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European Overview - Flood Risk Management Plans

Accompanying the document

REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC)
Second River Basin Management Plans
First Flood Risk Management Plans

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Acronyms

APSFR	Area of Potential Significant Flood Risk
CA	Competent Authority
CBA	Cost-benefit analysis
CIS	Common Implementation Strategy of the Water Framework Directive and the Floods Directive
CIS-WGF	CIS Working Group on Floods
EEA	European Environment Agency
EIA	Environmental Impact Assessment
ESIF	European Structural and Investment Funds
EU	European Union
EUSF	European Union Solidarity Fund
FD	Floods Directive (Directive 2007/60/EC)
FHRM	Flood Hazard and Risk Map
FRMP	Flood Risk Management Plan
iFRMP	international FRMP
iRBD	international River Basin District
iUoM	international Unit of Management
NWRM	Natural Water Retention Measures
PFRA	Preliminary Flood Risk Assessment
RB	River Basin
RBD	River Basin District
RBMP	River Basin Management Plan
SEA	Strategic Environmental Assessment
UCPM	Union Civil Protection Mechanism
UoM	Unit of Management
WFD	Water Framework Directive (Directive 2000/60/EC)
WISE	Water Information System for Europe

Executive Summary

Partly in response to the large floods along the Danube and Elbe rivers in the summer of 2002 and partly in response to mounting evidence that socioeconomic development[1] and climate change increase the chances that floods in Europe could become more catastrophic and frequent, in November 2007 the Floods Directive (FD) entered into force. The purpose of the Directive is to establish a framework for the assessment and management of flood risks, aiming at reducing the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods.

The Directive takes a three step cyclical approach to flood risk management by requiring Member States to (1) undertake, by December 2011, preliminary flood risk assessments (PFRA) leading to the identification of areas that are at significant risk of flooding, known as areas of potential significant flood risk (APSFR); (2) by December 2013, prepare flood hazard and risk maps (FHRM) showing how far floods might extend, the depth or level of water and the impacts there might be on human health, the economy, environment and cultural heritage and, finally, (3) prepare Flood Risk Management Plans (FRMP)[2]. These Plans were to be published by December 2015 and reported by March 2016 to the European Commission. Some FRMPs however were reported with delay and for two Member States the length of the delay did not allow for the inclusion of any of their FRMPs in the Commission's assessment, consequently these are not discussed in the present Overview[3].

The Commission's assessment[4] draws on two main sources: (1) depending on the number of FRMPs established in each MS either on all FRMPs, or on a representative sample and (2) Member State reporting to the European Commission (covering all FRMPs)[5]. The assessment focuses on and summarises the progress made in the process of managing flood risk in 26 Member States. It also identifies areas for further development. It can be concluded that Member States made good efforts in the preparation of their first ever FRMPs under the FD, with solid results. Various challenges in connection to flood risk management have also been identified, which should be addressed, depending on their nature, during the 2nd cycle of

[1] E.g. through the encroachment of assets into floodplains.
[2] Over 270 FRMPs were eventually prepared across the 28 Member States.
[3] This is the case for Greece's and the Republic of Ireland's FRMPs, which were not included in the assessment. The Republic of Ireland reported in May 2018 and Greece reported in October/November 2018. A FRMP for Spain's Canary Islands was not reported as of yet.
[4] The present report reflects the situation as reported by each Member State to the European Commission in 2016 or 2017 and with reference to FRMPs prepared earlier. The situation in the MSs may have altered since then.
[5] The format for reporting was jointly elaborated by the Member States and the European Commission as part of a collaborative process called the "Common Implementation Strategy".

implementation of the Directive (2016 to 2021) and in subsequent cycles[6]. Indeed, whereas establishing and publishing the Plans is an obligation under the Directive, the envisaged function of the Plans should primarily be that of a management tool, employed for the reduction of potential adverse consequences from significant flooding. In this sense, the recommendations put forward in the EU overview and the individual Member State assessments aim at strengthening flood risk management in the EU on the basis of good practice as it emerges from the implementation of the FD by the Member States themselves.

Governance and public participation

In almost all Member States the FRMPs have been adopted at various administrative levels and through various acts[7]. In almost all Member States the FRMPs underwent a Strategic Environmental Assessment (SEA), either across the board or in at least some Units of Management (UoMs)[8]. In 20 of the Member States assessed, objectives for flood risk management were set at the national level or by adapting national level objectives to regional/local circumstances. National and municipal authorities were reported by 19 and 18 Member States respectively as responsible for the implementation of measures to achieve the set objectives. For the majority of measures more than one authority was reported.

The Directive requires Member States to encourage the active involvement of interested parties in the production, review and updating of the FRMPs. All Member States used a variety of information channels for outreach to the public and stakeholders (most made draft FRMPs available via the internet, which was also the primary medium for the submission of written comments) and a broad range of stakeholders were involved in the preparation of the FRMPs, e.g. civil protection authorities were involved in 19 Member States in at least some of the UoMs assessed. Less information was found in the FRMPs, or Member State reporting, on how the effects of the consultation were taken into account; for ten Member States, information was not found for some or all UoMs assessed.

[6] There is no “sunset clause” in the Floods Directive.

[7] The establishment of the FRMP for the Canary Islands in Spain is pending. The Lithuanian FRMP was not adopted, instead the FRMP is a supporting document for the Water Sector Development Programme 2017-2023 and its Action Plan.

[8] UoMs in the sheer majority of Member States coincide with the Water Framework Directive’s River Basin Districts. Member States have designated a total of 209 UoMs for the implementation of the FD.

Integration of the Preliminary Flood Risk Assessment and the Flood Hazard and Risk Maps

To ensure FRMPs are as integrated as possible and to provide for continuity between the three steps of the flood risk management cycle, the FD foresees that the FRMPs will include the conclusions of the PFRA and FHRM steps. Indeed, all except two Member States[9] reported the conclusions of their PFRAs[10] as well as the conclusions of the FHRMs in their FRMPs. The FRMPs assessed, along with Member State reporting, provide some information in nearly all Member States[11] on how the FHRMs were used to prepare the Plans themselves. Detail on the choice of flooding sources included in the FRMPs were found in the FRMPs of few Member States[12], still, almost all Member States, save for four[13], provide at least some information about the sources of flooding considered in the FRMPs assessed.

Setting of objectives

According to the FD, Member States shall establish appropriate objectives for the management of flood risks. All MS set such objectives. In terms of number of objectives, some Member States set a few broad objectives, other Member States presented a larger number, often of more specific sub-objectives. An almost equal number of Member States (ten and nine respectively) explicitly set objectives for the reduction of the potential adverse consequences from flooding and for reducing the likelihood of flooding; the later objective however was on the whole represented less prominently in the FRMPs assessed than the former.

Whereas the objectives in 12 Member States include at least some specific and measurable elements, the objectives in 14 Member States are neither specific nor measurable in terms of what, where and by when should be achieved. Concretely defining measures and clearly linking these measures to objectives could serve as an alternative to defining specific objectives, provided the measures are selected and designed in such way that their completion would result in achieving the objectives set. 11 of the Member States included in this assessment made a link between their objectives and the measures to achieve them; five did so only for some UoMs and 11 did not establish a clear link. Three Member States – and only for

[9] Belgium and France for the PFRA and Malta and France for the FHRM.
[10] There are currently more than 7.000 APSFRs in the EU. Roughly 40% of these are located in Croatia. In Hungary two vast areas are designated as its APSFRs.
[11] For Croatia and Malta no information was found at the time of the assessment.
[12] Including Austria, Cyprus, Denmark, Luxembourg and Sweden.
[13] For Belgium, Malta and Romania, the FRMPs assessed do not provide information concerning the sources of floods considered, while for Bulgaria the information is provided in some but not all FRMPs assessed.

some of the UoMs – explained how the implementation of measures will lead to the achievement of objectives[14].

Not all objectives being elaborated to a degree that would allow them to be monitored against progress and not all measures being clearly linked to the objectives they seek to achieve, these taken together may pose a challenge for the 2nd cycle when the MS will provide an assessment of the progress made towards the achievement of the objectives.

Measures for the achievement of objectives

FRMPs should include measures for achieving the objectives established by the Member States. All Member States provided a list of measures and summary information for each measure. The number of measures varies significantly across the Member States, ranging from few individual measures to thousands of measure groups. More than half of the Member States assessed provided elements in terms of what the measures are trying to achieve, where (and which area their effects will cover), how and by when. Around 40% of the measures are protection measures, 25% prevention measures, another 25% preparedness and the remaining 10% recovery measures. In some cases, Member States have indicated that further specificity concerning measures will be developed in separate plans.

All MS reported on the prioritisation of their measures, either on a five point scale[15], or as a timetable. To illustrate, around 10% of the measures reported were of critical priority, 60% were of very high or high priority, 20% of moderate priority and the remainder of low priority. Many FRMPs provide at least some information on how progress achieved in the implementation of measures will be monitored, though in many cases with little detail[16]. All Member States assessed indicated the progress achieved at the time of reporting in the implementation of measures. These being the 1st FRMPs, about half of the measures were reported as not started. Roughly two-thirds of the Member States provided information on the methods used for prioritising the measures.

Specifically in terms of non-structural initiatives (i.e. measures not involving civil engineering structures), the FRMPs of all Member States assessed make reference to spatial planning and/or land use, however, the extent of information varies. All 26 Member States assessed include nature based solutions as measures (including Natural Water Retention Measures-NWRM to mitigate flooding) in some or all of their FRMPs, either as projects or as

[14] Bulgaria, Poland and Sweden.
[15] Low, moderate, high, very high or critical priority.
[16] An assessment of the progress made towards the achievement of the objectives is a requirement for the 2nd FRMPs.

preparatory studies. Despite insurance not being mentioned in the FD, in more than half of the 26 Member States assessed at least some FRMPs related measures are foreseen, including awareness raising on insurance schemes.

Financing of measures

Estimates of the costs of flood measures were made available by about half of the Member States assessed, though in many cases this information does not cover all FRMPs or all measures. For the Member States that provided (mostly partial) cost estimates, the numbers vary: EUR 19 million in one case, EUR 2.8 billion in another. A number of FRMPs indicated that cost estimates would be reviewed during the implementation of the measures.

In 23 of the 26 Member States, most of the FRMPs assessed identified funding sources, however, in many cases with only a generic reference, that is, identifying possible funding mechanisms rather than making budgetary commitments. For instance, in 14 Member States, the Cohesion Funds were indicated as a source.

Use of cost and benefit analysis

A majority of the Member States assessed, 19 of 26, have made some analysis of costs and benefits of their measures. Amongst the 19, fewer, 11 Member States out of the 26, used a cost-benefit analysis (CBA) in all UoMs assessed. A further five of the 19 Member States indicated the use of CBA for some of their FRMPs. When looking at the 19 Member States where a CBA (or an alternative method) was indicated, more than one third – seven Member States[17] – reported that it was used for all measures in at least some UoMs. Five Member States indicated that a CBA was only used for structural measures[18]. Further, across the 19 Member States that applied some form of analysis of costs and benefits, twelve provided clear information of the methodology used. In nearly all these cases, a national approach was developed.

Links between FRMPs and River Basin Management Plans (RBMPs)

The development of RBMPs under the Water Framework Directive (WFD) and of FRMPs under the FD are elements of integrated river basin management. The two processes should therefore use the potential for synergies and mutual benefits. Although in nearly all Member

[17] Austria, Finland, Lithuania, Luxembourg, Poland, Romania and Slovakia.
[18] Bulgaria, Cyprus, Estonia, Hungary and Slovenia.

States assessed, separate FRMPs and RBMPs were prepared[19] (very often however by the same authority), 21 out of 26 Member States make explicit reference to coordination with the environmental objectives set out in Article 4 of the WFD in all or at least some UoMs. On the other hand, in over half of Member States, the objectives of the FD were considered in the preparation of the RBMPs, according to the reporting of RBMPs under the WFD.

Consideration of the likely impacts of climate change

From the FRMPs assessed, 24 of the 26 Member States considered at least some aspects of climate change and ten provided strong evidence that climate change impacts were considered. 14 Member States discussed future climate change scenarios in their FRMPs. Among those which discussed climate scenarios, the time frame presented in the Plans varies. Scenarios for 2050 are seen in about half, and scenarios for 2100 are also cited in about half.

Less than half of the FRMPs assessed refer to the national adaptation strategies prepared by Member States under the EU Climate Change Adaptation Strategy. In about a third of Member States all FRMPs assessed referred to such national strategies[20]; in a further few Member States some, but not all FRMPs assessed, had such references[21].

International coordination within the framework of the Floods Directive

Article 8 of the FD calls for Member States to coordinate their flood risk management practices in transboundary River Basins (RBs), including with third countries, and, in solidarity, not to undertake measures that would increase the flood risk in neighbouring countries. Two large groups of RBs can be distinguished: (1) transboundary RBs where a formal international agreement and an international coordinating body exists[22], as well as an international FRMP (iFRMP) was produced; (2) transboundary RBs where at least one of these three elements is absent. It is clear that the presence of a coordinating body, ideally a river commission, provides a strong impetus to the process. Generally, for RBs benefiting from a river commission, permanent working groups have been set up, and in all cases the development of the iFRMP was done in consultation with the iRBMP. Common objectives for flood risk management were established at the international level and for almost all a limited number of joint coordinated measures were defined. Public consultation was performed and a joint communication strategy was put in place in some of the basins that have a river

[19] Four Member States presented some form of combined FRMP/RBMP, three of these for the whole country (Croatia, Lithuania and Malta) and one partly (Belgium for the Brussels and Flanders regions).
[20] Austria, Cyprus, Estonia, Croatia, Hungary, Malta, Poland and Slovakia.
[21] Belgium, Bulgaria, Italy, Portugal, Spain and the United Kingdom.
[22] Such as the International Commission for the Protection of the Danube River (ICPDR) or the International Commission for the Protection of the Rhine (ICPR).

commission. Likewise, consideration of climate change is more developed there. The appreciation of the upstream and downstream effects, at the basin scale, of measures that are geographically not in the vicinity of national borders is an area with room for development.

1. Introduction

While many Member States already had national policies to address floods, most of Europe's River Basins (RBs) are shared by more than one country. Before the Floods Directive (FD)[23] was put in place, European Union (EU) policy to tackle flooding mainly focused on emergency response and instruments that partially addressed or contributed to the management of flood risk. The Union Civil Protection Mechanism (UCPM)[24] was developed in 2001 to facilitate the mobilization of support and assistance in the event of major emergencies, including floods. In addition, following the 2002 floods in central Europe, the European Union Solidarity Fund (EUSF)[25] was created as a specific instrument for granting rapid financial assistance directly after a major disaster to help the affected areas to return to living conditions that are as normal as possible.

Whereas these instruments can provide relief to affected populations, they are not flood-specific and do not address the root causes of floods, nor are focused on preventing damage from floods. Consequently, there was scope for targeted and concerted action at European level that would result in better management of flood risks; this realisation led to the introduction of the FD in 2007.

This document provides an overview of the first Flood Risk Management Plans (FRMPs) produced by EU Member States and reported to the European Commission under the FD. 26 Member States are discussed[26]. The Plans operationally cover the period 2016-2021. Whereas establishing the Plans is a legal obligation under the Directive, the envisaged function of the Plans should primarily be that of a management tool, employed for the reduction of potential adverse consequences from significant flooding. In this sense, the recommendations put forward in the EU overview and the individual Member State assessments aim at strengthening flood risk management in the EU on the basis of good practice as it emerges from the implementation of the FD by the Member States themselves.

[23] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, OJ L 288, 6.11.2007, p. 27–34, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060

[24] http://ec.europa.eu/echo/what/civil-protection/mechanism_en

[25] https://ec.europa.eu/regional_policy/en/funding/solidarity-fund/

[26] The Republic of Ireland and Greece are not included due to very late reporting.

The European Commission's individual Member State assessment reports (published in parallel) provide relevant background detail to the present EU overview[27]. Together they should support and improve the implementation of the FD. The present document and its annexes should therefore facilitate the identification of good practice, as well as the reflection on areas of flood risk management that require improvement[28], through further development, in subsequent cycles of implementation of the Directive[29].

Next to the equivalent one for the Water Framework Directive (WFD)[30], this document underpins the implementation report from the European Commission to the European Parliament and the Council of the EU foreseen in Articles 18 of the WFD and 16 of the FD.

1.1. Rationale for continued action at the EU level

While floods are a natural phenomenon, human choices, historic and still widespread today, have a significant effect on their occurrence and impacts. Locating assets within floodplains or near the coast, the reduction of water-retaining surfaces, interventions to water courses or their surroundings and man-instigated climate change, all contribute to an increase in the likelihood and adverse impacts of flood events. Since some time already there is evidence that Europe is subjected to an increasing number of large, damaging floods. Figure 1 below shows that the number of large flood events over a 25-year period increased and it is clear from the recently prepared EU Overview of Risks[31] that floods remain the most common risk for Europe: 27 out of 28 Member States included floods as a main risk in their national risk assessments submitted to the European Commission under the UCPM[32].

[27] The Member States assessment reports reflect the situation as reported by each Member State to the European Commission in 2016 or 2017 and with reference to FRMPs prepared earlier. The situation in the Member State may have altered since then.

[28] See also Special report no 25/2018 from the European Court of Auditors: "*Floods Directive: progress in assessing risks, while planning and implementation need to improve*", https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=47211

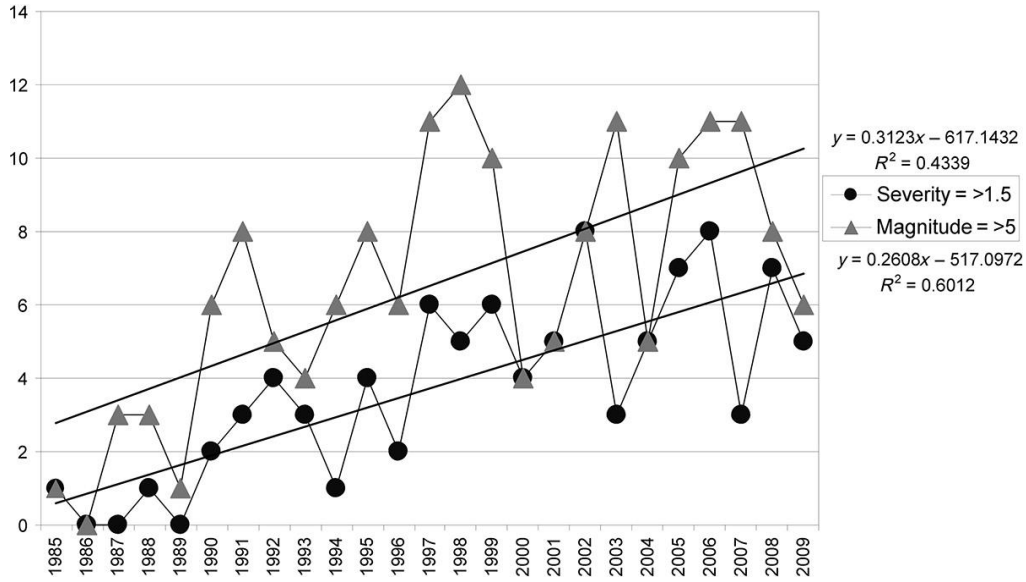
[29] There is no "sunset clause" in the Floods Directive.

