

Plumpton

Flood Investigation Report



Flood Event 5 December 2015

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.

On the 5th December 2015 various areas of Plumpton experienced flooding from ordinary watercourse and surface water. This caused both internal and external flooding to several properties due to the volume of rainfall and the incapacity of the drainage system which were not designed to accommodate such excessive flows.

This report has identified several contributing factors to the flooding including the heavy rainfall event and restrictions on the watercourses and drainage systems.

The report recommends various options with the intent to assist the Making Space for Water group with trying to identify options to reduce the flood risk including identifying sources of funding for possible options.

Event Background

Flooding Incident

Plumpton is a small village approximately 4 miles (6km) north of Penrith in Cumbria. The village is made up of the former separate hamlets of Salkeld Gate and Brockleymoore and consists mainly of houses along a minor road (the C3012) which connects the A6 to the B5305 near Skelton and also a few houses and farms along the A6 itself and Greenacres Park which is located to the east of the A6.

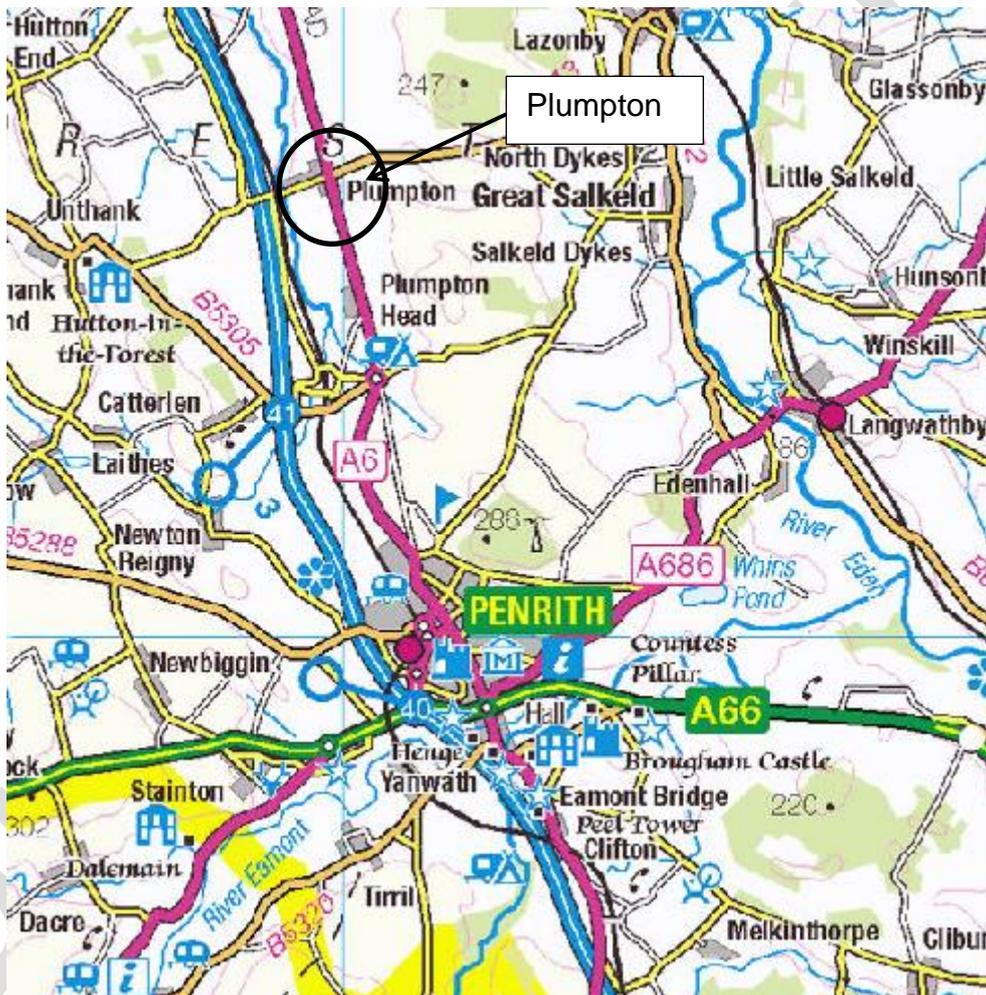


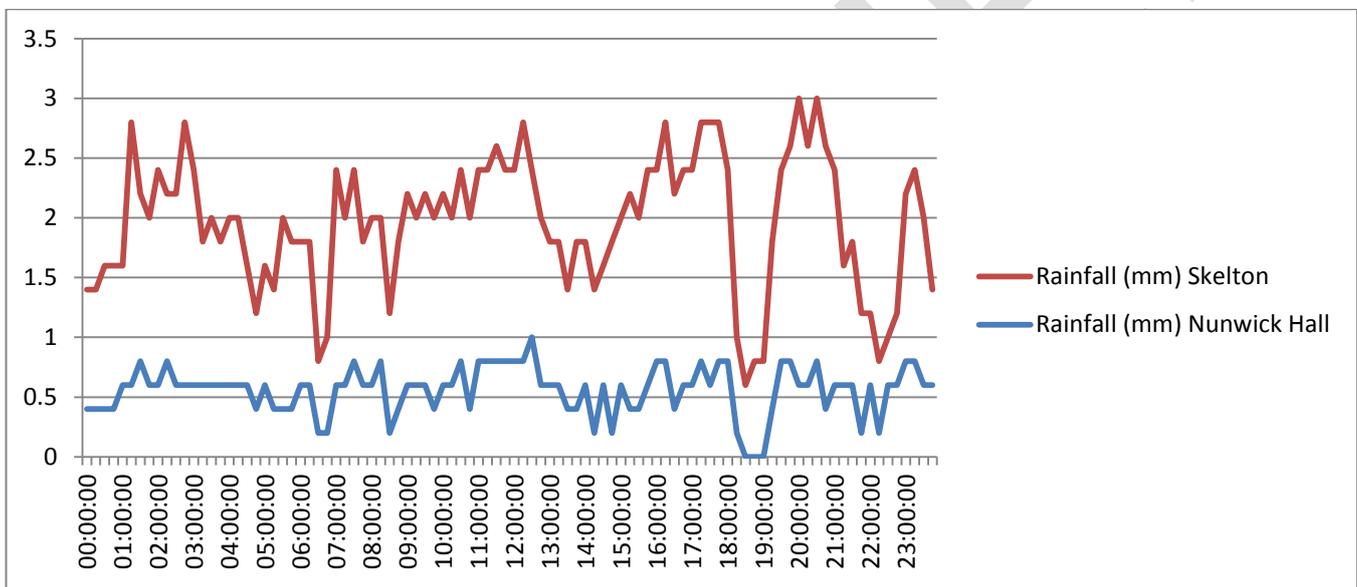
Figure 1: Location plan

Six properties were affected by the flooding internally. The majority of these were adjacent to the watercourse known as Brown Sike but others were affected by surface water runoff from surrounding fields which was conveyed along the highway. In addition to this part of the A6 became flooded (the A6 is a strategic diversion route for M6 closures).

Rainfall Event

