

# Ravenglass

## Flood Investigation Report 30



**Flood Event 30<sup>th</sup> August 2012**

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

Version	Undertaken by	Reviewed by	Approved by	Date
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# Executive Summary

Cumbria County Council as Lead Local Flood Authority has prepared this report with the assistance of other Flood Risk Management Authorities as it considers necessary to do so under Section 19 of the Flood and Water Management Act 2010.

The report identifies where flooding occurred in Ravenglass on 30<sup>th</sup> August 2012. 13 properties were reported to have suffered internal flooding. The most significant flooding occurred at the bottom of the hill where a flash flood from surface water collected at the low point under the railway bridge trapped behind a sea defence embankment. Highway drainage systems have been provided to convey water through the embankment but they were found to be damaged when inspected. In another two areas, properties alongside the main street suffered from flooding as a result of surface water runoff from high ground.

8 actions have been identified in the report which would minimise the risk of future flooding. The recommendations range from cleaning drainage systems, installing property level protection, to longer term solutions that may take many years following prioritisation within RMAs capital programs. The key recommendation is to remove the restriction in the drainage system by increasing the size of the outfall. Some of the actions have already been completed at the time of publication of this report.

# Event Background

## Flooding Incident

Figures 1 & 4 illustrate the locations affected by flooding during the heavy rain that occurred on the 30<sup>th</sup> August 2012. An important road in the village is Main Street which starts at the flood gates onto the beach at the southern end of the village and ends at the junction with A595 at the top of the hill above the village. There were two separate flooded areas referred to as Main Street North and Main Street South in this report. 13 properties suffered from internal flooding throughout the village.