[30] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p. 1–73, https://eur-lex.europa.eu/legal-content/En/TXT/?uri=CELEX:32000L0060

[31] Commission Staff Working Document – Overview of natural and man-made disaster risks the European Union may face{SWD (2017)176 final}; https://publications.europa.eu/en/publication-detail/-/publication/285d038f-b543-11e7-837e-01aa75ed71a1/language-en

[32] In November 2017, the European Commission proposed to strengthen the EU Civil Protection Mechanism by encouraging a stronger collective European response with the development of a reserve capacity (known as 'rescEU') to complement national capacities, and by stepping up disaster prevention and preparedness in Participating States to the Mechanism (http://europa.eu/rapid/press-release_IP-18-6766_en.htm).

Figure 1 ***Numbers of large floods in Europe each year during 1985–2009, based on Dartmouth Flood Observatory records***



Source: Zbigniew W. Kundzewicz, Iwona Pińskwar & G. Robert Brakenridge (2012): Large floods in Europe, 1985–2009, Hydrological Sciences Journal, *http://dx.doi.org/10.1080/02626667.2012.745082*

Estimates indicate that coastal and inland floods killed more than 2 000 people and affected 8.7 million in the period 1991-2015[33]. Most noticeable were the catastrophic floods in the summer of 2002 in the Danube and Elbe RBs, but also the 2013 summer flooding in central and south east Europe.

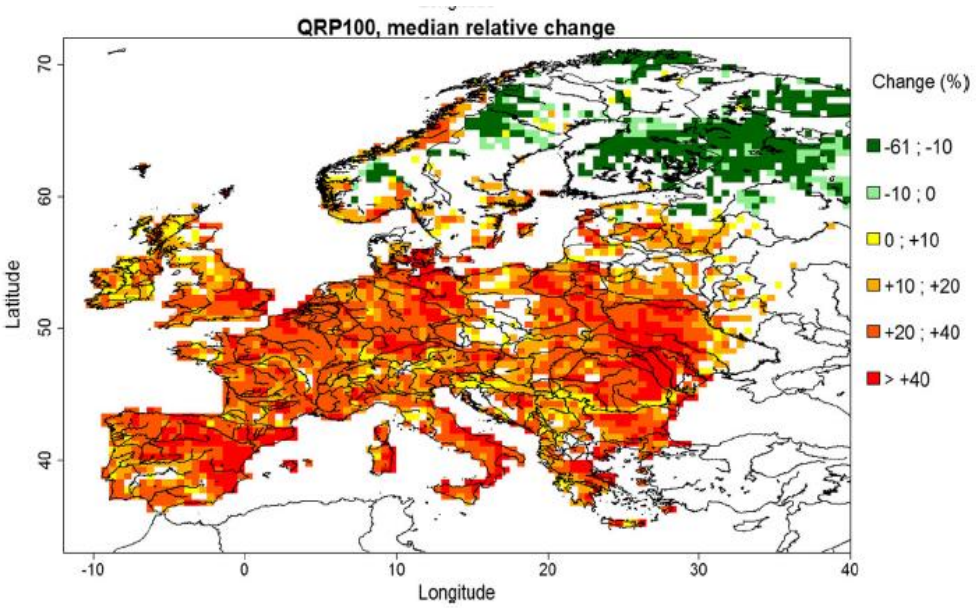
Economic losses caused by floods can be devastating, including damages to private housing, monuments, transport or energy infrastructure and various economic sectors. In addition to economic, social (including health) and cultural heritage damage, floods often have severe environmental consequences too, affecting terrestrial and aquatic ecosystems, e.g. through pollution. Potential cascading effects of a flood event may include the loss of vital infrastructure, the outbreak of epidemic or epizootic events, damage to industrial facilities causing the release of chemical or radioactive substances. Clearly hence implementing the FD contributes also to the implementation of policies other than flood risk management, e.g. the WFD.

Next to socioeconomic change, human induced climate change may increase the scale and

[33] EEA Report No 15/2017, "Climate change adaptation and disaster risk reduction in Europe Enhancing coherence of the knowledge base, policies and practices" Available at: https://www.eea.europa.eu/publications/climate-change-adaptation-and-disaster

frequency of floods in many parts of Europe. The Joint Research Centre of the European Commission found that even a 2°C rise in global temperature is still expected to lead to a significant increase in floods and droughts in many regions of Europe.[34]

Figure 2 ***Projections of future floods in Europe under a +2°C global warming – 100 year return period***



Source: Roudier, P., Andersson, J.C.M., Donnelly, C. et al. Climatic Change (2016): Projections of future floods and hydrological droughts in Europe under a +2°C global warming. 135: 341. https://doi.org/10.1007/s10584-015-1570-4. *http://link.springer.com/article/10.1007%2Fs10584-015-1570-4*

Under the no-adaptation scenario (i.e. assuming continuation of the current protection against river floods up to a current 100-year event), EU damages from the combined effect of climate and socioeconomic changes are projected to rise from EUR 6.9 billion/year to EUR 20.4 billion/year by the 2020s, EUR 45.9 billion/year by the 2050s, and EUR 97.9 billion/year by the 2080s.[35]

Considering these numbers, the importance of collecting accurate and consistent disaster loss data cannot be overstressed. However, disaster loss data remains an area requiring improvement, EU Member States included. Therefore, one of the actions listed in the

[34] https://ec.europa.eu/jrc/en/news/more-intense-floods-and-droughts-europe

[35] Rojas et al. (2013) Climate change and river floods in the EU: Socio-economic consequences and the costs and benefits of adaptation, Global Environmental Change 23, 1737–1751 available at: http://www.sciencedirect.com/science/article/pii/S0959378013001416#

"RescEU" Communication[36] is for Member States and the European Commission to promote a more systematic collection and dissemination of loss data. The European Commission, through its Joint Research Centre, has launched the Risk Data Hub (RDH)[37], expected to be the point of reference for curated EU-wide risk data, either through hosting relevant datasets or through linking to national platforms. The RDH integrates, among other tools, the European Flood Awareness System (EFAS)[38]. Member States can also input their own disaster loss datasets.

Floods are only one of the threats our societies are faced with next to other disaster risks (natural or man-made), the fight against crime and terrorism, border security. These threats involve issues such as chemical, biological, radiological and nuclear threats, crisis management, resilience etc. A range of research, technological developments as well as capacity-building, training and education projects, are striving to support the implementation of these policies.

However, the extent of the policy framework and the wide scope of supporting initiatives often lead to a lack of awareness about policies and/or project outputs by the "users"[39]. In response to needs expressed by different actors for improving exchanges of information and build up synergies among different types of activities (research, capacity-building, education and training, a "*Community of Users on Secure, Safe and Resilient Societies*"[40] was introduced by the European Commission in 2014 and has since become a recognized mechanism to exchange information both within the EU institutions and intergovernmental agencies and the many different actors involved in safety and security risk management.

Worldwide, beside windstorms, floods are the most frequent cause of natural hazard losses: about a third of all reported events and a third of the economic losses resulting from natural catastrophes are attributable to floods.[41] Disaster risk management aspects are underlined as critical to poverty reduction and enablers of sustainable development in the EU's consensus on development and contribute towards meeting the UN's Sustainable Development Goals. Indeed, flooding is directly relevant to two at least SDG goals: No 11 and No 13 on Sustainable Cities and Communities and Climate Action respectively. Work at the

[36] https://ec.europa.eu/echo/sites/echo-site/files/eu_disaster_management_rescue.pdf

[37] As part of the European Commission's Disaster Risk Management Knowledge Centre (DRMKC) for strengthening the interface between science and policy, https://drmkc.jrc.ec.europa.eu/partnership/Scientific-Partnerships/Risk-Data-Hub#documents/789/list

[38] https://www.efas.eu/

[39] Namely policy makers (at EU/national level), scientists (researchers/academics), industry (incl. SMEs), practitioners (e.g. first responders), and civil society (NGOs, general public, city networks etc.)

[40] https://www.securityresearch-cou.eu/node/5

[41] https://www.munichre.com/touch/naturalhazards/en/naturalhazards/hydrological-hazards/flood/flood/index.html

international level on disaster risk management is under the Sendai Framework for disaster risk reduction 2015-2030, adopted by United Nations (UN) Member States at the third UN world conference on disaster risk reduction in March 2015 and endorsed by the UN General Assembly. The European Commission launched an Action Plan in 2016 to support reaching the Sendai objectives[42] and the FD is one of its contributing elements.

[42] Commission Staff Working Document, Brussels, 17.6.2016, SWD(2016) 205 final/2, Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030, A disaster risk-informed approach for all EU policies; http://ec.europa.eu/echo/sites/echo-site/files/1_en_document_travail_service_part1_v2.pdf

2. Main elements of the Floods Directive

2.1. The objectives and key provisions of the Floods Directive

Given the clear need for a targeted and coordinated approach at EU level towards flood risk reduction, the FD was proposed as an instrument by the European Commission on 18 January 2006 and entered into force on 26 November 2007. The purpose of the Directive is to '*…establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods…*' (Article 1)

After transposition into national law and the necessary governance arrangements, that principally consisted of identifying UoMs[43] and Competent Authorities (CA), the Directive required Member States to make, by December 2011, preliminary assessments of flood risk (PFRA) leading to the identification of any areas that are at significant risk of flooding. By December 2013, the Member States were to have prepared FHRMs showing how far floods might extend, the depths or levels of floodwaters and the impacts that there might be on human health, the economy, environment and cultural heritage. The Directive also requires that the assessment of flood risk and associated mapping must be coordinated between the Member States sharing RBs that cross national boundaries. For the third major step in the risk management cycle, the Directive calls on Member States to prepare FRMPs, which were to be completed and published by December 2015. Building on the prior steps, the FRMPs should detail appropriate objectives and identify measures for achieving these objectives.

The following table provides an overview of the risk management cycle as defined by the FD.

[43] The UoM in most Member States coincide with the WFD's RBDs.

Table 1 Timetable for the implementation of the Floods Directive (2nd cycle focus)

Subject	**Deadline for completion (1st cycle)**	**Deadline for notification/reporting (following completion from the part of the MS)**	**2nd cycle implementation**	**Main reference**
Transposition and notification to the Commission	26.11.2009	26.11.2009	**-**	Article 17
Competent Authorities and Units of Management if different from WFD and notification to the Commission	26.05.2010	26.05.2010	**3 months after any changes**	Article 3(2) (and Annex 1 WFD)
Transitional measures (not relevant in the 2nd cycle)	22.12.2010	22.12.2010	**-**	Article 13
Preliminary Flood Risk Assessment-PFRAs/APSFRs	22.12.2011	22.03.2012	**22.03.19, every 6 years thereafter**	Articles 4 & 5, Article 15
Flood Hazard and Risk Maps-FHRMs	22.12.2013	22.03.2014	**22.03.20, every 6 years thereafter**	Article 6, Article 15
Flood Risk Management Plans-FRMPs	22.12.2015	22.03.2016	**22.03.22, every 6 years thereafter**	Article 7, Article 15
Commission's first implementation report		22.12.2018	**Every 6 years**	Article 16
Commission's second implementation report		22.12.2024	**Every 6 years**	Article 16

There are links between the purpose and approach to flood risk management prescribed by the

FD and the achievement of water quality objectives under the WFD. The FD states in its preamble that the implementation of the two Directives should '…*use the mutual potential for common synergies and benefits*...' (point 17 of the preamble). At the same time, Article 1 of the WFD says that the purpose of the Directive *"...is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:* [inter alia] ... *(e) contributes to mitigating the effects of floods and droughts"*…

The FD is in almost all Member States implemented at the level of the River Basin Districts (RBDs) designated under the WFD and the CA responsible for the WFD are generally also responsible for flood risk management under the FD (except where other UoM and CA are designated by Member States). The implementation cycles and reporting mechanisms of the two Directives are synchronized: the first set of FRMPs due in December 2015 should have been coordinated with the second RBMPs under the WFD (and possibly also integrated into), which were also due in December 2015. The public information and consultation mechanisms of the WFD can furthermore be utilised[44].

Measures can contribute to both Directives' ends. From a design and impact point of view, NWRM[45] are an example of measures that can contribute simultaneously to the achievement of objectives under the WFD and the FD by strengthening and preserving the natural retention and storage capacity of aquifers, soils and ecosystems[46]. At the same time, plans for new flood protection infrastructure need to be assessed in terms of potential impacts on the achievement of good status under the WFD.

2.2. The European Commission's 2015 implementation report

In accordance with Article 18(4) of the WFD the European Commission published in 2015 an interim report to the European Parliament and to the Council on the implementation of the

[44] Commission Staff working document SWD(2015) 51, final, Report on the progress in implementation of the FD, Accompanying the Document 'Communication from the Commission to the European Parliament and the Council – The WFD and the FD: Actions towards the 'good status' of EU water and to reduce flood risks. Available at: http://ec.europa.eu/environment/water/water-framework/pdf/4th_report/CSWD%20Report%20on%20the%20FD%20.pdf

[45] www.nwrm.eu

[46] COM(2015) 120 final, Communication from the Commission to the European Parliament and the Council – The WFD and the FD: Actions towards the 'good status' of EU water and to reduce flood risks. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0120

WFD, which also discussed the FD[47] and included an overview of the first steps in its implementation.

This report found that most Member States had developed new preliminary flood risk assessments, while few used existing assessments or relied on a combination of new and existing ones. Criteria for defining significant floods and methods for quantifying impacts were diverse across Member States and, in some cases, not systematically specified. Only one third of Member States explicitly considered climate and long-term socio-economic changes in their assessment of flood risk at the start of the decade. Despite these gaps, the report recognised that for the first time, all Member States acted together under the same policy framework to prevent or reduce social, economic and environmental damage from flood risk. The flood hazard maps and flood risk maps produced are a tool for decision makers and authorities to decide on, visualise, communicate (inter alia to the public) and implement measures aimed at reducing flood risks in an effective and sustainable way for water and the society. In addition, the report indicated that the FD has served as a strong incentive for the Member States to focus on prevention and awareness actions for flood risk management, in addition to protection measures.

2.3 The Common Implementation Strategy

Implementation of the WFD and the FD has been supported since May 2001 by informal co-operation under the Common Implementation Strategy (CIS)[48], led by Water Directors of Member States and the European Commission, with participation from relevant stakeholders. The CIS has successfully delivered thirty-six guidance documents; served as a valuable platform for exchange of experience and best practice on implementation among Member States, but also for exploring common issues of concern and joint responses. All documents produced under the CIS are made public on CIRCABC[49], a collaborative platform. Within the CIS, it is the Working Group on Floods (CIS-WG F) that primarily deals with issues pertaining to the implementation of the FD.

[47] COM(2015) 120 final, Communication from the Commission to the European Parliament and the Council – The WFD and the FD: Actions towards the 'good status' of EU water and to reduce flood risks. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0120

[48] http://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm

[49] https://circabc.europa.eu/w/browse/3644e20b-f5c5-46de-9d2f-3d9efb965fac

3. Approach to the Assessment of the Flood Risk Management Plans

After each of the two main steps of the flood risk management cycle defined by the FD, the European Commission produced assessments of the Member States' PFRAs and FHRMs. The present document bases itself on the assessment of the third and final step of the flood risk management cycle, the FRMPs. The document reflects firstly an assessment of the national (or sub-national) FRMPs prepared by Member States (in Part A of this document) and secondly, an assessment of international cooperation among Member States and with third countries in International River Basin Districts (iRBDs)/international Units of Management-iUoMs (in Part B of this document).

The assessment of Member States FRMPs drew on mainly two sources: (1) Member State reporting to the European Commission under the FD (covering all FRMPs)[50] and (2) depending on the number of FRMPs established in each MS either on all FRMPs, or on a representative sample[51]. Member States were requested[52] to report summaries of the key elements of their FRMPs. They were for example requested to report on measures taken under their FRMPs, thereby providing data including the location, costs, priority, responsible for the implementation authorities.

[50] Member States reported to the Water Information System for Europe (WISE, https://water.europa.eu/) via the European Environment Agency (EEA)'s ReportNet infrastructure and its Common Data Repository (CDR): http://cdr.eionet.europa.eu/ReportekEngine/searchdataflow?dataflow_uris=http%3A%2F%2Frod.eionet.europa.eu%2Fobligations%2F603&years%3Aint%3Aignore_empty=&partofyear=&reportingdate_start%3Adate%3Aignore_empty=&reportingdate_end%3Adate%3Aignore_empty=&country=&release_status=released&sort_on=reportingdate&sort_order=reverse&batch_size The format for reporting was jointly elaborated by the Member States and the European Commission as part of a collaborative process called the "Common Implementation Strategy".
Data must be reported in a clear and consistent way by all Member States. The assessment of the FRMPs was based on a common assessment template used for all Member States. The format for reporting was jointly elaborated by the Member States and the European Commission as part of a collaborative process called the "Common Implementation Strategy": http://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm
Whereas a key role of the Commission is to check compliance with EU legislation, the Commission also seeks information to allow it to determine whether existing policies are adequate. It also requires certain information to create a European-wide picture to inform the public.

[51] This report reflects the situation as reported by each Member State to the European Commission in 2016 or 2017 and with reference to FRMPs prepared earlier. The situation in the MSs may have altered since then.

[52] European Commission, Guidance for Reporting under the FD (2007/60/EC): Guidance Document No. 29 – A compilation of reporting sheets adopted by Water Directors CIS for the WFD(2000/60/EC), Technical Report 2013-071, 2013. Available at: https://circabc.europa.eu/sd/a/acbcd98a-9540-480e-a876-420b7de64eba/Floods%20Reporting%20guidance%20-%20final_with%20revised%20paragraph%204.2.3.pdf

The overview in Part A of this document is based on the Member States reports. As two Member States had not reported their FRMPs at the time of the assessment, the assessment of FRMPs is based on 26 Member States[53].

It should be noted that up to five FRMPs were assessed in each Member State. The FRMPs for assessment were chosen based on several criteria: first, to capture the variety of methods used (for example in Member States with a decentralised structure where regions or localities followed different approaches); second, to capture different types of flood sources; and third, to include UoMs that are part of larger transboundary units. Annex 1 provides the list of FRMPs assessed.

All chapters of Part A on national FRMPs indicate noteworthy good practices and areas for further development for all Member States (with the exception of the chapter on governance). Further, this overview highlights in boxes throughout the document a range of good practice examples collectively covering all Member States: These examples are intended to be illustrative and, owing to the diversity of flood risk Member States are faced with, the examples may or may not serve as good practice suitable for replication elsewhere. For further information and to gain a better appreciation of the context, the individual Member State assessment reports should be visited.

The assessment for international coordination under the FD (Part B) drew on Member States reporting, together with national FRMPs as well as on international FRMPs (iFRMP) for those iRBD where iFRMPs were prepared (for example the Danube or the Rhine basins). The assessment covered a total of 27 international basins, including those with lower levels of cooperation, where no iFRMP was prepared.

