



Calderdale Metropolitan Borough Council

Local Flood Risk Management Strategy

June 2016

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Revision History

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The considerable help of staff from Calderdale Metropolitan Borough Council, the Environment Agency, Yorkshire Water Services, the Canal and Rivers Trust, Network Rail is gratefully acknowledged in the preparation of this Local Flood Risk Management Strategy.

Much help was also provided by councillors and members of the public (especially the local flood groups in Todmorden, Hebden Bridge and Mytholmroyd).

Foreword

I am pleased to introduce the first draft of the Local flood Risk Management Strategy for Calderdale. The Strategy has been produced as a result of the Flood and Water Management Act 2010 and redeveloped following the flooding experienced on Boxing Day 2015.

The flooding experienced in Calderdale and specifically on Boxing Day 2015, highlighted many of the planning and emergency response challenges faced by the Council and its partners. On Boxing Day 2015, many communities were again hit by flooding, probably the worst in living memory. Across Calderdale approximately 3,500 homes and businesses were affected in addition to schools, bridges, substations, sewage treatment works and other infrastructure. The tangible cost of the floods is significant as is the emotional cost to both individuals and communities. Although the loss of life was thankfully avoided, the threat of this is ever present considering the complex nature of flooding experienced within Calderdale.

This Strategy sets out the objectives for the Council as a Lead Local Flood Authority to work in partnership with all stakeholders to better understand, reduce, manage and prepare for flood events. Working in partnership with the Environment Agency, Canal & Rivers Trust, Yorkshire Water and other 'Risk Management Authorities', the Council can tackle the tough challenges that lie ahead in ensuring flooding does not have the repeat impact on individuals, the community and the economic future of the borough.

In ensuring the continued economic viability of Calderdale, it is important to understand that the limitations placed on the Council and our partners. We cannot undertake every flood reduction measure and for where we can this will take some time. Whilst there are clear economic realities to the scale of flood protection, the business and economic impacts to Calderdale remain significant with many businesses still closed. Moreover, loss of life was only averted by swift response by the emergency services and that by occurring on Boxing Day meant the impact in schools and day care centres was only physical damage. This strategy sets out compelling reasons why measures and actions to ensure priority objectives are delivered.

The strategy identifies the actions that the council needs to take over the coming years to bring about improved, more sustainable approach to flood risk management that works with nature. It provides direction on what the strategic local objectives are, helps the Council to plan for the likely impacts of climate change and further development across the borough. The increased frequency of repeat events to our local community underlines why Calderdale has been allocated £35million of Special Grant. The council's lead role in safeguarding our community is clear by this strategy. These funds are to be prioritised through the existing multiagency partnership of the Calderdale Flood Recovery and Resilience Programme, which is locally accountable to the Calderdale community.

I look forward to the strategy being used to help target the Council's efforts, efficient use of limited resources and reduce flood risk within Calderdale.

Councillor Barry Collins - Deputy Leader

Cabinet Member - Regeneration & Economic Development

Executive Summary

Overview

Under the Flood and Water Management Act, Calderdale Metropolitan Borough Council has a legal duty to develop, maintain, apply and monitor a Local Flood Risk Management Strategy. This Strategy is a tool to help understand and manage flood risk within Calderdale. Its principal aims are to tackle local flood risk including flooding from surface water, groundwater and ordinary watercourses. However, in Calderdale flooding from Main Rivers, canals and reservoirs create complex and interconnected sources of flooding so this Strategy considers all flooding.

After summer 2016 consultation on the first draft, this document is the final document incorporating all applicable consultation responses. As a living document, in light of high flood risk and planned interventions to reduce this risk, we will produce a new strategy in 2022. We will also produce a formal action plan update in summer 2019 as the mid-point of this Strategy. The Strategy will be reviewed in April 2017 in parallel with the EA Flood Action Plan review and a further post review document published by October 2017.

Strategy Objectives

The Strategy has been based on four principle objectives:

- Building a better understanding of flood risk issues.
- Taking steps to reduce flood risk in Calderdale.
- Developing schemes that will manage residual flood risk.
- Being better prepared for flood events.

This Strategy lists several measures that will build towards the principle aims listed above. The most important measures that should be given the highest priority are:

- **Flood Risk Asset Data Register** - Completion of a register is a statutory requirement. The register is essential to understand what infrastructure affects flood risk in Calderdale, determine a management strategy for those assets and define maintenance procedures. A clear understanding of watercourses and assets is critical to understanding and reducing flooding.
- **Surface Water Management Plans** - Surface water runoff causes flooding problems across Calderdale. Surface water management plans have been completed for Todmorden and Walsden. However, this Strategy identifies the need for improved understanding of surface water runoff and hence pluvial flooding across the rest of Calderdale. Completed plans will assist in identifying the measures (including natural flood management interventions) to minimise the effects of flooding. Furthermore, such plans will help define Critical Drainage Areas, an important first step to developing robust management of runoff from new development identified within the Local Plan.
- **Development Control** - Inappropriate development that reduces floodplain storage or development that increases runoff will worsen flooding problems. The robust application of flood risk policy for new development is essential to avoid increased flood risk.

In line with the National Planning Policy Framework, Calderdale will decline applications that do not show: *"all flooding issues have been accounted for... most vulnerable development is located in areas of lowest flood risk... development is appropriately flood resilient and resistant... any residual risk can be safely managed... and it gives priority to the use of sustainable drainage systems"*. Robust application and enforcement of the Land Drainage Act 1991 with respect to Ordinary Watercourse Consents is essential to controlling frequent flood risk issues arising from these watercourses.

- **Natural Flood Management** - Sympathetic land management techniques can help reduce flood risk. Mapping locations across Calderdale where such measures may be most effective will allow early contact to with major stakeholders regarding land management initiatives with the greatest chance of success.
- **Prioritisation of schemes** - Several potential flood risk resilience and alleviation schemes have already been identified. Evaluation of these schemes and their benefits is needed to allow the most cost effective schemes to be advanced.

Staff resources

Effective water management is heavily reliant on high quality service management and timely responses as part of Calderdale's Planning duties. Early identification of the cause of flooding, and appropriate interventions and incident response, will safeguard lives, homes and properties. Calderdale flood risk team will comprise of:

- **Flood risk manager** - responsible for: implementation of the Strategy, overseeing the team's activities, managing external consultants, liaison with external risk management authorities and Calderdale stakeholders.
- **Four flood risk and drainage engineers** (two engineers plus two assistants) - responsible for: reviewing flood risk assessments and drainage studies, land drainage investigations, flooding reports, land drainage designs and advice on property level protection measures.
- **Flood risk asset manager** - responsible for: upkeep of the flood risk data asset register, integrating output from surface water management plans and other studies into the database, prioritising flood risk assets and flooding hotspots, development and updating of asset maintenance schedules and mapping of assets in geographical information systems.
- **At least two civil engineers** - responsible for: delivering the flood risk reduction schemes and the contractual management of design and build consultants during the implementation phase
- **Strategic partnership manager** - responsible for: liaison with external stakeholders, educating landowners and completion of funding applications for schemes.
- **Natural Flood Risk Management Project Officer** - responsible for natural flood management initiatives within Calderdale.

Funding

The following table summarises the funding available for Calderdale to help deliver the Strategy.

Funding Amount	Source	Purpose
£24.970m	Capital Grant for flood repairs approved by the Department for transport	Repair of infrastructure damaged by Boxing Day Floods
£1.375m	CMBC approved Capital resource	Current flood defence resources approved by the Council to deliver the FRRS 1 programme.
£3.0m	CMBC approved Revenue funding.	To provide immediate support to deliver recommendations contained in the Council's Strategy.
£9.0m	Capital Grant for flood repairs provided to the EA.	To repair flood defences and remove debris following winter 2015 flooding.
Potential Funding		
£5 million	Share of £40 million Government Emergency Relief Fund that may be available for the Yorkshire Region.	Deliver the recommended flood defence works within the "Mytholmroyd plan".

£14.6 million	Current Defra Flood Defence Grant in Aid contained within 6-year capital investment plan for Calderdale Flood Recovery and Resilience Programme.	For delivery of FFRS 1, 2, Hebden Bridge, Brighouse and Mytholmroyd.
£35 million	HM Treasury Special Grant that may be available to the Council or one of our partners.	Potential Flood recovery grant for delivery of FFRS 1 and FFRS 2, Hebden Bridge and Mytholmroyd
Total Approved and Potential Capital and Revenue Funding £92.945m		

This significant level of funding places Calderdale Council and its partners in a position to deliver most of the Strategy objectives.

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Abbreviations

ADEPT	Association of Directors of Environment of Planning and Transport
AStGWF	Area Susceptible to Groundwater Flooding
CDA	Critical Drainage Area
CFMP	Catchment Flood Management Plan
CMBC	Calderdale Metropolitan Borough Council
CRT	Canal and Rivers Trust
CSO	Combined Sewer Overflow
DAMS	Drainage Asset Management System
Defra	Department of the Environment, Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
EU	European Union
FAS	Flood Alleviation Scheme
FCERM	Flood and Coastal Erosion Risk Management
FDGiA	Flood Defence Grant in Aid
FIP	Flood Investment Plan
FRA	Flood Risk Assessment
FRRS	Flood Risk Reduction Scheme
FWMA	Flood and Water Management Act
HFM	Historic Flood Map
IFRA	Indicative Flood Risk Area
LGA	Local Government Association
LGTAG	Local Government Technical Advisory Group
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LPRG	Large Project Review Group
LRF	Local Resilience Forum
MM	Mott MacDonald
NFM	Natural Flood Management
NPG	Northern Power Grid
NPPF	National Planning Policy Framework
NR	Network Rail
OFWAT	Office of Water Services
PF	Partnership Funding
PFRA	Preliminary Flood Risk Assessment
PLP	Property Level Protection
RBMP	River Basin Management Plan
RFCC	Regional Flood and Coastal Committee

RMA	Risk Management Authority
SEA.....	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SuDS.....	Sustainable Drainage Systems
SWMP.....	Surface Water Management Plan
TFG.....	Todmorden Flood Group
uFMfSW	Updated Flood Map for Surface Water
YWS.....	Yorkshire Water Services

1 Strategy Background

1.1 Local Flood Risk Management Strategy

Calderdale Metropolitan Borough Council (CMBC) is the Lead Local Flood Authority (LLFA) under the Flood and Water Management Act (FWMA), which came into effect in August 2010. Under the FWMA, LLFAs have a duty to develop, maintain, apply and monitor a Local Flood Risk Management Strategy (LFRMS).

CMBC produced a draft LFRMS¹ in October 2014. This new LFRMS overhauls the previous document and takes account of the significant flooding that occurred in December 2015. Following the summer 2016 consultation on the Strategy and formal Council procedures, this Strategy is the final published document.

The LFRMS is a tool to help understand and manage flood risk within Calderdale using a catchment based approach. Its principal aims are to tackle local flood risk including flooding from surface water, groundwater and ordinary watercourses. However, in Calderdale flooding from Main Rivers, canals and reservoirs cannot be separated from managing other sources of flooding so this LFRMS considers all flooding.

This document represents the single strategic overarching plan for the River Calder and all other watercourses in Calderdale. It relies on and draws from other subsidiary documents provided by partners such as Yorkshire Water (YWS) and the Environment Agency (EA). These organisations are of critical importance to supporting CMBC in the development of a single focussed response to flooding across the communities.

In view of the significance and severity of flooding, and the frequency of repeat events, CMBC will seek to work at the heart of best practice on flood risk management to mitigate the risk of loss of life and avoid a repeat of such major events that impact our local businesses, economy, schools and crucially residents and communities within Calderdale. This will require support into and leadership within bodies such as the Local Government Technical Advisory Group (LG TAG) and the Association of Directors of Environment of Planning and Transport (ADEPT) - specifically the flood and coastal risk management working groups that seek to create centres of excellence.

This LFRMS is a living document and so this Strategy should be reviewed to ensure it remains fit for purpose. Given the severity of flooding in both 2012 and again in 2015 we will produce a formal update on progress and delivery after 36-months (Summer 2019). Moreover, a full review of this strategy will be published by Summer 2023. The Strategy will be reviewed in April 2017 in parallel with the EA Flood Action Plan review and a further post review document published by October 2017.

1.2 National Flood and Coastal Erosion Risk Management Strategy

This LFRMS fits with the aims of the National Flood and Coastal Erosion Risk Management Strategy (FCERM) (see Appendix A). The overall aim of the National FCERM Strategy for England is to ensure the risk of flooding and coastal erosion is properly managed by using the full range of options in a co-ordinated way. It is designed to support local decision-making and engagement in FCERM so that risks are managed in a co-ordinated way across catchments and along the coast.

1.2.1 Guiding principles

The FWMA states that LFRMSs must be consistent with the National Strategy. Principally, this refers to consistency with the overall aims and objectives, and in particular with the six guiding principles. These are:

- Community focus and partnership working.
- A catchment and coastal “cell” based approach.
- Sustainability.
- Proportionate, risk-based approaches.
- Multiple benefits.
- Beneficiaries should be allowed and encouraged to invest in local risk management.

¹ Calderdale Council. Economy and Environment, Planning & Highways. DRAFT Local Flood Risk Management Strategy for Calderdale. A Living Document. October 2014.

1.3 Local strategy issues

The Local Government Association (LGA) has published guidance² to assist councils with producing a LFRMS. Under the guidance, an LFRMS needs to consider the following issues:

- Being consistent with the national strategy and the guiding principles.
- Managing flood risk.
- Working together to protect people and property.
- Reporting on and reviewing the strategy.

1.4 Principal objectives

CMBC has considered the above guiding principles and issues leading to the development of four principle objectives for the LFRMS:

- Building a better understanding of local flood risk issues and how they interact.
- Steps that can be taken to reduce flood risk.
- Developing schemes that will manage residual flood risk.
- Being better prepared for flood events.

1.5 Strategy layout

This LFRMS is set out in eight chapters:

- **Strategy background.** Sets out the background to the development of the LFRMS.
- **Previous studies.** Describes previous studies of flood risk across Calderdale.
- **Flood risk in Calderdale.** Provides an overview of flood risk in Calderdale.
- **Risk management authorities and stakeholders.** Explains the roles of the principal Risk Management Authorities (RMAs) and stakeholders in Calderdale.
- **Strategy objectives.** Outlines the LFRMS objectives.
- **Strategy measures.** Summarises the measures needed to address the objectives.
- **Strategy actions.** Presents the detailed Strategy actions required.
- **Strategy delivery.** Presents the main challenges to delivery of the strategy including resourcing and funding.

² Local Government Association. Framework to assist the development of the Local Strategy for Flood Risk Management. A Living Document. 2nd Edition, November 2011.

2 Previous and ongoing studies

2.1 Introduction

This chapter describes previous studies of flood risk across Calderdale. These include:

- Strategic Flood Risk Assessment (SFRA)
- Catchment Flood Management Plan (CFMP)
- Surface Water Management Plans (SWMP)
- Preliminary Flood Risk Assessment (PFRA)
- River Basin Management Plan (RBMP)

The final section of the chapter provides an overview of the now published Calderdale Flood Action Plan which was developed in parallel with this strategy.

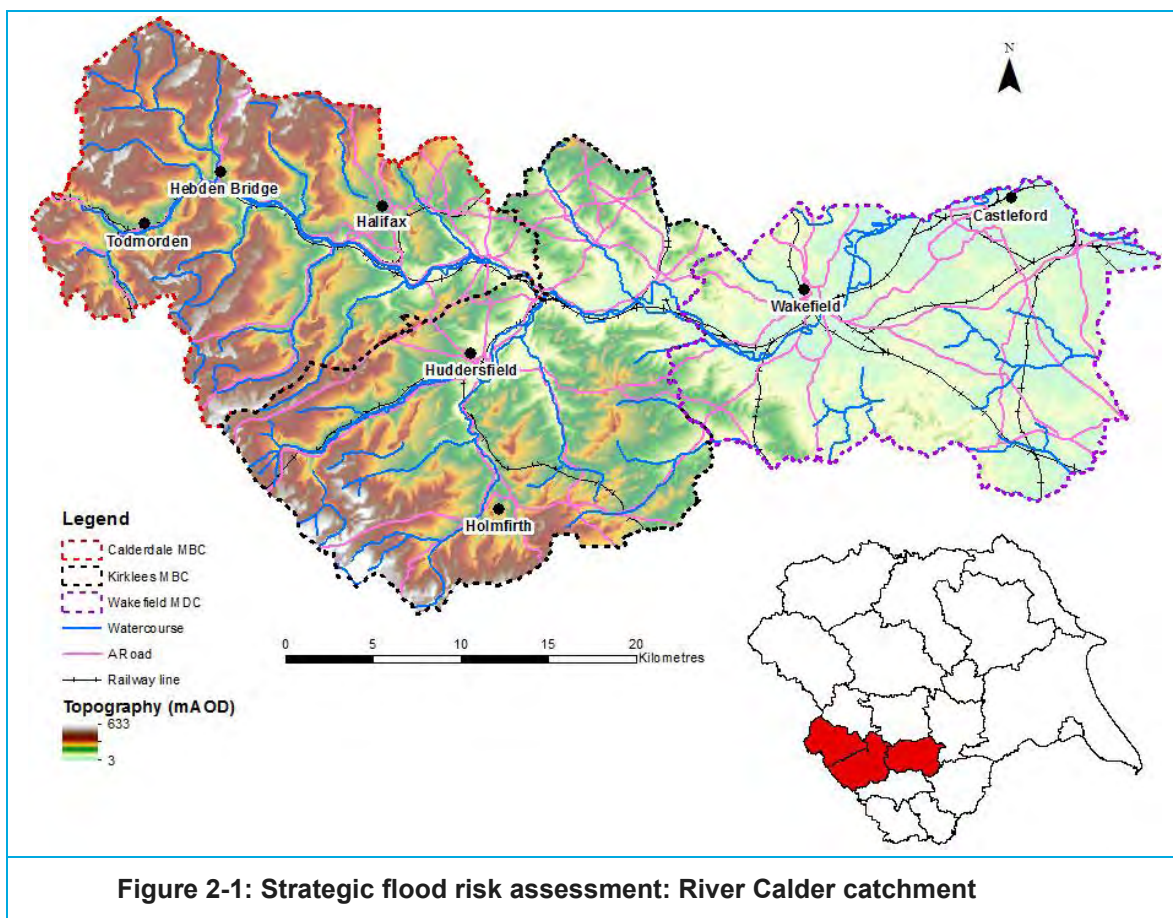
2.2 Strategic Flood Risk Assessment

SFRAs are prepared by Local Planning Authorities (LPAs). The document informs land use planning decisions by assessing all sources of flood risk and providing flood risk information which considers climate change implications. This allows local planning authorities to apply the Sequential Test (as part of the National Planning Policy Framework (NPPF)), assign suitable sites for development and identify how flood risk can be reduced. SFRAs inform local development documents or area action plans.

Calderdale's SFRA was compiled in conjunction with Wakefield and Kirklees Councils. The latest Draft Level 1 SFRA was produced in February 2016 and is split into two volumes.

- Volume I³ comprises generic information that is applicable to all three Councils.
- Volume II⁴ provides a review of flood risk across Calderdale.

Figure 2-1 shows the overall Calder catchment that is covered by the joint SFRA.



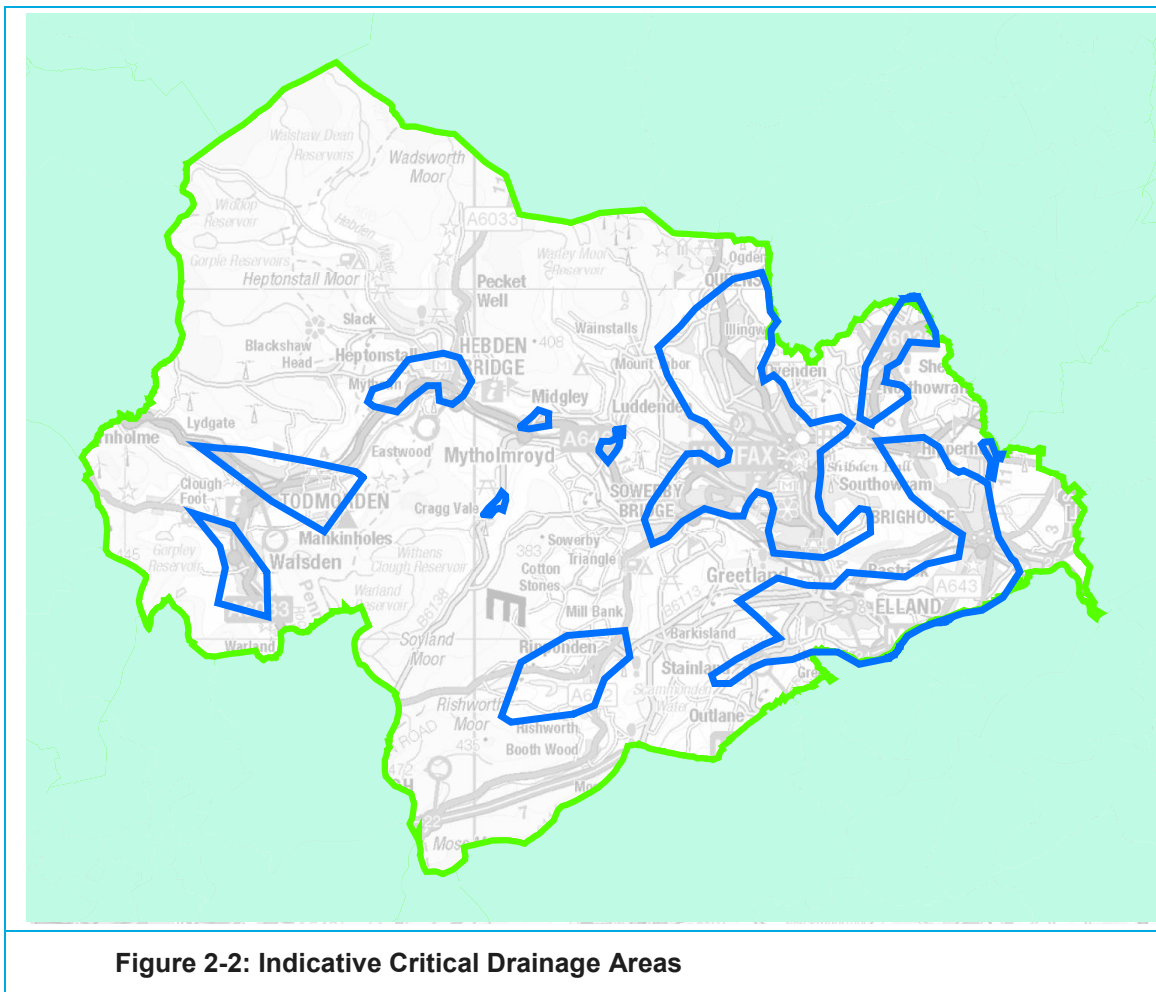
3 Calder Catchment Strategic Flood Risk Assessment – Volume I. Final Report February 2016

4 Calder Catchment Strategic Flood Risk Assessment - Volume II (Calderdale MBC). Final Report. February 2016.

The core output of the Level 1 SFRA is a series of flood risk maps illustrating the risk to potential development sites together with a development site assessment spreadsheet which helps LPAs with Sequential Testing of their sites. The Calderdale SFRA provides:

- A review of flood risk across Calderdale.
- The definition of functional floodplain in Calderdale
- Guidance regarding the application of the Sequential and Exception Tests
- A high level review of fluvial and surface water flood risk to proposed development sites
- A high level review of the potential for designating Critical Drainage Areas (CDAs)
- Guidance concerning the control of surface water runoff using SuDS.

Figure 2-2 shows the locations of the Indicative CDAs.



2.3 Catchment Flood Management Plan

CFMPs provided an overview of the flood risk across a river catchment and were produced by the EA. CFMPs recommended ways of managing flood risk now and over the next 50 to 100-years. CFMPs considered all types of inland flooding, from rivers, ground water and surface water. CFMPs are a high-level strategic planning tool aimed to identify broad policies for sustainable flood risk management at the catchment scale. The FWMA passed considerable responsibility for flooding to local authorities and so CFMPs have been superseded. Following the Boxing Day 2015 floods, the Government announced the production of a Catchment Plan for the Calder Valley (see section 2.7). This is expected by October 2016.

Although CFMPs are no longer updated, they provide a basic background to the catchment including information on the river and its tributaries as well as information on the topography, land use, soils and geology in the catchment and the impact on runoff. There is also information on current flood risks and management, including the catchment's flooding history, locations where people are at most risk and the potential types of damage. Types of assets at risk are outlined, including a summary of the potential consequences of catchment-wide flooding for specified probabilities of flooding.

The Calder CFMP⁵ was produced by the EA in December 2010. The plan covers the whole of the Calder catchment down to its confluence with the River Aire at Castleford. The CFMP split the catchment into eight sub-areas of which only three affect Calderdale.

- The Calder headwaters
- Ryburn and Hebble Brook
- Brighouse and Greetland

2.3.1 Policy approach

The CFMP identified two main policy approaches to flood risk management in Calderdale depending on the relevant sub-area.

Calder headwaters sub-area

For the Calder headwaters, the policy approach is to take further action to reduce flood risk. This approach is applied in areas of moderate to high flood risk where action can generally be taken to reduce flood risk and the case for further action is most compelling. Such an approach applies where there are many people at high risk, or where changes in the environment have already increased risk.

