

# Beetham and Milnthorpe Flood Investigation Report



Mill Weir, Beetham, Cumbria

## Flood Event 5<sup>th</sup>-6<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.

<b>Version</b>	<b>Prepared by</b>	<b>Reviewed by</b>	<b>Approved by</b>	<b>Date</b>
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# Executive Summary

The flooding experienced in Cumbria on the 5<sup>th</sup> of December 2015 was severe, and was the result of the effects of Storm Desmond. This storm caused a period of prolonged, intense rainfall across Northern England. This rainfall fell on catchments that were already saturated and resulted in high river levels and flooding throughout Cumbria and further afield.

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 Beetham and Milnthorpe on the 5<sup>th</sup>-6<sup>th</sup> December. This flood investigation has used a range of data collected from affected residents, professional partners, site visits, surveys of the area, and data collected by observers along with river and rainfall telemetry data recorded during the event.

This report details the flooding that occurred from the River Bela and from surface water. It identifies the flow routes and the causes of the flooding including where river banks were overtopped in Beetham and Milnthorpe. In summary, it is concluded that the flooding experienced in Beetham and Milnthorpe was a result of the following flooding mechanisms:

- The topography of Beetham Road serving to convey surface water from the adjacent valley sides towards the centre of the village near the War Memorial.
- Fluvial flows on the River Bela exceeding the capacity of Beetham Bridge, resulting in localised overtopping and outflanking around the sides of the structure.
- The central island on the River Bela reducing the effective capacity of the channel, resulting in the lateral displacement of floodwater onto the left bank floodplain in the Parsonage Fold area. This mechanism resulted in the majority of the property flooding that was reported in Beetham.
- Significant river flows on the River Bela around the Mill Weir resulted internal flooding Billerud Korsnäs Beetham Factory.
- Surface water flows affecting properties in The Strands, Milnthorpe.
- Fluvial flows eroding the embankments near The Strands coming close to undermining the Network Grid Gas main.
- Flooding to recreation ground and nearside river buildings, Milnthorpe.
- Fluvial flooding at Hang Bridge

Nine actions have been recommended in this report to manage future flood risk in Beetham and Milnthorpe, 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>

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# 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 will 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

Beetham and Milnthorpe are villages located in the far south east of Cumbria within the South Lakeland District, situated just to the north of the County border with Lancashire. The River Bela is a designated 'main river' that meanders through the village, flowing in a northerly direction towards the River Kent estuary. The A6 road, which connects Kendal with Lancaster, crosses the River Bela at Beetham Bridge in the village.

A site location map is shown in Figure 1.

The Environment Agency does not hold any records of historic flooding in Beetham or Milnthorpe