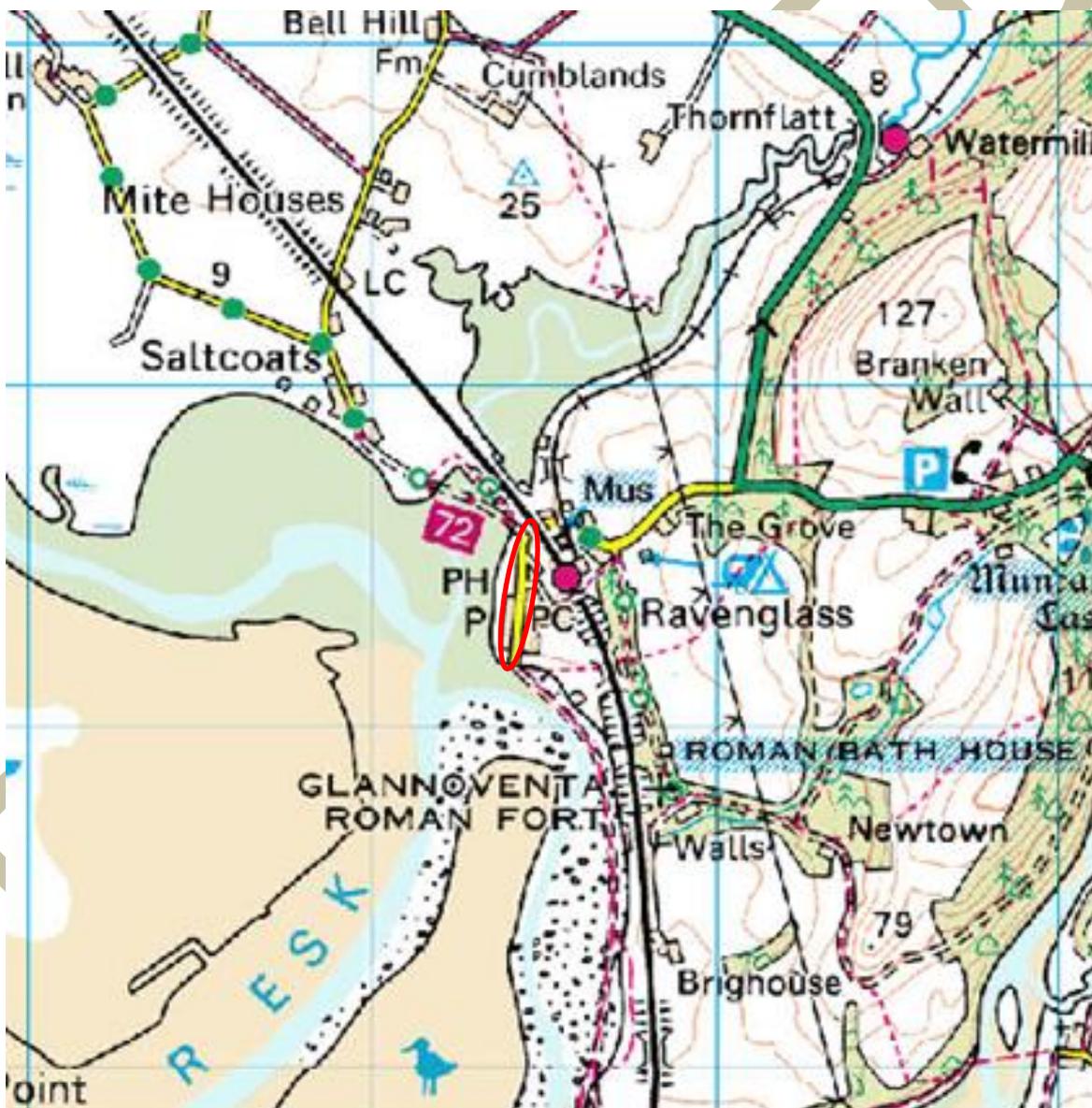


Figure 1. Location of flood effected areas in Ravenglass.

A full list of properties that experienced internal flooding is,

Main Street North Area

Church Rooms  
'Old School House'  
Muncaster Parish Hall  
'Irt View'  
'West View'  
'The Cottage'  
'Dune View'

Main Street South Area

'Greba Cottage'  
'Pennington Hotel'  
'Spindrift'  
'Herbert House'  
'1 Clifton Terrace'  
'Lorne Cottage'

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# Investigation

## Rainfall Event

According to radar data taken from a weather information provider, peak rainfall was 14mm/hr and occurred at about 02:00am. Drizzle started at 8:45pm and storm conditions started at 23:45pm. The storm finally subsided at 3:45am with 25mm total rainfall in seven hours.

