Viaduct Estate, Carlisle

Flood Investigation Report

Flooding 22nd November 2012
Photograph supplied courtesy of Cumbria Indoor Bowling Club

Flood Event
24/25th September 2012
and
22nd November 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
Preliminary	Helen Renyard	Anthony Lane		17th April 2013
Draft	Helen Renyard	Anthony Lane		24th April 2013
Final	Helen Renyard	Anthony Lane	Doug Coyle	7th November 2013

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Executive Summary

Cumbria County Council (CCC) 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 Viaduct Estate is located next to the River Caldew in the central part of Carlisle. It is protected by a flood defence wall that has been improved during 2010.

Three high level river events occurred during 2012 on the River Caldew. The highest occurred on 23rd June 2012 but did not cause flooding on the Viaduct Estate. The two other events on 24th/25th September and 22nd November 2012, with lower river levels, caused flooding on the Viaduct Estate.

During the September event 3no businesses suffered from internal flooding as well as the Lower Viaduct car park and the Viaduct Estate road. There was no reported internal flooding during the November event but flooding to the car park and road occurred.

The flooding was identified to be caused by debris lodged in the flap valve on a United Utilities (UU) surface water outfall close to the upstream end of the Lower Viaduct car park. This allowed river water to flow through the drainage systems into the Viaduct Estate area.

Debris in the flap valve has been cleared by the Environment Agency (EA). This report recommends that the asset owner carries out routine inspections to ensure that the flap valve remains free from debris.

A further event which happened on 18th May 2013 are detailed in Appendix 4 where river levels and rainfall amounts were similar or greater than those in the events detailed above but where there were no reports of flooding. This helps to conclude that the clearing of the flap valve has reduced the risk of flooding.

Event Background

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

Flooding Incident

The Viaduct Estate is located in Carlisle between the River Caldew and the West Coast Main Line and is mainly a retail area including a café and leisure facilities in the shape of an indoor bowling club and bridge club. There is also a large car park owned by Carlisle City Council as well as some redundant car sales buildings. The area is reasonably flat but raises at either side of the area north-westerly towards Castle Way and south-easterly towards Victoria Viaduct. The area is protected from flooding by the River Eden by a flood defence wall which was improved in 2009 following the January 2005 flooding.

