

19<sup>th</sup> December 2014

# Buckinghamshire County Council

## Flood Investigation Report

Oxford Road New Denham February 2014



19<sup>th</sup> December 2014

## Revision Schedule

**Buckinghamshire County council**

**Flood Investigation Report**

<b>Rev</b>	<b>Date</b>	<b>Details</b>	<b>Author</b>	<b>Checked and Approved by</b>
<b>1</b>	17/07/2014	Version 1 - draft	Karen Fisher	
<b>2</b>	18/11/2014	Final draft	Karen Fisher	
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19<sup>th</sup> December 2014

## Table of Contents

<b>Executive Summary</b> .....	<b>4</b>
<b>1. Introduction</b> .....	<b>5</b>
1.1 Background to investigation .....	5
1.2 Site Location .....	6
1.3 River network and drainage system .....	10
<b>2. Background/ History of flooding</b> .....	<b>12</b>
2.1 Catchment and site characteristics.....	12
2.2 Previous flood events .....	15
2.3 Data .....	15
2.4 Drainage assets/ structures or features that affect flood risk .....	16
<b>3. Analysis of February 2014 flood event</b> .....	<b>17</b>
3.1 Conditions at the time (I.e. ground conditions) .....	17
3.2 Condition of features/ structures.....	17
3.3 Condition of watercourse.....	17
3.4 What happened? (Flows paths, damage etc.) .....	17
3.5 Incident response .....	22
3.6 Possible causes .....	23
<b>4. Responsible Authorities and landowners</b> .....	<b>24</b>
4.1 Lead Local Flood Authority .....	24
4.2 South Bucks District Council .....	24
4.3 Environment Agency .....	24
4.4 Highways Authority – Transport for Buckinghamshire .....	24
4.5 Water Utility Company – Thames Water .....	25
4.6 Canal and River Trust .....	25
4.7 Landowners and riparian owners .....	25
4.8 Residents .....	25
4.9 Emergency Responsibilities .....	25
<b>5. Conclusions and recommendations</b> .....	<b>27</b>
5.1 Conclusions.....	27
5.2 Recommendations .....	29
<b>Explanation of Terms and Acronyms</b> .....	<b>32</b>
<b>Glossary and references</b> .....	<b>32</b>
<b>Contacts</b> .....	<b>33</b>
<b>Appendix 1 Environment Agency photos from Willowbank area</b> .....	<b>36</b>
<b>Appendix 2 Photos from fields to west of Oakside</b> .....	<b>42</b>
<b>Appendix 3 Environment Agency photos from Oakside</b> .....	<b>43</b>
<b>Appendix 4 Environment Agency photos from Oxford Road parade of shops</b> .....	<b>47</b>

19<sup>th</sup> December 2014

## Executive Summary

This report has been produced by Buckinghamshire County Council (BCC) to investigate the flooding that occurred in New Denham between 9<sup>th</sup> and 15<sup>th</sup> February 2014. The report provides details of the event and makes recommendations for Risk Management Authorities (RMAs) to undertake to reduce future flood risk.

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 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 February 2014 exceeded BCCs 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 the management of flood risk in the future.

The flood event in February 2014 occurred after a prolonged period of above average rainfall which caused the surrounding land to become saturated and an increased volume of surface water to flow into the highway drainage and main rivers. The River Colne was very high during this time and the river overtopped its banks at a location upstream of Willowbank and flood water flowed down a field to the west of the river and Willowbank and into the area around Oakside and houses on Oxford Road. Along by the shops at Oxford Road the river channel overtopped and flowed into shops. A list of recommendations is included which will begin to address the flooding and look at options going forward.

Since the flooding event the Environment Agency have undertaken some survey work on the low bank upstream of Willowbank and contact has been made with the residents and residents association to gain details of what occurred and to begin to discuss possibilities going forward.

19<sup>th</sup> December 2014

## 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 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 New Denham because it meets the following threshold: internal flooding of five or more properties or two or more business premises within an area of 1km<sup>2</sup>.

19<sup>th</sup> December 2014

## 1.2 Site Location

The area of Willowbank is located in New Denham, near Uxbridge, Buckinghamshire. Willowbank is a residential area between two branches of the River Colne. The River Colne flows from the north of the Willowbank residential area under the M40 motorway and at the Willowbank gauging station the river splits into two channels one flowing over a weir and into the main River Colne, continuing to flow southwards around the western edge of the Willowbank residential area. The other channel flows towards the Grand Union canal and joins this at Grid Ref 505275 185524. This combined channel then splits at the south-east corner of the Willowbank residential area Grid Ref 505225 184962 and the River Colne flows through a series of weirs and sluices to rejoin the branch from around the western side of the Willowbank area. These two channels join at High Bridge on Oxford Road on the Hillingdon/Buckinghamshire County Border and flows south along the border. The Grand Union canal continues south on a parallel course to the River Colne after the combined channel splits.

The area of interest and flooding in this report is within the Buckinghamshire County Council (BCC) borders. The houses and businesses impacted are within BCC area as discussed below.

19<sup>th</sup> December 2014

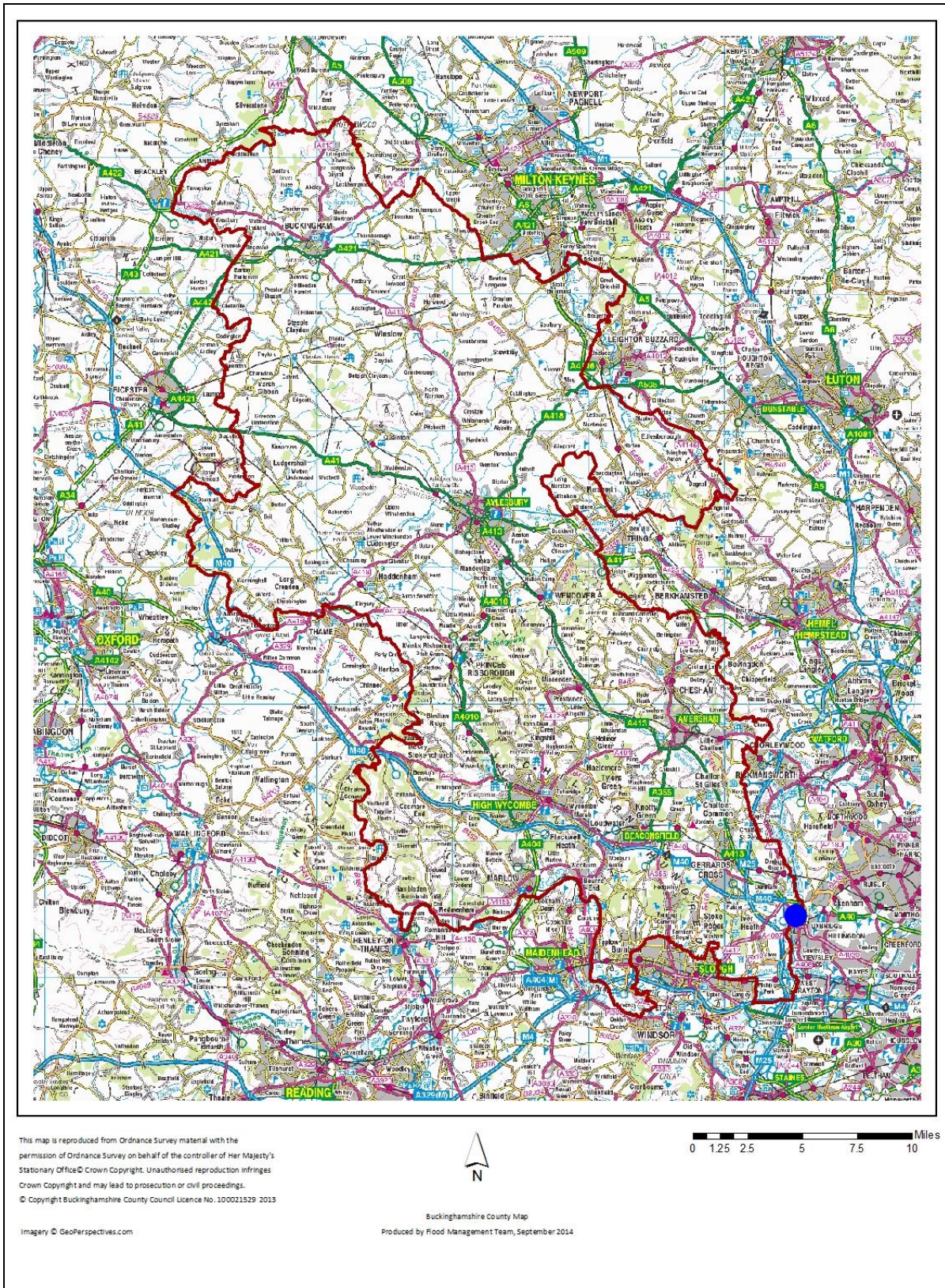
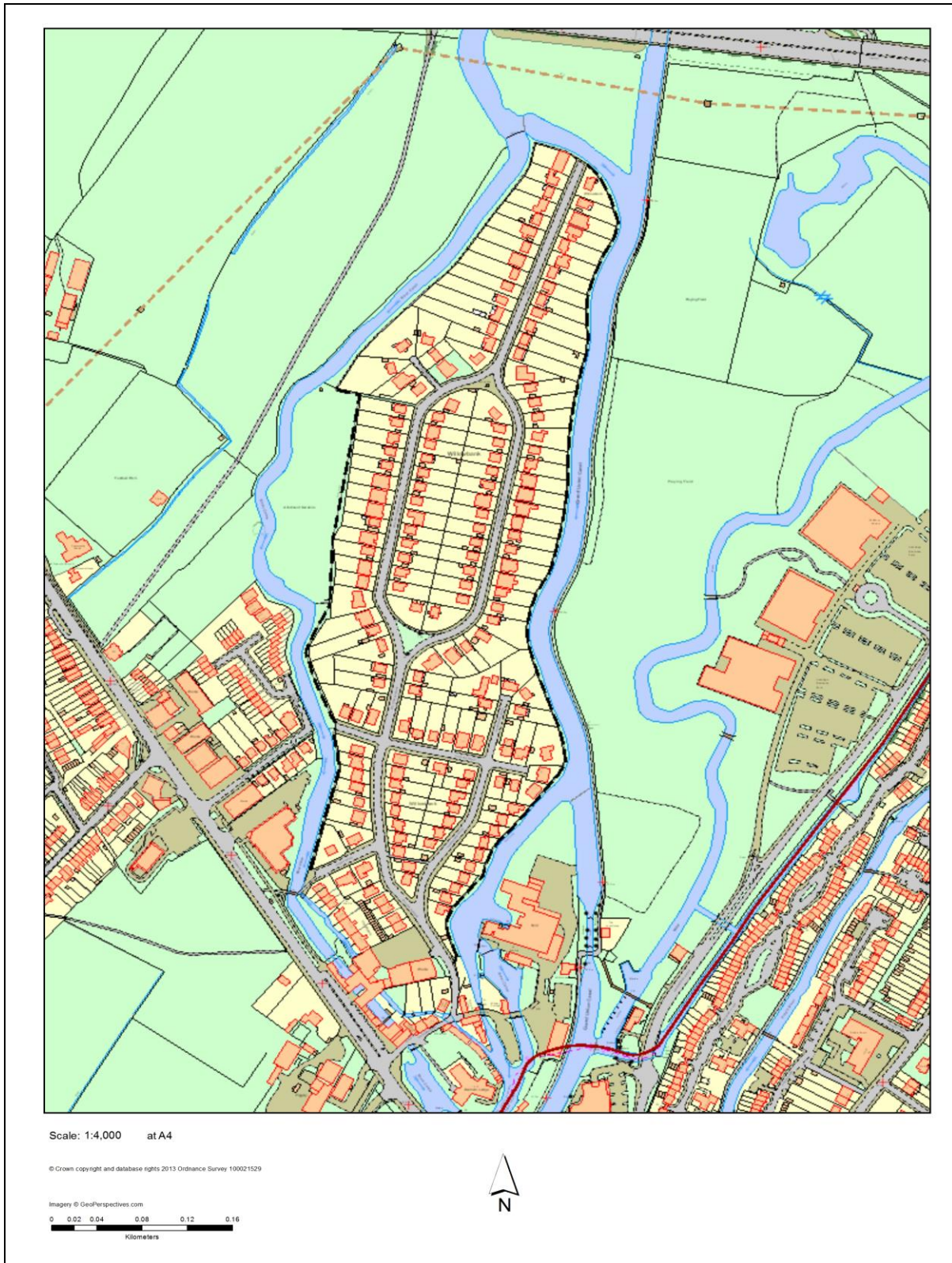


