Buckinghamshire County Council

Flood Investigation Report

Bishopstone, Aylesbury
24th December 2013 – 14th February 2014

Photos courtesy of Janet Cope, 7th January 2014 and Julian Cooper, 24th December 2013.

Revision Schedule

Buckinghamshire County council
Flood Investigation Report

30th May 2014
Final Revision number 3

Rev	Date	Details	Author	Checked and Approved by
1	19/05/14	Draft for review	Jessica Dippie	Karen Fisher
2	27/05/14	Final draft for review	Jessica Dippie	Karen Fisher
3	30/05/14	Final report	Jessica Dippie	Alex Back

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Executive Summary

This report has been produced by Buckinghamshire County Council (BCC) to investigate the flooding that occurred in Bishopstone between 24th December 2013 and 14th 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 Bishopstone 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 Bishopstone 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. Unmaintained rivers and features, along with undersized culverts and unnatural tight turns in the river caused the water to overtop and use the highway as a second flow route. A list of recommendations is included which, if followed, will reduce the flooding in Bishopstone.

Since the flooding event BCC has been working together with other RMAs, the Parish Council, and Land Owners to come up with solutions for this flooding issue, some of which are listed as recommendations in Table 2.

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 Bishopstone because it meets the following threshold:

- caused a transport link to be totally impassible:
  - 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
  - Class U highways – 24 hours or more.

1.2 Site location

Bishopstone is a rural village with approximately 100 houses located to the southwest of Aylesbury as shown in Figure 1.

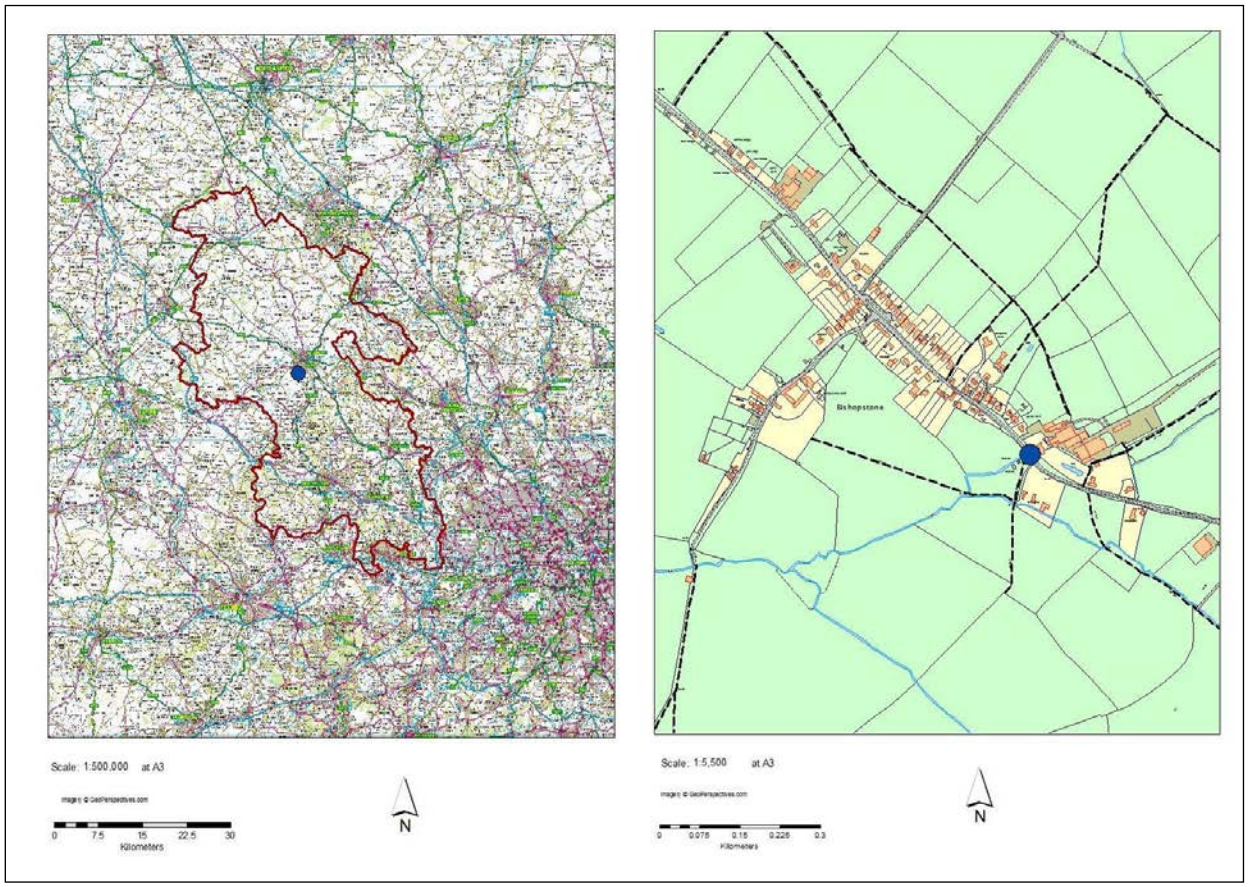

Figure 1 Location maps for Bishopstone at County and local level (Ordnance Survey License 100021529 2014)

