

Mitigating hydro-meteorological hazard impacts through improved transboundary river management in the Ciliwung River Basin

# RIVER GOVERNANCE AND FLOOD MANAGEMENT ARRANGEMENTS IN THE UNITED KINGDOM

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## About the Project

The project Mitigating Hydrometeorological Hazard Impacts Through Improved Transboundary River Management in the Ciliwung River Basin will examine how the current transboundary river management arrangements in the Ciliwung River Basin, Indonesia influence flood hazard impacts. The interdisciplinary project will bring together expertise in flood modelling, disaster risk reduction, urban planning, public policy, and behavioural science with the objective of identifying the environmental, socio-economic, political and organisational landscape associated with flood risk in the Ciliwung River Basin. The results will be used to inform improved transboundary river management arrangements for the Ciliwung Basin and provide a model for urban and peri-urban river basins elsewhere.

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- National Agency for Disaster Management (BNPB), Indonesia
- Indonesian Agency for Meteorological, Climatological and Geophysics (BMKG)
- National Planning and Development Agency-Directorate of Irrigation and Water Infrastructure (BAPPENAS)
- Indonesian Local Disaster Management Organisation (BPBD)
- Major River Basin Authority for Ciliwung and Cisadane Watershed (BBWS)
- BAPPENDA in West Java and DKI Jakarta Provinces

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# Contents

1.	Introduction	1
2.	Methods	2
3.	Background context	3
3.1.	The flood hazard in the United Kingdom	3
3.2.	Significant flood events	3
3.3.	Governance arrangements and paradigm shifts	5
3.4.	Overview of key actors	6
4.	River Governance and Flood Management Arrangements	7
4.1.	Political Pillar	7
4.1.1.	<i>Political agenda and political will</i>	7
4.1.2.	<i>Capacity</i>	7
4.1.3.	<i>Sectoral fragmentation</i>	7
4.2.	Legal/Institutional Pillar	8
4.2.1.	<i>Legal frameworks</i>	8
4.2.1.1.	EU Directives	8
4.2.1.2.	The Flood Risk (Cross-border) Regulations 2010	9
4.2.1.3.	Flood and Water Management Act 2010	9
4.2.1.4.	National Flood and Coastal Erosion Risk Management Strategy	9
4.2.1.5.	Catchment Based Approach Policy Framework	9
4.2.2.	<i>Horizontal and vertical integration</i>	10
4.2.2.1.	Coordinating institutions/mechanisms	10
4.2.3.	<i>Participation</i>	13
4.2.4.	<i>Civil Society</i>	14
4.3.	Operational Pillar	15
4.3.1.	<i>Technical cooperation</i>	15
5.	Summary	17
6.	Discussion	19
	References	21
	Annex: Governance arrangements for flooding and resilience in the city of Manchester, UK.	25
A.	Introduction	25
B.	Background	25
C.	Resilience in Greater Manchester	25
D.	Flood governance in Greater Manchester	26
E.	Challenges	27
F.	Summary and Discussion	28
G.	References (Annex)	29

# 1. Introduction

This work was conducted as part of the project Mitigating hydrometeorological hazard impacts through improved transboundary river management in the Ciliwung River Basin. This UK-Indonesia collaborative project, funded by NERC and Ristekdikti, aims to inform plans for improved transboundary river management to tackle flooding in the Ciliwung Basin, Indonesia. In developing recommendations for future river governance plans, the project has drawn on the practices of other countries also affected by flooding around the world.

The aim of this document is to highlight the ways rivers and flooding are managed in the United Kingdom (UK). In this document, the UK's management arrangements are described and examined to understand their effectiveness in overcoming potential challenges and barriers in river governance and management. This analysis draws upon previous studies and recent flooding events in the UK.

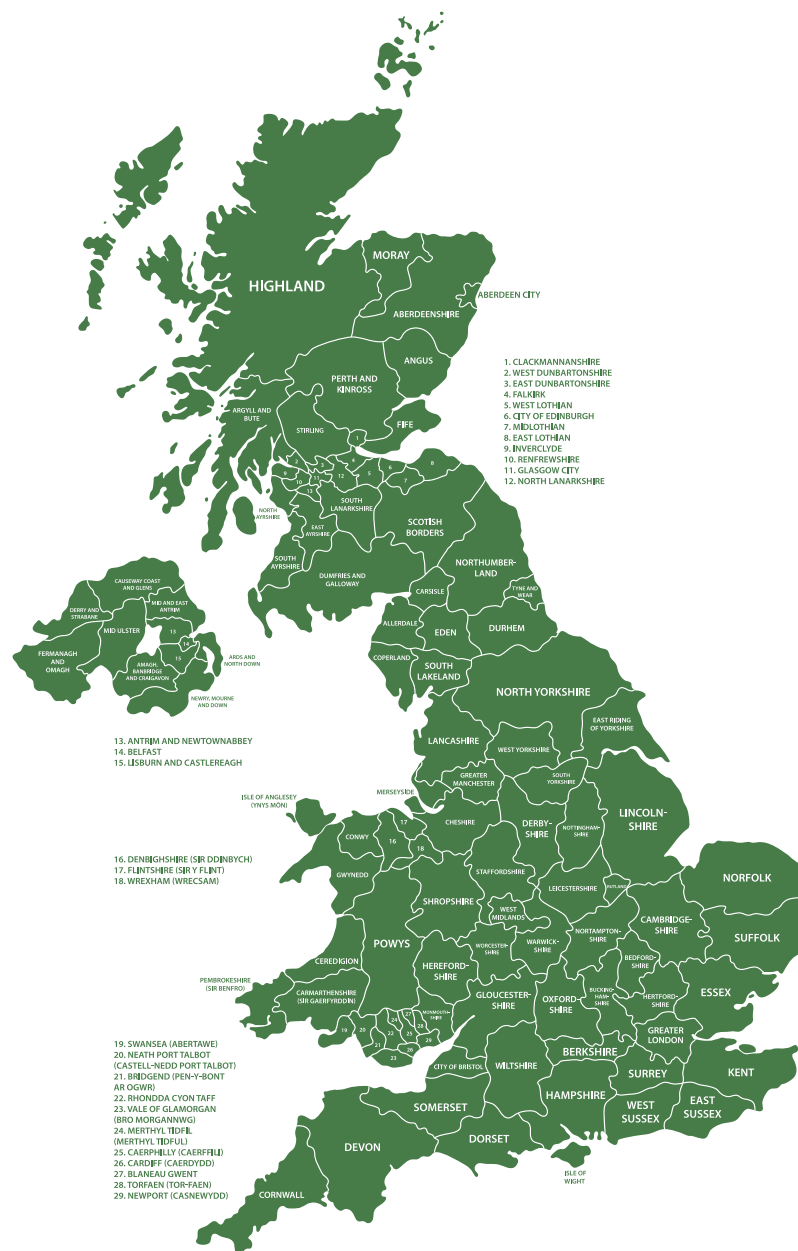


Figure 1. County regions of the United Kingdom (Pavel Cherepianyi/Alamy Stock Vector)

## 2. Methods

River governance and flood management arrangements in the UK were explored through a literature review. The review included documents from the academic literature, grey literature and UK Government documents and websites. The literature sources were retrieved through online searches using Google, Google Scholar and the University of Huddersfield's online portal 'Summon'. In order to ensure coherence with the wider project, this case study follows the structure set out in the project's conceptual framework that draws upon the three pillars of effective water governance proposed by Savenije and van der Zaag (2000). These also inform the structure of the document: Firstly, a background to flooding in the UK is provided, including an overview of the key actors and their roles. The river governance and flood management arrangements are then discussed in terms of the three pillars of effective transboundary water governance: Political, Institutional and Operational.