Figure 1a Location map of Willowbank at County level (Ordnance Survey License 100021529 2014)



19<sup>th</sup> December 2014



**Figure 1b** Location map of Willowbank area (Ordnance Survey License 100021529 2014)



19<sup>th</sup> December 2014



19<sup>th</sup> December 2014

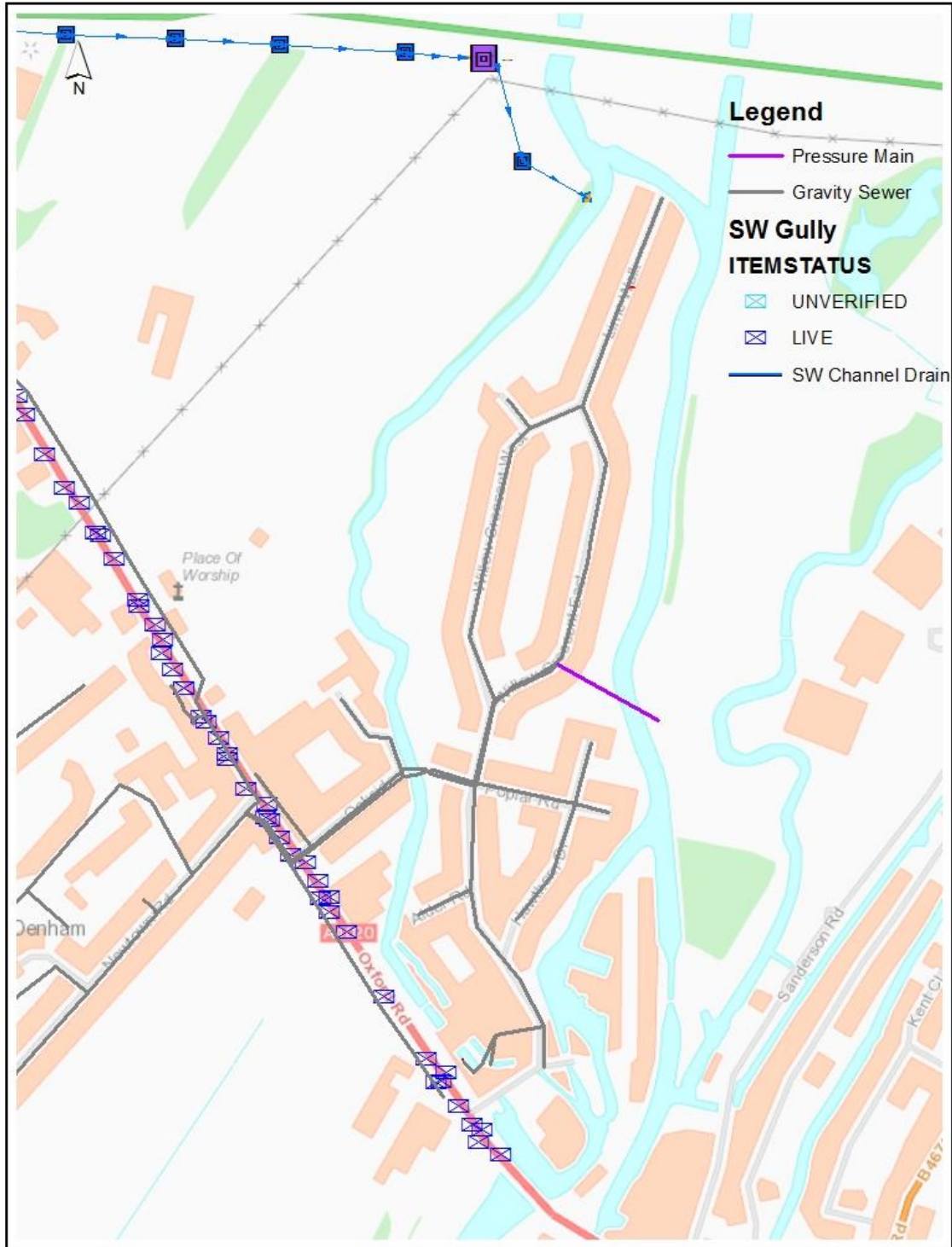
### 1.3 River network and drainage system

The river network in the area of Willowbank, New Denham is predominantly main river with the River Colne splitting into two branches at a weir to the north of the residential area and the channel flowing around the eastern side of Willowbank merging with the Grand Union Canal as described above. Main river routes fall under the responsibility of the Environment Agency and usually surface and highway water systems fall under the responsibility of Buckinghamshire County Council and Transport for Bucks respectively. On the Willowbank estate the situation is different from usual and the network of surface water drains with gullies in the road and surface water ditches is owned by Thames Water although Thames Water are still to confirm this formally. The foul water system present in the residential area is operated by Thames Water. The map of assets is shown in Figure 2.

The branch of the River Colne flowing around the western side of the Willowbank flows between Oakside and Poplar Road and then under a footbridge at the end of Alder Road. At this point, Grid Ref 504975 184859, the channel again splits with a mill channel running parallel to the north of the main channel which runs east parallel to Oxford Road. The main channel and mill channel both run behind and under properties along the Oxford Road. The main channel runs into a large pond at Grid Ref 505154 184663 by Denham Lodge. The mill channel runs along the back of the Mill Stream cottage and under The Old Mill House Road. This channel then joins with the River Colne branch coming along the east side of the Willowbank residential area and the river comes into a single channel at High Bridge under the Oxford Road.