The policy vision for the Calder headwaters is to continue developing a partnership working approach to reduce the risk of flooding. Responsibility for flood risk management assets is shared between several organisations (CMBC, EA and third parties). To ensure flood risk management is sustainable, an integrated approach to managing risk is needed. Of particular importance to this vision is the ability to improve the condition and function of the upland environment to reduce runoff and the high frequency of local floods. By developing this approach, it will contribute to wider economic, social and environmental benefits by working with partner organisations to maximise the range of benefits that can be achieved. The area and its character will become a safer location through greater appreciation of flood risk and the application of sustainable development and regeneration.

Ryburn and Hebble Brook and Brighouse and Greetland sub-areas

For the remaining two areas of Calderdale (Ryburn and Hebble Brook and Brighouse and Greetland) the policy approach is to take action to sustain the current scale of flood risk into the future. This approach is applied to areas of low, moderate or high flood risk where flood risk is already being managed effectively but where further actions may be needed to keep pace with climate change. This policy applies in areas where the risk of flooding is expected to significantly rise in the future and there will be a need to contain what would otherwise be an increasing flood risk.

The vision for the Ryburn and Hebble Brook sub-areas is that flood risk management will be increased to ensure that the implications of climate change will not result in further risk to people and property. This will ensure that communities remain sustainable through the maintenance of flood defence assets, flood warning and response procedures.

A multi-agency approach to managing flood risk will ensure that further development will reduce the risk of flooding through the use of sustainable urban drainage techniques, developer contributions and robust implementation of the NPPF.

Appraisal

For both policy options, additional appraisal to assess whether there are socially, environmentally sustainable, technically viable and economically justified options will be needed.

Table 2-1 summarises the findings for each area in more detail.

Table 2-1: Catchment flood management plan findings.

<div> <p>Policy Options</p> <p> Policy 4: Take action to sustain the current scale of flood risk to the future.</p> <p> Policy 5: Take further action to reduce flood risk.</p> <p> Policy 6: Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.</p> </div> <div> <p> Calderdale MBC</p> <p> Kirklees MBC</p> <p> Wakefield MDC</p> </div>		
Calder headwaters	Ryburn and Hebble Brook	Brighouse and Greetland
Issues		
<p>The River Calder, Hebden Water and Walsden Water cause river flooding. Flooding also comes from surface water and the Rochdale Canal. There are currently just under 3,800 properties at risk of river flooding during the one per cent flood, if undefended. Climate change will increase the risk of river flooding to just over 3,880 properties. The risk of flooding from surface water and the Rochdale Canal will also increase.</p>	<p>This sub area covers a narrow strip of the Calder catchment and the uplands of the River Ryburn and Hebble Brook. The area stretches from Luddenden Foot to the confluence of the River Ryburn and River Calder in Halifax. Flooding comes from the River Calder, Hebble Brook and the River Ryburn and also from sewers, culverts and urban drainage infrastructure. The sub area responds rapidly to Pennine rainfall. There are currently 2,200 properties at risk of river flooding from the one per cent flood assuming no defences. However existing defences provide some protection which reduces the flood risk. Climate change will increase the undefended risk of river flooding to 2,249 properties. More flooding will also occur from sewers, culverts and urban drainage infrastructure due to the increase in rainfall intensity predicted under climate change.</p>	<p>This sub-area covers a narrow corridor of the Calder catchment from downstream of Copley to Clifton Wood. The main watercourses and sources of flooding are the River Calder, Red Beck and Clifton Beck. In the headwaters of the Red Beck lies Cupworth Reservoir. Flooding also comes from sewers, culverts and urban drainage infrastructure. Currently there are 1,329 properties at risk during the one per cent flood assuming no defences. However, all but 82 of these currently benefit from defences. In the future, the undefended risk increases to 1,380 properties, 679 of these will benefit from current defences leaving 701 properties at risk with defences in place. Five areas of Brighouse have been identified as at risk of river flooding. Of particular concern is Armitage industrial estate where sandbagging to sections of defences is required.</p>
Key Messages		
<p>Work in partnership to reduce the risk of flooding from all sources.</p> <p>The characteristics of the catchment mean that runoff rates are high and flooding can happen quickly. This gives little time to warn people. Focus on resilience measures that are not dependent upon the actions of people at risk of flooding.</p> <p>Some communities are susceptible to rapid flooding from thunderstorms. Emergency response and flood awareness are particularly important.</p>	<p>Climate change is expected to increase the risk of flooding from all sources. Flood risk from urban sources, including surface water and drainage incapacity, are likely to increase over time.</p> <p>The location, layout and design of developments are important factors in managing future flood risk. Regeneration and redevelopment of some areas offer an opportunity to reduce flood risk; for example re-establishing river corridors and more effective management of runoff.</p>	<p>A long term delivery plan for asset management is required. It should assess the existing assets and their role in delivering the flood risk management policy and approach throughout the sub-area. This will enable the EA to plan for the most effective standard of protection to be maintained. This will be a major tool to inform partners, planning decisions and developers.</p> <p>The location, layout and design of development, are important factors in managing future flood risk so that past mistakes are not repeated. Regeneration and redevelopment of some areas offer an opportunity to reduce flood risk; for example re-establishing river corridors and more effective management of runoff.</p>
Actions		
<p>Produce a system asset management plan to determine the most sustainable approach to managing assets.</p> <p>Develop feasibility studies for flood alleviation schemes to reduce risk.</p> <p>Identify the implications of changing the flood regime on the South Pennine Moor SAC, SPA and SSSI.</p> <p>Ensure that emergency flood response plans are reviewed.</p> <p>Develop a role for a Sustainable Land Management Officer to promote sustainable land management practices.</p> <p>Investigate the interaction between Rochdale Canal, River Calder and Walsden Water.</p> <p>Produce and maintain a register of all culverts and outfalls.</p> <p>Increase the number of properties registered on the Flood line Warnings Direct service.</p> <p>Provide information to property owners and businesses on improving flood resilience and proofing.</p> <p>Carry out a wash land optimisation study.</p>	<p>Produce and implement a system asset management plan to determine the best approach to sustaining the current level of flood risk.</p> <p>Ensure that emergency response plans are reviewed.</p> <p>Promote the use of SuDS for the management of runoff, as per the recommendations of the NPPF.</p> <p>Carry out a flood warning feasibility study to address the potential to extend flood warning service coverage for Hebble Brook.</p> <p>Increase the number of properties registered on the Flood line Warnings Direct service.</p> <p>Produce and maintain a register of all culverts and outfalls within the sub-area.</p>	<p>Produce a system asset management plan to determine the best approach to sustaining the current level of flood risk.</p> <p>Ensure emergency response plans are reviewed regularly.</p> <p>With the owners of the caravan parks at Brighouse, ensure that residual risks of flooding are understood.</p> <p>Ensure that public awareness is raised through the installation of information boards and emergency evacuation plans are in place.</p> <p>Undertaking a surface water management plan for Brighouse.</p> <p>With English Heritage, identify flood risk and establish a management plan for Shibden Hall.</p> <p>Investigate the interaction between the Calder and Hebble Navigation and the River Calder and the risk of canal flooding.</p> <p>Produce and maintain a register of all culverts and outfalls and identify capacity and other issues.</p> <p>Investigate the implications of climate change scenarios on flood embankments at Armitage industrial estate in Brighouse.</p> <p>Improve public awareness of the risk of flooding from all sources.</p>

2.4 Surface Water Management Plans

SWMPs are produced by local planning authorities and outline the favoured surface water management strategy for the local area. SWMPs cover flooding from groundwater, sewers, drains, and runoff from land, ditches and small watercourses that results from heavy rainfall. The plans provide understanding of surface water flooding mechanisms and recommend mitigation measures. They can also provide evidence to inform PFRAs as well as fulfilling the requirement of the Flood Risk Regulations (2009) for flood risk management plans.

SWMPs can be used to enhance the SFRA evidence base and vice versa. SWMPs should influence land-use planning, future capital investment, future developments, drainage maintenance and emergency planning. They help identify where SuDS can be incorporated for future development sites as well as consider effects on water quality to ensure the control of untreated discharges.

The SFRA identified 11 indicative CDAs. A SWMP for Todmorden and Walsden, two of the CDAs, has been produced which identified 26 high risk flooding hotspots. SWMPs for the remaining nine indicative CDAs are to be produced. If an area is notified by the EA as a CDA then a Flood Risk Assessment (FRA) is required for any new development within the CDA.

2.5 Preliminary Flood Risk Assessment

PFRAs are produced by LLFAs in response to the Flood Risk Regulations (2009). PFRAs include basic, readily derived information such as river basin boundary maps, topography, land use and descriptions of historical flooding. They provide a general background knowledge of flooding issues.

Calderdale's PFRA⁶ came to the conclusion that surface water flood risk within Calderdale falls into four main categories:

- Flooding caused by the inhibition of surface water outfalls to the river during high Main River flows.
- Overloading and/or blockage of minor watercourses and other surface water infrastructure not influenced by Main Rivers.
- Surface water runoff from steeply sloping land or man-made surfaces.
- New development.

The PFRA made the following recommendations:

- Study the interfaces between Main River and other surface water infrastructure.
- Work with YWS to understand risks posed by the sewer network.
- Compile a consistent database of events and asset records from which to manage the infrastructure.
- Develop improved protocols to minimise the impact of development on flood risk.
- Develop closer liaison within CMBC between Highways and Engineer, Planning and Emergency Planning and Business Continuity Service Areas.
- Develop a rapport with Natural England with regard to land management.

Some progress of these recommendations has been made and they have guided the development of the strategy objectives (see Chapter 5).

2.6 River Basin Management Plan

RBMPs cover an entire river system, including river, lake, groundwater, estuarine and coastal water bodies. The River Calder catchment is included within the wider Humber RBMP. RBMPs are designed to protect and improve the quality of the water environment and are required under the Water Framework Directive. The Humber RBMP⁷ was updated in December 2015 and identified the following issues to tackle in the Calder catchment:

- Mitigation of the effects of heavily modified water bodies.
- Point source pollution, primarily from water company assets.
- Diffuse pollution, both urban and rural.
- Litter and invasive species.

⁶ Calderdale Metropolitan Borough Council. Preliminary Flood Risk Assessment. July 2011.

⁷ Environment Agency. River Basin Management Plan. Humber River Basin District. December 2015.

2.7 Calderdale Catchment Plan

Following winter 2015 devastating floods in the Calder Valley, the Environment Agency (EA) was tasked by the Secretary of State to put together a detailed Catchment Plan to manage and reduce the risk of flooding in Calderdale over the next 25 years. The plan titled 'Calderdale Flood Action Plan' contains the actions that communities and partners feel are essential to help Calderdale recover from the floods and to improve resilience and reduce the risk of flooding. The actions have been gathered through workshops, drop-in sessions and meetings held over summer 2016. Actions have been developed at a series of workshops with partners and the wider community, and have been informed by local knowledge and specialist consultant modelling, use of existing data, and linking to strategic plans.

Many of the actions are ongoing and form part of other plans and programmes, including the Calderdale Local Flood Risk Management Strategy, the 6-year investment programme and recommendations from the Calderdale Flood Commission Report.

The action plan is not a statutory document, but the Calderdale Flood Partnership Board has agreed to oversee the plan's delivery. This action plan is a 'living document' that will be discussed, monitored and updated by the Calderdale Flood Partnership. All members of the partnership are committed to its delivery and want an action plan that is available to everyone and which sets out a clear vision to inspire and encourage communities and organisations to work together to reduce the impact of future flooding.

The catchment plan will be broken down into the following themes:

- Strengthening defences.
- Natural flood management.
- Maintenance.
- Community resilience.
- Use of existing water infrastructure e.g. reservoirs, mill ponds, canal.

This strategy has been developed in conjunction with the Calderdale Flood Action Plan. The Calderdale Flood Action Plan will help to understand the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment. The plan will be used to inform planning and decision-making by key stakeholders including CMBC.

This Local Flood Risk Management Strategy, as required by Section 9 of the FWMA, is in principle a strategy to address the risk of flooding from surface water, groundwater and ordinary watercourses; local flood risk. Nevertheless, given the catchment topography, complex interaction of flood risk sources and significant risk of flooding from main rivers and canals, this Strategy addresses the risk from all sources of flooding. The structural and non-structural measures identified will define what action CMBC will take in partnership with others, to reduce and manage flood risk in Calderdale. Relevant objectives and measures are detailed in Chapters 5 and 6.

It is envisaged that a shared action plan will be produced incorporating both this Strategy's objectives and the EA Calderdale Flood Action Plan actions. The delivery of the shared action plan is to be overseen by the Calderdale Flood Partnership Board.

3 Flood risk in Calderdale

This chapter provides a strategic overview of existing flood risk from all sources within Calderdale. The datasets used in the assessment are presented along with a commentary on the existing overall flood risk from fluvial, surface water, groundwater, canals and reservoir sources. Finally, the locations of historic flooding are presented.

On Boxing Day 2015, Calderdale was the UK's worst affected Borough from flooding following sustained and heavy rainfall. Todmorden, Walsden, Hebden Bridge, Mytholmroyd, Sowerby Bridge and Elland were all struck by serious flooding. Across Calderdale approximately 3,500 homes and businesses were affected. Bridges at Elland and Mytholmroyd collapsed disrupting communications. Several electricity sub-stations failed causing power cuts across the valley. No lives were lost but that is probably due to the fortunate timing of the flood striking over the holiday period when schools and businesses were closed. The flood was the worst in living memory for many of those impacted.

The 2015 flood is the latest of many to have hit Calderdale. During the summers of 2012 and 2013 there were four major floods in Calderdale. In 2012 more than 900 properties and 253 businesses were flooded. The Upper Calder Valley was cut off and the main trunk road up the valley and the Leeds to Manchester rail link were impassable.

3.1 Flood risk datasets

Table 3-1 provides a summary of the key datasets used to describe the existing flood risk from each source.

Table 3-1: Available datasets related to sources of flooding	
Flood Source	Datasets
Fluvial flooding	Environment Agency Flood Map for Planning
	Environment Agency Risk of Flooding from Rivers and the Sea Map
	Environment Agency Flood Risk Mapping Studies
	Section 19 flood investigation reports
	Calder CFMP
	Historic evidence – Environment Agency Recorded Flood Outlines and Historic Flood Map, local evidence from CMBC drainage engineers
Surface water flooding	Risk of Flooding from Surface Water Maps – uFMfSW
	Calderdale PFRA
	Todmorden SWMP
	Local evidence from CMBC drainage engineers
	Section 19 flood investigation reports
Sewer	Yorkshire Water Services Historical Flood Records (DG5 Register)
Groundwater	Environment Agency Groundwater Susceptibility Maps
Canal	Canal and River Trust Asset Register
Reservoir	Environment Agency Reservoir Flood Maps (available online)

3.2 Fluvial flooding

Fluvial flooding is associated with the flooding from Main Rivers and ordinary watercourses. Fluvial flooding from watercourses depends on several catchment characteristics including the geography of the catchment, rainfall variations, channel steepness, the available floodplain, infiltration, the degree of urbanisation and the management of rural areas. Calderdale covers approximately 36,400ha and lies within the catchment of the upper Calder.

The Borough contains several Main Rivers including the River Calder which flows eastwards through the towns of Todmorden, Hebden Bridge, Mytholmroyd, Sowerby Bridge, Elland and Brighouse. The main tributaries off the Calder are Walsden Water in the west, the River Ryburn at Ripponden and Hebble Brook in the east which drains Halifax. Walsden Water flows through the town of Walsden and joins the Calder in Todmorden. Smaller Main River tributaries of the Calder include Hebden Water in Hebden Bridge, Cragg Brook at Mytholmroyd, Luddenden Brook at Luddenden and Red Beck, Jumble Dike and Clifton Beck (all in Brighouse).

Alongside the Main Rivers, there are approximately 7,000 ordinary watercourses across Calderdale. An ordinary watercourse is any watercourse that has not been designated as a Main River. These watercourses can vary in size considerably and can include rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows.

Figure 3-1 shows the river network within Calderdale including both Main Rivers and ordinary watercourses.

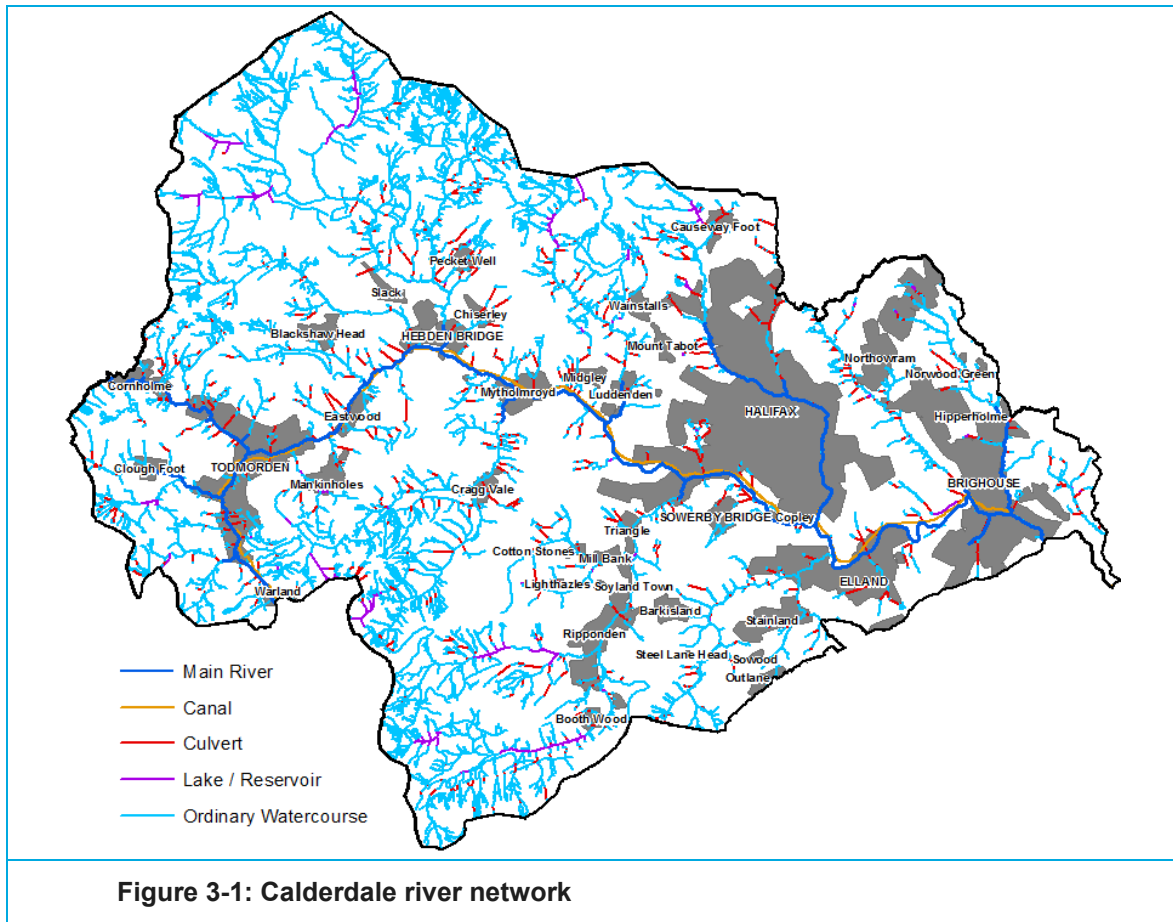


Figure 3-1: Calderdale river network

3.2.1 Environment Agency Historic Flood Map

The Historic Flood Map (HFM) shows areas of past fluvial flooding. The HFM covers the majority of the River Calder and Walsden Water with the urban areas of Todmorden, Eastwood, Hebden Bridge, Mytholmroyd, Halifax, and Elland in particular included. The EA are undertaking a post flood survey following the December 2015 floods and will update the HFM.

3.2.2 Environment Agency flood mapping

The EA's Flood Map for Planning is the main dataset used by planners for assessing likely flood risk at proposed development sites. The map is based on a generic approach supported by several detailed hydraulic river modelling studies which provide further detail on flooding mechanisms in critical areas.

The Flood Map for Planning provides flood extents for the 1 in 100-year fluvial (Flood Zone 3) and the 1 in 1,000-year (Flood Zone 2) fluvial flood events. The EA regularly update the Flood Zones as part of their flood risk mapping programme. Downstream of Elland the maps were updated in 2015. The maps upstream of Elland have not been updated since 2008 but are due to be revised by the end of 2016.

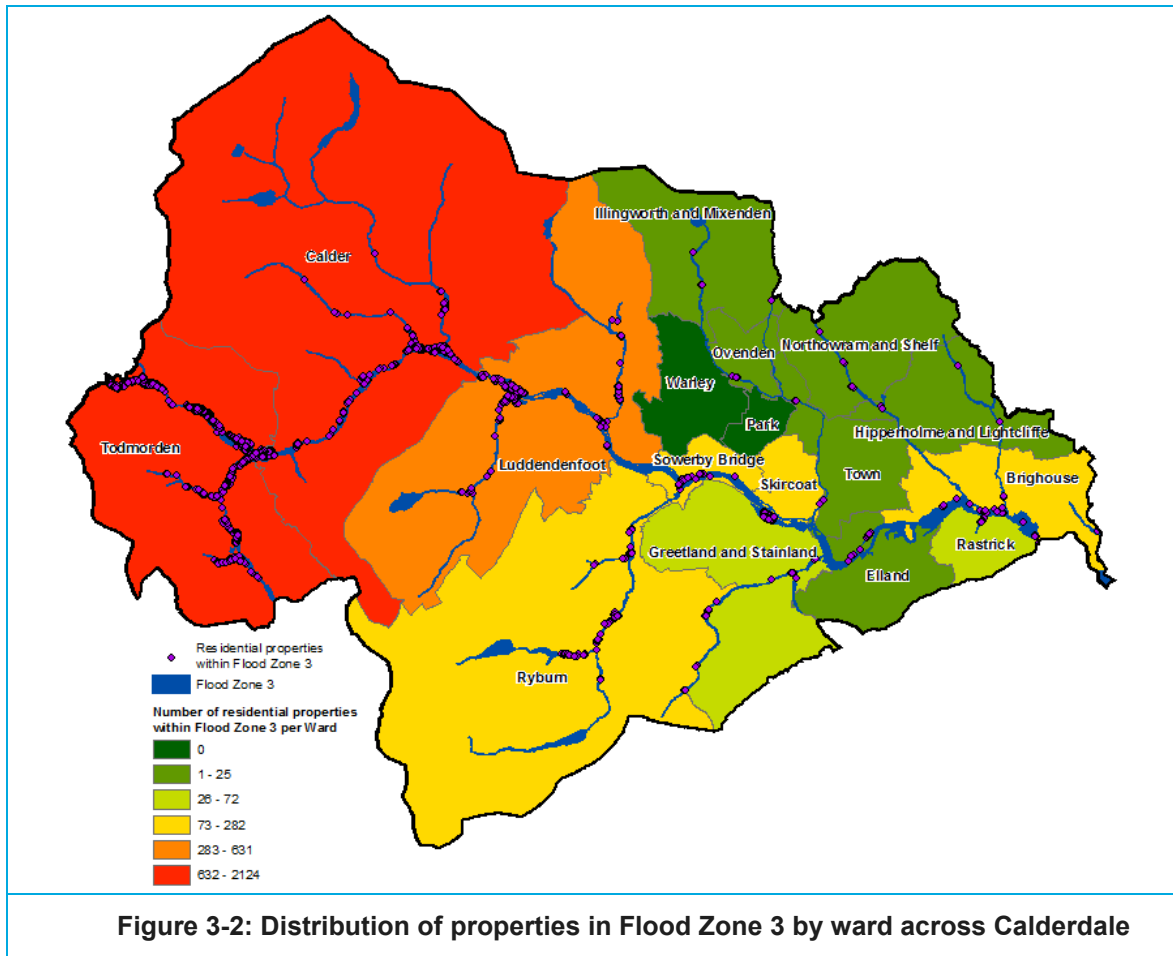
The EA Flood Map for Planning is precautionary in that it does not take account of flood defences (which can be breached, overtopped or may not be in existence for the lifetime of the development). Therefore, the map represents a worst-case extent of flooding. The Flood Zones do not consider sources of flooding other than from fluvial and tidal sources. As no account is taken of climate change certain events may continue to create severe and sustained impact.

The EA are in the process of updating their detailed hydraulic model of the River Calder and it would be expected that the Flood Map for Planning will be updated with output from that study.

The EA also provides a 'Risk of Flooding from Rivers and the Sea Map'. This map shows the EA's assessment of the likelihood of flooding from rivers and the sea, at any location, and is based on the presence and effect of all flood defences, predicted flood levels and ground levels.

Using Flood Zone 3 of the current Flood Map for Planning the number of existing residential properties potentially at risk from the 1 in 100-year fluvial flood event has been identified.

Figure 3-2 illustrates the distribution and total number of existing dwellings at risk in each Calderdale Ward.



Across Calderdale a total of 4,648 residential properties have been identified to be within Flood Zone 3. The Wards with the most properties at risk include Todmorden, Calder, and Luddenden Foot with 2,124, 805 and 631 residential properties at risk respectively. These numbers include the properties that may be protected, to some extent, by flood defences.

3.3 Surface water flooding

Surface water flooding includes:

- Surface water runoff (also known as pluvial flooding); and
- Sewer flooding

Surface water flooding can occur anywhere in Calderdale where ground levels and steep terrain cause surface water to flow and accumulate. There are certain locations though where the probability and consequence of these mechanisms are more pronounced due to complex hydraulic interactions in the urban environment. Urban watercourse connectivity, sewer capacity, and the location and condition of highway gullies all impact on surface water flood risk.

The updated Flood Map for Surface Water (uFMfSW) produced by the EA provides an overview of surface water flood risk. The uFMfSW is more refined than previous generations of the surface water flood map.

