



Appendix B

Flood Investigation Report Section 19, Flood & Water Management Act (2010)

Upper Calder Valley – 22nd June 2012 Flood Incident

Control Sheet

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Flood Investigation

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Executive Summary

On the 22nd June, a large storm brought heavy rainfall to the Pennine region. In Calderdale, the upper valley area was badly affected by flooding from a variety of sources. The communities and infrastructure worst affected by the flooding were principally those located in the Upper Calder Valley immediately adjacent to the River Calder, Walsden Water and the Rochdale Canal. The towns and villages impacted the most were Walsden, Todmorden, Hebden Bridge, Mytholmroyd, and Brearley/Luddenden Foot. The key infrastructure affected was the Rochdale Canal, Rochdale Road (A6033) and Halifax/Burnley Road (A646).

In response to the flood event this Section 19 - flood investigation report has been completed by Calderdale Metropolitan Borough Council (CMBC) as the Lead Local Flood Authority (LLFA), under the duties set out in Section 19 of the Flood & Water Management Act (2010). It was deemed necessary to complete an investigation as properties and infrastructure were badly affected throughout the borough.

A large data collection exercise was undertaken between key stakeholders, CMBC and third parties to understand the flood mechanisms, extent of flooding and an assessment of the damage created.

Approximately 250 businesses and 900 properties have been directly affected by the flood event. The report has identified the key areas that were mainly affected and the mechanisms that caused the flooding in those areas.

The main flood mechanisms have been identified as;

- Excessive surface water entering the Rochdale Canal overloading the canal network,
- The interaction between the Main River and the Rochdale Canal flooding surrounding areas,
- Sewer flooding along Rochdale, Halifax and Burnley Roads,
- Sub-catchment watercourses surcharging onto railways and highway,
- Main River overtopping defences,
- Hillside surface water runoff in Walsden.

It has been established that the river levels recorded have been some of the highest ever recorded in some parts of Upper Calder catchment. A full hydrological report has been completed by the Environment Agency (EA) for this storm event. The report should be reviewed in line with the findings of this report.

This report has identified the relevant risk management authorities and their roles and responsibilities for flooding, according to the Flood & Water Management Act (2010). This report summarises the activities risk management authorities have undertaken according to these roles and responsibilities.

All flood risk management authorities, strategic partners and community groups have undertaken activities to restore the Upper Calder Valley to a working order. All short-

term mitigation measures have been implemented. Capital works or investigations have been identified and are subject to resource and availability of funding. These are likely to continue through 2013.

This report shows the significant contribution each risk management authority, volunteer groups, community groups and local businesses have made during and post-flood event. It is hoped that all parties continue to build on these relationships for a speedy recovery.

In response to the flood event Flood Steering Groups have been set up to understand and manage the residual flood risk within the Upper Calder catchment. The Steering Groups consist of risk management authorities and third parties.

The Rochdale Canal, Main River and the sewer have played a pivotal role in the flood event. The EA, in collaboration with risk management authorities, is developing a hydraulic model to better understand flood risk within the catchment. The results of the modelling are expected in the summer of 2013.

Short-term plans have been implemented for the Christmas period to boost the local economies in the affected communities. The council will continue to engage with the local communities and implement the flood recovery plan.

Acknowledgements

The Council would like to thank Yorkshire Water Services Ltd, the Environment Agency, Network Rail, Canal & River Trust and the National Flood Forum for their assistance in this investigation.

The Council would like to thank members of the Calderdale community, businesses and community groups for their on-going assistance and support in the aftermath of the flooding this summer.

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1 Introduction

1.1 Background

An investigation into the flood event on the 22nd June 2012 is required as approximately 760 - 900 properties were affected by the flooding in the Calderdale area. There was also significant disruption to key infrastructure throughout the Upper Calder valley. Several kilometres of highway have been repaired and bridge and culvert structures suffered structural damage.

Calderdale Metropolitan Borough Council (CMBC) as the Lead Local Flood Authority (LLFA) has a responsibility to record and report flood incidents in accordance with Section 19 of the Flood and Water Management (2010) Act:

(1) On becoming aware of a flood in its area, a LLFA 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 report summarises the extent, flood mechanism and impact of the flooding in Calderdale. This report outlines the basic responsibilities of the risk management authorities involved, outlines their response to the flood event and identifies any potential future actions.

1.2 Flooding Location

The communities and infrastructure worst affected by the flooding were principally those located in the Upper Calder Valley immediately adjacent to the River Calder, Walsden Water and the Rochdale Canal. The towns and villages impacted the most were Walsden, Todmorden, Hebden Bridge and Mytholmroyd (see Figure 1).

The key infrastructure affected was the Rochdale Canal, Rochdale Road (A6033), Halifax/Burnley Road (A646), Copley Bridge and a section of public sewer.