## 3. Background context

### 3.1. The flood hazard in the United Kingdom

Flooding presents one of the greatest natural hazard risks in the UK. Expected annual damages from flooding amount to £1 billion across the country as a whole (Sayers *et al.*, 2015). River flooding is the most significant source, followed by coastal, surface and groundwater by proportion (Sayers *et al.*, 2015). Increases in the number of flood events are expected in the future, with increased flooding identified as the top climate change risk in the UK (Committee on Climate Change, 2017b).

### 3.2. Significant flood events

This section highlights several key flood events that have affected the UK in recent years. These particular events were selected as they have had particularly severe impacts in terms of the number of people affected and economic damages. Several of the events have also highlighted governance issues, or stimulated changes to how flooding is managed in the UK.

#### *Summer 2007*

One of the most significant flooding events in the UK was that of Summer 2007. Unprecedented rainfall amounts resulted in fluvial and pluvial flooding across large parts of the country in June and July. The floods resulted in thirteen fatalities and the inundation of 48,000 residential properties. Hundreds of thousands of people lost access to essential services such as mains power and water supply (Pitt, 2008). The response to this event was highly criticised. Concerns were raised over institutions working independently from one another and a lack of awareness of responsibilities between actors. The event spurred significant changes in how flooding is managed in the UK.

#### *Winter 2013/2014*

England and Wales were impacted by sustained flooding between December 2013 and March 2014. This flood event was unusual as several different types of flooding occurred during the period, including coastal, fluvial and groundwater. The country was affected by a series of mid-latitude storm systems. This led to a storm surge along the North Sea coastline, the most severe for 60 years, that resulted in flooding along the coast (Sibley *et al.*, 2015). Subsequent storms brought significant rainfall totals and resulted in major inundation of flood plains occurred, primarily in the south of England. Impacts of the flooding were exacerbated by high groundwater levels (Muchan *et al.*, 2016). The estimated total cost of flooding over the four-month period was £1.3 million. The greatest proportion of these costs were incurred by damages to residential property, businesses and flood management infrastructure (Chatterton *et al.*, 2016). Around 7,800 properties are thought to have been flooded (Thorne, 2014). Further impacts included inundation of agricultural land, and transport disruptions. The south west of England became inaccessible by rail due to damages to infrastructure. In some cases, communities became isolated for four to six weeks (Muchan *et al.*, 2016). These events sparked debates over channel maintenance, with many suggesting lack of maintenance as the cause. The authorities responded with a programme to dredge eight kilometres of the Parrett and Tone Rivers. However, this received criticism for not being a long term solution (Thorne, 2014).

### Winter 2015/2016

Severe flooding episodes occurred across the country in December 2015 and January 2016 driven by multiple consecutive mid-latitude storms that brought heavy rainfall. December 2015 experienced for the highest monthly rainfall on record (Met Office, 2019). Several rivers also reached record peak flows in Lancashire and Cumbria. The most significant flooding occurred in northern and western Britain and Northern Ireland (Marsh *et al.*, 2016). 16,000 properties were flooded in England in December alone. The unusually large spatial scale and long duration of the floods had significant impacts on health, livelihoods and wellbeing (Barker *et al.*, 2016).

### November 2019

More recently, flooding affected parts of northern England in November 2019 in areas of Sheffield and Doncaster when a month's worth of rainfall fell in one day. Over 1,000 properties in Doncaster were evacuated and there was wide spread disruption to rail and road transport. The event drew criticism over the suitability of flood defences in the area. After the same area flooded during the 2007 event, a £20 million flood management scheme was implemented with new flood defences. However, flooding still occurred in some areas and defences were only just retaining waters in others. This raised questions over the suitability of these defences with increasing flood severity with climate change (BBC News report, BBC1, 8<sup>th</sup> November 2019). The floods also highlighted issues surrounding the current planning system. The system was criticised for allowing development of residential houses in flood plain areas. In particular the building of social housing in flood zones which has been suggested to be placing more vulnerable people at greater risk (Bosher, 2019).



Figure 2. Emergency services responding to floods in Rotherham, 8th November 2019 (REUTERS / Alamy Stock Photo)



### 3.3. Governance arrangements and paradigm shifts

In the past, flood management in the UK was centralised and focused on flood defence. Shifts away from centralised governance began with the privatisation of water authorities in 1980s and the formation of the Environment Agency in 1995 (Benson and Lorenzoni, 2017). Similar moves away from flood defence towards more holistic flood risk management (FRM) occurred (Butler and Pidgeon, 2011), and over time there has been increased devolution from centrally orientated FRM towards more localised management, and the use of more diverse approaches.

Significant changes in how floods are managed came after the major floods in 2007. Following the flooding, an independent review was made into the effectiveness and suitability of flood management in the UK, known as the 'Pitt Review' (Pitt, 2008). The Review made over 90 recommendations on how to improve flood management. These changes were taken on board by the government, set out in DEFRA's Future Water Strategy (DEFRA, 2008), and legislated in the form of the Flood and Water Management Act 2010. The Pitt Review promoted increased decentralisation and localisation of flood management.

It is important to note that in the UK Flood and Coastal Erosion Risk Management is a devolved power. This means that arrangements in Scotland and Northern Ireland differ from those in England and Wales (Local Government Association, 2019a). Throughout this document arrangements refer to England unless otherwise specified.



Figure 3. Bystanders observe flooded streets resulting from the severe summer 2007 event (Nick Turner/ Alamy Stock Photo)



## 3.4. Overview of key actors

### *DEFRA*

The Department for Environment, Food and Rural Affairs (DEFRA) is the lead UK Government department for flood management, and sets out associated Flood and Coastal Erosion Risk Management policy (Benson and Lorenzoni, 2017; Local Government Association, 2019a).

### *Risk Management Authorities*

Risk Management Authorities (RMAs) are responsible for delivering the Flood and Coastal Erosion Risk Management policy set out by DEFRA. RMAs include: The Environment Agency (in England), Lead Local Flood Authorities (LLFAs), district and borough councils, coastal protection authorities, water and sewerage companies, internal drainage boards and highways authorities (Local Government Association, 2019a). These RMAs and their associated responsibilities are set out in national legislation (Flood and Water Management Act 2010) and have a legal mandate to act on flooding. The RMAs and their roles are summarised in Figure 6 on page 17.

### *Environment Agency*

The Environment Agency is a non-departmental public body sponsored by DEFRA and plays a main role in implementing Flood and Coastal Erosion Risk Management in England. The Environment Agency have a strategic role coordinating flood management and developing long-term national strategies. They also have operational responsibilities for managing risks from main rivers, the sea and reservoirs (Kuklicke and Demeritt, 2016). In Scotland and Northern Ireland, the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA) respectively hold similar roles.