3.3.1 Pluvial flooding

Pluvial flooding of land from surface water runoff is usually caused by intense rainfall that may only last a few hours, or even minutes in the case of some parts of Calderdale. In these cases, the volume of water falling on rural land can, in a short amount of time, exceed infiltration rates resulting in overland flow. Within urban areas, when rainfall intensity is too great for the urban drainage network it results in excess water flowing along roads, through properties and ponding in natural low spots. Therefore, areas at risk can lie outside the fluvial flood zones.

Pluvial flooding within urban areas will typically be associated with events greater than the 1 in 30-year design standard of new sewer systems. Crucially Calderdale has many old sewer and highway networks with significantly less capacity than the 1 in 30-year event. There is also a

residual risk associated with these networks due to possible network failures, blockages or collapses.

The main cause of surface water flooding in Calderdale is the steep topography surrounding the various towns and villages in the Borough. A number of other contributing factors include:

- Compromised drainage infrastructure.
- Poor land management.
- New developments.
- Surface water and watercourse interaction.
- Mine water.
- Canal breaching / overtopping.
- Large anomalous rainfall events.

A particular problem has been experienced in Brighouse and Todmorden where submerged drainage outfalls cause surface water to back up behind raised defences when flood levels are high in the receiving watercourses.

3.3.2 Sewer flooding

Combined sewers, conveying waste and surface water, serve many urban areas with residential homes, businesses and highways. Combined Sewer Overflows (CSOs), provide a release for excess flows from the drainage system into local watercourses or large surface water systems. Some areas may also be served by separate foul and surface water sewers which convey waste water to treatment works and surface water into local watercourses.

Flooding from the sewer network mainly occurs when flow entering the system exceeds its available discharge capacity, the system becomes blocked or it cannot discharge due to a high water levels in the receiving watercourse. Pinch points and failures within the drainage network may also restrict flows. Water then begins to back up through the sewers and surcharge through manholes, potentially flooding highways and properties.

It should be noted that sewer flooding in 'dry weather' resulting from blockage, collapse or pumping station mechanical failure (for example), is the sole concern of Yorkshire Water (YWS) as the drainage undertaker. The DG5 Register from YWS has assisted with cataloguing historical flood incidents.

The Section 19 flood investigation report for the 22 June 2012 flood event identified sewer flooding along the Rochdale, Halifax and Burnley Roads. The Section 19 flood investigation report for the 6 to 9 July and 25 August 2012 flood events stated that rainfall and surface water exceeded the design capacity (1 in 2-year event) of the sewer network and highway drainage systems leading to widespread flooding of areas such as Hebden Bridge, Mytholmroyd and Todmorden. Blinding of road gullies by leaves or debris and overshooting of gullies by high flows on steep roads is also known to be a factor.

3.4 Groundwater flooding

Groundwater flooding is caused by the emergence of water from beneath the ground, either at point or diffuse locations. The occurrence of groundwater flooding is usually local and unlike flooding from rivers and surface water, does not generally pose a significant risk to life because of the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas, and poses further risks to the environment and ground stability.

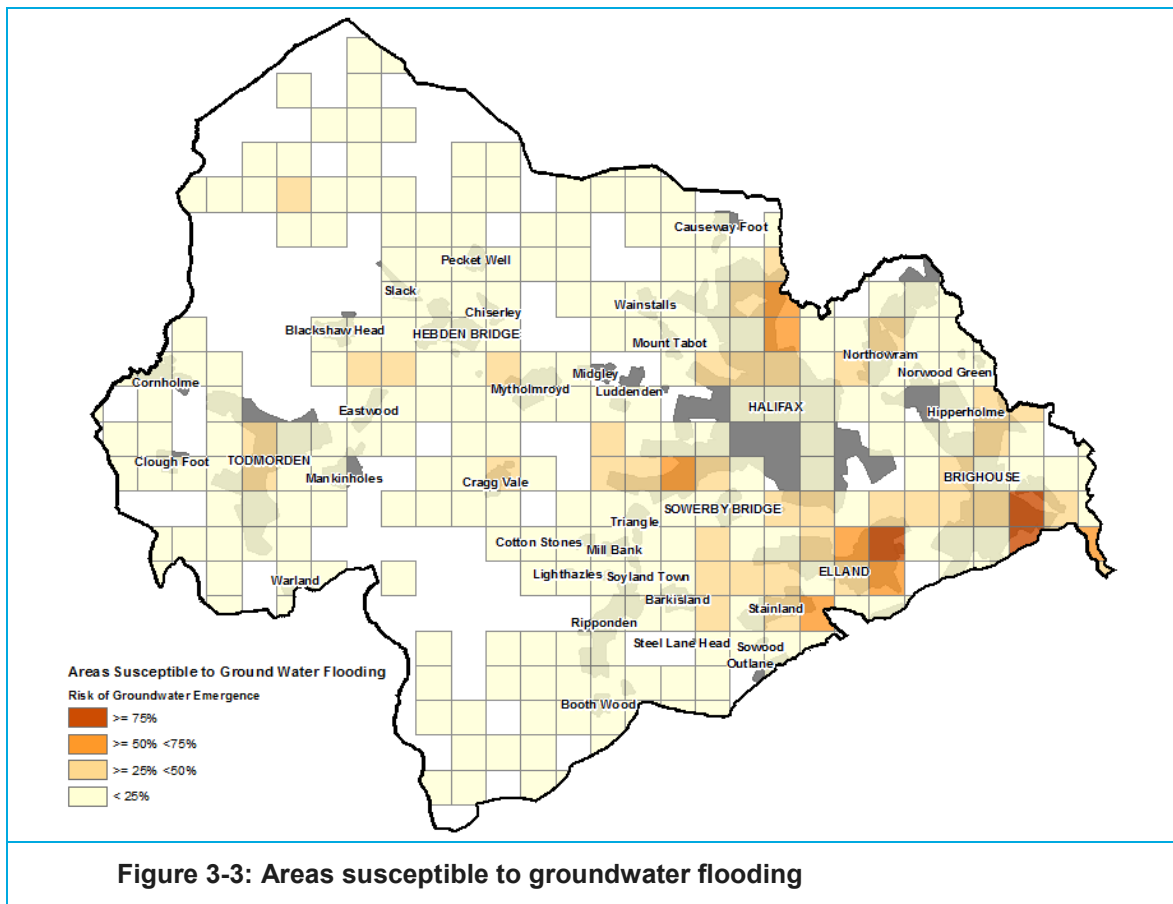
There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall, high in-bank river levels, artificial structures, groundwater rebound and mine water rebound. Properties with basements or cellars or that are located within areas susceptible to groundwater flooding are at particular risk.

Development within areas susceptible to groundwater flooding will generally not be suited to SuDS and proposals for infiltration drainage but this is dependent on a detailed site investigation and risk assessment.

3.4.1 Areas susceptible to groundwater flooding

The EA's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), provides the main dataset used to assess the risk of groundwater flooding. The AStGWF map uses four susceptible categories to show the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might be an issue. It does not show the likelihood of groundwater flooding occurring.

Figure 3-3 illustrates the AStGWF map. It shows that the risk of groundwater flooding is high in parts of Brighouse and in the east of Elland. However, across Calderdale the risk on the whole is minimal. There could however be localised problems in other areas, which are not identified on this strategic map.



3.5 Canal flooding

There are two sections of canal within Calderdale. The Rochdale Canal passes from Warland, through Walsden, Todmorden, Hebden Bridge and Mytholmroyd to where it joins the Calder and Hebble Navigation at Sowerby Bridge. The Calder and Hebble Navigation then passes east through Copley and Brighouse before entering Kirklees. The Rochdale Canal and the Calder and Hebble Navigation are owned and maintained by the CRT.

Both canals in Calderdale interact closely with the River Calder. During floods, flows from the River Calder, its tributaries and surface water runoff have been known to flow into the canal system causing flooding at locations some distance away. Excess flows of this nature can cause overtopping of the canal banks or breaching of embanked canal sections. The failure of canal assets such as lock gates and stop logs may also lead to flooding.

3.6 Reservoir flooding

A reservoir is usually an artificial lake where water is stored for household supply and industrial use, for canals systems, for providing compensatory flows to watercourses and other purposes, such as fishing lakes or leisure facilities. The risk of flooding from reservoirs is reduced through regular maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

The EA is the enforcement authority in England for the Reservoirs Act 1975. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. Local Authorities are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared. Local Authorities should work with other members of the Local Resilience Forum (LRF) to develop these plans.

There are 28 reservoirs of over 25,000m³ volume of water within Calderdale. Twenty-three are owned by YWS, three by United Utilities, one by the EA and one is under private ownership. Furthermore, there are several smaller reservoirs within Calderdale that do not fall under the requirements of the Reservoirs Act and so the implications of a failure have not been assessed.

These smaller reservoirs should be included in the Asset Data Register and flood risk assessed in the same way as for ordinary watercourses.

3.6.1 Reservoir Flood Maps

The EA has prepared reservoir flood maps for all large reservoirs that they regulate under the Reservoirs Act 1975 (reservoirs that hold over 25,000m³ of water). The maps show the largest area that might be flooded if a reservoir were to fail and release the water it holds. The reservoir flood maps can be viewed online on the Environment Agency's website.

3.7 Historic flooding

3.7.1 Fluvial flooding

Flooding is a regular feature in Calderdale. Appendix B contains a timeline of flooding incidents along the Calder valley that dates back to the early 1600's.

Runoff from the steep moorland above the urban areas in the Calder valley bottom causes major flooding problems. The road network often acts as a convenient pathway for flood waters. There is a particular issue with sedimentation of culverts and other drainage assets due to material being transported from the surrounding moorland into the channel network leading to blockages of flood risk assets. In the past this has led to backing up of flows causing flooding.

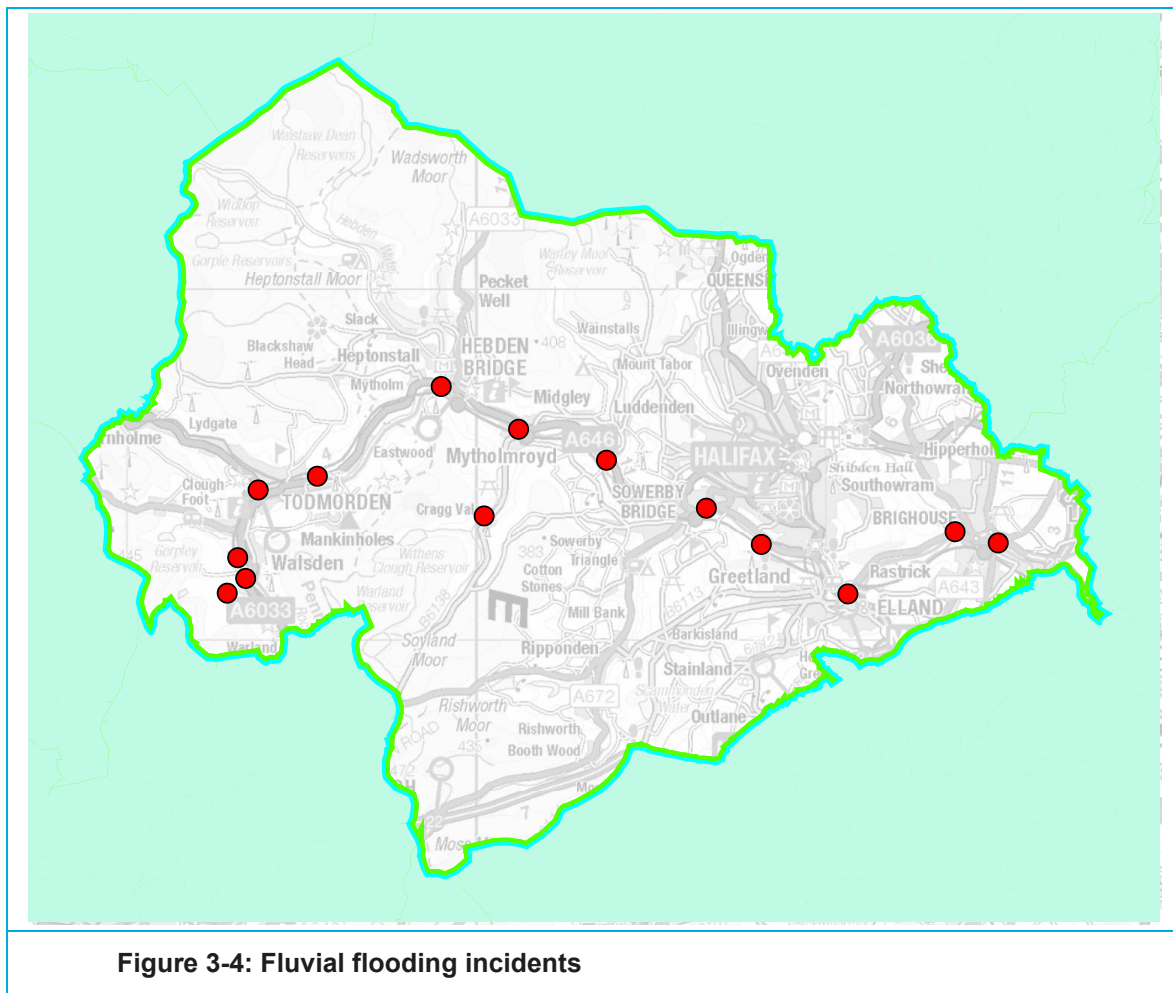
The following list provides an overview of known flooding hotspots along the Calder Valley:

- Todmorden, Flooding has regularly been recorded in Todmorden since the early nineteenth century. In 1982 large scale flooding occurred at the head of the River Calder caused by culverted river sections upstream of Todmorden becoming blocked due to a build-up of silt and bed material. This flood led to remedial works being carried out such as culvert clearance and the installation of silt / gravel traps.
- Walsden Water causes fluvial flooding of both Walsden and Todmorden. Walsden suffered greatly during the floods of 2012. A large number of small tributaries of Walsden Water which rapidly drain the surrounding moorland cause flows to exceed the capacity of the Walsden Water channel. A recently engineered flood balancing facility could not help prevent the flooding, as it is located on a branch of the channel that did not flood.
- Ramsden Clough, a tributary of Walsden Water, causes sedimentation at structures. If regular maintenance to clear the structures is not carried out, subsequent flooding, particularly of the road crossing near the cricket ground occurs. There are no silt / gravel traps in place on Ramsden Clough.
- Walsden – Railway Bridge 96 floods regularly due to low clearance and shoaling.
- Hebden Bridge – There are considerable flooding issues at Hebden Bridge especially around the Hebden Water / River Calder confluence. There are also known flooding issues related to the Rochdale Canal. Although the June 2012 and December 2015 floods are the most recent major events, flooding has been a regular feature in Hebden Bridge since the 1800's.
- Mytholmroyd – suffers from multiple flood mechanisms. Excessive vegetation cover on the banks of the Calder can cause backing up of flows. Vegetation clearance works are ongoing. The flood defences along the Calder in this area are in very poor condition. Raised defences, with a standard of protection of 50-years, have a number of large cracks in the walls which allow water to seep through. Significant damage was done to the defences during the December 2015 flood. White Lea Clough watercourse, adjacent to Midgley Road in the village centre, is prone to flooding. Also, recent (October 2013 and December 2015) flooding from the Rochdale Canal into the Clough caused out of bank flows. Frequent flooding of Mytholmroyd has been recorded back to the mid-nineteenth century.
- Cragg Vale - suffers fluvial flooding from Cragg Brook and due to the large number of tributaries running from the surrounding steep sided moorland. Cragg Brook caused flooding of Cragg Vale and Mytholmroyd in the late 1980s. Highway flooding is prevalent in Cragg Vale and Mytholmroyd. Culvert inspections are required to determine their capacity and condition.
- Sowerby Bridge is prone to fluvial flooding. There is a low lying area at the confluence with the River Ryburn that is particularly prone to flooding.
- The Rochdale Canal played a major part in the June 2012 and December 2015 floods in the Calder Valley. Excessive water from smaller moorland tributaries entered the canal.

Also, watercourses underneath the canal have overtopped due to culvert blockages caused by the deposition of bed material.

- Luddenden Brook produced one of the worst fluvial events recorded in Calderdale on the 19 May 1989. The Walshaw Dean rain gauge measured 192mm in under two hours leading to flooding of properties in Luddenden and Luddenden Foot.
- Copley, Halifax - suffered much historic flooding. Levees subsequently built on the River Calder to reduce the risk.
- Elland - the large meander on the River Calder, at Low Fields, flooded into the adjacent Calder and Hebble Navigation Canal caused flooding of properties in 2008, 2012 and 2015. There is also a high probability of flooding of the Low Fields Business Park. Part of this area of land is raised against flood waters but the lower parts almost flooded in 2008. Elland Bridge was so severely damaged by flooding during the December 2015 that it is being replaced.
- Clifton Beck, Brighouse - causes regular flooding of the Tesco car park and Wellholme Park. Much came from Yorkshire Water Services (YWS) sewers in 2008 flood but Clifton Beck was also responsible. There are also a number of properties at risk on River Street in Brighouse. Flooding of several properties occurred during 2008, 2012 and 2015 floods.

Figure 3-4 shows the locations of the above flooding incidents.



3.7.2 Surface water flooding

The Calderdale PFRA lists a number of historic surface water flood events, the locations of which are shown in Table 3-2.

Table 3-2: Historic surface water flooding locations	
Dover Bridge manhole, Callis, Wadsworth	Rosendale View, Todmorden
Allescholes Road, Todmorden	Broad Carr Farm on Sisley Lane, Todmorden
Blake Hill End, Northowram	Midgley Road Culvert - Mytholmroyd, Hebden Bridge
Clough Road, Walsden	Cornholme
Cross Stone Road, Todmorden	Cragg Road, Mytholmroyd
Hall Bank Lane / Stake Lane, Mytholmroyd	Watson Mill Lane, Sowerby Bridge
Inchfield Road, Walsden	Luddenden
Landemere Syke, Northowram	Halifax Centre
Lower Edge Road, Elland	Cooper Bridge Road, A62, Brighouse
Roselee Close, Siddal	

Further examples of pluvial flooding have been recorded:

- Kershaw Road, Walsden - cloudbursts have, in the past, caused severe damage to culverts, the highway, the railway, including Walsden Station, and seven properties.
- Hebden Bridge, July 2012 - overtopping of upstream Mill Reservoir caused flooding to Hebden Bridge due to a partial blockage of a culvert. The flooding can be attributed to a large scale pluvial event.
- Cooper Bridge, Brighouse - beyond the M62 boundary with Kirklees - surface water flooding of the road. The construction of a YWS sludge plant may have contributed to highway flooding in the past but YWS resolved this by funding the construction of a soakaway on YWS land. A secondary flooding issue under the railway bridge remains unresolved. This is caused by the infilling of a riparian drainage ditch, by a member of the community.
- A646, Mytholmroyd to Todmorden - several stretches of road regularly flood causing regular road closures. CMBC are currently investigating the causes of these incidents.
- Clough Foot, Bacup Road – Runoff from steep moorland on to Bacup Road causes flooding with the highway being known to flow like a river.
- At Sowerby Bridge a pluvial event around the golf course caused flooding of Watson Mill Lane which led to the road being eroded down to the sewer network below. A number of properties also flooded.
- Brookfoot, Brighouse - flooding from the main valley sewer which joins the Red Beck sewer - the downstream capacity is too small. A scheme set up to penstock and pump water around this section is often unsuccessful. The local factory is regularly flooded.

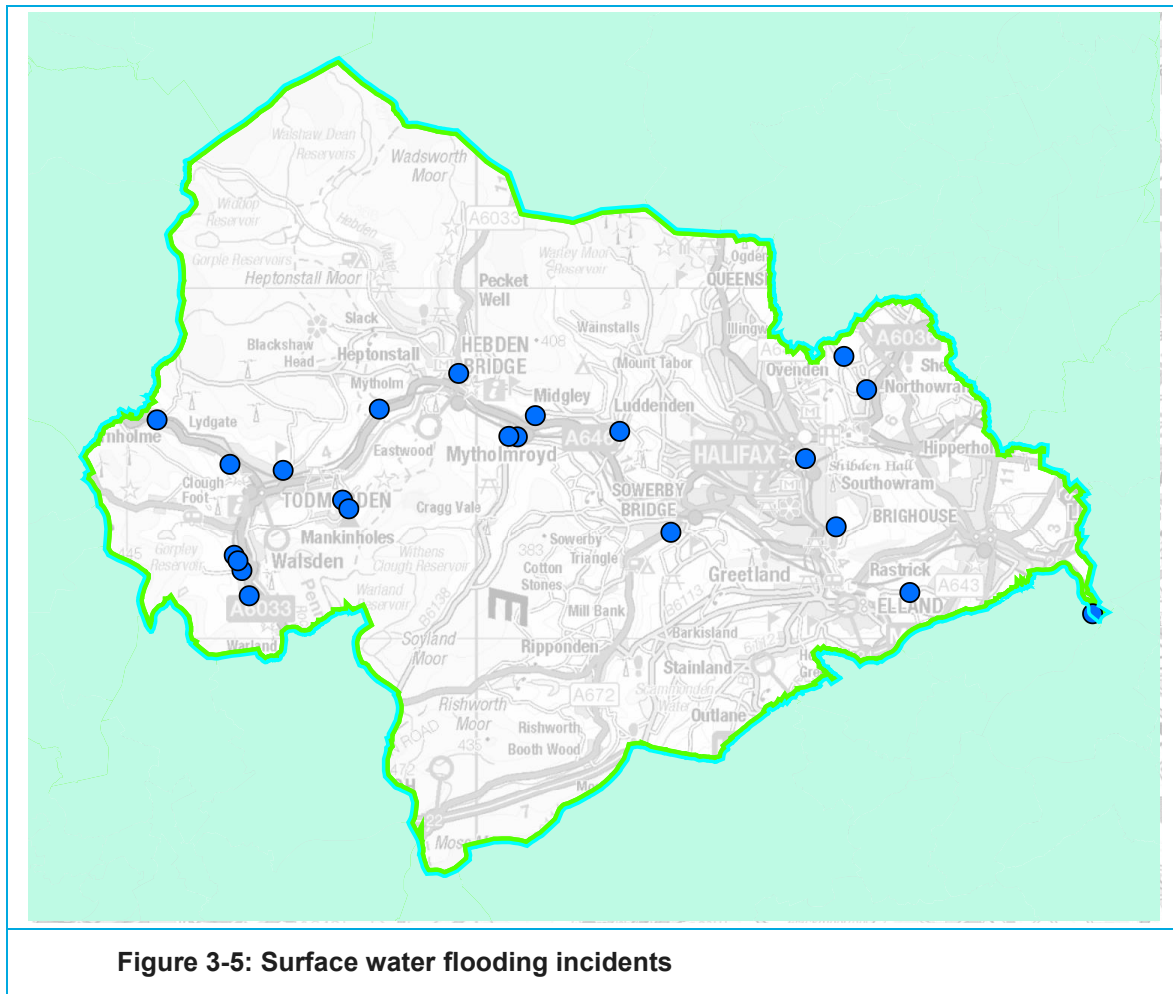
The Section 19 flood investigation report for the 22 June 2012 flood event identified the following surface water flooding mechanisms:

- Excessive surface water entering the Rochdale Canal overloading the canal network.
- Hillside surface water runoff in Walsden.

The Section 19 flood investigation report for the 6 to 9 July and 25 August 2012 flood events identified the following surface water flooding mechanisms, causing flooding in Hebden Bridge, Mytholmroyd and Todmorden:

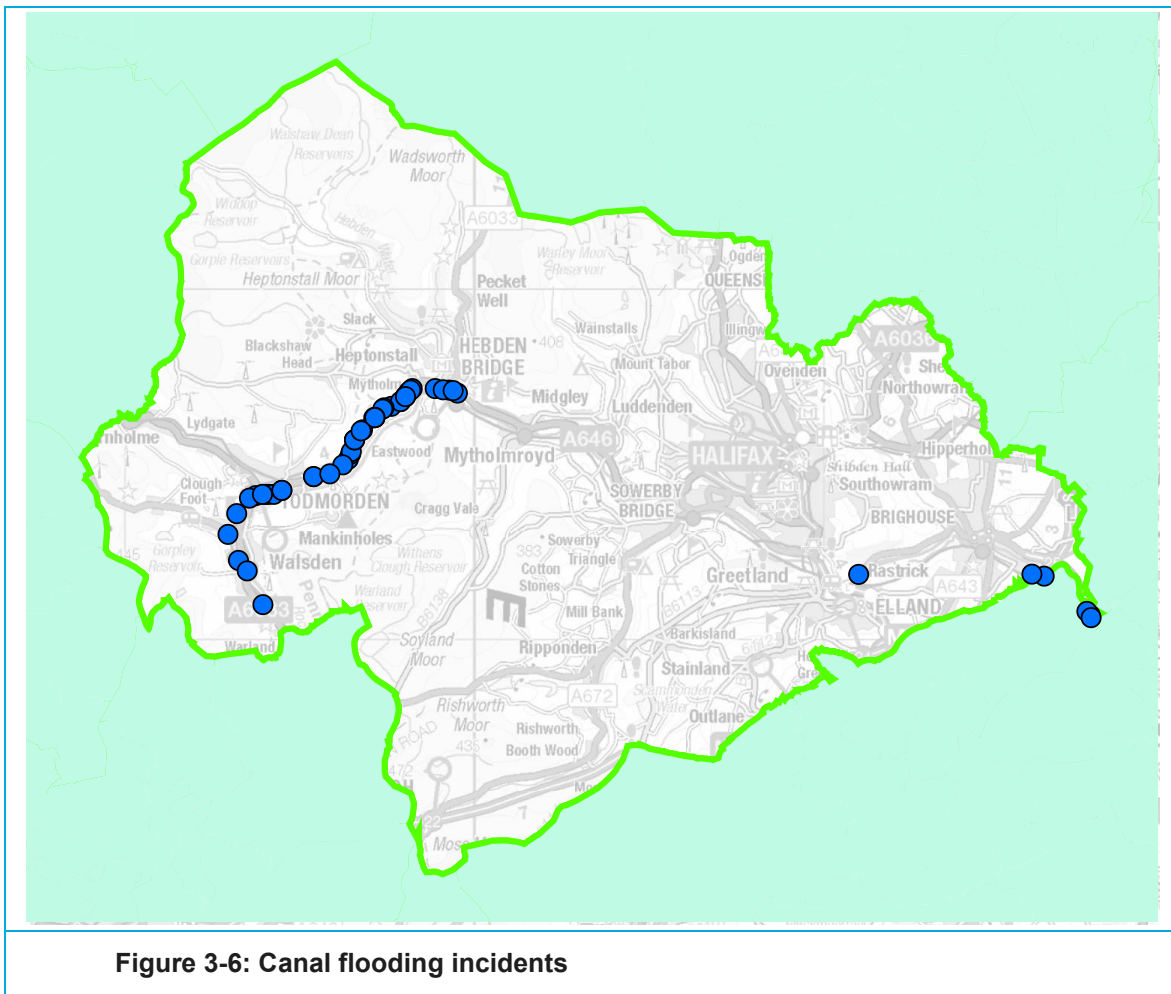
- The Nutclough Reservoir spillway and overflow were unable to contain flood waters leading to surface water flooding of the surrounding areas.
- Excess surface water entering the Rochdale Canal resulting in the canal overtopping.
- Hillside runoff caused significant damage to drainage and highway infrastructure, properties and footpaths.