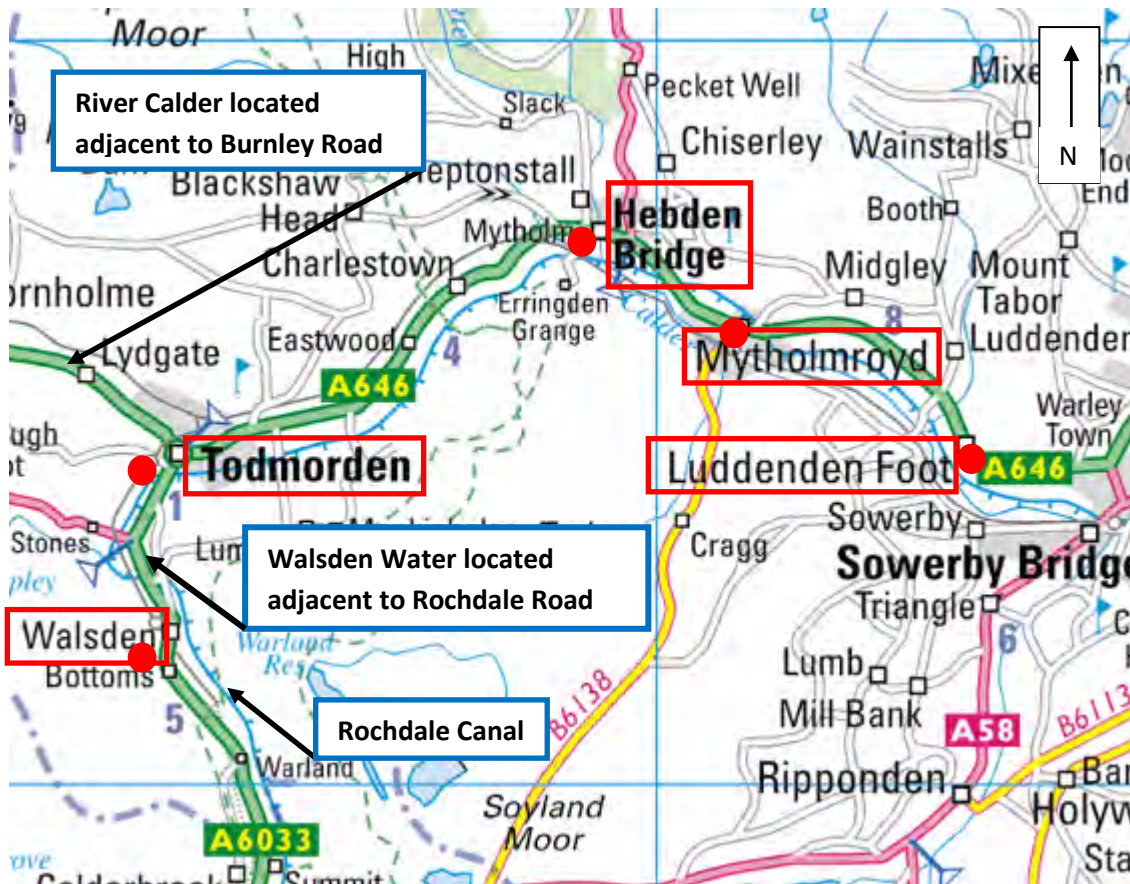


Figure 1 – Location of communities affected by 22nd June flooding (Source: streetmap.co.uk)

1.3 History of Flooding

Calderdale has a long history of flooding from a variety of sources including surface water flooding (pluvial), river (fluvial) or a combination of these. Significant fluvial and pluvial flooding has occurred in the recent past particularly 2000, 2006, 2007, 2009 and 2011. Due to the nature of the topography in the Upper Calder and Walsden Valleys, surface water collects quickly in the valley bottom because of steep valley sides and rapid runoff from thinly vegetated and impermeable surfaces. Many of the areas affected by flooding in this event have been affected by similar flooding in previous events. What distinguishes this flood event from the historic flooding is the flood mechanism which is discussed in Section 2.

The majority of the historical pluvial and fluvial flooding has occurred in the winter and has been the result of a period of prolonged heavy rainfall. However, more frequent annual surface water and fluvial flooding has occurred in the summer months as a result of short duration, high intensity storm events. The extent of the flooding in this event is within the areas indicated on the Environment Agency (EA) Flood Maps for Surface Water and fluvial flooding.

2 Flooding Incident

2.1 Flood Warnings and Alerts

A number of flood warning communications were received by CMBC and the local community prior to the 22nd June flood event. The key communications are summarised below:

- **21st June 10.30** – The Met Office (Flood Forecasting Centre) issued a Flood Guidance Statement (FGS) indicating a Low risk of surface water flooding due to slow moving high intensity, short duration storms and a low risk of river flooding in northern England,
- **21st June 14.30** – The Met Office issued an updated FGS warning of persistent, heavy rain in the Pennine areas of north, west and South Yorkshire and a Medium risk of river and surface water flooding. A Met Office Yellow warning was in force,
- **22nd June 10.30 and 14.00** – The Met Office indicated there to be a Medium risk of both surface water and river flooding for parts of North West and East England,
- **22nd June 11.28** – A flood alert was issued by the Environment Agency indicating possible flooding in the River Calder Upper Catchment. The Walsden Water river level recording station had triggered the flood alert, which also indicated that flooding was possible from Todmorden to Brighouse in the following two hours,
- **22nd June 19.39 - 20.07** – The EA reported that all the Flood Warning Sirens in Hebden Bridge, Mytholmroyd and Todmorden sounded, with the exception of the Walsden, Rochdale Road siren which failed. 3889 properties received flood alerts and warnings from the EA Flood Warning Service between 10.39 and 23.52 on the 22nd June. An average of 78% of the registered properties received a flood warning.

Residents in Hebden Bridge reported that they did not receive a flood warning via Flood Warnings Direct. On review, the flood levels had not reached the trigger level in Hebden Bridge for the flood warning to be issued.

EA flood warnings are available on the Calderdale Website, please use the following link;

<http://www.calderdale.gov.uk/advice/emergencies/flooding/index.html>.

2.2 Risk Management Authorities Immediate Response

A summary of the activities risk management authorities undertook during and immediately after the flood event is summarised below:-

Calderdale Metropolitan Borough Council

CMBC implemented relevant emergency plans during and after the flood event. In Todmorden evacuated property owners were directed to shelters. Sandbags were deployed in line with Council policy at properties in the centre of Mytholmroyd. The Calder then came out of channel in a number of locations up the valley seriously inhibiting the ability to deploy sandbags in the other townships.

An Emergency Planning control room was set up during the flood event. The Council's out of hours emergency response was then coordinated from the control room by Emergency Planning and other Service representatives. This included welfare arrangements for those sections of the community physically affected by the floods. An Emergency Planning Adviser was also in attendance at the multi agency control room at the police station to ensure there was a coordinated response between the Council and other responding agencies.

The Council emergency control room was open throughout Friday evening until 04:00 Saturday morning. Meetings were held on Saturday morning to coordinate Council Services and other agencies on the immediate tasks.

Drainage contractors were deployed across the borough during and immediately after the peak of the flood event to assist in the clean up operation. 24 hours following the flood event Council Services were dealing with an exceptionally high volume of flooding issues ranging from collapsed culverts to internal flooding to gully defects. Drainage gangs worked to unblock drainage infrastructure across the borough.

Safer, Cleaner, Greener operatives, Countryside teams and volunteers worked over the weekend to sweep and clear debris/discarded household items from the affected areas.

Officers from the Environmental Health and Housing teams dealt with and supported a wide range of activities including sourcing and distributing cleaning materials, distribution of de-humidifiers, electrical checks on donated goods and inspection and support to over 80 premises. Staff were on site in Todmorden for several weeks, from the start of the flood period until 13th July.

Neighbourhood Team members and community wardens were based in the affected communities to provide support and assistance to individuals who were affected by the flooding.