[53] Greece and the Republic of Ireland had not reported in time to be included in this assessment. Spain had reported 17 of 25 FRMPs at the time of the assessment, which was carried out on this basis. The Republic of Ireland reported in May 2018 and Greece reported in October/November 2018. A FRMP for Spain's Canary Islands was not reported as of yet.

Part A. Assessment of Member State Flood Risk Management Plans

4. Governance of Flood Risk Management

This chapter covers several issues related to the governance of flood risk management and of FRMPs. It firstly provides an overview of the number of UoMs and Areas of Potential Significant Flood Risk (APSFRs) designated by Member States and then considers the administrative level (local, regional or national) at which the Plans were prepared. The chapter then provides information on the level that the Plans were adopted at and discusses their legal status. The following section reviews the use of SEA procedures. The chapter proceeds to present an overview of Member States reporting of the FRMPs, and finally it considers links between the FRMPs and flood management plans that preceded the introduction of the FD.

4.1. Administrative level for the preparation of FRMPs

Member States have designated a total of 209 UoMs for the implementation of the FD. Within these UoMs, Member States identified 7.906 APSFRs[54] (the total as reported for the FRMP assessment[55]).

The following table shows the number of UoMs and APSFRs reported per Member State. APSFRs were first reported at the PFRA stage; some Member States updated their numbers later during the risk management cycle, which for some coincided with reporting their FHRMs or FRMPs. A 4% increase in the number of APSFRs took place between 2011 and 2015 (see Table 2 below).

In the majority of the Member States the UoMs correspond to the RBDs under the WFD. Italy is one exception as it follows the water governance scheme in place before the introduction of the WFD and consequently its UoMs cover different types of basins (national, interregional and regional basins): Italy has designated 47 UoMs but only 8 RBDs. Romania is another case, with 12 UoMs but only one RBD.

[54] Belgium, Italy and the Netherlands applied Article 13(1)(b) as a transitional measure in the 1st cycle of implementation of the FD and did not undertake a PFRA/identify APSFRs under the FD.

[55] 7 594 APSFRs were reported at the time of the PFRA.

Table 2 Number of UoMs and APSFRs reported

MS	UoMs	APSFRs (as reported at FRMP stage, 2015)	APSFRs (as reported at PFRA stage, 2011)
AT	3	391	391
BE	7		
BG	4	116	116
CY	1	19	19
CZ	3	269	269
DE	10	841	809
DK	4	10	10
EE	3	20	27
ES	25	1 306[56]	1 229
FI	8	21	21
FR	14	122[57]	146
HR	2	2 976	2 976
HU	1	2	2
IT	47		
LT	4	129	129
LU	2	15	15
LV	4	25	25
MT	1	4	
NL	4		
PL	10	268	268
PT	10	54	
RO	12	399	399
SE	10	18	18
SI	2	61	61
SK	2	559	383
UK	16	281	281
Total	**209**	**7 906**	**7 594**

Sources: Member States reporting to WISE. European Commission, European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk: Final report, Figure 9 (prepared by WRc and partners), September 2015. *http://ec.europa.eu/environment/water/flood_risk/pdf/pfra_reports/EU%20PFRA%20Overview%20Report.pdf*

Note: the table does not include either Greece (124 APSFRs reported at the PFRA stage), nor the Republic of Ireland (305 APSFRs), as these two Member States did not report in time for the FRMP assessment.

[56] There have been changes in Spain's APSFRs. The updated total will be 1 342 APSFRs.

[57] France noted that one APSFR was missing in the reporting for APSFRs (2012-2014). It was added in the update of the reporting of FHRMs in May 2017. It was therefore included in the count in the table above.

According to the Directive, Member States should prepare one FRMP for each RBD or UoM that contain APSFRs, or a set of FRMPs coordinated at the level of the RBD (Article 8.1). All FRMPs identify the level at which the planned, ongoing or executed measures take place. Member States have taken a variety of different approaches to the preparation of their FRMPs (see Table 3 below).

Table 3 Number of FRMPs per Member State and their geographical coverage

	National	**Regional**	**UoM/RBD**	**Sub-basin or Municipal**
AT	1			
BE			7	
BG			4	
CY	1			
CZ			3	(see Notes)
DE		40	5	
DK			2	20 (municipal)
EE			3	
ES			17	
FI				16 (APSFRs)
FR			14	
HR	1			
HU	1			
IT			~30	
LT	1			
LU	1			
LV			4	
NL			4	
MT	1			
PL			3	
PT			9	
RO	1		11	
SE				18 (APSFR)
SI	1			
SK			2	9 (sub-basin)
UK			13	23 (sub-basin)

Sources: Member States reporting and FRMPs.

Notes: The Czech Republic prepared both UoM-level and sub-basin FRMPs (the latter were not reported to WISE, nor assessed). Italy prepared FRMPs at UoM level and at the level of RBDs that comprise several UoMs; the estimate is made based on the links to FRMPs reported to WISE at the time of the assessment. Spain had reported 17 out of 25 FRMPs at the time of assessment.

Half of Member States assessed – 13 out of 26 – prepared an FRMP for each UoM where APSFRs were identified. Six Member States, however, prepared a single FRMP at national level covering all UoMs, and a further five Member States chose to develop Plans at a lower level, generally for sub-basins within an UoM. In Slovakia, the FRMPs prepared at the UoM level include sub-plans for sub-basins of the UoM. Germany and Italy followed a mixed

approach where some Plans are prepared at regional/Laender level and others at UoM level; in Denmark municipalities elaborated municipal FRMPs which were summarised in FRMPs at UoM level. In Finland and Sweden, FRMPs were prepared for individual APSFRs. In England and Northern Ireland, most plans are prepared at the UoM level, but in Scotland and Wales they are prepared at a lower level, for 14 Local Districts (Scotland) and eight FRMPs at the level of the Lead Local Flood Authorities (Wales).

A few Member States prepared FRMPs also for UoMs without APSFRs. One example is Estonia: an FRMP was developed for the Koiva UoM (EE3). Even though no APSFRs had been identified, national legislation called for an FRMP for each UoM, and the Koiva FRMP aims to avoid risks from potential floods in the future, with measures to improve the natural water retention capacities of the landscape (potentially also serving as a baseline for future action). In the United Kingdom as well, FRMPs were prepared for several UoMs such as Northumbria (UK03) that did not contain APSFRs. Austria's FRMP, prepared at national level, covers all three UoMs including the Elbe (AT5000), which does not contain APSFRs, though no measures are planned there.

In total, as shown in Table3, over 260 FRMPs were prepared across the 26 Member States[58].

4.2. Adoption and legal status of the FRMPs

The European Commission's 2012 assessment of the first RBMPs noted that their legal status varied across Member States. Key factors in determining legal status included the role of the Plans in the national hierarchy of policy and legal acts, the adopting authority and the procedure for adoption. The legal 'effect' of the plans on other administrative acts, such as permits and spatial planning instruments, would also vary. A similar analysis was carried out for the 1st FRMPs and is detailed below.

For nearly all Member States, information was available, either in the FRMPs or from other sources, on the legal status of the Plans (see Table 4). In at least eleven Member States, the FRMPs were approved at the level of national government. In Hungary, for example, the government adopted the national FRMP in March 2016 (via Decree 1146/2016).

In five Member States, the FRMPs were adopted by the Ministry for Environment: this was for instance the case in Latvia, where the Minister of Environmental Protection and Regional Development adopted the FRMP for the Daugava UoM (LVDUBA) in November 2015 and

[58] In addition to these, Greece prepared 15 FRMPs and the Republic of Ireland 29.

the other three FRMPs the following month. In Finland, the Ministry for Agriculture and Forestry, responsible for water management, approved the FRMPs in December 2015. In the Netherlands, the FRMPs are part of the National Water Plan (2016-2021), which was approved by the (at that time) Ministry of Infrastructure and Environment and the Ministry of Economic Affairs.

Authorities at UoM/RBD level approved the Plans in France and Italy. In mainland France, the basin prefects approved the Plans. In Italy, the RBD authorities adopted the FRMPs in March 2016 and the national government followed in February 2017. In Belgium, the FRMPs were approved by the three regions (Brussels, Flanders and Wallonia); in Portugal, while the plans for mainland UoMs were approved at national level, those for the autonomous regions of Azores and Madeira were approved by the regional governments. In Denmark, plans were prepared at municipal level and approved by municipal councils. Two overarching FRMPs were prepared in Denmark, however, these were not approved at national government level.

Table 4 Legal adoption of the FRMPs

	National Government	**Ministry of Environment**	**Other Ministry**	**UoM/ RBD**	**Regions**	**Local**	**Date of adoption**
AT		✓					March 2016
BE					✓		Brussels: January 2017 Flanders: December 2015 Wallonia: March 2016
BG	✓						December 2016
CY		✓					December 2016
CZ	✓						December 2015
DE				✓	✓		**
DK						✓	**
EE	✓						January 2016
ES	✓						January and April 2016; March 2018 **
FI			✓				December 2015
FR				✓			Late 2015 **
HR	✓						July 2016
HU	✓						March 2016
IT	✓			✓			RBD authorities: March 2016; Council of Ministers: February 2017
LT							*

	National Government	Ministry of Environment	Other Ministry	UoM/ RBD	Regions	Local	Date of adoption
LU	✓						March 2018
LV		✓					November and December 2015 **
MT		✓					February 2016
NL		✓	✓				December 2015
PL	✓						October, November and December 2016 **
PT	✓				✓		September and October 2016, 27 October 2017 **
RO	✓						December 2016
SE					✓		December 2015
SI	✓						July 2017
SK		✓					December 2015
UK							December 2015 for NI, Scotland and Wales; March 2016 for England

Sources: Member State reporting, FRMPs.

Notes: In Finland, the 'other ministry' refers to the Ministry for Agriculture and Forestry, responsible for water management. In the Netherlands, the 'other ministry' is the Ministry of Economic Affairs

** In Lithuania, the Water Sector Development Programme 2017-2023 was approved by the Government in February 2017 and the Action Plan of Water Sector Development Programme 2017-2023 by the Minister of Environment and Minister of Agriculture in May 2017: Both documents refer to and are partly based on the national FRMP.*

*** In Denmark, France, Germany, Spain, Latvia and Portugal, the date of adoption varies across the FRMPs.*

For almost all the Member States the FRMPs have been officially adopted, giving them legal status. A few of the FRMPs themselves provide information on their legal weight (see the box below for France).

Box 1 - The legal effect of the FRMPs

In **France**, the FRMP for the Rhône-Méditerranée UoM (FRD) contains a section on the legal weight of the plan, indicating that with the FRMP's approval, other plans and administrative documents need to be updated within three years to be compatible with its provisions. This section refers to plans at several levels, including the *Schémas de cohérence territoriale* (SCoTs, Schemas for territorial coherence), plans covering several municipalities, and to the *plans locals d'urbanisme* (PLUs) and *plans locals d'urbanisme intercommunal* (PLUIs), the main local planning documents. The FRMP also delineates

the scope of the FRMP compared to the RBMP for the Rhône-Méditerranée.

4.3. Strategic Environmental Assessments[59]

An SEA is mandatory for plans/programmes which:

- are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste/ water management, telecommunications, tourism, town & country planning or land use and which set the framework for future development consent of projects listed in the Environmental Impact Assessment (EIA) Directive, or

- have been determined to require an assessment under the Habitats Directive.

In 23 of the 26 Member States, it is clear that the FRMPs underwent an SEA in at least some UoMs. For example, an SEA is carried out for only some Swedish and French FRMPs. In Malta, on the other hand, an SEA screening was carried out, and on the basis of this, there was no full SEA undertaken on the Maltese FRMP. No information was found on SEA procedures in Denmark and Estonia; however, this may reflect an omission to provide information rather than the lack of an SEA procedure.

In some Member States, including Luxembourg, Latvia, Croatia, Cyprus and Portugal, the SEAs of the FRMPs were conducted together with the SEAs of the RBMPs and the results were reported in one of the two documents. In the Netherlands, the SEA was carried out on the National Water Plan (2016-2021), which includes the draft FRMPs.

The FRMPs in several Member States provide information on the SEA procedure. For example, in Bulgaria, draft results of the SEA procedures were open for public consultation at the same time as the FRMPs, so both drafts were discussed together. All four Bulgarian FRMPs provide information about the conclusions of the SEA procedures. In Poland, a stepwise scheme of public consultation and participation in the SEA procedure for the FRMP project was used. This gave interested parties the opportunity to participate in both the process of developing FRMP measures and in the SEA process. The FRMP for Croatia indicates that

[59] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32001L0042

neighbouring Member States and third countries were invited to provide comments as part of the SEA procedure.

4.4. Overview of Member State reporting of the FRMPs

MS were required to report to the European Commission on their first FRMPs by 22 March 2016. Half of EU's 28 Member States reported at least some of the FRMPs by that date (see Table 5 below). By July 2017, all Member States had reported except for Ireland, which reported in May 2018[60], and Greece, which published the FRMPs in the official gazette in July 2018[61] and reported in October/November 2018.

Table 5 Member State reporting of the FRMPs to WISE

	Reporting to WISE	**Updates**
AT	March 2016	
BE	March 2016 (February 2017 for one UoM)	July 2016
BG	December 2016	
HR	September 2016	
CY	September 2016 (January 2017 for XML)	
CZ	March 2016 (Sept 2017 national FRMP)	
DK	March 2016	
EE	May 2016	January 2018 (one UoM)
FI	March 2016	April 2017
FR	March 2016	September 217
DE	March 2016	June 2016
EL	October/November 2018	-
HU	March 2016	
IE	May 2018	
IT	March 2016	
LV	March 2016 (June 2016 FRMPs)	August 2016
LT	July 2017	
LU	October 2016 (June 2017 XML)	
MT	October 2016 (Dec 2017 XML)	
NL	March 2016	
PL	October 2016	December 2016
PT	Oct 2016 (March 2017 XML)	June 2017
RO	February 2017	
SK	March 2016	

[60] http://www.floodinfo.ie/about_floodplans/
[61] http://floods.ypeka.gr/index.php/sxedia-diaxeirisis

	Reporting to WISE	Updates
SI	August 2017	
ES	February-April 2016 (March-April 2018 for one UoM)	
SE	March 2016	May 2017
UK	March 2016	

Source: Member State reporting.

4.5. Links to previous plans

As noted earlier, some Member States have had long-standing policies to address flood risks. In these Member States, the FRMPs follow and build on previous plans to address flood risks. In Italy, for example, the regions and some RBs had prepared Plans for Hydrogeological Status (*Piani di Assetto Idrogeologico*, PAIs) to address hydrogeological risks including different types of flooding as well as landslides related to heavy rainfall. Italy used information from these earlier plans instead of undertaking a PFRA in the first cycle. In the Netherlands, well-known for its efforts to address flood risks from the sea, the FRMPs follow a set of major government initiatives taken over the previous decade (see the box below). The Dutch FRMPs include measures taken under other plans and programmes. This is the case for FRMPs in a few other countries as well: for example, in Croatia, the FRMP's infrastructure measures are based on a prior water infrastructure plan[62].

Member States may decide – under Article 13(3) of the FD – to make use of earlier FRMPs (i.e. finalised before December 2010) instead of preparing 1st cycle FRMPs, provided that their content is equivalent to the requirements of Article 7 of the Directive. The assessment found application of Article 13(3) in only one Member State, for a small share of the German FRMPs.

Box 2 - Previous flood risk initiatives

In the **Netherlands**, the four FRMPs refer to and build on recent and ongoing national programmes and legislation for flood risk management. These include the 2007 Room for the River Programme[63] (*Ruimte voor de Rivier*) to restore flood plains and other natural features as measures against flooding, now nearing completion. Another key initiative has been the Delta Programme[64] (first launched in 2008

[62] Specifically, the Multi-annual Program for the Construction of Water Structures for Regulation and Protection and Structures for Amelioration, for 2013-2021: http://www.voda.hr/hr/visegodisnji-programi-gradnje
[63] https://www.ruimtevoorderivier.nl/english/
[64] https://www.government.nl/topics/delta-programme/introduction-to-the-delta-programme

and most recently updated in 2017) to protect against flooding and secure freshwater resources in the face of expected climate change impacts. Related to the Delta Programme, the Netherlands took several Delta Decisions[65] (proposed in 2014 and adopted in the 2015 Delta Programme): the Decision for Water Safety, for example, states that by 2050, dykes and dunes should provide sufficient protection so that the risk of fatalities is no higher than 1 in 100,000 citizens per year.

[65] https://english.deltacommissaris.nl/delta-programme/delta-decisions

5. Public information and consultation

According to Article 1 of the 1998 Aarhus Convention "*In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters…*"[66] Directive 2003/35/EC[67] is providing for public participation in respect to the drawing up of certain plans and programmes relating to the environment with the objective to contribute to the implementation of the obligations arising under the Århus Convention. Provisions for public participation in environmental decision-making are to be found in a number of other environmental Directives, including the WFD and the FD.

Article 10(1) of the FD states that Member States shall make available to the public the FRMPs – and this was also the case for the previous phases in the flood risk management cycle, i.e. the preparation of the PFRAs and the FHRMs. Moreover, the active involvement of interested parties in the production, review and updating of the FRMPs should be encouraged (Article 10(2)). This chapter reviews the information available in the Member States reporting and the FRMPs assessed on information provision, public consultation and active stakeholder involvement[68]. Three distinct facets are discussed: (1) the provision of information to the public and stakeholders on the consultation itself, and the provision of FRMPs and related documents; 2) the actual public consultation and consultation methods; and (3) the active involvement of stakeholders.[69]

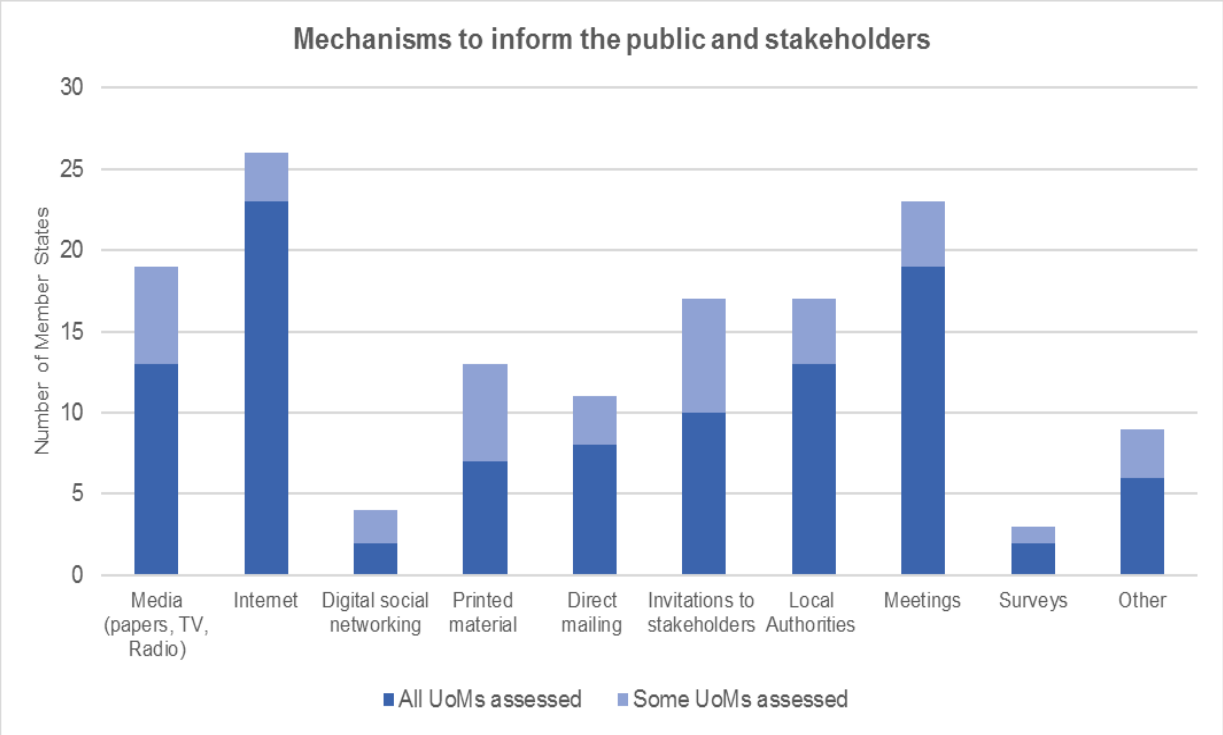
Effective public participation should result in adaptations which improve the evidence and assumptions in the FRMPs, refine the scope of the measures to be taken and increase stakeholders' ownership of the plans and commitment to their implementation. This aspect is explored by looking at how the plans were reported to have changed as a result of the consultation.