Figure 3-5 shows the locations of the above surface water flooding incidents.



3.7.3 Canal flooding

The Canal and River Trust (CRT) have provided their Asset Database, which includes a register of their assets including canals, major embankments and reservoirs together. The database includes 46 historic breach and overtopping locations including dates and a description of the cause and effects of the flooding. Figure 3-6 shows the locations of the breach and overtopping locations.



The CRT have provided feedback regarding where water flowed into and escaped from the Rochdale Canal during the December 2015 flood.

4 Risk Management Authorities and stakeholders

4.1 Introduction

The frequency and severity of flooding has had a major impact on local businesses, schools, and homes in Calderdale. As LLFA, CMBC will place itself at the heart of flood risk management within the Borough in order to mitigate the risk to life and the impact of such major events on our local communities. However, that role cannot be done in isolation and requires a partnership approach. This was a key theme of the Pitt Review that recognised RMAs should work in partnership to deliver better flood risk management for the benefit of their communities.

Partnership working is already a feature CMBC's approach to flood risk management via the:

- Calderdale Flood Recovery and Resilience Partnership.
- West Yorkshire Flood Risk Partnership.
- Yorkshire Regional Flood & Coastal Committee.

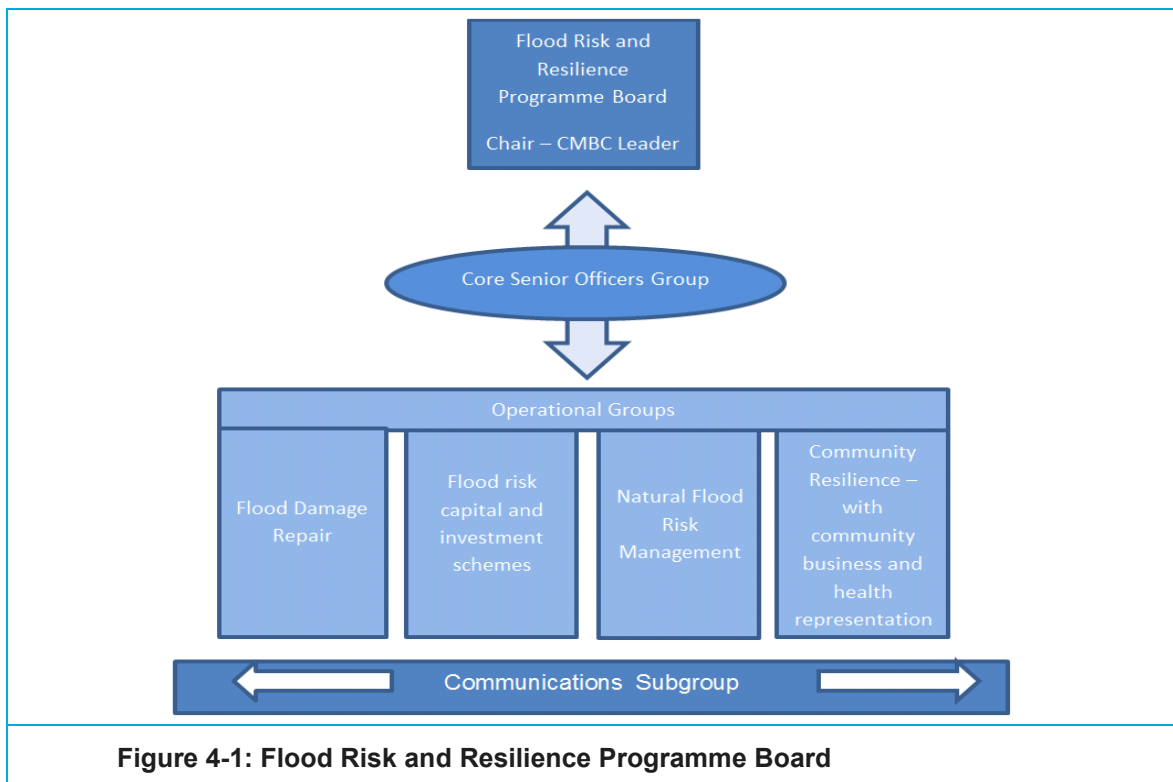
4.1.1 Calderdale Flood Recovery and Resilience Programme

The Calderdale Flood Recovery and Resilience Programme has been in place since the three flood events in 2012. The programme brings together a range of partners including the Council, the Environment Agency, Canal and River Trust, local flood groups, Yorkshire Water, Network Rail, and the voluntary sector. The aim of the partnership is to work together to substantially reduce the impact of flooding in Calderdale as well as supporting the local community to build its resilience against future flood events.

The delivery of the Programme is overseen by a Programme Board which is chaired by the Calderdale Council Leader. Members include local Councillors from all political parties, the Calderdale Council Chief Executive and the two borough MPs. The Board has recently had a governance review and as a result it has expanded its structure from two to four operational groups:

- Natural Flood Management,
- Flood Reduction and Investment,
- Flood Damage Repair
- Community Resilience

It also has a crosscutting Communications sub group.



4.1.2 West Yorkshire Flood Risk Partnership

The West Yorkshire Flood Risk Partnership looks at a strategy for all five of the districts in West Yorkshire (Bradford, Calderdale, Kirklees, Leeds and Wakefield) and includes representatives from the EA, YWS and the Regional Flood and Coastal Committee.

4.1.3 Risk management authorities and stakeholders

Under the FWMA, RMAs have a duty to co-operate with each other and to share data. For Calderdale, the FWMA defines the RMAs as:

- CMBC in its role as LLFA and Highway Authority.
- The EA.
- YWS in its role as the water and sewerage company

FCERM is now viewed by Government as a partnership between RMAs, stakeholders and the local communities. Therefore, CMBC will seek to work with a range of stakeholders in order to deliver the LFRMS. Relevant stakeholders include:

- Canals and Rivers Trust
- Riparian owners and householders
- Network Rail
- Northern Power Grid
- Local flood groups

This chapter describes the roles of the RMAs and stakeholders in Calderdale.

4.2 Calderdale Metropolitan Borough Council

CMBC has a range of different roles that are important for flood risk management. These include:

- Lead Local Flood Authority
- Statutory Consultee for Surface Water Drainage
- Emergency Planning
- Highway Authority
- Planning Authority

4.2.1 Lead Local Flood Authority

The FWMA 2010 identified Calderdale as the LLFA for the Borough. This gave CMBC a strategic role in overseeing the management of local flood risk. This strategic responsibility rests within the Economy and Environment Directorate, which includes other essential flood management and operational response ranging from Planning to Highways maintenance. As LLFA Calderdale must review flood risk from ordinary watercourses, surface water runoff and groundwater. Other key roles include:

- The Flood Risk Regulations 2009 require all LLFAs to produce a Preliminary Flood Risk Assessment (PFRA). The PFRA identifies any Indicative Flood Risk Areas (IFRA). Calderdale has completed its PFRA (see section 2.5) and the Borough does not contain an IFRA as defined for this purpose.
- Investigating Flood Incidents requires the collection of precise records to assemble an accurate picture of flood events. This enables the LLFA to assign responsibilities and examine whether RMAs exercised their functions in response to the flood.
- Asset Register - Flood Risk Assets are structures or features which are considered to have an effect on flood risk and should be recorded within an asset register (available for inspection by the public at all reasonable times). The Asset Register is a means to reduce confusion over asset ownership and maintenance and facilitates a rapid response should problems occur.
- Land Drainage Act 1991 - This Act remains unaltered by the new legislation with the exception of two sections which have been repealed. All the remaining provisions constitute permissive powers assigned to the LLFA. There are no statutory duties but the CMBC endeavours to investigate reports of flooding at any scale in order, subject to resources, to direct customers to the appropriate solutions/resources.

4.2.2 Statutory consultee for surface water drainage

SuDS approval and enforcement is administered through the Planning System and the Council as a LLFA is a statutory consultee to the LPAs for surface water drainage.

SuDS are mechanisms to ensure that surface water from development such as new housing or commercial sites, does not add to flood risk elsewhere. SuDS delay peak surface water run-off for later discharge and/or allow infiltration into the ground. SuDS also present an opportunity to ensure that water quality and public facilities are considered with the same importance as managing volumes of water. SuDS may also be applied to other forms of drainage (e.g. highway drainage) and can be retrofitted to any surface water installation if conditions are appropriate.

West Yorkshire Combined Authority standards for SuDS are available to developers as initial guidance on SuDS techniques.

4.2.3 Emergency Planning

The Emergency Planning Team is responsible for ensuring CMBC is prepared and ready to provide support to the Emergency Services during an emergency incident. The team also lead in assisting the community in the recovery and return to normality after an incident. They do this by preparing, maintaining and updating the Council's Emergency & Business Continuity Plans.

Local Authorities have the following duties under the Civil Contingencies Act:

- To carry out risk assessments of all threats to local resilience.
- To adopt preventative measures that will reduce, control or mitigate those threats.
- To prepare contingency plans in order to mitigate the effects of any incident.
- To coordinate multi agency planning for reservoir inundation within Calderdale.
- To respond to any emergency incidents (or assist in that response).
- To warn and inform the public during emergency incidents.
- To prepare "business continuity" plans that will ensure our continuing ability to respond to incidents and continue to provide our Services.
- Share information with other local responders to enhance co-ordination.
- Co-operate with other local responders to enhance co-ordination and efficiency.
- Provide advice and assistance to businesses and voluntary organisations about business continuity management.

Responding to and recovery from flood events is an essential element of council emergency planning and a key component of this Strategy. The overarching aim is to avoid a disaggregated approach to preparedness and response to flood events within the Borough. It is important to

have a clear line of responsibility concerning flooding issues and aligning emergency planning with the Strategy objectives.

Specific Calderdale Management roles during Flood Incident Management include:

- Monitor and disseminate weather patterns, hydrological conditions, and any final maintenance of drainage assets (CMBC Highways)
- Flood warnings to relevant Council services for action (CMBC Emergency Planning Team).
- Co-ordinate the Council's response to the incident (CMBC Critical Incident Management Team).
- Liaise with various partner organisations in order to provide an effective response.
- Warn and inform the public.
- Ensure the welfare of those affected is considered i.e. rest centres and transportation.

4.2.4 Highway Authority

As a Highway Authority, Calderdale has a range of duties and responsibilities. As part of normal 'winter maintenance' Calderdale Highways will monitor and analyse weather patterns, especially for snow and frost. Since Boxing Day 2015, it now monitors hydrological conditions and is building up local expertise on weather forecasting in conjunction with the EA, Northern Power Grid, and Network Rail.

CMBC has the duty to drain the highway, but not in all flood conditions, where the capacity of a highway drain is small compared to a main river. The national design standard for highway drainage only requires the system to be capable accepting flows generated by a 1 in 5-year return period storm event. Consequently, highway flooding is a regular event. Where highway drainage is connected to sewers or watercourses the Highway Authority is not in control of the capacity of the receiving pipe/culvert.

Under the Civil Contingencies Act, CMBC is only required to have regard for the potential situations. In practice, Calderdale Highways Authority provides the principal logistical mechanism for CMBC to respond to communities in flooding incidents. As damage to water assets and structures create risk to homes and properties as a result of water ingress and community severance by loss or impassability of bridges or roads, the aim of the work of the Highways Authority is to prevent flooding of and protection of the highway. This will include protection of key properties and assets that are deemed to be at risk.

4.2.5 Planning Authority

It is vital that local planning decisions consider risk from all forms of flooding as applicable. This is achieved by consultation with other stakeholders as relevant. The overall aim is to ensure that inappropriate development is avoided in areas of high flood risk and that where possible flood risk is reduced as a result of development.

4.2.6 Consenting Authority

The LLFA is the consenting body for works within ordinary watercourses.

4.3 Environment Agency

The EA is an executive, non-departmental public body responsible to the Secretary of State for Environment Food and Rural Affairs. Its principal aims are to protect and improve the environment, and to promote sustainable development. The EA take lead responsibility for risk based management of flooding from Main Rivers and the sea and the regulation of the safety of reservoirs with a storage capacity greater than 25,000m³. This volume is planned to be reduced to 10,000m³ when the relevant sections of the FWMA are implemented.

The EA has both a strategic overview of flooding of all kinds and local operational roles when it comes to management of flooding from main rivers and reservoirs and is the permitting body for works adjacent to and within main rivers.

4.3.1 Main Rivers

Main Rivers are watercourses shown on the statutory Main River map held by the EA and Defra. The EA has an annual programme of channel and asset maintenance to alleviate flooding problems from Main Rivers. It can also bring forward flood defence and improvement schemes through the Regional Flood and Coastal Committees (RFCCs), and it will work with LLFAs and local communities to shape schemes which respond to local priorities. Funding (partial) for this work is provided on qualification by Defra.

4.3.2 Reservoirs

The EA is responsible under the 1975 Reservoirs Act as an Enforcement Authority in England and Wales for reservoirs that are greater than 25,000m³. The EA must ensure flood plans are produced for specified reservoirs. However, responsibility for carrying out work to manage reservoir safety lies with the reservoir owner/operator who should produce the flood plans. The EA is also responsible for establishing and maintaining a register of reservoirs, and making this information available to the public.

4.3.3 Emergency planning

The EA contributes to the development of multi-agency flood plans, which are developed by LRFs and help the organisations involved in responding to a flood work together better. The EA also contributes to the National Flood Emergency Framework for England which includes guidance on developing and assessing these plans. It works with the Meteorological Office to provide forecasts and flood warnings of flooding in England.

4.3.4 Planning process

The EA is responsible for providing advice to planning authorities on development and flood risk; providing fluvial and coastal flood warnings; monitoring flood and coastal erosion risks and supporting emergency responders when floods occur.

4.3.5 Consenting Authority

The EA is the permitting body for works adjacent to and within Main Rivers.

4.4 Yorkshire Water Services

The principal responsibilities of YWS in relation to flood risk management are to:

- Respond to flooding incidents involving their assets.
- Maintain a register of properties at risk of flooding due to a hydraulic overload in the sewerage network (DG5 register).
- Undertake capacity improvements to alleviate sewer flooding problems on the DG5 register, as defined by the Office of Water Services (OFWAT).
- Provide, maintain and operate systems of public sewers and works for the purpose of effectively draining an area.
- Co-operate with other relevant authorities in the exercise of their flood and coastal erosion risk management functions.
- Have regard to national and local flood and coastal erosion risk management strategies.

4.5 Stakeholders

4.5.1 Canal and Rivers Trust

The responsibilities of the CRT relate to its function as a navigation authority. It is not funded for flood risk management except in the context of maintaining the canals and their feeder streams, by-passes and discharge weirs fit for purpose.

However, the events of 2012 and 2015 proved that the Rochdale Canal in particular is a critical asset in relation to flood risk management in Calderdale. Therefore, CMBC will seek to work in partnership with the CRT to respond to flood risk issues.

4.5.2 Riparian owners and householders

Riparian owners own the land adjoining a watercourse. They have rights and responsibilities as detailed within the EA document 'Living on the Edge'⁸. 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 they did not originate from their land. These debris may be natural or man-made; and
- Keep any structures that they own clear of debris. These structures include culverts, trash screens, weirs and mill gates.

⁸ Environment Agency - Living on the Edge. A guide to your rights and responsibilities of riverside ownership. 2014.

Riparian landowners are not expected to provide an emergency response to flood events. However, in keeping with their Land Drainage Act duties they should co-operate with the LLFA to reduce flood risk wherever possible. In extreme circumstances the LLFA might use its Land Drainage Act powers to require action by riparian owners.

It is the property owner's responsibility to take steps to reduce the potential impact flood waters can have on their property by making their property as resistant and resilient to identified flood risk as possible.

Flood events provide the opportunity to introduce resilience measures in conjunction with their insurers who are now beginning to recognise the value of doing more than replacing like for like.

A growing part of Calderdale's LFRMS is to promote the principles of self-help by local communities and at-risk property owners. The recently completed Defra Pathfinder project encouraged the setting up of local flood groups, providing assistance to residents to assess their property's suitability for resistance and resilience measures and general awareness within the Community of on-going risk.

4.5.3 Network Rail

Nationally, NR has a substantial commitment with regard to monitoring flooding to numerous structures, earthwork assets, line side equipment, depots and offices and so has a clear policy on managing flood risk. In applying the guiding principles for flood risk management, NR seeks to:

- Assess the vulnerability of existing assets and prioritise those needing action.
- Build resilience to flooding into the design of new assets.
- Mitigate the effects of flooding by adapting existing assets to include resilience measures.
- Work with the Met Office and EA to ensure flood warnings are available, site specific and provide adequate lead times.
- Ensure robust information technology (IT) and communication systems are in place to cope with events.
- Develop business continuity plans for coping during and after floods.
- Work with LRFs in order to share information and ensure effective emergency planning

4.5.4 Northern Power Grid

NPG operate the electricity distribution system across Yorkshire and the North East. NPG are responsible for distribution substations, primary substations, supply points and grid supply points. NPG have in place a code of practice for addressing flooding of their infrastructure from rivers and the sea. The code of practice presents a methodology for establishing flood risk, carrying out cost/benefit assessment and implementing flood mitigation measures that may be required.

This code of practice is aimed at ensuring that all ground mounted operational substation premises across NPG's area are adequately protected against the potential effects of flooding events. The effective application of the code of practice contributes to minimising damage caused to the substation population in the event of a flood and relies on:

- A suite of standard designs is available for flood defended ground mounted distribution substations to enable appropriate engineers to either adopt a standard flood defended design or modify such a design as required by the specific project;
- A programme of work is authorised to provide flood mitigation measures at existing major substation sites.

4.6 Local Groups

4.6.1 Todmorden Flood Group

The Todmorden Flood Group are a group of local people who work to help the local community with issues regarding flooding. The group wishes to influence what happens before, during and after a flood event and this is achieved by:

- Identifying and addressing areas of concern relating to flooding in the town,
- Gathering together information and experiences from affected people.
- Working closely with other organisations so that Todmorden is better equipped to cope with future floods.

The Group:

- Receives information from members of the Todmorden community concerning problems, needs and opinions about actions felt necessary.
- Identifies and supports vulnerable members of the community who are at risk and live in properties prone to flooding.
- Develop effective communications between residents and all organisations, including organisations who manage or influence flood risks (such as CMBC, Todmorden Council, the EA and YWS).
- Promote personal household flood resilience, assist with insurance queries and communicate with relevant agencies in order to create and implement local flood plans.
- Operates flood resilience stores at seven key areas across Todmorden. The stores store items to help before, during and after a flood event.

4.6.2 Hebden Royd Flood Action Group

The Hebden Royd Flood Action Group has developed a Community Flood Plan based on the main areas of Hebden Bridge and Mytholmroyd that have flooded in the past. The plan includes four flood stores supported by local people who act as key holders and distribute the equipment they hold for reducing flooding and cleaning up afterwards. The group works closely with CMBC and the EA to identify ways of preventing flooding or reducing the damage it does.

5 Strategy Objectives

5.1 Overview of strategy objectives

The strategy objectives have been split into four broad categories:

- Build a better understanding of local flood risk issues from all sources.
- Actively reduce flood risk.
- Manage and reduce residual flood risk.
- Improve preparedness to flood events.

The next chapter summarises the measures that need to be addressed within each of these categories in order to meet the Strategy objectives and comply with the National FCERM Strategy (see 1.2).

The subsequent chapter presents the detailed strategy measures required within each category, the progress to date against those measures, the actions required to deliver the strategy and the benefits of successful implementation.

6 Strategy Measures

6.1 Build a better understanding of local flood risk issues from all sources.

In order to target resources efficiently the strategy requires reliable information on which to base flood risk management decisions. The strategy objective for building a better understanding of flood risk from all sources is to be delivered by the following measures:

- **Build a Comprehensive Flood Risk Asset Data Register** - A comprehensive register provides a sound knowledge base for the management of flood risk. An up to date asset register including an assessment of asset condition, asset priority, ownership and maintenance regime will enable CMBC to target resources appropriately.
- **Improve Understanding of Existing Flood Risk** - Knowledge of the major flood risk areas, CDAs, the sources and mechanisms of flood risk and the numbers of properties at flood risk will allow CMBC to implement robust development control procedures and identify the most effective flood risk control measures to manage flood risk. Better recording of flood incidents will help identify flood risk hot spots.
- **Strategic Environmental Assessment** - An SEA is required to underpin the LFRMS so that there is confidence that implementation of the strategy will be sustainable and avoid adverse environmental impacts.

This part of the strategy meets the National FCERM objective for understanding the risks of flooding.

6.2 Actively reduce flood risk

Measures to reduce flood risk will increase the efficiency of proposed flood risk management measures. The measures to reduce flood risk are assembled in the following groups:

- **Increase Critical Infrastructure Resilience** - The failure of critical infrastructure during flood events hinders the flood risk response of RMAs and widens the impact of a flood event. Therefore, building resilience measures into critical infrastructure will minimise the impact of flood events allowing shorter recovery times following a flood.
- **Implement Robust Development Control Procedures** - Inappropriate development (in floodplains or CDAs) will reduce flood storage and increase runoff worsening the existing level of flood risk. The application of strong development control procedures will allow management of development without increasing flood risk.
- **Improve Asset, River and Habitat Maintenance** - Maintenance of flood risk assets (removal of debris etc.) will help them to perform to their best during floods. Such measures though require consideration of responsibility to the environment.
- **Improve Upland Catchment Land Management** - Management of the upland catchment offers the possibility of reducing runoff and so reducing flood risk in the valley below. Given the steep sided nature of the Calder valley such measures would be concentrated on the high plateau. Options for managing floodplain land and maximising storage may help reduce the speed of the flood wave along the valley. Such measures are unlikely to eliminate flood risk altogether but offer an opportunity to reduce flood runoff and hence risk.

This section of the strategy supports the National FCERM objective to avoid inappropriate development in areas of flood risk.

6.3 Manage and reduce residual flood risk

Although measures to reduce flood risk, outlined in section 6.2, will help alleviate flooding in Calderdale there will still be a residual flood risk that needs managing. Measures required to manage the residual flood risk have been grouped as follows:

- **Deliver the Calderdale Flood Investment Plan** - Several flood alleviation schemes had already been identified when the draft LFRMS was written. Delivery of these schemes will manage flood risk in some of the known Calderdale flood risk areas.
- **Improve Management of Surface Water Flows** - The steep sided nature of the Calder valley leads to severe problems managing surface water runoff. This causes flooding to property on the flow path. Further problems are caused by the ponding of surface water behind defences when high river levels prevent discharge.
- **Determine Scheme Priorities** - Assessing scheme priorities will ensure schemes deliver the best value for their investment.

This section of the strategy aligns with the National FCERM objective to build, maintain and improve flood management infrastructure.

6.4 Improving preparedness for flood events

Being prepared for an event will enable the effect of flooding on communities to be minimised. The following groups of measures are needed:

- **Test and Improve existing warning systems** - The first stage of preparedness is achieving adequate warning of an event. In the upper Calder valley this is a particular challenge where the time from rainfall falling on the catchment to peak flooding in the valley can be as little as half an hour.
- **Improve community resilience** - Rapid runoff presents challenges for the timely deployment of RMA staff during floods. Promoting community resilience will enable flood prone areas to cope better with events.
- **Risk management authorities and stakeholders** - Minimising the effects of flooding on critical infrastructure will enable communities and RMAs to cope better with flood events. Having a clear strategy for asset inspections during events will enable RMAs and stakeholders to deploy resources effectively when flooding occurs.
- **Improve Communication during and following a flood event** - A clear communication strategy will allow flood affected communities to know what steps to take to prepare for floods, where to find information during an event and where to find help after flooding has occurred.

These measures fulfil the National FCERM Strategy objectives to increase public awareness and improve the detection, forecasting and issuing of flood warnings.