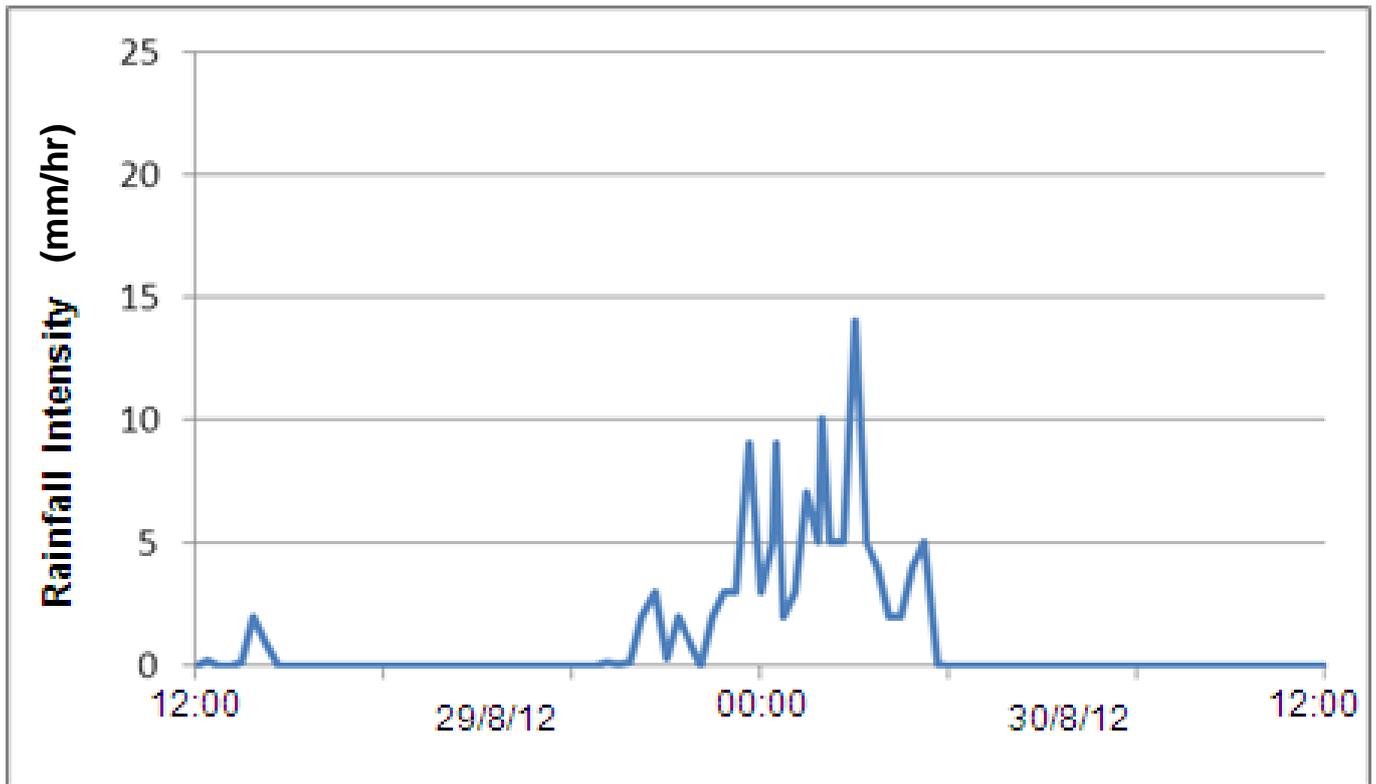


Figure 2. Rainfall data from 29-30 August 2012 taken from radar data for Ravenglass.

Heavy rain figures for Drigg rain gauge <http://wow.metoffice.gov.uk/>, which is 3.6km away, suggest the storm may have been even heavier than the radar figures indicate. The rain gauge shows 34mm fell throughout the storm at Drigg. The average total rainfall for the whole of August is 92mm (1981-2010) at St Bees Head.



# Map of Flow Routes

## North area of village

Water reached Main Street North after flowing down the road into the village. Ground infiltration rate would have been reduced because the fields were saturated after the wet summer preceding the event. Water poured out of the fields directly onto the road into the village and onto Walls Drive which also brought the water to the road into the village. The road channelled the water down to Main Street North. The flow of water exceeded the capacity of the road gullies and it pooled on the highway under the Cumbria Coast Line rail bridge. The build-up of water was the main cause of flood damage on 30/8/12.



**Figure 4. Surface water flow routes (arrows) and main flooded areas (oval). Some water was held back by a sea defence embankment (yellow). Key locations named in the report are identified.**

## South area of village

There were other overland flow routes that caused flooding in the southern half of the village. One was from the car park, through the alley next to the Pennington Hotel. Another route was from the southern field which is behind 'Rose Cottage', down the track and through rear gardens to Main Street South.

## Likely Causes of Flooding

### Surface Water

Surface water ran off the fields above the village, via roads and tracks to the residential areas.

Flood waters ran down the road into the village with flows from the fields on both sides. There was significant runoff from Walls Drive which rises to the south. Runoff from the other side of the rise makes its way south where there is a beck flowing around the southern side of the village.



Figure 5. Surface water flowing onto Walls Drive from the fields above.

On the other side of the road into the village, surface water discharged from the drive of the Ravenglass & Eskdale Railway engine shed area. A ditch is provided to stop the water reaching this driveway but it is overgrown and unmaintained.

Surface water flowed down the road into the village to Main Street North. The flood water built up to such a depth that it was able to enter properties on Main Street North through vents and through floors in the front part of these buildings. It was able to flow around to the back flooding

some of the properties from the rear. The low point is under the Cumbria Coast Line rail bridge. There is a spout hole (open pipe on the road surface) for surface water ponding at this location. This pipe drops into the rest of the road drainage system, joining water from the road gullies before draining to the sea outfall.