The location of the defences, which are embankments, on the main River Colne which protect the southern area of Willowbank are also shown in Figure 2.

19<sup>th</sup> December 2014



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Buckinghamshire County Map  
Produced by Flood Management Team, September 2014

**Figure 2 Network of assets**



## 2. Background/ History of flooding

### 2.1 Catchment and site characteristics

The areas of Willowbank and Oxford Road in New Denham are in the catchment of the River Colne and in particular the Lower Colne. The catchment topography shows two distinct areas. Within the northern and western areas of the catchment, the topography slopes steeply away from the Chiltern Hills towards the south east. Within the easterly and southerly areas of the catchment, where the majority of the rivers converge or meet the River Colne, the topography is lower lying with a gentle slope towards the south. Unconfined chalk dominates the geology, overlain by London clay along the southeast boundary of the catchment. The Colne area receives an average annual rainfall of 716 mm.

The area around Willowbank and Oxford Road, New Denham are partially in Flood Zone 2 and 3. Properties in Flood Zone 2 are at risk from flooding in a 1 in 1000 year event. Properties in Flood Zone 3 are at risk from flooding in a 1 in 100 year event. Figure 3 shows the areas at risk from river flooding based on the Environment Agency Fluvial flooding maps. The area of Willowbank is shown as being protected from 1 in 100 year (Zone 3) flooding by flood defences along the western and eastern branch of the River Colne. The area along Oxford Road by the parade of shops is shown as being in Flood Zone 3 (1 in 100 year) and the area further up Oxford Road by number 50 is in Zone 2 (1 in 1000 year). The banks from around Willowbank areas were put in place as part of the 2003 flood alleviation works and these include banks alongside the river which are designed to protect to a 1 in 100 year event.

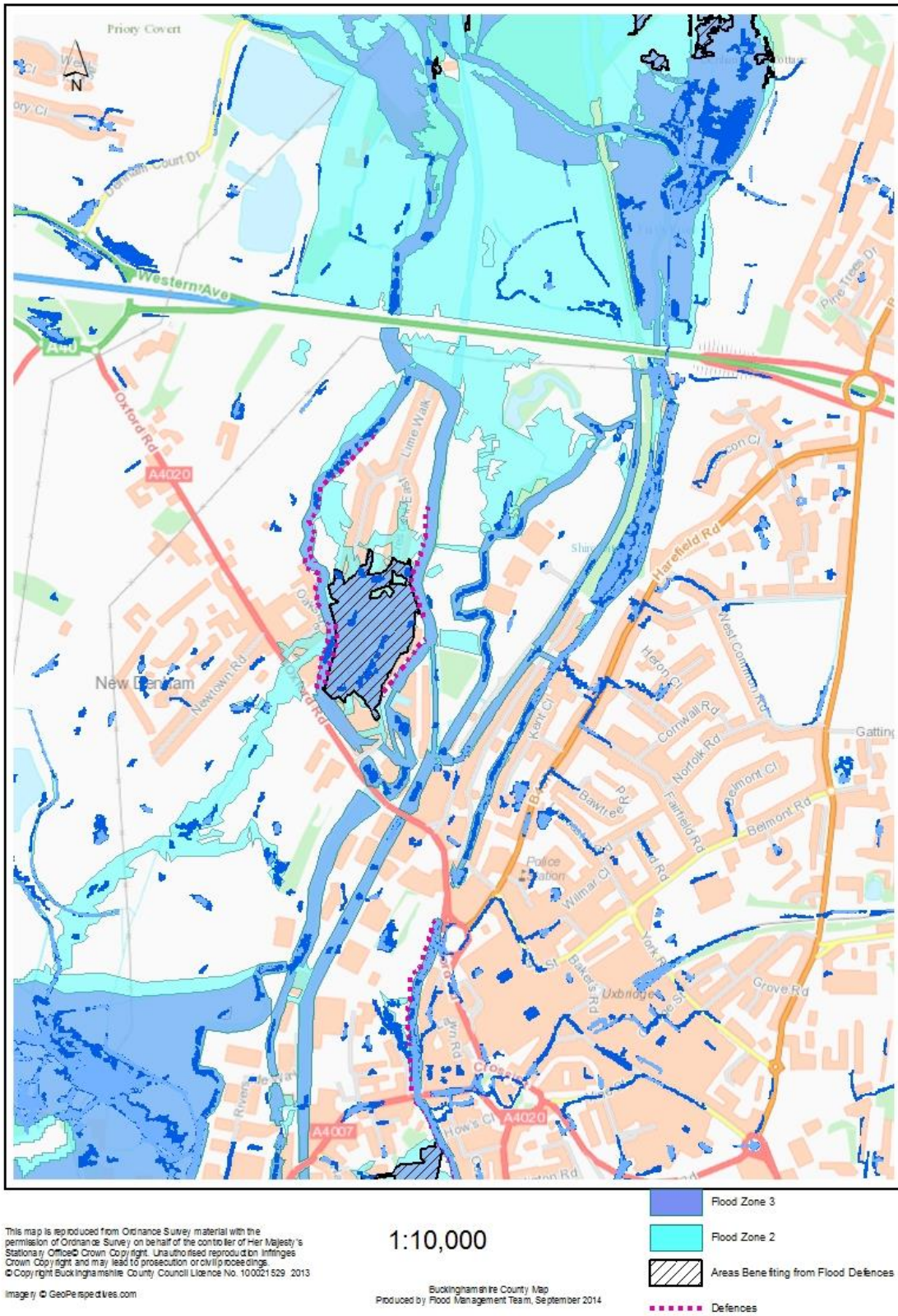
The predicted surface water flooding for a 1 in 100 year event is shown in Figure 4. This shows that the flooding from surface water running from the highways and hard surfaces will be very limited to the following locations where there are low spots:

- Corner of Willow Avenue and Poplar Road
- Southern end of Willow Crescent
- Back of houses along Hawthorn Drive

In addition the maps suggest that there would be limited surface water flooding in the open area, especially along the line of the ditch, to the west of the west branch of the River Colne, downstream of the M40.

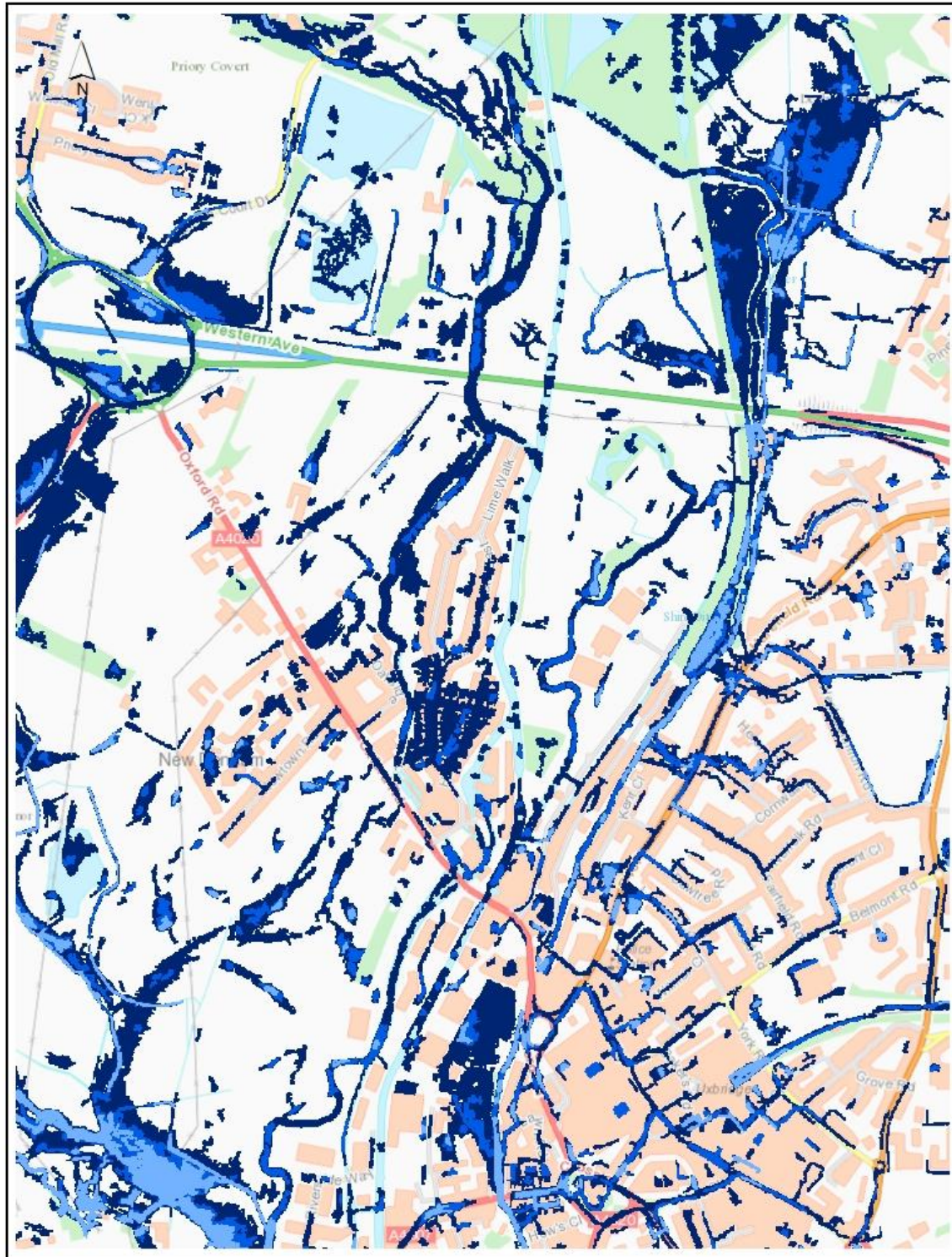
The surface water maps suggest that the surface water flooding will be limited in this area even in a 1 in 100 year event although in a 1 in 100 year event the flooding may be extensive.