1.3 Drainage system and river network

Standall's Ditch is a main river that flows through the southeast of Bishopstone, from the northeast to the southwest. Just south of Bishopstone it flows into Scotsgrove Brook, this is another main river. Scotsgrove Brook continues to flow in a southwest direction (see Figure 2) where it eventually joins the River Thame. Although Standall's Ditch is small it is classed as a main river which comes under the responsibility of the Environment Agency (EA).

Standall's Ditch appears to have been altered in the past where it flows through Bishopstone. This is evident due to the two right angled turns it makes, once as it enters the village (A) and turns to follow the road, and again just before it goes in to a culvert under the road (B) and exits Bishopstone, both turns have been marked on Figure 2 with a red circle.

Figure 2 Map showing main river names and direction of flow in Bishopstone, Aylesbury

Figure 3 shows the gullies in Bishopstone, these are all connected to the surface water drainage system which is owned and maintained by Transport for Buckinghamshire (TfB). The drainage system flows into Standall's Ditch via an inspection chamber upstream of the culvert under the road at point B in figure 2.

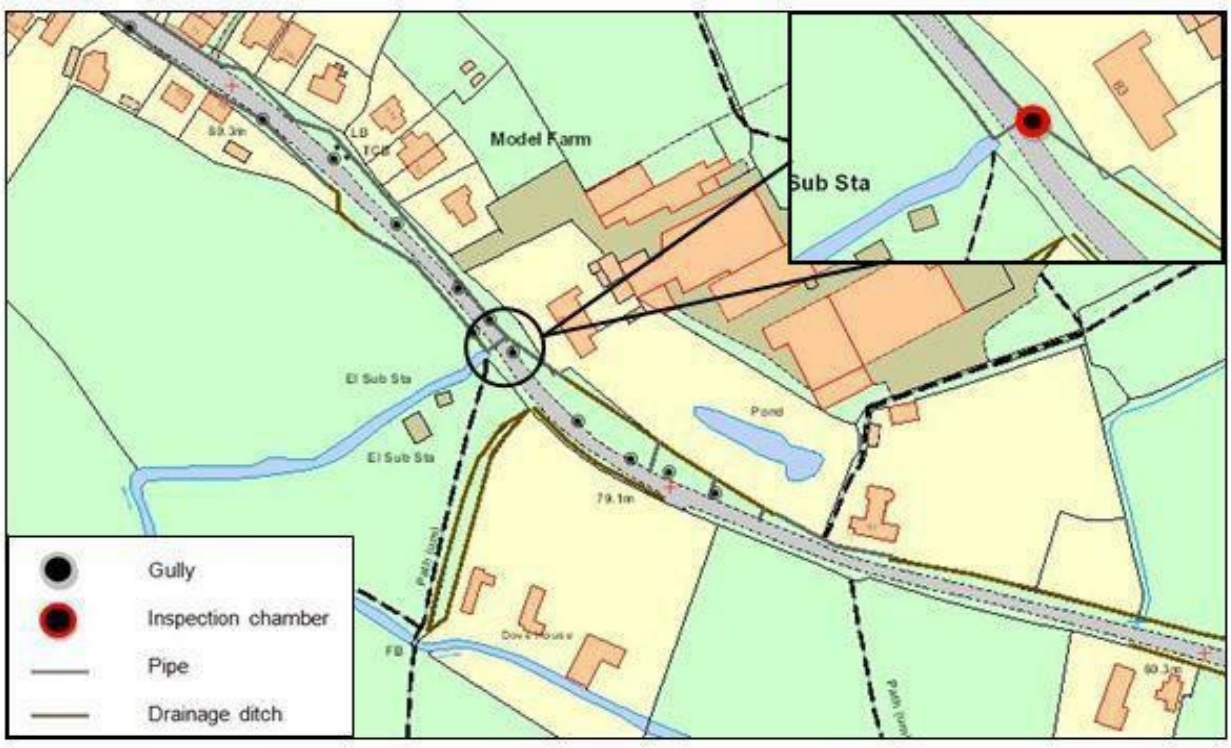

Figure 3 Map showing highway drainage in Bishopstone, Aylesbury

2. Background

2.1 Site characteristics

Standall's Ditch and Scotsgrove Brook are both main rivers as designated on the main river map produced by the EA. Standall's Ditch is culverted in some sections through the village, this allows for access to properties and the passage of flow under the highway. Standall's Ditch and Scotsgrove Brook drain a catchment of about 10km^2.

