

# Warcop

## Flood Incident Investigation Report



Warcop, Cumbria

## Flood Event 5<sup>th</sup> December 2015

This flood investigation report has been produced by the Environment Agency as a key Risk Management Authority under Section 19 of the Flood and Water Management Act 2010 in partnership with Cumbria County Council as Lead Local Flood Authority.

Version	Prepared by	Reviewed by	Approved by	Date
Draft for comment	Richard James	Jaime Ball	Ruth Goodall	31 August 2016
Rev 1	The Environment Agency Cumbria and Lancashire	The Environment Agency Cumbria and Lancashire		Nov 2016

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## Contents

<b>Executive Summary</b> .....	<b>4</b>
<b>Introduction</b> .....	<b>5</b>
Scope of this Report .....	5
Flooding History.....	6
<b>Event Background</b> .....	<b>9</b>
Flooding Incident .....	9
<b>Flood Investigation</b> .....	<b>13</b>
Rainfall Event.....	13
Impacts and Likely Causes of Flooding.....	14
<b>Recommendations</b> .....	<b>20</b>
<b>Next Steps</b> .....	<b>24</b>
<b>Appendices</b> .....	<b>25</b>
Appendix 1: Acronyms and Glossary .....	26
Appendix 2: Summary of Relevant Legislation and Flood Risk Management Authorities .....	29
Appendix 3: Useful contacts and links.....	31

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# Executive Summary

The flooding experienced in Warcop on the 5<sup>th</sup> December 2015 was severe and was the result of the effect of Storm Desmond. This storm caused a period of prolonged, intense rainfall across Northern England, falling on an already saturated catchment, and led to high river levels and flooding throughout Cumbria and beyond.

In response to the flood event, this Section 19 Flood Investigation Report has been completed by the Environment Agency as a key Risk Management Authority (RMA) working in partnership with Cumbria County Council as the Lead Local Flood Authority (LLFA), under the duties as set out in Section 19 of the Flood and Water Management Act 2010. This report provides details on the flooding that occurred in Warcop on the 5<sup>th</sup> December, and has used a range of data collected from affected residents, professional partners, site visits, surveys of the area, and data collected by observers and river & rainfall telemetry during the flood event.

There are no formal Environment Agency flood defences within Warcop. A number of residents within Warcop do, however, employ property resilience measures which may reduce the impact of a flood event.

Based upon a review of the site observations, local resident photographs and the Environment Agency flood event data it is concluded that the flooding mechanisms at this location are primarily a result of Main River fluvial flooding from the Lowgill Beck, Crooks Beck and surface water from the adjacent valley sides.

During the flood event fluvial floodwater exceeded the capacity of the river channel and spilled into the adjacent floodplain. Consequently 11 residential properties were impacted by internal flooding by the December 2015 flood event at this location.

17 actions have been recommended in this report to manage future flood risk in Warcop, which will require the involvement of a number of organisations and the local community.

Any additional information that residents and others can provide to the Environment Agency and Cumbria County Council to help develop our understanding of the flooding is welcomed. A lot of information has already been provided, much of which has been used to inform this report. The scale of this report means that not every piece of information can be incorporated into the document. Any additional information should be provided to:

<http://www.cumbria.gov.uk/planning-environment/flooding/floodriskassessment.asp>

# Introduction

Under Section 19 of the Flood and Water Management Act (2010) Cumbria County Council, as Lead Local Flood Authority (LLFA), has a statutory duty to produce Flood Investigation Reports for areas affected by flooding. Section 19 of the Flood and Water Management Act states:

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

This section of the Act leaves the determination of the extent of flood investigation to the LLFA. It is not practical or realistic for Cumbria County Council to carry out a detailed investigation into every flood incident that occurs in the County, but every incident, together with basic details will be recorded by the LLFA.

Only those with 5 or more properties/businesses involved will have investigations published. An investigation will be carried out, and a report prepared and published by the LLFA when the flooding impacts meet the following criteria:

- where there is ambiguity surrounding the source or responsibility of flood incident,
- internal flooding of one property that has been experienced on more than one occasion,
- internal flooding of five properties has been experienced during one single flood incident and
- there is a risk to life as a result of flooding.

As a flood Risk Management Authority (RMA), the Environment Agency have partnered with Cumbria County Council (CCC) to produce the 53 flood investigation reports across Cumbria.

## Scope of this Report

This Flood Investigation Report **is**:

- an investigation on the what, when, why, and how the flooding took place resulting from the 5<sup>th</sup>-6<sup>th</sup> December 2015 flooding event and
- a means of identifying potential recommendations for actions to minimise the risk or impact of future flooding.

This Flood Investigation Report **does not**:

- interpret observations and measurements resulting from this flooding event. Interpretation may be undertaken as part of the subsequent reports,
- provide a complete description of what happens next.

The Flood Investigation Reports outline recommendations and actions that various organisations and authorities can do to minimise flood risk in affected areas. Once agreed, the reports can be used by communities and agencies as the basis for developing future plans to help make areas more resilient to flooding in the future.

For further information on the S19 process, including a timetable of Flood Forum events and associated documentation, please visit the County Council website at:

<http://www.cumbria.gov.uk/floods2015/floodforums.asp>

To provide feedback on the report please email [LFRM@cumbria.gov.uk](mailto:LFRM@cumbria.gov.uk).