In December 2015 slow-moving low pressure systems driven by a sustained moist south-westerly airflow brought prolonged heavy rainfall to northern and western areas with the persistent unsettled weather (including the named storms ‘Desmond’, ‘Eva’ and ‘Frank’) causing widespread and repeated flooding. Based on data released by the Met Office, December 2015 was the wettest calendar month on record (in a series from 1910) with new 24-hour and 48-hour rainfall totals of 341.4mm (Honister Pass, Cumbria) and 405.0mm (Thirlmere, Cumbria), respectively, delivered by Storm ‘Desmond’.

Specifically for Plumpton, the two nearest rainfall gauging stations are Nunwick Hall (NY 55404 35978) and Skelton (NY 43590 36078) which recorded rainfall totals of 53.6mm and 135mm on 5 December 2015. The rainfall levels experienced throughout the 5 December 2015 at the two rainfall gauging stations are illustrated in *Figure 2* below.



Contains Environment Agency information © Environment Agency and database right

Figure 2: Rainfall data for the 2 rainfall gauging stations closest to Plumpton on 5 December 2015.

Throughout the 5 December 2015 the rainfall averages 1.5mm per 15 minute interval throughout the day at the two gauging stations. The rainfall therefore was relatively constant until a peak was experienced at 20:00 of 3.1mm. This peak in rainfall could have contributed towards groundwater reaching saturation point and watercourses to become bank full and flood surrounding areas.

Investigation

Map of Flow Routes

The following plans show the Environment Agency mapping of the Risk of Flooding from Surface Water. Although the mapping is used as a guide to indicate at risk areas the map does indicate some of the areas that were affected by the flood during December 2015.