### *Lead Local Flood Authorities*

The role of Lead Local Flood Authority (LLFA) is usually assigned to County Councils or Unitary Authorities (upper tier local government administrative units). Whereas the Environment Agency are responsible for **national** flood strategy and management, LLFAs have responsibility for the management of **local** flooding, this includes flooding from ordinary water courses, surface and ground water sources (Local Government Association, 2019a). LLFAs are responsible for developing local strategies for flood and coastal erosion risk management in their area, preparing and maintaining a preliminary flood risk assessment and flood hazard map, and preparing surface water management plans. They are also responsible for ensuring that local plans are in line with national policy.

### *Internal Drainage Boards*

In some parts of England, Internal Drainage Boards (IDBs) exist. IDBs are local public authorities that are responsible for managing water levels in areas of special drainage need. There are 112 IDBs in England. These areas are determined by local hydrology, not political borders. The main duties of the IDB include maintenance and improvement of ordinary water courses (but not main rivers which are covered by the Environment Agency). They fall under the authority of DEFRA and work closely with the Environment Agency and LLFAs (Association of Drainage Authorities, 2017).

### *District and borough councils*

District and Borough councils (lower tier local government administrative units) have the responsibility for carrying out flood risk management works on minor water courses in their area and coordinate with the LLFA and other RMAs (Local Government Association, 2019a).

## 4. River Governance and Flood Management Arrangements

### 4.1. Political Pillar

#### 4.1.1. Political agenda and political will

In 2010 the Conservative Government launched its 'Big Society' Agenda. Part of this agenda involved localising and devolving power from the central government to local governments. This change was legislated in 2011 in the form of the Localism Act which gave local authorities greater decision making powers on a range of issues including FRM (Begg *et al.*, 2015). There has also been a move by the government to shift responsibility for flood management to individuals and businesses, by encouraging the uptake of household and business level measures.

Increased localisation potentially indicates the Government's will to tackle flooding locally. This is often seen as a positive move, backed by the view that local management allows local priorities to be addressed more effectively. On the other hand, this could be viewed as a move from the Government to distance themselves by suggesting the problem lays with local actors instead (Butler and Pidgeon, 2011).

Other issues regarding increased localisation have been raised. Firstly, it required a fundamental change in the way people perceived their role and the role of the authorities. It has been noted that many citizens still believe that FRM should be the responsibility of the state (Begg *et al.*, 2015). Furthermore, local actors (including both the authorities and the public) require motivation and the resources to act; however they are frequently noted to suffer resource constraints (Begg *et al.*, 2015).

#### 4.1.2. Capacity

With local actors having greater responsibility for FRM, there are issues surrounding their capacity to take effective action. In terms of Local Authorities, it was found that LLFAs suffer from staff and resource constraints which hinders their FRM work. There are also concerns that LLFA staff may lack the required technical expertise to conduct their role (DEFRA, 2017). This may be in part related to the short-term nature of employment contracts and the frequent movement of staff between jobs (Robins *et al.*, 2017). In some instances, LLFA responsibilities are contracted out to external consultants. In terms of the public and small businesses, there are similar concerns that they may not be able to resource the implementation of flood measures themselves (van Buuren *et al.*, 2018).

#### 4.1.3. Sectoral fragmentation

There are many sectors involved in FRM in the UK. Relatively good coherence between flood management and wider water management has been noted. This has been attributed to the links between the European Water Framework Directive and the Floods Directive (see Section 4.2.1.1). Furthermore, there are a multitude of coordination mechanisms (e.g. committees and forums etc.) which allow representatives from different sectors to come together. This usually takes place on a basin or catchment basis, which could assist upstream-downstream coordination (coordination mechanisms are discussed further in Section 4.2.2.1). However, there are issues surrounding fragmentation between water related sectors and other sectors that are not directly water related – for example spatial planning and climate change adaptation. Spatial planning is important for avoiding inappropriate development in flood prone areas and ideally, spatial planning and FRM should be closely linked (Benson and Lorenzoni, 2017). However, a scale mismatch

between planning and FRM has been identified. Planning decisions are made at the local government level, while FRM predominantly takes place at the basin or catchment scale, which may mean they are not as aligned as they could be (Benson and Lorenzoni, 2017). Further concerns are identified regarding planning procedures. Local authorities must consult with the Environment Agency on any developments in at-risk areas. However, the Environment Agency can only provide advice and cannot prevent the application being approved (Begg *et al.*, 2015). van Buuren *et al.* (2018) note that private developers are able to pressure decision makers about developments in at-risk areas, increasing risk and vulnerability, and creating sectoral tensions.

## 4.2. Legal/Institutional Pillar

### 4.2.1. Legal frameworks

The UK has a strong legislative framework guiding FRM. As a member of the European Union, this includes EU Directives as well as national policy and legislation. Several key policies are outlined in the following section.

#### 4.2.1.1. EU Directives

As a current member of the European Union (EU), EU Directives influence the governance of river basins and flood management in the UK. There are two Directives with significant influence. These are the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC).

##### *Water Framework Directive*

The Water Framework Directive (2000/60/EC) (WFD) concerns the environmental quality of river basins, and has the aim of achieving improved environmental status. Although the WFD does not concern flood management directly, it has had a significant impact on the way river basins are managed across Europe. In particular it focuses on management at the river basin scale. It requires that EU Member States define River Basin Districts (RBDs) (an area covering one or more catchments) and develop River Basin Management Plans (RBMPs) for each RBD. There are nine RBDs in England, plus two RBDs that cross the border with Wales (Dee and Severn) and two that cross the border between England and Scotland (the Northumbria and Solway-Tweed RBDs). RBMPs are developed for each RBD and cover the entire water system (river, lakes, groundwater, estuarine etc.) and set out how organisations, stakeholders and communities will work together to improve the water environment. In the case of cross-border river basins, the Directive requires coordination between the different states/actors. However, the mechanisms for coordination are not prescribed and are at the discretion of the states concerned (wfdireland.ie, 2003). In the consultation process for the RBMPs published in 2016, respondents identified that the RBMPs did not fully consider other plans and strategies that affect or are affected by the RBMPs. For example, how they link with local authority plans and climate change adaptation (Environment Agency, 2019d).

##### *Floods Directive*

The EU Floods Directive (2007/60/EC) (FD) aims at achieving a consistent approach to flood management across Europe. The requirements of the FD include: flood risk assessment, flood risk mapping and establishment and implementation of Flood Risk Management Plans (FRMPs). Each Member State first identifies Flood Risk Areas (FRA) through a preliminary flood risk assessment. For each FRA, a flood risk map is produced and then FRMPs are drawn up for these zones (European Commission, 2019a). The FD is transposed into law in England and Wales via the Flood Risk Regulations 2009 (Benson and Lorenzoni, 2017). The Environment Agency work on main rivers, the sea and reservoirs, and LLFAs on local sources of



flooding (Environment Agency, 2019c). The preferred approach is for the Environment Agency and LLFAs to work together, with LLFAs' work feeding into the wider FRMP produced by the Environment Agency. Although this is not a requirement, alternatively LLFAs can produce separate FRMPs (Local Government Association, 2019b).

The FD was designed to be linked with the WFD. The FD is implemented on the same River Basin District level as the WFD. Both the WFD RBMPs and the FD FRMPs are reviewed and updated every six years, and both are led by the Environment Agency as the 'competent authority'.