Surface water from the village car park flowed through the car park entrance and over a dropped kerb on the lower west side provided for a footpath route. The profile of the adjacent road, Croftlands Drive, directed flood water down the alley next to the Pennington Hotel and onto Main Street South. A further source of surface water was the field to the south of the village from which runoff flowed down a track and through rear gardens to Main Street South, flooding Lorne Cottage.



**Figure 6. Impermeable surface of the car park and the dropped kerb which provided a flow route for flood water.**

### Surface Water Drainage System

Surface water drainage in Ravenglass is largely provided by the highway drainage system as the United Utilities sewer is a combined sewer which carries foul waste as well as roof water.

Highway drainage is only designed to carry the flows from the highway surfaces and not land outside these areas. Figure 7 shows the mapped surface water system and shows there are seven outfalls and therefore seven separate systems plus the combined sewer.

The northernmost system all converges on one point, labelled CP01 in Figure 7. This is a manhole found to be buried under the sea defence embankment. Two stone culverts connect to this manhole and carry the road drainage from Main Street North and from the road into the village.

The spout hole from the road surface also leads to the same buried manhole. The outlet for this manhole is a stone culvert but reduces to a 225mm diameter pipe. A pipe this size would be more than capable of conveying the water from the road surfaces but not excessive runoff from the surrounding fields.