The Business and Economy Team provided advice and assistance to over 200 flood-affected businesses. The primary activity was to try and get businesses trading as quickly as possible.

The Customer First teams acted as a point of contact for people after the floods. Offices in Todmorden and Hebden Bridge were open for extended hours and provided a weekend service. Customer First organised many activities including disposal of flood damaged items, logging flooding problems affecting customers and referral to specialist agencies for re-housing.

Volunteer Action Calderdale co-ordinated, provided support and managed volunteers across CMBC services and in the affected communities. The team were involved in helping the affected communities set up a Facebook page and mobilising local support for donations.

Faith groups and voluntary and community groups were active in the response and continue to be during the on-going recovery phase. Many businesses also supported the voluntary effort providing food, shelter, equipment and vehicles.

All the Schools in the Calder Valley, including Todmorden Children's Centre, were inspected by Health and Safety Officers following the floods. The inspections identified damage to either the building or playground equipment, which was removed or replaced. Hebden Vale Children's Centre and Central Street Infant School suffered the worst of the damage and were temporarily closed. The education of the Central Street pupils and Hebden Vale Children's Centre services were delivered from alternative buildings maintaining minimal disruption to the public and service users. Central Street School re-opened in September 2012.

Calderdale teams provided care and assistance to those people who were particularly vulnerable through old age or disability. Council Officer's arranged and co-ordinated activities for those affected by the floods.

Network Rail

During the flood event, track engineers were on site investigating flooding reports and alleviating flooding on the track where possible. Several sections of the Trans-Pennine route were badly affected. Track engineers worked around the clock to restore the service. Alternative services were arranged for passengers to continue their journey during the weekend.

Yorkshire Water

Yorkshire Water operational staff were on flood alert following the weather warnings in the week prior to the 22nd June. YW engineers implemented appropriate measure in preparation for the heavy rainfall. YW contractors worked to remove silt / debris from sewer systems and maintain sewer capacity.

Environment Agency

During the late evening of 22nd June the EA brought into operation the Centre Vale Park flood storage area manually in an attempt to mitigate downstream flooding occasioned by high flows in Walsden Water. The Upper Calder had not achieved its designed trigger levels for the Centre Vale facility to operate automatically.

Flood ambassadors and flood wardens were deployed during the flood event to the areas affected by the flooding to provide support and assistance to the affected communities and help the emergency response.

EA staff undertook watercourse surveys and checking key assets to identify blockages, damage and defects. Clean up teams were then directed to locations across the borough to address the problems identified.

EA staff were heavily involved in the post-flood event recovery liaising, co-ordinating and managing many aspects of the recovery plan. The EA provided immediate financial and resource support to other risk management authorities.

Note: Canal & Rivers Trust are not identified as a risk management authority under the Flood & Water Management Act (2010). However, for the purposes of this report their waterways was severely affected during the flood event and therefore their response during the event has been summarised below;

Canal and River Trust (CRT) – formerly British Waterways

On the 22nd June the Rochdale Canal, Canal in Huddersfield and Peak Forest canal were on alert. The call out teams were occupied with managing the flooding between Mytholmroyd and Summit in Walsden. Road closures hampered the ability of the call out teams to reach destinations in the upper valley.

Prior to the flood event CRT engineers implemented appropriate measures in preparation for the forecast heavy rainfall. In the week prior to the flood event, appropriate measures were applied to Locks 15, 25 & 31 as a result of natural rainfall. Operations staff reduced / turned away all the controlled feeders from the canal to reduce the inflow into the canal.

During the flood event the CRT emergency contact centre received over 150 calls from across the network over two days. Engineers were then distributed to a number of locations across the canal network. At approximately 7.30pm the on-call team attended lock 37 & 36 to stop the water from over topping

and washing away the approach ramps at the locks. The on-call team attended lock 28 to shut down all four paddles which were left open (possibly by a boater or local resident). It has been reported that a number of lock systems were interfered with by members of the public. This combined with road closures hampered the flood response although the call out teams worked throughout the flood event.

2.3 Data Collected

A data collection exercise was carried out after the flood event from the following partners:-

- The Environment Agency,
- CMBC,
- Network Rail,
- Canal & River Trust,
- Yorkshire Water Services,
- The Met Office Flood Forecasting Centre.

The data provided includes:

- Flood warning and guidance information,
- Hydrometric data – including rainfall depths, river flows and levels,
- Reports from officers and operatives of what happened during the flood event,
- Reports logged at the customer contact centre,
- Photographs and video footage – including footage from the internet,
- Surveyed flood levels taken from ‘wrack marks’ after the flood event,
- Online news reports,
- Flood extent outlines plotted from surveyed flood levels and local knowledge.

2.4 Areas Affected

The flood event was caused by a period of prolonged rainfall including bursts of high intensity, which raised river levels and saturated the River Calder catchment increasing rates of runoff. A large number of residential and business properties were flooded due to water overtopping riverbanks and surface water overwhelming drainage systems. The EA and Council have undertaken follow up surveys to assess the scale of the damage and determine the number of properties affected. A summary of the reported properties affected is provided in Table 1.

Location	Residential	Business	Other (either cellar or other property type)	Totals
Walsden	38	2	13	53
Todmorden	220	27	23	270
Hebden Bridge	30	97	92	219
Mytholmroyd	67	36	52	155
Breareley, Luddenden Foot	7	28	0	35
Totals	362	190	180	732

Table 1 – Reported Properties affected by the 22nd June flooding by location (Source: EA)

The Council, Network Rail and Canal & River Trust have been undertaking similar reviews of damage to their infrastructure.

Smaller surface water flooding incidents were recorded across the borough that affected properties and highway. The many investigations are still ongoing. Lower down the valley fluvial flooding was limited to the river channel and flood plain. However, at Park Road, Elland flood waters from the River Calder overtopped the riverbanks, flowed across fields at Elland Bridge into the Calder & Hebble Canal. This caused the canal to overtop and spill into the surrounding area.

Network Rail reported surface water flooding of the network at several places across the borough. The worst affected areas include a 1.6 kilometre stretch of track between Bridge 96 and Walsden Station, and Summit and Winterbutlee Tunnels were closed due to fluvial flooding from Walsden Water. The Calder Valley rail services were cancelled for the remainder of the day. Emergency works were undertaken to a landslip on the side of the track in Walsden. Fluvial flooding and excessive hillside runoff are considered to be the main contributors to flooding in this location.