19<sup>th</sup> December 2014



**Figure 3** Areas at risk from river flooding

19<sup>th</sup> December 2014



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Buckinghamshire County Map  
 Produced by Flood Management Team, September 2014

**Legend**

- 1 in 30 yr Surface Water Flood Event
- 1 in 100 yr Surface Water Flood Event
- 1 in 1000 yr Surface Water Flood Event

**Figure 4 Areas at risk from Surface water flooding**



19<sup>th</sup> December 2014

## 2.2 Previous flood events

There has been previous flooding in this New Denham and Willowbank area during the early 2000s. A flood alleviation scheme to protect Willowbank was installed with banks around the area in 1988 as part of the Lower Colne Improvements Scheme. The section between Poplar and Alder Roads was rebuilt in late 2007/early 2008 in response to seepage under the bank below the defence.

The following flood events and locations are those which the team from Buckinghamshire County Council, Environment Agency and South Bucks District Council are aware of from different sources of information in and around the area. The references given are from the Preliminary Flood Risk Assessment (PFRA), 2011.

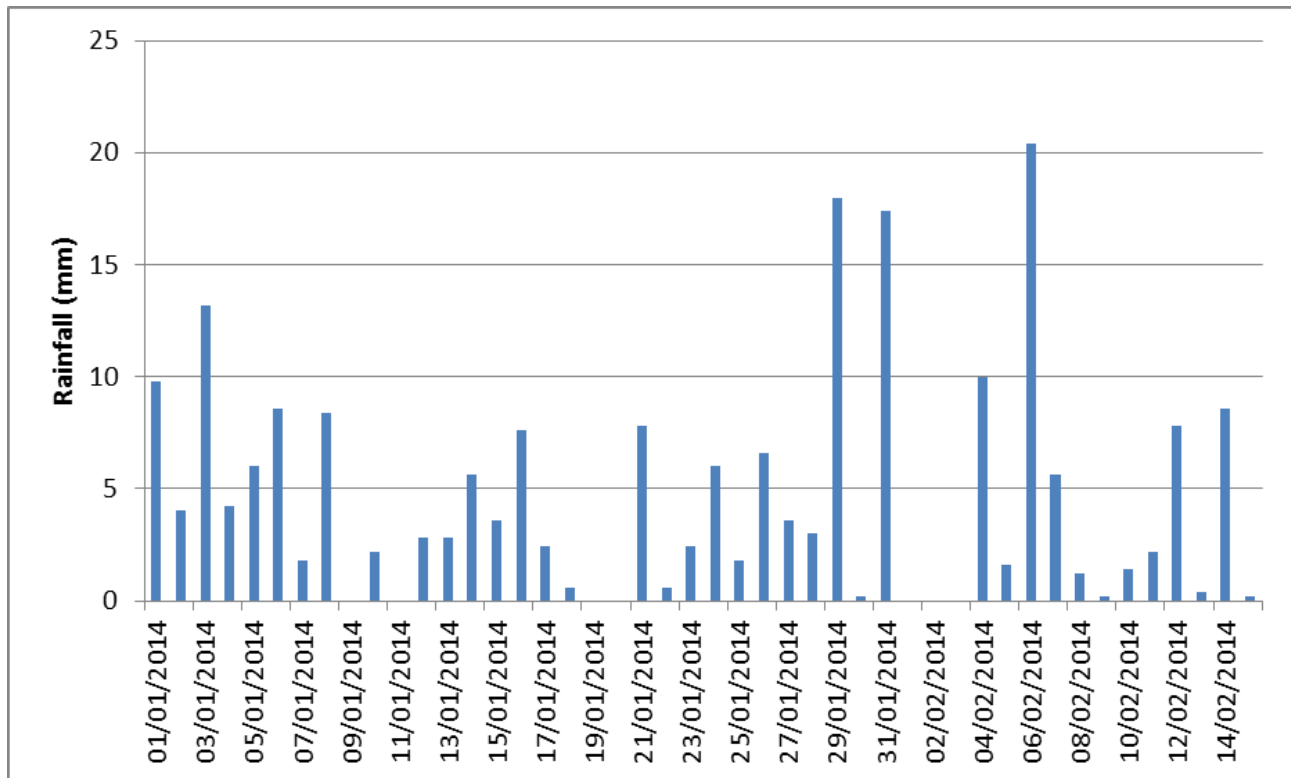
- 2006: 5 Campion Close Denham, UB9 5BX (Ref No. SBD-5)
- 2005: 15 Lower Road Denham, UB9 5EA (Ref No. SBD-34)
- 2004: 4a Middle Road Denham, UB9 5EG (Ref No. SBD-45)
- 2003: Willets Lane Denham (Ref No. SBD-76)
- 2003: 32 Denham Lodge, UB9 4AB (Ref No. SBD-77)
- 2003: Denham Green Lane (Ref No. SBD-81)
- 2002: Oxford Road, Denham (Ref No. SBD-109)
- 2001: Station Parade Denham (Ref No. SBD-130)

## 2.3 Data

The rainfall data from the nearest gauge at Iver Heath is shown in Figure 5. This shows the consistent rainfall through January and February 2014 and then three days of rainfall higher than 15mm in one day on 29<sup>th</sup>, 31<sup>st</sup> January and greater than 20mm on 6<sup>th</sup> February 2014.

Information from the gauging station indicates that before this 2014 event the maximum flow recorded was 22.169m<sup>3</sup>/s on 03/01/2003. The peak level reached at 8am on 9<sup>th</sup> February 2014 was 1.278m. This reading was taken on the upstream side of the weir. The datum at the site is 32.00mAOD.

The Environment Agency fluvial model shows that the return period for a flood level of 1.278m is between a 1 in 50yr flood (1.26m) and 1 in 100yr flood (1.29m).

19<sup>th</sup> December 2014

**Figure 5 Daily Rainfall amounts from 1<sup>st</sup> January to 14<sup>th</sup> February 2014**

## 2.4 Drainage assets/ structures or features that affect flood risk

The location of drainage and flood assets are shown in Figure 2. The Environment Agency has banks along the main river and weirs at the Willowbank gauging station which split and control the flow around the Willowbank island.

There are flood defences were initially built in 1988 as part of the Lower Colne Flood Improvement scheme to protect the Willowbank area. These defences are mainly banks which are linked to the weirs which control the flows upstream. The bank defences were improved in 2007/8. The banks built for protecting the Willowbank area are at a level of 33m AOD and climate change was not considered during the original design of these defences.

The defence banks were inspected on 9<sup>th</sup> December 2013 and the condition was rated as being fair.

There are surface water drains, ditches and gullies which are shown on Figure 2 which includes the open surface water ditches on Willowbank and the piped system from Alder Road going south along Willow Avenue to Tudor Cottage and along Hawthorn Drive. This surface water system is the responsibility of Thames Water although Thames Water are still to confirm this formally. The surface water drains discharge into the River



19<sup>th</sup> December 2014

Colne and so if the river levels are high then the surface water may not discharge efficiently.

## 3. Analysis of February 2014 flood event

### 3.1 Conditions at the time (i.e. ground conditions)

The extensive rainfall and wet conditions over the 3 months leading up to the flooding events of 9<sup>th</sup> February meant that the surrounding ground was saturated and the soil moisture deficit across the catchment was 0mm.

### 3.2 Condition of features/ structures

There are a number of structures along the River Colne in this area. The defence banks were inspected on 9<sup>th</sup> December 2013 and the condition was rated as being fair.

### 3.3 Condition of watercourse

The watercourse is reported by the EA to have been in fair condition. The watercourse in this location does not receive maintenance.

It is known that the flood water passed over two banks: one on the right bank at location 505139 185600 downstream of the M40 but 50m upstream of the weir at 505172 185575; and one at 504985 185326 on the left bank of the western branch of the River Colne. The bank on the western arm of the River Colne is part of a flood defence bank. This bank should only be breached in an event greater than 1 in 100 year. The Environment Agency in their investigations found that the flood kerb of this defence was exposed with the normal 100-150mm of topsoil being eroded. The overtopping had been reported to the Environment Agency and the EA Operations team were sent to build up the low points of this defence structure with sand bags – see below.