Figures 4, 5 and 6 below show the fluvial and surface water flood maps for the village. The fluvial flood map (see figure 4) shows the flooding which would occur from the main rivers in a 1 in 100 year (dark blue) and 1 in 1000 year (light blue) event. The flood water in these situations would come from the river and flow out onto the impacted areas shown on the map. From the EA's records Bishopstone is not shown to be affected by fluvial flooding.

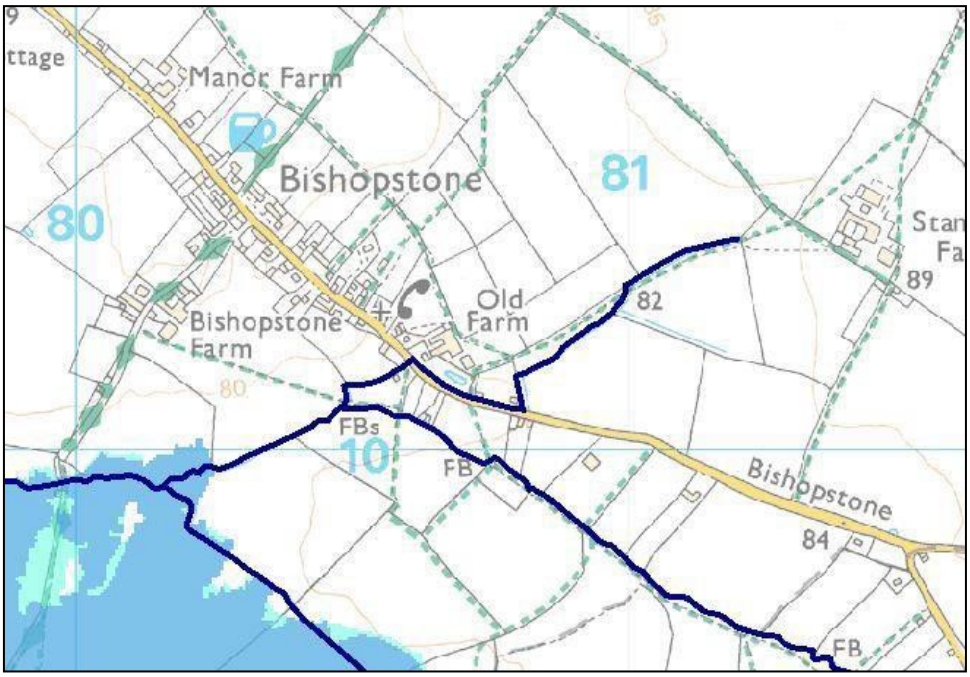

Figure 4 EA flood map showing Standall's Ditch and Scotsgrove Brook 1:100 year event (flood zone 3) in dark blue and 1:1000 year (flood zone 2) in light blue (EA, 2014)

The surface water flood maps show the difference in depths of flooding in the 1 in 100 year (see figure 5) and the 1 in 1000 year (see figure 6) events for the area surrounding Bishopstone. Surface water flooding occurs when extreme or prolonged rainfall cannot infiltrate into saturated ground, or flow into the rivers and/or highways drainage due to high volumes of water.