## Flooding History

Warcop is a village in the Eden district of Cumbria, located at NY7214, north of Kirkby Stephen and south of Appleby in Westmorland. The village is located near several Environment Agency Main Rivers, including the River Eden, the Lowgill Beck and Crooks Beck. The area is part of the upper River Eden river catchment and drains eventually to the Solway Firth and ultimately to the Irish Sea.

The main source of the flooding in Warcop is from the Lowgill Beck, Crooks Beck and surface water runoff. The flood risk from the watercourses mostly affects the residential properties along Brookside and Castlehill Road. The Environment Agency currently monitors the condition of over 2.5 km of the watercourse, including Crooks Beck, from Hayber Lane to near Penkeld by carrying out visual inspections on a periodic basis. Visual inspections are also carried out after significant events that may have caused damage or deposition of debris in the river basin. Over the last 3 years visual inspections have been carried out in January 2013, March 2014 and on 12 December 2015 following the floods. Maintenance is carried out on 135 m of Crooks Beck and was last carried out in February 2016 to remove a number of fallen trees. Routine maintenance is also carried out annually to manage flood risk by removing bed weed and controlling vegetation growth in the river channels in this area. Crooks Beck has benefitted from Environment Agency maintenance in the form of vegetation management, and post-event debris clearance in the past. The Environment Agency intends to continue with this programme as long as funding permits.

The local community has shown an interest in increasing their own maintenance of the channel by planning to undertake the grass cutting through the summer to improve the aesthetics of the village. There are no formal flood defences in Warcop and the Environment Agency does not operate a Flood Warning Service in Warcop.

A site location map of Warcop, the main rivers and the surrounding area is shown in **Figure 1** (overleaf).

Warcop has a history of flooding, with the earliest reported incident occurring in 1968. It has reportedly experienced minor flood events approximately 6 times in the intervening period and the latest recorded incident was in 2009 when the flooding from the River Eden cut off access and egress to the southern side of the village.

The November 2009 event was estimated to be an event with a probability greater than 1% Annual Exceedence Probability (AEP). The annual exceedence probability (AEP) describes the likelihood of a specified flow rate (or volume of water with specified duration) being exceeded in a given year. There are several ways to express AEP as shown in Table 1. Throughout this report AEP is expressed as a percentage. As such an event having a 1 in 100 chance of occurring in any single year will be a 1% AEP event.

**Table 1 Probabilities of Exceedance**

AEP (as percent)	AEP (as probability)	Annual recurrence interval (ARI)
50%	0.5	2-year
20%	0.2	5-year
10%	0.1	10-year
4%	0.04	25-year
2%	0.02	50-year
1%	0.01	100-year
0.1%	0.001	1000-year

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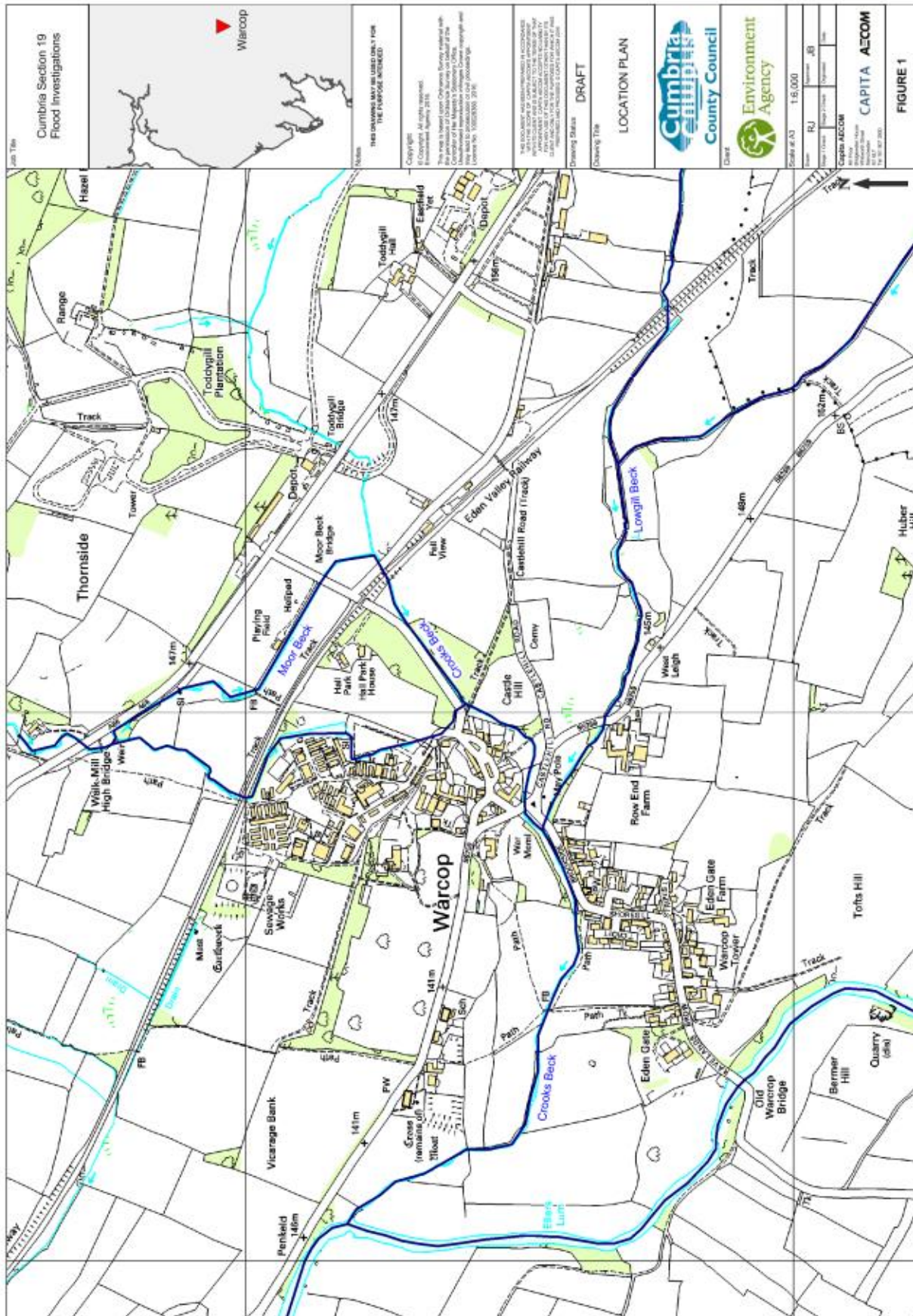