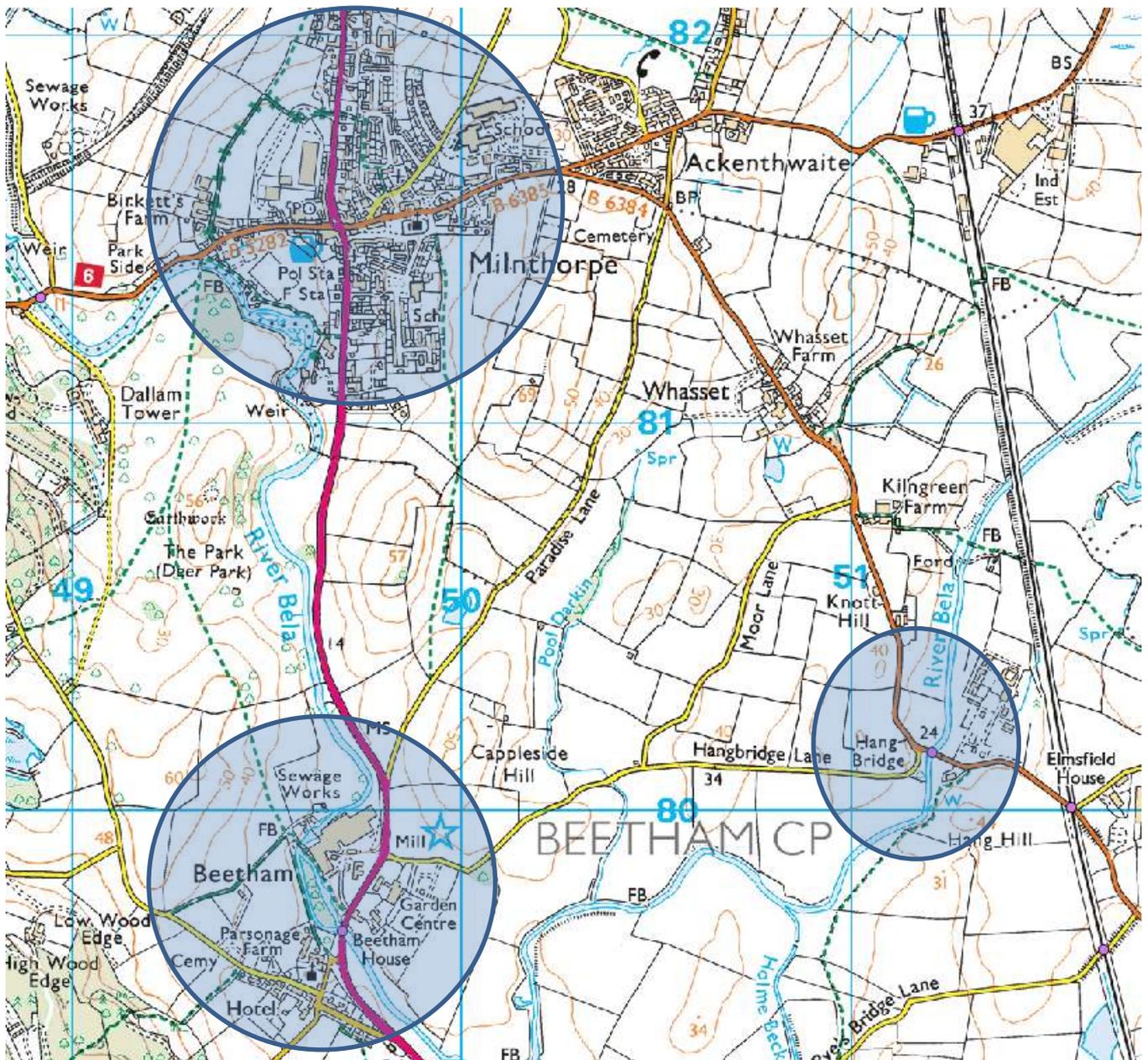


Figure 1: Location of Beetham and Milnthorpe (Hang Bridge)

# Event Background

This section describes the location of the flood incident and identifies the areas of the village that were flooded.

## Flooding Incident

### Beetham

The flooding that occurred on the 5th December 2015 in Beetham resulted in eight residential properties as reporting internal property flooding. The majority of these properties are located on the left bank of the River Bela downstream of Beetham Bridge around Parsonage Fold, and reported flood depths of up to 1.5m. Several residents were relocated after the flood due to the severity of the flood damage. The Billerud Korsnäs Beetham factory, which is a mill situated downstream of Parsonage Fold on the River Bela, was also affected by the flooding.



Figure 2: Wrack line in an external garage on the left bank of the River Bela at Parsonage Fold



**Figure 3: Wrack in an access gate outside properties on the left bank of the River Bela**



Figure 4: Evidence of surface water flooding around the Beetham War Memorial. Photo taken on 7<sup>th</sup> December at 10:36am.

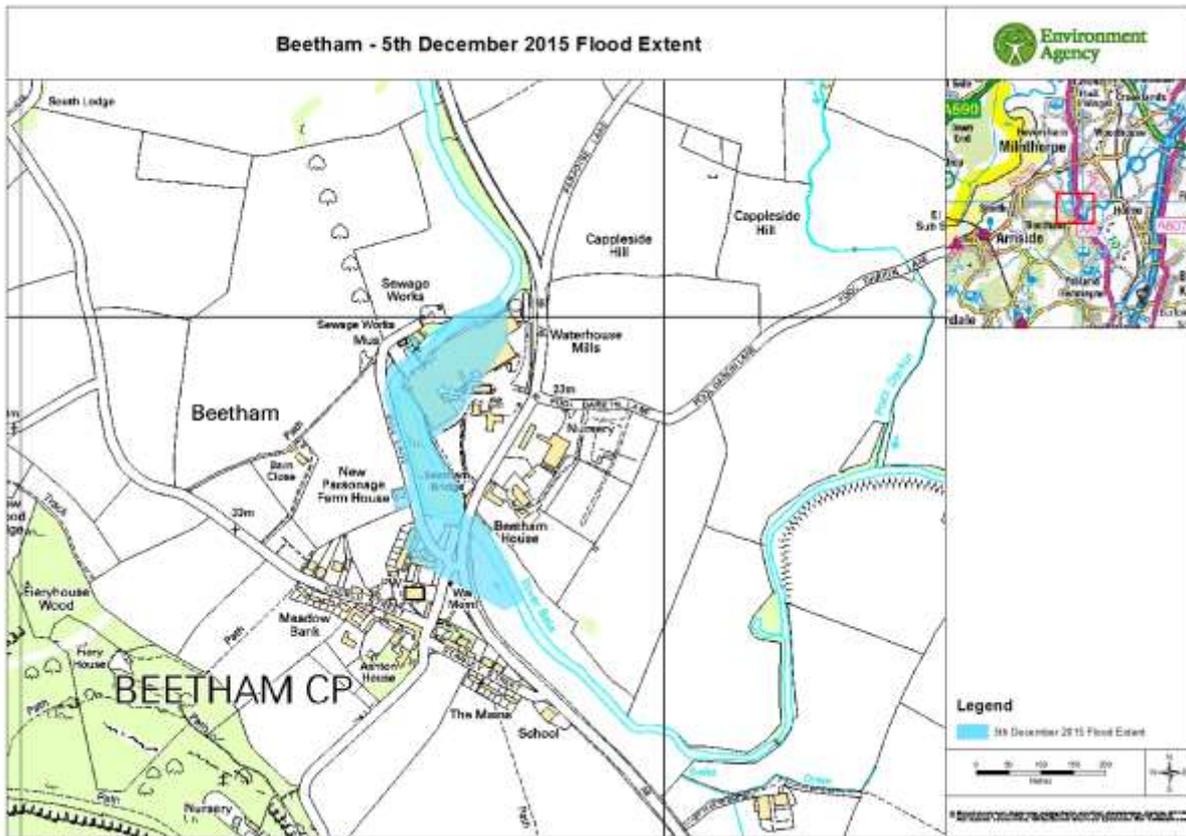


Figure 5: Extent of flooding in Beetham on 5<sup>th</sup> December 2015

### Milnthorpe

The flooding that occurred on the 5th December 2015 in Milnthorpe resulted in six residential properties as reporting internal property flooding. Fluvial flows eroded the embankments near The Strands which came close to undermining the Network Grid Gas main.