[66] http://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf
[67] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003L0035
[68] The majority of the information presented in this section is taken from the FRMPs. In some cases, Member States have provided additional information, however, this additional information are only included in the graphs that follow if evidence was found in documents reported to WISE.
[69] The CIS Guidance Document on Public Participation underlines that active involvement goes beyond consultation: '…it implies that stakeholders are invited to contribute actively to the process and thus play a role in advising the competent authorities.' European Commission, Public Participation in Relation to the Water Framework Directive, Guidance Document No 8 (of the C), 2003. Available at: https://circabc.europa.eu/sd/a/0fc804ff-5fe6-4874-8e0d-de3e47637a63/Guidance%20No%208%20-%20Public%20participation%20%28WG%202.9%29.pdf

5.1. Information provision on the consultation process

All of the Member States covered in the assessment have used a variety of information channels for communicating with the public and stakeholders on the FRMPs.

Figure 3 Mechanisms to inform the public and stakeholders



Source: Member State reporting and FRMPs.

The FRMPs for Austria, Germany and Slovakia explicitly refer to a strategic approach, starting at the initial phase of development of the FRMP, to provide information about the content and the preparation process of the Plans (see the box below on Austria). The communication and information channel that was used the most was the internet, followed by stakeholder meetings and the use of media such as newspapers, TV and radio (see Figure *3* above). With regard to the internet, several Member States set up dedicated websites on floods: one example is Poland, where the website dedicated to flood protection and to the Plans under development[70] was updated on an ongoing basis. Surveys and social media platforms were used least. Romania reported the use of a high number of information channels, followed by Austria, Belgium, Poland and Portugal, including the internet, public displays, printed thematic brochures and (online) dialogue platforms. An innovative approach was used in Poland: a film trailer shown in cinemas was used to reach out to the general public.

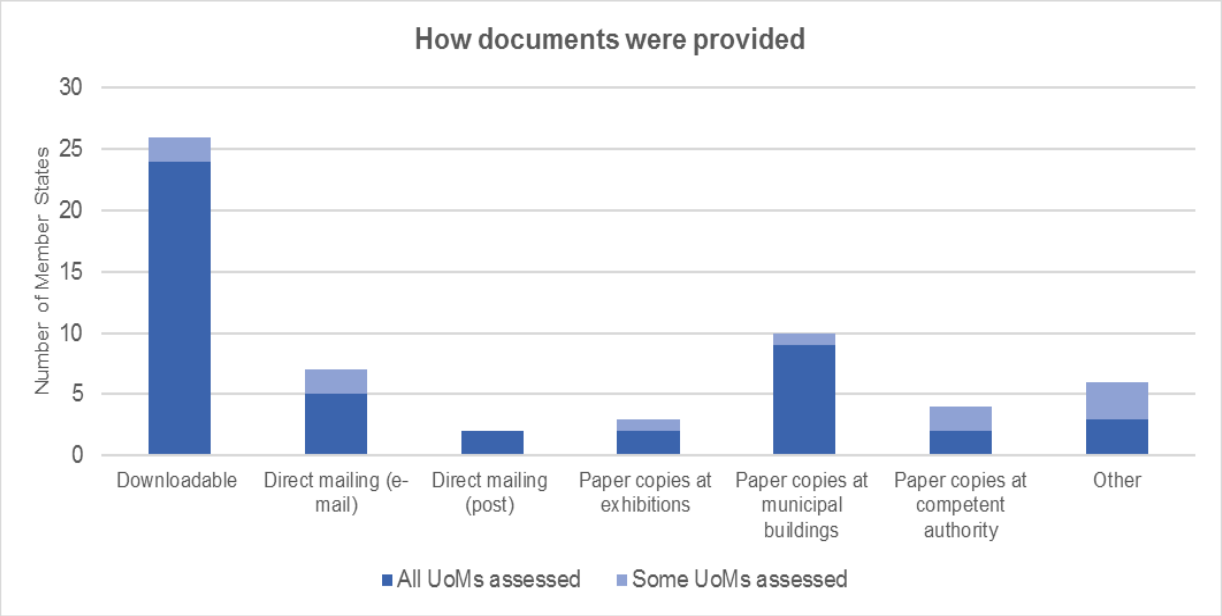
[70] www.powodz.gov.pl

Box 3 - Public information and consultation

In **Austria**, a broad public information and consultation strategy was followed for the consultation on the FRMP. Many public relations channels and several dialogue platforms for topics related to water management were used, such as the Round Table on Water and an internet platform called "*Flussdialog*"/River Dialogue, which targeted many different stakeholders as well as the general population.

In terms of providing the documents for consultation, 24 of the 26 Member States assessed made all draft FRMPs available via the internet, and two more did so in some of the UoMs assessed (see Figure 4 below). The second most common method was making paper copies available in municipal buildings, this was done by less than half of the Member States.

Figure 4 Mechanisms to provide FRMP documents to the public and stakeholders



Source: Member State reporting and FRMPs.

Relatively few Member States provided documents at the offices of competent authorities or regular exhibitions, and few provided them via direct mailing. (Croatian authorities specifically noted that printed versions were not distributed due to the large size of the document.) Direct mailing was used in Poland for all FRMPs; Poland was the Member States which used the most channels, six, to provide documents. In contrast, several Member States – including Bulgaria, Cyprus, the Czech Republic, Denmark, France, Hungary, Lithuania and Latvia – chose to work with downloadable documents only.

A few Member States also indicated that information on the FRMPs was provided also once they were completed: Slovenia is one example (see the box below).

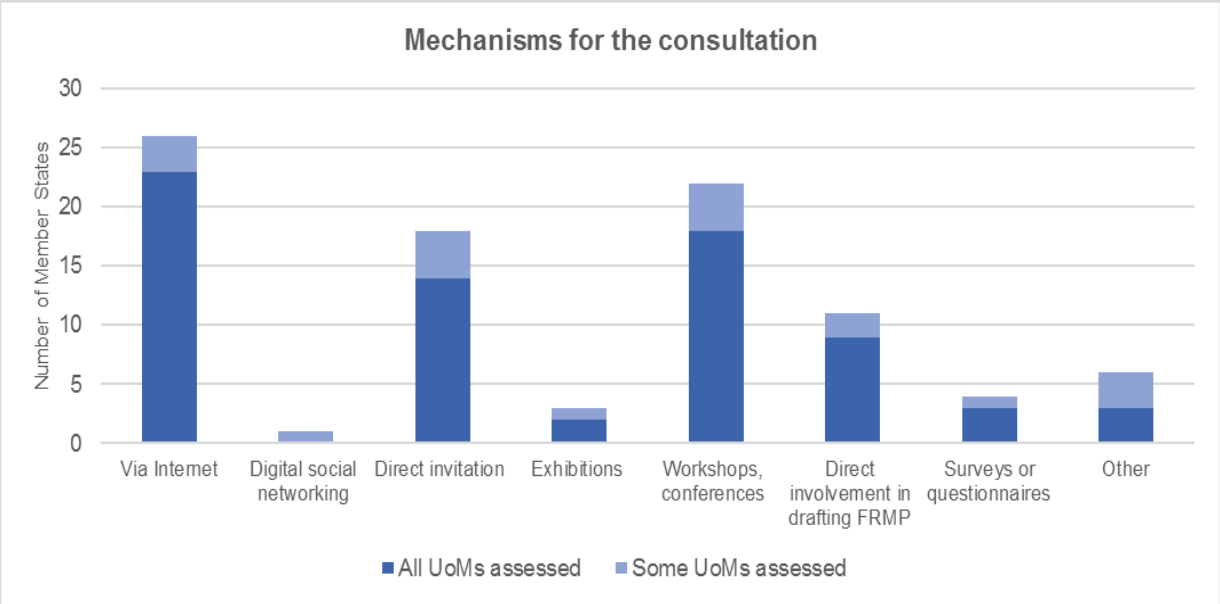
Box 4 - Informing the public about the final FRMP

After the publication of the final FRMP, **Slovenia** organised workshops with local inhabitants in flood-risk areas and with local water professionals. In December 2015, there were four workshops for the basins of Savinja river (at Ljubno ob Savinji), Mura and Drava rivers (at Murska Sobota), Sava river (at Ljubljana) and Soča and Adriatic rivers (at Nova Gorica) that explained the FRMP. In 2017, a public discussion and exhibition was held, covering both UoMs.

5.2. Consultation mechanisms

In all Member States, the internet was a crucial mechanism for the consultation process itself (see Figure 5 below). It was mainly used to submit written comments. A high number of Member States also used workshops and conferences to gather feedback on the consultation.

Figure 5 Mechanisms for the consultation



Source: Member State reporting and FRMPs.

On average, Member States use four different channels to carry out the consultation. The most popular channels to carry out the consultation were the internet, direct invitations and workshops and conferences. Bulgaria and Estonia used the highest number of channels, six each. In Poland, multiple events were held during the six-month FRMP consultation, including

conferences, focus meetings, Water Forum and expert meetings. Written comments could also be submitted by mail or email. After this period, further consultations were held as part of the SEA procedure for the plans.

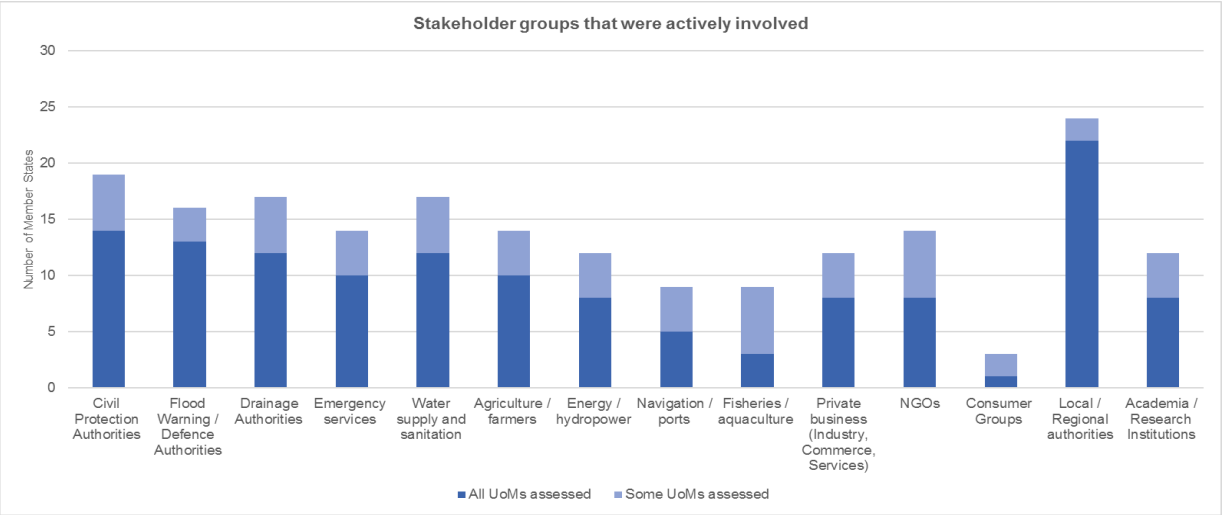
Discussions on social media platforms were an innovative method used by Finland. A discussion forum was also set up on the public consultation page for the Kemijoki catchment FRMP.

Three Member States used surveys of the public: this was seen, for example, in Bulgaria, where members of the public were asked about the main issues to be addressed in the FRMP. In Austria, over 11 000 individuals participated via an online questionnaire (the report does not say, however, if the questionnaire only looked at the FD or whether it also referred to the WFD, as both Directives are covered in the "*Flussdialog*" web portal). Latvia used a survey of local governments (rather than the public) as an early input to the FRMPs: the survey included questions about flood risks in the municipality, currently planned measures and possible non-traditional solutions to reduce flood risks.

5.3. Active involvement of stakeholder groups

In the majority of Member States, a broad range of stakeholders were actively involved in the preparation of the FRMPs (see Figure 6). The leading groups were local and regional authorities, involved in all the Member States for which information is available, and civil protection authorities. The latter were consulted for all FRMPs assessed in 14 of the 26 Member States – and in 19 Member States for at least some UoMs. Flood warning/defence authorities and water supply and sanitation companies were actively involved in more than half of the Member States. Consumer groups and academic and research institutions were actively involved in very few Member States, according to the information available.

Figure 6 Stakeholder groups actively involved in the preparation of the FRMPs



Source: Member State reporting and FRMPs.

Based on the information provided, on average stakeholders from about eight sectors were actively involved for all or part of the UoMs. Portugal and Germany were the Member States actively involving the widest variety of stakeholder groups (14) for its various UoMs, followed by Bulgaria and Hungary (each with 13).

No information was found in the documents uploaded to WISE, however, about the stakeholder groups consulted in the development of the FRMPs for two Member States: Lithuania and Slovenia.[71]

Box 5 - Active involvement of stakeholder groups

A broad range of stakeholder groups were actively involved in the mainland **Portuguese** FRMPs assessed. For the FRMPs for the Douro (PTRH3) and Vouga, Mondego and Lis (PTRH4A) UoMs for example, these stakeholders included: government bodies at different levels and for different sectors, economic interests and civil society associations. For the Douro, solid waste management companies and insurance companies were also mentioned.

In several Member States, the stakeholders involved varied among FRMPs: this was the case for Belgium, Bulgaria, Denmark, Germany, Finland, Italy, Portugal, Sweden and the United Kingdom. For example, in Denmark, where the plans were prepared at municipal level, stakeholders were involved depending on their relevance for and interest in local flood issues.

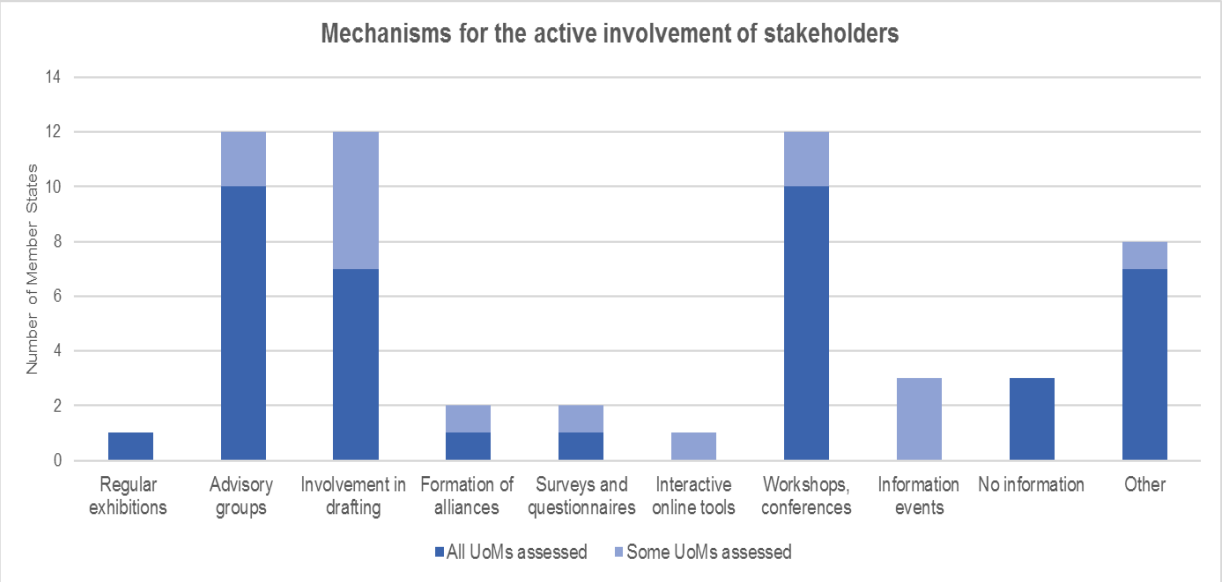
[71] Slovenia subsequently informed that this information is published in a separate report on public participation.

Nonetheless, most of the municipalities in Denmark involved a range of actors from public agencies and the private sector.

MS used a wide variety of mechanisms for the active involvement of stakeholders (see Figure 7 below). The most common were the establishment of advisory groups, workshops, technical meetings, seminars or conferences and involving stakeholders in drafting the FRMPs. Interactive online tools, information events, formation of alliances and regular exhibitions were the mechanisms used least frequently.

A common mechanism, used in about half of all Member States, was the establishment of multi-stakeholder advisory groups. Luxembourg, for example, created "Flood Management Partnerships" as a mechanism for local stakeholder involvement in flood risk management. In Bulgaria, active involvement included stakeholder meetings at regional and national levels and meetings of the Basin Councils: all four UoMs have Basin Councils (required by national law) that bring together stakeholders. These Councils provided feedback during the preparation of the FRMPs. In Poland, steering committees were created at water region and RB levels (both below UoM level). In Estonia, drafts of the FRMP were submitted for review and approval by the national Commission for RB Management, which brings together government bodies, national experts and water service companies. In one UoM in Portugal, an Advisory Committee with 16 representatives of different public, private and civil society bodies was formed to monitor the development of the FRMP. A consultative council was created for each of Latvia's four UoMs (see the box below).

Figure 7 Mechanisms for the active involvement of stakeholders



Source: Member State reporting and FRMPs.