Figure 1 Location Map



# Event Background

This section describes what is known about the timing and extent of the flood incident in December 2015 and identifies the areas that are known to have flooded.

## Flooding Incident

On the morning of the 5<sup>th</sup> December 2015 Warcop was affected by severe fluvial flooding from the Lowgill Beck and the Crook Beck (**Photograph 1** and **Photograph 2**). The first reported incidents of property flooding occurred at 04:30 hours and the flood reportedly peaked between 19:30 hours and 21:30 hours later that day. The severity and magnitude of the flood flows on the Lowgill Beck resulted in flood damage to the coping and parapet of Warcop Bridge (**Photograph 3** and **Photograph 4**).

The flooding in Warcop was made worse by a combination of surface water runoff from the hillside to the south of Warcop and the local sewerage system reaching capacity. The flooding incident resulted in 11 reported instances of internal property flooding (**Photograph 5**) and additional external flooding of outbuildings and gardens (**Photograph 6**).



**Photograph 1: Fluvial flooding on Brookside during the 5<sup>th</sup> December 2015 Flood Event**  
Source: ITV [<http://www.itv.com/news/border/update/2016-01-08/watch-flooding-in-warcop/>]

OS NGR NY 74696 15402



**Photograph 2: Fluvial flooding on Brookside during the 5<sup>th</sup> December 2015 Flood Event**  
Source: ITV [<http://www.warcop.org.uk/warcop-clean-up-after-the-floods/> ]

OS NGR NY 74647 15369



**Photograph 3: Extent of damage on Warcop Bridge looking downstream**  
5<sup>th</sup> December 2015, no timestamp

OS NGR NY 74800 15456





**Photograph 4: Flood Damage on Warcop Bridge over the Lowgill Beck, looking south  
15<sup>th</sup> December 2015, no timestamp**