Figure 6: Extent of flooding in Milnthorpe on 5<sup>th</sup> December 2015



**Figure 7: Aerial extent of flooding in Milnthorpe on 5<sup>th</sup> December 2015**



**Figure 8 Hang Bridge Flooding extent adjacent to Wings School Milnthorpe**

## Existing Flood Defences

There are no formal Environment Agency flood defences in this area.

# Investigation

This section describes the rainfall and fluvial events that occurred on the River Bela catchment and the likely causes of flooding.

This investigation was carried out by the Environment Agency using data collected from surveys of the area, and from the communities affected, with help from Cumbria County Council. This report has compiled this data to provide a detailed record of the flooding in Beetham.

## Rainfall and Fluvial Events

December 2015 was the wettest calendar month on record, with much of northern England receiving double the average rainfall for that time of year. This also followed a particularly wet November, which resulted in catchments that were already heavily saturated prior to the rainfall event associated with Storm Desmond.

From the 4<sup>th</sup> to the 7<sup>th</sup> of December 2015, Storm Desmond resulted in a period of prolonged rainfall across Cumbria, which was particularly intense over 5<sup>th</sup>-6<sup>th</sup> December and caused widespread flooding across the county. Over this period, new 24 and 48 hour rainfall records were set for the UK. Both of these were within Cumbria and broke the previous records, also within Cumbria, set in the November 2009 flood event, which saw widespread devastation in the towns of Cockermouth and Workington. The record-breaking total rainfall values are presented in Table 1.

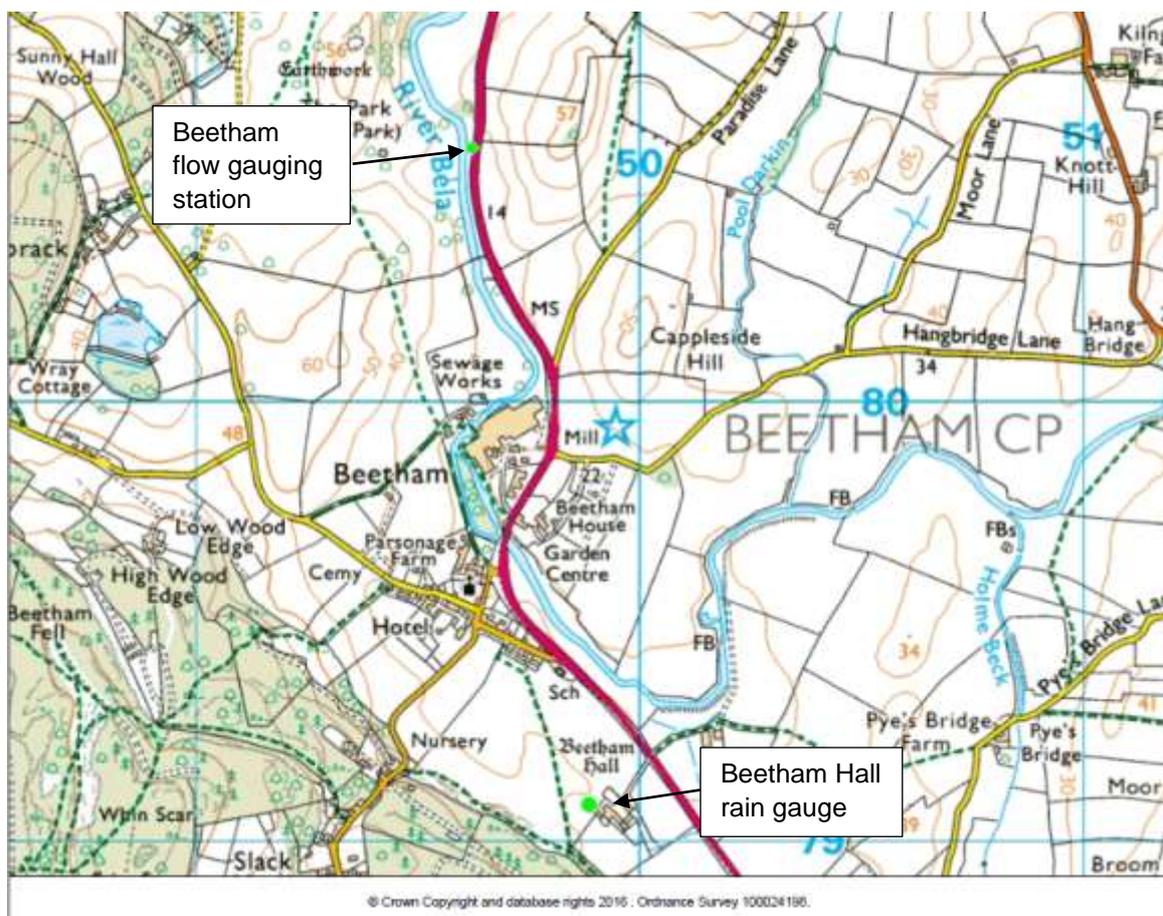
Rainfall Period	Storm Desmond			Previous Record		
	Date	Location	Total rainfall (mm)	Date	Location	Total rainfall (mm)
24 hour rainfall	December 2015	Honister Pass	341.4	November 2009	Seathwaite	316.4
48 hour rainfall	December 2015	Thirlmere	405.0	November 2009	Seathwaite	395.6

**Table 1: UK Rainfall Records**

Within the River Bela catchment, during Storm Desmond Beetham Hall rain gauge recorded a 24 hour maximum of 58.8mm and a 36 hour maximum of 69.4mm. These gaugings exceeded the previous highest recorded gaugings at Beetham Hall from January 1999. Table 2 summarises the recorded rainfall data at Beetham Hall from December 2015 and January 1999. Figure 6 shows the location of Beetham Hall rain gauge and Beetham river flow gauging station.