Foot and road bridges along main rivers and major sub-catchment watercourses were closed and monitored by CMBC staff and the emergency services. The river levels in many of these locations were above the soffit (the bottom of the bridge deck girder) of the bridges. Bridges affected on the River Calder include the County Bridge and Station Road Bridge. Bridges affected on the River Ryburn include Victoria Road and Stirk Bridges.

The main transport routes in the Upper Valley were closed at various locations due to severe flooding. Police vehicles were stranded in Mytholmroyd and fire crews were unable to reach their destination due to floodwaters. Later on in the evening the Police declared the flooding as a major incident and a Silver command was set up in Halifax police station.



Figure 2 - River Calder close to reaching overspill point on Caldene bridge (Source: CMBC)

The flood event occurred over a wide area and several mechanisms of flooding have been identified. In some areas, the flood mechanisms are interlinked. The timings of when the flooding occurred at different flooded locations vary throughout the borough. A summary of the flood incidents is explained by area in the following sections. Detailed maps of the flood mechanisms and affected areas can be found in Appendix A.

2.4.1 Cornholme and Lydgate

In Cornholme, there was a culvert collapse on the Red Water Clough close to the confluence with the River Calder, as Figure 3 illustrates. The EA and CMBC removed debris from the watercourse and surrounding area and the EA took steps to stabilise the culvert.



Figure 3 – The collapsed culvert on Red Water Clough, Cornholme (Source: EA)

The post office along Burnley Road and several properties on adjoining streets were affected by surface water flooding from the highway and ground water. It is understood that the highway drainage was overwhelmed in this location.

2.4.2 Walsden

The Walsden Water and Bottomly Clough overtopped their banks and flooded a 150m section of Network Rail track at Dean Royd Road. The main flooding mechanism is reported to come from Walsden Water as shown in Figure 4. The floodwaters built up to a significant depth above the line and contributed to extensive travel disruption.



Figure 4 – Flood waters spilling onto the rail track downstream of Dean Royd Road (Source: Network Rail)

Walsden Water overtopped Network Rail Bridge 96 and flooded approximately 600m of the track as far as Walsden Station (as shown in Figure 5). The floodwaters spilled over the rail embankment between Walsden station footbridge and the property at 554 Rochdale Road, flooding a significant area of Rochdale Road and nearby properties. The floodwaters continued to flow along the highway towards Todmorden. It is reported that the highway drainage was overwhelmed in this location.



Figure 5 - Flooding of Network Rail track at bridge 96, Walsden (Source: EA)

An open channel section of Birks Clough adjacent to the Cross Keys Pub in Walsden overtopped and floodwaters spilled onto Rochdale Road. In the same location, the Rochdale Canal was unable to discharge into Birks Clough via a weir. The canal water spilled onto the Rochdale Road. The combined floodwaters flooded the highway and nearby properties. The floodwaters continued to flow along the highway towards Todmorden. It is understood that the highway drainage was overwhelmed in this location.

Sections of riverbank on Birks Clough collapsed and the debris was transported into the culverts downstream, under the canal and into the open channel section reducing their capacity. A section of the road surface on Hollingworth Lane was replaced after surface water eroded the road surface.

The carriageway on Bacup Road suffered extensive damage from surface water eroding the road surface. The source of this water is still being investigated. CMBC highways have undertaken repairs to reinstate the highway. The drainage system along Bacup Road was overwhelmed and surface water collected on Rochdale Road in Gauxholme and flowed towards Todmorden. Properties at Charles Place, Vernon Place and Lock Street were affected by surface water flooding from Rochdale Road. It is reported that the floodwaters from Walsden Water was caused by infiltration through the river wall opposite Charles Place, contributing to surface water on Rochdale Road.

Rochdale Road was inundated with flood waters from the watercourse adjacent to Shoebread Dam. The EA reported that the waterfall at the base of the slope was in full spate and overtopping onto properties adjacent. Such was the force of the water that the property doors and windows were removed to avoid serious structural damage. The floodwaters flowed through the VolkerStevin site compound, for the Todmorden flood alleviation scheme to Walsden Water, and onto the Rochdale Road. The floodwaters spilled onto Daleside Road adjacent.

2.4.3 Todmorden

A 450m section of Rochdale Road and adjacent properties between the Golden Lion pub and Morrison's in Todmorden flooded. Floodwaters built up to a depth of 800mm (EA post flood event survey data) at the Golden Lion pub. The floodwaters are understood to be a combination of fluvial and pluvial flooding from a number of sources. It has been reported that the flooding started around 8.00pm in Todmorden.

The sloping topography between the Golden Lion pub and the Rochdale Canal allowed the floodwaters to enter the Rochdale Canal at a rate that overwhelmed the capacity of the downstream lock (Lock 18). The canal overtopped in this location and flooded the streets and car parks adjacent (Lever Street and Union Street) via a pedestrian access ramp and steps. The

additional water discharging into the Rochdale Canal resulted in the locks immediately downstream overtopping the canal towpath and flooding the waste ground (SD 94089, 24130).



Figure 6 - Flood waters from Rochdale Road spilling into the Rochdale Canal immediately below Lock 19 (Source: EA).

The combination of floodwaters from Lever Street and Union Street and the floodwaters from the wasteland further downstream overwhelmed the drainage system along Halifax Road adjacent to the Health Centre. A 430m section of highway and several adjacent properties flooded to a depth of approximately 400mm, as shown in Figure 7.

Properties and highway along Commercial Street, Todmorden was affected by flooded waters. At Marsden Mill, the flood water was recorded to a depth of 820mm. It is understood that excess water in the canal overtopped a sluice and flooded property and highway adjacent.



Figure 7 – Halifax Road flooded in the centre of Todmorden (Source: EA)

At several locations between Todmorden and Hebden Bridge there was flooding between the River Calder and Rochdale Canal. Figure 8 is an example of where the River Calder has spilled into the Rochdale Canal. Equally, there have been reported cases where the Rochdale Canal has spilled into the River Calder.



Figure 8: River Calder river wall breached and flowed into canal (Source: EA & CRT)

2.4.4 Eastwood

Properties and highway were flooded between 706 to 730 Halifax Road. Surface water accumulated on the highway and in property gardens from heavy rainfall and the main sewer. This subsequently entered the properties. Several cellars were also affected from ground water flooding.