7 Strategy Actions

7.1 Build a better understanding of local flood risk issues

Table 7-1: Actions to build a better understanding of local flood risk issues
<p>Build a Comprehensive Asset Data Register</p> <ul style="list-style-type: none"> • Update and expand the asset register to include all potential flood defence assets. • Identify high risk culverts, watercourses, highway drains and other drainage assets, structures and locations. Designate critical assets as required • Use asset management techniques to improve the long term performance of Flood Risk Management Assets. • Review and improve data collection and recording from all sources.
<p>Improve Understanding of Existing Flood Risk</p> <ul style="list-style-type: none"> • Work with the EA mapping teams to add local data to surface water flood risk maps to counter inappropriate national modelling assumptions. • Complete SWMPs for the whole borough reflecting flooding priorities. • Continue to develop integrated models of surface water sewer and watercourse flooding for at risk locations in Calderdale. • Improve understanding of flood risk, weather patterns, flooding mechanisms and flow paths to inform development of solutions using all available 'tools'. • Determine appropriate responses to the risks. • Improve recording of flood incidents and protocols for undertaking investigations.
<p>Strategic Environmental Assessment</p> <ul style="list-style-type: none"> • Carry out an SEA which complies with EU Directives and with the aspirations of the Environment and Infrastructure Project Board. • Develop and maintain a Strategic Environmental Assessment (SEA) for flood risk management. • Liaise with the EA, CMBC Environmentalists and other partner organisations to ensure that the document is practical and fit for purpose.

7.1.1 Progress to date

Build a Comprehensive Asset Data Register

Work on completing the asset register is ongoing. The floods of 2012, 2013 and 2015 underline the imperative to conclude this work at the earliest opportunity.

- The current register covers approximately 70% of the CMBC area. The areas that are not covered are generally sparsely populated (the moors above Heptonstall and Ripponden). The existing register is inclusive of significant ordinary watercourses.
- A record of the most significant flood risk assets (mainly culverts and trash screens) have been included within the Drainage Asset Management System (DAMS). Further work on recording the required details, as per the FWMA, is required. Other non-flood risk asset databases contain information relevant to the flood risk asset data register and these will need to be aligned.
- Recorded maintenance regimes and designation of critical assets based on flood risk prioritisation is to be carried out for the completed flood risk asset data register. Designation of critical assets is supported by the FWMA and consent is required for any works to a designated critical asset.
- An initial study on the potential criticalness of recorded flood risk assets has been undertaken and this will inform maintenance regimes in preparation of winter 2016.

Improve Understanding of Existing Flood Risk

The most comprehensive understanding of flood risk across the CMBC area was provided in the SFRA (see section 2.2).

- 11 indicative critical drainage areas were identified in the SFRA. These are: Walsden, Todmorden, Hebden Bridge, Ripponden, Halifax, Elland and Brighouse, Northowram and Shelf, Mytholmroyd, Luddenden, Cragg Vale and Bailiff Bridge.
- Two of these areas are covered by an SWMP. The Todmorden SWMP included Walsden and identified 26 high risk flooding hot spots. The ten most critical hotspots are

at: Oak Hill Clough, Cross Stone Road, Shakespeare Avenue, Rochdale Road (opposite Morrison's), Centre Vale Park, Kershaw Road (Walsden), Halifax Road (and adjacent streets), junction of Inchfield Road, Rochdale Road, Birks Lane and Newall Street, Woodhouse Road (Millwood) and Callis Bridge.

- YWS have undertaken and are progressing several Drainage Area Plans across Calderdale at Brighouse, Elland, Ripponden, Sowerby Bridge, Luddenden Foot, Todmorden and Hebden Bridge.
- A flood incident investigation policy have been drafted and are detailed in appendix E of this Strategy.

Strategic Environmental Assessment

A draft LFRMS⁹ was produced in October 2014 and an SEA of that strategy was developed in December 2014¹⁰. The SEA assessed the impact of the three flood risk management options:

- **Do Nothing** - where no action is taken and existing assets and ordinary watercourses are abandoned.
- **Maintain current flood risk** - where existing assets and watercourses are maintained in line with current levels of flood risk. Existing infrastructure is not improved over time and the effects of climate change are not taken into account.
- **Manage and reduce local flood risk** - take action to reduce levels of flood risk within the Calderdale and to reduce the social, economic and environmental impacts due to flooding.

The options were assessed against 11 objectives:

- Adapt to and mitigate the impact of climate change, including flood risk
- To ensure that flood management and related activities use natural resources more efficiently and sustainably, in particular, mineral aggregates, water and fuel
- To ensure protection and enhancement of biodiversity at designated and undesignated nature conservation sites
- Promote the conservation and wise use of land, and protect soil quality and quantity
- Prevent pollution to the water environment and protect resources
- To safeguard and promote existing public access, navigation and recreational resources and to promote education on the environment
- To reduce the flood risk to population and properties and to contribute to flood risk management within Calderdale
- Reduce economic cost of flood damage
- Ensure the potential impact of flooding on existing and future housing and critical infrastructure is minimised
- Protect and enhance the historic environment, heritage assets and their setting (including architectural and archaeological heritage)
- To protect and enhance attractive landscapes in terms of both their visual quality and their character and green infrastructure

The SEA concluded that the only realistic option was to apply the LFRMS. It was evident that by doing nothing or maintaining current levels of management, there are likely to be detrimental effects to the environment as assessed against the SEA objectives.

7.1.2 Actions required

Build a Comprehensive Asset Data Register

Compiling and maintaining an asset data register is a statutory duty under the FWMA. Defra and the public have a right to inspect the register. The following tasks are required to produce an asset data register that will enable management of CMBC's flood risk assets:

- Complete the flood risk asset database to include all CMBC's area.
- Update the DAMS database where required with maintenance, condition and ownership details (starting with high priority assets).

⁹ Calderdale Council. Economy and Environment, Planning & Highways. DRAFT Local Flood Risk Management Strategy for Calderdale. A Living Document. October 2014.

¹⁰ Calderdale Council Local Flood Risk Management Strategy. Strategic Environmental Assessment. Scoping Report. December 2014.

- Assess flood risk should an asset fail in order to create a prioritised list of assets after completion of the asset register..
- Designate assets posing a significant risk to flooding.
-
- Improve efficiency in updating the register upon identification of further assets.
- Identify assets that should be designated as critical assets under the FWMA and hence require consent for doing any works and require maintenance inspection schedules.
- Disseminate mapped asset database to CMBC stakeholders carrying out development control activity and other work affected by flood risk.

Improve Understanding of Existing Flood Risk

- Assess number and location of properties at flood risk across Calderdale from EA mapping data and information from other stakeholders.
- Assess sources of flooding and how they interact using integrated models where appropriate (may require the development of integrated models for specific areas).
- Better understand weather systems and hydrological prediction along with better logging and mapping procedures to update surface water flood maps with local data.
- Complete SWMPs for the outstanding indicative CDAs at Hebden Bridge, Ripponden, Halifax, Elland and Brighouse, Northowram and Shelf, Mytholmroyd, Luddenden, Cragg Vale and Bailiff Bridge. Confirming the CDAs is necessary in order to define the criteria for FRAs and surface water drainage requirements for proposed developments in CDAs. During the recent flooding in 2015, Brighouse has particularly been highlighted as at risk.
- Improve recording of flood incidents in a data register to help identify flooding hotspots.
- Integrate understanding of flooding hotspots to flood action plans implemented during events.

Strategic Environmental Assessment

Update the SEA in the light of updates to the LFRMS but it is not anticipated that the main conclusions of the SEA will fundamentally change.

7.1.3 Strategy benefits

Implementation of the above actions will have the following benefits:

- A fit for purpose data asset register that not only fulfils Calderdale's statutory requirements under the FWMA but, given the major and recurring flood impacts, the asset register should exceed statutory requirements.
- Understanding the flood risk will define the scale of the flooding problem facing Calderdale and the locations where resources should be most beneficially concentrated.
- Completion of SWMPs for the whole of Calderdale will define the surface water flooding issues and so allow control measures to be developed.
- Defining critical assets will allow enhanced maintenance to be undertaken at key locations alongside justification for lower levels of maintenance where limited risk occurs.

7.2 Actively reduce flood risk

Table 7-2: Actions to reduce flood risk
Increase Critical Infrastructure Resilience <ul style="list-style-type: none"> • Improve resilience of key utility infrastructure to flood risk • Liaise with Network Rail to develop measures to improve resilience of the Leeds to Manchester railway route to flood risk • Investigate measures to improve resilience of the main highway routes in Calderdale, in particular the A646 trunk route in the Upper Calder Valley • Encourage YWS to develop schemes to prevent sewer flooding wherever network deficiency is identified. • Encourage utility owners to promote flood resilience of their key assets at flood risk
Implement Robust Development Control Procedures <ul style="list-style-type: none"> • Establish a robust local plan and policies including a Supplementary Planning Document to support flood risk management • Identify CDAs so surface water drainage is a key feature of planning decisions

Table 7-2: Actions to reduce flood risk
<ul style="list-style-type: none"> • Work with Development Control Section to review planning controls, Ordinary Watercourse Consent, SuDS enforcement and ensure policies are implemented fully • Ensure land allocations in the local plan include all potential functional floodplain (washland) areas
Improve Asset, River and Habitat Maintenance <ul style="list-style-type: none"> • Develop regular maintenance programmes of critical assets to reflect flood risk management priorities • Encourage other RMAs, partners, stakeholders and riparian owners of critical and non-critical assets to carry out appropriate maintenance • Identify and implement improved river and habitat management in the Calder Valley • Establish stakeholder objectives by working with EA, flood groups and community organisations. • Help build local capacity to commission and deliver work. • Implement strategies in partnership with interested organisations.
Improve Upland Catchment Land Management <ul style="list-style-type: none"> • Develop a land management strategy that will potentially reduce upland runoff. • Develop initiatives with land and asset owners to implement natural flood management schemes to maximise water retention, storage and slow flows. • Develop a management protocol for upland catchments that maximises flood alleviation benefits for the downstream catchment.

7.2.1 Progress to date

Increase Critical Infrastructure Resilience

- Northern Power Grid (NPG): Eight electricity sub-stations were flooded during the Boxing Day flood event in 2015. Where possible, NPG have raised essential equipment by 0.4m to improve resilience and are re-locating key assets.
- Yorkshire Water (YWS) have undertaken a review of their critical assets that are at flood risk. In Calderdale, eight Waste Water Treatment Works and one Sewage Pumping Station have been identified as at flood risk. Detailed flood risk reports have been produced for these sites. No critical clean water assets were identified as at risk in the Calderdale area.
- YWS have undertaken or are progressing several Drainage Area Plans across Calderdale at Brighouse, Elland, Ripponden, Sowerby Bridge, Luddenden Foot, Todmorden and Hebden Bridge.
- Network Rail (NR): NR have completed schemes at Dobroyd Crossing and Birks Clough. Regular joint meetings are held with Network Rail and the EA.
- CMBC's Highways department has an emergency response plan for keeping roads open during flood events. This is currently being re-drafted in the light of the Boxing Day 2015 flood to ensure best practice is developed and applied within Calderdale.

Implement Robust Development Control Procedures

At present the Local Plan for Calderdale¹¹ is in draft form. The plan sets out Policy TP 25 with regard to flood risk:

The Council will require new development to be directed away from flood zones 2 and 3 in accordance with the principles of the National Planning Policy Framework. Development will only be permitted if it can be demonstrated that:

- *It would not give rise to the loss of floodplain storage;*
- *It would not impede the flow of flood water, surface water or obstruct the run-off of water due to high levels of groundwater;*
- *Measures required to manage any flood risk can be implemented;*
- *The management of surface water is done in a sustainable way. Development should enable/replicate natural water flows and decrease surface water runoff, particularly in Critical Drainage Areas, through Sustainable Drainage Systems, utilising green infrastructure where possible and as directed by local standards and guidance;*

¹¹ http://calderdale.objective.co.uk/portal/planning_services/lp/lp?pointId=s1441277601249#section-s1441277601249

- *Provision is made for the long term maintenance and management of any flood protection and or mitigation measures;*
- *It will take into account climate change;*
- *The benefits of it to the community outweigh the risk.*

Development should have full regard to and compliance with the advice of the Environment Agency (or equivalent agency), the objectives and priorities for flood risk management set out in the Local Flood Risk Management Strategy and the published evidence of local flood risk and its significance as included in Strategic Flood Risk Assessments, Surface Water Management Plans and other recognised sources of flood risk data.

The draft policy sets the direction for management of flood risk in relation to development control.

The draft SFRA has specified the locations of functional floodplain (Flood Zone 3b). The SFRA has also defined the extent of Flood Zone 3ai (areas that would be in Flood Zone 3b but have already been developed). Should sites in Flood Zone 3ai become available for new or further development (e.g. as brownfield sites) then both the risk at the sites and their role in managing flood risk in the surrounding area should be carefully considered in line with Local Plan policies.

Local standards and guidance for the implementation of SuDS has been jointly developed by the West Yorkshire Flood Risk Partnership.

An ordinary watercourse consenting procedure has been established as defined by the Land drainage Act and permissive powers are utilised where proposed consentable works are concerned

Improve Asset, River and Habitat Maintenance

An Asset Maintenance schedule defining required tasks and their frequency is partially complete and is to be aligned with the completed asset data register. Frequency of reviewing the proposed maintenance schedules is to be agreed

The EA issue guidance to RMAs and riparian owners regarding the maintenance of assets so that watercourses and structures are maintained free of debris and obstructions.

Local flood groups have a lot of information about areas that need a focus on maintenance. This information should be fed into the maintenance schedules compiled.

The Defra Flooding Resilience Community Pathfinder was a 2-year, grant scheme that concluded on the 31 March 2015. The study stimulated innovative approaches to community flood risk management. In Calderdale, the Pathfinder focussed on building community resilience through local flood groups.

CMBC has worked with the Todmorden Flood Group (TFG) who take up issues raised with key agencies (CMBC, EA and other services). The TFG:

- Liaise with services about proposed flood risk management measures
- Provide information on the states of rivers, culverts and other assets both before and after a flood event

There have been some volunteering days to help clear invasive species such as Himalayan Balsam.

Improve Upland Catchment Land Management

CMBC's Countryside and Woodlands Project Manager, along with the SOURCE, have led Calderdale's investigations regarding the complex issue of upland catchment management and the environmental issues concerned.

The SOURCE is a working partnership with a long term vision of ecological restoration in the headwaters of the River Calder. The partnership comprises several organisations and aims to:

- Minimize flash flooding through appropriately sited tree planting and moorland restoration
- Treat damaged land and control erosion
- Improve the quality of the River Calder
- Undertake educational activities and encourage volunteering so that people of all ages and from all walks of life become aware of the value of our rivers and uplands.

The organisations involved include: Treesresponsibility, the Calder and Colne Rivers Trust, the Upper Calder Valley Wildlife Network, Todmorden Moor Restoration Trust, Calder Futures, CMBC, the EA, YWS, Pennine Prospects and the White Rose Forest.

Several projects have been implemented including:

- Delivery of small scale interventions such as leaky dams and tree planting initiatives.
- Leeds University PhD research on the Colden catchment
- Working towards developing a good practice guide for the best way to intervene with natural flood management (NFM) measures.
- Projects to control invasive species such as Japanese Knotweed and Himalayan Balsam.
- A working group to investigate funding options for NFM measures
- Looking at integrated catchment management planning which is also linked to the Aire and Calder Catchment Plan.
- YWS have been instrumental in agreeing the benefits of wetter moors and sphagnum - this has formed the basis of the Government's blanket bog restoration plan.
- Moors for the Future have done work within Calderdale on upland restoration.

Important though these contributions have been they are small scale interventions that have not been backed up by a strategic assessment of the application of NFM measures across Calderdale. The forthcoming pilot study will help address this issue.

7.2.2 Actions required

Increase Critical Infrastructure Resilience

NR have identified infrastructure resilience schemes requiring further cooperation with partner organisations in order for the schemes to be delivered.

YWS aspire to protect their assets from a fluvial flood event with a 1 in 200-year (0.5 per cent annual probability) return period and where practical to also include an allowance for climate change and freeboard. However, investment would need to be based on customer willingness to pay and agreed with OFWAT.

Implement Robust Development Control Procedures

The draft policy in the Local Plan sets the direction for management of flood risk in relation to development control. Of key importance in applying the policy is the evaluation of Flood Risk Assessments. In line with the National Planning Policy Framework, applications that do not show: *"all flooding issues have been accounted for... most vulnerable development is located in areas of lowest flood risk... development is appropriately flood resilient and resistant... any residual risk can be safely managed... and it gives priority to the use of sustainable drainage systems"* can be declined.

Although the policy is sufficiently stringent, the implementation has been lacking because the following issues require attention:

- Although indicative CDAs have been identified, SWMPs necessary to confirm the extent of CDAs have not been completed. This is an essential task in order to control surface water runoff from new development having an adverse impact on the downstream catchment.
- The management of surface water drainage should be directed by the best practice local standards and guidance developed for West Yorkshire. Reviews of planning applications should ensure that the guidance is being applied.
- The draft SFRA has specified the locations of functional floodplain (Flood Zone 3b) and Flood Zone 3ai. Development in Flood Zone 3ai should be carefully considered so as to avoid worsening flooding elsewhere.

Improve Asset, River and Habitat Maintenance

The Asset Maintenance Schedule is partially complete. The following tasks are required to produce a maintenance schedule that will enable a risk-based approach to maintenance of CMBC's flood risk assets:

- Tie the current Asset Maintenance Schedule back to the Flood Risk Asset Data Register taking account of the risk posed by failure of the asset.
- Update the Asset Maintenance Schedule to ensure that those assets posing the greatest risk are assigned the highest priority for maintenance.
- Assess the frequency and type of maintenance required for each asset.

- Implement regular reviews of the schedule taking account of information on asset performance.
- Work with private riparian owners to ensure they understand their responsibilities with regard to asset maintenance and have programmes in place for implementation.
- Liaise with local flood groups to develop and update the Asset Maintenance Schedule taking account of local knowledge.

Improve upland catchment land management

A pilot study into the feasibility of applying natural flood management (NFM) measures to the Calder catchment has commenced. The study will:

- Liaise with wider stakeholders from across the Calderdale area.
- Undertake a strategic catchment screening exercise for the catchment above Brearley Weir for opportunity mapping to identify target/cluster areas for potential implementation of NFM measures (runoff attenuation features) and woodland NFM measures.
- Develop more detailed runoff models (up to four) for analysis in target/cluster areas and test NFM options.
- Quantify flood risk benefits of NFM options (including derivation of flood hydrographs & flood depth grids and linking to existing Calder FRM model, if appropriate)
- Quantify non-FRM benefits.

The pilot study is programmed to last five months; following the study, it is hoped a coherent approach will allow the development of NFM across the whole of Calderdale. Such an approach will probably comprise:

- Mapping locations (by modelling, local knowledge or a combination of the two) where NFM measures may be most effective.
- Mapping land ownership across Calderdale so that early contact can be made regarding land management initiatives.
- Working with land owners and partners to agree NFM measures that can be implemented on their land, match their economic model and comply with and environmental management requirements.
- Obtaining funding for NFM measures and implementing them.
- Developing maintenance schedules for NFM assets to ensure continued effectiveness of the assets.
- Assessing the role and relevance of land management practices including woodland management, water quality, connectivity (roads, tracks and drains) and the role of soils (compaction, landslips, erosion) and invasive species control.
- Collating data on the benefits, costs and impacts of the schemes through monitoring programmes.
- Funding technical specification for schemes.
- Educating and increasing knowledge and awareness of natural flood management for land owners, agents, local groups and residents.
- Through the MoorLIFE 2020 plan - build on work that has already been done by Moors for the Future to increase the resilience of the moorlands against climate change. The plan aims to expand existing work by supporting habitats such as clough woodlands and upland hay meadows, inspiring more volunteers and communities, raising fire awareness and expanding the improvement of drinking water and flood reduction.

The large number of reservoirs in Calderdale may have the potential to store flood waters and so reduce impacts on the downstream catchment. CMBC, YWS and EA will work together to consider whether reservoirs could be used to reduce flood risk in the downstream catchments taking into account the critical role that the reservoirs provide in ensuring Yorkshire's water supply and vital reservoir safety issues.

7.2.3 Strategy benefits

Implementation of the strategy measures to reduce flood risk will have the following benefits:

- CMBC will be able to robustly apply development control policy with respect to flood risk.
- Critical infrastructure will be more resilient to flooding.

- A whole catchment approach will allow the benefits of flood risk alleviation measures (including upland management) to be assessed across Calderdale.

7.3 Manage and reduce residual flood risk.

Table 7-3: Actions to manage and reduce residual flood risk
Deliver the Calderdale Flood Investment Plan (FIP) <ul style="list-style-type: none"> • Progress years 1 and 2 of the FIP with funding already secured. • Continue to develop the FIP through present and future phases and iterations. • Manage funding secured from central government to deliver Flood Risk Management schemes in a cost beneficial manner. • Investigate sources of capital match funding to support the medium and long term objectives • Ensure that Calderdale is represented at West Yorkshire Flood Risk Partnership and RFCC meetings at which programming is discussed.
Improve Management of Surface Water Flows <ul style="list-style-type: none"> • Investigate channelling surface water flows to designated low risk runoff routes
Determine scheme priorities <ul style="list-style-type: none"> • Use all available data across RMA and stakeholders to establish guidelines for determining scheme priorities for areas of greatest need. • Complete timely applications for entry to the EA Medium Term Plan for all identified proposals. • Have regard to the accrual of benefits rules which apply to FDGiA partnership funding to avoid 'double counting' of scheme benefits.

7.3.1 Progress to date Calderdale Flood Investment Plan

The Calderdale Flood Investment Plan was compiled following the 2012 and 2013 floods. The plan comprises four strands:

- Flood Risk Reduction Schemes 1,
- Flood Risk Reduction Schemes 2,
- Hebden Bridge Flood Alleviation Scheme (FAS).
- Mytholmroyd FAS.

Several Flood Risk Reduction Schemes (FRRS) were identified. Schemes that were considered to have the best potential to progress were split into two phases of work (FRRS1 and FRRS2). The EA are delivering the FRRS1 schemes on behalf of CMBC. The following table summarises the progress made with respect to FRRS1.

Table 7-4: Flood Risk Reduction Schemes: Phase 1.	
Scheme	Progress
Shop Lock - Todmorden	Completed.
Nutclough	Completed.
Erringden Hillside	Scheme is being appraised
Bacup Road	Completed.
Rochdale Canal	Scheme is being appraised.
Woodland View	Scheme to start onsite early 2017
Burnt Acres Wood	Scheme to start onsite early 2017
Pin Hill Lane	Scheme to start onsite early 2017
Kershaw Road, Todmorden	Scheme being picked up as part of the wider Walsden FAS
Park Road Elland	Scheme being appraised.

A description of the FRRS1 schemes is provided in Appendix C.

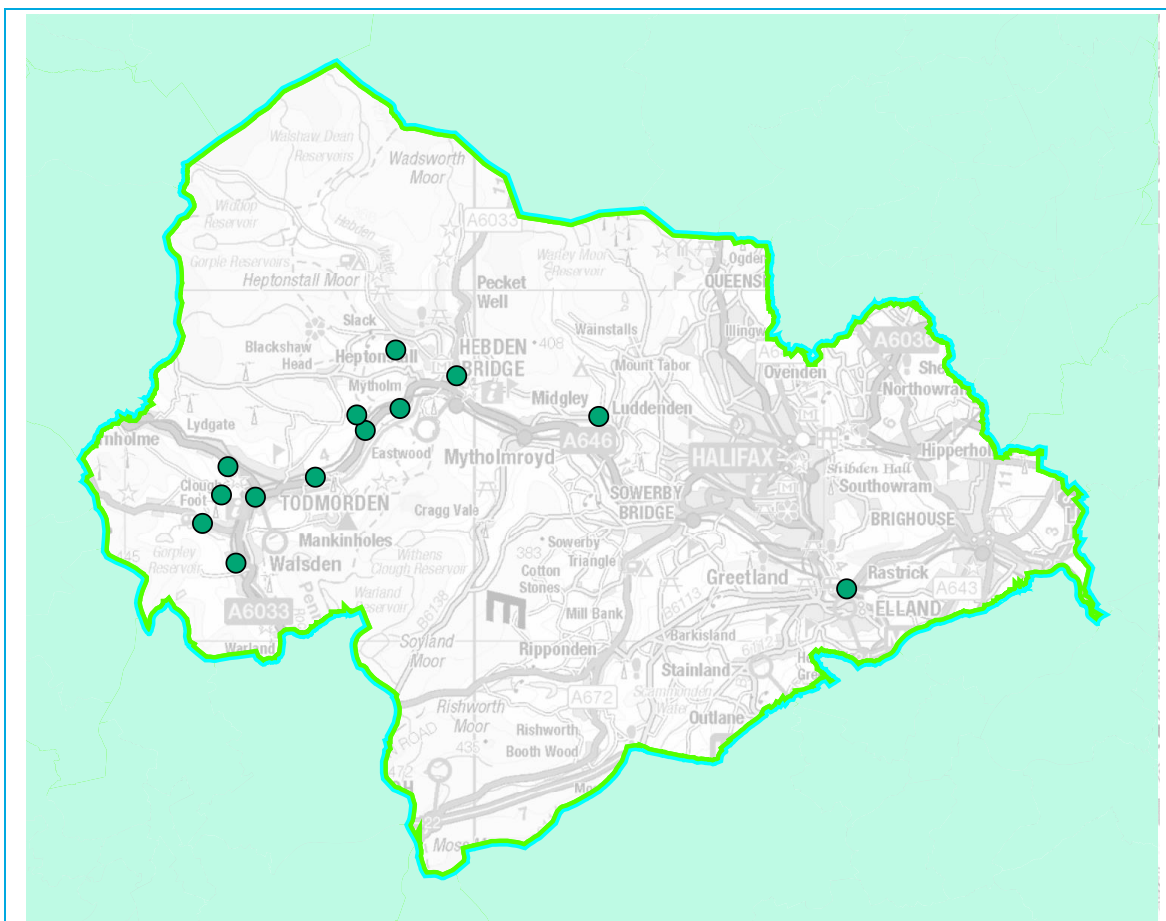


Figure 7-1: Flood risk reduction schemes: Phase 1

The FRRS2 studies are potential schemes that could be implemented across Calderdale. An initial list of potential schemes has been drawn up, the following table summarises the potential FRRS2 schemes.