Location	Rainfall Period	Storm Desmond		Previous Record	
		Date	Total rainfall (mm)	Date	Total rainfall (mm)
Beetham Hall	24 hour rainfall	December 2015	58.8	January 1999	57.2
	36 hour rainfall	December 2015	69.4	January 1999	63.0

**Table 2: Rainfall data from Beetham Hall rain gauge**



**Figure 8: Location of Beetham Hall rain gauge and Beetham river flow gauging station**

Beetham river flow gauging station is located on the River Bela approximately 800m downstream of the Mill Weir in Beetham, as illustrated in Figure 6. At Beetham gauging station, the peak flow on the River Bela was recorded at 129.0m<sup>3</sup>/s at 01:00 on Sunday 6<sup>th</sup> December. This was the highest river flow ever recorded at the gauge, and far exceeded the previous record flow of 80.1m<sup>3</sup>/s from January 1999.

Gauging Station	River	Peak flow (m <sup>3</sup> /s)	
		Dec 2015	Jan 1999
Beetham	Bela	129.0	80.1

**Table 3: Recorded peak river flows at Beetham river flow gauging station**

Source: Flow gauging station data obtained from Environment Agency records

## Sources of Flooding, Flood Flow Routes

### Beetham

A site visit was undertaken on the 7<sup>th</sup> June 2016 by the Capita AECOM survey team. The site visit included a walkover of Beetham and the surrounding area upstream and downstream of the village.

The Capita AECOM survey team commenced the site visit of Beetham with a visual inspection of the River Bela upstream of the A6 road bridge. Upstream of the A6 road bridge the River Bela is flanked by flat, low floodplains that are approximately 50m wide on either side of the river channel (Figure 7). This area affords a substantial volume of floodplain storage, though it has finite capacity which may result in overtopping or outflanking of Beetham Bridge once the capacity has been exceeded. The structure itself is comprised of three arches with two central piers (Figure 8). There is a significant capacity beneath the bridge during normal flow conditions and the soffit is approximately 2.5m above bed level. The structure may, however, constrain the passage of river flows during flood conditions. Structural damage was observed on the boundary wall on the downstream side of the structure (Figure 11).



**Figure 9: River Bela, looking upstream from Beetham Bridge**



**Figure 10: Looking upstream at Beetham Bridge**



**Figure 11: Structural damage on the walls downstream of Beetham Bridge**



**Figure 12: River Bela floodplain (looking upstream from Beetham Bridge)**

Downstream of Beetham Bridge the River Bela is braided around an established central island that is heavily vegetated. The presence of this island reduces the effective capacity of the river channel which may result in water being displaced laterally into the floodplain as identified through post-event liaison with local Beetham residents. Several residential properties, including the Parsonage Fold development, are present on the left bank of the river at this location and eight of these properties reportedly experienced internal property flooding. Residents reported that in places the flooding was up to a depth of 1.5m and this is corroborated by the observed wrack marks at this location. Figures 2 and 3 earlier in the report show evidence of the flooding that occurred at this location.



**Figure 13: Central island on the River Bela**



**Figure 14: Looking downstream on the left bank of the River Bela next to the central island**

The braided channel converges downstream of the central island where the River Bela meanders in a north-easterly direction towards the Mill Weir. The Mill Weir is located approximately 60-70m downstream of the central island, with the weir featuring a significant drop in level, illustrated in Figures 13 and 14. The Heron Corn Mill, which was constructed in 1740, is located on the left bank of the River Bela immediately downstream of the Mill Weir.



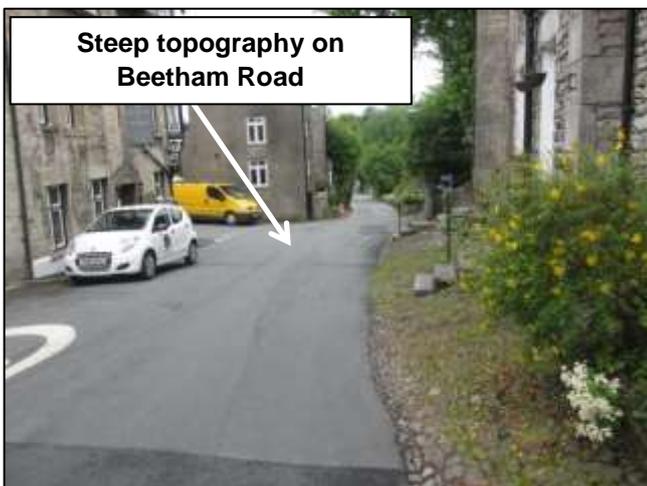
**Figure 15: Looking downstream at the Mill Weir**



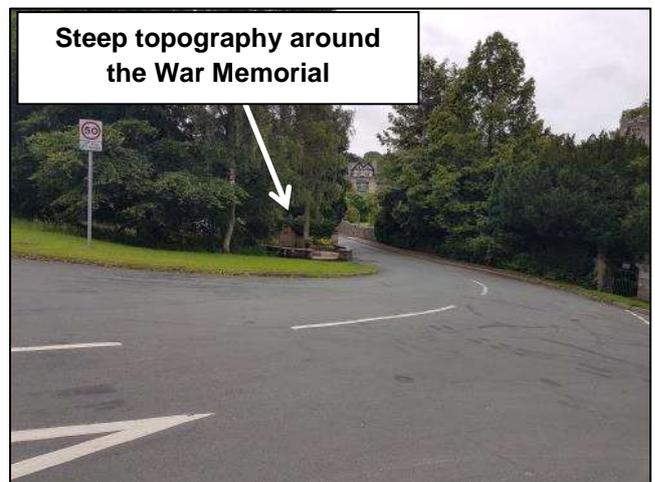
**Figure 16: Looking upstream at the Mill Weir**

The Billerud Korsnäs Beetham Ltd factory is located on the right bank of the River Bela at the Mill Weir. The factory produces paper for pharmaceutical packaging, food packaging and other types of industrial purposes. Parts of the factory suffered internal flooding.