### 3.4 What happened? (Flows paths, damage etc.)

The flood event occurred on Sunday 9<sup>th</sup> February 2014 and started with the surface water ditches on the island filling up. The foul sewers then started to over flow – apparently due to the local pumping station being overwhelmed, Thames Water responding by tankering away waste. Finally fluvial flood water came across the recreation ground from its northern end into gardens on Willow Crescent West and then onto the islands roads.

Sandbagging of doors and garages was observed along Willow Avenue, Willow Crescent West, Poplar Road and Alder Road. The flood defence between Poplar Road and Alder Road was all in order. There was evidence of pumping from three properties at the northern end of the island, near to the gauging station. Standing water was

19<sup>th</sup> December 2014

observed at the northern end of the recreation ground where a section of flood defence kerb exposed and accumulated vegetation from out of bank ponding of water. The water level at the gauge board on the western channel of the gauging station was noted as 32.90m AoD.

Residents had taken their own measures to protect their properties deploying sandbags, bought from local building merchants, and pumps. These actions had prevented several properties from flooding internally, especially on the corners of Poplar Road and Willow Avenue. The residents of 16 Willow Avenue were continuing with regular pumping (every three hours) as groundwater was still causing their garden to flood. It was reported that no sandbags had been supplied by the local authority. The estate surface water ditches and drains had not been cleared for a while, and the residents felt they had been left to fend for themselves. Residents were pleased that the flood defence between Poplar Road and Alder Road, rebuilt in 2005/6, had performed well, as they felt that without the rebuilding a large number of properties on the island would have been severely affected by fluvial flooding.

Residents reported that the flood defence at the northern end of the recreation ground had been over-topped, and showed the Environment Agency the place where this had happened. The flood kerbs of the defence were exposed with the normal 100-150mm of topsoil having been eroded. This over-topping was reported to the Environment Agency.

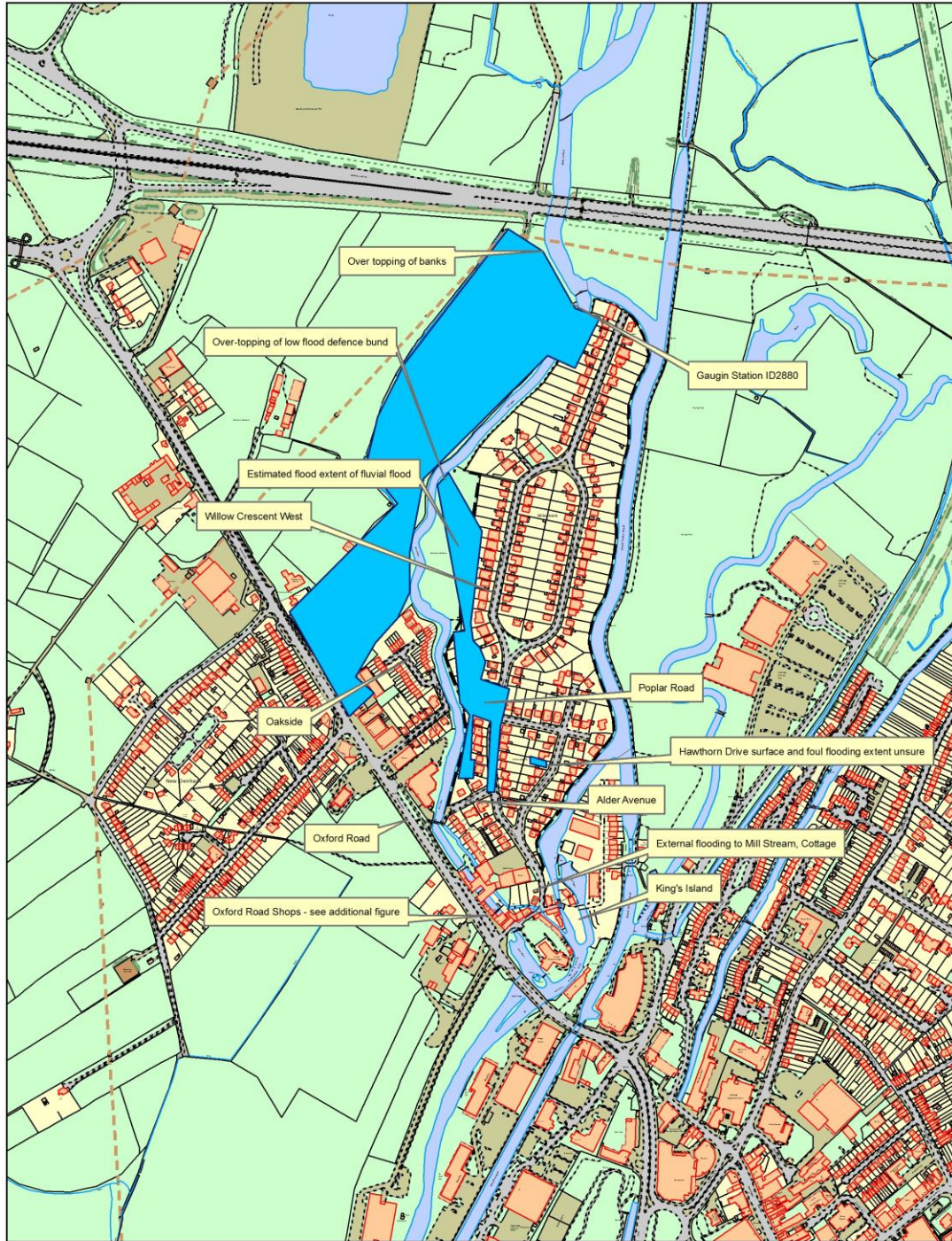
Following forecasts on the evening of the 11th February for further heavy rain in the coming days an Ops Team from the Environment Agency was sent to build up the low points of the defence with sandbags, which was carried out on the 12th February 2014.

The external area of Mill Stream Cottage at the southern end of Willow Avenue showed signs of both fluvial and foul sewer flooding. A builder was working on the property and reported that there was no internal flooding.

During the flooding there were reports to Bucks CC that the Canal and River Trust had opened sluice gates on the Grand Union Canal during the flooding causing increased flooding downstream. After discussions with the Canal and River Trust it would appear that the water coming into the canal system comes naturally from the River Colne and there are no known activities in Rickmansworth adding to this water. The Canal and River Trust have informed BCC that all the lock gates were closed but water levels were so high that water was overtopping the lock gates.

The River Colne flows around the King's Island. Weston Homes plc, the owners of the Kings Island site have inherited three flood paddles which could potentially be used to let water out of the Grand Union back into the River Colne but it is unclear whether those were in use during the flooding. It is understood that one sluice next to the King's Island main gate was opened by the Fire and Rescue Service –see the time line in Section 3.5.

19<sup>th</sup> December 2014



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**Figure 6** Location of flooding in February 2014 in Willowbank and Oakside



19<sup>th</sup> December 2014

Figure 6 summarises the flow routes and flooding in the Willowbank and Oakside areas.