Table 7-5: Flood Risk Reduction Schemes: Phase 2.	
A646 The Square, Mytholmroyd	Luddenden
Cross Stone Rd, Todmorden	Luddenden Foot
Dean Clough, Halifax	Sowerby Bridge West
Jumble Dyke, Brighouse	Ripponden
Machpelah Screen, Hebden Bridge	Brighouse
Oak Hill Clough/Ashenhurst Road, Todmorden	Lower Bank House
Railes Close, Midgley	Sowerby Bridge
River Ryburn/Calder Confluence, Sowerby Bridge	Copley Village
Shaw Wood Road, Todmorden	Dean Clough
Walsden	Commercial street
Shade	Pecket Well, Keighley Road
Todmorden North	Cragg Road
Calderside	Cotton Stones
King Street (Mytholm)	

A fuller description of the potential FRRS2 schemes is provided in Appendix D.

This list is not exhaustive and schemes will be work in progress with other potential schemes identified. It is anticipated that FRRS2 will progress as follows:

- Analyse the impact of the December 2015 flooding in relation to each scheme. This work has now been completed
- Draw up a list of schemes in isolation to identify potential new schemes. The work has now partially been completed. Further analysis of schemes proposed post 2012 floods is to take place.
- Develop a prioritised list of schemes. The existing schemes have been prioritised from the information gathered so far. Further work is programmed to carry out an initial assessment of the schemes to more accurately conclude on existing flood risk and impact.
- Draft a comprehensive programme to deliver the schemes. This will follow on from the initial assessments and securing of funding following approval of outline and strategic businesses cases.

Hebden Bridge FAS. Mott McDonald (MM) are currently carrying out an appraisal for the scheme. The main areas being looked at for potential works are the confluences, opportunities for upstream storage (including work with YWS to investigate potential opportunities through operational change to use of their reservoirs), NFM and containment works within the town. The project was presented to the Large Project Review Group (LPRG) in February 2016 for approval for completion of the detailed appraisal and business case. It will need to be re-presented to the LPRG following completion of the appraisal stage.

Mytholmroyd FAS. The Mytholmroyd FAS is also in the EA's six-year plan. The scheme is concentrated on channel widening (where possible) and improving / raising the river walls, several of which collapsed during the November/December 2015 floods. The Secretary of State for Environment Food and Rural Affairs has announced that funding will be available for the Mytholmroyd FAS.

CMBC continues to take part in the West Yorkshire Partnership meetings where the allocation of the Local Levy is agreed and are members of the Yorkshire Regional Flood and Coastal Committee. In the 2016 Budget, the Chancellor of the Exchequer announced an allocation of £35-million for Calderdale to tackle flood risk management matters.

Improve Management of Surface Water Flows

Several of the FRRS1 schemes have already addressed or will resolve surface water management issues. In particular, the Nutclough, and Bacup Road schemes are either completed or well progressed.

Brighouse and Todmorden have been identified by YWS to be part of a pilot study for developing a new way of investigating issues caused by the sewer network. These are being called Catchment Investigations. A particular area of focus of these studies will be areas that suffer flooding from the sewer network and to investigate short, medium and long term solutions with the aim of developing multiple benefit, multiple agency solutions.

Determine scheme priorities

The FRRS1 schemes were prioritised based on the feasibility of solutions, known high risk areas and the raw Partnership Funding (PF) score for FDGiA. As the FRRS1 schemes have been appraised the order of priorities has changed. For instance, the Park Road Elland scheme dropped to the lowest priority of the schemes in FRRS1 although this is now being reviewed in order to deliver the scheme as part of FRRS1 as a matter of priority..

The FRRS2 schemes are to be prioritised on the basis of impact, cost and benefit subject to funding criteria.

7.3.2 Actions required

Deliver the Calderdale Flood Investment Plan

- Continue FRRS1.
- Support EA in delivery of Hebden Bridge FAS and Mytholmroyd FAS.
- Deliver FRRS2 schemes following feasibility and PAR studies.
- Review flood risk areas to identify schemes not covered by FRRS1, FRRS2, Hebden Bridge FAS or Mytholmroyd FAS.

Improve Management of Surface Water Flows

- Undertake SWMPs for indicative CDAs.
- Use results of SWMPs and YWS DAP studies to identify sites with critical surface water drainage problems.
- Map sites with critical surface water drainage problems and use results to investigate potential for addressing issues by designating low risk runoff routes to direct flow to watercourses.
- Map locations of old stone culverts and collapsed sewers that allow water to escape.

Determine scheme priorities

- Undertake feasibility and Initial Assessment studies of potential FRRS2 schemes and any new schemes found via SWMP process to assess priorities.

7.3.3 Strategy benefits

Implementation of the strategy measures to manage flood risk will have the following benefits:

- Prioritisation of schemes so investment is directed in the most beneficial manner.
- Delivery of flood risk reduction schemes for Calderdale.
- A strategic appraisal of surface water flood risk across Calderdale.

7.4 Improve preparedness to flood events

Table 7-6: Actions to aid preparedness
Test and Improve existing warning systems <ul style="list-style-type: none"> • Existing flood warning measures will be improved by extending the rain gauge network, using telemetry, use of CCTV network, Flood Forecasting Centre and available data. • Ensure that the current flood response plans and other multi-agency plans continue to be reviewed and updated to reflect legislative changes.
Improve community resilience <ul style="list-style-type: none"> • Build relationships with the Flood Action Groups in the upper Calder valley to ensure their work is aligned with the strategy. • Ensure legacy outcomes from the Defra Community Flood Resilience Pathfinder programme support the strategy. • Work with communities that are part of the EA's Rapid Response Catchment, to ensure their work is aligned to the strategy. • Promote measures for property level protection, building on the work done during the Defra Pathfinder Programme.
Risk management authorities and stakeholders <ul style="list-style-type: none"> • Maximise liaison with RMAs and emergency services. • Encourage sharing of data to improve understanding of flood risk.
Improve Communication during and following a flood event <ul style="list-style-type: none"> • Communicate risk, warning and preparedness to all stakeholders and encourage self-help. • Communicate information on flood risk in simple non-technical language that can be understood by both partners and stakeholders. • Continue to develop the community-led web portal, Eye on Calderdale. • Review plans for communicating information before, during and after events. • Encourage and assist private owners to be prepared for flood events.

7.4.1 Progress to date

Test and Improve existing warning systems

- Within the flood warning procedures, Emergency Planning at CMBC are the first to receive flood warnings from the EA.
- Late prediction of the Boxing Day 2015 floods suggests there is an issue with the EA forecasting models taking account of antecedent conditions and rainfall prediction.
- Performance of the flood warning system has been reviewed as part of the FWMA Section 19 investigation in to the December 2015 floods.
- The EA undertake testing of the flood siren in the communities along the Calder valley.

- The LRF have coordinated training and flood warning exercises which have been undertaken on a regular basis since the 2012 and 2013 and again post 2015 events. This is a shared responsibility across West Yorkshire.
- Recent flood events have highlighted surface water flooding occurs behind flood defences and is not able to drain into the river. The flood warning system has not taken this issue into account.
- During the Boxing Day 2015 floods the RMAs coordinated activity from the combined control room at the police station in Halifax.
- CMBC are developing GeoPDFs which are interactive PDFs that can be used to give an indicative outline, depth, velocity and indication of impact dependent on forecasted rainfall and existing ground saturation conditions. These are to be used for winter 2016 for the most critical sites area.
- In parallel to the above the Council is also preparing a series of Incident Management Plans for the most critical areas. These plans will detail the preventative and response actions to take given a certain pre determined trigger. The actions are to be reflective of the response of CMBC operational staff.

Improve community resilience

- The Pathfinder project worked with flood groups in Todmorden and Hebden Bridge/Mytholmroyd. Each group has a community flood action plan and there are 11 flood stores in place.
- The EA have initiated the Flash Flood programme.
- Housing officers at CMBC are able to complete Property Level Protection (PLP) surveys, assess issues of cellar flooding for householders and provide advice on resilience to flooding.
- Some work has been done in the upper Calder valley to provide resilience measures (barriers, raising electricity supply etc.) for communities.

Risk Management Authorities and stakeholders

- CMBC have developed partnerships with the EA, YWS and Network Rail. Meetings are held regularly to discuss the forward programme and the management of the FRRS1 projects.
- The Calderdale Flood Recovery and Resilience partnership, comprising the EA, YWS, CMBC (councillors, flood risk, emergency planning, highways, communications teams) and CRT, has met regularly since the 2012 floods.
- CMBC have an Emergency Flood Response Plan but it relies on emergency services understanding CMBC's core business and is patchy in relation to actions carried out by Highways at CMBC.
- Highways at CMBC also have an emergency response plan and integration with other plans is needed. The main focus of the Highways response plan is with keeping roads open across Calderdale.
- The West Yorkshire Flood Risk Partnership provides the opportunity to coordinate activity across several organisations including the EA, YWS, the CRT, Network Rail and elected members.
- Debriefs following the December 2015 floods have led to an improvement plan equipping staff with better technology in order to improve coordination and information sharing during events at a strategic level by Gold, Silver or Bronze command centres.

Improve Communication during and following a flood event

- The Pathfinder project developed the Eye on Calderdale website which provides a one stop shop for flood risk advice and dissemination of flood warnings.
- The Pathfinder project worked with several householders and businesses to increase resilience and awareness of flooding.
- CMBC works closely with flood groups (Todmorden and Hebden Royd) set up as part of the Pathfinder work. These community groups are advising on response to flood risk.
- CMBC's website has relevant information on flood risk management and is required to be kept up to date for communicating accurate information.

7.4.2 Actions required

Test and Improve existing warning systems

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- Liaise with the EA regarding updates to the flood forecasting and flood warning systems, assess the use of new technology for monitoring floods and ensure lessons learnt are implemented.
- Revise flood warning areas in the light of the Boxing Day 2015 floods.
- Continue regular flood warning exercises to ensure processes are fit for purpose.

Improve community resilience

- Support the community flood groups who provide immediate support during flood events. Ensure flood stores are restocked following events.
- Update and improve the Eye on Calderdale website to ensure advice is relevant and resolve ownership issues of the website.
- Continue the work from the Pathfinder study so that housing officers provide advice for home owners and businesses concerning suitable PLP measures.
- Work with home owners, businesses, the EA and the insurance industry to help provide cost effective insurance to flood prone communities.
- Discuss the aims and implementation of this LFRMS with the community flood groups and across all stakeholders to ensure community engagement in strategy development.

Risk Management Authorities and stakeholders

- Apply lessons learnt from studies into flooding on rapid response catchments (EA Flash Flood programme) to Calderdale.
- Continue the work of the Calderdale Flood Recovery and Resilience partnership to coordinate recovery activity from the 2012, 2013 and 2015 floods.
- Develop partnership with the CRT about flood risk management in relation to the Rochdale Canal and the Calder and Hebble Navigation. Work with CRT to minimise risk of flooding from the waterways.
- Work with YWS and other landowners to identify whether changes to upland management could benefit downstream flood risk.
- Liaise with YWS to consider whether the reservoirs in the Calder Valley could be used to reduce flood risk downstream, whilst maintaining their primary function in providing Yorkshire's drinking water.
- Collaborate with Network Rail to develop schemes that reduce risk to NR property and the wider community (e.g. Bridge 96 and Kershaw Road).

Improve Communication during and following a flood event

- Work closely with community flood groups to continue the legacy of the Defra Flooding Resilience Community Pathfinder project.
- Liaise with CMBC's internal stakeholders (flood risk management, emergency planning, highway maintenance and development control) to ensure closer cooperation between departments and coordination of efforts before, during and after events.

7.4.3 Strategy benefits

Implementation of the strategy measures to improve preparedness will have the following benefits:

- Improved flood forecasting, warning and dissemination service.
- Calderdale is better prepared to cope and prepare for future floods.
- Better cooperation between CMBC, RMAs and stakeholders across Calderdale.

7.5 Prioritised Actions

This LFRMS has listed several objectives. The most critical ones requiring immediate action are:

Flood Risk Asset Data Register - Completion of the Flood Risk Asset Data Register is essential in order to understand what infrastructure affects flood risk in Calderdale, determine a management strategy for the assets, know who is responsible for each asset and define maintenance procedures. Without this key understanding the focus of the strategy cannot be defined.

Surface Water Management Plans - Surface water runoff causes flooding problems across Calderdale but SWMPs have only been completed at Todmorden and Walsden. Without complete SWMPs there is no understanding of the surface water flood risk areas and hence the measures that could be taken to minimise the effects of flooding. Furthermore, SWMPs will help

define CDAs an important first step to developing robust management of runoff from new developments.

Development Control - Inappropriate development that reduces floodplain storage or development that increases runoff will worsen Calderdale's flooding problems. Therefore, the robust application of CMBC's flood risk policy with respect to new development is essential to avoid increasing flood risk issues across Calderdale. Of key importance in applying the policy is the assessment of FRAs for new development to ensure all flooding issues have been accounted for. Furthermore, robust application of the flood incident investigation policy is required to ensure the existing local flooding risk is not worsened and resources are effectively prioritised.

Natural Flood Management - Mapping land ownership and locations across Calderdale where NFM measures may be most effective. This will allow early contact to be made with major land owners regarding land management initiatives with the greatest benefit and chance of success.

Prioritisation of schemes - Several potential flood risk resilience and alleviation schemes have been identified. An evaluation of the potential schemes and their benefits is needed to allow the most cost effective schemes to be advanced in the programme.

8 Strategy delivery

8.1 Introduction

The Strategy is a tool to help understand and manage flood risk within Calderdale. This document has set out an overarching plan for managing flood risk from the River Calder and all other watercourse in Calderdale. CMBC will take lead responsibility for delivery of the Strategy but will require backing from supporting organisations to deliver a single focussed response to flooding across the communities.

This chapter presents the measures necessary for delivery of the Strategy, the organisations accountable for those actions, the timetable for implementation, the resources required and the funding needs that should be met to ensure its delivery. There are four sections:

- **Task responsibilities** - This section sets out the strategy measures, assigns responsibility for these to the various RMAs and stakeholders and provides an estimated timescale for achievement of each objective.
- **Staff resources** - Delivery of the strategy will require CMBC to assign adequate staff resources to achieve the objectives. This section sets out the staff resources required.
- **Estimated strategy costs** - The estimated cost for delivery of the strategy measures are set out.
- **Strategy funding** - This section sets out the confirmed sources of funding for flood risk management in Calderdale.

8.2 Task responsibilities

This Strategy is a single strategic comprehensive plan for the River Calder, other main rivers and ordinary watercourses within Calderdale. It relies on and draws from other subsidiary documents provided by partners such as Yorkshire Water and the Environment Agency. These organisations are of critical importance to supporting CMBC in the development of a single focussed response to flooding across the communities.

Calderdale Metropolitan Borough Council (CMBC) will take the lead in implementing the Strategy with assistance from:

- The Environment Agency (EA)
- Yorkshire Water (YWS)
- Canal and Rivers Trust (CRT)
- Network Rail (NR)

The measures necessary to deliver the four key strands of the Strategy were presented in Chapter 6. Tables 8-1 to 8-4 show the measures associated with each strand of the Strategy, the organisations responsible for each measure and the anticipated timescale for delivery.

The tables have been colour coded:

- Measures shaded in red are tasks with the highest priority.
- Tasks that have a short term timescale (completion by 2018) have been highlighted in yellow.
- Tasks that have a medium term timescale (completion by 2023) have been highlighted in blue.
- Several of the measure will require an ongoing commitment and these have been highlighted in green.
- Some measures could be sub-contracted to consultants. Where this is deemed appropriate it is highlighted in the fourth column of the tables.

8.2.1 Background data

Table 8-1 presents the strategy measures necessary to develop robust background information concerning flood risk management across Calderdale. The priority measures have been highlighted red.

Table 8-1: Implementation of measures to develop background data								
Accountable Organisation			Sub-contracted task	Strategy Measure	Strategy Action	Timescale		
CMBC	EA	Other				PRIORITY ACTION	Short term (by 2018)	Medium term (by 2023)
Calderdale Metropolitan Borough Council			Consultant	Build a Comprehensive Flood Risk Asset Data Register	Complete flood risk asset database.	X		
			Consultant		Assess flood risk associated with asset and prioritise.		X	
					Implement updating of asset database from site.		X	Ongoing
			Consultant	Improve Understanding of Existing Flood Risk	Complete SWMPs for indicative CDAs.	X		
			Consultant		Assess total number of properties at flood risk across Calderdale.		X	
					Integrate understanding of flood hotspots to flood action plans.		X	
				Strategic Environmental Assessment	Update SEA in the light of updated LFRMS.		X	

8.2.2 Reduce flood risk

Table 8-2 presents the strategy objectives that will contribute to reducing flood risk across Calderdale. The priority tasks have been highlighted in red.

Table 8-2: Implementation of measures to reduce flood risk								
Accountable Organisation			Sub-contracted task	Strategy Measure	Strategy Action	Timescale		
CMBC	EA	Other				PRIORITY ACTION	Short term (by 2018)	Medium term (by 2023)
Calderdale Metropolitan Borough Council	EA	NR		Increase Critical Infrastructure Resilience	Co-operation of partner organisations to progress schemes for Kershaw Road and Bridge 96.			
		YWS			Protect YWS assets from a 1 in 200-year flood event.			
	EA	YWS		Implement Robust Development Control Procedures	Define CDAs in association with the EA.	X		
					Implement robust assessment of FRAs and drainage designs.	X		
				Improve Asset, River and Habitat Maintenance	Link asset maintenance schedule back to flood asset database.		X	
					Assign priorities to asset maintenance.		X	
					Review asset maintenance schedule.		X	
	EA				Work with riparian owners to educate them as to their responsibilities.		Ongoing	Ongoing
					Liaise with local flood groups accounting for local knowledge.		Ongoing	Ongoing
	EA		Consultant	Improve Upland Catchment Land Management	Feasibility study of catchment land management .	X		
	EA		Consultant		Mapping land ownership across Calderdale. .	X		
	EA		Consultant		Mapping locations where NFM measures may be most beneficial and cost effective.		X	
			Consultant		Collating data on the benefits, costs and impacts of the schemes through monitoring programmes.		X	
					Develop role of the NFM Project Officer.		X	
					Work with land owners and partners to agree NFM measures that can be implemented.		Ongoing	Ongoing

8.2.3 Manage flood risk

Table 8-3 presents the strategy objectives that will help manage flood risk across Calderdale. The priority task has been highlighted in red.

Table 8-3: Implementation of measures to manage flood risk								
Accountable Organisation			Sub-contracted task	Strategy Measure	Strategy Action	Timescale		
CMBC	EA	Other				PRIORITY ACTION	Short term (by 2018)	Medium term (by 2023)
Calderdale Metropolitan Borough Council	EA			Deliver the Calderdale Flood Investment Plan	Continue FRRS1 schemes.	x	X	
	EA				Support to EA in delivery of Hebden Bridge FAS and Mytholmroyd FAS.			X
	EA				Develop and deliver FRRS2 schemes.			X
	EA				Identify potential new schemes.	x	X	Ongoing
				Improve Management of Surface Water Flows	Identify surface water flooding sites from SWMPs and DAPs.		X	
					Map sites with critical surface water drainage problems.		X	
					Map locations of collapsed sewers and culverts.		X	
	EA		Consultant	Determine scheme priorities	Undertake feasibility and PAR studies of FRRS2 schemes	X		

8.2.4 Preparedness

Table 8-4 presents the strategy objectives that aid preparedness for flood events in Calderdale.

Table 8-4: Implementation of measures to aid preparedness								
Accountable Organisation			Sub-contracted task	Strategy Measure	Strategy Action	Timescale		
CMBC	EA	Other				PRIORITY ACTION	Short term (by 2018)	Medium term (by 2023)
Calderdale Metropolitan Borough Council	EA			Test and Improve existing warning systems	Review performance of flood warning system.		X	
	EA				Liaise with EA regarding updates to forecasting and warning systems.		X	
	EA				Revise flood warning areas, if necessary.		X	
Calderdale Metropolitan Borough Council	EA			Improve community resilience	Continue flood warning exercises and enhance understanding of weather systems.		Ongoing	Ongoing
					Support community flood groups and ensure flood stores are restocked.		Ongoing	Ongoing
					Improve Eye on Calderdale website.		X	
					Provide advice for homeowners concerning property level protection.		Ongoing	Ongoing
					Liaise with community flood groups concerning strategy implementation.		Ongoing	Ongoing
Calderdale Metropolitan Borough Council	EA			Risk management authorities and stakeholders	Apply lessons from Flash Flood programme to Calderdale.		Ongoing	Ongoing
		CRT			Develop partnership working with CRT.		Ongoing	Ongoing
	EA	YWS			Liaise with YWS concerning upland management and reservoir operation.		X	Ongoing
	EA	NR			Collaborate with NR to reduce risk to the wider community.		Ongoing	Ongoing
				Improve Communication during and following a flood event	Work closely with community groups to continue Pathfinder legacy.		Ongoing	Ongoing
					Liaise with CMBC's internal stakeholders.		Ongoing	Ongoing

8.3 Calderdale staff resources

8.3.1 Flood risk tasks for Calderdale

Delivery of the flood risk strategy objectives will require input from CMBC staff for the following tasks in parallel with statutory duties discharged under the FWMA:

- Management of consultants undertaking completion of the asset data register, SWMPs, PLP schemes and land management studies.
- Development of the asset data register and keeping it updated with ownership and maintenance details.
- Prioritising assets and identifying flooding hotspots.
- Investigating flooding incidences.
- Apply development control and OWC enforcement procedures.
- Review of FRAs and drainage studies as part of the planning process to ensure consistent application of CMBC's flood risk policy from the Local Plan.
- Management and delivery of FRRS1 and FRRS2 schemes.
- Liaison with EA, YWS, NR and other stakeholders, educating landowners
- Completing funding applications for schemes.
- Update the SEA.
- Highways - better understand weather system knowledge beyond current statutory focus on snow and ice to include water.
- Highways Maintenance activity both cyclical and in the run-up to a likely event to be improved.
- The management response from highways to be further improved through additional incident response, communication systems, equipment (including sandbags and capacity to access and protect critical council assets).
- Maintain the Eye on Calderdale website.
- Improve and deliver better emergency planning.
- Improve and deliver better communication prior during and post flood event..

8.3.2 Calderdale flood risk management team

In order to deliver this activity, the Calderdale flood risk team will require the following staff:

Flood Risk Manager - responsible for:

- Implementation of this strategy and overseeing implementation by other internal and external stakeholders.
- Overseeing the team's activities.
- Managing consultants.
- Developing policies and procedure outlined within this Strategy.
- Liaison with external RMAs and internal CMBC stakeholders.
- Conducting S19 investigations for major flood events.
- Developing FRRS Phase 2 and other flood alleviation schemes.
- Aiding in securing funding to deliver flood risk management works.
- Improving preparedness and contingency to flood events.
- Providing technical leadership with reference to drainage and flood risk

Flood Risk and Drainage Engineers (four in total: two engineers plus two assistants) - responsible for:

- Reviewing FRAs and drainage studies
- Conducting land drainage investigations and service request investigations
- Investigating flooding reports
- Conducting drainage and flood alleviation designs as applicable to available resources
- Advice on PLP measures

- Discharge permissive and statutory duties as defined in relevant water and drainage legislations.

Flood Risk Asset Mapping Officer - responsible for:

- Upkeep of the flood risk data asset register.
- Integrating output from SWMPs and other studies into database.
- Prioritising flood risk assets and flooding hotspots.
- Development and updating of asset maintenance schedules
- Improving mapping and GIS of flood risk.

Civil engineers (at least two engineers needed given scale of work of next 3 to 4 years) - responsible for delivering the FRRS1 and FRRS2 schemes and supervision of design and build activity.

Strategic Partnership Manager - responsible for:

- Liaison with EA, YWS, NR and other stakeholders,.
- Securing funding from local, regional and European sources including LG3, Interreg and ESIF
- Managing and supporting the Calderdale Flood Risk and Resilience Programme Board and sub groups.
- Overseeing the delivering of FRRS Phase 1 as the Senior User from the Council.
- Manage both RMA and other stakeholders in their liaison with the Council to deliver shared objectives concerning reducing flood risk.
- Liaising with the EA in delivery of flood alleviation schemes as the Senior User from the Council.
- Support local flood groups.
- Oversee the delivery of NFM measures within Calderdale.

Natural Flood Risk Management Project Officer - responsible for:

- Delivering natural flood management measures as detailed in this Strategy and the Calderdale Flood Action Plan.
- Coordinate the delivery of NFM measures across all stakeholders including voluntary groups.
- Map landowners within Calderdale as per identified low risk areas or NFM suitable areas.
- Liaise with landowners to aid delivery of NFM
- Work with stakeholders and Risk Management Authorities to secure funding for identified NFM measures.

8.4 Estimated strategy costs

The following table summarises the estimated costs associated with implementing key aspects of the flood risk management strategy in Calderdale.