#### 4.2.1.2. The Flood Risk (Cross-border) Regulations 2010

The Flood Risk (Cross-border) Regulations 2010 were drawn up in order to fully transpose the FD into UK Law. The FD was transposed into English Law via the Flood Risk Regulations 2009 and into Scottish Law by the Scottish Flood Risk Management Act 2009. However, as the Solway-Tweed RBD crosses the border between England and Scotland, special regulations had to be established. The Regulations were put in place so that it was necessary for Scotland and England to coordinate on the development of FRMPs. Under the Regulations, SEPA and the Environment Agency work together, and a Cross-border Advisory Group was established (2010b) (see also Solway-Tweed case study in Section 4.2.2.1).

#### 4.2.1.3. Flood and Water Management Act 2010

The Flood and Water Management Act 2010 (FWMA) is the underpinning legislation for flood management in England. Under the FWMA the Environment Agency is given strategic overview responsibility and is required to produce the overarching Flood and Coastal Erosion Risk Management Strategy that guides FRM in England. The Act also requires LLFAs to produce Local Flood Risk Management Strategies.

The FWMA includes specific requirements on 'cooperation and arrangements' which states that defined Risk Management Authorities (RMAs) must cooperate with one another (2010a). The FWMA has been commended for clearly defining who is involved in flood management and what their roles and responsibilities are (Clegg *et al.*, 2019). As part of this cooperation requirement, the Environment Agency are also responsible for establishing Regional Flood and Coastal Committees (RFCCs), of which there are 12 in England. The Environment Agency consults with the RFCCs on work they plan to conduct in their region and must take the comments of the RFCCs into account (Environment Agency, 2013). More information about the coordinating function of the RFCCs is available in Section 4.2.2.1.

#### 4.2.1.4. National Flood and Coastal Erosion Risk Management Strategy

Under the FWMA, the Environment Agency are required to develop a national flood management strategy which sets out an overarching strategy to guide FRM across England (see DEFRA and the Environment Agency (2011)). This strategy sets out the current and future risks from various forms of flooding, the current management arrangements and organisations involved, guiding principles and funding arrangements. FRMPs required under the FD should be in line with this national strategy. The current strategy, published in 2011, is currently under review with the view to publishing a new strategy in 2020.

#### 4.2.1.5. Catchment Based Approach Policy Framework

In 2013 DEFRA published a policy framework setting out its intentions to embrace the **Catchment Based Approach** (CaBA) (DEFRA, 2013). The CaBA is a civil society initiative that promotes collaborative working at the catchment scale with the aim of protecting the natural water environment (Catchment Based Approach, 2019). The focus on catchment management has been indicated as a mechanism for horizontal and vertical coordination (Rollason *et al.*, 2018). The embracement of the CaBA came after DEFRA was challenged by other organisations over the effectiveness of WFD RBMPs. Under the CaBA each RBD is

divided up into smaller catchments. The aim of this is to provide a bridge between management planning at the RBD level (via RBMPs) and activities implemented at the local water body scale (Environment Agency, 2016b). Thus the CaBA helps to integrate management across catchments, and supports the RBMP process and implementation of the WFD (Foster *et al.*, 2018). The CaBA promotes partnership working, and integrated and inclusive catchment management. The policy framework led to the establishment of over 100 community-based Catchment Partnerships and the development of associated Catchment Management Plans. For more information about the Catchment Partnerships and their coordinating function, please see Section 4.2.2.1.

Although the intention of the CaBA was to bridge management scales, there are concerns over the ability of it to achieve this practically. It has been suggested that linkages between RBMPs and catchment management are not made explicit enough, and that the WFD has become part of the CaBA, rather than the other way around (Foster *et al.*, 2018). Rollason *et al.* (2018) suggest that the catchment approach has led to better horizontally integrated management, but vertical integration is still limited. Also of note is the fact that the CaBA and Catchment Partnerships are non-statutory (DEFRA, 2013). Consequently, there is no legal mandate for them to operate or draw up Catchment Management Plans, which draws into question how well they are implemented compared to statutory requirements.

## 4.2.2. Horizontal and vertical integration

There are many individual actors and institutions working in water governance in the UK. These actors are distributed vertically across governance levels, and horizontally across sectors and space. Across both vertical and horizontal planes, there has been efforts to provide coordination mechanisms that allow the different actors to work together (Robins *et al.*, 2017). These mechanisms, which usually take the form of committees, forums etc. are often composed of representatives from various governance levels and actors from across the river basin. The following section describes in further detail some of the main coordinating mechanisms used. Figure 6 provides a summary of the coordination mechanisms across the different governance levels (see page 17).

### 4.2.2.1. Coordinating institutions/mechanisms

#### *Regional Flood and Coastal Committees*

Regional Flood and Coastal Committees (RFCCs) were established under the Flood and Water Management Act 2010 to meet demands for greater local-level influence on flood management (Lorenzoni *et al.*, 2016). The aim of the RFCCs is to provide a link between the Environment Agency, LLFAs other RMAs and relevant bodies. To provide an example, the Yorkshire RFCC includes appointees from DEFRA, the Environment Agency, County Council (LLFAs), and councillors from county, city and borough councils within the RFCC area. Their role is to make decisions on local priorities, and also help to ensure coherent plans for FCERM across catchments and shorelines (Environment Agency, 2019b). Including a range of members in the RFCCs has been deemed positive, as they are not dominated by the Environment Agency as previous committees were. One issue with RFCCs is that the funding they receive is still determined by central government calculations, thus the RFCCs struggle to promote local level priorities in practice (Lorenzoni *et al.*, 2016).

#### *Liaison Panels*

Liaison panels for the implementation of the EU WFD were established at both national and RBD levels. The National Liaison Panel consisted of representatives from major sectors and national organisations. Their role was to contribute to the implementation of national measures, enable and encourage the action of others and to track general progress of RBMPs (Environment Agency, 2016b). The RBD liaison panels (one for each of the RBDs) included representatives from major sectors, organisations and catchment

partnerships. They were responsible for: contributing evidence to RBMPs, tracking measures, working with members to ensure a broad base for decision making and championing the Catchment Based Approach. However, the RBD liaison panels have since been disbanded. The reason for this was that focus was being given to catchment and local level delivery of the WFD. As such, they were no longer required. However, during the RBMP consultation process, some respondents indicated that this created a 'missed level' (Environment Agency, 2019d).

### *Catchment Partnerships*

Catchment Partnerships were established following DEFRA's Catchment Based Approach (CaBA) policy framework (see Section 4.2.1.4). Catchment Partnerships engage people and groups from across society (water companies and environmental charities etc.) with the aim of improving water environments (Catchment Based Approach, 2019). There are currently 103 Catchment Partnerships in England (catchmentbasedapproach.org). Many of the partnerships have also developed their own Catchment Management Plans (CMPs) that set out aims and objectives for the catchment. These include areas such as habitats, water management, tourism and recreation, and planning. Flooding, although not the single focus, is often included as a key element.

Although the Catchment Partnerships and CaBA are set out in the DEFRA policy framework, they are non-statutory. Therefore, they do not have a formal mandate to operate (Robins *et al.*, 2017). The Environment Agency is only required to give them 'due regard' in the development of RBMPs (Robins *et al.*, 2017). It has also been highlighted that the partnerships are often underrepresented in RBMP consultations (Environment Agency, 2019d). Despite this, it is evident that CMPs have been included in some RBMPs. For example, in the Humber RBD RBMP the associated catchment partnerships are listed along with a summary of their work, aims and objectives (Environment Agency, 2016a).