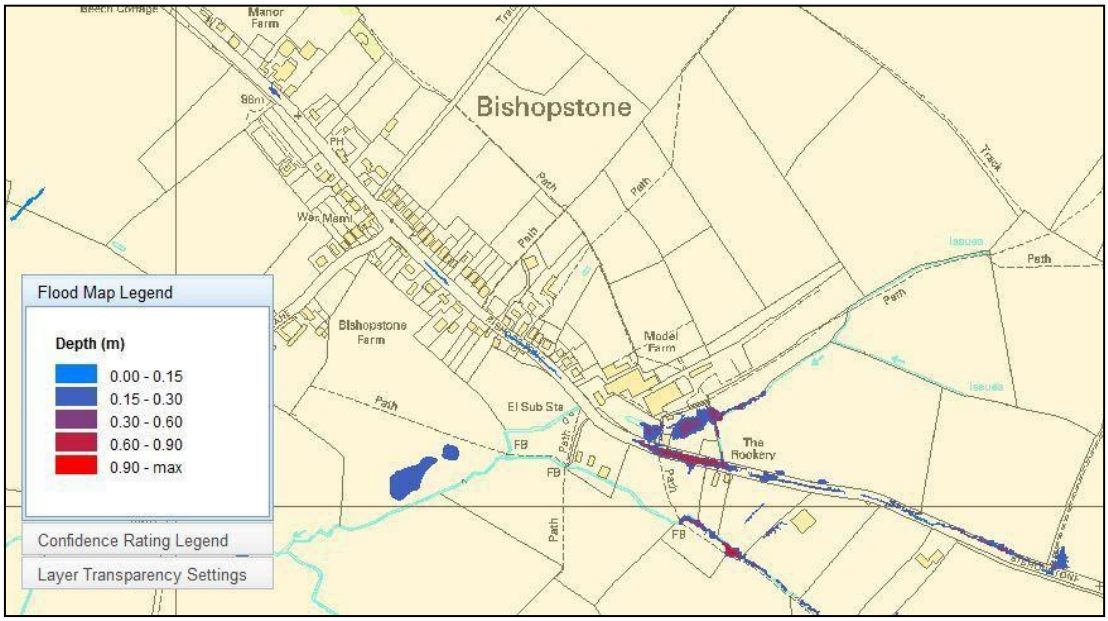

Figure 5 1:100 year surface water flood map showing predicted depth across Bishopstone (EA, 2013)

From both figure 5 and figure 6 is can be seen that the southeast of Bishopstone is predicted to experience the most surface water flooding. The surface water flooding shown in these maps is true to the flooding which was experienced during this flood event. Although the flood event in Bishopstone was significant, it is unlikely that a 1 in 100 year rainfall event occurred locally between 24th December 2013 and 14th February 2014. This indicates that the actual flooding occurs more frequently than predicted in the maps.

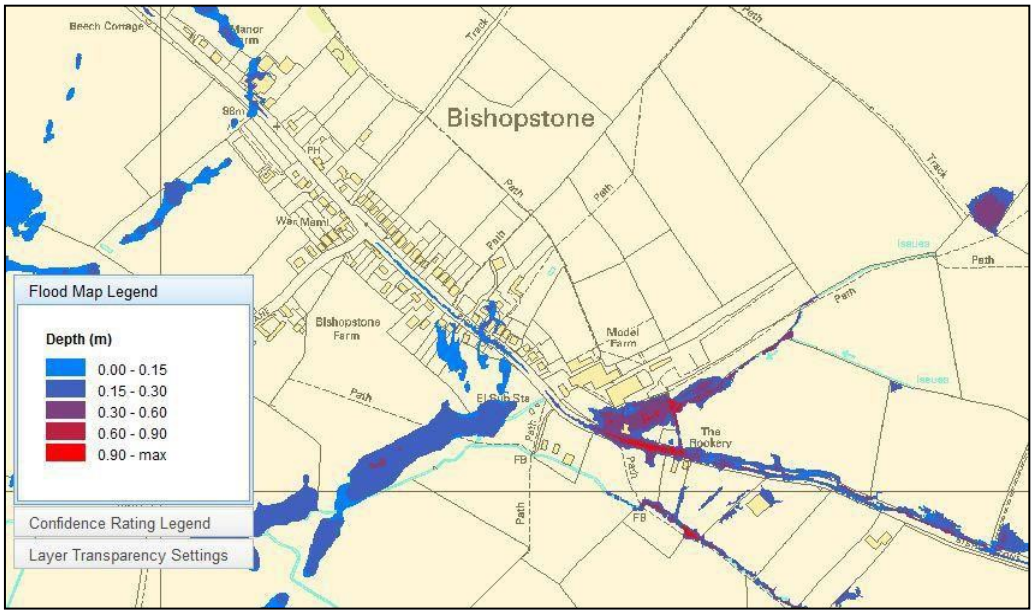

Figure 6 1:1000 year surface water flood map showing predicted depth across Bishopstone (ES, 2013)