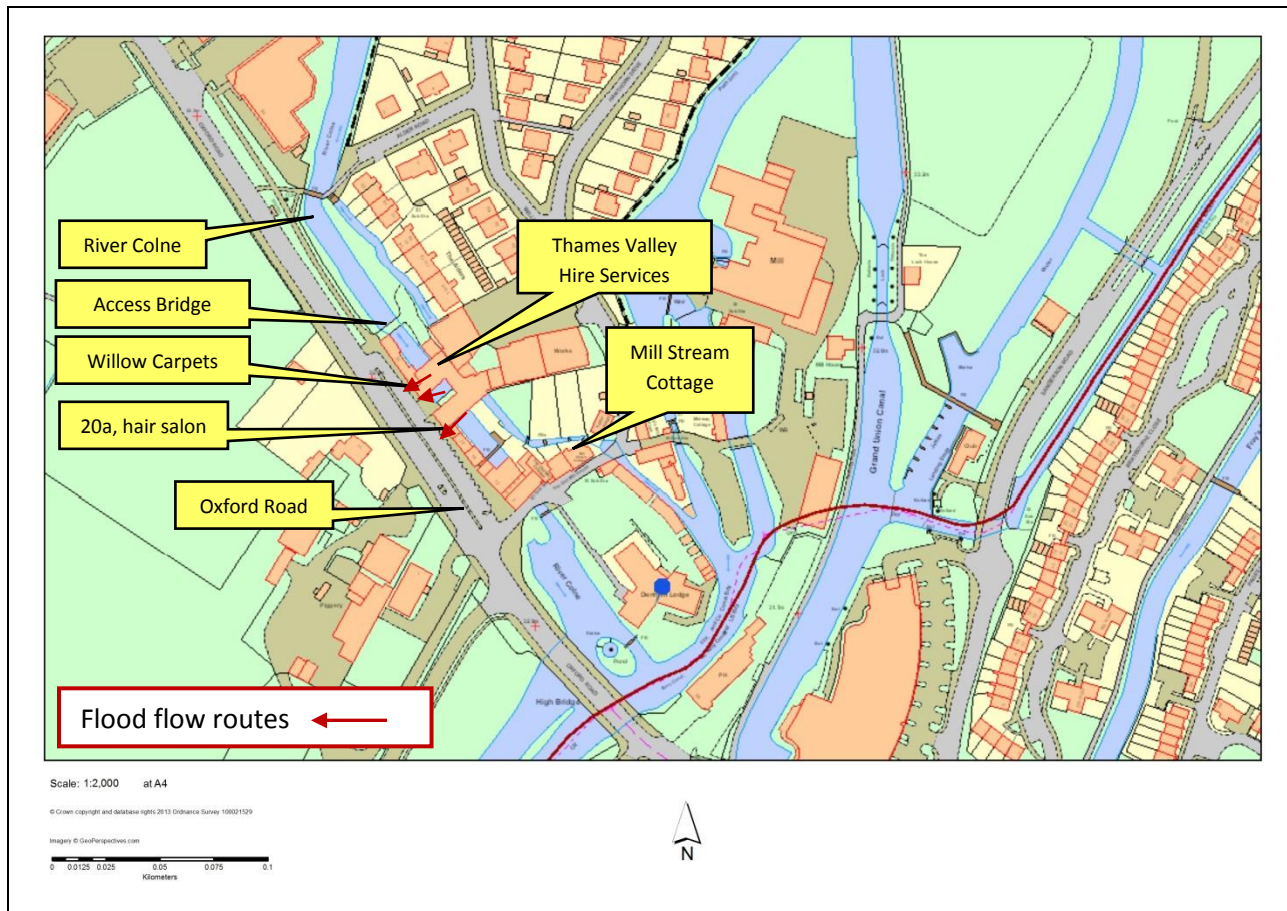
In the Oakside area local residents reported that the flood water had not over-topped the adjacent bank, but flowed overland after coming out of bank further upstream near the gauging station weir at the northern end of Willowbank Island. No internal flooding had been reported, although numbers 25 – 29 were nearest to flooding with water reaching the door thresholds. There was evidence of sandbagging around all properties surrounding the 'T' end of the street and along the riverbank as far as the sheet pile wall.

Flood water was reported as filling the car park areas beside the properties and gardens behind them, and car park adjacent to the western side of the estate. The water level had been recorded on the side of number 25 by a yellow crayon line by the social landlord, London & Quadrant.

The properties beside the river, number 42 – 44, had higher sandbag walls by their doors and some evidence of flow, although the residents there reported there was no riverside flooding.

During the period after the flooding, horses were stuck in fields to the west and north of the site with little opportunity to get feed to them. This created much distress to the tenant farmer. Buckinghamshire County Council and South Buckinghamshire District Council were in regular contact to help and support although little could be done before the water subsided.

The river water which flowed through the field with the horses around the Oakside area then flowed down to through the car parks to the properties on the Oxford Road and the pub and filling station. There was internal flooding to at least 4 properties and the businesses.

19<sup>th</sup> December 2014

**Figure 7 Location of flooding and features around the Oxford Road.**

Figure 7 shows flood routes around the Oxford Road area. There were reports of some flooding at the parade of shops on the Oxford Road. The newsagent in the parade of shops advised that the hair salon and carpet shop had been flooded internally.

On investigation the Environment Agency staff found that there was a gap between the hair salon, Hair by Debbie, and adjacent building (northern side), and that the right bank height on the shop side was significantly lower than the opposite left bank. There was also evidence of gravels being washed out of the gap on to the pavement. The hair salon was closed. On hearing of further rainfall forecast in the coming days, the low point in the bank was reported to the FIDO the following day and an Environment Agency Operations Team asked to raise the bank in the gap with sandbags, which they did the same day (12th February 2014).

The occupier of the carpet shop, Willow Carpets, reported that flood water had come through the bankside wall of the property, through the shop and into the road. They were in the process of clearing up after the flood.

The Thames Valley Hire Services business behind the carpet shop reported no internal flooding, though confirmed the carpet shop flooding as they own the property and let

19<sup>th</sup> December 2014

part of the premises to the carpet business. Thames Valley Hire Services had erected a temporary defence to direct flood water away from their entrance and on to the road should an event reoccur.

After the flooding from observations made at the rear of the Oxford Road properties, it can be seen that some of the downpipes and soil vent pipes are in a poor state of repair. The flood water may have come up through these pipes and into the properties.

The access bridge across the river at the northern end of the parade had debris on the inner faces of its beams indicating the event reached over the soffit level. The occupier indicated the maximum water level and said there was no over-topping of the bridge parapets.

### 3.5 Incident response

09/02/2014	
08:59	Following report of possible blockage at southern end of Willowbank (River Colne) and rising levels, requested Environment Agency gang attend site
09:03	Contacted member of public who reported blockage at Willowbank and advised that a gang were on their way to check
11:30	Gang report no blockage at Willowbank
11:37	Bucks F&R Service opened the sluice owned by Allied Mills at Kings Mill Cottage at the south end of Willowbank.
12:00	Bucks F&R Service found the sluice at Willowbank but there was no operating gear. They opened it anyway with available tools. They asked if EA could assist but EA said couldn't due to not having anyone available plus it isn't EA sluice
12:38	EA replied to email from Bucks F&R Service with photo of sluice, asking if it's the right one to operate. EA investigated, even though it's not their structure
12:50	EA respond to Bucks F&R Service to say sluice should only be opened no more than 150mm in two stages. F&R service got a key to the structure from a local security guard. . As soon as sluice opened levels began to drop upstream.
12/02/2014	
08:38	Site operative requests 20 sandbags to put in two low spots in the Willowbank recreation area. Also requested 6 sandbags for a gap at the rear of 20A Oxford Road to prevent flood water coming out of the River Colne
08:52	Request for sandbags for Willowbank passed on to gang with photos of locations

19<sup>th</sup> December 2014

10:02	Gang on site at Willowbank and just seeking final confirmation of where to place sandbags
14/02/2014	
11:28	Gang in Denham speaking to members of public and say it was roughly 18 inches from properties last night. Gang will check a nearby culvert.
15 to 18/02/2014	
	BCC and SBDC help residents and tenant farmers with residual impacts of flooding

*Details of Thames Water response have not been received so could not be included*

### 3.6 Possible causes

Prolonged rainfall caused the land to be saturated and therefore there was increased water from the catchment entering river network. The rainfall in this area created a fluvial event which was measured as between a 1 in 50 year and 1 in 100 year event.

Initial flooding was from surface water in the Willowbank area which was not able to flow away due to poorly maintained drainage channels and then high river levels.

Overtopping on the right bank upstream of the gauged weir at Grid Ref 505134 185613. The overtopped flood water flowed into a field and into a residential area around Oakside and through onto Oxford Road.

The EA defences were breached at Grid Ref 504983 185326 and fluvial flood water flowed into gardens on Willow Crescent West and Willow Avenue.

The business properties in the parade of shops along Oxford Road were flooded due to:

- high flood levels,
- lack of flood defences along this area,
- restrictions to the channel in terms of overbuilds and access tracks backing the flow up; and
- poor pipe overflow systems creating water backing up into properties.

19<sup>th</sup> December 2014

## 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 BCC Local Flood Risk Management Strategy (2013-2018).

### 4.1 Lead Local Flood Authority

The LLFA in this area is Buckinghamshire County Council. BCC have a role as a RMA in coordinating management of local flood risk from surface water, ground water and ordinary watercourses in the county. River Colne is classified as main river so therefore the responsibility for the flooding from rivers in this area comes under the EA. Any flooding from surface water comes under BCC as the LLFA.

### 4.2 South Bucks District Council

South Bucks District Council (SBDC) 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 management of surface runoff, groundwater and ordinary water courses.

### 4.3 Environment Agency

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

River Colne through New Denham and around Willowbank is Main River and therefore the EA are the RMA for fluvial flood risk in this area.

### 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.



19<sup>th</sup> December 2014

#### **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. In this situation it is understood but not confirmed by Thames Water that they own the open surface water ditches on the Willows which flow into a pipe system (also owned by Thames Water) from Alder Road going south along Willow Avenue to Tudor Cottage and piped system along Hawthorn Drive.

#### **4.6 Canal and River Trust**

The Canal and River Trust are responsible for the canal network. In this location the Grand Union Canal would be their responsibility.

#### **4.7 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).

#### **4.8 Residents**

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

#### **4.9 Emergency Responsibilities**

The emergency responsibilities are outlined in table 1 below.