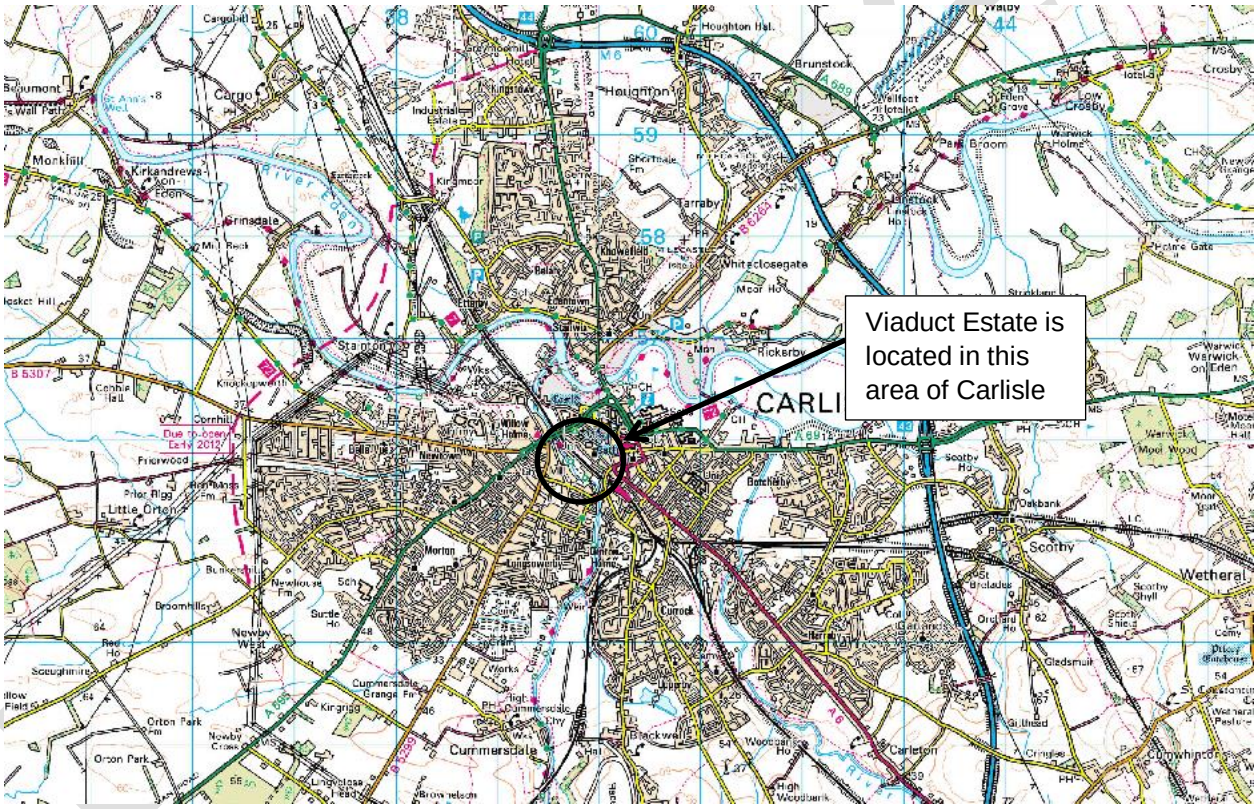

Figure 1: Location plan

3no business, Cumbria Indoor Bowling Club, Margie's Sugarcraft (units 10 & 11) and a vacant unit (unit 12) suffered internal flooding. The Lower Viaduct car park and the Viaduct Estate road were also flooded during the 24th/25th September 2012 event. There are no reports of internal flooding during the 22nd November 2012 event but the Lower Viaduct car park, Bowling Club car park and estate road did suffer from flooding. It should be noted that an event on 23rd June 2012 created the highest recorded river level on the River Caldew but there are no reports of flooding in the Viaduct Estate area. The location of the car park and flooded properties are indicated on the plan in figure 4.

Investigation

This section provides details of the authorities who have contributed to this investigation, an analysis of flow routes and details of likely causes of flooding. Also included are details of the rainfall event and any previous flooding history in the area.

The Fire Service attended both the September and November 2012 events to try to assist in pumping flood water away from properties. The EA, UU and Carlisle City Council have also provided input into this report.

Information gathered from business owners suggests that surface water surcharged from the gullies and manholes in both events. Property owners have also provided information to indicate the height of the flooding which has helped to confirm flood levels. There were no clear flood routes as the flooding was caused by surcharge from the surface water sewer systems rather than surface water being unable to enter the sewer systems.

The following photographs taken during the event on 22nd November 2012 indicate that the flooding occurred by surface water surcharging through the drainage systems.

Photographs 1 & 2: Flood water surcharging from gullies and manholes
Photographs provided courtesy of Cumbria Indoor Bowling Club 22nd November 2012.

In both the September and November 2012 flood events flood waters extended over the Lower Viaduct car park, Viaduct Estate Road and surrounded Cumbria Indoor Bowling Club and The Bridge Club. The following plan indicates the approximate area of flooding and includes water levels at various points that suggest the river level and flood level were at similar levels. The plan provides river levels during both the September and November 2012 events, however, it should be noted that the flood height levels cannot be relied on to be as accurate as the river levels recorded by the EA but do indicate that flood height levels followed a similar pattern to river levels. Also the flood height levels were obtained approximately 300m downstream of the river gauging station explaining why they are at lower levels than the gauging station.