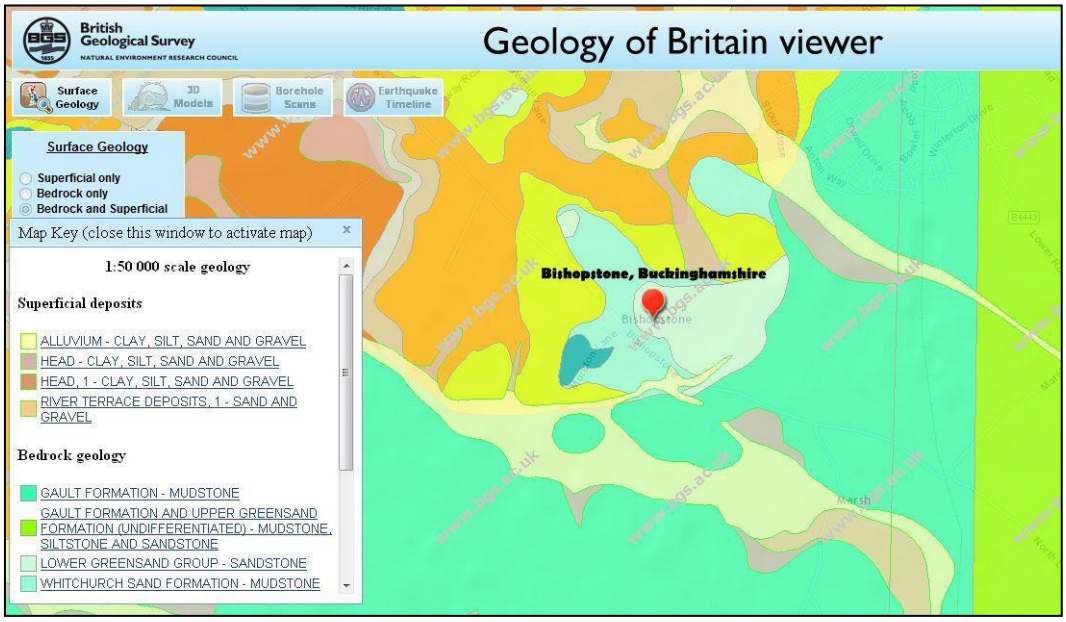

Figure 7 Geology of Bishopstone (BGS online map, 2014)

Bishopstone is situated on superficial head (clay, silt, sand and gravel) and the solid geology is sandstone (lower greensand group) as shown in figure 7 above. The valley of Standall's ditch slopes from 85mAOD either side of the village down to 80mAOD where the river flows through Bishopstone village and out towards the southwest. The mixture of a sloping valley and the superficial head shows the likelihood of surface water flooding in this area.

2.2 Previous flood events

It has been reported locally by residents of Bishopstone and members of Stone and Bishopstone Parish Council (SBPC) that a flood event similar to this one has occurred almost every year in the same location since the recording started in 1994 (Records from Julian Cooper, Resident). The records show that since 1994 there have been six severe flood events, defined as a flood event that covers verges, residential gardens, and occasionally internally flooding houses, it inundates the highway with flood water for a length of roughly four hundred meters at a depth that is impassible. Three of these events caused internal flooding to properties. The same records also show that the frequency of flood events where the highway is submerged has increased in the past few years.

The residents of Bishopstone have kept photographic evidence (see appendix) of several past flooding events. The evidence indicates that these events are due to the large quantities of surface water that runs off the fields in the surrounding area, causing Standall's Ditch to reach capacity and the excess water to use the highway as a separate flow path. This explanation for the winter 2013/14 events is explored further in section 3 below.

3. Analysis of 24 December 2013 – 14 February 2014 Flood Event

3.1 Conditions at the time

The EA provided rainfall data for the period of 19th December 2013 to 27th February 2014. The nearest EA rain gauge is Aylesbury Sewage Treatment Works (STW) (TP261923) near the Aylesbury Vale Parkway Station. Figure 8 gives the daily rainfall totals from the Aylesbury STW for December, January and February. From this data it can be seen that there were constant high levels of rainfall with peaks on 23rd December, 5th and 7th February.

This high rainfall over the two month period meant that the ground would have been saturated and both Standall's Ditch and Scotsgrove Brook would have been close to capacity.