On the south side of the village Beetham Road joins the A6 near Beetham Bridge. The topography of this road climbs sharply towards the southern side of the village past the War Memorial and towards Saint Michaels Church, cresting around the junction with Stanley Street (Figure 17 and Figure 18). This area was observed as flooded during the event by local residents, as illustrated in Figure 4 earlier in the report. Given the steep topography of the road, it is concluded that this resulted from surface water from the adjacent valley sides, although this may have combined with fluvial floodwater from the River Bela at the bottom of the road near the War Memorial.



**Figure 17: Beetham Road, looking north towards the junction with the A6**



**Figure 18: Beetham Road near the junction with the A6 and the War Memorial**

It is concluded that the flooding experienced in Beetham was a result of the following flooding mechanisms:

- The topography of Beetham Road serving to convey surface water from the adjacent valley sides towards the centre of the village near the War Memorial.
- Fluvial flows on the River Bela exceeding the capacity of Beetham Bridge, resulting in localised overtopping and outflanking around the sides of the structure.
- The central island on the River Bela reducing the effective capacity of the channel, resulting in the lateral displacement of floodwater onto the left bank floodplain in the Parsonage Fold area. This mechanism resulted in the majority of the property flooding that was reported in Beetham.
- Significant river flows on the River Bela around the Mill Weir resulted in possible structural damage and undermining around the Billerud Korsnäs Beetham factory. The factory was reportedly affected by internal flooding.

## Milnthorpe

Surface water overland flows from high ground above Beetham Road caused flooding into The Strands but no identified source has been pointed out during the investigation. Therefore below is a guestimate of the overland flow.

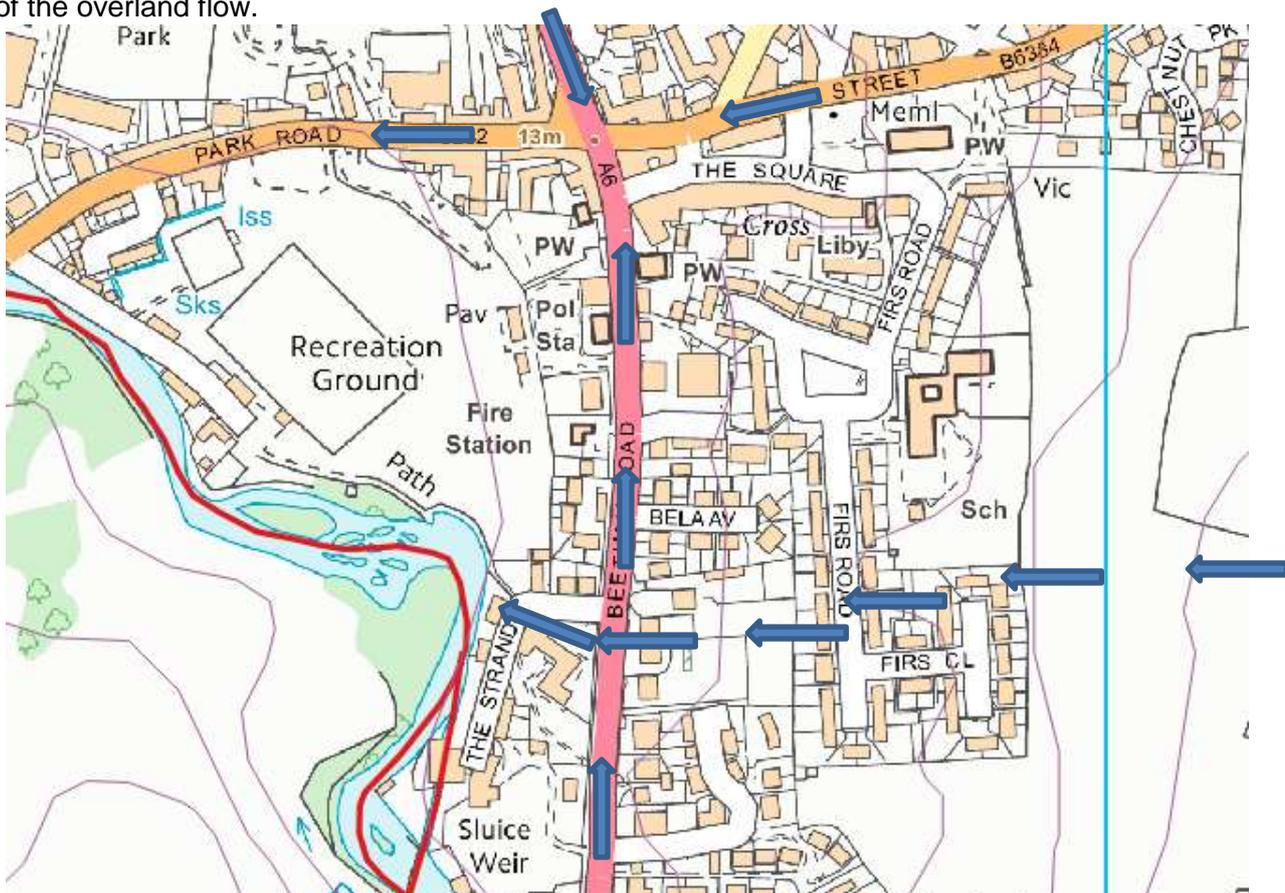


Figure 21: Surface water overland flow route.