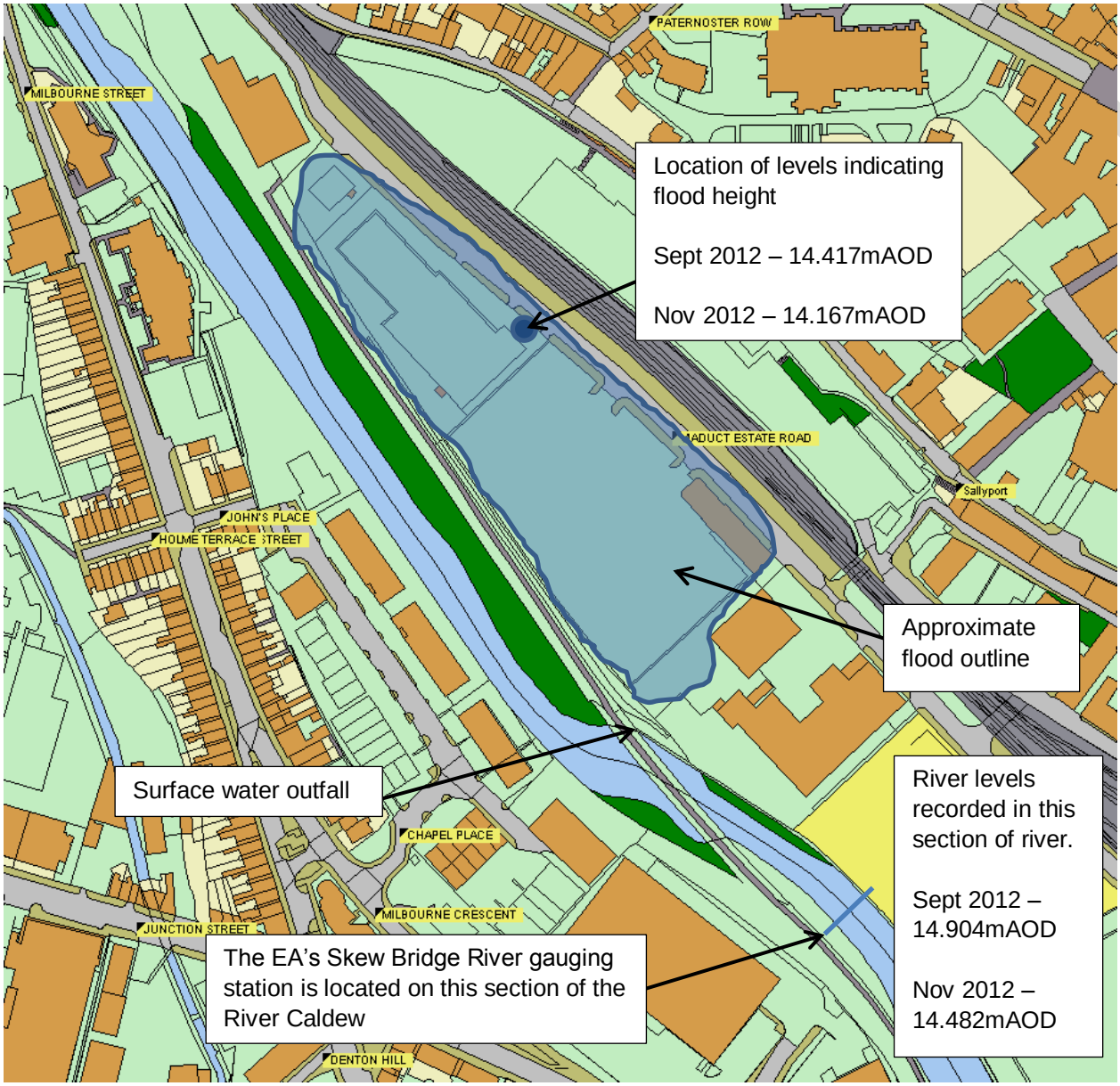

Figure 2: Plan indicating approximate flood area and providing flood levels

Carlisle City Council's Highway Supervisor was on site during the November flood and confirmed that the flood level was at its highest level at approximately 19.30 hours on 22nd November 2012. Information from the EA records the peak river level during this event at 19.45 hours which would suggest that flood levels and river levels are interlinked. The Supervisor also confirmed that flood waters had all dissipated by 21.30 hours. The river levels recorded at

21.30 hours were over 0.5m less than at 19.45 hours which would have allowed the flood water to drop below the ground levels in Lower Viaduct car park and the surrounding area.

Rainfall Event

There have been three significant rainfall events causing high river levels on the River Caldew during 2012. The event on the 23rd of June 2012 produced the highest recorded river level on the River Caldew but there was no reported flooding in the Viaduct Estate area.

The event on the 24th/25th September and 22nd November 2012 caused flooding to the Viaduct Estate area, even though river levels were lower than June 2012.

The graphs below and on the following page show recorded river levels and rainfall from the EA's river gauging station at Skew Bridge (behind Dunelm) and rain gauges at Mosedale (upper reaches of Caldew catchment) and Willowholme, Carlisle. The river gauging station at Skew Bridge records the river levels in the River Caldew in metres above a datum height at the station which can then be converted to metres above ordnance datum (mAOD). This can then be used to make comparisons between the river levels and the height of flooding in the Viaduct Estate area as is indicated in figure 2. The rain gauges at Mosedale and Willowholme record the actual depth of rainfall in mm per hour.

