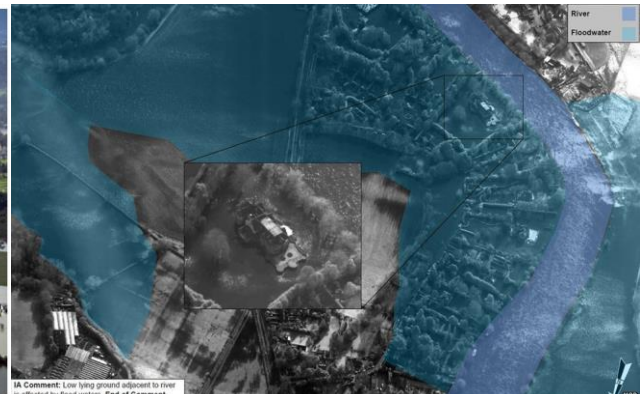


8<sup>th</sup> December 2015

# Buckinghamshire County Council

## Flood Investigation Report

### Bourne End, January and February 2014



8<sup>th</sup> December 2015

## Revision Schedule

### Buckinghamshire County council Flood Investigation Report

December 2015

Final Report Number 2

Rev	Date	Details	Author	Checked and Approved by
1	July 2015	Draft for Review	D Allan	Checker: S Morris Approver: A RW
2	December 2015	Final Report	D Allan	J Dippie

8<sup>th</sup> December 2015

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## Executive Summary

This document has been produced by Buckinghamshire County Council (BCC) to report on the investigation into the flooding that occurred in Bourne End during January and February 2014. The report provides details of the event and makes recommendations on measures which the Risk Management Authorities (RMAs) could adopt to reduce the impact from future flood events.

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 to investigate:

- Which RMAs 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 Bourne End exceeded BCC 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 to identify the RMAs responsibilities during the event. The recommendations are there to help the RMAs learn lessons from the event and to improve the management of flood risk in the future.

The flood event in Bourne End occurred after a prolonged period of above average rainfall which caused water levels in the River Thames to peak, overtopping the banks and flooding low lying areas of Bourne End. The drainage system in the centre of the town became overwhelmed from the volume of surface water runoff and caused further flooding. Recommendations are included which, if undertaken, will reduce the flood risk in Bourne End. The recommendations comprise two types of actions:

- To assess or improve existing structures (culverts and drains); and
- To improve the co-ordination and communication of the RMA responses.

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## 1. Introduction

### 1.1 Background to investigation

Buckinghamshire County Council (BCC) as the Lead Local Flood Authority (LLFA) has a responsibility to record and report flood incidents as detailed within Section 19 of the Flood and Water Management Act 2010:

#### Section 19

(1) On becoming aware of a flood in its areas, a LLFA must, to the extent that it considers it necessary or appropriate, investigate:

- (a) Which Risk Management Authorities (RMA) have relevant flood risk management functions; and
- (b) Whether each of those RMAs 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 RMAs.

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 Bourne End because it meets the following threshold:

- Internal flooding (including to basements) to five or more residential properties within an area of 1 km<sup>2</sup>.
- Class A and B highways and other railway links were flooded for 4 hours or more; and
- Class U highways were flooded for 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.
- 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

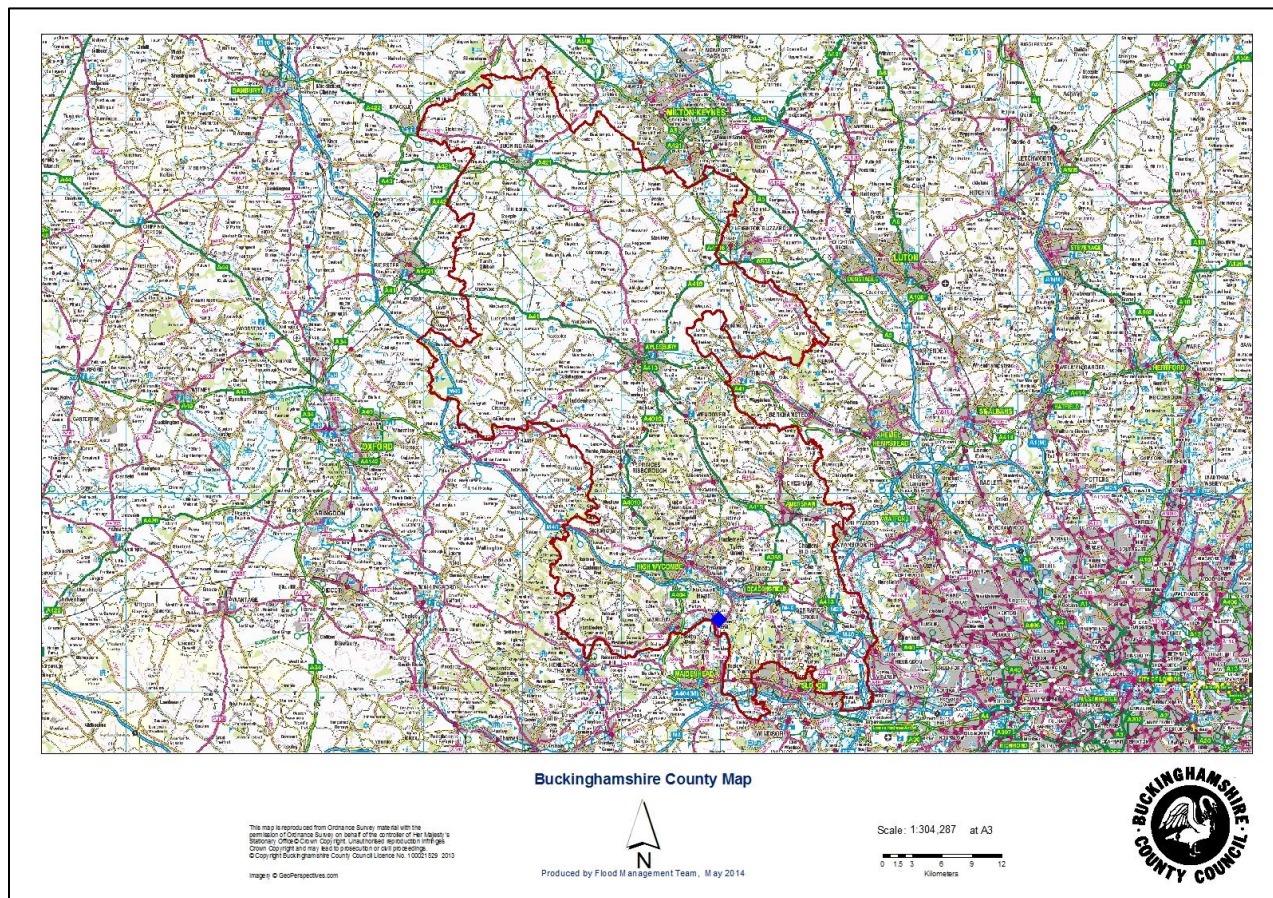


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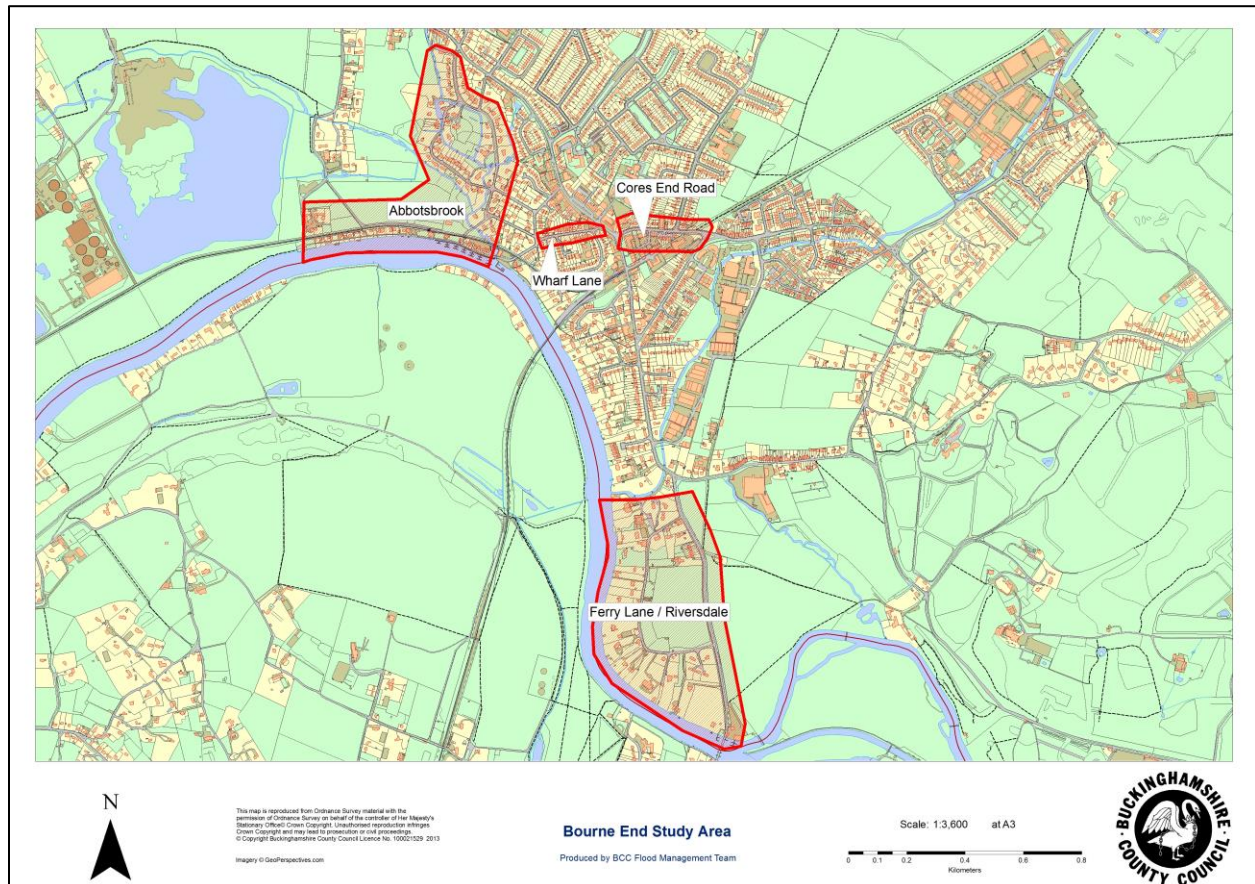
## 1.2 Site Location

Bourne End is located at the confluence of the River Wye and the River Thames in south Buckinghamshire, approximately 4 km to the east of Marlow (Figure 1). Figure 2 shows the areas within Bourne End where flooding was experienced in January and February 2014.