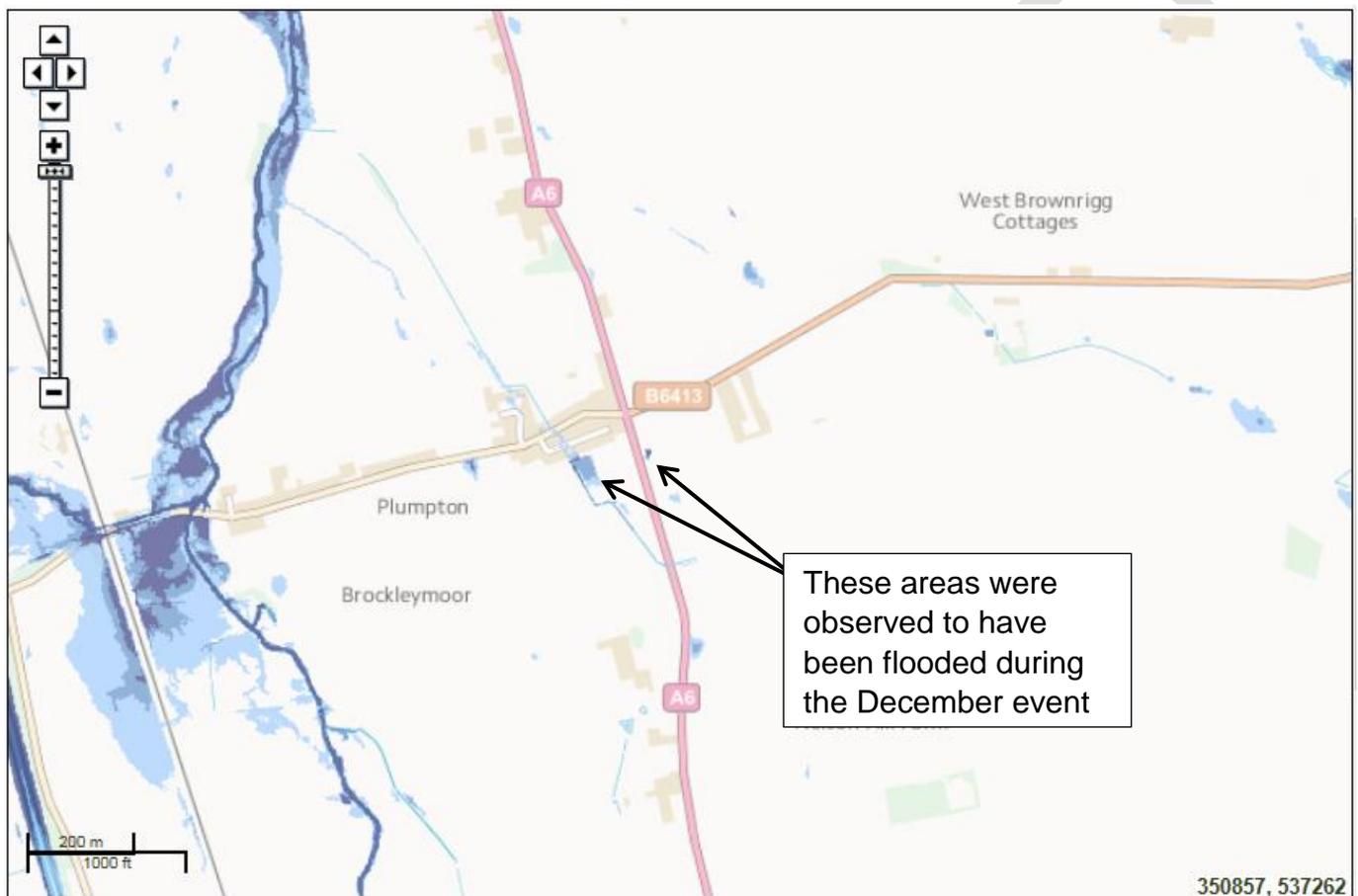


Figure 3: Extract from Environment Agency's Surface Water Mapping for the Plumpton area

Information has been gathered from residents regarding the flooding from a flood drop-in forum in April 2016 and site meetings with upstream landowners. Following the issue of the draft report further information and comments were received and have been included in this report in Appendix 4 with the this report being updated accordingly.

The following plan summarises the information that was obtained from residents and other interested parties following the flooding.

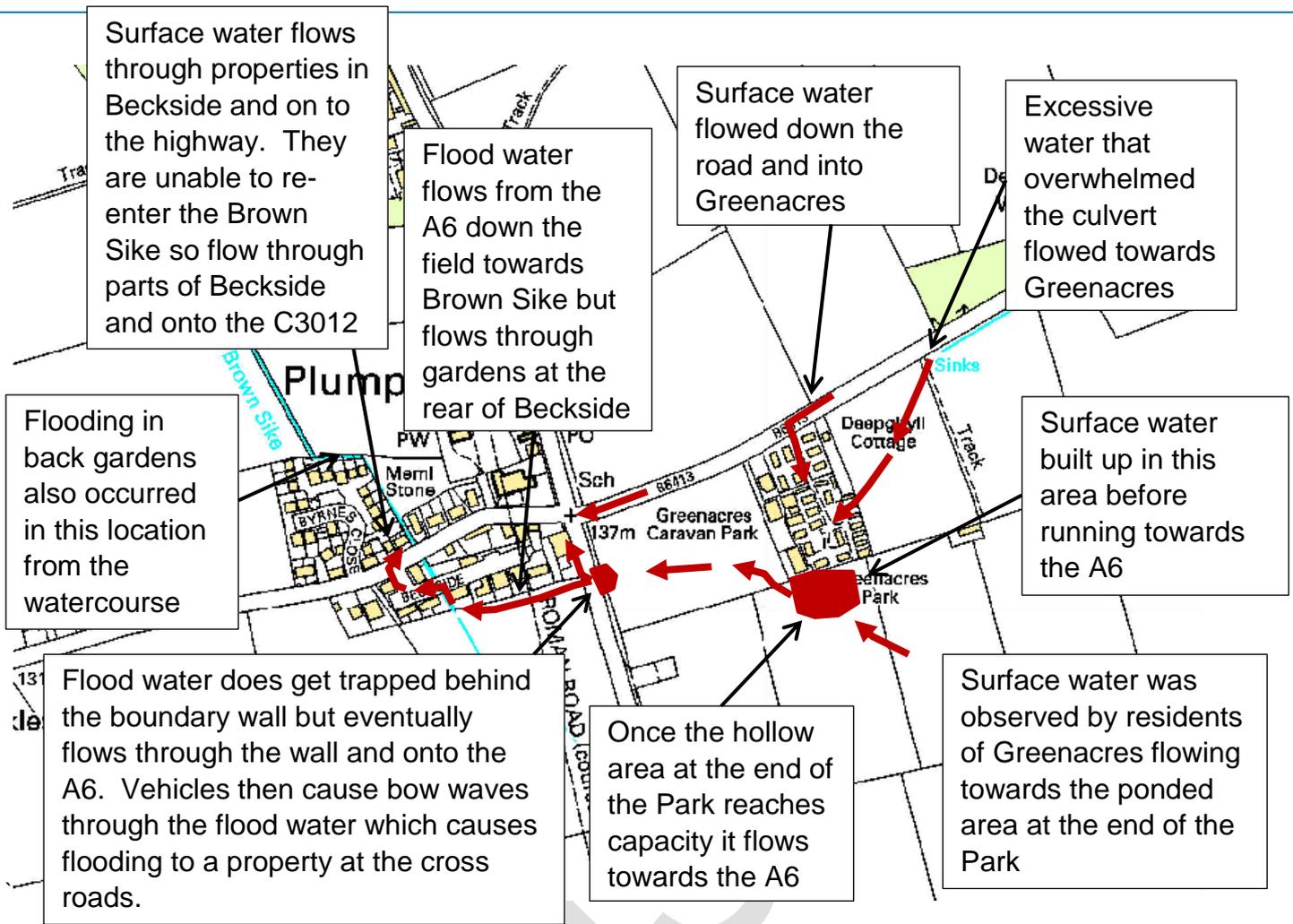


Figure 4: Plan illustrating flow routes around the Greenacres Park area during the December 2015 event

Residents of Greenacres Park were flooded from two sources, the overflow from Brown Sike as it tried to enter the culvert under the B6413 and the field to the south of them.