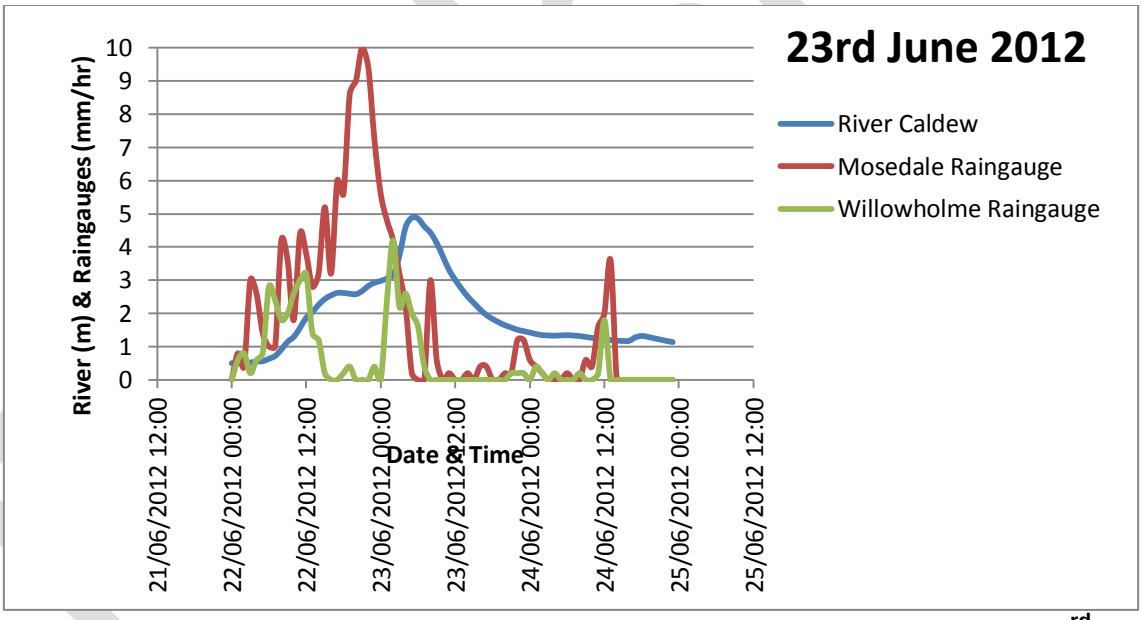

Figure 3a: Hydrograph and Hyetographs showing river and rainfall data on 23rd June 2012

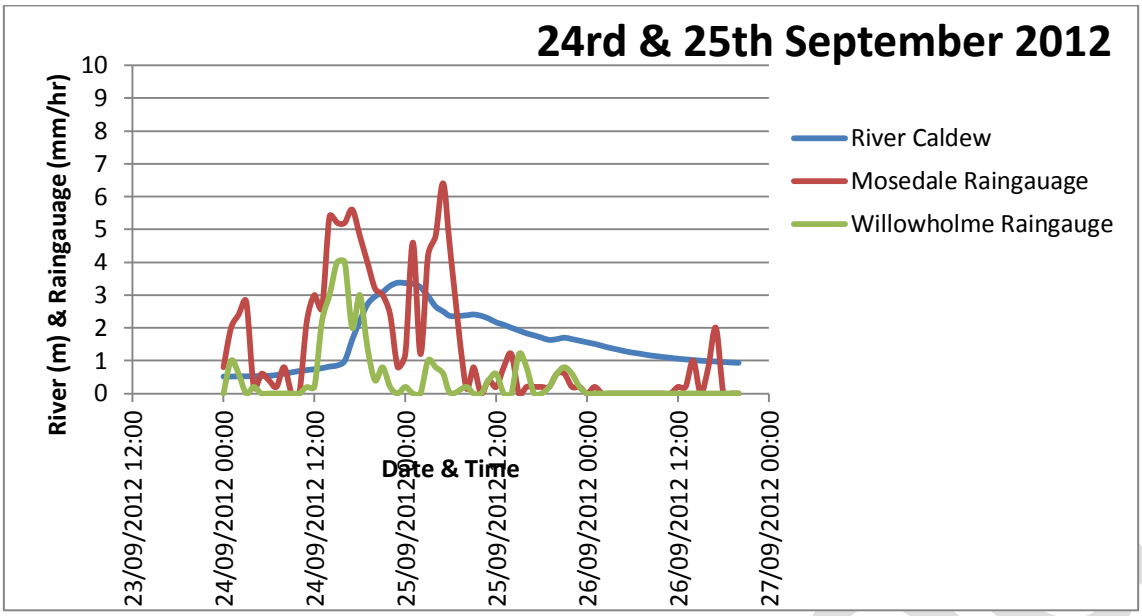

Figure 3b: Hydrograph and Hyetographs showing river and rainfall data on 24th & 25th September 2012