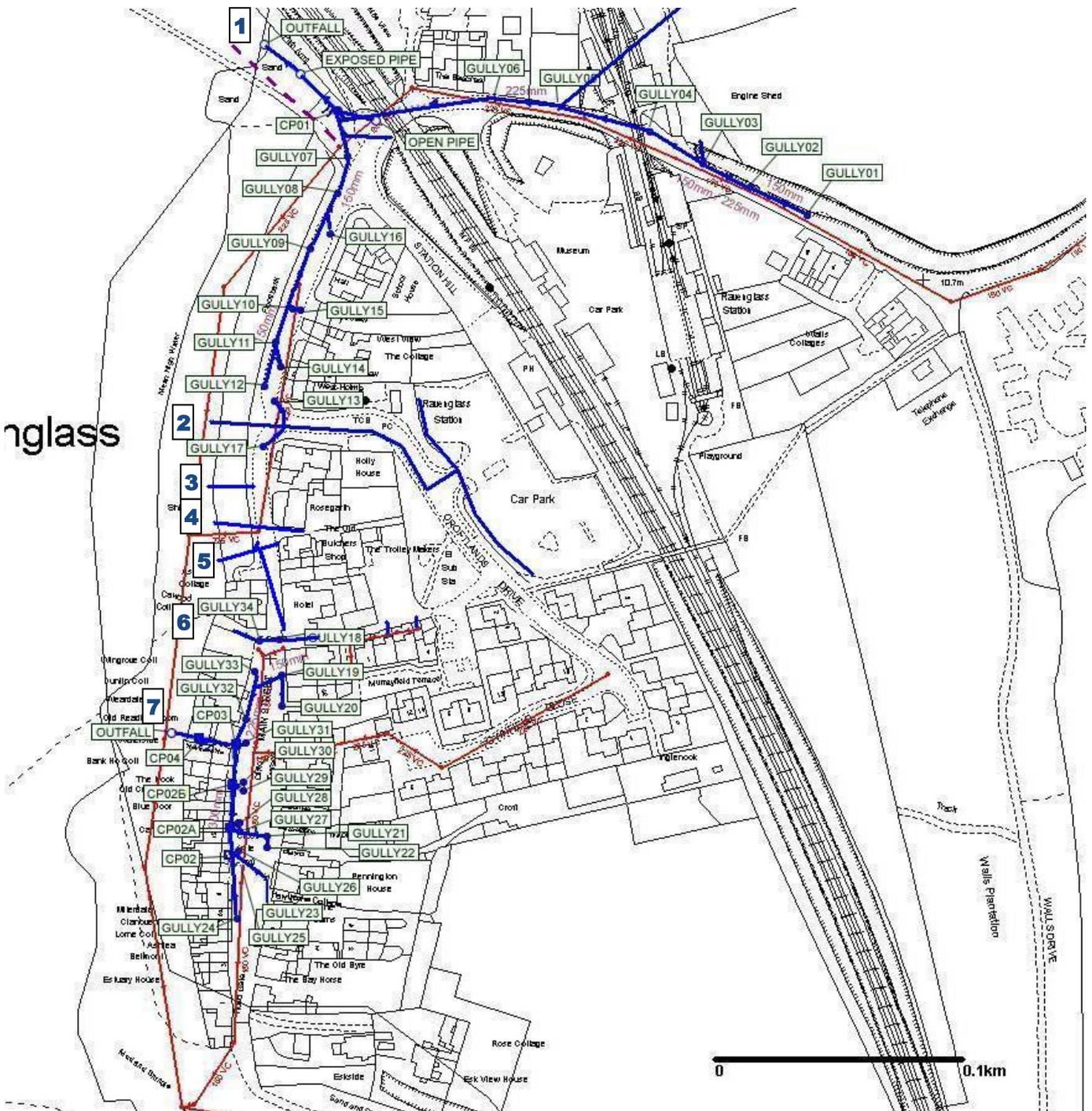


Figure 7. Piped surface water drainage system in Ravenglass. Blue lines are surface water only, mainly highway drainage. Red lines are the United Utilities combined sewers. The dashed purple line is the pipe on stilts that can be seen near the surface in the estuary, which is the old highways surface water outfall. Each outfall has been numbered 1 to 7 from north to south.

A considerable amount of debris was removed from the highway drainage in the road into the village, and a collapse was found in one location. This was between the two railway bridges and seems to have caused subsidence on the road which allows water to seep out onto the surface. A gully alongside the southern abutment to the rail bridge had also collapsed. Any water that could not flow in the highway drainage would have run over the surface instead and would have discharged to the buried manhole under the sea defence embankment via the spout hole instead of the highway drains. The 225mm diameter sea outfall pipe was found to be compromised 15m downstream from the buried manhole by a collapse.

The highway system outfall is visible from the footpath alongside the railway bridge and the pipe portal lies within the estuarine sands (red circle in Figure 8). Water from this pipe has scoured out the sand forming a channel. The pipe may have extended further out into the river channel but has progressively retreated as the scour channel has moved further backwards towards the shore.



**Figure 8. Outfall of northernmost surface water system (Outfall 1 in Figure 7).**

The next system is from the village car park, owned by the Lake District National Park Authority which is responsible for maintenance of the associated drainage. The gullies in the car park were found to be full of debris and a bus shelter has been constructed over one of the gullies. This meant that the flood water stayed on the surface and was able to flow over the dropped kerb (see Fig. 6). The piped system from the car park joins the highway drainage system in Croftlands Drive and the outlet to the shore is through the flood defence embankment adjacent to the road junction where Croftlands Drive meets Main Street (Outfall 2 in Figure 7). This outfall was not visible until the road gullies were jetted above and water blew out the shingle in front of the pipe. The outfall is a broken clay pipe underneath shingle; the pipe is full of beach material as it is open in a few places.



**Figure 9. Broken pipe on beach carrying car park drainage (Outfall 2 in Figure 7).**

The next three outlets (outfalls 3, 4, and 5 in Figure 7) with flap valves are in reasonable condition but a lot of material was removed by jetting and residents report that the flaps do not open freely.

The next system runs down the alleyway (which is not adopted highway) to the south of the Pennington Hotel and blockage problems were identified at the rear of the hotel buildings. Surface water drainage from this unadopted area continues across the road and down the path within the garden of 'Spindriff'. The system was found to be blocked within the curtilage of the property and the system outlet could not be found.

The remainder of the road gullies at the south end of Main Street outfall on to the beach through a flap valve adjacent to the footpath at 'The Old Reading Room'. A considerable amount of gravel was found in this system, and a thick salt deposit was found in the pipe work which was extremely difficult to remove. This is likely to have formed from sea water entering the system at high tide. A flap valve is provided to prevent this happening; further investigation is required.