**Figure 1** Buckinghamshire County Map



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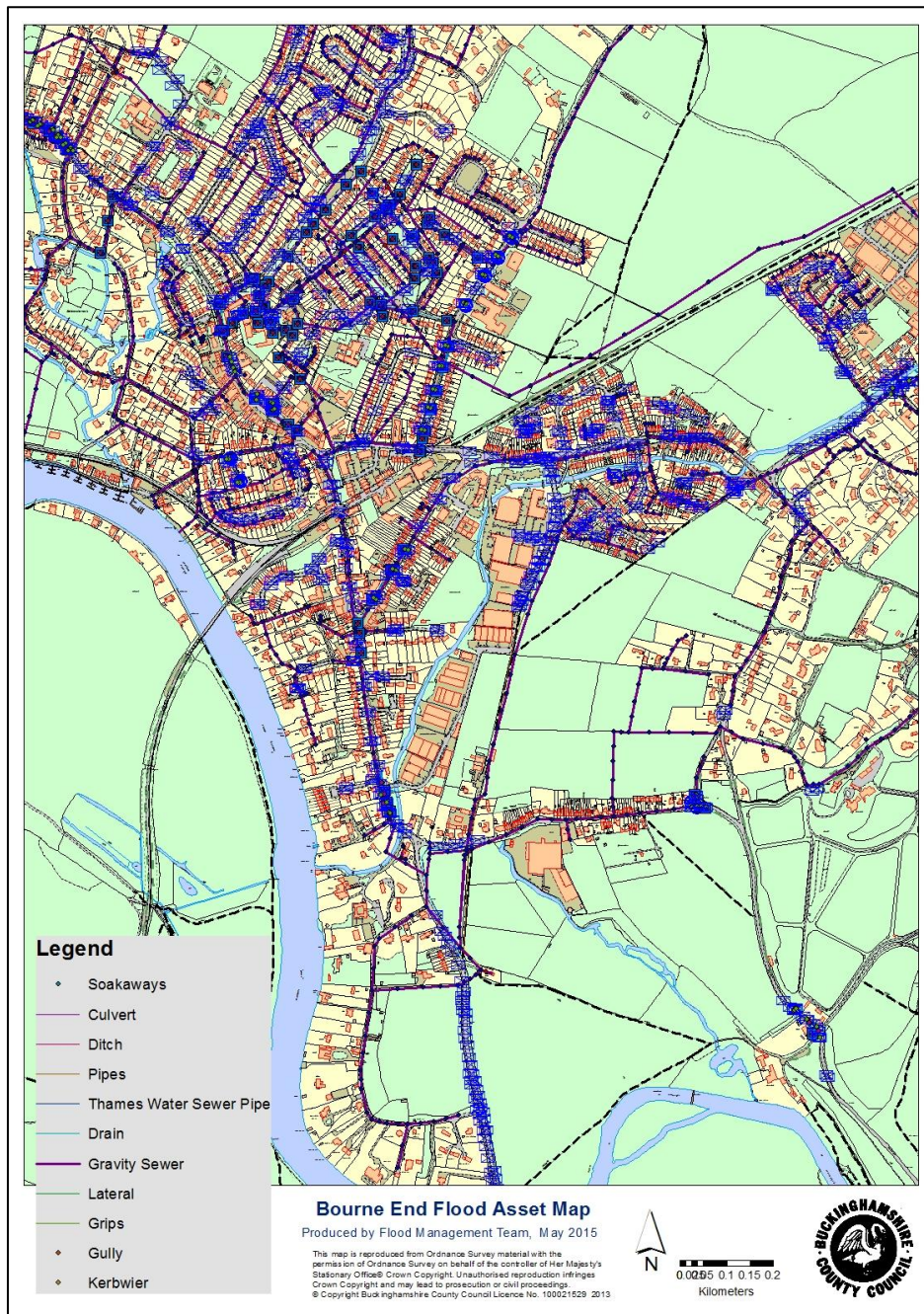
**Figure 2** Bourne End Study Areas

### 1.3 Drainage system and river network

Bourne End is located on the left bank of the River Thames (designated by the Environment Agency (EA) as a Main River) on permeable River Terrace deposits (gravels). In Bourne End, surface water runoff is managed via a piped drainage network (Figure 3). Surface water is routed through these drainage pipes which discharge into the River Wye and River Thames. The River Wye too is designated by the EA as a Main River. The other watercourse identified within Bourne End is Abbots Brook which is a designated Ordinary Watercourse (Figure 4). The watercourses are predominantly open channel except where they pass under roads.



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**Figure 3** Study Area drainage and assets network

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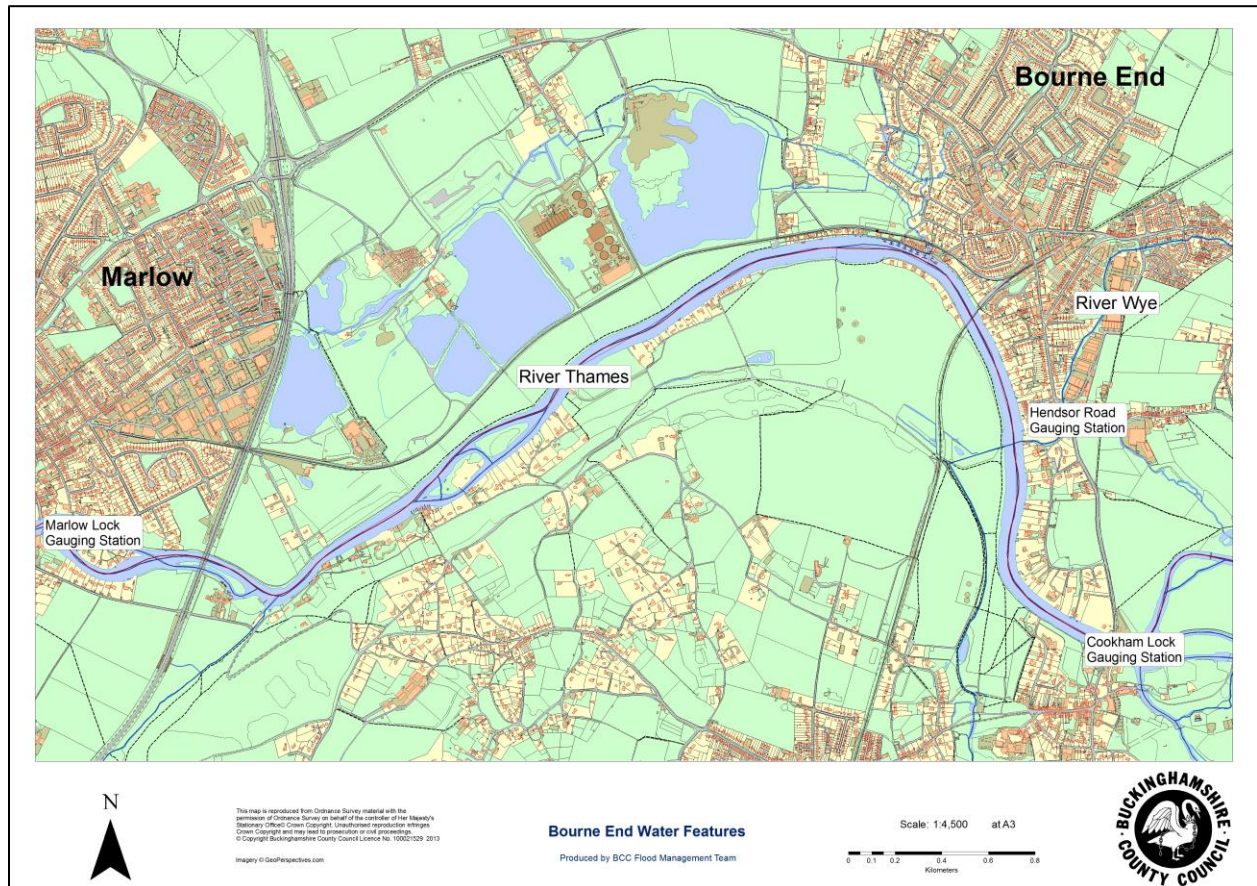