In addition, issues have been raised about funding availability for the Catchment Partnerships. Although they are currently supported by DEFRA, securing long term funding is not guaranteed, leaving them financially vulnerable (Robins *et al.*, 2017; Rouillard and Spray, 2017). There are further concerns regarding the actual levels of collaboration within the Partnerships. It has been noted that some organisations are fundamentally driven by their own priorities. Individual objectives may not necessarily align with the objectives of others, which hinders partnership working (Rouillard and Spray, 2017; Foster *et al.*, 2018).



## CASE STUDY

### CROSS-BORDER FLOOD MANAGEMENT IN THE SOLWAY-TWEED RIVER BASIN DISTRICT

The Solway-Tweed RBD is presented here as a case study as it provides an insightful example of a RBD that crosses the border between England and Scotland. Although the Solway-Tweed is not considered an international RBD, reporting procedures differ between England and Scotland. Therefore, special consideration for the basin had to be made for the implementation of the EU FD.

Both Scotland and England's flood management plans must comply with the FD. In England arrangements must also be in line with the FWMA, while in Scotland they must comply with the Flood Risk Management Act. Under the Scottish legislation, flood management plans should be produced at the local plan district level (European Commission, 2019b). This has meant that the Environment Agency produce a FRMP for the part of the RBD that falls within England and SEPA produce two Flood Risk Management Strategies for Scotland (one for the Tweed and one for the Solway), as opposed to a single FRMP for the RBD. It was decided that as most of the catchments fall within either Scotland or England, it was suitable to retain the English procedure in catchments within England and the same in Scotland, and implement a duty to coordinate assessments, maps and plans (2010b). This is also perhaps because there was no major

risk of cross-border flooding identified during risk assessments. A Cross-border Advisory Group was set up between EA and SEPA to coordinate management.

Despite the differing approaches to flood management planning in England and Scotland, a study by Bracken *et al.* (2016) found that there are good, well established professional networks between stakeholders. They found that six stakeholder groups met regularly, each with different environmental remits, but overlapping with flooding in some way. Of the people attending these group meetings, five people were common to all groups. It was noted that this may be inefficient, but actually these people take the role of intermediaries, which strengthens coordination. Strong personal connections and trust were identified as good aspects of these networks. Due to the strength of the networks, Bracken *et al.* (2016) noted that knowledge and information sharing across institutional borders was also good. However, some issues were identified. It was noted that actors find it difficult to understand where the jurisdiction of one organisation starts and ends regarding practical actions (e.g. in terms of main rivers versus tributaries).



Figure 4. View of the swollen River Tweed, Scottish Borders, following heavy rainfall, February 2020 (Iain Masterton/Alamy Stock Photo).

## CASE STUDY

### THE TWEED FORUM

The Tweed Forum provides an example of a Catchment Partnership and a well-established organisation that promotes partnership working between actors in the Tweed Catchment, while operating across the border between Scotland and England.

The Tweed Forum was first set up as an informal liaison group in 1991, before the establishment of the WFD and CaBA. Overtime the forum gained funding and became more formalised. The forum gained attention from the Government and became part of the area advisory group for the WFD basin management planning process in 2009 (Rouillard and Spray, 2017). As a recognised leader in catchment management planning, the Forum now provide ecology and project management consultancy services to others (Tweed Forum, 2019).

The Forum is a registered charity and operates via a Steering Group and a Board of Trustees. The Steering Group is composed of members from both English and Scottish organisations including the Environment Agency and the Scottish Environmental Protection Agency (SEPA), the National Park Authority, the Council, Scottish Forestry, and Scottish National Heritage (Tweed Forum, 2019).

The Forum developed the Tweed Catchment Management Plan (TCMP) in 2002. The plan is

updated iteratively over time, with the current plan covering the period 2015-2021. It was developed through consultation and public participation. The Plan sets out non-statutory management proposals arranged around seven strategic aims: 1. Water quality, 2. Water resources, 3. Habitats and species, 4. Riverworks, 5. Flood management, 6. Tourism and recreation and 7. CMP delivery and development. Although the TCMP goes beyond the remit of the WFD RBMPs (i.e. includes aspects such as tourism), efforts have been made to synchronise the TCMP with the RBMP for the Solway-Tweed RBD. As the catchment crosses the border between Scotland and England, it is impacted by different administrative and regulatory systems. The CMP clearly sets out all the regulations that the basin is impacted by from England, Scotland and the EU.

As the Tweed Forum would appear more well established and well regarded than other Catchment Partnerships, this has allowed it to better integrate top-down and bottom-up scales of governance. As a trusted organisation, they provide an intermediary between state and society, which has been suggested as a good way to bridge governance scales (Rouillard and Spray, 2017). As a trusted intermediary, the Forum may have greater power than typically found in other Catchment Partnerships.

### 4.2.3. Participation

There has been ever increasing emphasis on the importance of participation in water management decision making, and participation is now a legal requirement in some cases (Benson *et al.*, 2014; Mehring *et al.*, 2018).

Participation is a legal requirement of the WFD. EU Member States are required to hold three public comment procedures in the development of RBMPs (Benson *et al.*, 2014). In an assessment of compliance with WFD requirements on participation in England and Wales, it was found that in most cases the requirement was met and in some exceeded (Benson *et al.*, 2014). However, several authors suggest that more can be done to truly ensure effective participation in water management. It has been argued that although the Government's discourse and the CaBA are angled towards an inclusive participatory process, it is not fully achieved due to the persistence of technocratic ways of working and top-down governance (Mehring *et al.*, 2018; Rollason *et al.*, 2018). This has resulted in participation being constructed, rather than being truly 'done with' communities (Mehring *et al.*, 2018). It is also suggested that by adopting a broad-brush approach, the participation doesn't acknowledge that communities are varied and have different needs. Other authors have suggested that there is still scope to increase the involvement of community groups and include local people's knowledge more widely (Benson *et al.*, 2014; Bracken *et al.*, 2016).



#### 4.2.4. Civil Society

Prior to the 1980s/1990s the public were viewed as passive in the flood management process. Flood management was seen as the sole responsibility of the Government to 'keep the water out'. However, local actors and communities are now regarded as a critical part of effective flood management. There has been increasing emphasis on individuals taking greater responsibility for managing their own flood risk (Butler and Pidgeon, 2011). For example, this has included the Government encouraging the uptake of household level flood management measures (Bonfield, 2016).

Although there has been greater onus on local actors and individuals taking responsibility for protecting themselves from flooding, there are concerns over the agency of local people. It has been found that local people often perceive flood risk management to be the responsibility of local government and that they are unwilling to take on responsibility for flooding themselves. However, Butler and Pidgeon (2011) suggest that this may in fact be related to power and agency. Local actors have been given the responsibility, but they lack the power and agency to act.

#### Local Floods Groups

Local flood groups have also emerged across the UK (also known by 'action group', 'forum', 'committee'). These groups are composed of local volunteers and they partake in a variety of activities such as performing channel management, habitat restoration, dissemination of flood warnings, raising awareness and providing first response during flood events. Many of these groups have emerged bottom-up, spurred by a significant flood event (Forrest *et al.*, 2018). Alternatively, some of the groups were also encouraged as part of the Environment Agency's 'Flood Resilience Community Pathfinder' project, which launched in 2012 and encouraged local action through financial support (Mees *et al.*, 2016).