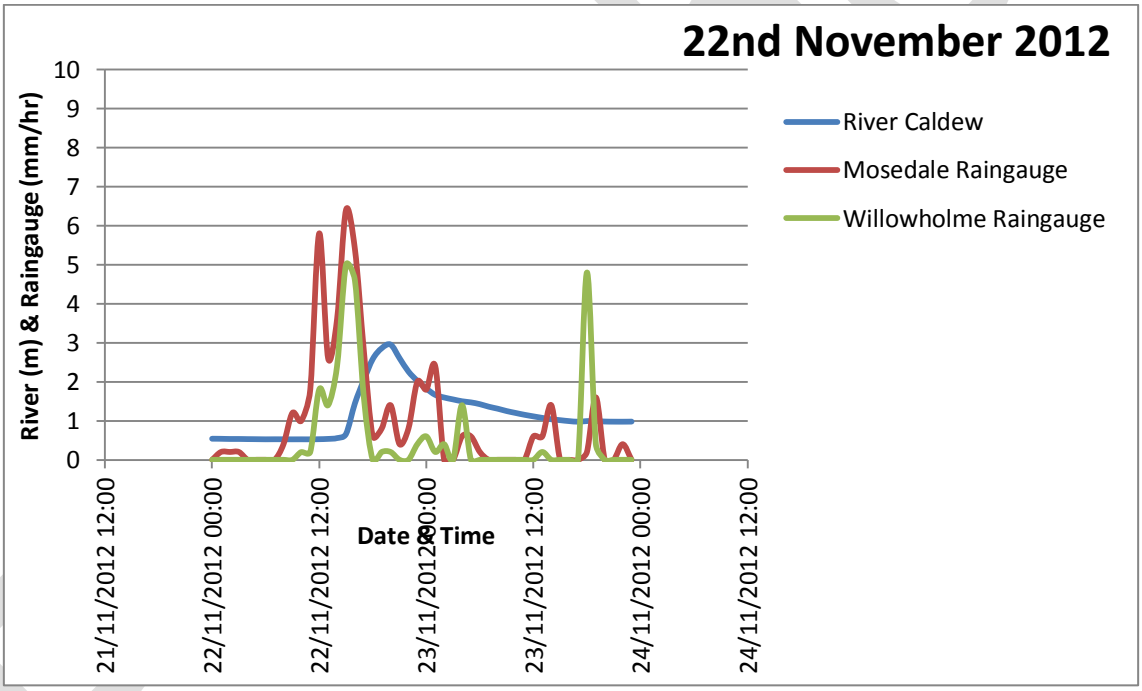

Figure 3c: Hydrograph and Hyetographs showing river and rainfall data on 22nd November 2012

The information in the graphs has been used to determine if there was a significant difference in the amount of rainfall in Carlisle that may have caused the flooding in September and November 2012 but not caused flooding in June 2012. The rainfall graphs show that there was heavy rainfall in Carlisle (recorded on the Willowholme rain gauge) for all three events prior to the peak river level in the river Caldew. This would rule out the likelihood of the flooding being caused by incapacity of the drainage system because flooding would have occurred during the June 2012 event as well as during the events in September and November 2012.

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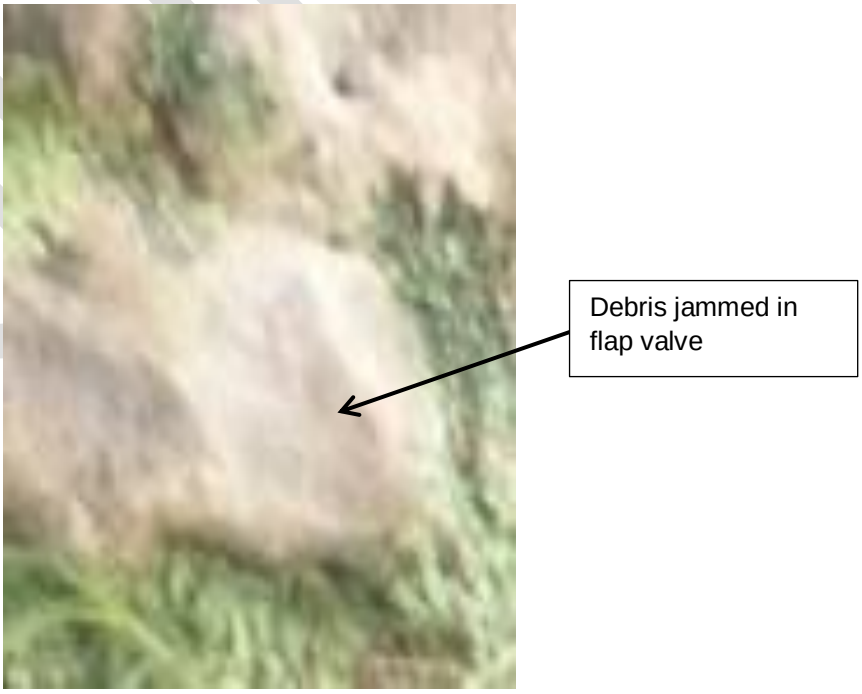
Likely Causes of Flooding

Business owners have expressed concern that the flooding may have been caused by surcharging from the foul sewer overflow from the system that runs through Town Dyke Orchard Car Park, indicated in figure 4. However, there are unlikely to be any connections through which this could happen between the manhole in the Town Dyke Orchard car park and the flap valve at the River Caldew as any connections will mean that foul sewage would be discharged to the River Caldew during normal flows. Also if this sewer was to surcharge then the initial flooding would be expected in the Town Dyke Orchard car park. As there has been no recorded reports of flooding from the manhole in Town Dyke Orchard car park flooding from this source has been ruled out. These details are highlighted in figure 4.