The culverted section of Brown Sike runs from adjacent the B6413 (NGR: 350171, 537256) in a south westerly direction until it discharges into an open section near the A6 (NGR: 349974, 536816). From observations on old maps it appears that this section of watercourse was culverted between 1867 and 1900. The following plan indicates the route of the culvert.

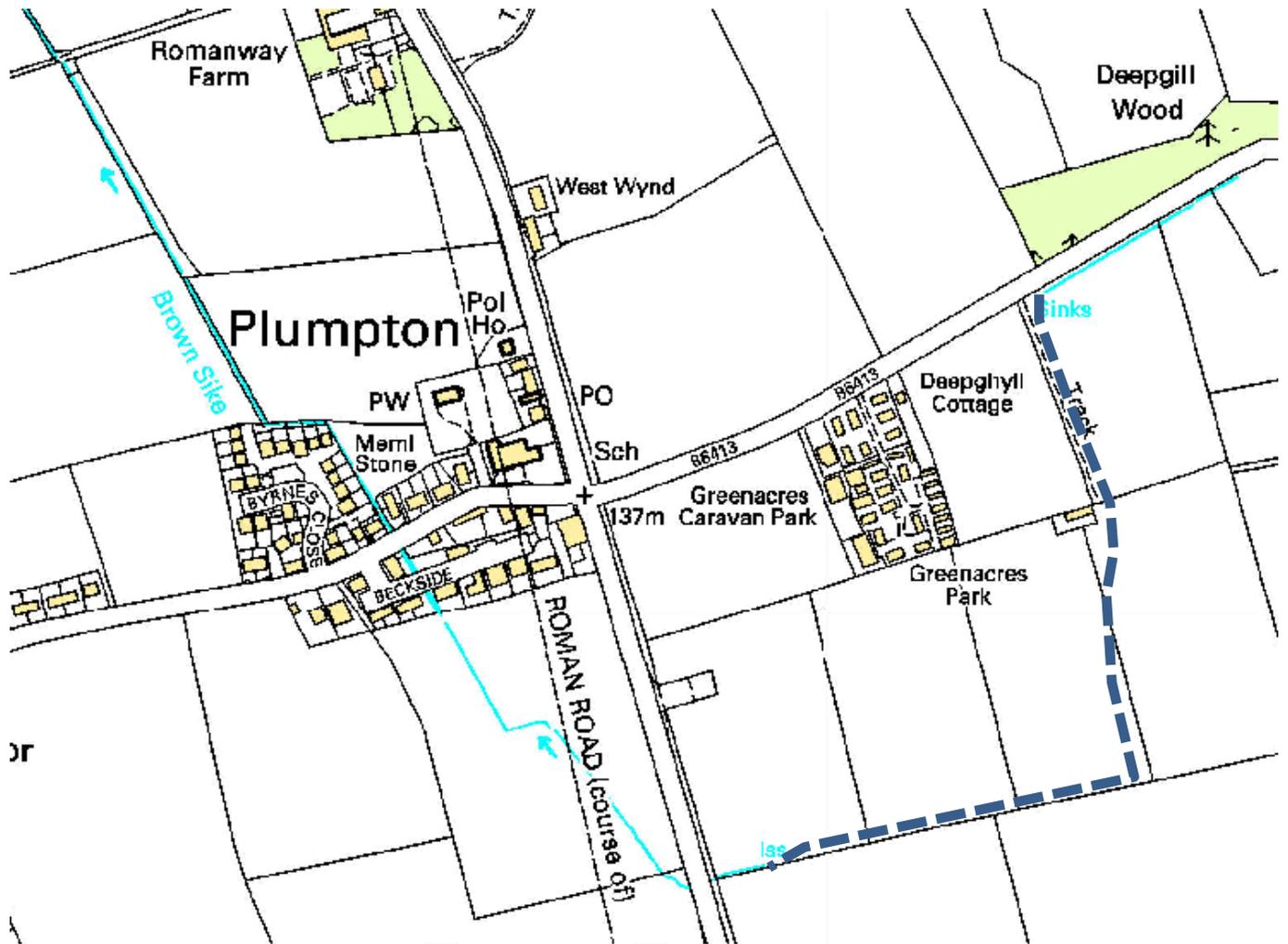
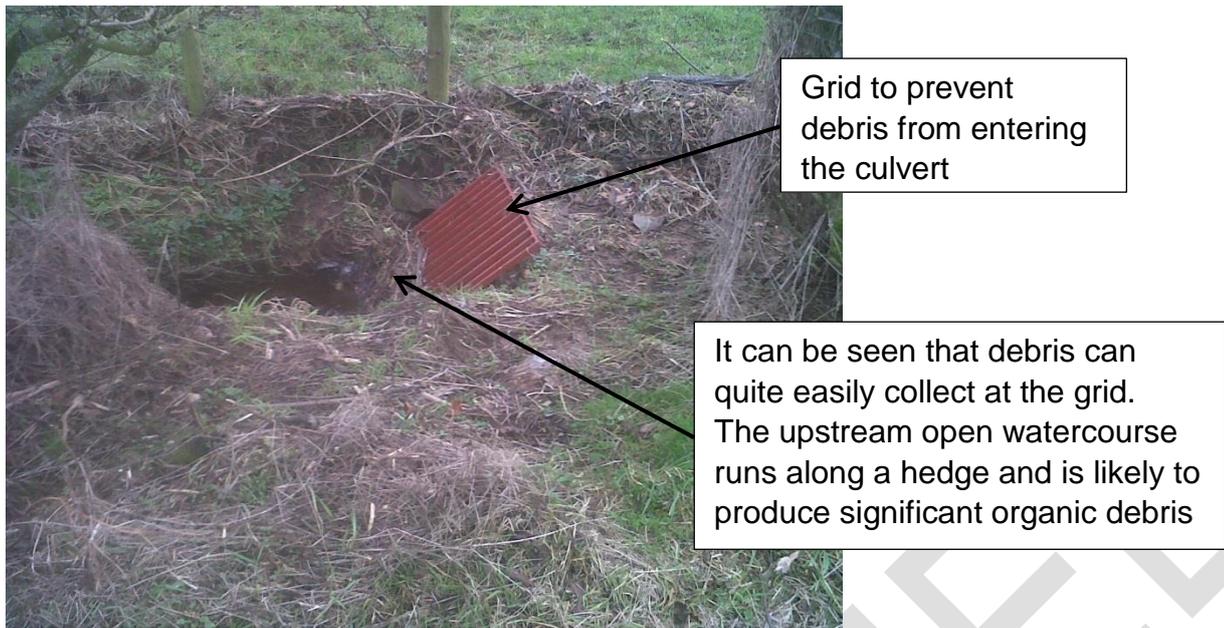