Figure 5. Volunteers act to reinforce a footpath along the banks of the river Parrett, Somerset, February 2014 (Steven May/Alamy Stock Photo)



Although flood groups have shown their worth assisting during flood events (Simm, 2012), some issues surrounding these groups have been raised. Firstly, there are concerns over the sustainability of these groups overtime as volunteers suffer from volunteer fatigue, or apathy. As they are voluntary, issues have been raised regarding time pressures on the volunteers, balancing their voluntary work with other priorities. There are also issues surrounding the representativeness of the groups as it has been noted that the aims of the flood groups may not necessarily reflect the priorities of the wider community (Forrest *et al.*, 2019). For the most part, these groups are poorly funded and obtain their funding in an opportunistic manner (Cook *et al.*, 2012).

## 4.3. Operational Pillar

### 4.3.1. Technical cooperation

#### *Data and information sharing*

In DEFRA's evaluation of Local Flood Risk Management, it is noted that the FWMA 2010 has increased data sharing between LLFAs and other Risk Management Associations. It has also increased the amount of data and information available on local level flooding, by requiring more local level assessments and cooperation between actors. However, the issue of commercial sensitivity still hinders the sharing of data held by water companies (DEFRA, 2017).

#### *Flood Forecasting Centre*

The Flood Forecasting Centre was established in 2009 after the 2007 severe flood event. The Centre is a joint initiative between the Met Office and the Environment Agency. It provides a combined hydrometeorology service for the forecasting of all natural flood events (river, surface, coastal and groundwater). The centre is manned by staff from both organisations so that they are able to pool their resources and knowledge to provide a better forecasting service (Met Office and Environment Agency, 2019). The Centre makes it easier for the two institutions to coordinate their flood forecasting approaches and overcome institutional barriers.

#### *Climate adaptation plans*

The Climate Change Act came into force in 2008. The Act sets legally binding targets to reduce carbon emissions by 2050 and also sets out actions to adapt to climate change. Under the act, a Climate Change Risk Assessment (CCRA) and National Adaptation Programme (NAP) are produced every five years. Flooding, as one of the greatest climate change risks in the UK features prominently in both documents (Clegg *et al.*, 2019). The NAP has been noted as being consistent with water related policies such as the National Flood and Coastal Erosion Risk Management Strategy, and the FWMA (Committee on Climate Change, 2017a).

An important aspect of the Climate Change Act 2008 is the Adaptation Reporting Power (ARP). The ARP requires key industry organisations, including water companies to report to the Government on how they are adapting to climate change (DEFRA and the Environment Agency, 2011). An analysis of the ARP revealed that 78% of companies reviewed showed evidence of change in the management of climate risks, suggesting it has been a good stimulus for adaptation (Jude *et al.*, 2017). The climate change progress report highlights that the water sector have been good at planning to deal with a range of climate change scenarios, including scenarios beyond 2oC of warming (Committee on Climate Change, 2019).

The new National Strategy on Flood and Coastal Erosion Risk Management being prepared for 2020 also has a stronger focus on climate change, setting out a strategy to reduce flood risk up to the year 2100 (Committee on Climate Change, 2019; Environment Agency, 2019a).

## 5. Summary

Figure 6 summarises the multi-level governance arrangements in England. It includes additional aspects applying to Greater Manchester in order to demonstrate arrangements at the sub-national level, and the linkages with wider resilience measures (see Annex for complete case study). The diagram highlights the different coordination mechanisms and actors in play at the different governance levels.



Figure 6. Multi-level governance arrangements (laws, strategies, plans, and coordination mechanisms) relevant to river flood management in England and Greater Manchester (at the sub-national level). Relevant authorities and their roles are summarised in the left column (for a full summary of key actors, please refer to Section 3.4).

### Summary of the role of each aspect presented in Figure 6.

**Civil Contingencies Act 2004** is the legislation for civil protection and emergency management. It required the establishment of **Local Resilience Forums (LRFs)**. Their boundaries are the policing areas for England, and their purpose is to enable a multi-agency response to emergencies.

**Greater Manchester Resilience Forum** is the LRF for Greater Manchester. The GMRF developed the **Greater Manchester Resilience Strategy** through international initiatives. The strategy sets out five resilience priorities for the area.

**Flood and Water Management Act 2010 (FWMA)** is the legislation for the management of water and flooding. It requires the Environment Agency to prepare the **National Flood and Coastal Erosion Risk Management Strategy**. The strategy sets out the long term vision, and provides guidance for other governance levels. **Local Flood Risk Management Plans** are prepared at the local level, and should be aligned with the national strategy.

**Regional Flood and Coastal Committees** are a sub-national coordination mechanism established under the FWMA. Their role is to help align national and local flood management priorities and decision making. They advise on and approve programmes of work.

**The Flood Risk Regulations 2009** transposed the EU Floods Directive into national law. They set out the duties of the Environment Agency and local authorities to assess and map flood risk, and to develop **Flood Risk Management Plans (FRMPs)**. FRMPs are produced for each River Basin District and they include identification of flood risk areas, and measures to manage the identified flood risk.

**Catchment Based Approach** is DEFRA's policy framework setting out the catchment based approach to river management. Its purpose is to support catchment scale collaborative action to improve the local water environment. It encouraged the establishment of **Catchment Partnerships** which include a range of local stakeholders and deal with a range of catchment issues. Some Catchment Partnerships may have also developed their own **Catchment Plans**. These aspects are supported by government, but are not legislative requirements.

Other coordination mechanisms for flood management in Greater Manchester include the **GM Flood and Water Management Board** that includes representatives from the local authorities, as well as other RMAs and holds a strategic decision-making role. The **GM Flood Risk Officers Group** brings together the local flood risk officers from the local authorities, and is responsible for managing the delivery of flood risk management.



## 6. Discussion

The UK has a strong legislative framework that guides river and flood management. The positives of the existing legislation are that it helps to set out the key actors and their roles and responsibilities, for example through the FWMA. It is widely understood that clear roles and responsibilities are an important aspect of successful river and flood management (Jha *et al.*, 2012). This legislation also provides a legal requirement for the listed key institutions to act on flooding, creating impetus and drive. Furthermore, the existing legislation also contributes towards catchment and river basin scale planning and management. This is primarily achieved through the European Water Framework and Floods Directives, and DEFRA's Catchment Based Approach policy. Taking catchment and basin approaches to flooding is positive in terms of achieving successful transboundary management and for addressing flood risk holistically (Savenije and van der Zaag, 2000). Having these European and national policies and strategies helps to guide and coordinate an overall approach to be applied throughout all areas. In this way, the overarching strategies contribute to horizontal alignment of actions, as although it may be smaller governance units acting on flooding, they are all working to a larger strategy. One criticism of the UK legislation is that it is constantly evolving. This makes it difficult for actors to keep up with developments and sustain their practice (Bracken *et al.*, 2016).

Despite this, it can be seen that having overarching strategies in place does not necessarily override the complexities of river and flood management coordination in practice. River and flood management planning remain distributed across multiple layers of governance. For each RBDs there will be a RBMP, a FRMP, and within those areas local flood management plans produced by LLFAs, plus catchment management plans. Flooding may only be part of the broader remit of these plans, but they all need to be coordinated, which can prove difficult in practice (Bracken *et al.*, 2016). It would also appear to be the role of the smaller units, the LLFAs and the catchment partnerships, to align themselves with the wider plans. The capacity of these smaller units to do this and implement fully could be drawn into question as these actors are often noted to be resource and staff poor (DEFRA, 2017; Robins *et al.*, 2017). It has been suggested by (Savenije and van der Zaag, 2000) that too much delegation to smaller administrative units could be counterproductive and that the basin level is most appropriate for decision making.