Table 8-5: Estimated costs of implementing flood risk management strategy	
Capital schemes	
FRRS Phase 1 schemes	£6.0-million
FRRS Phase 2 schemes	£38.8-million
Hebden Bridge FAS	£15.0-million
Mytholmroyd FAS	£10.5-million
Implementation of NFM measures	£3.0-million
Post Boxing Day recovery	£34.0-million
Resources - Flood risk management team	

Flood risk management team (employed directly by CMBC - gross cost (substantial posts already exist)	£½-million per annum
LLFA duties (maintenance, investigation and revenue works)	£0.5 - million per annum
Consultant costs	£350,000

8.5 Funding

The following table summarises the external and internal funding available for flood risk management in Calderdale.

Table 8-6: External and internal sources of funding for flood risk management in Calderdale		
Funding Amount	Source	Purpose
£24.970m	Capital Grant for flood repairs approved by the Department for transport	Repair of infrastructure damaged by Boxing Day Floods
£1.375m	CMBC approved Capital resource	Current flood defence resources approved by the Council to deliver the FRRS 1 programme..
£3.0m	CMBC approved Revenue funding.	To provide immediate support to deliver recommendations contained in the Council's Strategy.
£9.0m	Capital Grant for flood repairs provided to the EA.	To repair flood defences and remove debris following winter 2015 flooding.
Potential Funding		
£5 million	Share of £40 million Government Emergency Relief Fund that may be available for the Yorkshire Region.	Deliver the recommended flood defence works within the "Mytholmroyd plan".
£14.6 million	Current Defra Flood Defence Grant in Aid contained within 6 year capital investment plan for Calderdale Flood Recovery and Resilience Programme.	For delivery of FFRS 1, 2, Hebden Bridge, Brighouse and Mytholmroyd.
£35 million	HM Treasury Special Grant that may be available to the Council or one of our partners.	Potential Flood recovery grant for delivery of FRRS 1 and FFRS 2, Hebden Bridge and Mytholmroyd
Total Approved and Potential Capital and Revenue Funding £92.945m		

This significant level of funding places CMBC in a position to deliver most of the LFRMS objectives. Calderdale does seek the above £35million special grant to be administered by the Flood Risk and Resilience Programme Board to support the detailed delivery of this strategy. We

will do this by working with the EA and recognising national approaches set out by Defra. However, CMBC is directly accountable to its communities for the safeguarding of people, homes and jobs and as such is the most local public body to provide an integrated and swift response to flood impacts.

Appendices

A National Flood and Coastal Erosion Risk Management Strategy

A.1 National Flood and Coastal Erosion Risk Management Strategy

The LFRMS fits with the aims of the National Flood and Coastal Erosion Risk Management Strategy (FCERM). The overall aim of the National FCERM Strategy for England is to ensure the risk of flooding and coastal erosion is properly managed by using the full range of options in a co-ordinated way. It is designed to support local decision-making and engagement in FCERM so that risks are managed in a co-ordinated way across catchments and along the coast.

The National Strategy sets out strategic aims and objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It states that Government will work with individuals, communities and organisations to reduce the threat of flooding and coastal erosion by:

- Understanding the risks of flooding and coastal erosion, working together to put in place long-term plans to manage these risks and making sure that other plans take account of them
- Avoiding inappropriate development in areas of flood and coastal erosion risk and being careful to manage land elsewhere to avoid increasing risks
- Building, maintaining and improving flood and coastal erosion management infrastructure and systems to reduce the likelihood of harm to people and damage to the economy, environment and society
- Increasing public awareness of the risk that remains and engaging with people at risk to make their property more resilient
- Improving the detection, forecasting and issue of warnings of flooding, planning for and co-ordinating a rapid response to flood emergencies and promoting faster recovery from flooding

A.2 Guiding principles

The FWMA states that LFRMSs must be consistent with the National Strategy. Principally, this refers to consistency with the overall aims and objectives, and in particular with the six guiding principles. These are:

- **Community focus and partnership working:** Risk Management Authorities (RMAs) need to engage with communities to help them understand the risks, and encourage them to have direct involvement in decision-making and risk management actions. Working in partnership to develop and implement local strategies will enable better sharing of information and expertise, and the identification of efficiencies in managing risk.
- **A catchment and coastal “cell” based approach:** In understanding and managing risk, it is essential to consider the impacts on other parts of the catchment or coast. Activities must seek to avoid passing risk on to others within the catchment or along the coast without prior agreement. In developing local strategies LLFAs should ensure that neighbouring LLFAs within catchments are involved in partnerships and decision making. Strategic plans such as Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs) should be used to help set strategic priorities for local strategies. Regional Flood and Coastal Committees (RFCCs) will have an important role in this approach.
- **Sustainability:** LLFAs should aim to support communities by managing risks in ways that take account of all impacts of flooding (for instance on people, properties, cultural heritage, infrastructure and the local economy) and the whole-life costs of investment in risk management. Where possible, opportunities should be taken to enhance the environment and work with natural processes. Risk management measures should also be forward looking, taking account of potential risks that may arise in the future and being adaptable to climate change. Government guidance has been published setting out the link between sustainable development and risk management.
- **Proportionate, risk-based approaches:** It is not technically, economically or environmentally feasible to prevent flooding and coastal erosion altogether. A risk-based management approach targets resources to those areas where they have greatest effect. All aspects of risk management, including the preparation and implementation of

local strategies, should be carried out in a proportionate way that reflects the size and complexity of risk. The assessment of risk should identify where the highest risks are and therefore the priorities for taking action. The LFRMS provides an opportunity to agree a local framework for risk based decisions and interventions with local communities and stakeholders.

- **Multiple benefits:** As well as reducing the risks to people and property, FCERM can bring significant economic, environmental and social benefits. In developing and implementing local strategies, LLFAs should help deliver broader benefits by working with natural processes where possible and seeking to provide environmental benefit, including those required by the Habitats, Birds and Water Framework Directive. Measures such as the use of Sustainable Drainage Systems (SuDS) to manage risk should be considered wherever possible as they can also deliver benefits for amenity, recreation, pollution reduction and water quality. Further benefits can be realised in relation to regeneration, growth and emergency planning.
- **Beneficiaries should be allowed and encouraged to invest in local risk management:** The benefits achieved when flood and coastal erosion risks are managed can be both localised and private, through the protection of specific individuals, communities and businesses. In developing local strategies, LLFAs should consider opportunities to seek alternative sources of funding for managing local flood risk rather than relying solely on Government funds. However, LLFAs should consider the balance they wish to achieve in relation to major coastal and fluvial schemes, where the scale of local contributions required to make up partial national funding may be much more significant than that usually needed for surface water management schemes.

B Appendix - Calderdale Flooding History

This flood history has mostly been derived from the Eye on Calderdale website¹². The flood history draws heavily on research by Issy Shannon¹³ and Molly E Sunderland¹⁴. The flood events in the Calder Valley have been presented starting with the most recent flood in 2015.

B.1 21st Century

26 December 2015

Over Christmas and Boxing Day, Pennine areas had over 60mm of rainfall in 24 hours and some locations had over 100mm. Many of these locations had already seen over twice their usual amount of rainfall in December and this followed an extremely wet November. Many locations along the River Calder saw the highest ever recorded river levels.

The flooding on 26 December 2015 occurred when rivers rose rapidly because the ground was already saturated from previous heavy rain. Many of the Environment Agency's measuring stations recorded the highest ever recorded river levels. In excess of 2,800 homes and 1,600 businesses were seriously affected with a building washed away in Mytholmroyd and Elland Bridge seriously wrecked. In addition to this a number of substations, schools, roads and bridges were also damaged. Unlike previous floods, communities further down the valley including Sowerby Bridge, Elland and Brighouse were also seriously flooded

12 December 2015

Surface water flooding throughout Walsden, Cornholme, Todmorden, Callis, Hebden Bridge, Mytholmroyd, Sowerby Bridge and Brighouse. River levels on the River Calder were high but breached only in Sowerby Bridge. Hebden Water breached flooding Oldgate in Hebden Bridge and contributing to the flooding in Market Street. Roads suffered from surface rain water and drainage systems unable to cope.

14 November 2015

Extensive rain caused road closures due to flooding on Burnley Road, Todmorden. Centre Vale Park was used as a flood storage area. Flooding on the road also occurred at Eastwoods, Mytholm, Mytholmroyd, Brierley, Kebroyd on the Halifax Road to Ripponden, Burnley Road just outside Hebden Bridge, Burnley Road in Todmorden and the A58 near the junctions with the A641 and at Chain Bar due to localised flooding.

Some premises suffered minor flooding especially due to run-off from hilltops.

31 March 2015

Ripponden Old Bank was closed following localised flooding as a result of a blocked culvert.

19 December 2014

Surface water caused nine properties across the area to suffer some degree of flooding, with a further six properties narrowly missing being flooded.

8 July 2014

Rain in Elland caused highway disruption and one property flooded.

29 July 2013

Large storm clouds brought heavy rainfall to the Upper Valley which was affected from a number of sources. The communities worst affected were those immediately adjacent to Walsden Water and the River Calder, impacting on Walsden, Todmorden and Hebden Bridge. Two watercourses located above Kershaw Road, Walsden were unable to cope with the level of flow and suffered severe erosion, overloading and blocking the drainage system. Excess surface water from the damaged culverts spilled onto the railway line at Walsden Station, flooding properties along Rochdale Road. Birks Clough overtopped, and this water combined with excess rain run-off from surrounding hills then flooded properties along and adjacent to Burnley Road.

12 History of flooding in Calderdale. www.eyeoncalderdale.com

13 Issy Shannon. The Valley Under Water. www.eyoncalderdale.com

14 Molly E Sunderland. It's Water Under the Bridge. www.eyeoncalderdale.com

31 December 2012

Flooding caused by run-off down Hebble End was avoided in Market Street, Hebden Bridge, due to CMBC staff and volunteers working together to divert the flow and keeping drains and street gullies clear of debris.

25 August 2012

Again, flash flooding affected the Jumble Hole area from Blackshawhead to Callis Bridge, causing additional flooding to properties across the Upper Valley. Substantial quantities of silt and rubble were deposited in Burnley Road and surrounded nearby terraced properties. The drainage system on Burnley Road was unable to cope and the Fire Service spent several hours pumping water into the river.

9 July 2012

Flash floods in Hebden Bridge, Eastwood & Mytholmroyd. Three weather systems hit the area on the 9 July 2012, causing torrential rain to fall on already heavily saturated ground, and resulting in major flooding incidents across the Upper Valley, with over 43mm of rainfall. This caused surface water flooding but did not result in high river levels. Again, saturated ground caused water to run off the hillsides. Nutclough dam overtopped and there was extensive flooding in Keighley Road. Rubble and silt from the hillsides blocked drains and culverts. Around 100 homes and businesses suffered, some for a second time.

22 June 2012

Major flooding across the Upper Valley down to Brighouse. The River Calder and River Hebble overflowed causing major damage. This flood event was the largest fluvial event (fluvial flooding happens when rivers burst their banks because of sustained or intense rainfall) on record across the Upper Calder Valley, and the third largest across the lower reaches of the River Calder. Rainfall raised river levels all along the River Calder and filled all available storage. From midday onwards, steady rainfall continued to fall. More than a month's rainfall fell in the 24-hours of the 22 June 2012. The rivers rose to unprecedented levels causing the worst flooding since 2000. Over 900 properties and businesses were affected by the resulting flooding when Walsden Water, the River Calder, various tributary rivers and the Rochdale Canal burst their banks. Hebden Bridge recorded its highest ever river level (3.311 metres) and Mytholmroyd saw levels over 4.9 metres. Some properties flooded to a depth of over 1m.

As well as the flooded premises, there was structural damage to road surfaces, culverts and bridges, plus major disruption to traffic and local people, including the railway line, stranding many people in transit.

The towns and villages most affected were Walsden, Todmorden, Eastwood, Hebden Bridge (including major flooding at Callis, Woodland Villas and Charlestown), Mytholmroyd and Brearley/Luddenden Foot.

There was also flooding in other parts of the Borough, such as in Sowerby Bridge, Elland and Brighouse.

19 November 2009

Surface water caused cellar flooding on Commercial Street, Todmorden, with additional flooding of roads in Walsden.

21 January 2008

Walsden flooding affected the railway cutting at Deanroyd Road worse than in 2012/3. Rochdale Road, Todmorden, was closed between the A646 Burnley Road and the junction with Inchfield Road, Walsden, due to flooding. Areas around Centre Vale Park were flooded, along with properties on Burnley Road near Todmorden High School.

2 to 3 July 2006

Reports highlight that properties on Eagle Street flooded when the river overtopped its banks due to heavy rainfall. Many roads in and around Todmorden were closed, with approximately 20 properties flooded in cellars (kitchens) on Industrial Street, Commercial Street and Sackville Street. 30 properties on Halifax Road, 12 properties including the Public House on Burnley Road, and 20 to 30 properties on Rochdale Road opposite Morrison's Supermarket all flooded from surface water run-off. St Joseph's School on Wellington Road was also reported to have flooded. Properties in Walsden were flooded when a culvert under the railway line at Rochdale Road became blocked and Walsden Water surcharged onto the railway line. Also, three properties on Rochdale Road at the junction with Strines Street flooded from Ramsden Clough.

B.2 Late 20th Century

3 to 4 June 2000

Flooding to areas of Walsden via Bridge No. 96 was worsened by the collapse of waterside walls at Rochdale Road and Sackville Street, with overtopping at the Safeway's bridges, Callis Bridge and Hebden Bridge.

Severe flooding affected approximately 500 homes with reports that water reached up to 8-feet deep in some areas. The following roads/streets were flooded: Hazelwoods, Industrial Street, Cambridge Street, Stackhills Road, Hope Street, Derdale Street, Der Street, River Street, and Commercial Street. Millwood Works, Industrial Units at Eastwood and Todmorden Sewage Works at Eastwood were also affected by flooding.

Hebden Bridge suffered widespread flooding with properties and businesses on virtually all of the streets in the area being underwater. The following roads/streets (among others) were affected: Stubbing Holme Road, Market Street, Old Gate, Bridge Gate, Holme Street, New Road, Hope Street and Albert Street. Calder Holmes Park was also flooded.

Several industrial units in Mytholmroyd flooded.

Brearley and Luddenden Foot - reports of property flooding, some from surface water. Playing fields in the areas flooded. Industrial units at Luddenden Foot and the business park at Longbottom Bridge were also affected.

The playing fields, Victoria Road, Water Street and industrial units off Hall Street in Sowerby Bridge were affected by flooding.

31 January 1995

Road flooding in Hebden Bridge and Callis Bridge due to snow melt. The level was just below the defences at Mytholmroyd. Sewers surcharged in Cragg Road and Burnley Road, Mytholmroyd, was flooded to a depth of 3-feet.

Flooding in Walsden and Commercial Street, Todmorden.

19 December 1993

Flooding of cellars and basements on Cragg Road, Mytholmroyd, due to rain overloading surface drains.

2 December 1992

Lesser flood in Mytholmroyd. Brearley playing fields, cellars of properties on Cragg Road and a property in Dale View were flooded, but no surface flooding.

23 January 1992

Serious flooding in Calder Valley recorded, mainly in Mytholmroyd and Brighouse.

5 January 1992

Brearley playing fields in Mytholmroyd flooded.

21 December 1991

Flooding in Mytholmroyd. Burnley Road was flooded to a depth of 600mm (almost two feet) and properties fronting the road were flooded. Flooding was due to penetration through the riverside walls and surcharging of surface drain outlets.

September 1991

River came over its bank at Mytholmroyd.

26 to 28 December 1990 and 1 January 1991

Flooding in Todmorden. Bridge No. 96 overtopped.

19 May 1989

Severe localised flash flooding across the Calder Valley, and on secondary rivers such as Hebden Water, caused flooding damage to gardens, outhouses, culverts and a mill complex, and a number of houses were flooded to a depth of 1m (over three feet) in Luddenden (from Luddenden Brook).

Hebble Brook flooded to a depth of 2m (over 6 feet) above bank level causing erosion damage. There was damage to sewers and properties in Halifax and damage to bridge supports and

retaining walls along Red Beck. 193mm (7½-inches) of rainfall was recorded in two hours at Walshaw Dean reservoir but the validity of this reading is disputed.

Possibly the second most rain intense event on record for the area.

15 April 1986

Burnley Road flooded.

16 January 1986

Brearley playing fields flooded.

21 December 1985

Brearley playing fields in Mytholmroyd was flooded.

19 December 1982

River came over its bank at Caldene Bridge, Mytholmroyd, causing Burnley Road to flood. Massive flood damage at Cornholme.

2 to 4 August 1982

Thunderstorms caused severe flooding of Cornholme, Portsmouth and Lydgate. 190 properties were affected including domestic properties, shops, offices, public houses, industrial premises and council properties. Burnley Road was closed to traffic for 12-days.

25 June 1982

The River Calder burst its banks at Brearley. Flooding from Cragg Brook, White Lee Clough and surface water drains in Mytholmroyd. Burnley Road was flooded and the bridge over Cragg Brook was washed away.

3 January 1982

Flooding on the Calder, considered the worst flooding in Yorkshire since March 1947. A total of 900 industrial and domestic properties were affected.

Cottages at Scar Bottom and Elphaborough Close were flooded to a depth of 2 to 3 feet.

29 to 30 December 1981

River Calder at danger levels.

27 to 28 October 1980

Highest flow (from 1971 to 1995) was recorded at Elland. Road flooding at Rochdale Road, Walsden Road and Callis Bridge. There was some flooding of cellars to properties built over the culverted section of the River Calder in Todmorden.

27 October 1979

Brearley playing fields at Mytholmroyd were completely flooded. Again, no reports of properties in Mytholmroyd being flooded.

7 to 8 April 1979

High flow in the River Calder after 15mm (over 1.2 inch) of rain.

9 March 1979

Brearley playing fields at Mytholmroyd were completely flooded. No flooding of properties was recorded in Mytholmroyd on this occasion.

28 to 31 December 1978

High flows in the River Calder, reaching 116.7mm (almost 5 inches) of rain in four days in Yorkshire, almost half of which fell on the 27th of December.

1 to 2 January 1976

Snowmelt resulted in flooding in Todmorden at Burnley Road from Centre Vale, Victoria Road and Pudsey Road. Hundreds of homes in Todmorden were flooded.

Blocked culvert on White Lee Clough at Spring Gardens, Mytholmroyd, caused water to flow down Midgley Road. Centre of Mytholmroyd flooded to a depth of 2-feet.

17 July 1975

Flooding upstream of centre of Todmorden at Coronation Terrace caused by a mudslide. Affected were Burnley Road between Portsmouth and Mons Mill (50 houses affected) and the moorland road to Hebden Bridge and Bacup.

22 January 1975

Minor flooding in Mytholmroyd, Brearley playing fields and properties at the Square and Acre Villas. Railway line at Walsden blocked by landslip.

19 October 1971

Brearley playing fields flooded. Caldene Bridge within 2 feet of overtopping. Road at Callis Bridge under 3 to 4 feet of water.

17 October 1967

Cragg Brook and Rochdale Canal in Mytholmroyd overflowed. Many premises flooded to a depth of 2 feet. Situation alleviated by on-going improvements scheme. Flooding of playing fields and cricket ground to 6 feet deep. One report suggested it was the 'worst floods since 1946'. Callis Bridge also affected.

20 February 1966

Sowerby Bridge 42.1'

8 February 1966

Sowerby Bridge 43.1'

9 December 1965

Flooding in Sowerby Bridge 43.6'. Elland Weir was breached. Cellars in Victoria Road, Todmorden, were flooded from Major Clough.

8 to 12 December 1964

Flooding in Todmorden (from Major Clough) on Burnley Road, Victoria Road, Gledhill Street and Blind Hill area, as well as at Centre Vale Park and Cricket Grounds and Calder College of Further Education.

River came over the bank at Mytholmroyd and the Dusty Miller pub was flooded to a depth of 3-feet. Burnley Road and house cellars were flooded.

9 December 1964

Flooding in Calder Valley, Callis Bridge particularly affected.

September 1962

River came over its bank at Mytholmroyd. Road at Callis Bridge under 1 foot of water.

26 August 1962

Burnley Road in Mytholmroyd flooded to kerb level, plus some cellars in houses.

27 November 1960

Flooding of premises in and around Brighouse. Flooding of roads and mills from Clifton Beck. Land between Elland and Brighouse flooded but no flooding in Elland town. Flooding from River Ryburn in Sowerby Bridge.

Some flooding of cellars at Hebden Bridge and Mytholmroyd. Flooding in Todmorden narrowly avoided.

October 1954

Minor flooding of roads to a depth of 1 foot at Callis Bridge and Mytholmroyd.

22 August 1954

Minor flooding around Brighouse, but not in the town centre. More serious flooding at Clifton Beck. Land between Elland and Brighouse flooded. Serious flooding at Hebden Bridge and Mytholmroyd. No flooding Todmorden but damage caused in Walsden. Winterbutlee Tunnel flooded to a depth of 2 feet.

21 August 1954

Flooding in Mytholmroyd from River Calder and Cragg Brook. Burnley Road flooded to 3 feet deep with adjacent houses also flooded.

21 January 1954

Flooding of roads at Callis Mill and Mytholmroyd, and houses at King Street, Hebden Bridge. Light flooding of roads in Todmorden.

8 September 1951

Road flooding at Hebden Bridge and Mytholmroyd.

B.3 Early 20th Century

6 or 8 September 1950

Flooding in Todmorden at Burnley Road, Centre Vale Park (river overtopping at Gandy Bridge), West Street (18 inches at No. 9) Carrfield and Jobling Terrace in Cornholme, Albert Terrace and 'Hamerton' (Hamilton) Terrace. There was 12 inches of water in the Jockey Tavern.

Flooding was from Walsden water and a contributory cause was the breaching of a 'flood wall' on Rochdale Road, opposite Waterside Mill.

Flooding of roads and some properties at Callis Bridge and Mytholmroyd.

Summer floods in Ripponden. No further details available.

20 November 1947

Minor flooding at Hebden Bridge and Mytholmroyd.

30 May 1947

Disastrous flooding in Brighouse, entirely from Clifton Beck. Considered more serious than Sept. 1946. River Calder was contained, however there was flooding in Mytholmroyd due to the blockage of culverts on tributaries.

December 1946

River came over its bank in Mytholmroyd.

20 September 1946

Mytholmroyd's Worst Flood until the 2015 Boxing Day floods.

River Calder flooded after 2-days of heavy rain; 2-inches of rain fell in 24hours followed by another ½-inch over the next 12-hours. The Calder Valley was the most seriously affected in the local area. The Calder and Hebden rivers overflowed and Mytholmroyd, Lower Copley, Salterhebble, Hebden Bridge, Sowerby Bridge, Brighouse and Todmorden were seriously affected.

The flood level in Walton Street, Sowerby Bridge, was 21-inches above the 1866 level. One resident stated that the flooding was the worst he remembered over the last 50-years, with much damage to buildings and property. Public call for improved flood defence measures.

Flooding in Todmorden at Burnley Road, Victoria Road and Wellington Road. Parts of Todmorden were under 4-feet of water. Walsden flooded at Winterbutlee Tunnel and the railway station, where water was level with the platform.

Serious flooding in Brighouse, affecting low-lying areas next to the Calder and in the area around Clifton Beck. Land between Elland and Brighouse was flooded. Flooding at Copley affected 150 houses and Sterne Mill. Industrial premises at Sowerby Bridge were flooded.

Flooding in Hebden Bridge from the River Calder and Hebden Water.

The number of properties flooded in the 1946 event (Brighouse to Todmorden) was reported as 905. The 1946 event was estimated to have a return period of 100-years at Brighouse and Mytholmroyd, and 33-years at Todmorden.

354 properties in Mytholmroyd were affected, some flooded to 5 or 6-feet deep. Burnley Road was closed for 11-hours.

2 February 1945

Flooding of roads around Hebden Bridge.

23 January 1944

River Calder overflowed at Brighthouse. Severe local flooding at Hebden Bridge, Callis Bridge and Mytholmroyd. Three deaths reported.

August 1938

Serious flooding at Walsden.

10 October 1935

Number of houses flooded in Mytholmroyd. 'Considerable havoc' caused in Walsden.

22 to 24 September 1935

Flooding in Todmorden at Burley Road, Hudson Street (Cornholme), Garden Street, Wellington Road and Vale Street. Major Clough overflowed down Victoria Road.

1933

No details available (mentioned incidentally).

1922, 1923 and 1928

Mytholmroyd suffered the worst of the flooding in the Calder valley

1921

Whole of the Calder Valley suffered when the heavens opened so suddenly people were taken completely unawares. Hillside streams turned into raging torrents and low-lying land from Luddenden Foot to Todmorden was inundated. The water subsided as quickly as it had risen and a massive mopping-up operation began: it was noted that the Calder appeared to be subject to serious flooding every 10 years or so.

10 February 1920

Severe flood in upper reaches (Todmorden and Mytholmroyd). Walls in Mytholmroyd knocked down.

12 November 1901

Walls between Callis Bridge and Hebden Bridge demolished. Footbridge over Calder at Stubbins washed away. Worst flood since 1866 in middle and upper reaches of the valley.

B.4 19th Century

1895

Photo of flooding at Gandy Bridge, Todmorden. No further details.

13 December 1891

Callis Bridge wrecked. Highest flood since 1866.

1 January 1881

Heavy rains caused a landslip on the hillside above the railway line between Todmorden and Dobroyd.

December 1880

"Serious flooding" was reported in Todmorden, Hebden Bridge and Mytholmroyd: the Hole in the Wall, Hebden Bridge, was inundated to a depth of four feet and the Dusty Miller, Mytholmroyd, to 3ft 8ins – "only eight inches lower than the great flood of 1837," it was noted.

17 May 1879

A "very heavy thunderstorm" was recorded but not, apparently, followed by the dreaded floods.

October 1877

Unlucky Cobden residents remained under water for nine days.