Figure 5: Approximate location of culverted section of Brown Sike

It is understood that some works have been carried out on the culvert at various times, with the most major works being carried out when a major gas main was installed through the field. An initial survey of the culvert has been carried out by a contractor on behalf of the National Grid. The survey has identified some locations where improvements and repairs are required. Although the Utility provider has stated that major works have been carried out by them on the culvert they do not consider themselves to be the riparian owner of the structure.

The entrance to the culvert is protected by a grid as shown in photograph 1. This is designed to trap debris from entering the culvert and creating a blockage within the culvert, however, it also creates a zone where debris can collect and block the entrance. Photograph 2 shows the debris that was washed over the field due to either a blockage of the culvert or under capacity of the culvert.



Photograph 1: Grid at the entrance to the culvert next to the B6413

During the December flood event the culvert overtopped allowing flood water to run across the field towards Greenacres Park.



Photograph 2: Debris from the flood water taken after the flooding had ceased

Another flood route towards Greenacres Park was from the highway. It is evident from the slot drain across the entrance that surface water runoff from the highway has been an historic issue in this area. The entrance to the Park is in an area where there is a dip in the road. It is also understood that the gullies and slot drain discharge to soakaways in the verge and during an event with the magnitude of storm Desmond soakaways are probably very unlikely to operate as they should. Photograph 3 demonstrates the flow routes into the Park entrances.



Photograph 3: The B6413 outside Greenacres Park

During the December event some of the residents created an opening in the boundary between the Park and the field to the south which allowed some of the flood water to dissipate. The hollow area to the south of the Park also fills with runoff from the surrounding fields and then flows towards the A6. Flooding of the A6 has been a concern of CCC Highways team for some time and alleviations works have been carried out to try to reduce the flooding on the highway as this is an important route as an M6 diversion.

The following photographs indicate the work that had been carried out. It is also known that there is a highway drainage pipe from the A6 to Brown Sike in this location and that it appeared to be under capacity for flows produced during heavy rainfall which lead to the installation of the alleviation feature. However, upon further investigation it was discovered that this pipe was severely damaged. Therefore, further works have been completed in October/November 2016 to repair the collapsed drain that conveys drainage from the Greenacres Park area and the A6.



Photographs 4 & 5: Drainage works to alleviate flooding on the A6

However, even though the above feature was installed prior to the December flood event the drainage pipe was still damaged and there was still flooding on the A6. Vehicle movement through this created bow waves which caused flooding to a property in close proximity to this area.

Once the flood water escapes through this hole it flows west to meet Brown Sike again. Photograph 6 shows the location of Brown Sike from the A6.



Photograph 6: Looking from the A6 towards the rear of the properties in Beckside

The flood water from the A6 joins the Brown Sike before it starts to flow through the village of Plumpton; however, as it entered the rear of Beckside it flowed out of bank and through a garden onto the highway. At this point it was unable to re-join the Brown Sike and flowed into a lower area where it caused internal flooding to properties.

The majority of Brown Sike through Plumpton is open watercourse except where vehicle crossing points are required. In the vicinity of Plumpton there are three culverted crossing points. Two are under adopted highways and the third is for the access to the wastewater treatment works. The following photographs indicate the condition of some of the reaches of open culvert through the village.



Photographs 7-10: Photographs of the open sections of culvert through Plumpton

The following plan indicates the location of the culverted vehicle crossing points.