Figure 4 Study Area river network



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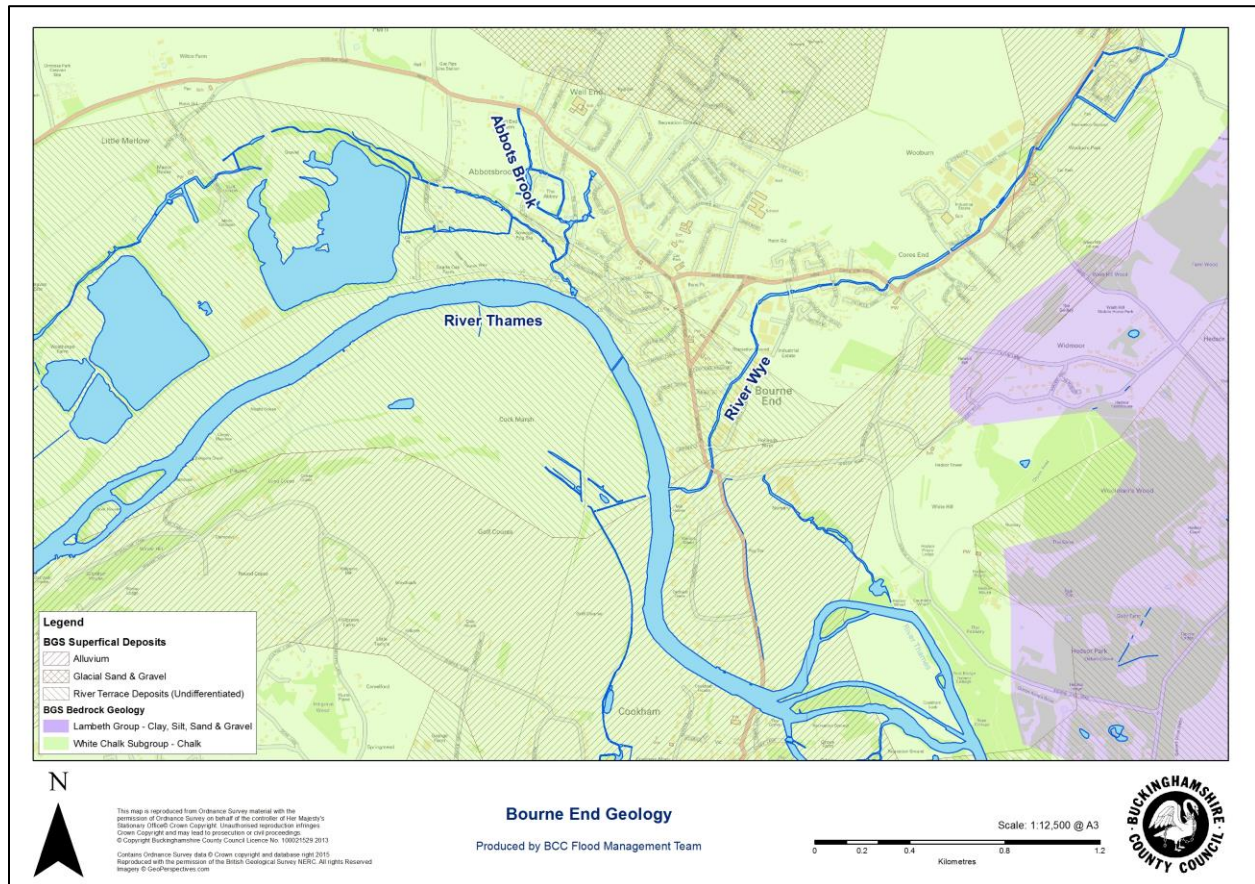
## 2. Background

### 2.1 Catchment characteristics

Bourne End is located on River Terrace Gravels that overly a Chalk aquifer. To the north of Bourne End is the Chilterns, a major Chalk aquifer in which groundwater flows south towards the River Thames and Bourne End. Figure 5 shows the bedrock and superficial geology around Bourne End, details are presented in Table 2.1. Water levels in the gravels respond to changes in the water levels in the River Thames and River Wye but are also fed from the underlying Chalk aquifer and the Chilterns Chalk aquifer that lies to the north west of Bourne End.

**Table 2.1** Bourne End Geology

Bedrock Geology	Superficial Geology
Lewes Nodular Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 86 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.	Taplow Gravel Formation - Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.
	Shepperton Gravel Member - Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.
	Alluvium - Clay, Silt, Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.

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**Figure 5** Geology of Bourne End

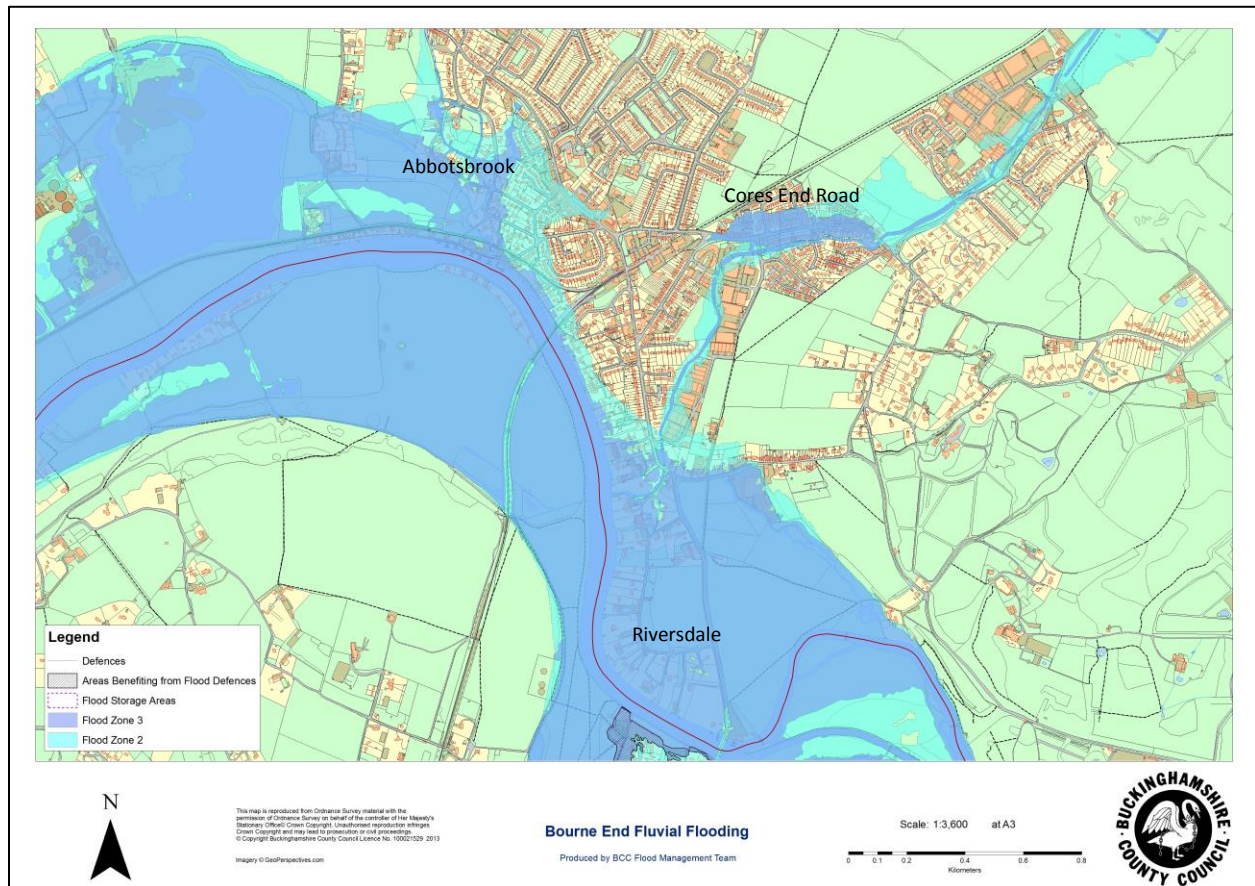
The River Thames and River Wye are classed as Main River as designated on the Main River Map produced by the Environment Agency (Figure 4). At Bourne End the River Thames drains a catchment area of over 6,758 km<sup>2</sup>. Both the size of the catchment and the characteristics of the geology it drains, leads to the River Thames responding slowly to rainfall events. Typically, the river rises slowly over a week or more to its peak and recedes equally slowly. The River Wye drains a catchment area of 134 km<sup>2</sup>. This is predominantly groundwater fed but has a noticeably flashy response from the growing urban areas within the catchment. The River Wye is culverted under several roads as it passes through Bourne End before discharging to the River Thames.