Remaining flooding was out of bank flooding causing damage to roadside walls at Hang Hill next to Hang Bridge and erosion of embankments at the recreation ground

# Recommended Actions

The following table details recommended actions for various organisations and members of the public to consider using the Cumbria Floods Partnership's 5 Themes: Resilience, Upstream Management, Strengthening Defences, Maintenance and Water Level Management Boards (WLMBs). Some of these recommendations may have already been carried out or are ongoing.

Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
Strengthening Defences	Environment Agency	Undertake an Initial Assessment to appraise a range of options that could provide an improved standard of flood protection to properties in Beetham.	2017
	Cumbria County Council Highways	Investigate the current performance of the highways drainage network around the War Memorial and consider improvements if necessary. Investigations have started with some improvement but more investigation needed. Potential relief drainage system.	2017
Maintenance	Cumbria County Council Highways	Clean Drains and Gullies in Beetham & Milnthorpe. More investigation and cleaning to be carried out next few months.	December 2016 and July 2017
	Environment Agency	A new Environment Agency system is being developed to make it easier for communities to understand what maintenance work is being carried out in their area. Improvements will show exactly when, where and what maintenance is being planned each year. Make sure that communities understand how they can access information on planned maintenance at: <a href="https://www.gov.uk/government/publications/river-andcoastal-maintenance-programme">https://www.gov.uk/government/publications/river-andcoastal-maintenance-programme</a>	2017
	Cumbria County Council Highways	Repair road side walls at Hang Hill. Work completed	Dec 2016
	National Grid Gas	Temporary repairs to river bank below The Strands. Permanent repairs to follow later. Ongoing discussions with consultants Cain Bioengineering with regard permanent repairs and river diversion overflow. Delays due to changes at National Grid.	2016 Temp repair Perm summer 2017-2018

<b>Resilience</b>	Environment Agency and LLFA	Review the influence that the weir has on the upper reaches of the river near Beetham Bridge	2017
	Residents and South Lakeland District Council	Implement flood resilience measures within flooded properties to reduce the impacts of future flooding. South Lakeland District Council is administering the Flood Recovery and Resilience Grants of up to £5000 per property to help people better protect their homes. A further £2000 top up grant can also be applied for from the Cumbria Flood Recovery Fund.	Closing date for grant applications was March 2017
<b>Resilience</b>	South Lakeland District Council, Cumbria County Council and Environment Agency	Review Local Development Plans and Strategic Flood Risk Assessment to reflect current understanding of flooding. New FRA in process at SLDC	2017
	Cumbria County Council, United Utilities, Environment Agency and Electricity North West.	Review the resilience of critical transport, utility and power supply infrastructure in relation to flood risk.	2017
	Cumbria Local Resilience Forum*	Review and update plans to enable homes and business to be better prepared for flooding and reduce the impacts of flooding. For example, review of evacuation procedures / emergency response.	2017
	Cumbria Strategic Flood Partnership (CSFP)	The CFP action plan will consider Natural Flood Management (NFM) options to reduce flood risk across the catchment. This may also include land use changes and/or flood storage. Bids being assessed for £2.2m	Bids 2017
<b>Upstream Management</b>	CSFP, Farmers, Landowners, Community Groups, Trusts.	Explore opportunities for natural flood management solutions to be used upstream of Beetham and Hang Bridge area in order to 'slow the flow' and manage peak river levels.	Medium term (over next 5 years)

**Table 4: Recommended actions for consideration**

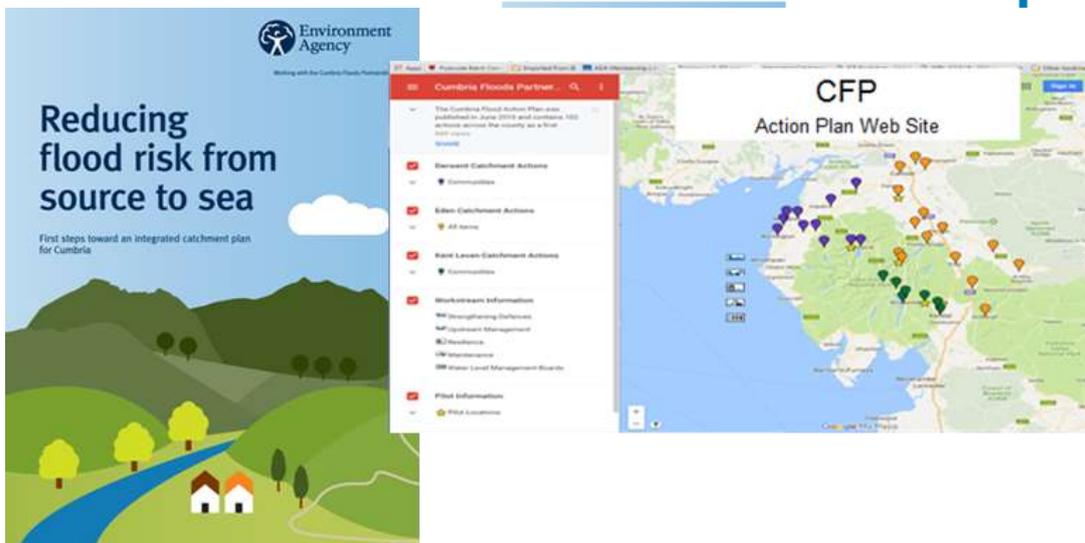
\*The Cumbria Local Resilience Forum includes emergency services, local authorities, Cumbria County Council, Environment Agency, Maritime Coastguard Agency and health agencies along with voluntary and private agencies. Under the Civil Contingencies Act (2004) every part of the United Kingdom is required to establish a resilience forum.