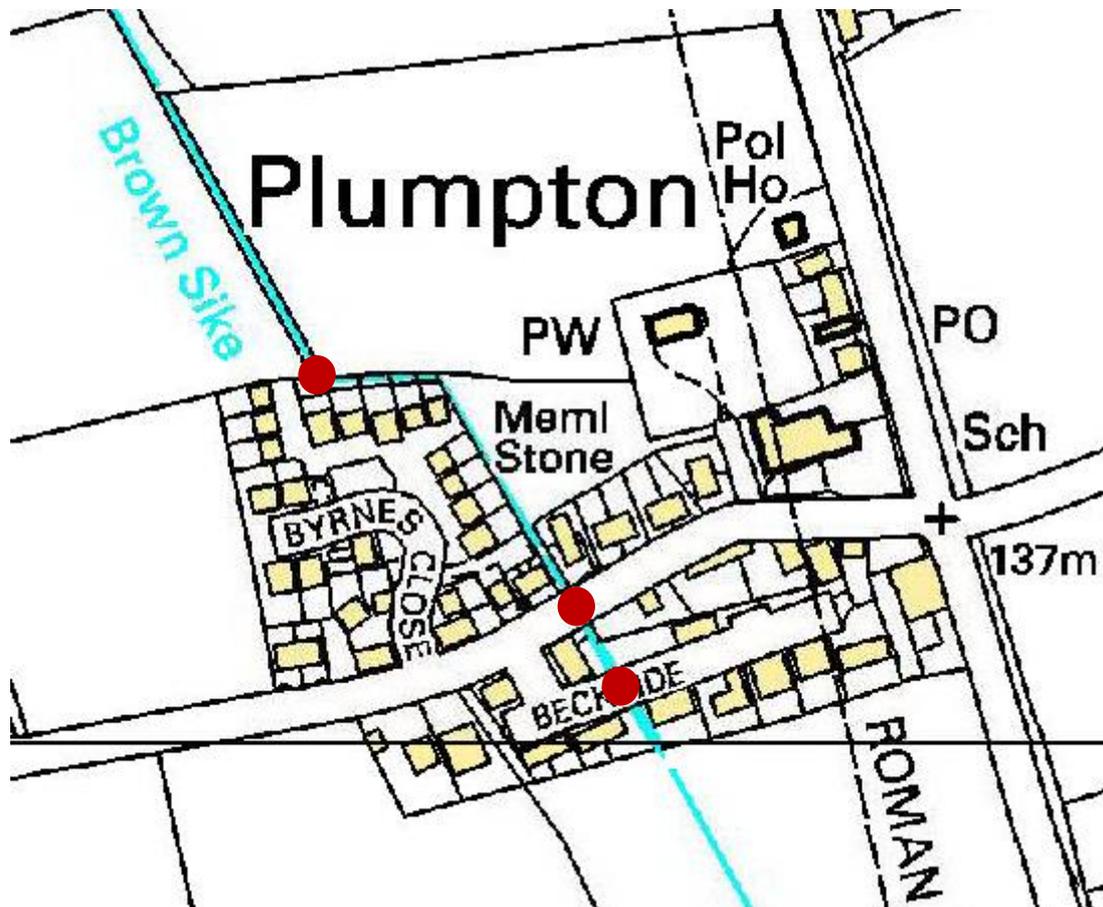


Figure 6: Location of culverted vehicle crossings shown by red dots

CCC has been informed that some of these crossing points had appeared to be causing a backing up effect during the flooding event. It was discovered that following the flood event that part of the structure under the C3012 was damaged and partially blocking the watercourse. As an action following the flooding CCC will carry out an assessment to establish the capacity of each culvert, and where required will work with the relevant owners to increase the size of the structures.

The vehicle crossing at the rear of Byrnes Close was particularly highlighted by the residents as being a restriction and caused the watercourse to back up and flood into some gardens. This vehicle crossing was constructed to allow access to the Wastewater Treatment Works.

Likely Causes of Flooding

It is evident from the information gathered that the primary cause of the flooding was the rainfall event which created large volumes of surface water that overwhelmed the Brown Sike and in particular the culverted section from the B6413 to the A6.

During investigations it was observed that the downstream end of the Brown Sike culvert appeared to be damaged. Although in normal flows this appears to allowing water to discharge

it is not known if this damage would have created a restriction during the flood event. It is also not known if this damage was caused during the December flood event.

Also the National Grid survey of the culvert indicated that there was also a poor repair on a section of the culvert, although it was not known if this caused debris to collect within the culvert during the flood event. Photographs 11 & 12 indicate the damage to the culvert.



Photographs 11 & 12: Damage at the downstream end of Brown Sike culvert

Another factor is the lack of capacity in the highway drainage to deal with extreme events. Highway drainage systems are designed to deal with runoff from highway surfaces and are not designed to deal with excessive runoff from surrounding land. In respect of the drainage at the entrance to Greenacres Park it is difficult to provide suitable drainage in this location as there are no easily accessible outlets to a suitable watercourse. Attempts have been made to drain the highway to soakaways but during events such as storm Desmond their effectiveness is limited.

The flooding on the A6 is caused by flood flow from the area near Greenacres Park discharging directly onto the highway. The highway drainage is unable to deal with this volume of flood water. Flooding to a property is also increased due to the movement of vehicles through this flood water. Investigations by CCC's Highway Department have identified that the piped drainage system from the A6 just south of the Plumpton crossroads was damaged. This was repaired in October/November 2016.

Flooding around the Beckside and Byrnes Close area is caused by the inability of flood water to be maintained within the watercourse channel. It was identified following Storm Desmond that one of the channels making up the road crossing on the C3012 (road through Plumpton) is partially blocked. Works to replace the road crossing are provisionally programmed in for 2017/18.