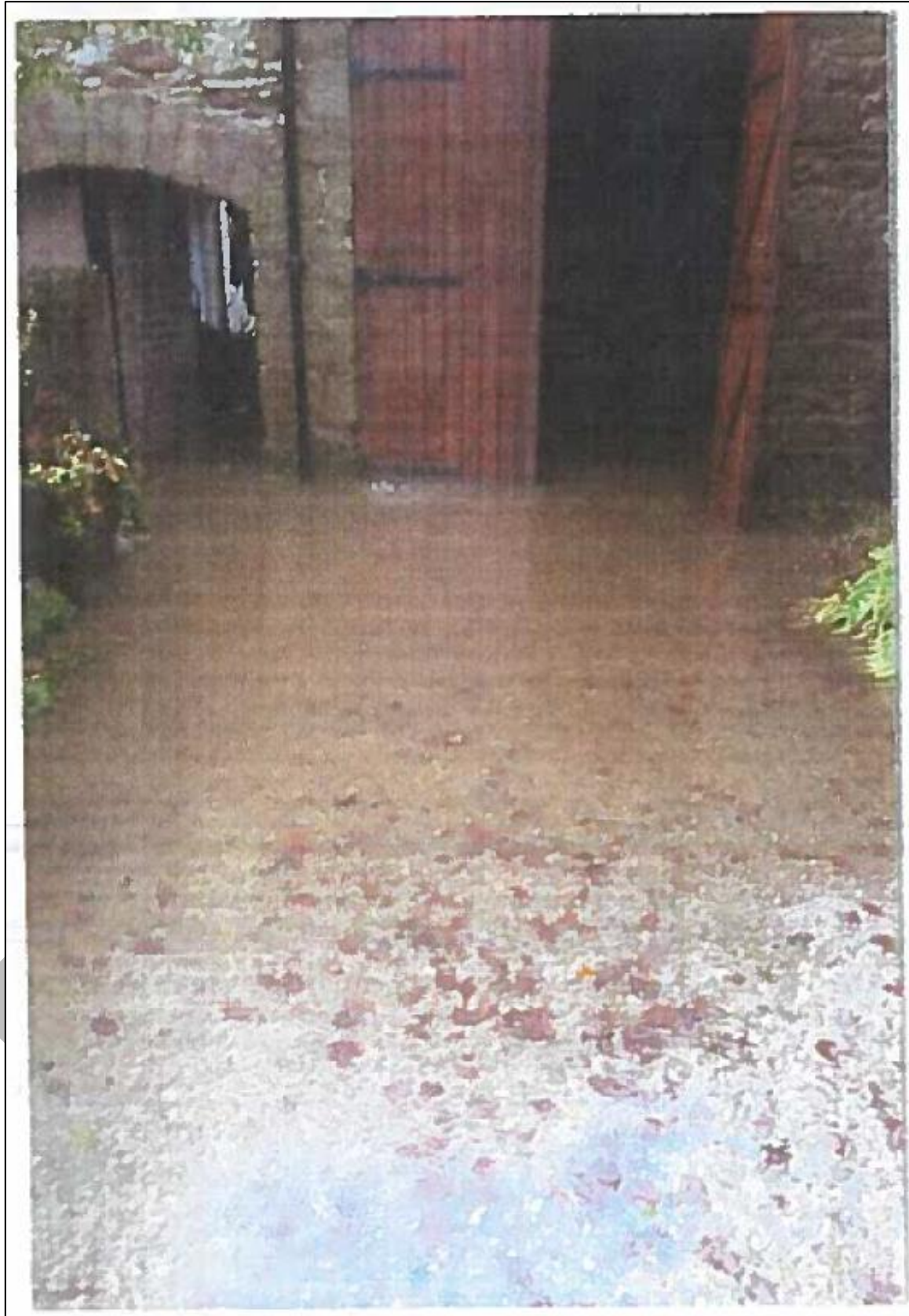
**OS NGR NY 74800 15456**



**Photograph 5: Residential property flooded on Brookside  
15<sup>th</sup> December 2015, no timestamp**

**OS NGR NY 74765 15419**





**Photograph 6: Outbuildings flooding at the Croft  
5<sup>th</sup> December 2015, no timestamp**

**OS NGR NY 74847 15527**



# Flood Investigation

This section of the report provides details of the rainfall event that caused the flooding and any previous flood history in the area.

## Rainfall Event

December 2015 was the wettest calendar month on record with much of the northern UK receiving double the average December rainfall. This also followed a particularly wet November and as such much of the soil within the Cumbria catchments was already saturated.

From the 4<sup>th</sup> to the 7<sup>th</sup> of December there was a period of prolonged, intense rainfall caused by Storm Desmond. Over this period, new 24 hour and 48 hour rainfall records were set for the UK. Both of these were within Cumbria and broke the previous records set during the November 2009 Cumbria floods.

Table 2 shows the record levels of rainfall that fell prior to the flooding event. Table 3 shows the rainfall more widely recorded over the catchment on the 4<sup>th</sup> and 5<sup>th</sup> December 2015. Figure 2 shows the location of rain gauges downstream at Appleby and upstream of Warcop at Great Musgave, Kirkby Stephen and Aisgill.

**Table 2 : UK Rainfall Record<sup>1</sup>**

	Previous record November 2009		Current Record December 2015	
	Location	mm	Location	mm
24 hour rainfall	Appleby	316.4	Appleby	341.4
48 hour rainfall	Warcop	395.6	Warcop	405

Return periods (calculated using historical rainfall event data) have been calculated for this event. Two of these locations have recorded rainfall that is estimated to be rarer than 0.1% AEP.

**Table 3 Rainfall recorded at gauges around Appleby**

Monitoring Station	Rainfall (mm)			Estimated Annual Exceedance Probability <sup>2</sup>
	4 <sup>th</sup> December	5 <sup>th</sup> December	Rolling 24 hour Rainfall	
Appleby Castle	Gauge not open during this period	Gauge not open during this period	Gauge not open during this period	
Appleby Mill Hill	50.3	61.6	111.9	
Brackenber	13.2	76.6	82.6	
Aisgill	9.44	97.5	104.75	

<sup>1</sup> Taken from met office – [www.metoffice.gov.uk/public/weather/climate-extremes](http://www.metoffice.gov.uk/public/weather/climate-extremes)  
<http://www.metoffice.gov.uk/climate/uk/interesting/nov2009>

<sup>2</sup> Calculated using FEH DDF methodology, this estimation is not calibrated for values with an AEP less than 0.1%