Box 6 - Consultative Councils

A Consultative Council was set up in each of **Latvia's** four UoMs to coordinate the interests of state institutions, local authorities and non-governmental organisations as well as private companies and other interest groups in matters related to the achievement of environmental quality and flood risk objectives in the area concerned. The main function of the Consultative Council was to evaluate the RBMP, FRMP and programmes of measures in accordance with the public interest and provide opinions and recommendations for further development of the plans to the national body responsible, the Latvian Environmental Geology and Meteorology Centre[72]. The companies involved were from the drainage, water, agriculture and energy sectors. During the development of the FRMPs, the Consultative Councils also participated in negotiations with the Ministry of Agriculture, which is the responsible authority for implementation of flood risk management measures in rural areas.

In the United Kingdom, Scottish UoMs had Local Advisory Groups which included representatives from a range of sectors, including government agencies, local authorities, non-government organisations, utility companies and land and asset managers. In Northern Ireland, a consultation network was set up to ensure all relevant stakeholders had an opportunity to participate in discussion and exchange of information and views on the preparation of FRMPs. Within this network there were three main groups: an FD steering group, an FD stakeholder group and flood forum groups for each RBD.

In Denmark some municipalities put groups in place to work on specific aspects of the FRMP. These included relevant interests such as neighbouring municipalities and landowners or companies that might be affected by the Plan.

In Finland, all the FRMPs assessed had a flood group made up of representatives of stakeholders that was directly involved in drafting the FRMP. Stakeholders outside the flood groups were able to contribute to the FRMP through specially-organised workshops.

Workshops and conferences were a mechanism used in 12 Member States. In Estonia, for instance, a total of 25 meetings and workshops were held with interested parties. Stakeholder meetings to discuss the draft FRMPs were organised at regional, UoM/RBD and national levels.

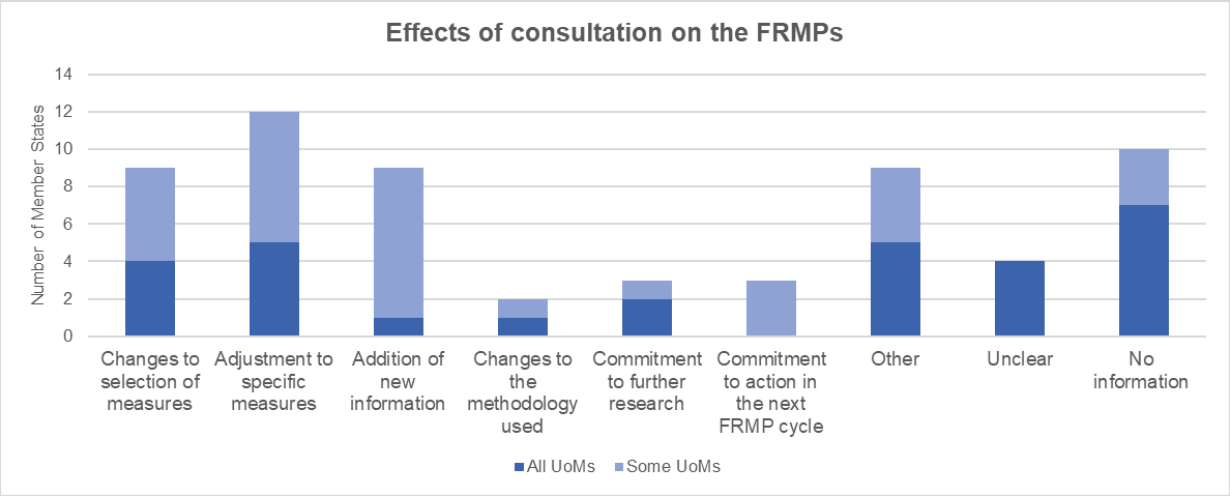
[72] Latvian Environment, Geology and Meteorology Centre which is responsible for the development of the Plans.

5.4. Incorporating consultation results in the FRMPs

With regard to the effects of the consultation, for about a third of the Member States assessed, no information was found in the FRMPs or Member States reporting on how the results of the consultation had been taken into account[73].

Where information was found, this often indicated that adjustments had been made to specific measures which had already been selected (12 Member States), and that new information had been added to the FRMPs (9 Member States). In nine Member States, changes were made to the actual selection of measures (see Figure 8).

Figure 8 Effects of consultation on the FRMPs



Source: Member State reporting and FRMPs.

Changes to the methodology used as a result of the consultation were reported by Finland as a result for one of its UoMs and by Croatia for its FRMP (which covers both of that Member States' UoMs). In Luxembourg, the FRMP provides extensive information on how consultation results were considered (see box below).

[73] Information was in some Member States included in background documents. For instance, Bulgaria, Spain and Hungary prepared Annexes to the FRMPs with extensive information on the outcomes of the stakeholder consultations; in Italy, the website for the Eastern Alps RB district (ITA) provided relevant documents, but similar information was not found on the websites for other FRMPs assessed in Italy.

Box 7 - The effects of consultation on FRMPs

In **Luxembourg**, the proposal and selection of measures was part of the active involvement process, particularly through workshops organised for the Flood Management Partnerships, and consultation of local authorities in flood risk areas. The measures proposed from these workshops were largely incorporated in the FRMP.

Comments received as a result of the initial consultation on the draft FHRMs in 2010/11 were also examined and incorporated into the final draft FHRMs which were made available to the public in 2014, together with the draft FRMP. For example, following public consultation and reference to updated data, some recalculations were performed on some of the maps, and localised adjustments were made in some APSFRs. In addition, the legend of the Flood Risk Maps was simplified.

In four Member States, the specific impacts of the consultation are not clear (Spain, France, Lithuania, and the Netherlands). In some Member States, FRMP consultations were carried out in conjunction with consultations with other matters, for example the RBMP. The Maltese authorities, for example, combined flood management consultations with a number of other water-related topics. Eventually, the Maltese stakeholders attending discussions were more concerned on issues such as water scarcity, which subsequently became the main emphasis of stakeholders.

For ten Member States, information was not found for some or all UoMs assessed. In Finland, three out of five FRMPs assessed included information on the effects of consultation on the plans. In the United Kingdom, the only UoM found that provided a summary of the changes made as a result of the consultation response was the Neagh Bann in Northern Ireland. For Italy, while some information on the consultation responses was found on websites, there was no systematic overview provided on the effects of consultation in any of the five FRMPs assessed.

5.5. Summary of good practice and areas for further development

As noted in section 4, the assessment found that all Member States engaged in noteworthy practices; similarly areas for further development were identified in all. The following paragraphs summarise, based on the Member States reports and the FRMPs assessed, the good practices and areas for further development identified in involving stakeholders in the drafting process for FRMPs.

5.5.1 Good practice

Many Member States reports and FRMPs underline the efforts made to organise broad stakeholder consultations at various stages of the development of the FRMPs and at various levels of influence or competence. Several highlight a strategic approach and an emphasis on broad public participation. Reference was made to the use of coordination commissions, partnerships, consultative councils or working groups to streamline the process between national, regional and local authorities.

Workshops, information fora and technical meetings were organised to actively involve and engage stakeholders. When it comes to informing the general public, some Member States created dedicated websites to provide information on the consultations and publish surveys and summary reports. This facilitates access to information by stakeholders and members of the public with different levels of technical expertise.

Including feedback on the results of consultations in (annexes to) the FRMPs was also practiced by several Member States, showing an increased awareness of the importance of transparency. In one case, a workshop was organised to provide feedback to participants on how their input had been used, in a more proactive approach. Information from the public has been used in the different planning and development phases of the FRMPs. This shows greater willingness on the part of Member States to take account of the concerns and suggestions of stakeholders and members of the public.

Some Member States are also linking more streamlined participation with integration across different levels of governance (local, regional, national, transnational) and different objectives (water quality, flood management, marine). This is likely to contribute to more efficient planning and greater stakeholder buy-in.

5.5.1. Areas for further development

Although broad public information and consultation campaigns were set up by the Member States, the concrete effects of these activities and the way in which the consultation activities have influenced the final FRMP, are in many instances not summarised in the FRMP itself. Lack of information on the effectiveness of the participation methods used, for example in

terms of the number of people involved, the input received and how the input was used should as well be addressed in the 2nd cycle.

Better stakeholder analysis and greater transparency about the stakeholders who have participated in the planning process would be likely to encourage greater efforts from the part of the stakeholder groups who are currently not being brought round the table to become partners. It may be the case, particularly in Member States where a strong public participation culture has still to be developed, that stakeholders and members of the public only demonstrated a low level of interest, despite the invitation to participate. In these cases, apart from continuing to foster a culture of public participation across the spectrum, it may be worthwhile to measure the success of the channels of communication used, or the messages passed and, if these were low, to consider alternatives.

The duration of public consultation varied between Member States (and for the United Kingdom, also between FRMPs).

On this basis, the following recommendations can be made for the preparation of the second FRMPs:

- Information on public and stakeholder involvement should be provided more systematically in the second FRMPs.

- To ensure greater coordination with the public consultation for the RBMPs – and to ensure adequate time is provided to the public to respond, in the next cycle Member States should consider providing the same, or at least parallel periods for the consultation of the FRMPs and the RBMPs.

6. Integration of the Preliminary Flood Risk Assessments and Flood Hazard Maps and Flood Risk Maps

The FRMPs are based on the prior work carried out by Member States: the PFRAs and FHRMs. These three steps together form part of a chain, as the FHRMs are to be prepared for the APSFRs identified as a conclusion to the PFRA stage, and the plans are to be established "on the basis of" the FHRMs (Article 7 of the FD). The conclusions of these previous steps should be integrated in the FRMPs (in accordance with the Annex of the FD).

6.1. Overview of the previous steps

MS were to complete their PFRAs by 22 December 2011 (Article 4 of the FD) and then prepare their FHRMs by 22 December 2013 (Article 6). The results of these two prior steps were made public by the European Commission in 2015. Member States had three months to report their PFRAs and FHRMs after they were completed. Most countries were covered by the 2015 European Commission assessments. Exceptions were: Greece (which was late with the reporting of both the PFRAs and the FHRMs, now reported); Bulgaria (which was late with the reporting of the FHRMs, now reported); and Croatia, Malta and Portugal, which were late in concluding their reporting.

6.1.1. Assessment of the previous steps

Overall, the assessment of the PFRAs[74] found that:

- Some Member States considered in their preliminary assessment all types of floods depending on their source[75] while others only some types, but without providing an explanation why certain types were excluded. In the cases where reasons were provided, some types of floods were not included because of their unpredictability

[74] European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm

[75] According to the Guidance for Reporting under the FD (2007/60/EC) (p.61)Member State were to consider the following types of floods based on the sources of flooding, defined by the CIS Working Group on Floods (WGF): fluvial, pluvial, groundwater, seawater, floods from artificial water-bearing infrastructure, and other. The guidance is available at: https://circabc.europa.eu/sd/a/acbcd98a-9540-480e-a876-420b7de64eba/Floods%20Reporting%20guidance%20-%20final_with%20revised%20paragraph%204.2.3.pdf

or because insufficient data were available; in a number of cases, Member States indicated their intention to include the missing flood types in future assessments.

- MS were to report the adverse impacts of past floods in terms of four main categories: human health, environment, cultural heritage and economic consequences. In most cases, the impacts of historic floods were mainly reported in terms of human health (reflecting the information on record), while the consequences of potential future floods were reported in terms of economic losses.

- To identify and quantify potential future adverse consequences of floods, Member States applied different methods. Some countries used modelling (hydrological and hydraulic), while others applied GIS analysis; for many, details about the methods were not provided.

- 16 of the 23 Member States assessed considered climate change in their PFRAs, however, the approaches used were mostly not clear.

The assessment of the FHRMs[76] found that:

- For eight Member States, there were differences between the APSFRs identified in the PFRA and those for which FHRMs were prepared.

- Some types of floods associated with the APSFRs were not included in the FHRMs. The most common source of floods mapped by Member States was fluvial (mapped in 25 Member States). The most common sources of reported historical flood events were fluvial (66% of events) followed by pluvial (20%) and sea water (16%). In terms of potential future floods, the sources reported were fluvial (76%) followed by sea water (18%) and pluvial (8%).

- Even though all Member States (except the island Member States of Cyprus and Malta) share RBs with neighbouring countries, in most cases (15) it was not clear if shared flood hazard and flood risk areas were designated and mapped and if information was exchanged[77].

[76] EU overview of methodologies used in preparation of Flood Hazard and Flood Risk Maps, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm

[77] It was subsequently (i.e. post reporting) clarified by the Member States that information was exchanged.

The 2015 FHRM assessment identified areas for improvement and provided recommendations for each Member State. In the assessment of the FRMPs, the previously identified areas for improvement were revisited. However, the majority of the FRMPs assessed do not provide explicit information if and how these issues have been addressed and if the recommendations from the 2015 assessment have been considered in the FRMPs. Although the information available in some of the FRMPs assessed suggest that progress has been made and some of the areas for improvement have been addressed, to obtain an accurate picture the assessments of the 2nd cycle PFRAs and FHRMs must be carried out first.

6.1.2. Application of Article 13

A Member States may have decided as a transitional measure for the 1st cycle of implementation of the FD not to undertake the PFRA or identify APSFRs and/or prepare FHRMs under the FD, if the country had finalised an equivalent exercise before 22 December 2010. The assessment of the PFRAs[78] indicated that Article 13(1)(a) and (b) were applied in 10 Member States:

- Latvia and Luxembourg notified the use of Article 13(1)(a) across all their territories;
- Belgium, Italy, the Netherlands and Portugal[79] notified the use of Article 13(1)(b) across all their territories;
- Denmark, Slovakia, Spain and the United Kingdom notified the use of combinations of Articles 4, 5, 13(1)(a) and/or 13(1)(b) (i.e. they applied Article 13(1) over part/s of their territory).

The assessment of FRMPs found that only a few of these Member States mentioned the application of Article 13(1) in their FRMPs. The five Italian FRMPs assessed did so, explaining that Italy used the previous Plans of Hydrogeological Status to identify areas of flood risk. Latvia's four FRMPs note that a risk assessment was carried out in 2007.

[78] European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm

[79] Portugal subsequently modified its approach and implemented Article 4.

6.1.3. Changes since the last reporting

The assessment of FRMPs and Member States reporting looked for evidence on whether Member States have updated their APSFRs or their FHRMs since their last reporting on the subject. In 9 of the 26 Member States assessed, the FRMPs refer to changes. FRMPs in Germany, Spain, Romania, Sweden and Luxembourg report modifications to the APSFRs, for example in terms of boundaries or the total numbers of areas designated. In Belgium, Croatia, Italy, Romania and Poland, some FRMPs report changes to the FHRMs, e.g. to provide information missing from the 1st. cycle, reflect updates in the APSFRs or refine the information in the FHRMs (see the box on Poland below). In seven Member States, the number of APSFRs changed between the PFRA stage and the FRMP stage (see Table 2 in section 4).

Box 8 - Example of changes to the previous steps reported in the FRMPs

In Poland, the FRMPs refer to changes in the identification of flood hazards and risks: a verification of the FHRMs was carried out in 2014; the FRMPs were based on maps that were updated in 2015 following this verification. The FRMPs explain that the flood hazard maps published in December 2013 were prepared based on a terrain model validated for the years 2011-2013. In 2014, the flood hazard maps were reviewed in connection to comments made by administrative authorities and other stakeholders, concerning inter alia, the fact that the maps did not include infrastructure and property investments completed later than the acquisition of the numerical terrain model. In the period from 22 December 2014 to 22 June 2015, further comments of administrative authorities were received regarding needs to include flood risk and the methodology used in the development of maps (including for maps for seawater flooding in terms of wavelengths). To meet these expectations, a further scenario was prepared for the FRMPs, containing updated ranges of flood risk areas in relation to the areas indicated in the FHRM in 2014.

6.2. Conclusions of the PFRAs

Nearly all Member States assessed included the conclusions of their PFRAs in their FRMPs (with the exception of France and Belgium; the latter applied Article13(1)(b) and did not prepare a PFRA under the FD). Most often these conclusions are presented as a textual description, a list or a summary of the APSFRs. Nearly all Member States provide also maps of the APSFRs designated, such as summary maps or more detailed maps of example APSFRs. In most cases, the FRMPs also provide links to websites where these and more detailed maps can be found. The Belgian and French FRMPs also include links to APSFR maps even though

they do not provide details about their PFRAs. In at least four Member States, however, the internet links provided in the FRMPs were not functional at the time of the assessment of the FRMPs. In three other cases, web-links to maps are provided only for some but not all of the FRMPs assessed.

The FRMPs in a few Member States note that, in addition to APSFRs, other risk areas were designated. One example is Latvia, where priority flood areas are designated; another is Finland, where flood areas not judged as significant were identified.

In ten of the 26 Member States assessed, the FRMPs provide information not only about the conclusions of the PFRAs but also the methodology and process of their preparation (the box below provides an example from Bulgaria.

Box 9 - FRMPs that provide information on the PFRA process

In **Bulgaria,** although the structure and level of detail of the PFRA presentation varies across the FRMPs, all four present a brief description of the PFRA, information about the main floods and their causes in the past, analysis of the potential floods in the future (e.g. causes and impacts) and a description of the designation of APSFRs. The Black Sea FRMP provides a description of the national methodology for the PFRA, including information used to model future floods. The East Aegean FRMP also provides detailed maps of the past and potential future floods together with references and sources for the analysis.

6.2.1. Inclusion of flood conveyance routes

Article 2(1) of the Directive defines flooding as "*the temporary covering by water of land not normally covered by water*." According to Articles 4 and 7(3) of the FD, Member States should include flood conveyance routes in their PFRAs and FRMPs respectively. In both Articles, flood conveyance routes are mentioned next to flood extent. This is because flood conveyance routes can be defined either as the progression of flood water downstream, or, once out of the channel (alternatively, once it has accumulated e.g. due to intense raining) as the course that flood water follows as it spreads, or extends, beyond the area that it normally covers. Depending on the source, the characteristics and the mechanism of the flood[80], whereas in a rural, flat area, flood water may spread in all directions, in an urban area with a more varied terrain (e.g. valleys) and several "obstacles" (such as buildings or large vehicles) flood

[80] Guidance Document No. 29, "Guidance for Reporting under the FD", pp. 59-66.

water may follow a narrower path, roughly along what would have been a thalweg prior to the urbanisation of the area.

The assessment of the PFRAs[81] showed that conveyance routes were one of the aspects most often not included in the PFRAs: Only six Member States provided information on the conveyance routes of historical floods. For the FRMPs as well, only some of the FRMPs assessed include explicit information about flood conveyance routes. Among these, the FRMPs of five Member States – the Czech Republic, Latvia, the Netherlands, Poland and Slovakia – provide information about the identification of flood conveyance routes. In the Netherlands, for example, conveyance is mentioned throughout the Rhine FRMP (NLRN) to highlight that rivers need more space to allow the evacuation of water. Other FRMPs mention that flood conveyance routes were considered but without providing further detail (this was the case for FRMPs assessed in Bulgaria, Cyprus, Finland, Germany and Slovenia). However, in yet other FRMPs assessed, no references to flood conveyance routes were found.[82]

Box 10 - Using the PFRA in the development of FHRMs: examples from Austria and Cyprus

In **Austria,** the FRMP reports that the PFRA and the identified APSFRs were used as the basis for developing the FHRMs; some additional sources of information were also consulted (results from run-off models, zoning/hazard zoning according to Austrian law, hazard zoning plans according to the 1975 forestry law, and the floods zoning for Austria). The FRMP states that the flood hazard maps cover more areas than the APSFR if possible, but it is not specified how much more or which areas in addition to the APSFRs.