The fluvial flood map (see Figure 6) shows the flooding that would occur from the River Thames or the River Wye in a 1 in 100 year event (1% chance of occurring in a year) (medium blue) and 1 in 1,000 year event (0.1%) (light blue). The dark line represents the centre lines of the River Thames and River Wye. These show that the western and



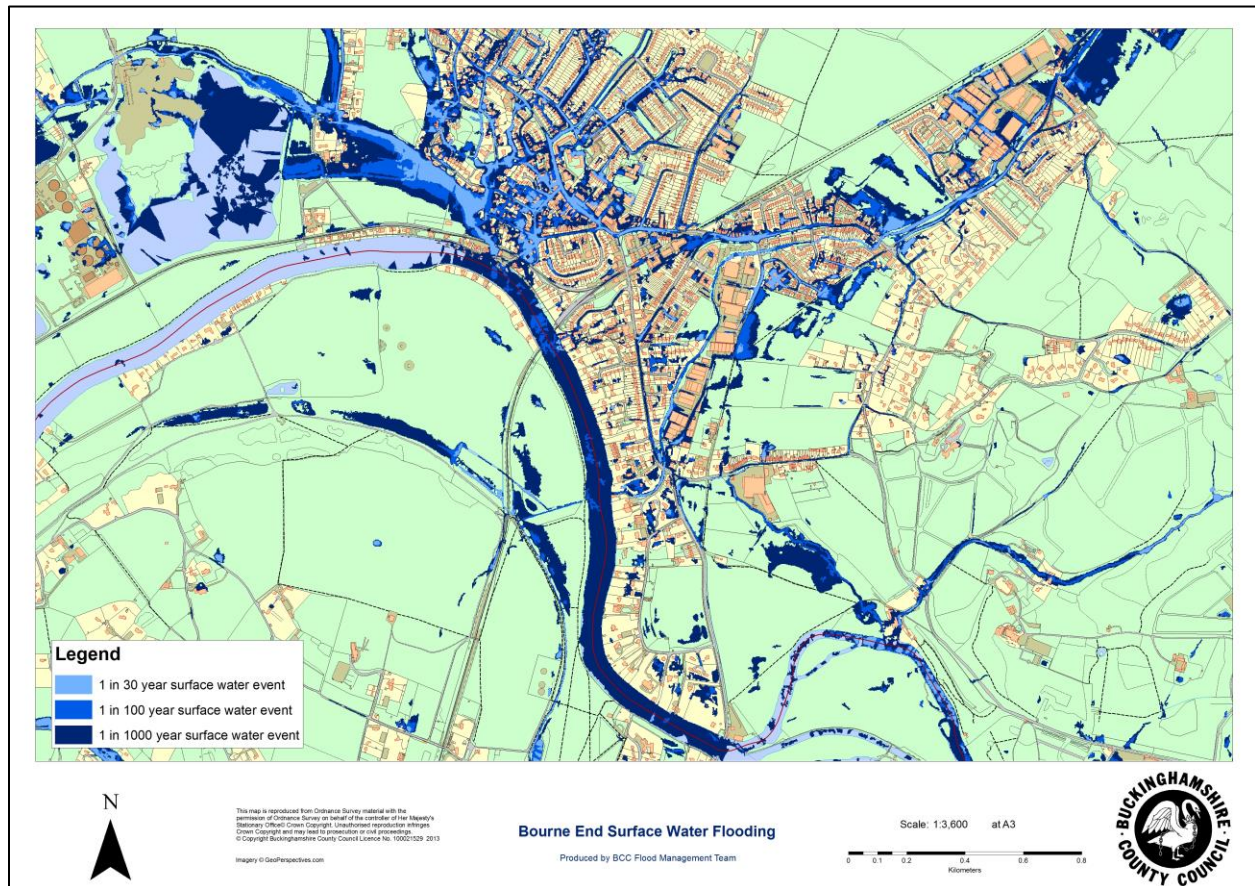
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southern areas of Bourne End are vulnerable to the 1 in 100 (1% Annual Exceedance Probability (AEP)) flood event and the 1 in 1,000 (0.1% AEP) flood event. To the east of Bourne End, where the River Wye flows, there are areas vulnerable to the 1 in 100 and 1 in 1,000 flood event, particularly along Cores End Road.



**Figure 6** EA flood map showing the River Thames and Wye 1 in 100 year event (Flood Zone 3) in dark blue and 1 in 1,000 year (Flood Zone 2) in light blue (EA, 2014)

The surface water flood map (see Figure 7) shows the extent of flooding in the 1 in 30 (3.3% AEP), 1 in 100 (1% AEP) and the 1 in 1,000 (0.1% AEP) events for the Bourne End area. Surface water flooding occurs when extreme or prolonged rainfall cannot infiltrate into the saturated ground or flow into the rivers or highways drainage due to the large volumes of water. Many of the areas vulnerable to surface water flooding in Bourne End are those same areas vulnerable to fluvial flooding, but these areas also extend further north into the town following the main transport routes where the drainage network is unable to cope with the volumes of water.

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**Figure 7** EA Surface Water Flood Map showing the 1 in 30, 1 in 100 and 1 in 1,000 events (EA, 2014)

The Defra groundwater flood map (Jacobs, 2004) also indicates that large areas of Bourne End would have groundwater at, or within 2 m of, the ground surface in a winter similar to that of 2000/01. Detailed maps of the areas vulnerable to groundwater flooding are not currently available for this area.

## 2.2 Previous flood events

There is a long history of flooding from fluvial and surface water sources along the River Thames. Table 2.2 provides a brief summary of the flood history, most of it making reference to flooding along the River Thames reach that passes Bourne End; there are very few specific details with regards to flooding within Bourne End

8<sup>th</sup> December 2015**Table 2.2** Bourne End Flood History

Date	Source	Detail	Reference
1749	Fluvial (Thames)	"Never did more wet fall in rain and snow than at this time; for the waters were continually out of their bounds for the last 5 or 6 weeks so that according to the papers the navigation of the Thames and Severn was at a stand."	BHS Chronology
1768	Fluvial (Thames)	By letters from Great Marlow, in the county of Bucks, by Monday's post, we are informed of great losses sustained by the inhabitants, from the overflowing of the River Thames by the late heavy rains, and that the navigation of the river is stopped, the Thames being then above a mile over by the flood. The banks of the river are at present so much overflowed in Berkshire that the West-country barges cannot come to London."	BHS Chronology
1891	Fluvial (Thames)	Flooding from Thames	Woman and Her Sphere (online)
1894	Fluvial (Thames)	Notably the highest flood was that of November 1894, followed by March 1947.	BHS Chronology
1897	Snowmelt	1897 February 1-5 Rainfall observer at Slough (Upton) noted (p[5]) "Rain 1.92 in., followed by floods, which culminated on the night of the 7th. The melting of snow on the Marlow Hills was greatly responsible for the flood."	BHS Chronology
1897		1897 February 4/14 Observer at Cookham (Vicarage) noted p[6]: "Thames in flood; highest on 7th."	
1903	Fluvial (Thames)	1903 November 29 rainfall observer at Marlow noted "More than an inch of rain in 24 hours caused a renewal of the floods." [Thames]	BHS Chronology
1947	Fluvial (Thames)	Oxford, Reading, Maiden head, Windsor-all the towns of the Thames valley suffered gravely from the Thames flood. The thaw in the Cotswolds was felt almost immediately in the waters of the Thames, which rose steadily, and by March 11 had already over- flowed its banks at Windsor, familiar victim of floods. By next morning, though, things were beginning to look serious in the Thames valley. The river was rising at the rate of 1.5 inches an hour and thousands of acres of low-lying ground on its banks were already inundated. By the following day, March 13, the river was four feet above normal at Windsor bridge, and was still rising. The water was into the town at Maidenhead, and quite deep in the low-lying parts of Marlow. On March 14, with the rivers all over southern England overflowing, the Thames was in monstrous flood, more than eight feet above normal, for instance, on the gauge at Bray lock. Its waters were	BHS Chronology



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Date	Source	Detail	Reference
		spreading deeply across many of the riverside towns above Teddington.	
1968	Fluvial (Wye)	Parts of Bourne End flooded when River Wye burst its banks	Wycombe District SFRA
1974	Fluvial (Thames)	River Thames flooded land around Cookham and Bourne End	The Cookham Plan
1990	Fluvial (Thames)	River Thames flooded land around Cookham and Bourne End	The Cookham Plan
Jan & Dec 2000	Fluvial (Thames)	River Thames – flooding through Bourne End, particularly around Riverside	Wycombe District SFRA & Residents Questionnaire
Jan 2003	Fluvial (Thames)	River Thames – flooding through Bourne End, particularly around Riverside	Wycombe District SFRA & Residents Questionnaire
29/11/2006	Fluvial	A4155 The Parade, Bourne End	Wycombe District SFRA
17/01/2007	Fluvial	Cores End Road flooded	Wycombe District SFRA
12/02/2007	Fluvial	Cores End Road flooded	Wycombe District SFRA
20/02/2007	Fluvial	Chalklands, Bourne End	Wycombe District SFRA
28/02/2007	Fluvial	A4155 The Parade, Bourne End	Wycombe District SFRA
06/03/2007	Fluvial	Chapman Lane, Bourne End - flooding from Abbots Brook	Wycombe District SFRA
08/03/2007	Fluvial	A4155 Marlow Road, Bourne End - flooding from Abbots Brook	Wycombe District SFRA
14/05/2007	Fluvial	Parade Court	Wycombe District SFRA
22/06/2007	Fluvial	Cores End Road	Wycombe District SFRA
29/06/2007	Fluvial	Cores End Road	Wycombe District SFRA
06/08/2007	Fluvial	Elm Lane – flooding from Abbots Brook	Wycombe District SFRA
24/09/2007	Fluvial	Wharf Lane	Wycombe District SFRA



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Date	Source	Detail	Reference
08/10/2007	Fluvial	Cressington Place- flooding from Abbots Brook	Wycombe District SFRA
16/11/2007	Fluvial	Hedsor Road	Wycombe District SFRA
03/12/2007	Fluvial	Thames Close	Wycombe District SFRA
11/01/2008	Fluvial	Cores End Road	Wycombe District SFRA
21/01/2008	Drain	A4155 Marlow Road	Wycombe District SFRA
2012	Fluvial (Thames)	River Thames	Wycombe District SFRA
Oct 2012	Pluvial	Bourne End, Burnham Close. Issue with blocked gullies.	Bucks Free Press
Dec 2012	Fluvial (Thames)	Bourne End flooded over Christmas holidays	BBC

Transport for Buckinghamshire (TfB) records indicate that there is an ongoing issue with flooding along the A4094 Ferry Lane, resulting from heavy and persistent rainfall and inadequately maintained drains, combined with the low freeboard along the banks of the River Thames.