Business owners have also expressed concern that flooding occurs when the river levels are high and there is heavy rainfall in the Carlisle area. Rainfall intensities reached similar levels during each of the three events investigated in 2012 but flooding occurred only during the latter two. The graphs in the Rainfall Event section show levels of rainfall and river levels for the June, September and November 2012 events.

Following routine inspections by the EA it was identified that the flap valve on the surface water sewer discharging to the River Caldew upstream of the Lower Viaduct car park was jammed open by debris. It is unclear how long the debris had been in place but the EA inspection sheets identify the flap valve to be clear from debris on 25th May 2012 but not on 30th November 2012.

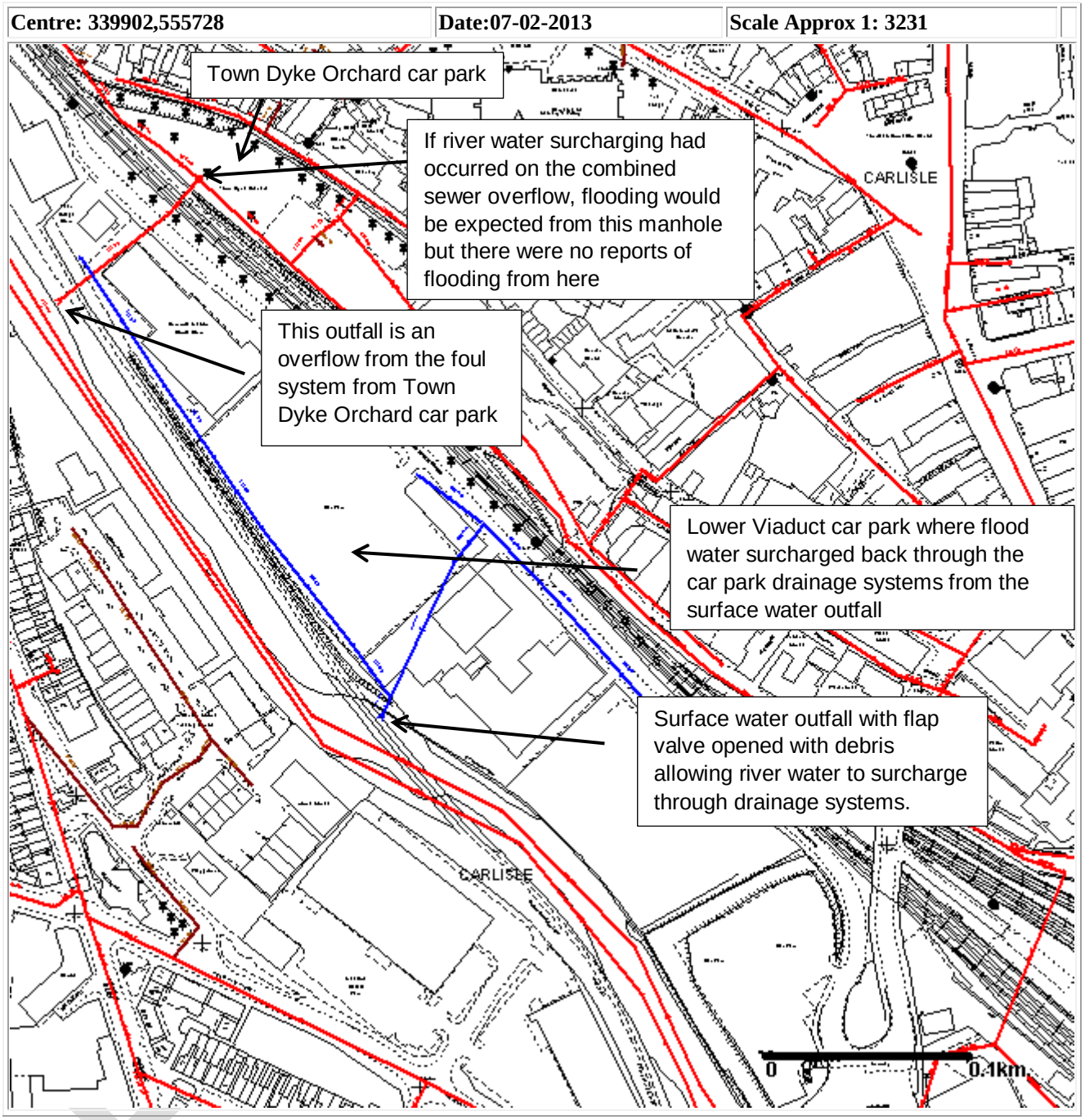
From the information available the most likely cause of the flooding is due to the surface water outfall being jammed open allowing river water to flow back through the drainage systems to flood the Viaduct Estate area. The following photograph shows the surface water flap valve.



Photograph 3: Debris jammed in flap valve on surface water outfall
Photograph courtesy of the EA

The plan on the following page shows the location of the surface water outfall.