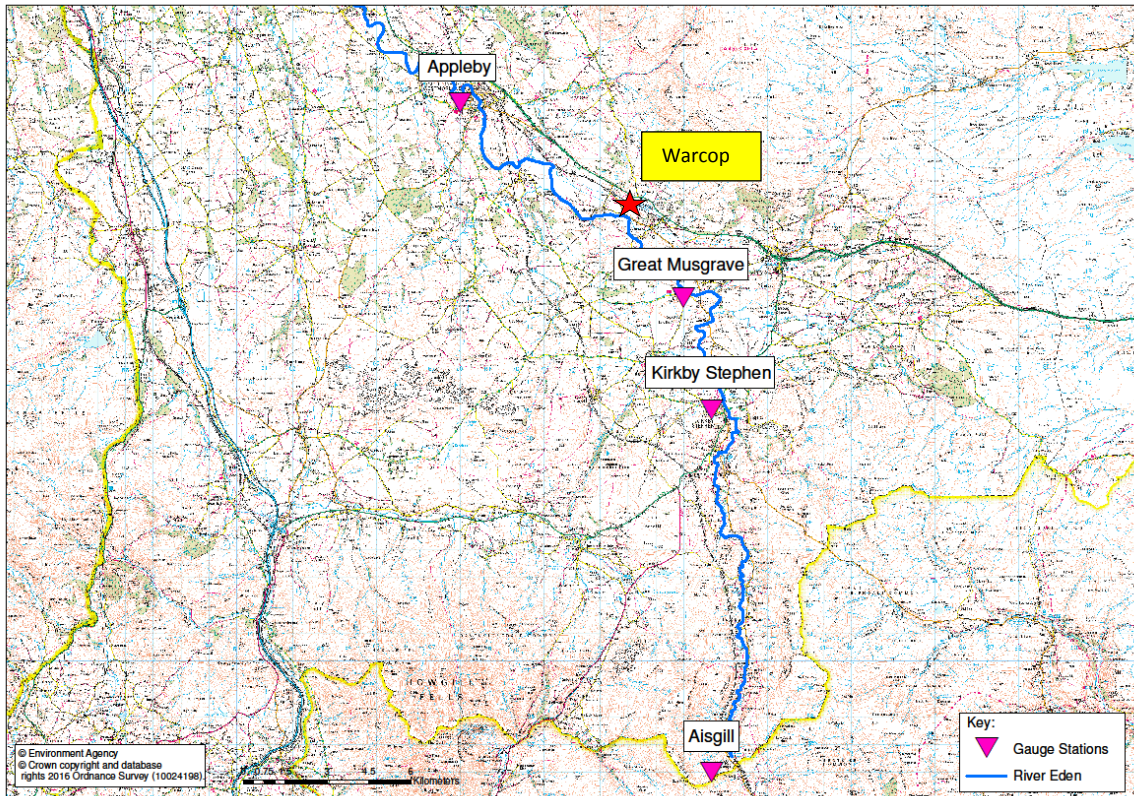


Figure 2: Location of rain gauge stations in the upstream of Warcop

## River Flow Measurement

The Environment Agency do not operate a flood flow gauging station on either the Lowgill Beck or Crooks Beck. Whilst flood flows were recorded on the River Eden, the flooding in Warcop was a result of the flows on Lowgill Beck and Crooks Beck. It is therefore not possible to analyse how critical the flood flows were during the 5th December 2015 event.

## Impacts and Likely Causes of Flooding

A site visit was undertaken on Monday 25/4/16 by the Capita AECOM survey team. The weather was clear and cold. The survey team initiated the site visit with a visual inspection of Lowgill Beck, the adjacent residential properties and bridges over the watercourses.

Key features, observations and photographs from the site visit are presented in **Figure 3** (overleaf).







The Lowgill Beck is flanked by relatively flat floodplains which are not significantly elevated above the dry weather flow in the watercourse (**Photograph 7**). The floodplains were lightly vegetated and were well maintained at the time of the site visit. Property thresholds on Brookside Road were observed as being only slightly higher than road level which may result in an increased level of flood risk to these properties (**Photograph 8**).



**Photograph 7: Crooks Beck looking downstream**

**OS NGR NY 74735 15424**



**Photograph 8: Property thresholds on Brookside Road**

**OS NGR NY 74731 15415**

Brookside Road passes over the Lowgill Beck via a small twin arch bridge ('Warcop Bridge' as shown in **Photograph 9**). This structure has a very limited flow capacity due to low soffit levels relative to river bed levels. The limited capacity of this structure resulted in floodwater bypassing the structure and damaging the coping and parapet due to the magnitude of the flood flows (as shown previously in **Photograph 4**). At the time of the site visit the flood damage had been repaired and the structure restored to its original condition.

A larger arch bridge spans the Crooks Beck immediately north of Warcop Bridge ('New Warcop Bridge'). This structure has a much greater capacity than Warcop Bridge, although evidence of coping loss was observed on site (**Photograph 10**).



**Photograph 9: Warcop Bridge over the Lowgill Beck**

**OS NGR NY 74797 15454**



**Photograph 10: Bridge over the Crooks Beck looking upstream**

**OS NGR NY 74823 15493**



There are a number of surface water flowpaths leading into the centre of Warcop due to the topography of the wider river valley (as shown in **Photograph 11**, **Photograph 12** and **Photograph 13**). A significant surface water flowpath was observed by local residents on Shoregill during the 5<sup>th</sup> December 2015 flooding incident (not pictured) as surface water exceeded the capacity of the local drainage system during the event. This surface water flooding was compounded by blocked drains and gullies in this area and combined with the fluvial flooding on Brookside.



**Photograph 11: Potential surface water flowpath on the B9259**

**OS NGR NY 74814 15517**



**Photograph 12: Potential surface water flowpath on the B9259**

**OS NGR NY 74834 15565**



**Photograph 13: Potential surface water flowpath near Lane Cottage**

**OS NGR NY 74769 15403**

The local sewerage network around Brookside and Shoregill is pumped to a sewerage treatment works that is located approximately 600m north of this area. Local residents accounts of the 5<sup>th</sup> December 2015 flooding imply that the pumping station on Brookside was overwhelmed as a result of the surface water and fluvial floodwater entering and exceeding the capacity of the local drainage network.