Many of the houses around Hedsor Road, Riversdale and Ferry Lane have a built in level of resilience in the form of stilts as a result of living in an area of known flood risk. This results in a reduced number of incidents of flooding being reported at these properties.

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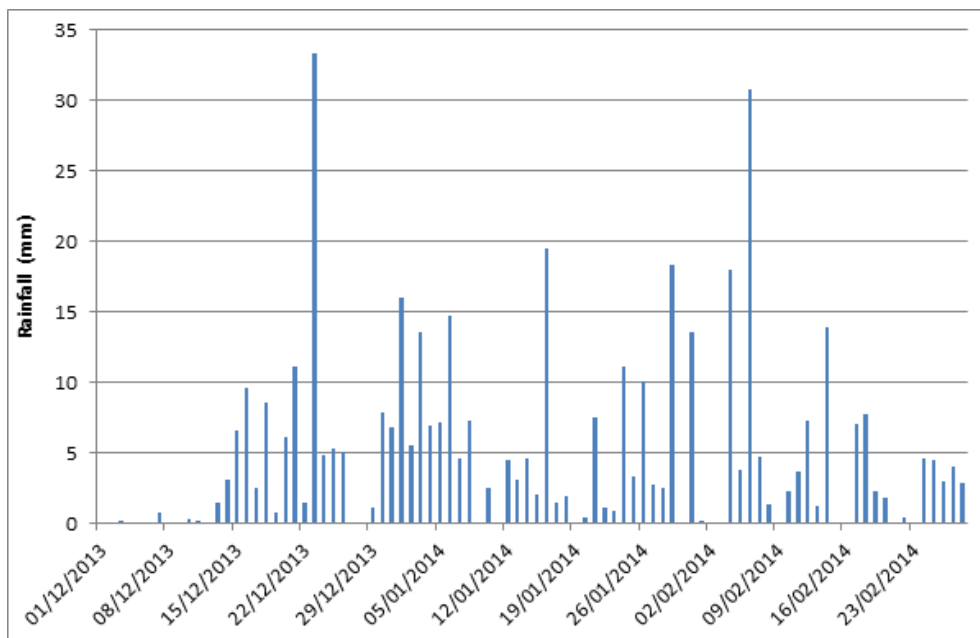
## 3. Analysis of January - February 2014 Flood Event

### 3.1 Conditions at the time

#### Rainfall

The Environment Agency provided rainfall data for the period 1<sup>st</sup> December 2013 to the end of February 2014. These data were recorded at the Hambledon rain gauge which lies approximately 12 km to the west of Bourne End and can be considered as representative of the rain that fell in Bourne End. Figure 8 shows the daily rainfall for three months starting December 2013. This winter period was unusually wet. There were many days when rain fell and a large number of very wet days. The 23<sup>rd</sup> December 2013 and 6<sup>th</sup> February 2014 were particularly wet with over 30 mm recorded on both days at the Hambledon rain gauge.

To put this into context, from October 2013 to the end of February 2014, the area received 193% of the long term average rainfall. February 2014 was unusually wet receiving 334% of the long term average rainfall for February making it the wettest February on record in the area (Environment Agency, 2014).



**Figure 8** Hambledon Rainfall (December 2013 to February 2014)

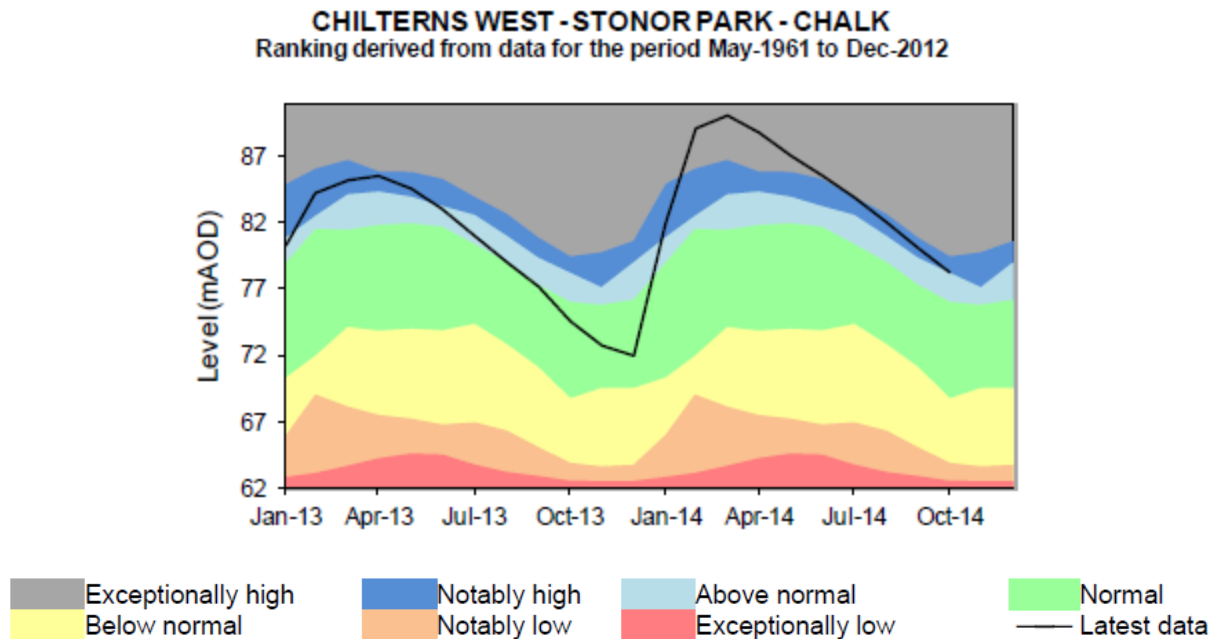
#### Groundwater

Groundwater levels started rising in December 2013 in the Chalk aquifer underlying the

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Chilterns as is normal in the late Autumn. However, the exceptional rainfall allowed water levels to rise within the Chalk to unprecedented levels as measured at the observation borehole at Stonor Park (this borehole is considered representative of the Chilterns). By the New Year, groundwater levels at Stonor Park had reached new highs and continued to rise throughout January (Figure 9). The water held within the Chilterns Chalk flows south to the River Thames and River Wye.

The water levels in the Terrace Gravels beneath Bourne End are also controlled by water levels in the River Thames. As the river levels rise, water levels in the gravels rise. Therefore groundwater levels rose in and around Bourne End from both the excess flow from the Chilterns and are held up by the high water levels in the River Thames. However, groundwater was not identified as being a cause of flooding in Bourne End.



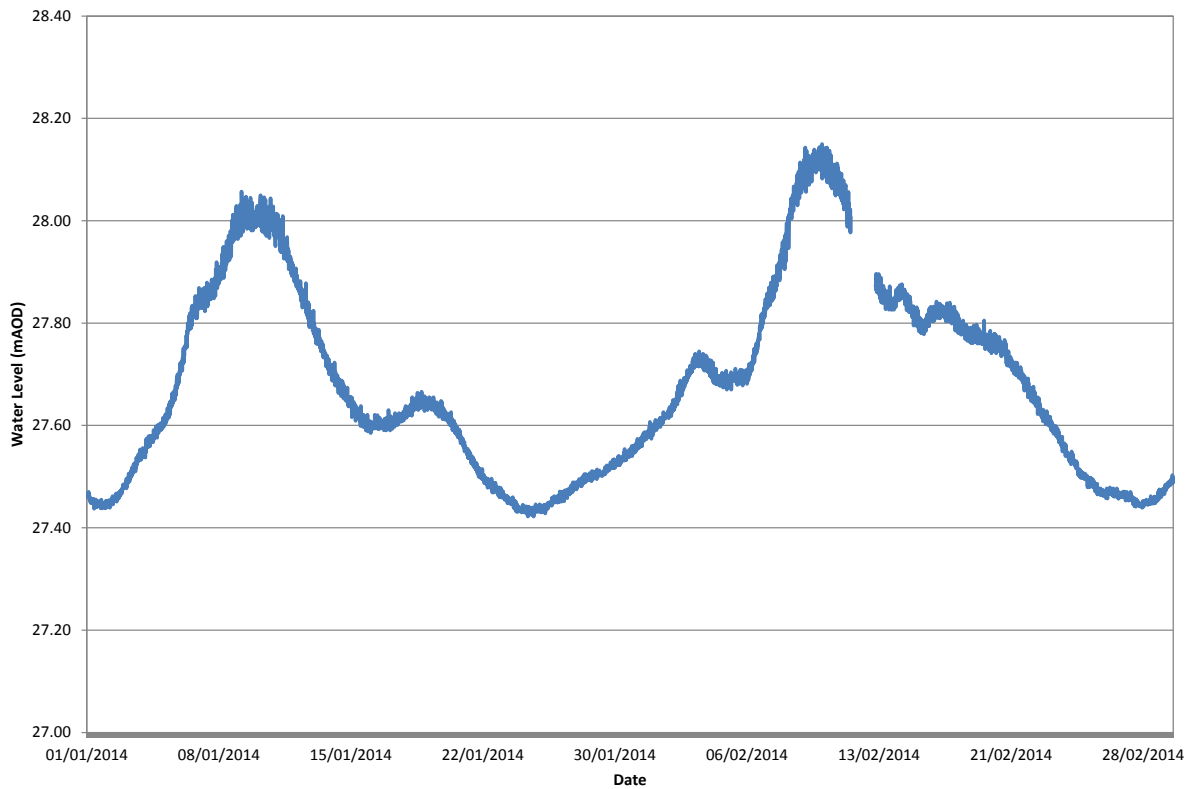
**Figure 9** Groundwater levels in the Chilterns (From EA Monthly Water Situation Report, South East Water Situation Report (October 2014))