Issued to CUMBRIA **of** Cumbria CC **on 07-Feb-13** **NOT FOR RESALE OR NON-APPROVED USE**



Extract from Map of Public Sewers

Do not Scale

Red or Brown - Foul Sewers
Blue - Surface Water Sewers

——— Public Sewer
– – – – – Highway Drain
— – — – Private Sewer
— – – — Pumping Main

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded.United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown

United Utilities

Figure 4: Plan showing location of surface water outfall

Flooding History

The Viaduct Estate area was also flooded in January 2005. Information provided by the owner of one of the flooded properties suggests that the area flooded from surface water prior to any fluvial flooding. However, due to the extent of the flooding in January 2005 confirmation of the cause of the initial flooding is not available. It is possible that the flooding mechanism was caused by similar circumstances to those in 2012 by river water back flowing through the surface water outfall.

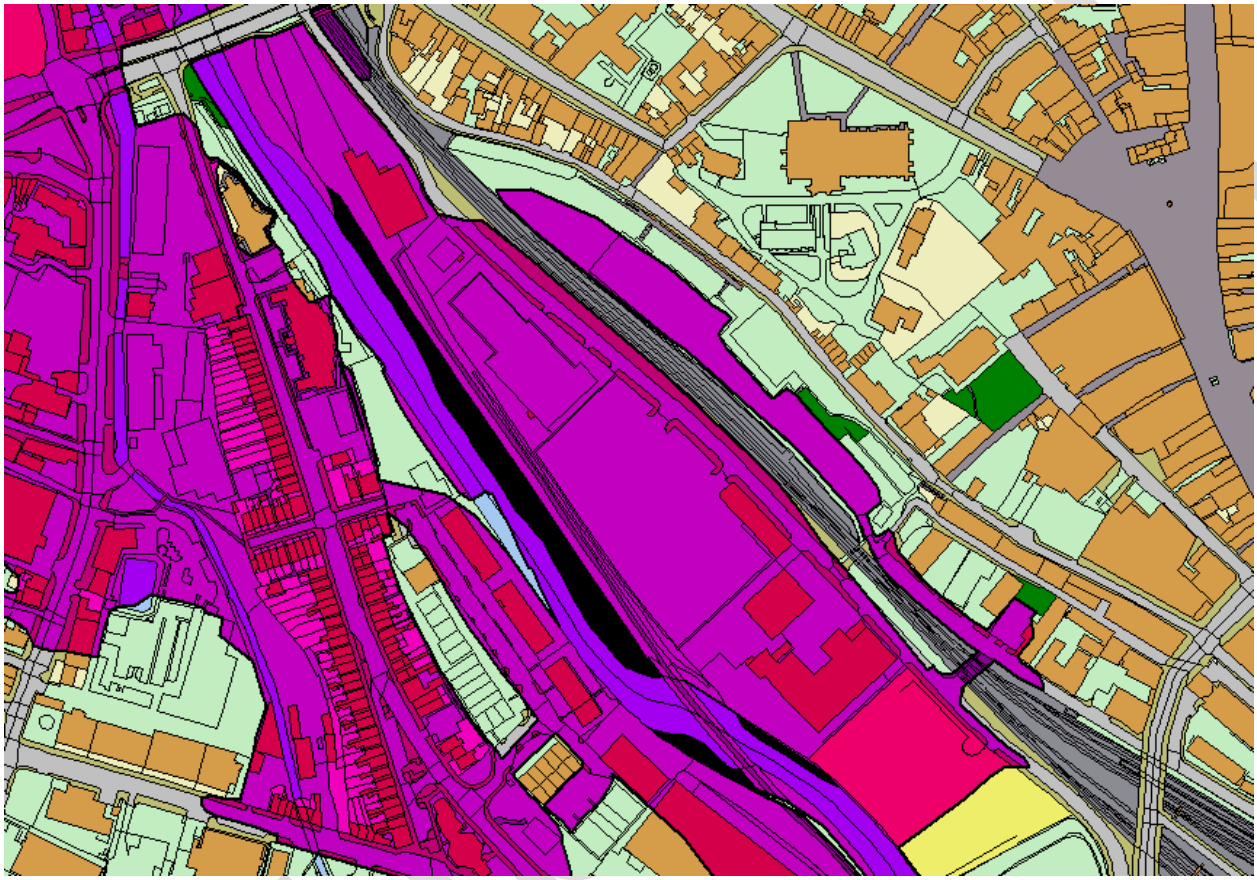


Figure 5: Outline of the flooding during January 2005 indicated in purple

Recommended Actions

Action by	Recommended Action	How
EA	Clear debris from surface water drainage flap valve	Remove debris to allow flap valve to close correctly. COMPLETED
UU	Continue to monitor build up in the flap valve.	Inspect periodically to ensure no build-up of debris. ON-GOING
UU	Review suitability of existing flap valve structure	Use current best practice guidelines to ensure flap valve operates with minimum risk of blockages
Business owners and users of the Viaduct Estate	Continue to report any flooding that occurs in the future	Use the contact details provided for UU, EA and CCC in Appendix 3 of this report
Business owners and users of the Viaduct Estate	Remain vigilant and report any debris build up in the location of the surface water outfall near Skew Bridge	Report debris in the surface water flap valve to UU on 0845 746 2200.