Figure 9 - Flooding of the highway and properties along Halifax Road (Source: CMBC)

Properties and highway between Callis Bridge and Woodland View were affected by floodwaters from sewer, the River Calder and a small watercourse. The sewer surcharged and flooded the highway initially, however, the main flood mechanism came from the River Calder overtopping the river wall to a depth of approximately 1m. In addition, properties at Woodland View were affected by excess surface water spilling from Knott Wood culvert.



Figure 10 - River Calder overtopping the river wall at Callis Bridge, Eastwood (Source: CMBC).

2.4.5 Hebden Bridge

At approximately 8.30pm Bridge Gate was inundated with surface water, which flowed onto New Road. The likely source of the flooding is from Hebden Water overtopping the riverbanks.

Highway drainage was unable to cope with surface water from heavy rainfall on Stubbing Holme Road. In addition, floodwaters from the River Calder were able to penetrate the river wall at several locations along the length of the road exacerbating the flooding on the highway.

Properties and highway along Palace House Road and New Road were flooded as a result of surface water runoff from steep hillsides, which deposited large amounts of debris onto the highway.



Figure 11 – Flooding in the centre of Hebden Bridge (Source: ITV)

2.4.6 Mytholmroyd

Surface water gathered on Burnley Road from a number of sources. A manhole collapse on the White Lee Clough culvert and a blockage at the upstream trash screen, flooded the highway and nearby property along Midgley Road. It is reported the pumping station at the Midgley Road and Burnley Road junction was operating for approximately 8 hours.

Floodwater was observed seeping through apertures in the floodwall at Caldene Bridge at 8pm. Between 9.45pm and 10.15pm, the river overtopped the river walls upstream and downstream of Mytholmroyd Bridge flooding nearby property (as shown on Figure 12) and contributing to the flood waters accumulating on Burnley Road.



Figure 12 - Flood waters overtopping river wall downstream of Caldene Bridge (Source: CMBC).

Several properties along Dale View were affected by ground water flooding and floodwaters from the River Calder overtopped the north riverbank and flooded the bowling green and highway. It is reported a Yorkshire Water foul sewage pumping station at Dale View failed during the flood event.

2.4.7 Cragg Road

Cragg Brook overtopped the riverbank at the Shoulder and Mutton pub flooding the pub and highway to a depth of approximately 0.5 metres. The watercourse overtopped the riverbank at Rose Villas and Vale Terrace, flooding cellars and gardens.

Cragg Road was inundated with surface water flooding at culvert crossings under the road on sub-catchment watercourses. These culverts were blocked with debris and overwhelmed by flood waters.

2.4.8 Sowerby Bridge

The shops at the junction with West Street and Water Street suffered basement flooding. The apartments on Water Street adjacent to Victoria Bridge had significant basement car park flooding. A number of cars were damaged and have been written off. It is reported the flooding occurred around 10.00pm.

Mearclough Bridge and a Yorkshire Water sewer suffered severe damage during the flooding.

2.5 River Levels and Flows

Initial river level data has been provided by the EA for the various gauging stations in the River Calder catchment. This river level data is still being verified by the EA for a number of sites particularly Walsden Water and Lennox Road, Portsmouth in the Upper Calder. More information can be found in the hydrological facts summary issued by the EA on the 29th June ¹.

The river levels on the Calder at Hebden Bridge, Mytholmroyd and Sowerby Bridge on the 22nd June 2012 were higher than those in June 2000 and are the highest recorded at these sites. For other sites across the Upper Calder catchment river levels were amongst the highest in the EA records with those of the Lower Calder exceeded by a number of events in recent years. Table 2 shows the confirmed peak water levels and the times of the peak at the gauging stations along the River Calder.

Site	Peak Level (m)	Date & Time (GMT)
Todmorden Centre Vale	1.6	22/06/2012 19:30
Todmorden	2.3	22/06/2012 19:45
Todmorden Callis Bridge	2.2	22/06/2012 21:30
Hebden Bridge	3.3	22/06/2012 22:15
Mytholmroyd	4.9	22/06/2012 22:00
Brearily	2.7	22/06/2012 22:15
Sowerby Bridge	2.4	22/06/2012 23:45
Copley Bridge	4.5	23/06/2012 00:30
Elland	2.0	23/06/2012 01:15
Brighouse	1.8	23/06/2012 02:15

Table 2 – Peak river levels along the River Calder on the 22nd – 23rd June (Source: EA)

An initial peak river flow has been calculated for the River Calder at Mytholmroyd of 190 cubic metres per second (m³/s). Mytholmroyd is the only flow measurement gauge on the Upper Calder and an initial estimate of this flow suggests a flood return period of between 1 in 50 and 1 in 70 years. This return period relates specifically to Mytholmroyd and not to the flood event generally or the River Calder as a whole.

The river levels, flows and return periods presented are initial estimates only and more information will become available over the coming months following issue of the EA's hydrology report.

2.6 Rainfall Analysis

The 22nd and 23rd June Calder Catchment rainfall event is hydrologically complex and the EA is undertaking work to better understand the causes and impact of the rainfall¹. Both the EA and Yorkshire Water Services (YWS) have provided CMBC with rain gauge data, however, this data is unchecked and has therefore been used with caution. CMBC are also still awaiting YWS data from gauges installed in the Todmorden area for their Drainage Area Study (DAS). At present the conclusions are:

- The peak rainfall (unverified) on the 22nd June was 85mm over a 24 hour period,
- The peak rainfall intensity over a 1 hour period was recorded as 15mm,
- The EA and YWS rain gauge data are consistent with each other and also with the Hydrological Summary provided by the Centre for Ecology and Hydrology (CEH),
- River levels in the River Calder catchment were very high and at some locations exceeded the highest ever recorded levels,
- The EA are planning to produce a flood hydrology report in the coming months.

During the flood event Yorkshire Water had rain gauges deployed in the Upper Valley in preparation for the Drainage Area Plan modelling. This information will be made available in the coming months.

¹ June 2012 Flood Hydrology Facts, Environment Agency

3 **Roles, Responsibilities and Post Flood Event Activities**

Local flood risk in Calderdale is managed by the Risk Management Authorities (RMAs) as defined in the Flood and Water Management Act (2010). Each RMA has specific responsibilities in relation to flood risk management and should co-ordinate their activities with each other. The RMAs have been contacted as part of the ongoing flood investigation and will contact relevant stakeholders and third parties depending on the identified source of the flooding.