15 July 1877

"Dangerously high" floods spread from Blind Lane down through Roomfield and Sandholme to the centre of Todmorden, filling basements rooms. "The area over which the water spread was probably wider than in any known flood in Todmorden."

1875

Cobden was "visited by one of those floods which are of frequent occurrence in that locality."

8 December 1874

According to the Todmorden and Hebden Bridge Historical Almanack "some of the dwellings were flooded to a depth of from 4 or 5 feet."

July 1870

Three people lost their lives when Burnley Valley and areas as far afield as Bacup were inundated. This was generally accounted the worst flood of the century.

1869

Further flooding

17 November 1866

Recorded as the second highest flood after 1775. High-water mark left in Walton Street, Sowerby Bridge.

8 September 1861

The whole of the Upper Valley suffered "one of the greatest floods ever experienced"

6 November 1860

There was "notable flooding in the town and below," heralding a decade in which it never seemed to stop raining.

7 August 1859

Another catastrophic rise in the Calder caused devastation in Hebden Bridge when the river rose "a foot in less than ten minutes," turning open ground from Salem Mill to the White Horse Hotel into a vast lake. The same floods also wrought havoc in the Cheapside, Pavement and Salford areas of Todmorden - "nearly covering the looms in Mr Chambers' mill;"

6 August 1857

A child drowned in the swollen River Hebden followed a week later by a "considerable rise" in the River Calder resulting in "great damage" in Todmorden and Hebden Bridge.

26 October 1855

"Todmorden was visited by one of the largest floods within the recollection of the oldest inhabitants." A wall opposite Wadsworth Mill came crashing down and the overflowing Calder turned Burnley Road into a river. Hebden Bridge escaped relatively lightly but at Mytholm "the water rose to the exact height as during the flood of 1837." Green's Mill, Portsmouth, suffered serious damage in the torrential downpour and a joiner's shop at Gauxholme was "swum away."

August 1855

Todmorden suffered a "severe and lengthy thunderstorm" during which "vivid flashes of lightning were quickly succeeded by loud claps of thunder." Around 5pm "the rain poured down in torrents filling the different brooks which wind their way through the valley." Terrifyingly, a 15-yard high "wall of water" then rushed down the turnpike road, inundating homes and properties including the National School. "The meadows in the neighbourhood presented the appearance of a vast lake.

22 December 1837

Hebden Bridge had highest flood recorded. The arches of the canal viaduct at Black Pit were unable to take the waters which consequently rose to the height of the canal and ultimately flowed over it

29 November 1834

A great flood did considerable damage in Todmorden and neighbourhood

Early 1831

Walls in the lane leading to Christ Church Todmorden were washed away in a deluge

16 November 1830

Great flood in Todmorden

B.5 Pre-19th Century

1775

Flooding level reaches 'highest ever'.

1722

Ripponden Parish Church and Stirk Bridge destroyed.

1673

Similar to 1615. Bridges are damaged.

1615

Earliest flood on record. Elland Bridge is destroyed.

C Appendix - Flood Risk Reduction Schemes - Phase 1

FRRS1 Schemes		
Scheme	Description	Stage
Shop Lock - Todmorden	Scheme to ensure that flows overtopping or bypassing Shop Lock on the Rochdale Canal do not increase the flood risk to Todmorden.	Completed.
Nutclough	Improvements to an existing reservoir near Nutclough Mill in Hebden Bridge as well as enhancements to surface water drainage collection on Keighley Road.	Completed.
Erringden Hillside	Scheme to safely channel and collect surface water from the hillside and discharge it into the Rochdale Canal or River Calder.	Scheme has been appraised.
Bacup Road	Scheme to improve the drainage of the hillside to the north of Bacup Road by discharging the flows into the Midgeldon Brook.	Completed.
Woodland View	Terrace of properties adjacent to the River Calder that are prone to frequent flooding. Scheme aims to improve the local drainage infrastructure to enhance the SoP provided to these properties.	Scheme has been appraised and funding has been approved. A performance specification for the work has been developed and work is due to start onsite early 2017.
Burnt Acres Wood	Pumped surface water scheme to minimise local disruption on the A646 Halifax Road as well as reduce flood risk to local businesses and residential properties.	Scheme has been appraised and funding has been approved. A performance specification for the work has been developed and work is due to start onsite early 2017.
Pin Hill Lane	Scheme had been earmarked for construction but has since received objections from the landowner.	Scheme has been appraised and funding has been approved. Work is due to start onsite early 2017.
Kershaw Road, Todmorden	Complex scheme with a large hillside catchment that drains into a largely culverted system through the residential development around Kershaw Road. The culverts are prone to blockage and a scheme is planned that includes upland natural flood management with coarse rock screen capturing debris from the incoming tributaries feeding onto the culverted system.	This was only an investigative scheme with some modelling. Initial discussion have taken place between EA, Network Rail and CMBC regarding the scheme. The scheme will now be picked up as part of the wider Walsden FAS
Park Road Elland	Scheme initially developed by Atkins and reviewed by JBAB. The proposed scheme had high construction costs with a small pool of benefits to justify the scheme. The flood risk at this location is complex (due to the interaction with the Rochdale Canal)	The scheme is being further appraised by CMBC and the EA.

D Appendix - Flood Risk Reduction Schemes - Phase 2

FRRS2 Schemes	
Scheme	Details
Oak Hill Clough/Ashenhurst Road, Todmorden	There are a large number (125+) of residential properties at risk of flooding due to a culvert collapse, blockage or simply from capacity exceedance. Existing screening arrangements are life expired and channel side structures are becoming undermined and at risk of collapse. The estimated existing standard of protection (without any infrastructure failure) is 1 in 15-years. Issues at Ashenhurst Road have been identified to be as a result of infrastructure capacity and surface water runoff. Modelling work needs to be continued from FRRS Phase 1 work prior to a scheme being developed and appraised.
Machpelah Screen, Hebden Bridge	Flooding occurred here in 2012 and problems have been identified with this culverted watercourse in the past. Flooding blocks the road with debris and required preventative action by the council to protect properties. Given the age and condition of the culvert it is highly likely that this site will flood repeatedly in the years to come.
Calder-Ryburn confluence, Sowerby Bridge	Flooding occurred here in 2008. Water levels did not get high enough to cause significant damage however, a slightly more prolonged or higher event would have led to significant damage and disruption with 73 residential and 77 commercial properties at risk.
Railles Close Midgley	Flooding occurred here in 2012 and a near miss occurred in 2014. Flooding events caused by short-lived storms have occurred in the past. The scheme at Pin Hill Lane (part of FRRS1) will provide a partial solution to flooding at Railles Close (we have not double counted properties). A further scheme is required however to prevent flooding from another overland flow route. Approximately 24 properties are at risk on Railles Close
Shaw Wood Rd, Todmorden	Flooding has occurred here in 2000 and 2012. Properties affected include several businesses and a residential care home. When flooding occurs the properties are isolated with the river to one side and the canal to the other
Dean Clough, Halifax	Flooding occurred in 1989 resulting in culvert collapses. The culverts have deteriorated further since this time and other collapses have occurred. Existing screen arrangements on Ovenden Brook have become life expired. Significant numbers of businesses are at risk including Lee Bridge Industrial Estate and Dean Clough office park. There are also council assets at risk such as the waste transfer station.
A 646 The Square, Mytholmroyd	Flooding occurred here in 2012 and there have been near misses since. Surface Water flows off the main Burnley Rd and floods a low lying courtyard affecting 6 residential properties. While only a small number of properties are at risk the pathway for flooding is from the highway and only a small scheme is required to alleviate this problem
Copley Village	Copley village is at risk from both river and surface water flooding. The village has a good standard of protection from river flooding due to the existing defences however there is a risk from surface water flooding. Surface water flooding occurred in 2010 and there is the potential for significant numbers of properties to be inundated. At present the exact risk and mechanisms are not fully understood.
Luddenden	Local land drains have failed causing overtopping of flood walls. This then enters several homes in the area. Further investigations are required.
Brighouse	This is a new project - risk from Calder, ordinary watercourse and sewer, need to produce PPF and benefit area. Need to influence owner of properties to use grant for scheme. Initial Assessment needs to progress.
Kershaw Road, Walsden	Move from FRRS1 into FRRS2. Non-Main River - package to together for a Walsden Scheme. Initial Assessment needs to

FRRS2 Schemes	
Scheme	Details
	progress.
Walsden	<p>Fluvial flooding occurred due to culvert capacities being exceeded and by poorly maintained river walls leaking. Water entered properties from beneath and through flows from river walls overtopping and through missing sections. There is a restriction to culverts due to debris build-up along river beds and poorly sized culverts. These issues were experienced in 2015</p> <p>Surface water flooding is comprised of many isolated issues including undersized systems, a lack of development planning, damage to existing infrastructure which includes collapsed floodwalls, poorly maintained/blocked drainage systems, and road/kerb levels diverting flows towards low lying properties. This was intensified by a combined sewer system surcharging effluent into surrounding properties.</p>
Shade	<p>The rise in the river and canal water levels caused flooding of cellars and back gardens along the river. Road gutters and gullies are blocked due to resurfacing and historical/existing road drains no longer being adequate to convey flows. A damaged land drain flows onto adjacent road and floods nearby properties. Remedial works to existing 1.5m high floodwall along the Rochdale Canal to be undertaken. A large number of properties at high risk are situated at the foot of the steep valley between the Rochdale Canal and Walsden Water. No surface water drainage system observed on the hillside, this causes extreme overland flow down the hillside into properties and other infrastructure. Upstream storage to be considered.</p>
Todmorden North	<p>Ground floor levels of properties along Burnley Road approx. 700mm lower than road level. No surface water drainage system observed in many side streets, many other blocked gullies identified. Most properties have basements and are subject to flooding.</p> <p>A scheme needs to be assessed compromising the following outline options:</p>
Calderside	<p>Deterioration visible throughout existing River/Canal walls,</p> <p>Houses in this area have thresholds lower than the road level and highly susceptible to flooding. Existing floodwall is assumed to be of suitable structural soundness to cope with additional wall height. This canal bank re-build is required.</p> <p>A scheme needs to be assessed compromising the following outline options:</p>
King Street (Mytholmroyd)	<p>Stubbing Drive Bridge (HX7 6LU) potentially restricted the water flow of River Calder, causing the flows to backup, resulting in the bridge parapet wall and adjacent river wall collapsing. Adjacent properties flooded including the Stubbing Wharf.</p> <p>A scheme needs to be assessed compromising the following outline options:</p>
Luddenden Foot	<p>Luddenden Brook overtops due to debris build-up at the YW sewer pipe crossing, restricting upstream flows. This causes adjacent businesses, properties and A646 to flood. Low elevation properties are at further risk due to the Canal and river overtopping</p>
Jumble Dyke, Brighouse	<p>Jumble Dyke is a tributary of the River Calder that flows through Rastrick and Brighouse primarily in culvert. Not much is known about the flood risk however the latest surface water flood maps show a significant number of properties at risk in this location. This will only be exacerbated by and culvert failure or blockage. The potential for significant risk is the reason we have pushed this</p>

FRRS2 Schemes	
Scheme	Details
	project forward for inclusion in FRRS2
Cross Stone Road, Todmorden	Flooding and near misses have occurred repeated times to properties along Cross Stone Rd. Overland flow even in normal winter conditions causes flow on the highway which causes damage and potential for icing.
Sowerby Bridge West	Remedial works required to existing stone culvert (Boulder Clough), highway drainage system and private land drains. For work to be undertaken the road will need to be closed for a significant period.
Ripponden	The River overtopped its banks along existing flood defences and flooded several businesses. Also flooded several properties further from the road; the issues seem to be focused around a private road.
Mytholmroyd Station	Over 50 ground floor flats on Elphaborough Close were submerged with up to 4 feet of water on Boxing day 2015. Many of the elderly residents had to be rescued from their homes. On Scout Road a number of properties, both residential and commercial were flooded. A landslide resulted in evacuation and long term closure of the road. A scheme is required to provide flood defences and improved road drainage.
Lower Bank House	Properties immediately adjacent to the river and are below the road level (Branch Road). There is a lack of necessary flood defences and surface water drainage. Water level at Mill Pond is above the car park level. Additional drainage and improvements to existing drainage are required.
Sowerby Bridge	Existing flood defences need further analysis to determine required works for an adequate level of protection against flood risk to be achieved. The location to be analysed further should include the Town Hall and Wharfe Street area. Improvements to existing drainage is required along Town Hall Street.
Commercial Street	Properties within the area have flooded 5 times in the last 20 years. River water gets into cellars into the houses and also seeps through the flood wall. Debris build-up has raised the bed level of the river by approx. 500mm reducing capacity and causing flows to breach the floodwall. Overland flows exceed the surface water drainage system capacity causing manholes and gullies along Halifax Road to surcharge. The area between the Canal and River, incl. Halifax Road, is at a low elevation and acts as a pond. Water flows into the area from high grounds either side, and ponds as it can't flow out to the Calder. Issues along the Canal include gaps in the towpath wall, lack of canal storage capacity, insufficient capacity in the bypass channels at the locks and insufficient capacity at the offtakes to the river.
Pecket Well, Keighley Road	Flooding has been caused by the culverted Hebden Beck under Victoria Road restricting flows causing the Beck to back up and overtop its banks. Flood walls are also insufficient to protect against the backwater effect.
Cragg Road	In winter 2015 Cragg Brook overtopped and flooded businesses and highway to a depth of approximately 0.5m. The watercourse overtopped the riverbank at Rose Villas and Vale Terrace, flooding cellars and gardens. Cragg Road was inundated at the confluence of Cragg Brook and a local tributary with surface water on the roads and flooding from watercourse culverts beneath the road junction. These culverts were blocked with debris and overwhelmed by floodwater.
Cotton Stones	Impact to residential properties from source of groundwater, further investigations are required. Improvements to existing drainage infrastructure needed. Further investigations required in this area.

E Flood Investigation Policy

E.1 Background

The Flood and Water Management Act 2010 designated all county and unitary authorities as 'Lead Local Flood Authorities' and introduced a number of new duties. The Flood Risk Management Team is responsible for ensuring CMBC is delivering its duties as a LLFA. One of the new duties assigned to a LLFA is the duty to investigate flood incidents in its area. This policy outlines CMBC's now legal requirements to investigate flood incidents and provides details on the CMBC will apply in deciding whether or not an investigation is appropriate.

The Flood and Water Management Act 2010 places a duty on the Council, as the Lead Local Flood Authority for its area, to investigate flooding incidents that it becomes aware of, to the extent that it considers necessary or appropriate.

Section 19 of the Act states:

(1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate-

(a) which risk management authorities have relevant flood risk management functions, and

(b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

(2) Where an authority carries out an investigation under subsection (1) it must-

(a) publish the results of its investigation, and

(b) notify any relevant risk management authorities'

The term 'risk management authorities' refers to a number of organisations who have responsibility for flood risk management. As the CMBC is responsible for ensuring all of the risk management authorities are working together to resolve flood problems. Whilst CMBC has a duty to investigate flood incidents in its area, it may be the responsibility of one of the other risk management authorities, or even the land or property owner themselves, to take action to resolve the issue.

The FWMA is clear that the LLFA's responsibility for investigation only extends as far as establishing which of the risk management authorities has a flood risk management function and whether it will be exercised. The use of the phrase 'to the extent that it considers it necessary or appropriate' allows each LLFA to set investigation criteria which is appropriate to their area and priorities. The FWMA allows LLFAs to use their discretion in deciding under what circumstances it is necessary and appropriate to investigate a flood incident in their area. CMBC will, therefore, prioritise flood incidents which occur in Calderdale and this policy outlines what our response will be for requests to investigate flood incidents.

E.2 Threshold for investigation

E.2.1 3.1 Section 19 investigations

This policy has been developed to enable CMBC to plan resources effectively and to ensure members of the public are aware of the support they can expect when they are affected by a flood incident. An investigation under Section 19 of the FMWA can be a resource intensive process. CMBC will therefore require one of the following criteria to be satisfied in order to establish whether a Section 19 investigation is 'necessary or appropriate':

- 1) Internal flooding* to five or more residential properties in close proximity** during one flood event, or
- 2) Internal flooding* to one or more properties on two or more occasions in the previous 5 years, or
- 3) Internal flooding to two or more business/ commercial premises during one flood event, or
- 4) Flooding has affected critical infrastructure*** for a period in excess of 3 hours from the onset of flooding, or
- 5) Where there are specific health and safety concerns (e.g. environmental health or risk to life), or
- 6) If there is ambiguity surrounding the source or responsibility related to a flood incident in addition to one of the above.

*Internal flooding, refers to any habitable space inside a dwelling that is affected by flooding.

**Close proximity is where it is reasonable to assume that the affected properties were flooded from the same source or interaction of sources.

***Critical infrastructure investigations under Section 19 will not take place if the infrastructure owner or operator is conducting their own investigation.

Critical Infrastructure refers to:

- Railway lines and stations;
- Highways and motorways;
- Utility infrastructure including electricity generating power stations, power lines, substations and wind turbines, water treatment works and sewage treatment works;
- Police, ambulance and fire stations and command centres;
- Telecommunications installations;
- Hospitals;
- Universities, colleges and schools;
- Local authority main offices;
- Residential institutions such as care homes, children's homes, social services homes, prisons and hostels.

E.3 Flooding of the highway

CMBC is responsible for ensuring the public highway is safe and well maintained. This responsibility for the highway includes highway drainage assets such as gullies and ditches where serving the highway. Where flooding to the highway infrastructure occurs it will continued to be investigated by the Council in its role as the Highways Authority. However, where highway flooding is a contributory factor to property or critical infrastructure flooding, it may be appropriate for a Section 19 investigation to take place.

E.4 Wide scale emergency flood investigations

Where a wide scale flood incident occurs, this will usually meet the criteria for a Section 19 investigation. However it would not be practical to carry out individual Section 19 investigations for each affected group of properties or piece of key infrastructure. In these incidences, the Flood Risk Management team will conduct one Section 19 investigation into the incident.

E.5 Discretionary investigations

There may be flood incidences, which may not meet the Section 19 criteria, but CMBC may consider that an investigation should still be undertaken. In such an incident a formal report will not be produced. CMBC may decide that a discretionary investigation is appropriate in the following situations:

- Instances of repeat internal residential/commercial property flooding but where the criteria for a Section 19 investigation has not been met.
- Where the depth or velocity of flood water poses a specific threat.
- Where those affected by floods are particularly vulnerable.

CMBC retains discretion to investigate flood incidents that do not meet the criteria for a Section 19 investigation, if considered appropriate and subject to the availability of resources.

E.6 Flood incidences which will not be investigated

There are a number of situations where it is inappropriate for the Council to undertake any investigation actions. These include flood issues which pose no immediate threat to life, residential or commercial property or key infrastructure. This includes but is not limited to:

- A flood incident which has affected external property buildings or grounds such as sheds, garages or gardens.
- A flood incident which has affected agricultural land or open space.

It is not appropriate for CMBC to support investigations into these types of flooding. It will therefore, be the responsibility of the riparian landowners to undertake their own investigations in these circumstances. CMBC will try and assist in providing information to members of the public on what may be appropriate courses of action, where requested.

E.7 Purpose and Scale of Investigations

Any investigations undertaken will seek to establish the likely causes of the flooding incident, the relevant risk management authorities, and identify any recommended actions to be undertaken by the relevant risk management authorities in order to reduce the risk of a recurrence. The investigations will be undertaken during, or as soon as possible after, the flooding incident, and will be appropriate to the scale and nature of the flooding incident.

Small scale flooding incidents, and incidents where the relevant risk management authorities are immediately apparent or are undertaking actions to alleviate the cause of the flooding incident, are likely to require limited investigations.

Large scale flooding incidents, incidents where the relevant flood risk management authorities are unclear, and incidents where a number of risk management authorities are involved, are likely to require more detailed investigations. In such circumstances the Council will work closely with the risk management authorities involved and may, where appropriate, prepare a detailed report.

E.8 Flood Investigation Procedure

The following procedure will be followed for all investigations under this policy

- Flood reported to the LLFA;
- Flooding log started;
- Flood investigator appointed;
- Initial LLFA assessment undertaken as to whether this constitutes a section 19 report;
- If yes, formal notification issued to partner risk management authorities notifying of the investigation and requesting any relevant information (see Appendix B for formal notification);
- Flood investigation undertaken and report drafted in consultation with partner risk management authorities;
- Draft report issued for comment;
- Report and associated actions approved by the Councillor for, Emergency Planning;
- Finalised report to be published on the Council's internet as below (section 5).

- Where a number of flood investigations are needed simultaneously, investigations will be prioritised by the Projects Manager in consultation with other stakeholders

E.9 Publication of Findings of Investigations

The findings of all formal Section 19 investigations undertaken by the Council, as Lead Local Flood Authority, will be recorded on internal systems and a report published on the Council's website.

E.10 Timescales

The length of time a flood investigation takes will relate directly to the complexity and scale of the flood. It is not possible to set out a generic timeframe in which the flood investigation will be complete. However, it should be commenced as soon as possible after WBC becomes aware of the flood and updates should be provided as to which floods have been reported and the estimated timeframe for the initiation, and where possible, expected completion date of the flood investigation

Definitions

Organisations

Environment Agency - is a non-departmental public body, established in 1996 and sponsored by the UK government's Department for Environment, Food and Rural Affairs (Defra), with responsibilities relating to the protection and enhancement of the environment in England.

Lead Local Flood Authorities - are county councils and unitary authorities. Under the Flood and Water Management Act they are required to coordinate flood risk activity with other local bodies and communities through public consultation, scrutiny and delivery planning.

Local Resilience Forums - are multi-agency partnerships made up of representatives of local public services, emergency services, local authorities, the NHS, the Environment Agency. These agencies are defined as Category 1 Responders under the Civil Contingencies Act.

Office for Water Services - is the economic regulator of the water and sewerage companies in England.

Regional Flood and Coastal Committee - manages flood matters in a region on behalf of Defra. Flood Defence Grant in Aid funding is allocated regionally and prioritised by the RFCC.

Risk Management Authorities - have responsibilities and powers to undertake flood risk management activities. Under the terms of the Flood and Water Management Act they include, the Environment Agency, the Lead Local Flood Authority, district councils, internal drainage boards, the highway authority and the water and sewerage undertaker.

West Yorkshire Flood Risk Partnership - is a sub-regional meeting of West Yorkshire unitary authorities setup to agree scheme priorities and make recommendations to the RFCC.

Legislation and regulations

Flood and Water Management Act - The Act that governs the management of risks in connection with flooding and coastal erosion

Flood Defence Grant in Aid - The system by which government makes central funds available for flood risk schemes.

Flood Risk Management Regulations - The regulations that transpose the EU Floods Directive on the assessment and management of flood risk into UK Law.

Land Drainage Act - The Act that governs the management by internal drainage boards and local authorities in relation to land drainage.

National Planning Policy Framework - The government framework which controls planning policy.

Water Framework Directive - is the European Union directive which commits EU member states to achieve good ecological status of all water bodies.

Documentation

Calderdale Flood Investment Plan - a plan of schemes and activities that was drawn up in response to serious flooding in 2012 and 2013.

Catchment Flood Management Plans - consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding.

Local Flood Risk Management Strategy - a strategy required under the Flood and Water Management Act for a Lead Local Flood Authority to develop, maintain, apply and monitor local flood risk management in its area.

Preliminary Flood Risk Assessment - a document that identifies flood risk areas and explains the 6-year cycle of planning to reduce flood risk.

River Basin Management Plans - set out how organisations, stakeholders and communities will work together to improve the water environment.

Shoreline Management Plan - is a large-scale report, assessing the risks associated with coastal processes (not applicable to Calderdale).

Strategic Flood Risk Assessment - is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk.

Surface Water Management Plan - is a plan to address identified surface water flood risks.

Terminology

Catchment - the area naturally draining to a stream, river, reservoir or surface water system.

Combined Sewer Overflow - a device which relieves overloaded sewers by allowing them to spill to rivers and other watercourses.

Cost benefit analysis - a process that compares the whole life costs of a scheme against the damages the scheme saves.

Critical Drainage Areas - are areas with critical drainage problems as notified by the EA.

Culvert - a structure that encloses a watercourse.

Digital Terrain Model - is a topographic model of the bare earth's surface that can be manipulated by computer programs.

Flood risk - the statistical chance of a flood with a particular severity occurring.

Flood risk management - a term that has replaced flood defence in recognition that we cannot defend against all flooding.

Fluvial flooding - flooding caused when rivers and ordinary watercourses overtop their banks.

Functional Floodplain - areas adjacent to river channels that are needed during floods to allow water to flow or be stored.

Groundwater flooding - flooding that occurs when levels of water in the ground rise above the surface.

Large Project Review Group - is an EA group that assures projects costing more than £10-million (or if there are significant environmental impacts).

Local Levy - a system of precepts levied on local authorities by the EA which has recently been ploughed back into local schemes.

Main Rivers - are larger streams and rivers or smaller watercourses of strategic importance along which the EA has primary responsibility for managing flood risk.

Medium Term Plan - the EA's plan by which national flood risk management expenditure is scheduled.

Ordinary watercourse - All watercourses not designated as Main River.

Pluvial flooding - is flooding caused by high intensity rainfall.

Return Period - the statistical frequency at which a flood or storm is expected to be repeated.

Riparian owner - The owner of land through which a watercourse flows.

Sewer flooding - is flooding that occurs when the capacity of sewers is exceeded.

Sustainable Drainage Systems - are systems designed to allow drainage from development to mimic runoff prior to the development taking place.

Washland - is an area adjacent to a river where water will be stored during a flood. They can be either formal (designed to flood) or natural (flood naturally).