In **Cyprus**, the PFRA created a database of valuable information about past flooding events, their gravity, extent, location, frequency and the subsequent impacts on the population, the economy and the environment. The PFRA process contributed to the identification of existing drainage and flood-relief mechanisms and provided a detailed depiction of current land uses in Cyprus, particularly in relation to sources of flood. The codification and examination of these data, in combination with climate change considerations, was used in the identification of APSFRs. The PFRA and APSFRs were then used as the basis for developing the FHRMs.

[81] European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm

[82] Some Member States, including Austria and Italy, note that conveyance routes were considered in the FHRMs though they were not referred to in the FRMPs assessed. E.g. in Italy, conveyance routes are used to define measures.

The reasons why conveyance routes were one of the aspects often not included in the FRMPs (and PFRAs) are not clear. Possible explanations could be little or no information on past floods, uncertainty about the probability (or the most likely location) of natural or flood defence exceedance (or failure); not accurate enough digital models of the terrain or the built environment; not powerful enough hydrodynamic models.

6.2.2. Information how the PFRA was used in the development of the FHRMs

Although the level of detail provided across Member States varies, in most cases the results of the PFRAs were used to inform the FHRMs and FHRMs were prepared for the APSFRs identified during the PFRA: This process is described in the FRMPs of 15 of the 26 Member States. The FRMPs of some Member States provide also information on how the FHRMs were prepared based on the PFRAs (see the box above) or how the preparation of the FHRMs resulted in some updates of the PFRA/APSFRs (see the box below for examples).

Box 11 - Updating the APSFRs in the FHRM process: examples from Hungary and Luxembourg

In **Hungary,** the flood risk modelling that was used for the PFRA has been updated to take into account recent infrastructure (such as roads) and buildings in the floodplain. A 2D numerical modelling technique[83] was introduced and applied to calculate the potential flooding, and this work required updating of the information based on the flood basins, resulting in some modifications of the PFRA results. For the FHRMs, Hungary revised the design flood protection levels[84] on all rivers that were the subject of mapping: the new levels draw upon the modification of the findings of the PFRA.

In **Luxembourg,** the FRMP reports that some recalculations were performed on the maps for some APSFRs. Recalculations of mapping data involved consideration of additional measures (extended re-naturalisation measures in the Alzette APSFR A01, and ecologically oriented flood protection measures in the Sauer APSFR A03); and in some locations more detailed modelling using a two-dimensional water level model (Nordstad in A01, Roudbach/Attert confluence A12/A11). These updates were undertaken in the maps made available to the public in 2014.

[83] A 2D numerical model was applied as, according to the FRMP, this is the only technique with which interim changes could be tracked effectively and the calculations could be run taking into account the new circumstances.

[84] Design flood level is the water level for the base flood used in planning for Hungary's FRMP, this refers to the water level for a 1% probability flood (based on a flow rate at a given section of the river for the 1% probability flood)

6.3. Conclusions from the FHRMs

Nearly all Member States assessed reported the conclusions of the FHRMs in their FRMPs (with the exceptions of France and Malta). Most often these conclusions are presented as a short textual description or explanation and links to websites where the maps can be found (it should be noted that the French FRMPs assessed contain links to FHRMs even though details about these maps are not provided). Some FRMPs reproduce examples of FHRMs. The internet links provided in some FRMPs were not functional at the time of the assessment: this was the case for all FRMPs assessed in six Member States and for some but not all of the FRMPs assessed in four other Member States.

Box 12 - A web site on risk management for the public

In **the Netherlands**, FHRMs can be seen found on a web site – http://www.risicokaart.nl – that provides the public with information on flood risks and other risks, including hazardous substances, fires and nuclear accidents. Online maps can be accessed by entering a local address. The web site also provides information on preparation in case of a flood, alert networks and actions to take during a flood event. A similar website exists in the United Kingdom: https://www.gov.uk/check-flood-risk

6.3.1. Flooding sources

As noted above, the assessment of Member States' PFRAs noted that in many cases, not all conceivable flood sources were explicitly considered. The assessment of FRMPs found a continuation of this practice: The majority of the FRMPs assessed provide only limited information about the sources of floods considered, likely making the implicit assumption that the sources considered in previous steps of the cycle are carried over. In few cases, namely Belgium, Malta and Romania, the FRMPs assessed do not provide any information concerning the sources of floods considered, while in Bulgaria's case, the information is provided in some but not all FRMPs assessed. Many of the FRMPs assessed mention flood sources without explanation why some types of floods have not been included – this is the case for the FRMPs from 12 Member States.

The assessment of the PFRAs[85] indicated that four Member States had not included any information on sources of flooding in their flood risk assessments since they applied Article

[85] European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm

13(1)(b). All other Member States, except for Luxembourg[86], had considered fluvial floods in their assessments. Thirteen Member States had considered all five types of flooding sources – fluvial, pluvial, groundwater, seawater and floods from artificial water bearing structures (AWBS)[87]; of these, only four Member States considered all five types of floods as significant, while for five Member States there was no information why some types of considered were significant or not. Of the other countries, eight Member States provided explanation why some types of flooding sources were not considered as significant while seven countries excluded some types of flooding without providing a justification[88].

Considering the sources of flooding for which FHRMs were prepared, the assessment of the FHRMs[89] analysed information for 26 Member States (Bulgaria and Greece were late with the reporting) and found at the time that all Member States[90] prepared maps for fluvial floods. In addition, 17 Member States prepared maps for seawater floods, 14 for pluvial floods, 9 for floods from AWBS and only 4 for groundwater floods[91].

Explanations or justification of the choice of flooding sources included in the FRMPs were found only in the FRMPs of some Member States including Austria and Denmark (described in the box below) as well as Cyprus, Luxembourg and Sweden. Hungary, Slovakia and Slovenia report covering 'all relevant' sources of floods either separately or together, while the Portuguese FRMPs explain that additional sources of flooding will be considered in the next management cycle.

Box 13 - Examples of explanations which sources of floods have been included in the FHRMs

In **Austria,** fluvial and pluvial floods are considered significant. However, no APSFRs have been designated so far for pluvial flooding, as these are very local events in Austria, and the uncertainties were considered too high. Floods from groundwater and artificial water bearing structures are not considered significant, and again no APSFRs have been designated. Hence, APSFRs have been designated only for fluvial floods (including floods from lakes) and as a result FHRMs have been

[86] Subsequently Luxembourg clarified that it was in fact fluvial flooding that was considered.
[87] Table 10 in European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, p.40, link as above.
[88] Table 13 in European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk, September 2015, pp.49-50.
[89] EU overview of methodologies used in preparation of Flood Hazard and Flood Risk Maps, September 2015, available at: http://ec.europa.eu/environment/water/flood_risk/overview.htm
[90] Except Luxembourg, however, as noted in an earlier footnote, it was fluvial flooding also for Luxembourg.
[91] Table 3.1 in EU overview of methodologies used in preparation of Flood Hazard and Flood Risk Maps, September 2015, p.19.

produced only for this type of floods.

In **Denmark,** the FHRMs in all FRMPs assessed cover only fluvial and seawater floods. Neither in the FRMPs assessed, nor in the national web-GIS, are there maps for groundwater floods or floods from artificial water bearing structures (according to the PFRA assessment, the latter are not relevant for Denmark; information was not found, however, to indicate if groundwater floods could be relevant[92]). Pluvial flooding was not assessed at the PFRA stage. Nevertheless, for one of the five municipal FRMPs assessed a local map was prepared showing the combined effect of flooding from seawater, fluvial and pluvial sources.

Considering the information available in the FRMPs assessed (a summary is provided in the following table) the most significant source of flooding in the majority of the Member States is fluvial floods. Some Member States considered also seawater floods or the combined effects of multiple sources of floods (in fact Slovenia and Slovakia presented only the combined effects of different types of floods). Overall, few Member States considered pluvial and groundwater floods or floods from artificial water bearing structures.

Table 6 Types of flooding sources reported in the FRMPs assessed per Member State

MS	Fluvial	Pluvial	Seawater	Ground-water	AWBS	Other sources	Multiple sources
AT	✓		Not relevant				
BE[93]	NA	NA	NA	NA	NA	NA	NA
BG	✓		✓				
CY	✓						
CZ	✓	✓	Not relevant	✓	✓		
DE	✓		✓				✓
DK	✓	✓	✓				
EE[94]	NA	NA	NA	NA	NA	NA	NA
ES	✓		✓				✓
FI	✓		✓				
FR	✓		✓				
HR	✓	✓	✓		✓	✓	✓
HU	✓	✓	Not relevant	✓	✓		
IT	✓		✓				

[92] European Commission, Assessment of Flood Hazard and Flood Risk Maps Member State Report: DK – Denmark, 2015. Available at: http://ec.europa.eu/environment/water/flood_risk/pdf/fhrm_reports/DK%20FHRM%20Report.pdf

[93] At the FHRM stage, Belgium prepared maps for fluvial, pluvial, sea water, groundwater and AWBS floods.

[94] At the FHRM stage, Estonia prepared maps for fluvial, pluvial and sea water floods.

MS	Fluvial	Pluvial	Seawater	Ground-water	AWBS	Other sources	Multiple sources
LT	✓		✓		✓		✓
LU	✓		Not relevant				
LV	✓	✓	✓		✓		✓
MT[95]	NA	NA	NA	NA	NA	NA	NA
NL	✓		✓				
PL	✓		✓				
PT	✓						
RO[96]	NA	NA	NA	NA	NA	NA	NA
SE[97]	✓				✓		
SI	(✓)	(✓)	(✓)		(✓)	(✓)	✓
SK	(✓)	(✓)	Not relevant	(✓)			✓
UK	✓		✓		✓		

Sources: Member State reporting and FRMPs.
Notes: AWBS=Artificial Water Bearing Structures; NA=Not available (i.e. information was not available in the FRMPs assessed, footnotes were added based on the 'EU overview of methodologies used in preparation of Flood Hazard and Flood Risk Maps' report); (✓)=the flood type was considered through the assessment of 'multiple sources' of floods.

6.3.2. Using the FHRMs in the development of the FRMPs

The FRMPs assessed, along with Member States reporting to WISE, provide some information in nearly all Member States on how the FHRMs were used to prepare the Plans themselves (with the exception of Croatia and Malta whose FRMPs do not describe how the FHRMs informed the plans).

Many FRMPs refer to the FHRMs informing the definition of the measures. Some Member States report that the FHRMs informed the setting of objectives or priorities and the public participation process (for an overview see the following table).

Table 7 Use of the FHRMs in the development of the FRMPs per Member State

MS	Setting FRM priorities	Setting FRM objectives	Defining FRM measures	Public participation process
AT			✓	
BE	✓		✓	
BG	✓	✓	✓	
CY		✓	✓	

[95] At the FHRM stage, Malta prepared maps for pluvial floods.
[96] At the FHRM stage, Romania prepared maps for fluvial and pluvial floods.
[97] In Sweden, separate maps for floods from AWBS were produced but these were not included in the FHRMs.

MS	Setting FRM priorities	Setting FRM objectives	Defining FRM measures	Public participation process
CZ	✓	✓	✓	✓
DE		✓	✓	✓
DK	✓	✓		
EE	✓	✓	✓	✓
ES	✓		✓	✓
FI	✓	✓	✓	✓
FR	✓		✓	✓
HU	✓	✓	✓	✓
IT			✓	
LT	✓	✓	✓	✓
LU			✓	✓
LV	✓	✓	✓	✓
NL	✓			✓
PL			✓	✓
PT	✓		✓	✓
RO	✓	✓		✓
SE	✓	✓	✓	✓
SI				✓
SK	✓	✓		
UK	✓		✓	✓

Sources: Member State reporting and FRMPs.
Notes: FRM=Flood Risk Management; information not found in the FRMP for Malta; in Croatia the FHRMs informed the assessment of potential damages.

Despite these references, few FRMPs provide a detailed explanation of the role FHRMs played in the preparation of the Plans.

Box 14 - Using the FHRMs in the development of the FRMPs

In **Portugal**, all FRMPs include a standard text regarding the relevance of the FHRM work and its results for the definition of the FRMP. In four of the FRMPs assessed[98] it is clearly stated that the FHRMs have been used to define and prioritise flood risk measures and their type (although it is not clear how the maps guided the definition of objectives). The measures were devised and prioritised considering the damages identified in the FHRMs, and in particular addressing the significance of: human lives at jeopardy, potential damage to the environment, potential damage to infrastructure and potential damage to hazardous industry.

In **the United Kingdom**, the English FRMPs assessed (Solway Tweed for the English part of UK02

[98] Portugal subsequently clarified that this approached was applied for all mainland FRMPs.

and Severn, UK09) state that in developing the proposed measures, conclusions were drawn from FHRMs which help to identify risks and opportunities. In the Scottish strategies assessed (Clyde and Loch Lomond in UK01 and Solway in the Scottish part of UK02), it is stated that the FHRMs helped inform the selection of measures to manage flood risk in Potentially Vulnerable Areas. Target areas within the Potentially Vulnerable Areas have been set to focus measures.

6.4. Coordination with other Member States and third countries

6.4.1. PFRA/APSFR stage coordination

The assessment of the PFRA and FHRM stages found that inter-MS provision of information was lacking regarding transboundary cooperation[99], including on the existence of shared flood risk areas. The FRMPs assessed provide some information on this topic. Nearly all Member States which share UoMs with neighbouring Member States report that coordination took place during the PFRAs, even though common transboundary APSFRs were hardly identified. In fact, references to shared APSFRs were found in the FRMPs of only two Member States assessed: Bulgaria (APSFRs shared with Greece to the south and Romania to the north) and Finland (APSFRs shared with Sweden). This is contrary to at least one international FRMP, where transboundary APSFRs were identified. Considering the transboundary nature of significant flooding, this apparent contradiction should be resolved in the direction of appreciating the whole extent of an APSFRs' area of influence (upstream and downstream), as opposed to resorting to exclusively nationally defined APSFRs.

In most cases, the FRMPs assessed, as well as Member States reporting, refer to coordination on flood risk management through the river commissions for international RBs. In some cases, coordination under bilateral agreements is also reported, for example between Germany and the Netherlands. The FRMPs for both Bulgaria and Slovenia, for example, describe bilateral meetings with neighbouring Member States and, in Bulgaria's case, also with third countries.

6.4.2. FHRM stage coordination

As noted above, very few assessed FRMPs refer to shared APSFRs, which would require preparation of joint FHRMs. The FRMPs in Bulgaria and Finland provided an overview of work on joint FHRMs (see the box below).

[99] The Member States subsequently clarified that the absence of information was an omission and that there exists transboundary cooperation, as was later largely confirmed by the assessment of national and international FRMPs.

In other Member States, FRMPs indicate that information on FHRMs was exchanged with neighbouring countries and via international RB commissions. Luxembourg's FRMP, for example, refers to close co-operation with neighbouring Member States within international RB commissions as well as within an Interreg project called TIMIS Flood (Transitional Internet Map Information System on Flooding).

Box 15 - Examples of international coordination on joint FHRMs

In **Bulgaria**, FHRMs were prepared for all risk areas shared with other Member States in transboundary UoMs. The development of the FHRMs for these two transboundary APSFRs was coordinated and based on mutually agreed methodologies within the international Danube RB, and with Greece. The Danube FRMP explains that the FHRMs for the Bulgarian area of the Danube were prepared as part of the project Danube Floodrisk[100], which included all countries from the ICPDR as partners to the project. As part of the project all national methodologies were coordinated and a common database with all necessary data was set up. The preparation of the FHRMs for the transboundary area with Romania was bilaterally coordinated at each step of the preparation. The preparation of the FHRMs for the transboundary APSFR shared with Greece was coordinated by the technical sub-group to the joint expert group under the Joint Declaration for Cooperation in the Area of Water Management with Greece. At its meetings, the methodologies of the two countries were discussed, a common methodology (e.g. concerning the scenarios to include) for the development of the FHRMs in the transboundary areas was agreed and necessary data exchanged.

In **Finland**, the only international UoM analysed in detail for this assessment is Tornionjoki (FIVHA6), shared with Sweden, with an APSFR shared on both sides of the border. In this catchment, flood maps were elaborated in co-operation with Swedish authorities. In the FRMP summary, it is indicated that the Finnish-Swedish Transboundary River Commission and the Swedish authority MSB (*Swedish Civil Contingencies Agency*) gave their written opinions on the designation of the APSFR. Moreover, in the FRMP it is explained that a joint Interreg IV A project, "Detailed inundation planning in the lower part of Tornio River", carried out from 2009-2012, estimated flood risk. A specific coordination body was not formed for the FRMP; rather, coordination work was carried out by the authorities of both regions and via the Finnish-Swedish Transboundary River Commission. The corresponding **Swedish** FRMP also refers to the Interreg IV A project, but provides fewer details.

[100] http://www.danube-floodrisk.eu/

6.5. Summary of good practice and areas for further development

In terms of **good practices**, the FRMPs of all Member States assessed provide information about the previous steps of the flood risk management cycle, and nearly all provide conclusions from the PFRAs and the FHRMs together with maps of APSFRs and examples of FHRMs (even if in some cases the maps are provided only via web-links). Some Member States provide details about the process of preparing the PFRAs and the FHRMs. A few Member States (including Bulgaria, Finland and Luxembourg) provide detailed descriptions of coordination during the PFRA and FHRM stages with neighbouring Member States and third countries.

Areas for further development identified in the FRMPs assessed include the following:

Although Member States often state that the PFRAs and the FHRMs informed the development of FRM priorities, objectives and measures, details how insights from previous phases were used are missing in many of the FRMPs. For instance there appears to be room for progress in estimating flood conveyance routes.

Some countries do not provide links to websites where all maps of APSFRs or FHRMs can be found while in some cases, the web-links provided in the FRMPs are no longer functional.

Although most Member States provide at least some information about the sources of flooding considered in the FRMPs, this information is not available in all FRMPs assessed and in some cases the omission of some conceivable sources of flooding is not explained or clearly justified.

Considering the transboundary nature of flood risk, some Member States nevertheless do not provide details on international coordination during the PFRA and FHRM phases in their FRMPs.

On this basis, the following recommendations can be made for the preparation of the second FRMPs:

- In the next cycle, Member States should provide more information on the main sources of flooding identified, on how the results of the PFRA and FHRM steps were used in the preparation of the FRMPs (including conveyance routes) and on the approach to international coordination for the prior steps of the risk management cycle as well as the Plans themselves.

- Online access to PFRA/APSFR information and FHRMs should be provided and maintained in order to preserve and make available the full context within which the FRMP is developed and implemented.

- The full extent of an APSFRs' area of influence (upstream and downstream) should be considered with a view to identifying APSFRs with a transboundary dimension; this aspect is also relevant in deciding on measures.