### River Levels

The unusually wet weather occurred across much of the catchment of the River Thames that drains to Bourne End. Water levels in the River Thames peaked on the 10<sup>th</sup> January and then steadily dropped. However, following further rainfall in February the River Thames rose to a higher peak between the 9<sup>th</sup> and 11<sup>th</sup> February in Marlow and

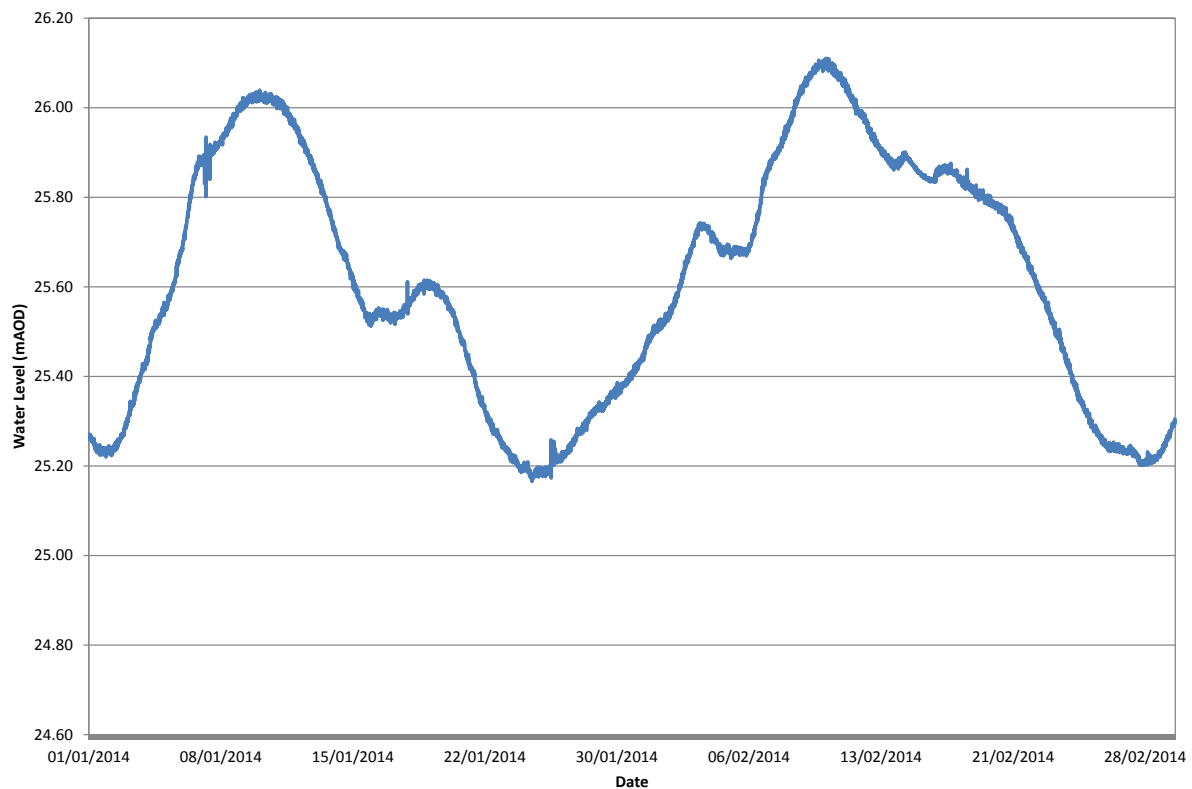
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Cookham. Figures 10 and 11 show the water levels in the River Thames as measured at Marlow Lock and Cookham Lock.



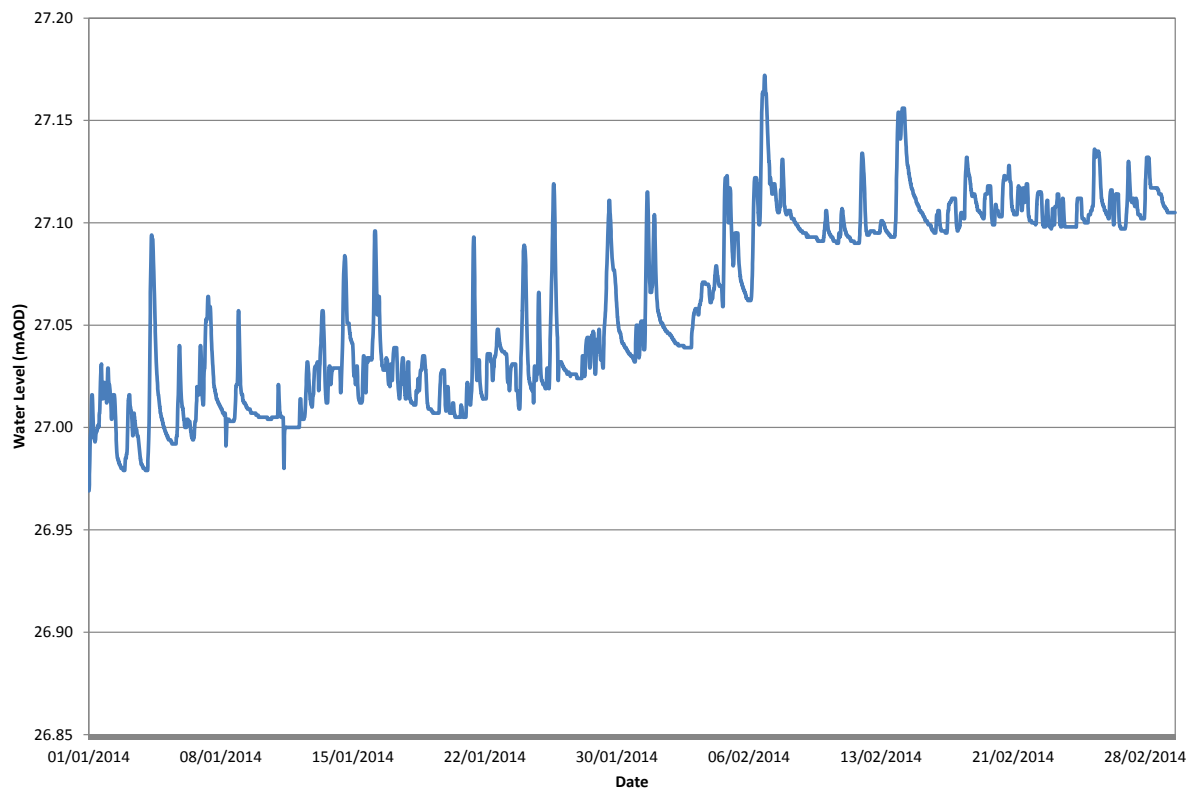
**Figure 10** River Thames water levels at Marlow Lock (upstream levels)



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**Figure 11** River Thames water levels at Cookham Lock (upstream level)

The levels for the River Wye, which flows through Bourne End, have been presented in Figure 12. This shows that the levels continued to rise throughout January and February, with two noticeable peak levels on the 7<sup>th</sup> and 14<sup>th</sup> February. The continued rise is a result of the groundwater feeding the river, rather than purely reacting to rainfall events; although peak levels corresponding to rainfall events falling on the flashy, urban areas can be noted. The peak levels are also a result of the inability of the River Wye to discharge into the River Thames as a result of the high river levels recorded there.

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**Figure 12** River Wye water levels at Hedsor

A flood warning was issued on the 6<sup>th</sup> January 2014 and remained in force until 14<sup>th</sup> January for the River Thames at Bourne End including Spade Oak Reach, Cockmarsh and Riversdale. A second warning issued on 6<sup>th</sup> February lasted until 21<sup>st</sup> February.

No warnings were issued for the River Wye (River Wye West Wycombe to Bourne End) (none issued since 29<sup>th</sup> Nov 2010).

### 3.2 Condition of features and watercourses

No reports identified any temporary blockages to ordinary watercourses immediately prior to or during the January and February floods at Bourne End. Nor were any reports received of any blockages in the Main River Thames or River Wye.

However, the insufficient drainage capacity of the drains and culverts along Cores End Road and Wharf Lane were a contributing factor to the flooding in this area. Works undertaken in this area during the flooding removed large quantities of debris, including

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bricks and concrete. The high groundwater levels and continuing surface water runoff impeded these works.

The EA Operations team reported that prior to the winter floods they carried out routine annual maintenance on the River Wye in the Bourne End area in December 2013. This consisted of weed cutting, bank clearance and obstruction removal.

During the periods of high flows during the winter event the EA field team regularly attended the area as part of incident response, ensuring that the structures and channel were clear of obstructions and debris. Unfortunately the EA did not log each visit.