Based upon a review of the site observations, local resident photographs and the Environment Agency flood event data it is concluded that the flooding mechanisms at this location are primarily a result of:

- Significant fluvial flows on the Lowgill Beck and Crooks Beck exceeding the capacity of the river channel and spilling laterally onto the floodplain on Brookside and the area around the Croft
- The fluvial flooding was exacerbated by limited capacity under both Warcop Bridge and New Warcop Bridge. The former resulted in damage to the coping and parapet over the bridge, whilst the latter resulted in rising water resulting in external flooding around the adjoining outbuildings.
- Surface water from the adjacent valley sides impacted on a number of residential properties around Brookside and Shoregill. The volume of surface water exceeded the capacity of the local drainage network. The effective capacity of the network was also reduced as a result of debris and siltation within the highways gullies at these locations. This source of flooding combined with the fluvial floodwater from the Crooks Beck.
- The local sewerage pumping facility was overwhelmed by the volume of floodwater and resulted in backing up of wastewater entering the system.

The various flooding mechanisms across Warcop are illustrated in Figure 4.



# Recommendations

Table 2 details recommended actions for various organisations and members of the public to consider.

**Table 2: Recommended Actions for Warcop**

Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
Strengthening Defences	Environment Agency	An initial assessment of Warcop will be carried out to appraise whether a flood mitigation scheme could be technically or economically feasible against Flood Defence Grant-in-Aid criteria. Improve flood plain utilisation to increase the potential to reduce the risk to property on Brookside.	Nov 2017
	Risk management authorities, operating authorities and asset owners	Assess the vulnerability of key infrastructure* to future flooding events, and take action to reduce the risk.  * Roads, railways, power supplies, water supplies, telecommunications, gas, sewage treatment works and bridges	2017
Maintenance	Environment Agency	Investigate opportunities to provide flood flow attenuation in the river catchment upstream of Warcop (i.e. slowing the flow with leaky dams and tree planting)	2017
	Cumbria County Council	Investigate the current performance of the highways drainage network around Brookside and Shoregill. Consider capacity improvements if necessary.	Winter 2016



<b>Maintenance</b>	Environment Agency	Improve the published maintenance programme to make it easier for communities to find out what and where maintenance is planned.	2017
	Cumbria Flood Risk Strategic Partnership	Support local communities, landowners / occupiers to carry out maintenance works legally.	Ongoing
<b>Community Resilience</b>	Eden District Councils	Promote the uptake of property level resilience grants available to householders and businesses affected by the 2015 floods.	March 2017
	Cumbria Local Resilience Forum	Stakeholder engagement and community resilience: Cumbria Local Resilience Forum to work proactively with the local communities to improve awareness of flood risk, severe weather warnings and resilience to subsequent events. Emphasis should be placed on preparing for flooding before an event happens.	2016
	Cumbria Local Resilience Forum	Communication: Continue to encourage residents to report issues of flooding. Outline who this should be reported to and what mechanisms are available to report flooding (phone, email, mobile app etc.). Additional information could be made available through the council website. This would be used to ensure as many records as possible are noted.	Ongoing

	Community Resilience Network (subgroup of Cumbria Local Resilience Forum)	Encourage the community in Warcop to have an Emergency Plan in place and support the community to develop and test the effectiveness	2017
	Cumbria Flood Risk Strategic Partnership Cumbria County Council, district authorities, Environment Agency	Develop multi agency flood plans to ensure organisations and local communities are ready for Winter 2016.	2016
	Planning authorities; Cumbria County Council, Eden District Council, Lake District National Park, Yorkshire Dales National Park	Update strategic flood risk assessments (local councils' documents which represent their understanding of flood risk across their district) by using the latest knowledge and data following Storm Desmond.	Summer 2017
	Eden District Council	Update long term spatial plans (which are used to decide where housing and other building works can take place) in response to Storm Desmond.	Review by 2021
Upstream management	Environment Agency and Cumbria County Council as lead local flood authority	Identify land management opportunities and locations for natural flood management projects by working with landowners, commoners, and the farming communities to use their knowledge of the catchment. These will include; soil aeration, bunds, leaky dams, woodland creation, woodland management and river restoration.	2017

	Environment Agency and Natural England	Investigate and seek opportunities to undertake projects such re-meandering channels and re-connecting rivers to the natural flood plain as part of the Cumbrian River Restoration Strategy.	2021
	Natural England and Forestry Commission	Seek opportunities to increase the uptake of natural flood management measures through schemes such as Countryside Stewardship and Catchment Sensitive Farming as part of an integrated approach to managing catchment.	TBA
	Natural England	Update Catchment Sensitive Farming proposals (including new Farm Advice Framework contracts) to include natural flood management advice.	2017