It has also been reported that a fence across Brown Sike downstream of the C3012 road crossing was also causing the watercourse to back up. This has since been removed.

During investigations some residents commented that there used to be a holding area for water upstream which had limited the flow in Brown Sike. The area in question which is southeast of West Brownrigg is within a Site of Special Scientific Interest (SSSI) and it is understood from the

landowner that works were carried out by Natural England that may have reduced the water holding capacity of the area. This area feeds into Brown Sike. The LLFA will investigate this with Natural England to see if there is any opportunity to increase the water holding capacity of the area particularly during extreme events. The following plan indicates the area.

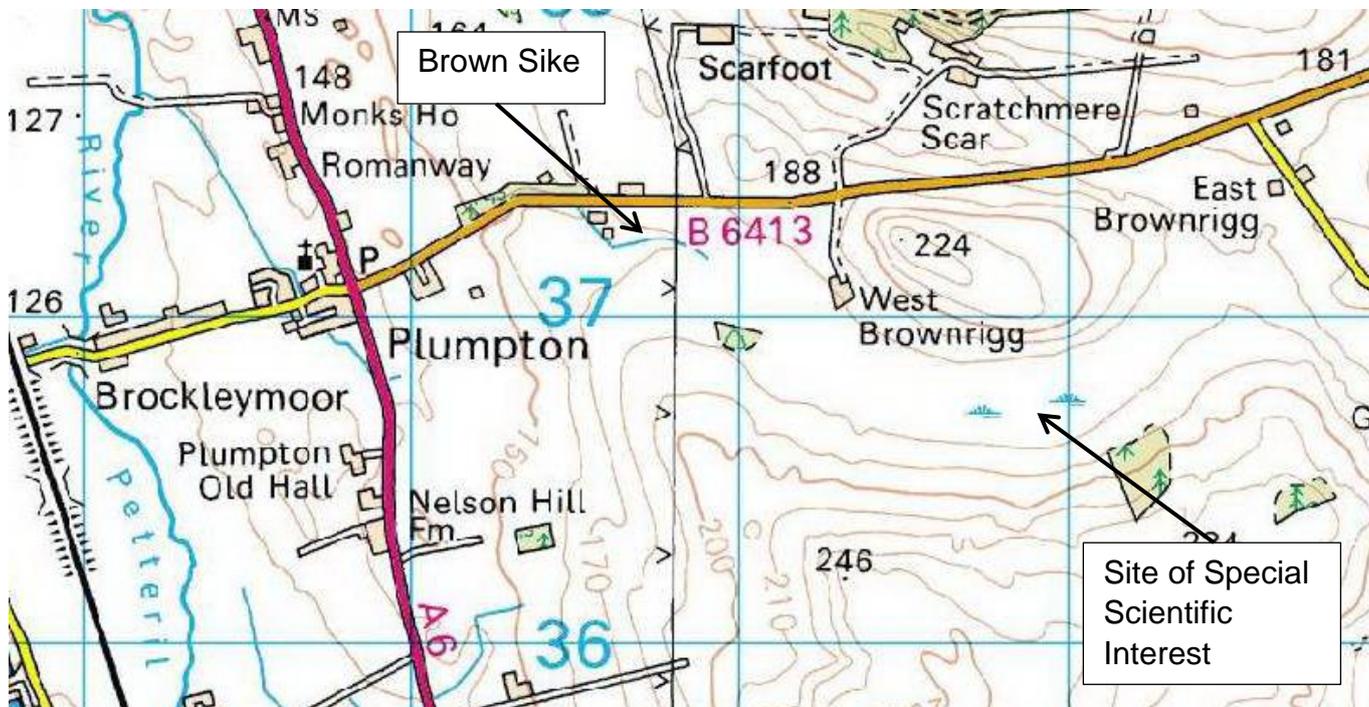


Figure 7: Site of Special Scientific Interest

Flooding History

Cumbria County Council Highways department have been involved in investigating flooding to the A6 as it is known that flooding has occurred quite frequently in recent years. Some works have been undertaken to try to reduce the risk of flooding on the A6 as this is an important road as it is the diversion route if the M6 needs to be closed and traffic diverted. When the A6 floods continued traffic movement causes flood water to be pushed towards the crossroads of the A6, B6413 and the C3012 and this is known to cause flooding to a property.

Recommended Actions

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

Cumbria Flood Partnership Theme	Action by	Recommended Action	Timescale
Maintenance	LLFA / Highways	Investigate highway drainage on the B6413 and A6 to confirm discharge points and condition	A6 discharge points have been investigated with the investigation on the B6413 still to be actioned.
	Highways	Carry out repairs to damaged drain downstream of A6.	Completed October/November 2016
	LLFA / Gas Utility company / Landowner	CCTV culverted section of Brown Sike from B6413 to A6 and progress identified actions	CCTV survey completed October 2016. Repairs and improvements ongoing
	LLFA	Assess capacity of vehicle crossing culverts on public highway.	Complete
	LLFA	Assess capacity of open sections of watercourse and liaise with landowners where appropriate to arrange cleaning	Prior to financial year 2017/18 to ensure any works to vehicle crossings on the public highway do not impact on downstream properties

Strengthening Defences	Vehicle crossing owners (UU track and public highways)	Where required upsize vehicle crossing culverts	Unknown as this will depend on landowner permissions and budget provision. Funding has provisionally been identified within the 2017/18 highways budget for the public highway crossings.
Upstream Management	LLFA / Eden Rivers Trust / Natural England / Landowner	Investigate possibly of increasing flood storage potential within SSSI	When resources are available.
	MSfWG	Investigate other areas of possible upland storage	When resources are available.
Community Resilience	Residents	Investigate property level protection for affected homes (flood doors, concrete floors etc). Grants available via District/Borough Council	2016
	Community	Consider the formation of a Community Action Group to assist vulnerable within the community	Timescale to be dictated by the community need and their requirements

* 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.