### **3.3 What happened?**

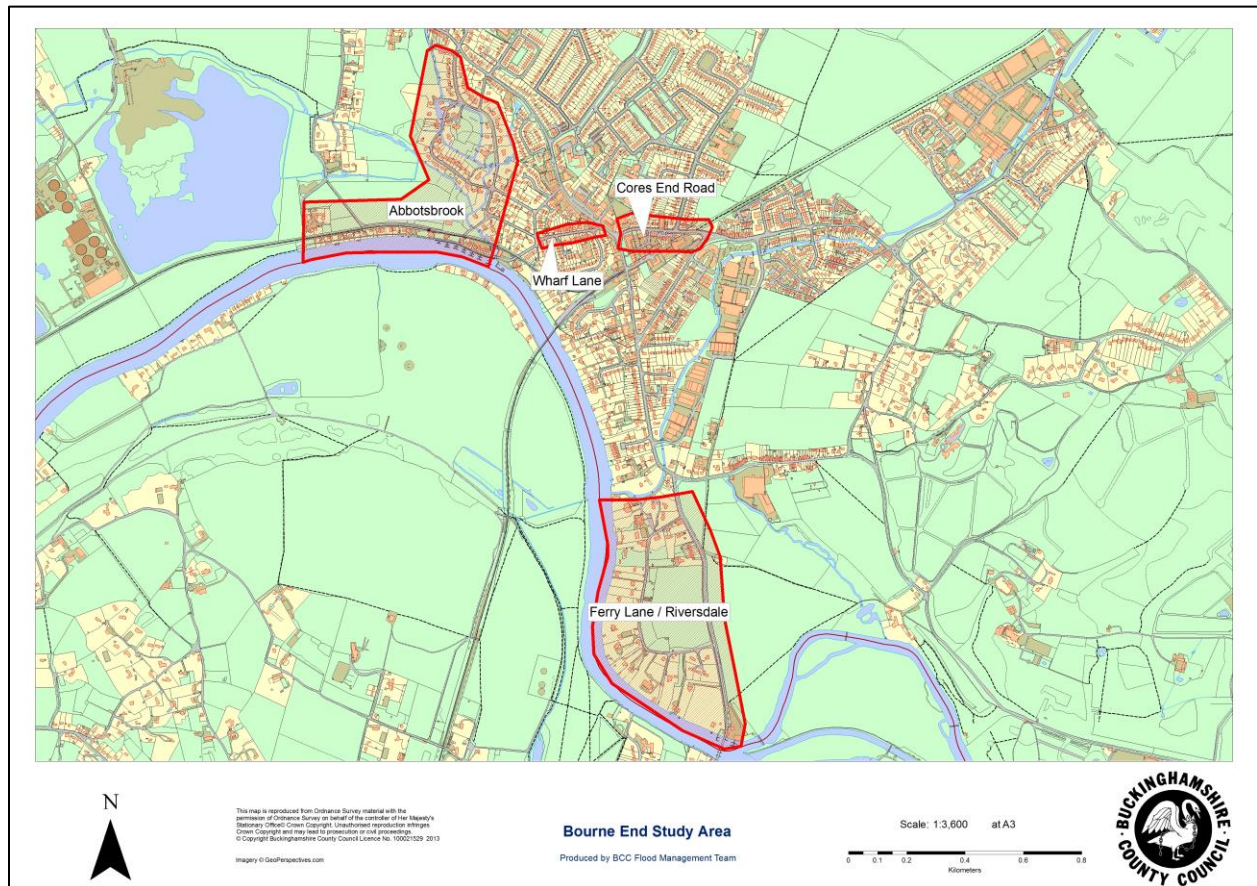
At the beginning of January, with the ground waterlogged and water levels in the River Thames high, problems of flooding began in low lying areas of the Thames basin. On the 6<sup>th</sup> January the EA issued a Flood Warning for the Bourne End reach and the River Thames peaked around the 10<sup>th</sup> January. Problems of flooding continued in the region until mid-month as the River Thames slowly dropped. However, this was only a brief lull before the rainfall on the 6<sup>th</sup> February and a second peak on the River Thames on the 10<sup>th</sup> February caused further and more severe flooding in the region, with properties flooded and roads remaining impassable until 21<sup>st</sup> February. Distinguishing between the other flood mechanisms is difficult as problems of groundwater, surface water and sewer flooding are usually interlinked. However, from the information provided by residents and RMA the main areas impacted by flooding are shown on Figure 13 and the following has been surmised:

- Upper Thames Way / Riverside Road - inundated from flood waters from the River Thames.
- Cores End Road / Wharf Lane – flooded from surface water overwhelming the road drainage network. Emergency works were undertaken to investigate the condition of culverts and blockages were removed. Sandbags were deployed to protect properties and a 'Supersucker' was used to remove the flood waters.
- Hedsor Road, Riversdale and Ferry Lane (A4094) including access to Cookham Bridge were all inundated by flood waters from the River Thames. A number of properties in this vicinity are elevated on stilts to provide a degree of resilience and flood barriers and other measures installed to protect individual properties from flooding. The properties along Riversdale are accessed by a private road and the residents had access to two aluminum boats to allow them to move from

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their properties to higher ground.

- Abbotsbrook / The Drive – low lying land inundated by Abbots Brook, no reports of properties flooding, only gardens. This is a private estate and access was not sought during the flooding.



**Figure 13** Areas subject to flooding in January and February 2014 (areas outlined in red)

Information provided by BCC indicates that only two properties were flooded internally in the Riversdale area in January and February 2014, however, a number of other properties in the vicinity of these two properties would also have suffered from flooding, not necessarily internally. The incident record (Table 3.1), comments that approximately 20 properties were inundated, centering around both Abbotsbrook and Riversdale.



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### 3.4 Possible causes

#### *The weather conditions*

- Unusually wet December 2013, January and February 2014; and
- Intense rainfall in February 2014.

#### *The ground conditions*

- Water levels in the Chalk under the Chilterns and in Bourne End (Chalk and gravels) were unusually high causing groundwater to emerge at the surface; and
- Soils were completely waterlogged and unable to hold any further rainfall.

#### *The condition of the watercourses and drainage systems*

- Water levels in the River Thames overtopped the banks and flowed onto the floodplain. There were no reports of blockages in the River Thames or River Wye. The Environment Agency estimate that upstream at Marlow the flows equate to a 1 in 20 (5% AEP) flood event.
- The inability of the River Wye to freely discharge to the River Thames, again there were no reports of blockages and the River Wye was never put on flood alert, but the levels presented in Figure 12 suggest it was backing up from the Thames.
- Drainage culverts along Cores End Road were blocked with debris and unable to convey the volumes of water from site.

### 3.5 Incident response

Table 3.1 provides a summary of the incident response following a request to response providers to provide information. At the time of writing, no information has been received from Thames Water. The EA did not grant access to their incident log. The response of the EA has been determined from their West Area Flood Report (EA, 2015). Largely missing from this table is the response of individuals and businesses in protecting their own assets.

Thames Valley Police declared the Thames-wide flooding as a major incident. The Thames Valley Local Resilience forum facilitated Strategic Coordination Group meetings twice daily where partner agencies could work together to support each other. The Strategic Coordination Group liaised closely with the Government and the Ministry of Defence.

EA Flood Ambassadors and Flood Data Recorders were sent to Bourne End in January and February to provide advice to residents and businesses and monitor flooding.

8<sup>th</sup> December 2015**Table 3.1** Incident Response Collated Log

Date	Location	Response Provider
6 January @ 11:10	Flood Warning issued for 456 properties close to the River Thames at Bourne End	EA
6 January	<ul style="list-style-type: none"> <li>Sand bags deployed to Bourne End; exact number and location not recorded.</li> <li>Information from an inspection indicated that water levels were higher than last year (2013) with water at property thresholds in Abbotsbrook, Bourne End</li> </ul>	BCC
8 January	<ul style="list-style-type: none"> <li>Ferry Lane (A4094) flooded, access prevented to Cookham Bridge</li> <li>Bourne End - private road (Riversdale) flooded. No properties reported to be flooded, but many of the properties have individual defences including being built on stilts</li> </ul>	
10 January	Environment Agency Flood Ambassadors visited Bourne End	EA
11 January	Environment Agency Flood Ambassadors visited Bourne End	EA
12 January	Environment Agency Flood Ambassadors visited Bourne End	EA
14 January @ 16:12	Flood Warning removed	EA
6 February @ 18:26	Flood Warning issued for 454 properties close to the River Thames at Bourne End	EA
7 February	Environment Agency Flood Ambassadors visited Bourne End	EA
8 February	Environment Agency Flood Ambassadors visited Bourne End	EA
10 February	Ferry Lane closed due to flooding	TfB
12 February	Wharf Lane about to be closed due to flooding	TfB
13 February	<ul style="list-style-type: none"> <li>Cores End Road closed due to flooding, 100 sandbags requested for deployment at the junction between New Road and Highfield Road on the same side of the road as the church.</li> <li>Fire Service facilitating social care staff visiting to No. 1 Ferry Lane which is closed due to flooding</li> </ul>	BFRS
14 February @ 15:44	Floodwater affecting homes along Hedsor Road (Riversdale). An officer attended to assess the situation and give advice.	BFRS
14 February	<ul style="list-style-type: none"> <li>Wharf Lane, Cores End Road and Ferry Lane – still closed</li> <li>Bourne End – approximately 20 properties flooded (mostly centred around Abbotsbrook and Riversdale)</li> <li>Cores End Road - The 'Supersucker' was called to this location and has cleared part of the flood and will return again to clear the rest.</li> </ul>	WDC / TfB
15 February	<ul style="list-style-type: none"> <li>Wharf Lane, Cores End Road and Ferry Lane – still closed</li> <li>'Supersucker' used at Cores End Road to remove flood water</li> <li>The RAF built a sandbag wall along Cores End Road which consisted of approximately 400 sandbags. Water still rising, but being kept at bay.</li> <li>Handy Cross supervisor to speak to BFRS at the Pound Lane Brief at 1000hrs to see if they can move a pump to Core End Road</li> </ul>	TfB
17 February	Wharf Lane, Cores End Road and Ferry Lane – still closed	TfB

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Date	Location	Response Provider
21 February @ 08:49	Flood Warning removed, all roads reopened	EA / TfB

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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 (LLFA) in this area is Buckinghamshire County Council (BCC). BCC 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 Wycombe District Council

Wycombe District Council (WDC) 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 BCC, to carry out flood risk management work which will benefit the management of surface water 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 (HA) which is undertaken by Transport for Buckinghamshire (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](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 4.1 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 4.1** Roles and responsibilities in an emergency, during and after a flood event

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

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## 5. Conclusions and recommendations

### 5.1 Conclusions

A number of issues contributed to the flooding that occurred in parts of Bourne End in January and February 2014. These are summarised as follows:

- The ground in and around Bourne End was saturated due to above-average prolonged rainfall and unusually high groundwater levels;
- The drainage infrastructure did not have sufficient capacity to cope with the volumes of surface water draining to them;
- Those areas of Bourne End close to the River Thames and Abbots Brook were flooded directly when water levels rose above the river bank.