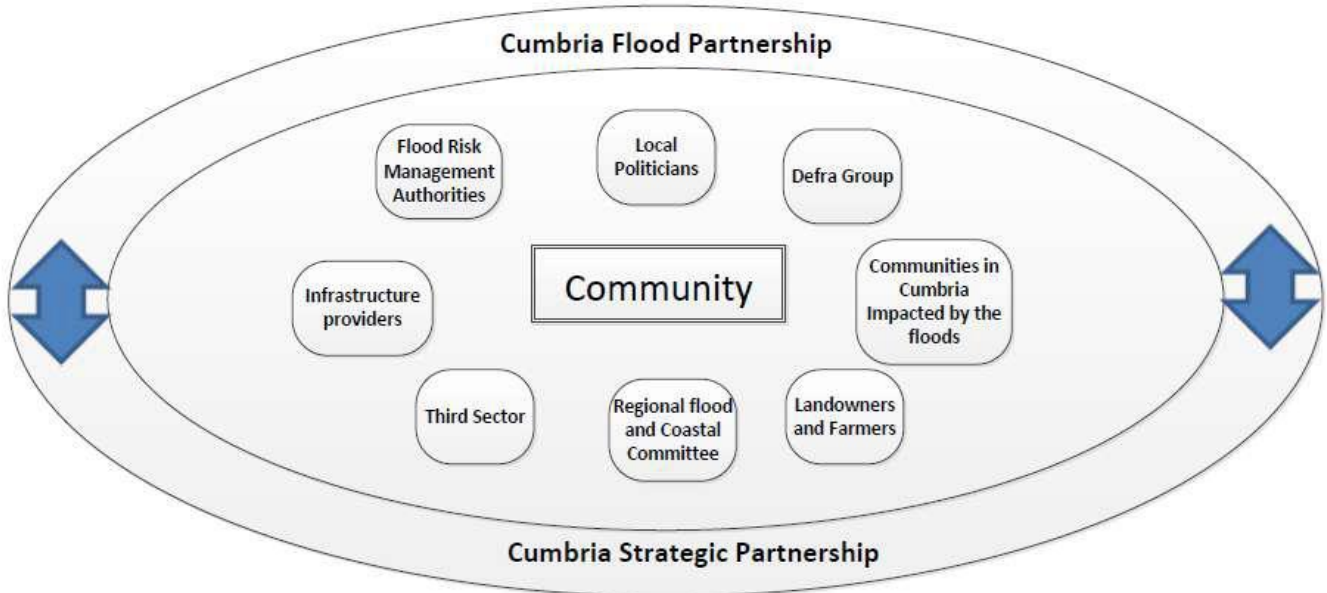
# Next Steps

The Cumbria Floods Partnership has brought together a wide range of community representatives and stakeholders from a variety of sectors to plan and take action to reduce flood risk. The Cumbria Floods Partnership, led by the Environment Agency, has produced a 25 year flood action plan for the Cumbrian catchments worst affected by the December 2015 flooding.

The plan considers options to reduce flood risk across the whole length of a river catchment including upstream land management, strengthening flood defences, reviewing maintenance of banks and channels, considering water level management boards, and increasing property resilience. The Cumbria Floods Partnership structure below details how these 5 themes are being delivered in the Flood Action Plans which will be completed in July 2016.

The 'Cumbria Floods Partnership' was set up by Flood Minister Rory Stewart MP following December's floods, and includes all of Cumbria's Flood Risk Management Authorities. They are working alongside the existing 'Cumbria Strategic Partnership', which was formed as part of the Flood and Water Management Act 2010 and comprises of the County's Flood Risk Management Authorities (RMAs) including the Environment Agency, Cumbria County Council, Local Authorities, and United Utilities. Both partnerships are working with communities, businesses, and relevant stakeholders to understand and reduce flood risk across Cumbria.

The figure below helps demonstrate how the two partnerships are working together:



**Cumbria Flood Partnership and Cumbria Strategic Partnership**

# Appendices

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## Appendix 1: Acronyms and Glossary

### Acronym Definition

EA	Environment Agency
CCC	Cumbria County Council
LLFA	Lead Local Flood Authority
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991

### Term Definition

Aquifer	A source of groundwater comprising water-bearing rock, sand or gravel capable of yielding significant quantities of water.
Attenuation	In the context of this report - the storing of water to reduce peak discharge of water.
Catchment Flood Management Plan	A high-level planning strategy through which the EA works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
Culvert	A channel or pipe that carries water below the level of the ground.
De Facto Flood Defence	A feature or structure that may provide an informal flood defence benefit but is not otherwise designed or maintained by the Environment Agency
Flood Defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Floodplain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood Resilience	Measures that minimise water ingress and promotes fast drying and easy cleaning, to prevent any permanent damage.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress and disruption)
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Flood and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Flood Storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Flood Zone	Flood Zones are defined in the NPPF Technical Guidance based on the probability of river and sea flooding, ignoring the presence of existing defences.



<b>Term</b>	<b>Definition</b>
Flood Zone 1	Low probability of fluvial flooding. Probability of fluvial flooding is < 0.1%
Flood Zone 2	Medium probability of fluvial flooding. Probability of fluvial flooding is 0.1 – 1%. Probability of tidal flooding is 0.1 – 0.5 %
Flood Zone 3a	High probability of fluvial flooding. Probability of fluvial flooding is 1% (1 in 100 years) or greater. Probability of tidal flooding is 0.5%(1 in 200 years)
Flood Zone 3b	Functional floodplain. High probability of fluvial flooding. Probability of fluvial flooding is >5%
Fluvial	Relating to the actions, processes and behaviour of a water course (river or stream)
Fluvial flooding	Flooding by a river or a watercourse.
Freeboard	Height of flood defence crest level (or building level) above designed water level
Functional Floodplain	Land where water has to flow or be stored in times of flood.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Inundation	Flooding.
Lead Local Flood Authority	As defined by the FWMA, in relation to an area in England, this means the unitary authority or where there is no unitary authority, the county council for the area, in this case Cumbria County Council.
Main River	Watercourse defined on a 'Main River Map' designated by DEFRA. The EA has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Overland Flow	Flooding caused when intense rainfall exceeds the capacity of the drainage systems or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water.
Residual Flood Risk	The remaining flood risk after risk reduction measures have been taken into account.
Return Period	The average time period between rainfall or flood events with the same intensity and effect.
River Catchment	The areas drained by a river.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Sustainability	To preserve /maintain a state or process for future generations
Sustainable drainage system	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.