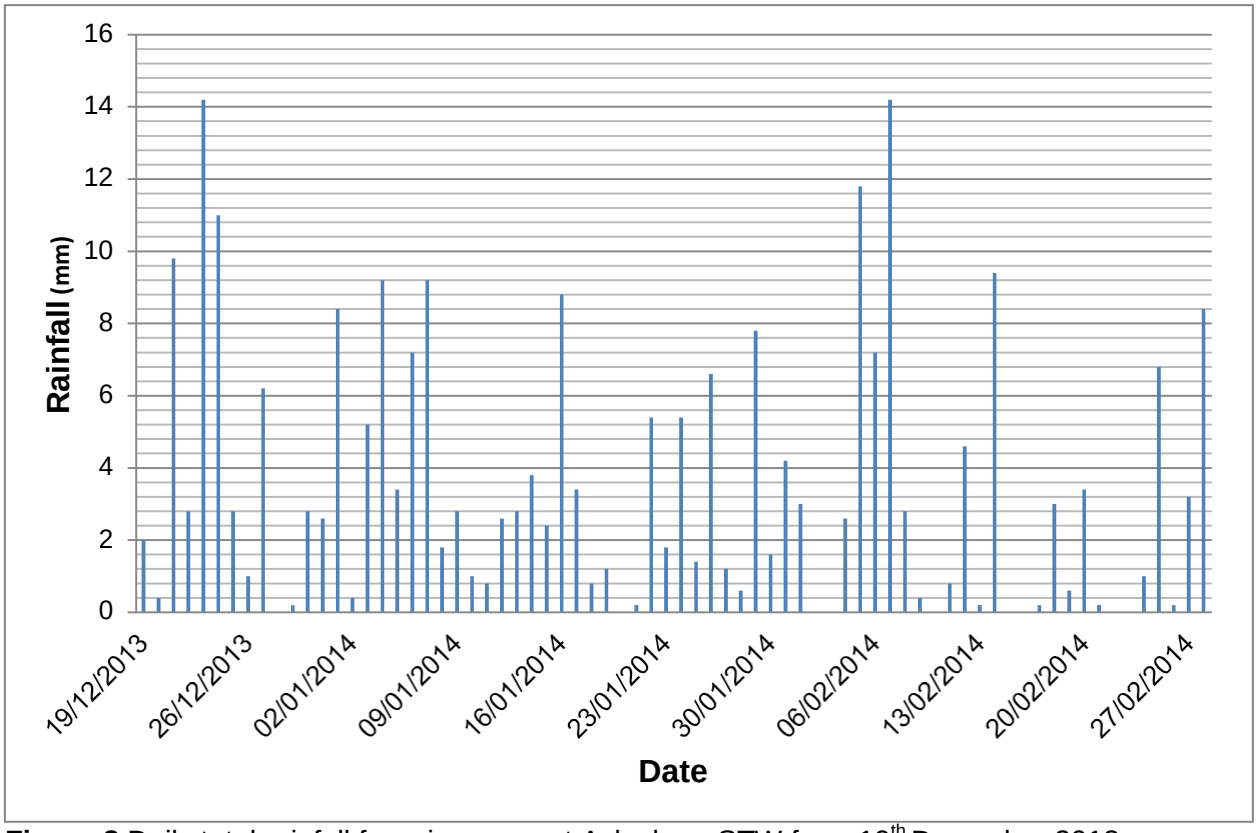

Figure 8 Daily total rainfall for rain gauge at Aylesbury STW from 19th December 2013 to 27th February 2014 (EA, 2014)

3.2 Condition of features

The highway drainage and the culvert under the road (see B, figure 2) did not have any obstructions during the flooding event; however they were full to capacity during heavy rainfall, and therefore were unable to take the full volume of flow. The highway ditches would also have been at capacity with the volume of rainfall and runoff. On inspection after the rainfall event it appeared that the highway ditches had not been maintained properly which reduced their capacity greatly.

3.3 Condition of watercourse

The section of watercourse downstream of the road culvert (for road culvert see B on figure 2) was silted up in areas, not allowing the full volume of flow to be conveyed. Due to this, water backed up in the watercourse and flowed on to the highway contributing to the flooding.

The EA do not undertake maintenance on Standall's Ditch of Scotsgrove Brook under their routine maintenance schedule for the Thames region. Therefore the maintenance should be undertaken by the respective Riparian Owner.

3.4 What happened?

Bishopstone experienced a prolonged period of flooding from 24th December 2013 to 14th February 2014 with two severe flooding events on 24th December and 7th February. Due to the saturated catchment, when large amounts of rainfall fell on the area it ran off the fields in large volumes as surface water which proved too much for the main rivers and highway drainage to convey downstream.

The main river, Standall's Ditch, was breached where it makes a ninety degree turn (see A, figure 2) to follow the highway as it enters Bishopstone; the water that flowed out of the river at this point used the highway as a second flow path, making its way into the village and to the lowest spot. It is also assumed that surface water flowing off the fields from the southeast of Bishopstone was of a large volume and too much for the highway ditches to convey, therefore more flood water made its way on to the highway.

These severe floods caused at least two properties in Bishopstone to flood internally and they also resulted in the only road through Bishopstone to be impassable. The highway was closed both on 24th December and 7th February by TfB and the road closures stayed in place for two to three days after each event, this is the time it took for the flood water to subside.

3.5 Possible causes

The weather conditions

- Continued high levels of rainfall throughout December, January and February (see figure 8).
- Peaks in the rainfall on 23rd December, 5th and 7th February (see figure 8).

The condition of the main rivers

- The water levels in Standall's Ditch and Scotgrove Brook were high due to excessive rainfall.
- Standall's Ditch was very overgrown with thick vegetation in the section upstream of Bishopstone (upstream of point A on Figure 2); this would have reduced the capacity of the river.
- Standall's Ditch has unnatural ninety degree turns (see figure 2, points A and B), causing fast flowing water to breach the watercourse.
- The culverts under access drives in Bishopstone (section between points A and B, figure 2) are undersized which reduced the flow that Standall's Ditch can convey and caused water to back up.
- The outfall of the main culvert under the road (point B on figure 2) is a 300mm diameter pipe which is smaller than the 600mm diameter inlet pipe, reducing the flow that can be conveyed through.
- Standall's Ditch appears to be silted up downstream of the culvert (at point B on figure 2), not allowing the flow to get away fast enough and causing the flood water to back up.
- Downstream of the culvert (point B, figure 2) some trees had fallen in to the watercourse, contributing to the back up of water and reducing the conveyance flow.

The condition of highway ditches and drainage

- Unmaintained highway ditches reduced the capacity for flood water.
- The connections between ditches were not maintained properly and in some places cut off the conveyance of flows completely.
- The highway drainage was full to capacity and unable to take the full volume of flow.