7. Setting objectives for the management of flood risks

The FRMPs should describe the objectives for the management of flood risk for the APSFRs identified. These objectives should focus on reducing the "potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity" (Article 7(2) of the FD). Where appropriate, the objectives should also focus "on non-structural initiatives and/or on the reduction of the likelihood of flooding".

To appreciate by when objectives are to be achieved, they need to be measurable, if possible with clear targets and a timeframe for their achievement: if this is the case, quantitative indicators can be defined to monitor progress towards the targets.

7.1. Overview

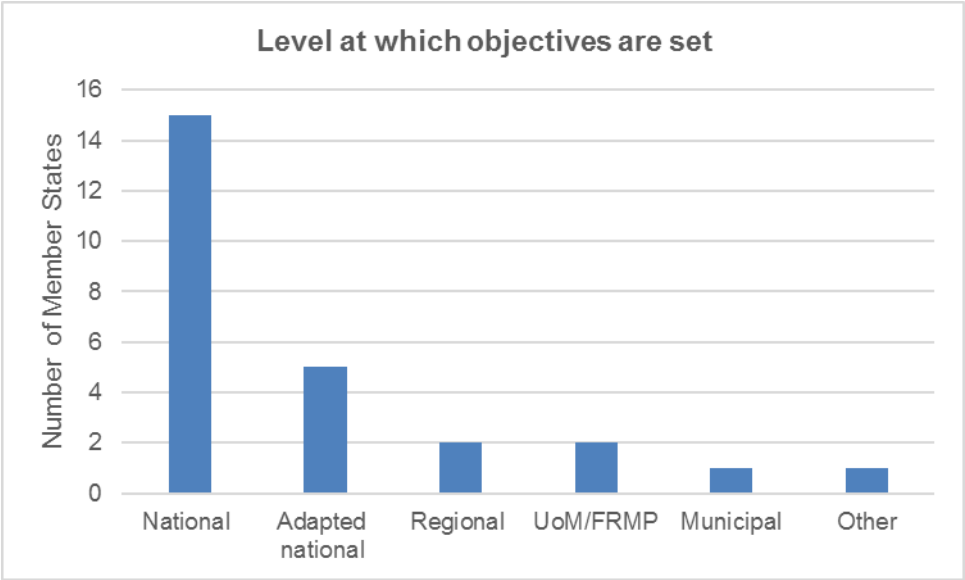
7.1.1. Administrative level at which objectives are set

All Member States assessed have set objectives in their FRMPs[101]. Figure 9 below shows the level at which the objectives are set across the 26 Member States that reported in time for inclusion in the assessment.

Objectives are set at national level in 15 of the 26 Member States where all FRMPs have the same objectives (or in the case of Austria, Hungary, Cyprus, Croatia, and Malta, a single national FRMP). Portugal follows a nearly national approach: Common objectives were set for the FRMPs covering the mainland UoMs, and these were also adopted in one autonomous island region (Madeira, PTRH10); the other autonomous island region (Azores, PTRH9) set its objectives independently.

[101] Only one exception has been identified: One of Denmark's 20 municipal FRMPs was at a "strategic level" (taken to mean that its provisions need not be very detailed) and does not contain objectives.

Figure 9 Level at which FRMP objectives are set



Source: Member State reporting and FRMPs.

In five Member States – Estonia, France, Germany, Spain and Sweden (see box below) – a set of national objectives is adapted at the level of individual FRMPs. In France, three objectives are set in a national floods policy; the FRMPs, which are prepared at UoM level, refer to these objectives and also set their own. In Germany, one of the five FRMPs assessed – for Bavaria's Danube FRMP in DE1000 – further articulates the four national objectives into six "action objectives"; two other FRMPs assessed – the Elbe UoM (DE5000) and the Schlei/Trave UoM (DE9610) both identify three further objectives (for example, one further objective is to "take into consideration the interests of regionally responsible actors". In Spain, eight national objectives are set, and the FRMPs then prioritise these based on their local situations.

Box 16 - Adapting national objectives to the level of the FRMP

In **Sweden** there are four national objectives which are then refined further in each FRMP into specific objectives, measure related objectives and knowledge objectives with the result of each FRMP having a slightly different set of objectives.

The five FRMPs assessed use the structure of three objective 'types' in different ways:

- The FRMP for Älvsbyn defines 9 specific objectives;
- The FRMP for Falun has 30 objectives, including specific, measure-oriented and knowledge objectives;

- The FRMP for Karlstad presents 16 specific and knowledge objectives but no measure-oriented objectives;
- The FRMP for Kristianstad has 17 objectives, including specific, measure-oriented and knowledge objectives;
- The FRMP for Stockholm defines 14 specific objectives.

In two of the 26 Member States, objectives are set at regional level: Belgium and the United Kingdom (for the latter, "regional" level refers to the four jurisdictions of England, Northern Ireland, Scotland and Wales). In one Member State, Denmark, FRMPs were prepared at municipal level, and each municipality set separate objectives.

Objectives were set at UoM/FRMP level in only two Member States: in Finland, where each FRMP, prepared for a sub-UoM catchment, sets its own objectives; and in Italy, where objectives are set for each FRMP (some FRMPs are prepared at UoM level and others at RBD level – in Italy the two designations in most cases have different geographical boundaries). In Italy, however, all but three UoMs follow a similar approach recommended at national level, with objectives set for the four themes of reducing adverse consequences to human health, economic activity, cultural heritage and environment. In figure 9 above, the one "other" refers to Portugal, where mainland UoMs take a national approach, while the islands take a regional/UoM approach (although Madeira identifies the same objectives as those on the mainland).

7.1.2. Structure and number of objectives

In addition to setting objectives at different geographical scales, several Member States have used a two-level approach for their objectives. For example, in Croatia, two main objectives are set, which are neither specific nor measurable, but are accompanied by two strategic aims which are indeed specific and measurable. Poland has set three main areas for its objectives: (1) halting any increase in flood risks, (2) reducing existing flood risks and (3) improving the management system for floods. Under these three areas, more detailed objectives are set. This approach is seen in eight Member States, around a third of those assessed (in three of these Member States, namely Belgium, Germany and the United Kingdom, a two-level approach is used in some but not all FRMPs).

In terms of the number of objectives, some Member States set a few broad objectives: an example is seen in the box below on Austria. Other Member States present a larger number,

often of more specific sub-objectives, in their FRMPs: Table 8 showing the objectives for Bulgaria provides an example.

Box 17 - Flood risk management objectives

The FRMP's objectives in **Austria** are based on the "*Hochwasserrisikokreislauf*" (flood risk cycle), which itself is based on the disaster risk management cycle (response/rehabilitation and reconstruction/prevention and mitigation/preparedness). From this, four generic objectives are formulated:

1 Avoidance of new risks prior to a flood event.

2 Reduction of existing risks prior to a flood event.

3 Reduction of adverse consequences during and after a flood event.

4 Strengthening the awareness of hazard and risk.

Table 8 Bulgaria's national objectives and their sub-objectives

Objective	**Sub-objective**
1.Protecting human lives and public health	1.1 Minimising the number of people hurt or impacted by floods;
	1.2 Ensuring the fast conveyance of waters from urban areas in cases of intensive rainfall or floods;
	1.3 Re-establishing normal living conditions
	1.4 Minimising the number of impacted social infrastructure
2.Higher level of protection of the critical infrastructure and businesses	2.1 Improving the protection of the technical infrastructure
	2.2 Improving the protection of important economic and cultural and historic sites
3.Increasing the protection of the environment	3.1 Improving the protection of the sewerage systems;
	3.2 Improving the protection of industrial sites (mainly IPPC and SEVESO sites);
	3.3 Minimising the impacted areas for protected waters, protected territories and protected zones;
	3.4 Improving the water retention capabilities of agricultural, forest and coastal areas.
4.Improving the preparedness and reactions of the population:	4.1 Increasing the preparedness of the population in case of floods
	4.2 Improving the reactions of the population in case of floods

5.Improving the administrative capacity for flood risk management	5.1 Creating a modern normative base for territorial planning and FRM
	5.2 Providing operative information for FRM
	5.3 Enhancing the qualification/skills of the personnel responsible for FRM
	5.4 Minimising the flood risk along the water route of the whole RB
	5.5 Ensuring the adequate reactions of the public institutions in case of floods

This variety shows the different ways in which Article 7 of the FD has been implemented in the various Member States, with adaptation to local circumstance and context, including their geographies, administrative flood risk management structures and policy or methodological legacies.

Since risk is generally defined as the product of "impact x likelihood", the two following sections examine how these two dimensions were considered in objective setting (cf. Article 7(2) and point 2 in the preamble of the FD).

7.1.3. Objectives to reduce adverse consequences from floods

The FD calls for objectives to address the "potential adverse consequences of flooding". This is the case for the objectives in all the FRMPs assessed[102].

For ten of the Member States assessed[103], strong evidence was found that the objectives specifically consider all four areas cited in the Directive: human health, economic activity, environmental, and cultural heritage: in other words, these are specifically cited in the objectives (see Figure 10 below). In Latvia, for example, the overall objective of flood risk management across four FRMPs is to reduce adverse consequences of floods on human health, environment, cultural heritage and economic activities, including the reduction of potential surface water pollution and of erosion processes along the sea, rivers, and lake shores.

For 16 other Member States, the evidence was considered less strong, and one or more of these four areas were not explicitly cited. In Hungary, for example, the FRMP states that the objectives address adverse consequences to human health first, and environment and economic activity second; cultural heritage is not specifically mentioned. In Denmark, all 20 municipal

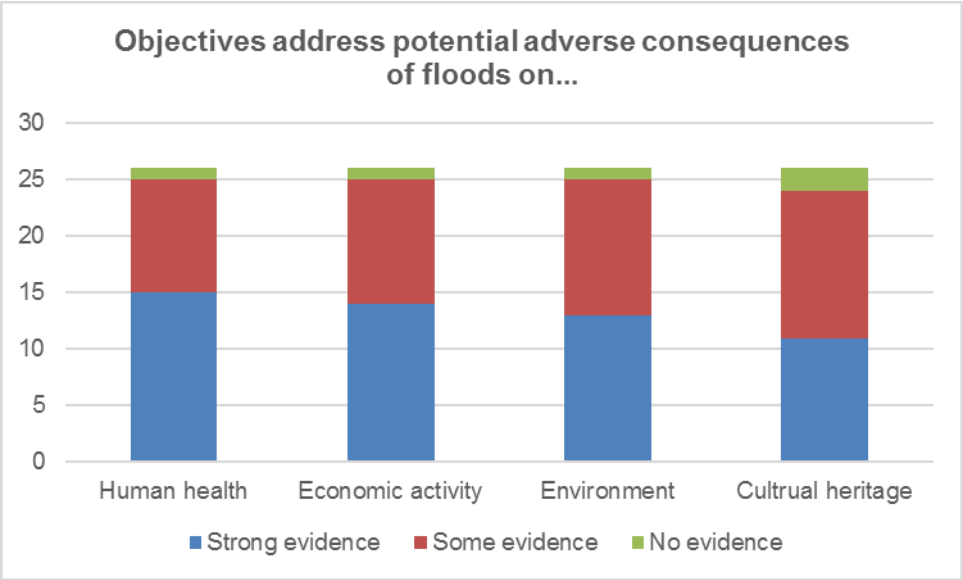
[102] It should be noted that in Malta the objectives refer to specific actions to be taken rather than broader goals such as reducing adverse consequences of flooding. However, Maltese confirmed that the primary objective for the development of the FRMP was to reduce such potential adverse consequences

[103] Bulgaria, the Czech Republic, Estonia, Finland, Germany, Italy, Lithuania, Luxembourg, Romania and Sweden.

FRMPs call for reducing adverse consequences of flooding; however, not all refer explicitly to consequences on human health, economic activities, cultural heritage or the environment.

In several FRMPs, quite specific objectives are developed for these areas. For example, in Lithuania, the third objective of the FRMPs is that "no new significant pollution sources that may be hazardous to the environment and public health shall be established in low probability flood zones (0.1% of probability)". In Romania, national objectives include the goal to minimise flood risks on transport infrastructure, and the following indicator is identified for this objective: Length and importance of the transport infrastructure (roads, railways, railway stations, ports, airports, etc.) exposed to flood risk.

Figure 10 Evidence that FRMP objectives address potential adverse consequences of floods



Source: Member State reporting and FRMPs.

Somewhat fewer objectives address cultural heritage. One example is seen in Italy, where the FRMP for Sardinia (ITR201) sets two objectives for cultural heritage: Mitigation of possible damages to the landscape system; Safeguarding archaeological and architectural sites, historical and artistic heritage, monuments, museums.

7.1.4. Objectives to reduce the likelihood of flooding

For the second dimension, i.e. objectives to explicitly address the reduction of the likelihood of flooding, these were almost equally referred to by the MS, but on the whole represented less prominently in the FRMPs assessed: Thus, strong evidence was found in the FRMPs of 9 of

the 26 Member States assessed, and some or weak evidence in 15 Member States, with no evidence in two Member States[104]. Reducing the likelihood of flooding would mean fewer cases where there is natural or defence exceedance. This could for example be via a reduction in peak flows (through for instance natural water retention upstream), instead of, or next to, reinforcing defences. This finding should warrant closer attention in the 2nd cycle of implementation.

Examples of Member States that set objectives in this area include Slovenia, whose FRMP also links the objective for the reduction of the likelihood of flooding to measures related to proper planning, construction and the management and maintenance of infrastructure for protection from adverse effects of flood waters, among others. Further, both Austria and Germany call for the mitigation of existing risks prior to a flood event and the mitigation of new risks. In addition, the Czech Republic set the reduction of the likelihood of flooding as one of the two strategic objectives. This is further addressed by a specific objective, reduction of flood danger (through implementation of measures aiming at flood retention, flood peak reduction, increase of natural water retention, implementation of good agricultural and forestry practices enabling water retention and proper rainwater management in urban areas).

In a few Member States, objectives refer to specific initiatives to reduce the likelihood of flooding, and the focus there seems to be on protection from flooding. For example, some of the municipal FRMPs in Denmark call for improving infrastructure, such as sea dykes, to reduce the likelihood of flooding. Other Danish FRMPs identify a level of protection to achieve: The Solrød FRMP defines a target of protection against 2.8m sea level rise for its infrastructure, equivalent to a 1000-year return interval event for some areas.

7.1.5. Objectives for non-structural initiatives

A majority of the Member States assessed, 15 out of 26, provide strong evidence that their objectives call for non-structural initiatives, such as improving the process of flood risk management, addressing flood issues in land use planning or raising awareness amongst the population. In Bulgaria, for example, two objectives call for improving the preparedness of the population for floods and the reactions of the population in flood events; in addition, five objectives call for improving administrative capacity for flood risk management, including the legal basis for territorial planning and the skills of personnel. In Latvia, an objective calls for improving the information base by developing a Flood Risk Information System and

[104] Portugal and Sweden.

improving early warning. Portugal's objectives call for improving knowledge and forecasting and also improving spatial planning and exposure management in flood risk areas.

In seven further Member States, there is some evidence for non-structural initiatives. In Italy, for example, the five FRMPs assessed did not include objectives in this area[105]; however, all five include non-structural measures. Moreover, the FRMP for the Po UoM (ITN008), the largest in Italy, calls for "improving knowledge of [flood] risk". In the United Kingdom, raising awareness of flood risks is an objective in the England and Northern Ireland FRMPs assessed, but such non-structural initiatives are not part of the objectives for the equivalent documents assessed for Scotland; it should be noted although that in Scotland, non-structural initiatives are a mandatory consideration in the development of all measures.

Finally, in four Member States, the objectives do not specifically call for non-structural initiatives.

7.2. Specific and measurable objectives

From the second cycle onwards, FRMPs should include an assessment of the progress made towards the achievement of the objectives set (Annex of the Directive). Defining objectives with at least some degree of specificity – and linking measures with objectives – would aid this assessment of progress. To be specific, an objective should provide clear information on what should be achieved, on the location where it should be achieved and on the timetable for achievement. To be measurable, it should be possible to express the objective in a quantitative form; ideally, a target should be set.

The objectives in 12 Member States include at least some specific and measurable elements. This is the case for all objectives set in the Finnish FRMPs assessed (see the box below).

Box 18 - Measurable objectives

In **Finland**, some objectives set quantitative targets to be achieved (e.g. number of flooded dwellings, economic damage from floods, and number of days key services are disrupted by floods) and clear locations where the objectives will be achieved (e.g. which APSFR). It is clear how some of the objectives will be achieved (e.g. by specifying measures) but there is no information by when.

The FRMPs assessed include quantifiable objectives which cover all dwellings or sites hard to

[105] Although it must be noted that all FRMPs assessed include non-structural measures.

evacuate. For example, in the FRMP of Kokemäenjoki catchment area (part of FIVHA3) an objective is set that all permanent housing in the flood risk area is protected from floods or preparedness to floods is such that the health and safety of people are not compromised.

Numerical targets are not common. Nevertheless, one example is found in the FRMP of Hamina and Kotka coastal area (part of FIVHA2), where an objective sets the maximum hours of power, heat, water and telecommunication loss due to floods.

Some Member States have linked indicators to their objectives, making them more specific and measurable: this is the case in Bulgaria and Romania (see the box below). On the other hand, in Poland, the FRMPs set out common indicators to monitor the achievement of the three objectives, although the objectives themselves do not contain targets.

Box 19 - Indicators to measure the achievement of objectives

Romania has identified quantitative indicators for each of its national objectives. Examples include: number of inhabitants exposed to floods, transport infrastructure exposed to floods, agricultural land exposed to floods; number of museums, churches and monuments exposed to flood risk; number of areas under the IPPC – IED, Wastewater and Seveso II Directives that are subject to flood risks. For each indicator, a minimum and an 'aspirational' target is set.

Bulgaria also identified indicators for its national objectives: for example, objective 1.4 is to minimise the number of social infrastructure facilities affected by floods, and the indicator for this is "the number of social infrastructure facilities potentially impacted by floods with a 1% probability of occurrence". However, a time frame for achieving these objectives is not set.

In little over half of the Member States assessed – 14 out of 26 – the objectives are neither specific nor measurable. Many Member States have set objectives in general terms: For example, Germany's national objectives include the reduction of adverse consequences during a flood event and the reduction of adverse consequences after a flood event. In Spain, one of the eight general objectives is more specific compared to Germany's example above, to "increase the perception of flood risk and self-protection strategies on the part of the population and social and economic agents", however not measurable.

7.3. Setting the objectives: coordination

The FRMPs in several Member States describe the process for setting objectives; however, most FRMPs assessed have at best brief information on this topic.

In several Member States, the FRMPs refer to discussions among government bodies. In Germany, for example, the overall objectives for all plans were set by LAWA, the Working Group on water issues of the Federal States and the Federal Government[106], and thus were agreed among the Federal States and the Ministry of Environment. In Romania, the objectives were coordinated at national level by the working group set up to develop the FRMPs, which included specialists from the Romanian Waters, RB Administrations, and the National Institute for Hydrology and Water Management.