Term	Definition
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
Sustainable Flood Risk Management	Sustainable Flood Risk Management promotes a catchment wide approach to flooding that uses natural processes and systems (such as floodplains and wetlands) to slow down and store water.
Topographic survey	A survey of ground levels.
Tributary	A body of water, flowing into a larger body of water, such as a smaller stream joining a larger stream.
Watercourse	All rivers, streams, drainage ditches (i.e. ditches with outfalls and capacity to convey flow), drains, cuts, culverts and dykes that carry water.
Wrack Marks	An accumulation of debris usually marking the high water line.
1 in 100 year event	Event that on average will occur once every 100 years. Also expressed as an event, which has a 1% probability of occurring in any one year.
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.

## Appendix 2: Summary of Relevant Legislation and Flood Risk Management Authorities

The table below summarises the relevant Risk Management Authority and details the various local source of flooding that they will take a lead on.

Flood Source	Environment Agency	Lead Local Flood Authority	District Council	Water Company	Highway Authority
<b>RIVERS</b>					
Main river					
Ordinary watercourse					
<b>SURFACE RUNOFF</b>					
Surface water					
Surface water on the highway					
<b>OTHER</b>					
Sewer flooding					
The sea					
Groundwater					
Reservoirs					

The following information provides a summary of each Risk Management Authority's roles and responsibilities in relation to flood reporting and investigation.

Government – DEFRA develop national policies to form the basis of the Environment Agency's and the LLFA's work relating to flood risk.

Environment Agency has a strategic overview of all sources of flooding and coastal erosion as defined in the Act. As part of its role concerning flood investigations this requires providing evidence and advice to support other Risk Management Authorities (RMA's). The EA also collates and reviews assessments, maps, and plans for local flood risk management (normally undertaken by LLFA).

Lead Local Flood Authorities (LLFAs) – Cumbria County Council are the LLFA for Cumbria. Part of their role requires them to investigate significant local flooding incidents and publish the results of such investigations. LLFAs have a duty to determine which RMA has relevant powers to investigate flood incidents to help understand how they happened, and whether those authorities have, or intend to, exercise their powers. LLFAs work in partnership with communities and flood RMA's to maximise knowledge of flood risk to all involved. This function is carried out at CCC by the Local Flood Risk Management Team.

District and Borough Councils – These organisations perform a significant amount of work relating to flood risk management including providing advice to communities and gathering information on flooding. These organisations are classed as RMA's.

Water and Sewerage Companies manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They make sure their systems have the



appropriate level of resilience to flooding and where frequent and severe flooding occurs they are required to address this through their capital investment plans. It should also be noted that following the Transfer of Private Sewers Regulations 2011 water and sewerage companies are responsible for a larger number of sewers than prior to the regulation. These organisations are classed as RMA's

Highway Authorities have the lead responsibility for providing and managing highway drainage and certain roadside ditches that they have created under the Highways Act 1980. The owners of land adjoining a highway also have a common-law duty to maintain ditches to prevent them causing a nuisance to road users. These organisations are classed as RMA's

Flood risk in Cumbria is managed through the Making Space for Water process, which involves the cooperation and regular meeting of the Environment Agency, United Utilities, District/Borough Councils and CCC's Highway and LFRM Teams to develop processes and schemes to minimise flood risk. The MSfWGs meet approximately 4 times per year to cooperate and work together to improve the flood risk in the vulnerable areas identified in this report by completing the recommended actions. CCC as LLFA has a responsibility to oversee the delivery of these actions.

Where minor works or quick win schemes can be identified, these will be prioritised and subject to available funding and resources will be carried out as soon as possible. Any major works requiring capital investment will be considered through the Environment Agency's Medium Term Plan process or a partners own capital investment process.

Flood Action Groups are usually formed by local residents who wish to work together to resolve flooding in their area. The FAGs are often supported by either CCC or the EA and provide a useful mechanism for residents to forward information to the MSfWG.

## Appendix 3: Useful contacts and links

### Sign up for Flood Warnings

<https://www.gov.uk/sign-up-for-flood-warnings>

Environment Agency – Prepare your property for flooding; a guide for householders and small businesses to prepare for floods

<https://www.gov.uk/government/publications/prepare-your-property-for-flooding>

Environment Agency – What to do before, during and after a flood: Practical advice on what to do to protect you and your property

<https://www.gov.uk/government/publications/flooding-what-to-do-before-during-and-after-a-flood>

Environment Agency – Living on the Edge: A guide to the rights and responsibilities of riverside occupiers

<https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities>

Flood and Water Management Act 2010:

<http://www.legislation.gov.uk/ukpga/2010/29/contents>

Water Resources Act 1991:

<http://www.legislation.gov.uk/all?title=water%20resources%20act>

Land Drainage Act:

<http://www.legislation.gov.uk/all?title=land%20drainage%20act>

## Translation services

If you require this document in another format (e.g. CD, audio cassette, Braille or large type) or in another language, please telephone 01228 606060.

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