3.6 Incident Response

During both severe flood incidents on 24th December 2013 and 7th February 2014 residents of Bishopstone reported the dangerous levels of flood water in the highway to TfB, who subsequently closed the road on both occasions.

Following the flood event, TfB organised a meeting between BCC Flood Management Team, TfB, SBPC, Land Owners, EA and the County Councillor for the area. There were two meetings where the flooding issue was discussed and possible actions were put forward, some of these are listed in table 2.

Those residents that experienced internal flooding of their property contacted BCC to enquire about the Repair and Renew Grant funded by Central Government. BCC was able to point them towards AVDC who are coordinating the grant scheme for the Aylesbury District.

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. Standall's Ditch and Scotsgrove Brook are 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 Aylesbury Vale District Council

Aylesbury Vale District Council (AVDC) 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.

The Standalls Ditch which flows through Bishopstone and later turns in to the Scotsgrove Brook are both 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.

4.5 Water Utility Company – Thames Water

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

4.6 Landowners and riparian owners

Landowners and riparian owners must maintain any culvert, or the bed and banks of 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/publications/riverside-ownership-rights-and-responsibilities

4.7 Residents

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

4.8 Emergency Responsibilities

The emergency responsibilities are outlined in table 1 below.

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

Local (County and District) Authorities

- Coordinate emergency support within their own functions
- Deal with emergencies on 'non main rivers'
- Coordinate emergency support from the voluntary sector
- Liaise with central and regional government departments
- Liaise with essential service providers
- Open rest centres
- Manage the local transport and traffic networks
- Mobilise trained emergency social workers
- Provide emergency assistance
- Deal with environmental health issues, such as contamination and pollution
- Coordinate the recovery process
- Manage public health issues
- Provide advice and management of public health
- Provide support and advice to individuals
- Assist with business continuity

Police Force

- Save life
- Coordination and communication between emergency services and organisations providing support
- Coordinate the preparation and dissemination

Fire and Rescue Service

- Save life rescuing people and animals
- Carry out other specialist work, including flood rescue services
- Where appropriate, assist people where the use of fire service personnel and equipment is relevant

Ambulance Service

- Save life
- Provide treatment, stabilisation and care at the scene

Utility Providers

- Attend emergencies relating to their services putting life at risk
- Assess and manage risk of service failure
- Assist with recovery process, that is, water utilities manage public health considerations

Internal Drainage Board

- Operate strategic assets to reduce flood risk in partnership with RMAs and public

Town and Parish Councils

- Support emergency responders
- Increase community resilience through support of community emergency plan development

Voluntary services

- Support rest centres
- Provide practical and emotional support to those affected
- Support transport and communications
- Provide administration
- Provide telephone helpline support

Environment Agency

- Issue Flood Warnings and ensure systems display current flooding information
- Provide information to the public on what they can do before, during and after a flood event
- Monitor river levels and flows
- Work with professional Partners and stakeholders and respond to requests for flooding information and updates
- Receive and record details of flooding and related information
- Operate water level control structures within its jurisdiction and in line with permissive powers
- Flood event data collection
- Arrange and take part in flood event exercises
- Respond to pollution incidents and advise on disposal
- Assist with the recovery process, for example, by advising on the disposal of silt, attending flood surgeries

5. Conclusions and Recommendations

5.1 Conclusions

There were a number of issues that contributed towards the prolonged flooding and two severe flood events that occurred in Bishopstone, including the extreme rainfall experienced and the condition of watercourses and features at the time. Looking into the history of flooding in Bishopstone, it is clear that this flood was not a one off event and that if no action is taken Bishopstone will continue to flood in a similar manner.

A summary of the main possible causes for the flooding between 24th December 2013 and 14th February are listed below:

- Prolonged rainfall caused the land to be saturated and therefore there was increased surface water entering the surface water system and river network.
- Standall's Ditch has unnatural ninety degree turns (see A and B in figure 2), causing fast flowing water to breach the watercourse.
- The culverts under access drives in Bishopstone (section between A and B, figure 2) are undersized which reduces the flow that Standall's Ditch can carry through and caused water to back up.
- The outfall of the main culvert under the road (see B in figure 2) is a 300mm diameter pipe which is smaller than the 600mm diameter inlet pipe, reducing the flow that can be conveyed through.
- Standall's Ditch appears to be silted up downstream of the culvert, not allowing the flow to get away fast enough and possibly causing the flood water to back up.

5.2 Recommendations

Some recommendations have been put forward and are summarised in table 2 below. They include some actions such as maintenance of the watercourses and highway drainage; these actions have to be ongoing throughout the year to make a difference. The table also includes some more strategic actions, such as, to discuss the possibility of a flood alleviation/water management area upstream of Bishopstone. The idea would be to hold back some of the volume of flow during these extreme events to reduce the likelihood of Standall's Ditch breaching.

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 in Bishopstone.