Flooding in Bourne End appears to have been restricted to three areas and arose from fluvial and surface water. The likelihood of it occurring was probably rarer than a 5% AEP fluvial flood based on historical data. In such an extreme event, local drainage systems are unlikely to have sufficient capacity to cope.

### 5.2 Recommendations

Table 5.1 presents a number of recommendations that if implemented could improve the management of future flood events. They are drawn from an analysis of the January and February 2014 flooding and from a review of correspondence and documentation that followed the flooding.

The recommendations comprise two types of actions:

- To assess and if necessary improve existing structures (culverts and drains); and
- To improve the co-ordination of the management responses.

Particular areas where improvements can be made are:

- Regular maintenance of drains and gullies;
- Communication on the provision and arrival of assistance. Improved planning would ensure all resources are utilised effectively; and
- The allocation, distribution and number of sandbags and assistance with using them.

8<sup>th</sup> December 2015**Table 5.1** Recommendations

Authority/Stakeholder	Recommended actions
TfB	<ul style="list-style-type: none"> <li>• Investigate drainage network throughout the Cores End Road and Wharf Lane area to assess capacities.</li> <li>• Carry out cleansing of all gullies and highway drainage throughout as part of the ongoing maintenance schedule.</li> </ul>
BCC	<ul style="list-style-type: none"> <li>• Identify the riparian owners of Abbots Brook and ensure the owners are aware of their responsibilities.</li> <li>• Facilitate sharing of information between RMAs and the community.</li> <li>• Distribute information on flooding to residents.</li> </ul>
WDC	<ul style="list-style-type: none"> <li>• Improve access to sand and sandbags</li> </ul>
Thames Water	<ul style="list-style-type: none"> <li>• Improve community communication.</li> </ul>
Riparian Landowners	<ul style="list-style-type: none"> <li>• Ensure that the Abbots Brook is maintained in a suitable manner. The guidance given in the EA's 'Living on the Edge' booklet regarding riparian owner responsibilities should be followed.</li> <li>• Undertake clearance of vegetation with guidance from relevant RMAs.</li> </ul>
Residents	<ul style="list-style-type: none"> <li>• Develop a household flood action plan.</li> <li>• Participate in a community flood group.</li> <li>• Incorporate additional flood protection measures in properties known to be at risk of flooding; sacrificial ground floor, flood barriers, stilts etc.</li> </ul>

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## Explanation of Acronyms

Term	Definition
Act (or The Act)	The Act refers to the Flood & Water Management Act 2010
AEP	Annual Exceedance Probability. A flood or rainfall event with a 1 in 100 (1%) chance of being exceeded in any year has an AEP of 1/100 or 1%.
Attenuate	Providing temporary storage or other measures designed to reduce the volume of surface runoff which could cause flooding. A particular focus is on reducing the peak flow.
BCC	Buckinghamshire County Council
BFRS	Buckinghamshire Fire & Rescue Service
BGS	British Geological Survey
BSFMG	The Buckinghamshire Strategic Flood Management Group was formed in 2009 to co-ordinate work amongst relevant stakeholders and Partners.
CFMP / Catchment Flood Management Plan	Catchment Flood Management Plans are produced by the Environment Agency to give an overview of the flood risk in the two primary catchments in BCC's area: Great Ouse and Thames.
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency, which has a Strategic overview role for flood and coastal erosion risk management
Flood	The temporary inundation by water of property or land not normally covered with water
FMfSW	Flood Map for Surface Water
Flood & Water Management Act 2010 (FWMA)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which (partly) is to clarify the legislative framework for managing local flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a river.
Groundwater Flooding	Occurs when water levels in the ground rise above the natural surface. Low lying areas underlain by permeable strata (e.g. Chalk) are particularly susceptible.
IDB	Internal Drainage Board. Applicable to only one area in Buckinghamshire for which the Buckingham and River Ouzel Internal Drainage Board has flood risk management responsibilities.



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<b>Term</b>	<b>Definition</b>
LLFA / Lead Local Flood Authority	Local Authority responsible for taking the lead on local flood risk management
Local Flood Risk	Flooding from sources other than Main Rivers, which principally concerns surface runoff, groundwater and ordinary watercourses. BCC has a responsibility under the Flood & Water Management Act to manage flooding from these sources.
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.
MTC	Marlow Town Council
Multiple Benefits	As well as reducing the risks to people and property, flood risk management can bring economic, environmental and social benefits.
Ordinary Watercourses	All watercourses that are not designated Main River, and which are the responsibility of local authorities or IDBs
Partner	A person or organisation with responsibility relating to flood risk management for the decision or actions that need to be taken.
PFRA / Preliminary Flood Risk Review	A report produced by BCC in response to the Flood Risk Regulations 2009 which summarises local flood risk across BCC's area and provides a number of detailed maps recording local flood incidents
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authorities (RMA)	Organisations that have a key role in flood and coastal erosion risk management as defined by the Flood & Water Management Act 2010. These are BCC (the Lead Local Flood Authority and Highways Authority), District Councils, Environment Agency, Buckingham and River Ouzel Internal Drainage Board, Anglian Water and Thames Water
SFRA	Strategic Flood Risk Assessment. These are produced by each District to give an assessment of flood risk from all sources and its implications for land use planning.
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations; includes the public and communities.
Strategy	Under the Flood & Water Management Act 2010, BCC have a duty to develop, maintain, apply and monitor a strategy for local flood risk management

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<b>Term</b>	<b>Definition</b>
Sustainability	In the context of this Strategy, the risk of flooding must be reduced now, but in a way which does not compromise the interconnected needs of the economy, society and environment in the future.
Surface water/runoff	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer. The term 'surface water' is used generically to refer to water on the surface and is often associated with periods of intense rainfall.
SWMP	Surface Water Management Plan
TfB	Transport for Buckinghamshire
TW	Thames Water Utilities Ltd
WDC	Wycombe District Council

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## References

Reference in document	Refers to:
Environment Agency (2014)	Environment Agency Monthly Water Situation Report South East Region. February 2014
Environment Agency (July 2014)	Environment Agency Flood Report Winter Floods 2013/14 West Thames Area (July 2014)
Jacobs (2004)	Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS 23) Final Report Volume 2.
Buckinghamshire County Councils Local Flood Risk Management Strategy (2013-2018)	<a href="http://www.buckscc.gov.uk/environment/flooding/">http://www.buckscc.gov.uk/environment/flooding/</a>
Environment Agency 'Living on the Edge'	<a href="https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297423/LIT_7114_c70612.pdf">https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297423/LIT_7114_c70612.pdf</a>
Wycombe District SFRA	<a href="http://www.wycombe.gov.uk/Core">http://www.wycombe.gov.uk/Core</a>

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## Contacts

### Lead Local Flood Authority



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

Telephone: 0845 370 8090

Email: [FloodManagement@buckscc.gov.uk](mailto:FloodManagement@buckscc.gov.uk)

Website: [www.buckscc.gov.uk/flooding](http://www.buckscc.gov.uk/flooding)

### Environment Agency



National Customer Contact Centre  
PO Box 544  
Rotherham  
S60 1BY

Telephone: 0370 850 6506

Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)

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

### District Council



Wycombe District Council  
Queen Victoria Road  
High Wycombe  
HP11 1BB  
Telephone: 01494 461 000

#### Opening times

Monday - Thursday  
8.45am – 5.15pm  
Friday  
8.45am – 4.45pm

### Highways Authority

Transport for Buckinghamshire

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Telephone: Transport and Roads – 0845 230 2882  
Out of hours emergencies (Highways) – 01296 486630  
Email: [ffb@buckscc.gov.uk](mailto:ffb@buckscc.gov.uk)  
Website: <http://www.transportforbucks.net/Transport-and-roads.aspx>

### **Water Utility**



Thames Water  
PO Box 286  
Swindon  
SN38 2RA

Telephone: 0845 920 0800  
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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## Appendix

### Appendix A: BCC criteria for a Section 19 Investigation

- Internal flooding (including to basements) to five or more residential properties within an area of 1km<sup>2</sup>;
  - Internal flooding of two or more business premises within an area of 1km<sup>2</sup>;
  - Internal flooding (including to basement) of at least one property for one week or longer; and
  - 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; and
    - 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.