The Risk Management Authorities are:-

- Calderdale Metropolitan Borough Council
- The Environment Agency
- Yorkshire Water

The roles and responsibilities of the RMA's are identified and discussed below. Canal & River Trust are a Navigation Authority, Network Rail are a significant transport authority and the and they have both been included in this section, as they have an important role in helping to manage flood risk and are both members of the multi-agency project group formed to respond to these events.

3.3 **Lead Local Flood Authority**

The Council is the LLFA and has flood risk management goals and permissive powers to manage flood risk within its boundary from ordinary watercourses, groundwater and surface water run-off. It is the landowner's responsibility to maintain and manage water related assets on their land with the exception of the public sewer and property surface water systems.

CMBC are also responsible for development of the Local Flood Risk Management Strategy, Asset Plans and Investigations.

According to the roles and responsibilities identified above CMBC has undertaken the following activities in response to the flood event:-

CMBC received 630 flood related calls, over several weeks, through the customer contact centre and direct to Council Services. The Sustainable Environment Group received 179 of the 630 flood related calls. The 179 calls consisted of;

- 10 incidents of damages to walls and landslides,
- 17 incidents of infrastructure damage on watercourses,
- 29 reports of debris and blocked gullies affecting drainage systems,

- 30 properties where internal flooding had occurred,
- 105 incidents required further investigation.

Cellars that flooded were as a result of ground water infiltration or surface water entering the property from overland flow. The majority of the cellars that flooded were located along or close to Burnley Road, Halifax Road and Rochdale Road.

Calls received from the customer contact centre were filtered as high, medium and low priority. High priority cases, such as internal property flooding, have been addressed first. Major works / detailed studies have been identified and will be dealt with when funding and resource identified.

The Council's Highways Term Maintenance Contractor, Amey LG, began deploying sandbags to the pre-determined vulnerable locations shown in the Highways Service Emergency Manual. However, sandbags were only distributed to Mytholmroyd before roads were closed. Other townships were supplied late partially or not at all.

In the days following 22 June as the weather continued to threaten. The quickly convened Flood Recovery Committee began to stock and issue sandbags to the public on request from Todmorden Community College. This was in conflict with both policy on the Council website and the message being relayed to customers by the Contact Centre. The practice was consequently ceased.

There was severe damage to several culverts across the borough. These were assessed and prioritised. All works to culverts identified for repair in the aftermath of the flooding has been completed.

Repairs to retaining walls and geotechnical assessments were undertaken across the borough Locations included:- Bacup Road, Allescholes Road, King Street, Woodhouse Road, Red Brink Lane and Lumbutts Road.

Planning and Highways undertook condition assessments of the carriageway and bridges as necessary throughout the borough and prioritised emergency works accordingly. Mearclough Bridge and Canal Road required urgent repairs. YW infrastructure was also damaged in this location. 32 main roads across the borough were damaged and required urgent repair. Several minor roads suffered carriageway damage and minor works was undertaken in these locations.

Approximately 18 Public Rights of Way were damaged, small contractors, landowners, volunteers and CMBC undertook repairs to reinstate or reduce further deterioration of the footpaths. This work is ongoing and will take several months to complete.

3.4 Water and Sewage Company

Yorkshire Water Services is the statutory sewerage undertaker for Calderdale with a duty to effectively drain sewers in accordance with the Water Industry Act (1991) and the Flood and Water Management Act (2010).

YW has undertaken the following activities in response to the flood event:-

- Yorkshire Water received 50 calls at their customer contact centre from across the borough during and after the flood event. 22 calls related to cellar flooding, 12 calls related to garden flooding and 15 related to other incidents of flooding.
- Sections of the sewer in the Upper Valley have undergone emergency de-silting works to improve hydraulic capacity of the sewer. However, there are still areas unknown to YW where silt could have entered the sewer. YW have scheduled works to return the sewer to its pre-flood condition. Large problems will be reviewed to assess the long-term need for capital investment.
- Engineers were called out on site to manage the floodwaters at the pumping station at Brookfoot, near Brighouse. Damage was reported to the sewer at Mearclough Bridge due to the high water levels.
- The flooding exceeded the design capacity (1 in 30 year event) of the sewer system. The sewerage infrastructure suffered little damage but there were blockages and sections of the network were overloaded.

3.5 Environment Agency

The EA is responsible for managing flood risk from Main Rivers, the sea and reservoirs including coastal erosion risk management. The EA has permissive powers to maintain Main Rivers, overview of all forms of flooding and development of a National Flood Risk Strategy.

The EA will encourage third party asset owners to maintain their property in an appropriate condition and take enforcement action where it is appropriate. The EA may undertake maintenance or repair of third party assets only where it can be considered justified in the interests of public safety and there is no alternative option.

According to the roles and responsibilities identified above the EA has undertaken the following activities in response to the flood event which are discussed below.

A post flood response clean up was required within main river limits on the Calder between Walsden Water and Brighouse. Post flood response has included;

- Improving channel conveyance by removing debris to the pre-flood condition. This work is currently on-going.
- All culverts on the Calder and Walsden Water up to Millwood have been inspected and all defects reported.
- A full channel survey has been undertaken to identify any damage / defects and identify any third party assets that have / are failing.
- Emergency works to third party assets acting as flood defence, such as garages at Mytholmroyd and a retaining wall at Stoney Royd Lane, have been undertaken.

118 defects have been identified from the post flood surveys and inspections. All defects have been prioritised as being low, medium or high risk. The 'quick wins' have been identified and have been implemented.

The EA and CMBC undertook jointly funded culvert repairs and debris clearance in the culvert under Todmorden Market on the Walsden Water. In addition, the River Calder river wall on Stoney Royd Lane, Todmorden is being repaired by the EA and jointly funded by the EA, CMBC and the landowner.

It is anticipated that 80% of the defect list will be addressed by December 2012 and 100% by April 2013. Works that have been identified to take longer than 3 months are subject to design and strategic decisions required.

Shoal removal in Todmorden has been undertaken quickly due to the updated modelling and Todmorden Flood Alleviation Scheme. The remaining locations on the shoal removal project will depend on the results of ongoing modelling to ascertain its long-term benefit. The EA have been working alongside Network Rail to remove the shoal under Bridge 96 in Walsden. Other areas are being considered for shoal removal in advance of the re-modelling.