## High Tide

This occurred at Workington at 9:59pm on 29/8/12.

It has been suggested that a high tide may have prevented the flood water from escaping into the sea but the times suggest that the storm had barely started at high tide. The peak of the storm and the flooding occurred at around 2am. The tide is unlikely to have been a factor in this flood event.

On 31/10/12 the flooding occurred during the day and photo records show that the tide was out on this occasion.

## Sewer Flooding

Sewage surcharged from a small gully in the yard of 'Spindriff' provided to drain surface water; this flooding entered the property. For sewage surcharge to occur, the gully must be connected to the combined sewer.

Further investigations will be needed to identify the outfall of the system in the alleyway alongside the Pennington Hotel, restrictions in the system and the surcharging gully in 'Spindriff'.

## **Flooding History**

Reports suggest that flooding had occurred four times in the Main Street North area from June to August 2012; previous history is uncertain.

At 'Spindriff' there had been surface water flooding on the 24<sup>th</sup> August 2012 followed by the sewage flood as described on 30<sup>th</sup> August.

The Main Street North area flooded again on 31<sup>st</sup> October 2012. Residents have pointed out that when this area is flooded it blocks the only vehicular routes to the central areas of the village and present access difficulties for emergency vehicles.

# Recommended Actions

Action by	Recommended Action	How
County Highways	Ensure Highway drainage system in village is repaired, clean and functioning.	<ul style="list-style-type: none"> <li>• CCTV survey / dye testing / jetting. COMPLETED.</li> <li>• Repairs. PARTIALLY COMPLETED.</li> <li>• Construct new manhole for maintenance at buried manhole in the green. COMPLETED</li> <li>• Increase size of outfall pipe from buried manhole. Look at options to create new outfall at a higher level. COMPLETED</li> <li>• Repair outfall for Croftlands Drive / car park system. ONGOING, HIGHER OUTFALL TO BE IMPLEMENTED</li> <li>• Investigate an improved design for flap valves that stops sea water entry and allow surface water to pass.</li> <li>• Create access to catchpits in Main Street South either by creating a new manhole or by moving the double gullies. COMPLETED</li> </ul>

Action by	Recommended Action	How
MSfWG / Land Owner	Reduce the volume of run off from fields onto Main Street.	<ul style="list-style-type: none"> <li>Investigate improved methods of land management.</li> <li>Investigate possibilities for diversion of flows from Walls Drive.</li> <li>Ensure field drainage systems where they exist are effective.</li> </ul>
Land Owner / MSfWG	Reduce the volume of run off from fields onto Main Street South flood area.	Investigate flow routes and improved methods of land management from field behind Rose Cottage.
Lake District National Park Authority	Ensure car park drainage system is able to operate at full capacity.	<ul style="list-style-type: none"> <li>Regular maintenance for car park gullies.</li> <li>Move or alter bus shelter to allow access.</li> <li>Look at locations of dropped kerbs and whether they can be moved so surface water is retained in the system.</li> </ul>
Copeland Borough Council	Improve street sweeping regime.	Manage road sweeping programme to concentrate on priority gully areas.
MSfWG / Land Owner	Locate the outfall of the Pennington Hotel system.	Dye testing could reveal if the outfall is in the UU combined sewer.
'Spindrifft' Property Owner	Investigate where surface water drain outfall is. If combined sewer, remove connection to remove risk of sewage flooding.	CCTV survey. Create new outfall to the shore. County Highways investigate to identify a different route for surface water.
Residents	As flood risk can never be eliminated, residents who know they are at risk of flooding should ensure any future flooding, in all areas, causes minimal damage.	Ensure own <a href="#">properties are protected</a> by resilience measures. Formation of a Community Action Group could coordinate measures.

## Next Steps

Cumbria County Council as the LLFA will continue to ensure that any actions identified within the actions table of this report are appropriately taken forward by each Risk Management Authority identified. Actions will continue to be prioritised through the Making Space for Water process and monitored through regular meetings of the group. Details of the MSfWG members and summary of related processes are detailed in Appendix 3.