Table 2 Recommendations

Authority/Stakeholder	Recommended Action
All RMAs	• To work together to produce a maintenance schedule for land owners to follow. • Organise a vegetation management demonstration day for local residents and land owners, led by the EA.
EA	• Carry out a survey of the levels of Standall's Ditch downstream of the culvert. • Carry out one off channel clearing and re-grading/de-silting of Standall's Ditch downstream of the culverts if required after the level survey. • To distribute 'Living on the Edge' booklets to residents and land owners adjacent to Standall's Ditch and Scotsgrove Brook. • 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.
TfB	• Conduct a survey of the culvert to establish the location where its diameter decreases. • To consider the benefit of increasing the size of the culvert outfall to match the culvert inlet size. • Carry out cleansing of all gullies and highway drainage and continue to do so as part of the agreed maintenance schedule. • To investigate installing a trash screen on the culvert inlet and ensure that the trash screen is cleared regularly as part of the agreed maintenance schedule. • To ensure the open section of watercourse upstream of the culvert on BCC land is maintained to an agreed standard.
BCC	• To ensure the owners of culverts and watercourses/ditches within the area are aware of their responsibilities. • To discuss the possibility of a flood alleviation area and/or land management practices upstream of Bishopstone with appropriate RMAs and Land Owner. • To facilitate sharing of information between RMAs and the community. • 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. • To discuss increasing the size of culverts under access drives with relevant RMAs and Riparian Owners. • To discuss setting up a Bishopstone Flood Group with residents, land owners and relevant RMAs.
AVDC	• To aid residents of Bishopstone if they wish to apply for the Repair and Renewal Grant offer from Central Government.
Riparian Landowner	• Undertake clearance of vegetation and debris on any adjacent ordinary watercourses (including ditches) and main rivers with guidance from relevant RMAs. • To follow the guidance given in the EAs booklet 'Living on the Edge' about their responsibilities as riparian owners.
Residents	• Take measures to protect themselves and their property when flooding is imminent. • Continue to document and photograph flood incidents where possible and report flooding to AVDC and/or BCC and EA.

Explanation of Acronyms

Acronym	Definition
AVDC	Aylesbury Vale District Council
BCC	Buckinghamshire County Council
BGS	British Geological Survey
EA	Environment Agency
FWMA	Flood and Water Management Act
LLFA	Lead Local Flood Authority
RMA	Risk Management Authority
SBPC	Stone and Bishopstone Parish Council
TfB	Transport for Buckinghamshire

References

Reference in Document	Refers to:
BGS online map, 2014	http://mapapps.bgs.ac.uk/geologyofbritain/home.html
EA, 2013	Updated flood maps for surface water https://www.gov.uk/government/publicati
EA, 2014	Environment Agency flood map https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Contacts

Lead Local Flood Authority

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

Telephone: 084537 08090
Email: FloodManagement@buckscc.gov.uk
Website: www.buckscc.gov.uk/flooding

Environment Agency

National Customer Contact Centre
PO Box 544
Rotherham
S60 1BY

Telephone: 03708 506506
Email: enquiries@environment-agency.gov.uk
Website: https://www.gov.uk/government/organisations/environment-agency

District Council

Aylesbury Vale District Council
The Gateway
Gatehouse Road
Aylesbury
Bucks HP19 8FF

Opening times
Monday - Thursday
8.45am – 5.15pm
Friday
8.45am – 4.45pm*

Telephone: 01296 585858

*Customer service centre closes

at 4pm on Friday

Highways Authority
Transport for Buckinghamshire
Telephone: Transport and roads – 01296 382416
Out of hours emergencies (Highways) – 01296 486630
Email: tfb@buckscc.gov.uk
Website: www.buckscc.gov.uk

Water Utility

Thames Water
PO Box 286
Swindon
SN38 2RA

Telephone: 0845 9200 800
Website: http://www.thameswater.co.uk/help-and-advice/16739.htm

Emergency Response

Buckinghamshire Fire and Rescue Service
Address: Buckinghamshire Fire & Rescue Service, Brigade HQ, Stocklake, Aylesbury, Bucks, HP20 1BD
Telephone: 01296 744400
Website: http://bucksfire.gov.uk/

Thames Valley Police
Telephone: 101 in non-emergency, 999 in emergency
Website: https://www.thamesvalley.police.uk/

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

Appendices

Appendix A: BCC criteria for a Section 19 Investigation

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

- Caused a transport link to be impassable for the following periods:

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

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

Appendix B: Photos taken by residents of Bishopstone and RMAs.

Mark Bale, 20th July 2007

Janet Cope, 7th January 2014

Janet Cope, 7th January 2014

TfB, 7th January 2014

Mark Bale, 7th February 2014

Martin Innes, 7th February 2014

Martin Innes, 7th February 2014

Martin Innes, 7th February 2014

Adele Bolkonsky, 7th February 2014