19<sup>th</sup> December 2014**Table 1 Roles and responsibilities in an emergency, during and after a flood event**

<b>Local (County and District) Authorities</b> <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>	
<b>Police Force</b> <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>	<b>Utility Providers</b> <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>
<b>Fire and Rescue Service</b> <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>	<b>Internal Drainage Board</b> <ul style="list-style-type: none"> <li>• Operate strategic assets to reduce flood risk in partnership with RMAs and public</li> </ul>
<b>Ambulance Service</b> <ul style="list-style-type: none"> <li>• Save life</li> <li>• Provide treatment, stabilisation and care at the scene</li> </ul>	<b>Town and Parish Councils</b> <ul style="list-style-type: none"> <li>• Support emergency responders</li> <li>• Increase community resilience through support of community emergency plan development</li> </ul>
<b>Environment Agency</b> <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>	
<b>Voluntary services</b> <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>	

19<sup>th</sup> December 2014

## 5. Conclusions and recommendations

### 5.1 Conclusions

There were a number of issues that contributed towards the flooding that occurred in the Willowbank area of New Denham including the extreme rainfall experienced prior to at the time.

There were 4 properties flooded internally along Oxford Road in addition to a number of businesses. At the parade of shops along Oxford Road two properties were flooded internally. Numerous properties in Willowbank and Oakside had external flooding in gardens and roads and individuals protected their properties with sandbags and by pumping.

The area of Willowbank and Oxford Road between Poplar Road and High bridge is at risk from 1 in 100 year and 1 in 1000 year flooding. Some of the Willowbank area, on the island between the western and eastern arms of the River Colne, is protected by flood defences. These defences were built in 1988 and updated in 2007/8 and designed to protect the area against a 1 in 100 year event. In the area benefitting from flood defences shown in Figure 3 there were no properties flooded internally. The defences did overtop as shown in Figure 4 at location Grid Ref 504983 185326 and caused external flooding of gardens along Willow Crescent West and Willow Avenue.

Early on in the event, heavy rainfall and saturated ground conditions caused some surface water flooding in roads and gardens which was not able to discharge as the channels were poorly maintained and the high river levels would prevent discharge into the river.

There was a breach of the right river bank upstream of the weir at Grid Ref 505134 185613. The water flowed down through a field and then into the area around Oakside and then through to Oxford Road where four properties on Oxford Road were flooded internally. In Oakside a number of properties were close to flooding internally and externally and outbuilding flooding occurred. The event recorded was between a 1 in 50 and 1 in 100 year event. The flooding occurred in areas outside of the flood zones as the bank upstream of the weir was breached

The area along by the parade of shops on Oxford Road is in flood Zone 3 – a high flood risk area. This area is not protected by defences and so in this event (measured as being between 1 in 50 and 1 in 100 year event) the flooding of some of these properties might be expected as they are in a vulnerable area. The configuration of bridges and buildings over the river and mill channel means that the river is restricted through this

19<sup>th</sup> December 2014

area and easily becomes blocked. The soil vent pipes and outlets from surface water pipes flowing into the channel were likely to have been surcharged and under water which would have created backing up into the properties. Some of the pipes are broken and in need of repair – see photo.



A summary of the main possible causes for the flooding between are listed below:

- Prolonged rainfall caused the land to be saturated and therefore there was increased water from the catchment entering river network. The rainfall in this area created a fluvial event which was measured as between a 1 in 50 and 1 in 100 year event.
- Initial flooding was from surface water in the Willowbank area which was not able to flow away due high river levels.
- Overtopping on the right bank upstream of the gauged weir at Grid Ref 505134 185613. The overtopped flood water flowed into a field and into a residential area around Oakside and through onto Oxford Road.
- The EA defences were breached at Grid Ref 504983 185326 and fluvial flood water flowed into gardens on Willow Crescent West and Willow Avenue.
- The business properties in the parade of shops along Oxford Road were flooded due to:
  - high flood levels,

19<sup>th</sup> December 2014

- lack of flood defences along this area,
- restrictions to the channel in terms of overbuilds and access tracks backing the flow up; and
- poor pipe overflow systems creating water backing up into properties.

## 5.2 Recommendations

Some recommendations have been put forward and are summarised in table \* below. They include some actions such as maintenance of the defences and structures and these actions have to be part of an ongoing schedule. The table also includes some more strategic actions, such as looking at where defences need to be upgraded to take account of climate change or areas upstream where flood water can be attenuated or stored.

When discussing the possible causes it was clear that several actions could be undertaken by a variety of the RMAs involved to help to alleviate and manage the flooding issue.

Authority/Stakeholder	Recommended Action
All RMAs	<ul style="list-style-type: none"> <li>• To work together to liaise and look at the catchment to consider options for flood management which could include:               <ul style="list-style-type: none"> <li>○ flood attenuation upstream by adapting land use,</li> <li>○ further embankments or increased embankment heights alongside the Willowbank residential area</li> <li>○ investigation of possible areas in the catchment where flood storage could be implemented;</li> <li>○ Flood protection for properties and businesses on Oxford Road</li> </ul> </li> <li>• Make improvements to the emergency response and co-ordination from all organisations</li> <li>• Share information regarding operation of structures and assets</li> <li>• Work with the Residents Association group in this area to help to develop Community Flood Groups and flood action plans</li> </ul>
EA	<ul style="list-style-type: none"> <li>• Carry out a survey of the levels of the right bank which was breached upstream of the gauging weir – <b>Already done</b></li> <li>• To use the information from the flood to revisit the modelling on the River Colne and update this so it</li> </ul>

19<sup>th</sup> December 2014

	<p>accurately reflects the observed situation.</p> <ul style="list-style-type: none"> <li>• Investigate if flood warnings issued in this area are accurate and sufficient and encourage those at risk to sign up</li> <li>• To distribute 'Living on the Edge' booklets to residents and land owners in Willowbank and New Denham area</li> <li>• If required to use enforcement action under Section 25 of the Land Drainage Act where land owners have failed to maintain/remove obstruction from main rivers.</li> <li>• Determine the operating procedure for King's Island sluice gates and communicate this to the management company so that they can discharge their duties effectively</li> </ul>
TfB	<ul style="list-style-type: none"> <li>• Carry out cleansing of all gullies which they are responsible for</li> </ul>
BCC	<ul style="list-style-type: none"> <li>• To ensure the owners of culverts and watercourses/ditches within the area are aware of their responsibilities.</li> <li>• To facilitate sharing of information between RMAs and the community.</li> <li>• If required to use enforcement action under Section 25 of the Land Drainage Act where land owners have failed to maintain/remove obstructions from ordinary watercourses.</li> <li>• To discuss setting up a Willowbank/New Denham Flood Group with residents, land owners and relevant RMAs.</li> </ul>
SBDC	<ul style="list-style-type: none"> <li>• To aid residents of New Denham and Willowbank if they wish to apply for the Repair and Renewal Grant offer from Central Government.</li> </ul>
Thames Water	<ul style="list-style-type: none"> <li>• Clarify the ownership of the surface water system within Willowbank area.</li> <li>• Confirm maintenance schedule for that surface water system</li> <li>• Undertake CCTV survey of lower part of piped surface water system from Alder Road going south along Willow Avenue to Tudor Cottage and for piped system along Hawthorn Drive</li> <li>• Ensure that drainage channels are kept clear.</li> </ul>
Canal and Rivers Trust	<ul style="list-style-type: none"> <li>• Explain the assets that are owned and operated by the Trust to the other RMAs</li> <li>• Communicate operations during a flood event to other RMAs</li> </ul>

19<sup>th</sup> December 2014

Riparian Landowner	<ul style="list-style-type: none"><li>• Undertake clearance of vegetation and debris on any adjacent ordinary watercourses (including ditches) and main rivers with guidance from relevant RMAs.</li><li>• To follow the guidance given in the EAs booklet 'Living on the Edge' about their responsibilities as riparian owners.</li><li>• Management company to understand and undertake the operation of sluice gate at King's Island</li></ul>
Residents	<ul style="list-style-type: none"><li>• Take measures to protect themselves and their property when flooding is imminent.</li><li>• Sign up to flood warnings if their property is at risk</li><li>• Continue to document and photograph flood incidents where possible and report flooding to SBDC, BCC and EA.</li></ul>

19<sup>th</sup> December 2014

## Explanation of Terms and Acronyms

Acronym	Definition
AOD	Above Ordnance Datum
BCC	Buckinghamshire County Council
Bucks CC	Buckinghamshire County Council
EA	Environment Agency
FIDO	Flood Incident Duty Officers
FWMA	Flood and Water Management Act
LLFA	Lead Local Flood Authority
PFRA	Preliminary Flood Risk Assessment
RMA	Risk Management Authority
SBD	South Buckinghamshire District
SBDC	South Buckinghamshire District Council
TfB	Transport for Buckinghamshire
TW	Thames Water