Three critical areas have been identified for future work, these include;

- The River Calder river model will be updated and is to include the Rochdale Canal. This is to study the interactions between Main River and the Canal. This will help to confirm and prioritise key areas for gravel works along the full length of the Calder. It will form an evidence base for further strategic flood risk approaches.
- Shade culvert on Rochdale Road, Back Waterloo, Waterside Cottages and Market Hall culvert have been identified for repair.
- The EA in conjunction with Calderdale Council have repaired a retaining wall at Stoney Royd Lane.

3.6 Riparian Owners

Riparian landowners are those who own land adjoining a watercourse. They have rights and responsibilities as detailed within the EA document 'Living on the Edge'. A riparian owner's basic responsibility is to maintain the free flow of the contents of the watercourse. This could involve all or any of the following:-

- Maintain the bed and banks of the watercourse, and also the trees and shrubs growing on the banks;
- Clear any debris, even if it did not originate from their land. This debris maybe natural or man-made;
- Keep any structures that they own clear of debris. These structures include culverts, trash screens, weirs and mill gates;
- If they do not carry out their responsibilities, they could face legal action under the 1991 Land Drainage Act;
- Riparian landowners must understand and act upon these responsibilities.

3.6.1 Network Rail

Network rail are the riparian landowner for a number of third party assets on ordinary watercourses and land drainage systems. According to the roles and responsibilities identified above Network Rail has undertaken the following activities, which are discussed below.

During the flood event, track engineers were on site investigating flooding reports and alleviating flooding on the track where possible. Track engineers walked over the network post-flood event to survey defects / damage along the line. Maintenance and bridge inspections have been undertaken on culverts and bridges along the network.

Existing track drainage systems were overwhelmed in the flood event. Long-term action plans are being considered for increasing capacity of the drainage network at key locations.

3.6.2 Canal & River Trust

Canal & River Trust (CRT) is the riparian landowner and a Navigation Authority for a number of third party assets on ordinary watercourses and land drainage systems. In addition, they are responsible for maintenance and

management of the Rochdale Canal. According to the roles and responsibilities identified above CRT has undertaken the following activities:

Following the flood event the Canal & River Trust engineers identified 32 defects requiring attention. CRT's term contractor is working on addressing all the damage caused and it is estimated that it will take a number of weeks/months to complete the works for the most affected areas.

The principal tasks that the CRT contractors have been undertaking are:

- Repairs to collapsed masonry walls along the canal - these are generally cosmetic and provide protection to the clay liner from boat wash and impacts;
- Culvert blockages will be removed - there are 17 control structures between Littleborough and Sowerby Bridge but none of these have trash screens at the culvert inlets which causes maintenance problems; the culvert at Beaumont Clough (above Lock 12) and Birks Clough were particular problem areas. CRT have spent £50k removing the debris from the culvert under the canal on Birks Clough;
- Sections of eroded tow path are being reinstated - the canal network between Lock 19 to 11 received the most damage to the towpath as it is un-surfaced. It is likely that the recent erosion will not be addressed in the short term;
- Debris accumulation in the canal will be removed - a lot of debris entering the canal and in places there is limited draft for the boats; However, the canal remains navigable at present.

The CRT, in conjunction with the EA and CMBC, is reviewing the operational performance of the canal, locks, intakes and by-washes across the network.

3.7 Additional Activities

3.7.1 Flood Steering Groups

The EA are updating the River Calder river model, which will be used to replicate the June 22nd flood event and identify any significant changes to the river channel. In addition, the EA are working with CRT to better understand the interaction between the Rochdale Canal and Main River.

3.7.2 National Flood Forum

The National Flood Forum caravan visited communities throughout the borough to provide advice and collate information on the flooding that occurred on the 22nd June and 9th July. Representatives from key stakeholders attended the caravan to discuss the flooding with the affected

communities. Information and advice on flooding can be found at <http://www.floodforum.org.uk/>.

Flood Kits are currently being assembled by the CFFC for distribution among applicants to Upper Valley Flood Fund. These kits include items such as temporary lighting equipment, sterilisation equipment and work gloves.

3.7.3 Community and Business Groups

The Council established the RISE (Recovery Investment for a Stronger Economy) grant scheme, with a total fund of £250,000 available to businesses. So far 147 applications have been received from businesses, and £210,000 has been paid out. Around 90% of businesses have now re-opened.

The Council provided business rates relief for a period of 3 months to around 30 businesses.

Three public drop-in events were organised by the Council, in partnership with the Community Foundation for Calderdale (CFFC), Environment Agency, Yorkshire Water, National Flood Forum and Voluntary Action Calderdale, to provide information on 'who does what' in floods and give advice on how to make homes and business premises more resilient. The events were held at Todmorden on 13th October, Hebden Bridge on 29th October and Mytholmroyd on 3rd November, over 250 people attended. Events were publicised in the press and via a mail-shot to 6,500 properties.

The CFFC established a Flood Relief Fund on 23 June with an initial £10,000. The fund raised £150,000; £50,000 of which was from the Council. Other contributions have come from local companies, Todmorden Town Council Hebden Royd Town Council, the general public and groups across the UK and internationally. To date the CFFC has handled and approved 231 applications for Flood Relief grants.

The fund was used to provide Flood Resilience Grants to individual properties, which included renting de-humidifiers and replacement of damaged white goods. The fund has also been used to contribute towards property level flood protection products. To date 27 Flood Resilience applications have been approved.

Flood Kits are currently being assembled by the CFFC for distribution among applicants to Upper Valley Flood Fund. These kits include items such as temporary lighting equipment, sensitisation equipment and work gloves.

4 Conclusions

Note: Due to the complex nature of the flood event it is difficult to confirm responsibilities until the hydraulic modelling being undertaken by the Environment Agency in liaison with Yorkshire Water, the Council and Canal & River Trust. The modelling is programmed for completion summer 2013 and the report will then be updated.