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# Appendices

## Appendix 1: Residents feedback to draft report

**From the Flood Forum held in Muncaster Parish Hall, Ravenglass, 7pm, 15<sup>th</sup> April 2013**

A number of comments were received from residents. These comments will identify and support future work and will be used to identify where further investigations are needed. Between the 30/8/2012 flood event and the flood forum, flooding had occurred in Main Street North twice monthly in September, October and November 2012 and once in December.

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## Appendix 2: Glossary

### Acronyms

CCC	Cumbria County Council
EA	Environment Agency
FAG	Flood Action Group
LFRM	Local Flood Risk Management
LLFA	Lead Local Flood Authority
MSfWG	Making Space for Water Group
RMA	Risk Management Authority
UU	United Utilities

### Measurements

ha	Hectares (1ha = 10000m <sup>2</sup> or 2.5 acres)
km	kilometre (1km = 1000m or 0.6miles)
l/s	Litres per second

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## Appendix 3: Summary of Relevant Legislation and Flood Risk Management Authorities

The Flood Risk Regulations 2009 and the Flood and Water Management Act 2010 (the Act) have established CCC as the LLFA for Cumbria. This has placed various responsibilities on CCC including Section 19 of the Act which states:

### Section 19

- (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.

A 'Risk Management Authority' (RMA) means:

- (a) the Environment Agency,
- (b) a lead local flood authority,
- (c) a district council for an area for which there is no unitary authority,
- (d) an internal drainage board,
- (e) a water company, and
- (f) a highway authority.

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 EA's and CCC'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. The EA also collates and reviews assessments, maps and plans for local flood risk management (normally undertaken by LLFA).

Lead Local Flood Authorities – Cumbria County Council is 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 risk management authority 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 risk management authorities 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.

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.

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.

Flood risk in Cumbria is managed through the Making Space for Water process which involves the cooperation and regular meeting of the EA, UU, 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 EA's Medium Term Plan 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 4: Main Street North Catchment Analysis