## References

Reference in document	Refers to:
BGS online map, 2014	<a href="http://mapapps.bgs.ac.uk/geologyofbritain/home.html">http://mapapps.bgs.ac.uk/geologyofbritain/home.html</a>
BCC, 2011	Buckinghamshire County Council (2011). Preliminary Flood Risk Assessment. BCC, Aylesbury.
EA, 2014	Environment Agency flood map <a href="http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&amp;y=355134.0&amp;scale=1&amp;layerGroups=default&amp;ep=map&amp;textonly=off&amp;lang=e&amp;topic=floodmap&amp;utm_source=Poster&amp;utm_medium=FloodRisk&amp;utm_campaign=FloodMonth13">http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&amp;y=355134.0&amp;scale=1&amp;layerGroups=default&amp;ep=map&amp;textonly=off&amp;lang=e&amp;topic=floodmap&amp;utm_source=Poster&amp;utm_medium=FloodRisk&amp;utm_campaign=FloodMonth13</a> Contains Environment Agency information © Environment Agency and database right
Flood and Water Management Act (FWMA) 2010	<a href="https://www.gov.uk/flood-risk-management-information-for-flood-risk-management-authorities-asset-owners-and-local-authorities">https://www.gov.uk/flood-risk-management-information-for-flood-risk-management-authorities-asset-owners-and-local-authorities</a>
BCC 2013	BCC Local Flood Risk Management Strategy (2013-2018), BCC, Aylesbury



19<sup>th</sup> December 2014

## 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](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: 03708 506506

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

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

### District Council



South Buckinghamshire District Council  
Capswood  
Oxford Road  
Denham  
Bucks  
UB9 4LH

Telephone: 01895 837200

Email: 01895 837200

Website: <http://www.southbucks.gov.uk/>

19<sup>th</sup> December 2014

### Highways Authority

Transport for Buckinghamshire

Telephone: Transport and roads – 0845 2302882

Out of hours emergencies (Highways) – 01296 486630

Email: [fb@buckscc.gov.uk](mailto:fb@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>

### Canal and River Trust



Canal &  
River Trust

#### Milton Keynes office

South East Waterways  
Canal & River Trust  
First Floor North  
Station House  
500 Elder Gate  
Milton Keynes  
MK9 1BB

Email: [enquiries.southeast@canalrivertrust.org.uk](mailto:enquiries.southeast@canalrivertrust.org.uk)

Website: <https://canalrivertrust.org.uk>

Telephone: Non-urgent events 08:00 to 18:00, Monday to Friday 0303 040 4040

Urgent response 0800 47 999 47

### 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/>

19<sup>th</sup> December 2014

**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>

19<sup>th</sup> December 2014

## Appendix 1 Environment Agency photos from Willowbank area



P1010098 TQ0501385015 Gauge Board  
Opposite Poplar Road, reading 32.61mAOD

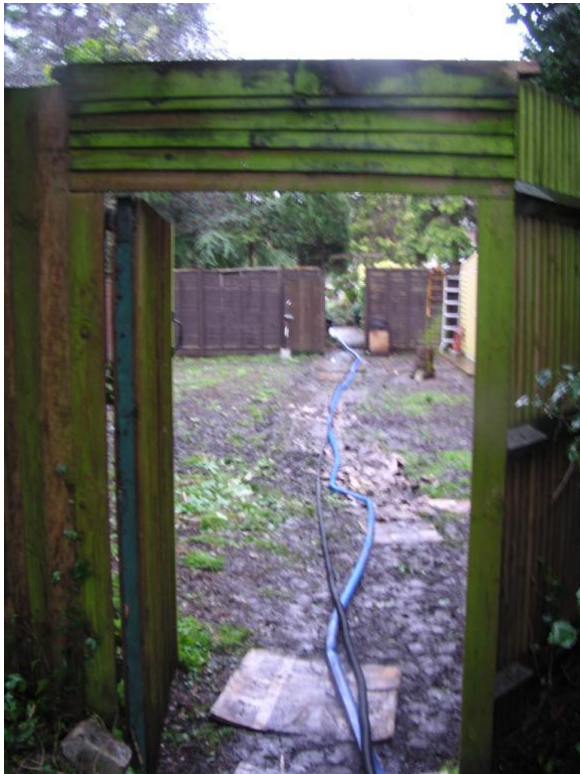


P1010099 TQ0501385015 Looking S d-s  
Rebuilt flood defence between Poplar Road and Alder Road. Maximum water level reported by residents as to just below the middle step of the fishing platform.

19<sup>th</sup> December 2014



P1010104 TQ0497484861 looking E channel w-l  
Water level at the footbridge by Alder Road, 11 courses of bricks from the top of the wall.



P1010105 TQ0499185074 16 Willow Av  
Pumping



P1010107 TQ0500185118 79 Willow  
Cres W pumping

19<sup>th</sup> December 2014



P1010114 TQ0518685568 Looking W g-b location



P1010115 TQ0518685568 Looking W g-b reading

19<sup>th</sup> December 2014

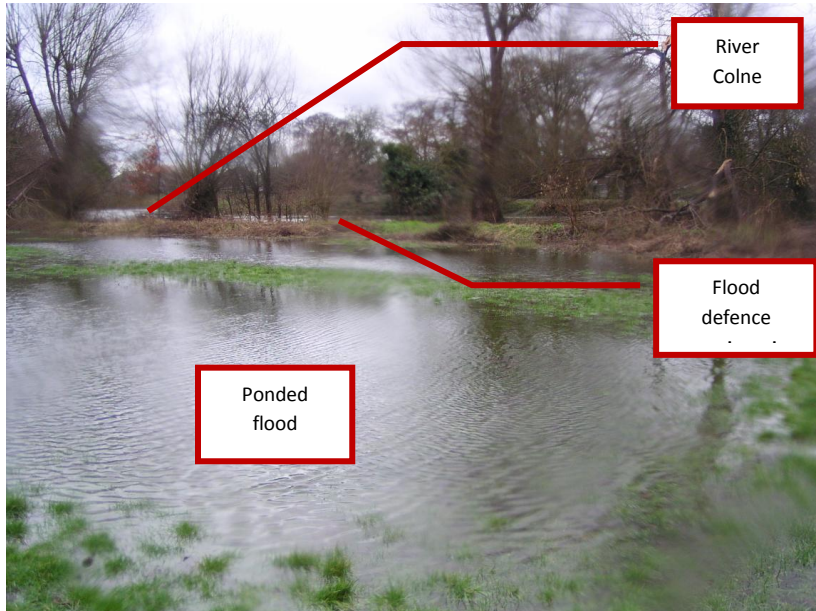


P1010117 TQ0518685568 Looking N g-stn



P1010118 TQ0518485546 Looking SSW trash line

19<sup>th</sup> December 2014



P1010120 TQ0500885306 Looking SW Rec Grnd ponding  
In front of the flood defence, with the river behind.



P1010123 TQ0499285317 Looking W defence overtopping point  
With flood kerb exposed.



19<sup>th</sup> December 2014



P1010126 TQ0498785308 Looking S Rec Grnd ponding-flow route



P1010122 TQ0501585023 2 Poplar Rd water-level

19<sup>th</sup> December 2014

## Appendix 2 Photos from fields to west of Oakside



19<sup>th</sup> December 2014

## Appendix 3 Environment Agency photos from Oakeside



P1010108 TQ0500185118 Looking W to Oakeside  
Evidence of sandbagging in Oakeside properties, number 42-44, from Willowbank Island.



P1010127 TQ0488185165 Looking NNE ponding-flow route  
Reported overland flow route from River Colne near gauging station at the north of Willowbank Island (ID 2880).

19<sup>th</sup> December 2014



P1010128 TQ0488185165 looking SE ponding-flow route  
Reported flow route towards Oakside



P1010130 TQ0493885111 looking NW flow route  
Reported flow route into Oakside

19<sup>th</sup> December 2014



P1010131 TQ0497585128 looking SW 43-42 Oakside  
Significant sandbagging, though no riverside flooding reported.



P1010133 TQ0491785087 Looking NE 25-27 Oakside  
Sandbagging to properties that came closest to flooding internally. Water level marked with yellow crayon in bottom left corner.

19<sup>th</sup> December 2014



P1010136 TQ0489385097 Looking N overland flow route  
Reported flow route from P1010128 (above).



P1010137 TQ0489385097 Looking SSE car park  
Reported maximum flood extent at edge of westerly car park.

19<sup>th</sup> December 2014

## Appendix 4 Environment Agency photos from Oxford Road parade of shops



P1010140 TQ0503584750 Looking E 20a Oxford Rd  
The gap beside the hair salon through which flood water flowed.



P1010143 TQ0504084755 Looking NE low bank level  
Showing the low bank compared the opposite bank and bridge soffit.

19<sup>th</sup> December 2014



P1010147 TQ0500384787 Looking SE Willow Carpets



P1010149 TQ0502684761 Looking NE TV Hire Temp defence Thames Valley Hire Services entrance and temporary defence (scaffold boards and foam sealant to the right).



19<sup>th</sup> December 2014



P1010148 TQ0500184790 Looking NE Bridge



P1010145 TQ0500984800 Bridge max w-l u-s

19<sup>th</sup> December 2014



P1010154 TQ0510884741 Looking N culvert exit w-l  
Water level in the channel by Mill Stream Cottage.