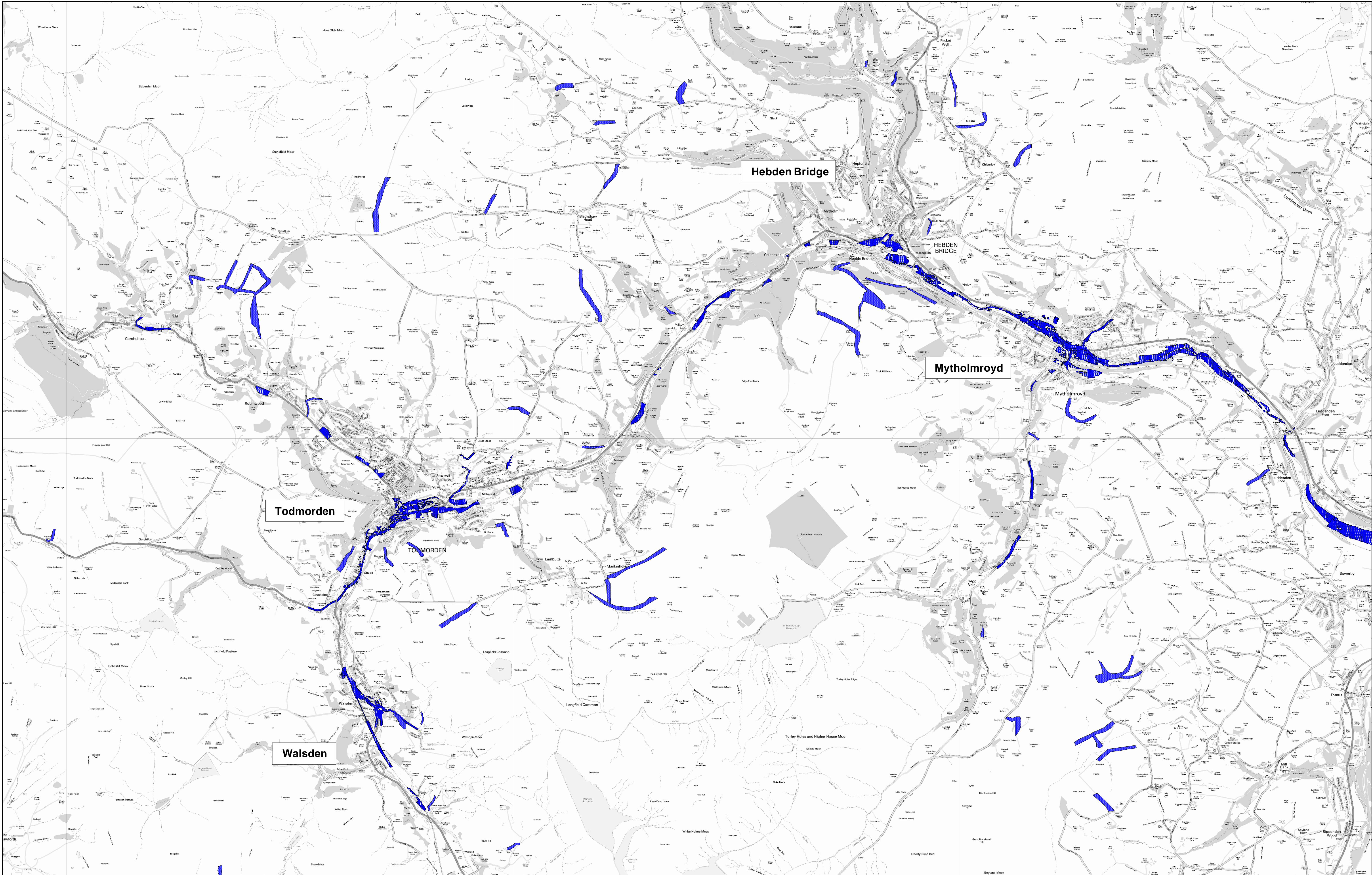
1. The flooding on the 22nd June significantly affected many key communities in the Upper Calder valley. Historic flooding and flood risk mapping show that these communities are at significant risk of flooding from a variety of sources.
2. This flood event generated the highest recorded river levels for the River Calder in some parts of the Upper Calder valley. The majority of the flooding occurred in flood zones 2 and 3. The main flood mechanisms were;
 - Rainfall and surface water exceeded the design capacity (1 in 30 year event) of the sewers and highway drainage, although the sewerage infrastructure suffered little damage,
 - Floodwaters overtopped river walls in the affected communities,
 - Excess surface water entering the Rochdale Canal resulting in the canal overtopping,
 - The interaction of flood water between the River Calder and Rochdale Canal
 - Hillside runoff caused significant damage to drainage and highway infrastructure, properties and footpaths.
3. The Environment Agency, in collaboration with Yorkshire Water, the Council and Canal & River Trust are developing a model to study the river network and the interaction between the Rochdale Canal, main rivers, sewer and surface water systems. This will improve risk management authorities' current understanding of flood risk in the Upper Calder valley.
4. Risk management authorities with the National Flood Forum have provided flood advice and support, via a series of flooding workshops, in the affected communities.
5. All risk management authorities and other strategic partner organisations and stakeholders have provided useful information to help identify the flood extents, mechanisms and damage caused. Cooperative working should continue share knowledge and information on actions that are undertaken.
6. The data collection exercise has identified information gaps with collating data of this type and at this scale. CMBC need to have a robust structure to be able to collate this data quickly. This will help to improve the response and recovery plans in future flood events.
7. The majority of the flood warnings worked well, however the Walsden (Rochdale Road) siren appeared to fail. This should be reviewed in line with the trigger levels for the flood warning service in Hebden Bridge.

8. A full hydrological report is to be completed by the EA for this storm event. The report should be reviewed in line with the findings of this report.
9. The location and number of rain gauges in the River Calder catchment should be reviewed to ensure they are appropriately located and that there is an adequate number to effectively measure rainfall.
10. All risk management authorities and strategic partners have identified and are undertaking a schedule of works, where possible, to return watercourses, property and infrastructure to their condition prior to the flood event. A significant amount of works has been undertaken to restore the Upper Calder valley. Some activities will continue into 2013. This will form part of the Environment & Infrastructure Group work in helping to develop the Overall Flood Recovery Plan currently under preparation.
11. It is essential that flood risk assets in the Upper Valley are suitably maintained and the riparian owner identified, to reduce flood risk in future significant rainfall events.
12. Property owners should continue to be made aware of the flood resistance and resilience measures available. The LLFA and EA should provide support and advice to the community on property level protection, where appropriate.

5 References

- 1 June 2012 Flood Hydrology Facts, Environment Agency

Appendix A: Flood Maps





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