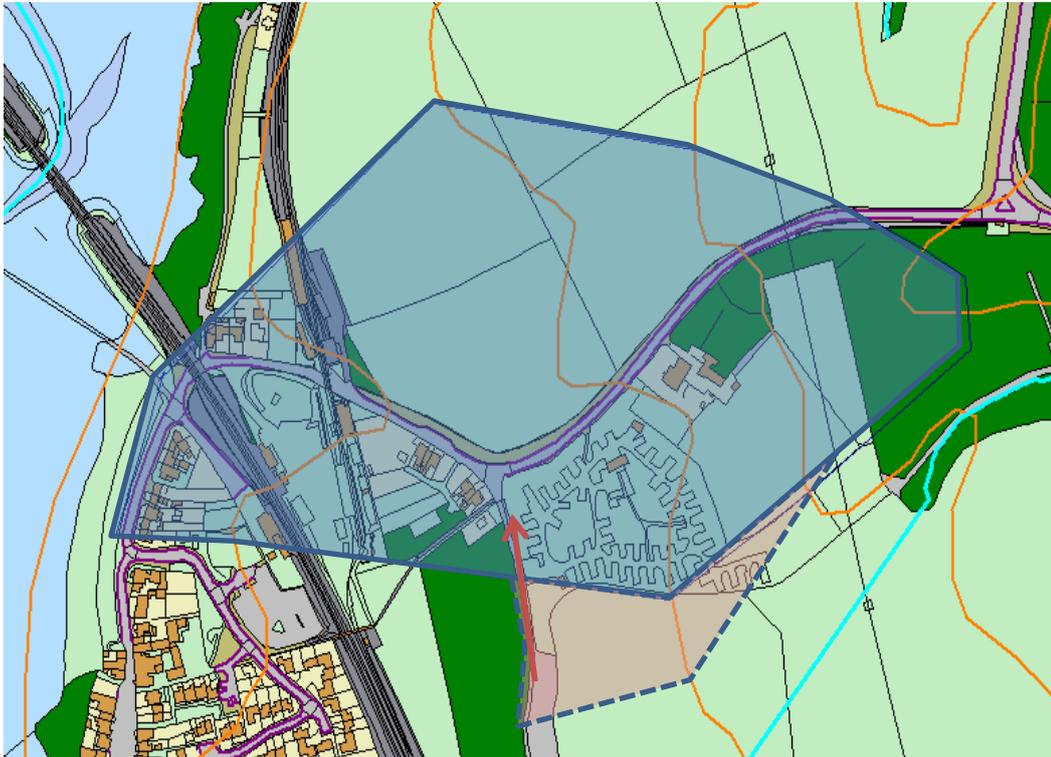


Figure 10. Catchment area affecting Main Street North.

Water follows the topography and all the surface water runoff from the 14ha catchment, shaded blue in Figure 10, flows through the Main Street North flooded area at some point on its way to the sea. The water flows onto the road into the village from both sides and an examination of the contours (orange lines) shows that there is a natural flow route into the village which is occupied by the road.

The catchment boundary crosses Walls Drive but the catchment divide is further south. The water that reaches Walls Drive between the blue catchment boundary shown in Figure 10 and the crest (shaded red) would naturally flow towards the car park and the Pennington Hotel area. Walls Drive diverts this water northward (red arrow) adding another 1.5ha (shaded red) to the Main Street North catchment which is 11% of the total.

All runoff from this area is prevented from reaching the sea by the sea defence embankment. The only means of passing this barrier is via the buried manhole which discharges via a 225mm pipe. At an estimated slope angle of 1 in 14 this could have a flow capacity of 125l/s. The peak rainfall of 14mm/hr over the 1.4ha of road surface served by the pipe could have generated a flow of 55l/s. The pipe would have adequate capacity for that flow but not the 550l/s that would have been generated by the wider catchment. It must be noted here that all flow calculations in this report are based on gross oversimplifications and are for illustrative purposes only – they should not be used for design purposes.

It is unlikely that the buried manhole under the sea defence embankment can operate effectively under flood conditions because when all the pipes are working at full bore, there is 2.5 times more cross-sectional area of pipework entering the manhole compared to the combined cross-sectional area discharging from it. One circular pipe to the outfall would need

to be 350mm diameter to provide the same cross-sectional area as the pipework that enters the manhole.



**Figure 11. Schematic of inlet and outlet pipes at the buried manhole.**

To reduce flooding from Walls Drive by up to 11%, as much water as possible should be diverted southwards to the beck that bypasses the village instead of northwards to Main Street. The ground levels do not make this an easily achievable solution. Another option would be to divert some of the water west, straight down the slope but this would require the construction of a totally new drainage system which would have to cross the railway and the village centre, possibly connecting with the car park system.

## Appendix 5: Useful contacts and links

To report flooding: Incident hotline tel: 0800 80 70 60 (24hrs)

Floodline: tel. 0845 988 1188

**Cumbria County Council (Local Flood Risk Management):**

[lfrm@cumbria.gov.uk](mailto:lfrm@cumbria.gov.uk), [www.cumbria.gov.uk](http://www.cumbria.gov.uk), tel: 01228 221330

**Cumbria County Council (Highways):**

[highways@cumbria.gov.uk](mailto:highways@cumbria.gov.uk), [www.cumbria.gov.uk](http://www.cumbria.gov.uk), tel: 0845 609 6609

**Cumbria County Council Neighbourhood Forum:** tel: 01946 505022

[cumbria.gov.uk/sayit](http://cumbria.gov.uk/sayit)

**United Utilities:** tel: 0845 746 2200

**Copeland Borough Council**

[info@copeland.gov.uk](mailto:info@copeland.gov.uk), [www.copeland.gov.uk](http://www.copeland.gov.uk), tel: 0845 054 8600

**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>

**Highways Act 1980:**

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

**EA – ‘Living on the Edge’** a guide to the rights and responsibilities of riverside occupation:

<http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx>

**EA – ‘Prepare your property for flooding’** how to reduce flood damage including flood protection products and services:

<http://www.environment-agency.gov.uk/homeandleisure/floods/31644.aspx>

## Translation services

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