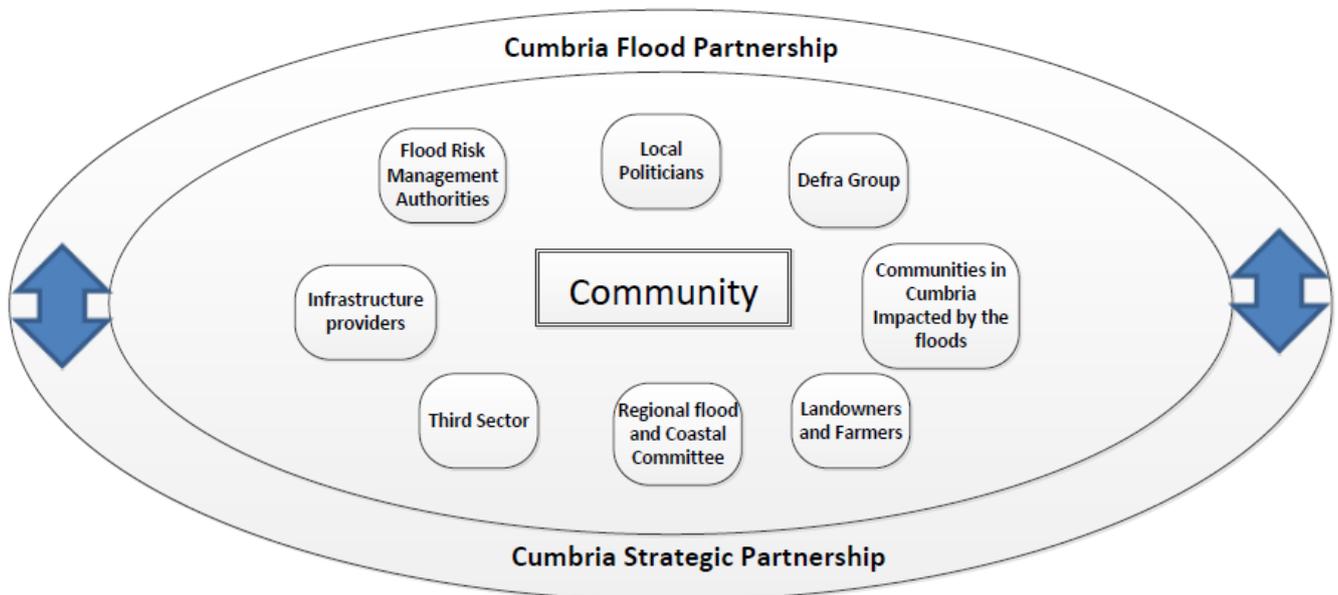
Residents and property owners who are aware that they are at risk of flooding should take action to ensure that they and their properties are protected. Community resilience is important in providing information and support to each other if flooding is anticipated. Actions taken can include laying sandbags and moving valuable items to higher ground, to more permanent measures such as installing floodgates, raising electrical sockets and fitting non-return valves on pipes. Anyone affected by flooding should try to document as much information about the incident as possible.

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, 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 defenses, 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 'Cumbria Floods Partnership' was set up by Flood Minister Rory Stewart 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 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.

This diagram below helps demonstrate how the two partnerships are working together:



Appendices

Appendix 1: Glossary

Acronyms

EA	Environment Agency
CCC	Cumbria County Council
UU	United Utilities
LLFA	Lead Local Flood Authority
MSfWG	Making Space for Water Group
FAG	Flood Action Group
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991
SSSI	Site of Specific Scientific Interest

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

The Flood Risk Regulations 1999 and the Flood and Water Management Act 2010 (the Act) have established Cumbria County Council (CCC) as the Lead Local Flood Authority (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
RIVERS					
Main river					
Ordinary watercourse					
SURFACE RUNOFF					
Surface water					
Surface water on the highway					
OTHER					
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 Cumbria County Council'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 (LLFAs) – 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 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 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.

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Appendix 3: Useful contacts and links

Cumbria County Council (Local Flood Risk Management):
lfrm@cumbria.gov.uk, www.cumbria.gov.uk, tel: 01228 221330

Cumbria County Council (Highways):
highways@cumbria.gov.uk, www.cumbria.gov.uk, tel: 03003032992
Out of hours emergencies should be reported via the Police on 101

Cumbria County Council (Community Development Team)
tracey.moran@cumbria.gov.uk, www.cumbria.gov.uk, tel: 01768 812661

United Utilities: www.unitedutilities.com, tel: 0845 746 2200

Eden District Council
Customer.services@eden.gov.uk, www.eden.gov.uk, tel: 01768 817817

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>

Appendix 4: Summary of feedback to draft report

The following information has been received either at the Flood Forum held in Plumpton on 29th June 2016 or subsequent meetings with landowners and residents.

- Confirmation of flow paths through Greenacres Park
- Verbal information regarding other potential obstructions to the watercourse within Plumpton
- Concern that remedial work to contain the water within the culverted section of Brown Sike could increase flooding at the rear of Byrnes Close.

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