Next Steps

CCC 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 2.

Appendices

Appendix 1: Glossary

Acronyms

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

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.

Appendix 3: Useful contacts and links

Cumbria County Council (Local Flood Risk Management):
lfrm@cumbria.gov.uk, www.cumbria.gov.uk, tel: 01228 211300

Cumbria County Council (Highways):
highways@cumbria.gov.uk, www.cumbria.gov.uk, tel: 0845 609 6609

Cumbria County Council (Neighbourhood forum):
paul.carrigan@cumbria.gov.uk, **www.cumbria.gov.uk**, tel: 01228 221054

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

Carlisle City Council:
www.carlisle.gov.uk, tel: 01228 817200

Environment Agency:
www.environment-agency.gov.uk,
Floodline: 0845 988 1188, **General Enquiries**: 03708 506 506

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: Update following river and rainfall event on 18th May 2013

This update provides information on the significant event that occurred on the 18th May 2013 and provides a hydrograph / hyetograph graph which demonstrates that similar or higher levels of rainfall and river levels were reached to the previous events on 23rd June 2013, 24th/25th September 2013 and 22nd November 2012.

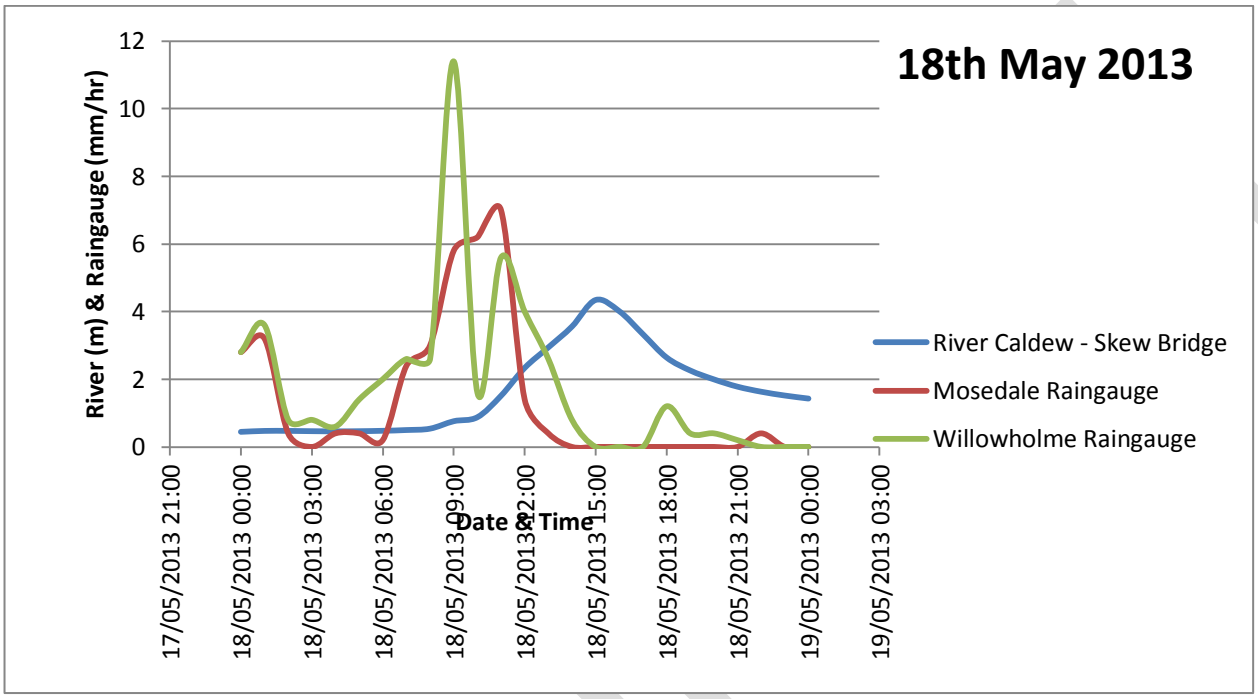


Figure 6: Hydrograph and Hyetographs showing river and rainfall data on 18th May 2013

CCC has not received any reports from the public or other Risk Management Authorities to suggest that flooding occurred on 18th May 2013. From this it can be concluded that the clearing of the flap valve on the surface water system has helped to prevent flooding during this event.

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