# Next Steps – Community & Catchment Action Plan

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, is producing a 25 year flood action plan for the Cumbrian catchments worst affected by the December 2015 flooding, including Carlisle. The plan will consider 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.

The diagrams below helps demonstrate how the two partnerships have now come together:

## Cumbria Flood Partnership



## NEW Cumbria Strategic Flood Partnership



# Defra 25 Year Environment Plan Cumbria Flood Action Plan Local Flood Risk Management Strategy

<p><b>2016 – Cumbria Pioneer</b></p> <p>DEFRA 25 Year Environment Plan and vision New and innovative ways of working Making best use of resources Working at Catchment scale through engagement and commitment Place based decision making within DEFRA vision <b>Lead – Jez Westgarth, Environment Agency</b></p>	<p><b>January 2016 - Cumbria Flood Partnership</b></p> <p>Created following December 2015 floods Local knowledge and expertise Integrated catchment management Community focus 25 year Cumbria Flood Action Plan <b>Lead– Rory Stewart MP, Environment Agency and 3 Catchment Directors</b></p>	<p><b>2013 – LLFA Cumbria Strategic Partnership</b></p> <p>Flood and Water Management Act (2010) Professional partnership providing strategic leadership for flood risk management Reporting to RFCC Coordination and cooperation between Risk Management Authorities (RMA's) <b>Lead – CCC as LLFA</b></p>
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## Communities



**Communities working together across Cumbria**

# Appendices

## Appendix 1: Acronyms and Glossary

<b>Acronym</b>	<b>Definition</b>
EA	Environment Agency
CCC	Cumbria County Council
SLDC	South Lakeland District Council
LLFA	Lead Local Flood Authority
FLAG	Flood Action Group
LFRMT	Local Flood Risk Management Team
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991
UU	United Utilities

<b>Term</b>	<b>Definition</b>
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

<b>Term</b>	<b>Definition</b>
	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.
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.

<b>Term</b>	<b>Definition</b>
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.
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.

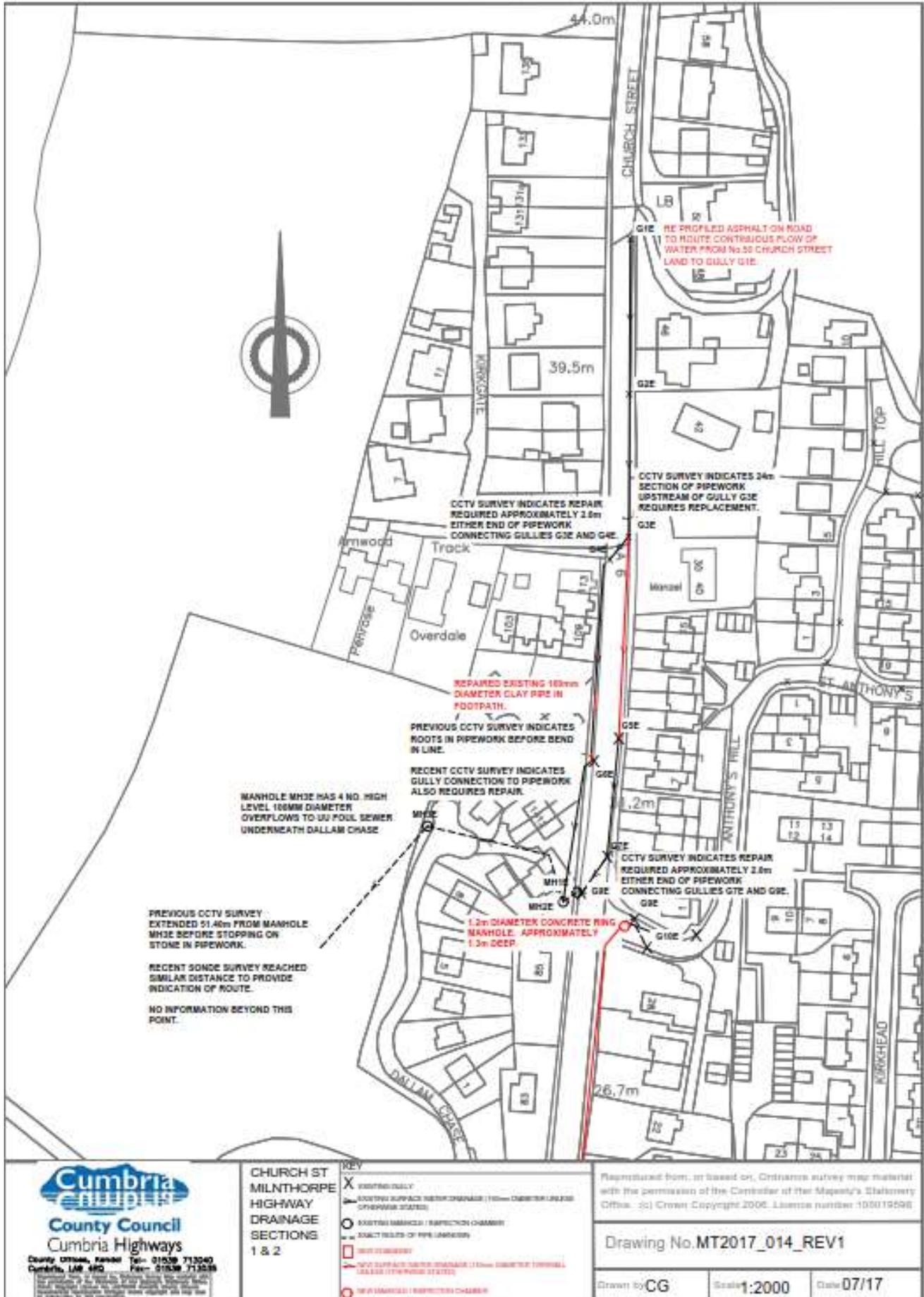
## Appendix 3: Highway Drainage Investigations