There are numerous coordinating bodies designed to enable all the different actors in water management to come together (e.g. RFCCs, catchment partnerships etc.). These organised groups, committees and forums allow stakeholders to come together, discuss and make decisions, and are often seen as beneficial in river basin management to avoid contradicting actions in the basin (Donzier, 2011). On the other hand, it can be seen that these coordinating bodies operate at different scales, for example, regional, basin district catchment. Thus, it is difficult to tell how well these bodies coordinate their actions across these scales and there is the potential for duplicated efforts. Benson and Lorenzoni (2017) note that despite prolific coordinating groups, water management is not as coordinated in practice as the number of coordination mechanisms suggests.

It is also clear from this review that the designated risk management authorities are not the only actors with responsibilities for river and flood management. There has been ever increasing onus on householders, private businesses, community groups and individuals to take action against flooding. In some cases, these actors have been found to be very useful. The Tweed Forum example shows the importance of non-statutory groups in the management of river basins. This group has been successful because of its strong personal networks between actors and good levels of trust, highlighting the importance of these aspects also. However, it is possible that the Tweed Forum is more of an exception than the rule. In broader terms, the links between more local actors (e.g. catchment-based groups) and communities with the wider RMAs could be drawn into question. Concerns have been raised over the quality and effectiveness of current stakeholder and community engagement, and consultation mechanisms.

It is important to find a balance between localisation of actions, so that local needs can be addressed, while still being able to coordinate actions. This is related to the importance of not over-complicating arrangements, while still having enough capability to tackle what is a complex flood problem.

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# Annex: Governance arrangements for flooding and resilience in Greater Manchester, UK

## A. Introduction

The governance arrangements for the management of river flooding in the UK are complex. Therefore, to demonstrate how the arrangements apply in a particular location, this annex provides a case study of flood management arrangements in Greater Manchester. Greater Manchester was chosen for this case study as it is a large urban agglomeration consisting of 10 local authorities, thus there are local borders to be crossed in order to achieve coordinated management. This case study shows how the different components of flood and river governance in the UK, presented in the main report, link together with resilience in an urban context.

## B. Background

Greater Manchester is the United Kingdom's second largest urban agglomeration after the capital city London, covering an area of approximately 1,280 square kilometres, and with a population of 2.8 million (Greater Manchester Resilience Strategy). Greater Manchester is also the largest economic hub outside of the capital (Greater Manchester Resilience Strategy).

Greater Manchester is a 'combined authority'. This is where local authorities join together in partnership to work on common local issues. There is a total of ten local governments in Greater Manchester (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan). Combined authorities hold certain powers, the core responsibilities being economic development and transport, but there may be other policy areas that they are responsible for (Sandford 2017; Grigg 2021).

Greater Manchester faces a range of hazards including flooding, severe weather, infectious disease, environmental pollution and industrial accidents, as well as emergencies associated with transport, loss of essential services and mass gatherings (Greater Manchester Resilience Forum).

Flooding poses one of the highest disaster risks in the area (Greater Manchester Resilience Forum). A large part of Greater Manchester was identified as a flood risk area, under national flood risk assessment and planning procedures. The risk area covers nine of the ten local authorities, in which there is over 111,900 residents at risk (Environment Agency 2016a). The primary types of flooding faced are surface water and fluvial. Surface water flooding is the most frequent type of flood event in Greater Manchester, with 162,979 properties at risk (Greater Manchester Combined Authority 2021b). There are an estimated 63,478 properties at risk from river floods (Greater Manchester Combined Authority 2021b).

Floods have resulted in a range of impacts. For example, flooding severely affected northern and western parts of Britain in December 2015 when the country experienced storms and very high rainfall. In Greater Manchester 2,250 properties and 500 business premises were inundated (Greater Manchester Resilience Strategy). Road networks were affected, with a sinkhole occurring on the M62 in Greater Manchester, a major highway connecting the east and west of the country (Marsh et al. 2016). Significant damages also affected the canal network, in particular the Rochdale Canal (Marsh et al. 2016).

## C. Resilience in Greater Manchester

Like Jakarta, Greater Manchester is part of the Resilient Cities Network (previously 100 Resilient Cities). This network of cities from across the globe made a commitment towards building urban resilience (Resilient Cities Network 2021). Manchester is also one of the 564 cities involved in Making Cities Resilient 2030 (previously Making Cities Resilient Campaign 2010-2020). The programme provides a resilience roadmap

for cities to improve resilience over time, and is focused on connecting, building partnerships, city-to-city networks, and sharing experiences and knowledge (UNDRR 2021). Membership in these networks, as well as other governance structures in the United Kingdom, have allowed Greater Manchester to develop a collaborative, multi-stakeholder approach to disaster resilience. For example, the networks have enabled Greater Manchester to learn from others, and the use of tools provided by the networks, such as the Local Government Self-Assessment Tool, have brought stakeholders together on the topic of resilience and to build partnerships (Oldham and Astbury 2018). Tools from the Resilient Cities Network have also led to the development of the Greater Manchester Resilience Strategy (Greater Manchester Resilience Strategy).

The Greater Manchester Resilience Strategy 2020-2030, sets out the vision for improving resilience in Manchester. The strategy defines resilience as “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience” (Greater Manchester Resilience Strategy) (p14). The Strategy was developed through workshops, consultations and exchanging knowledge with other cities as part of the Resilient Cities Network and Making Cities Resilient 2030 (Greater Manchester Resilience Strategy). Flooding and severe weather are set out in the Strategy as key risks faced.

The development of the Resilience Strategy was led by the Greater Manchester Resilience Forum (GMRF). Local Resilience Forums (LRFs) were set up nationally, as a statutory requirement, following the introduction of the Civil Contingencies Act in 2004. The purpose of the forums was to enable cooperation for multi-agency emergency preparedness and response. They include, as a statutory duty, emergency responders such as the emergency services, local authorities, the National Health Service, and the Environment Agency. There are 38 LRFs in England based on the boundaries of local policing areas (Cabinet Office 2021). The Civil Contingencies Act states that the emergency responders involved are required to cooperate and must meet a minimum of bi-annually (Cabinet Office 2013). The GMRF is one LRF that has developed from its initial core team of emergency responders to include other public, private, academic and voluntary organisations, so that there are now over 80 agencies involved (Greater Manchester Resilience Strategy). The GMRF is tasked with coordinating action and assessing progress of the strategy (Greater Manchester Resilience Strategy).

The Greater Manchester Resilience Unit (GMRU) and the Local Authority Civil Contingencies and Resilience Unit (CCRU) are units of the Greater Manchester Combined Authority (GMCA). The CCRU leads civil contingency services across the ten local authorities. Its purpose is to ensure a multi-agency response to emergencies (Manchester City Council 2021). The GMRU has secretarial responsibility for the GMRF. Both led by the same Greater Manchester Chief Resilience Officer (Greater Manchester Combined Authority 2020). Chief Resilience Officers were appointed as part of an initiative by the Resilient Cities Network. Their role is to support communication between government departments and stakeholders, support the development of a resilience strategy, and to ensure projects are combined with a resilience view and that they are aligned (Berkowitz 2014).

#### **D. Flood governance in Greater Manchester**

In addition to the resilience arrangements, which are multi-hazard, there are additional governance arrangements in place for the management of flooding.

On a broad scale, Greater Manchester lies within the North West River Basin District (NW RBD). RBDs are large river basin areas (seven in England), that may contain multiple catchments, comparable to Indonesia’s Wilayah Sungai. RBDs were initially established as part of arrangements set out by the European Union’s Water Framework Directive. The directive was transposed into law through the Flood Risk Regulations 2009, and since the United Kingdom left the European Union, RBD governance structures remain. For each RBD, a Flood Risk Management Plan (FRMP) is produced and updated every six years. A



FRMP identifies areas of flood risk and how authorities will manage that risk (Environment Agency 2016b). Within the NW RBD there are 15 management catchments, four of which cross Greater Manchester (the Irwell, the Upper and Lower Mersey, and the Douglas) (DEFRA 2021).

For coordination and decision-making purposes in the north-west region, there is the North West Regional Flood and Coastal Committee (NW RFCC). This is one of 12 RFCCs in England that were established as a statutory requirement under the Flood and Water Management Act 2010 (see Section 4.2.2.1 of the main report). The committee is made up of flood risk management authorities, such as the Environment Agency, water and sewerage companies (in Greater Manchester this is United Utilities) and lead local flood authorities (LLFAs). Their role is to help align national and local flood management priorities, and they advise on and approve programmes of work in the region.

In many of the UK's smaller catchments there are Catchment Partnerships. Such partnerships were set up as part of the Government's Catchment-based Approach (DEFRA 2013) (see Section 4.2.2.1 of the main report). The purpose of the partnerships is to enable collaborative working locally. This was with the acknowledgement that RBDs were too large to enable effective participation (Environment Agency 2018). They tackle a range of catchment issues such as pollution and biodiversity as well as flooding. There are catchment partnerships in the Irwell, Upper and Lower Mersey and Douglas catchments that cross Greater Manchester (Catchment Based Approach 2021).

At combined authority level there is the Greater Manchester Flood and Water Management Board (GM FWMB). The Board consists of representatives from the ten local authorities, the Environment Agency and United Utilities, among other risk management authorities and organisations. The board has a strategic role in decision making for flood and water management in Greater Manchester (Fletcher 2019; The Flood Hub 2021; Walker and Johnston). There are several members of the FWMB that are also members of the NW RFCC, which provides interfacing with the wider catchment (The Flood Hub 2021).

In order to build greater partnership, GMCA, the Environment Agency and United Utilities recently signed a Memorandum of Understanding (September 2021). The purpose of the MoU is to allow more collective working between these key water management organisations, with the overall aim to achieve more sustainable water management, including reduction of flood risk (Greater Manchester Combined Authority 2021a; Manchester City Council 2021).

On a local scale, each individual local authority also has a role to play as a Lead Local Flood Authority (LLFA). Their focus is on local flood risk, such as flooding from surface water and ordinary water courses. Each has a local flood risk management strategy that outlines the approaches that will be taken. This should be aligned with the national flood risk management strategy (Manchester City Council 2014). To coordinate the delivery of flood risk management, there is the Greater Manchester Flood Risk Officers Group. This is a group composed of the lead officers from the local authorities, plus other partners. The group is responsible for managing the delivery of flood risk management (The Flood Hub 2021).

## E. Challenges

There are several issues that still pose challenges to effective flood governance in Greater Manchester. The first challenge is the limited capacity of some local authorities. In particular, local authorities are noted to have insufficient revenue to fully deliver their flood management duties and to manage partnerships (Greater Manchester Combined Authority 2021b). Funding is not fixed for flood management at local authority level, therefore other priorities compete for available funding (Greater Manchester Combined Authority no date). The limited capacity of local authorities is exemplified in the case of surface water flooding. The local authorities, as LLFAs, have duties to manage local flood risk, including surface water flooding. Surface water flooding is a significant issue in the city, and it is also one of the most complex to understand hydrologically. However, local authorities do not always have sufficient in-house capacity to deal with this issue. For example, they often lack the capacity to assess the impacts of surface water flooding

after a flood, which means there is not a consistent or complete data set on surface water flooding to work from (Greater Manchester Combined Authority 2021b).

A further challenge is communicating with areas of catchments that are located outside of Greater Manchester during a flood event. For example, the Greater Manchester Combined Authority (2021b) identified that during recent flood events it was not possible to obtain a complete picture of potential flood impacts in Greater Manchester resulting from upper catchments located in other counties. They suggest that it would be beneficial to build better relationships with neighbouring LRFs to tackle this problem in the future.

Another identified issue is the administrative assignment of 'types' of water courses. The Manchester Ship Canal is a large canal that connects Manchester to the Irish Sea. Two of the main rivers (Irwell and Mersey) in Greater Manchester flow into the Canal, therefore the canal is of importance hydrologically for flooding. However, the Ship Canal is assigned as an ordinary water course, which means it is managed by the local authorities. The GMCA, in their evidence to the Environment Food and Rural Affairs Committee's review of flood management, suggest that it would be more appropriate to consider the Ship Canal as a main water course to account for its significance in the area (Greater Manchester Combined Authority no date).

## F. Summary and Discussion

This study has presented the case of Greater Manchester, and the governance approaches taken to resilience and flooding in the area.

There are several aspects identified that have supported Greater Manchester in achieving coordinated governance for flooding and wider resilience. Firstly, Greater Manchester has been able to make use of its membership in the Resilient Cities Network and Making Cities Resilient international initiatives. The initiatives have provided tools that Greater Manchester have been able to make use of. From this, efforts towards wider resilience have been pushed forward, for example, through the appointment of a Chief Resilience Officer, and the development of the Greater Manchester Resilience Strategy. As noted by Oldham and Astbury (2018), the GMRF, has been able to develop beyond its initial role in emergency management to take a broader resilience focus. The GMRF supports working across both organisational and administrative borders, bringing different actors together. The Chief Resilience Officer, as a member of the Forum and reporting to GMCA, provides an important point of contact and leadership role.

There are additional governance arrangements in place that address flooding specifically. A prominent feature is that there are multiple coordination mechanisms in place across the vertical levels of governance. There are key organisations and individuals that are members of more than one coordination mechanism, which supports linkages between the vertical levels of governance. For example, the government authorities, Environment Agency and United Utilities are present in different platforms at various levels. Similarly, there are plans produced at multiple levels, for example for RBDs, catchments, and each local authority and these plans should be aligned with the national strategies and plans.

For horizontal coordination, the GMCA supports the local authorities and coordination between them, as well as supporting sectoral coordination by bringing different actors together through the GMRF and other coordination platforms. Nevertheless, it has been noted that greater coordination with neighbouring LRFs and counties, and wider catchment areas outside of Greater Manchester, is an area where coordination could be improved.

Another feature of the UK and Greater Manchester governance system is that legislation sets out certain requirements for coordination. For example, LRFs are required by law, and the relevant authorities are required to coordinate. The RFCCs are also required by law, and risk management authorities are required to cooperate on flood management. This ensures a certain degree of coordination.

One challenge within the flood governance system would appear to be the duties that local authorities are required to conduct, and the technical capacity and financial resources that they have available. This means that local flood management may not be fully realised effectively.

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