### Beetham



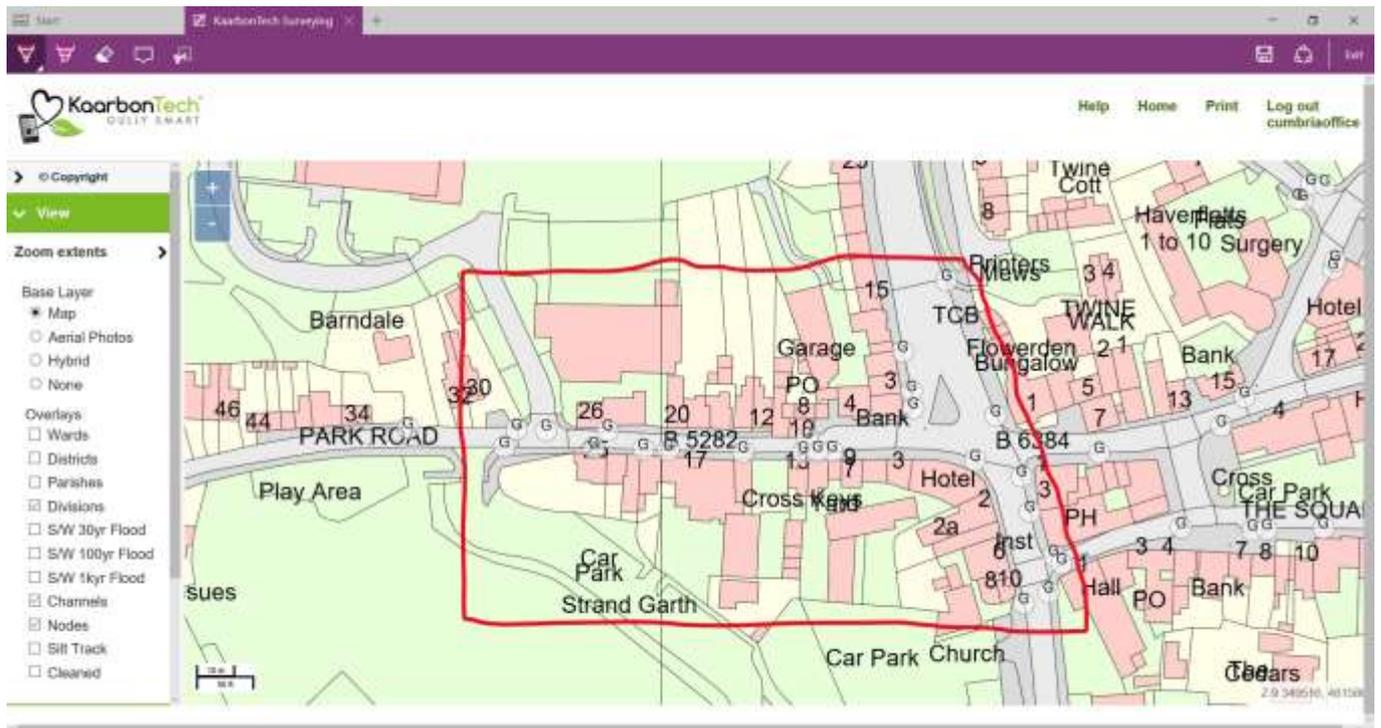
Investigations still to be completed for drainage running down an adopted road past New Parsonage Farm House. Potential relative drainage if existing drainage cannot be improved

# Milnthorpe





Further drainage investigation Milnthorpe prior to resurfacing summer 2017



## Appendix 4: Links to Other Information on Flooding

**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>

## Appendix 5: Flood Alerts

### **011WAFLE: Kent and Bela Catchments**

Alert issued on Friday 04/12/2015 at 15:22

Alert removed on Thursday 10/12/2015 at 16:18

**Customers in Flood Alert area registered on FWD: 227**

**Contacts (landline, mobile, email etc.) in Flood Alert area registered on FWD: 609**

**Successful contacts: 531**

**Unsuccessful contacts: 78**

#### **Alert Message:**

A Flood Alert has been issued by the Environment Agency for the Rivers Kent and Bela. Flooding is possible for Rivers Kent and Bela. Low lying land and roads will be affected first. Be prepared to protect yourself, family, pets and property.

Heavy and persistent rainfall, along with strong South-Westerly winds, is forecast to continue this evening through until Sunday 06/12/2015. With the ground already saturated the river levels are expected to rise further and we may see some significant impacts. The forecast is likely to result in Flood Warnings being issued on Saturday. We advise that you keep an eye on the situation by listening to weather forecasts, checking our web pages or calling Floodline. We are continuing to monitor the situation and have workers on site operating defences and clearing blockages where required.

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<sup>1</sup>Contact Successful if at least one attempt to contact a fully-registered recipient registered to the property returned a status of "Acknowledged", "Successfully Received", "Successfully Sent" or "Unacknowledged"