Other Member States refer to discussions at international level: Luxembourg's FRMP refers to coordination with the international commissions for the Meuse[107], Mosel-Saar[108] and Rhine[109]; Hungary's FRMP refers to coordination with the international commission for the Danube[110]. Only one plan, Finland's Tornionjoki FRMP (FIVHA6) refers to bilateral coordination: Finland shares this international UoM with Sweden, and objectives were coordinated between the authorities of the two Member States.

With regard to consultation with the public and stakeholders, most FRMPs assessed did not explicitly state that consultation was undertaken on the objectives themselves. On the other hand, several did note, for example in Croatia, that the objectives were part of the general public and stakeholder consultations carried out on the FRMP. However, one example is seen in Italy's Eastern Alps FRMP (ITA), where stakeholder workshops covered a series of topics, and early workshops discussed the FRMP's objectives. In Luxembourg public participation was an integral part of preparing the FRMP, including setting overall objectives, and identifying more detailed local objectives and measures.

In two Member States – the Czech Republic and Poland – the FRMPs state that objectives were built on the objectives of previous flood and water management plans. Bulgaria notes that a preparatory project financed by EU's Cohesion Policy supported the development of the FRMPs, including their objectives.

[106] http://www.lawa.de/index.php?a=2
[107] http://www.meuse-maas.be/Accueil.aspx
[108] http://www.iksms-cipms.org/servlet/is/392/
[109] https://www.iksr.org/en/
[110] https://www.icpdr.org/main/

7.4. Summary of good practices and areas for further development

Looking across the Member States, it is clear that there are some **good practices** – for example, addressing the likelihood of flooding and non-structural initiatives in objectives, as well as providing clear information on the process for the development of objectives – as well as some areas for further development which are highlighted in the previous sections. One main finding in terms of **areas for further development** applies to the majority of the Member States: The objectives are not specific or measurable in terms of what should be achieved, on the location where it should be achieved and on the timetable for achievement. This finding should be further evaluated, also in relation to the findings on the measures set for achieving the objectives (discussed in chapter 8).

On this basis, the following recommendation can be made for the preparation of the second FRMPs:

- For the second cycle, FRMP objectives should be as specific and measurable as possible to be able to make an assessment of progress towards the achievement of objectives set. Ideally, objectives should be SMART: Specific, Measurable, Attainable, Realistic and Timebound.

8. Measures for the achievement of objectives

At the general level, the FD states that FRMPs "*...shall include measures for achieving the objectives established…*" (Article 7(2)). The Annex of the Directive requires MS to include as a component of their FRMP/s a summary of the measures. As a consequence, at the EU level it is challenging to create representative statistics of measures across the EU. Moreover, Member States could report their measures as either "individual" or "aggregated"[111]. The following analysis therefore provides a high level illustration to appreciate the situation rather than an accurate account of measures selected by the Member States to be used for scientific analysis.

All Member States that reported provided a list of measures and summary information for each measure. The number of measures reported, however, varies significantly across the Member States from 17 568 measures in Germany[112] to 10 measures in Malta (see Table 9 below). The variance goes beyond any possible differences in size, population or flood risks assessed: For example, comparing two Member States in north-western Europe of similar populations, France reported 648 measures while the United Kingdom reported 9 391. In terms of individual or aggregated measures, here too, there is no clear pattern, with three Member States reporting only individual measures, nine reporting only aggregated measures and 14 reporting both types of measures (based on 26 Member States that reported by April 2018)[113].

Some differences in approach are explained in the FRMPs. Estonia's FRMPs, for example, set out a three-level structure of 12 "measure blocks", the broadest category, each with one or more "measure groups" (24 measure groups in total) and then 110 specific "actions"[114]. Several Member States reporting only aggregated measures, as Estonia, indicated either in their FRMPs or in subsequent communication that the measures reported incorporate a higher number of activities and projects. Most Member States however did not use a hierarchy like this for their measures.

[111] The Reporting Guidance mentions that "Measures can be reported as individual measures (recommended for major projects) or aggregated measures,…" and also notes that measures may be comprised of "many individual projects". European Commission, Guidance for Reporting under the FD (2007/60/EC), 2013, pp. 54-58.

[112] Germany reported only aggregated measures, each of which can include a set of individual actions.

[113] It is also worth noting that it appears (through comparison of reported information with the FRMPs) that several Member States did not report the, at the time, actual number of measures (as reflected in the FRMP), either because the individual situation of a Member State did not conform with a standardised reporting system, or because of an error in the reporting.

[114] Estonia reported the number of "measure groups". Due to such structures and possibly other reasons, for a few Member States the number of measures listed in the FRMPs differs from the number reported to the European Commission via WISE. Where possible, information presented here is based on WISE reporting.

Table 9 Number of measures reported by each Member State

	Aggregated	Individual	Total
AT	9 775	0	9 775
BE	184	484	668
BG	61	133	194
CY	5	33	38
CZ	55	6	61
DE	17 568	0	17 568
DK	28	0	28
EE	70	0	70
ES	1 171	192	1 363
FI	0	412	412
FR	50	601	648
HR	107	0	107
HU	46	0	46
IT	6 741	1 605	8 346
LT	61	0	61
LU	70	813	883
LV	15	81	96
MT	0	10	10
NL	116	0	116
PL	0	2 429	2 429
PT	223	76	299
RO	791	2347	3 138
SE	210	138	348
SI	40	0	40
SK	32	1 381	1 413
UK	336	9 055	9 391

Source: WISE electronic reports 2016 and 2017.

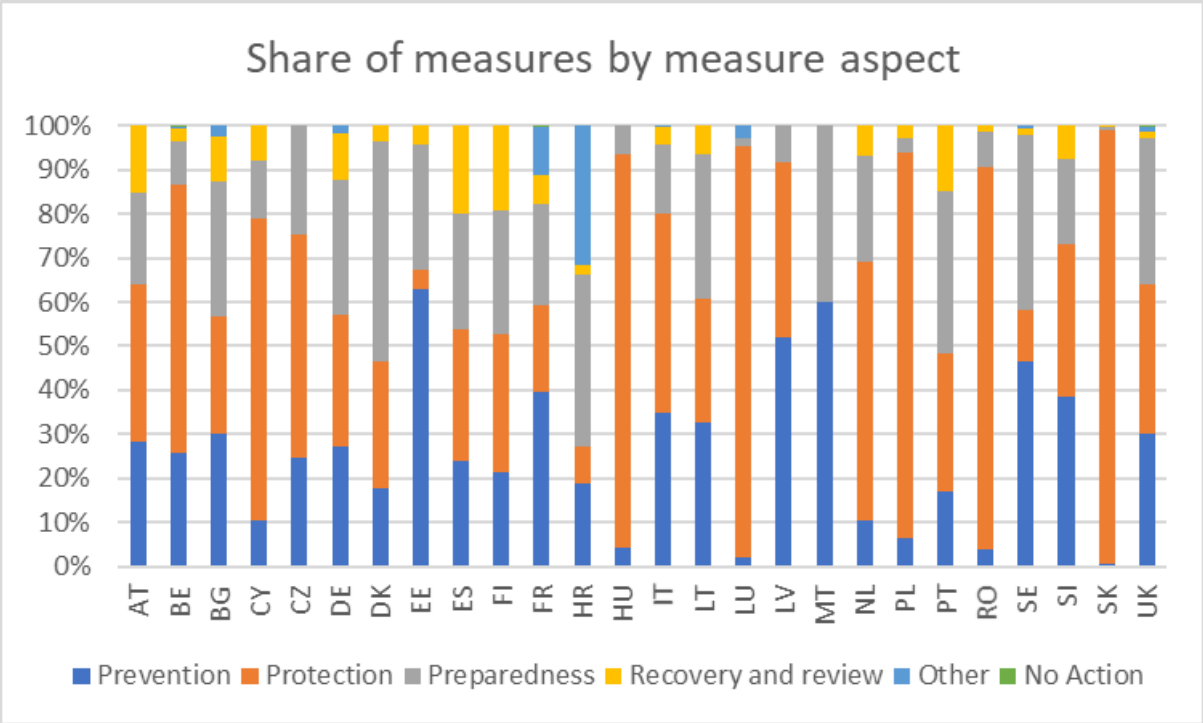
Notes: Member States including Estonia, Germany and Slovenia have indicated that the measures reported will be elaborated through a higher number of activities and projects. Croatia's FRMP, prepared at national level, contains 54 measures (53 national and one in only one of the two Croatian UoMs); in the reporting at UoM level, a total of 107 measures were indicated (54 in one UoM and 53 in the other). Italy later noted that there is a total of 8 348 measures, rather than 8 346, a reporting inaccuracy. In Latvia, the FRMPs detail 101 measures, compared to 96 measures reported to WISE.

Consequently, due to the many differences in approach, the numbers of measures cannot be compared across Member States (the sections that follow refer to shares rather than numbers of measures).

Specifically with regard to the nature of measures, the FD stipulates that FRMPs "…*shall address all aspects of flood risk management*…" (Article 7(3)). In their reporting, Member

States were requested to assign each measure to one or more aspect: prevention, protection, preparedness and recovery & review ("no action" or "other type of measure" could also be chosen)[115].

Figure 11 Share of measures by measure aspect[116]



Source: WISE electronic reports 2016 and 2017.

Note: Based on all measures reported for 26 Member States. Please note that some measures were reported for more than one aspect; all aspects reported are included.

The share of measures assigned to each aspect varies across Member States (see Figure 11 above), however, on average, 41% of measures are protection measures, 26% prevention measures, 24% preparedness, 8% recovery & review, and 1% 'other' (including the choice of "no action"). In Hungary, Luxembourg and Slovakia, the vast majority of measures are assigned to protection, while in Estonia more than half of the measures are for prevention. It is also worth noting that Member States reported 'No Action' measures[117].

[115] As Member States could assign a single measure to more than one measure aspect and measure type, there was some double-counting when counting the total measures: This occurred in nine Member States.

[116] Owing to the distinction between individual and aggregated measures – and due to the inherent difficulty in averaging across measures of a varied nature, charts such as this one are of an illustrative value.

[117] "No action" can generally be a management response to risk, provided the risk is at an acceptable, to the exposed party, level. In the context of this assessment, several Member State reported "no action" measures. In France, these included activities to gather information, for example on the resilience of existing infrastructure, and in Belgium, to delineate the role of different actors in flood management; in the United Kingdom as well,

8.1. Measurable and specific flood risk management measures (including location)

Measures are considered specific and measurable if their description is clear in terms of what they are trying to achieve, where they are to be achieved (and which area their effects will cover), how they are to be achieved, and by when they are expected to be achieved. This information will support the monitoring of implementation and the evaluation of their results.

In the FRMPs assessed, more than half of the Member States considered provided all or most of these elements in their measure descriptions. Many Member States list measures in tables that specify fields such as: location, implementation timeframe, budget, responsible entity, indicators for monitoring progress. Examples are seen in Member States including Bulgaria, Finland and Spain (see the box below). In Austria, a catalogue of measures and a background document provide these elements. In Italy, a detailed table was annexed to the FRMP for the Eastern Alps (though for other Italian FRMPs assessed, the list of measures contained fewer fields).

Box 20 - Providing detailed information on measures

The five FRMPs in **Spain** provide information on the location of the measures (some at UoM level, others at APSFR level and others at a specific location, for example along a river). The FRMPs also indicate the timeframe for implementation, the budget, the responsible authority and provide indicators for monitoring progress. Nonetheless, the information tables include some gaps (for example, budgets are not provided for ongoing measures carried out by authorities). The indicators for the most part measure the progress of implementation; they do not refer to the impact of measures.

Section 8.2 provides further detail on the location of measures reported by Member States. A further key dimension is the extent to FRMPs present the links between their measures and their overall FRMP objectives: This is discussed in Section 8.3.

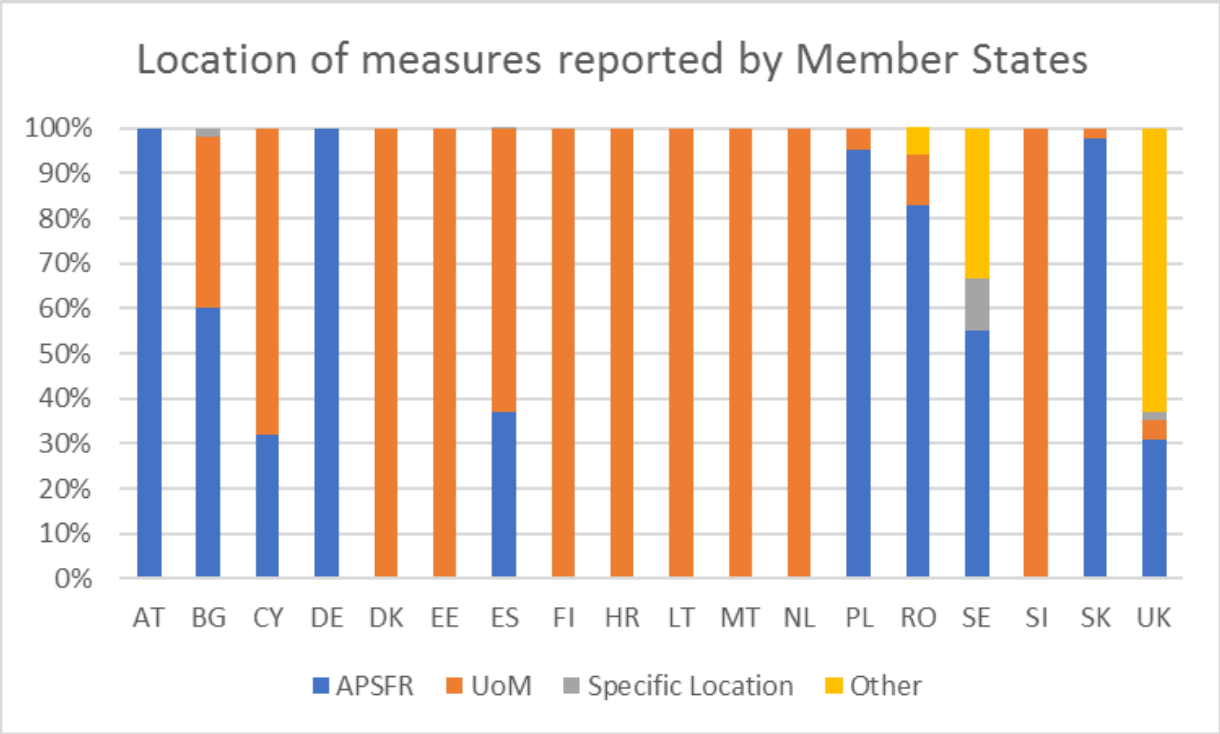
8.2. Location

For many kinds of measures, the location will be broad, such as national or UoM scale: This will be the case, for example, for actions to raise public awareness, initiatives to improve flood

some studies and assessments are listed in this category, but so are some other activities such as wetlands restoration. In Malta, this was a WISE reporting inaccuracy.

warning systems and laws or guidance to integrate floods in spatial planning. Other measures will have specific locations. This will be the case for infrastructure investments as well as natural water retention measures.

Figure 12 Location of measures reported by Member States



Source: WISE electronic reports 2016 and expert elaboration.

Notes: Compiled from Member States reporting to WISE on location and geographic coverage of measures. Information reported in the reporting sheets could be aggregated in 18 out of 26 Member States. As the reporting fields were open and Member States followed different approaches to reporting, results should be considered indicative. "Other" refers to catchment and local levels in Sweden and the United Kingdom and national level in Romania and Sweden (although in the case of the latter, the five measures reported at national level should have been reported at APSFR level).

MS reporting to WISE provides an overview of *where* measures will be achieved. For 18 Member States, it was possible to compile this data (see Figure 12 above)[118]. As shown, eight of the 18 Member States indicate that all measures are at the level of the whole UoM. This is

[118] Member States were asked to report information on the location and geographic coverage of measures in the Reporting Sheets. The fields were open, and Member States reported in a variety of ways. Many Member States provided enough information to determine the level of the location, i.e. APSFR or UoM. The figure in this section is compiled from responses to both questions.

related in part to the level at which measures are reported. A number of Member States, including Croatia and Estonia, indicate in their FRMPs that each measure reported can include multiple actions or projects, which may have more specific locations.

Five Member States indicate that at least 80% of measures are the level of the APSFR (this includes Germany, which also indicated that its measures will be carried out via individual projects). Fewer Member States reported more detailed locations: these include Sweden and the United Kingdom, where around 60% of measures are reported at catchment and local levels.

For some Member States, more detailed information was found in the FRMPs assessed. One Member States, Lithuania, has embedded planned infrastructure measures in its FHRMs (see box below). For the Member States which had measures with locations that could not be easily aggregated in the graph above, the table below shows the location of measures, with information taken from the FRMPs and the reporting sheets.

Box 21 - Locating measures on flood maps

Lithuania has indicated the specific locations for infrastructure measures. Moreover, an interactive, online map of the FHRMs contains the proposed locations for embankments and the territories they protect as a layer. The map is available at: http://vanduo.gamta.lt/cms/index?rubricId=6d87deab-3ecc-412a-9b66-7fd6361f26ba (accessed in June 2018).

Table 10 Location of measures reported by Member States (where locations cannot be apportioned)

	BE	*CZ*	*HR*	*FR*	*HU*	*IT*[119]	*LU*	*LV*	*PT*
International			✓						
National			✓		✓			✓	
RBD/UoM	✓	✓	✓	✓	✓	✓	✓	✓	

[119] Not all UoM use all locations listed in the table's lines.

	BE	*CZ*	*HR*	*FR*	*HU*	*IT*[119]	*LU*	*LV*	*PT*
Sub-basin		✓			✓	✓			
APSFR or other specific risk area	✓	✓		✓		✓	✓	✓	
Water body level	✓		✓	✓				✓	
More detailed than water body	✓					✓			
Other			✓	✓					

Sources: Member State reporting and FRMPs.

8.3. Linking objectives and measures

In the preamble of the FD there is reference to the objective of the Directive, "*namely the establishment of a framework for measures to reduce the risks of flood damage…*" and in Article 7(3) to FRMPs including "*measures for achieving the objectives established…*". Concretely defining measures and clearly linking these measures to objectives could serve as an alternative to defining specific objectives, provided the measures are selected and designed in such way that their completion would result in achieving the objectives set within a timeframe. Consequently, the relationship between measures and objectives is a key issue. There should be a clear pathway from objectives to measures, along with an analysis of how the measures contribute to the objectives. This section draws from the section on objectives and looks at four elements for this pathway: (1) whether objectives are specific (and thus measurable); (2) whether the measures are specific (and measurable); (3) if a link is made between objectives and measures; and finally, (4) whether FRMPs report that there are mechanisms to indicate if the implementation of measures will ensure the achievement of objectives.

To recall, section 7.2 of this document indicates that the FRMPs in 12 Member States are to some degree specific in terms of objectives. The table below assesses Member States in terms of the specificity of their objectives and their measures: Whether objectives or measures are general, specific or partially specific[120]. It also indicates if there are clear links reported between the measures and objectives next to whether it is clear that implementation of the measures will achieve the objectives.

[120] This overview inevitably involves an aggregation of different Member States approaches: for example, 'partly specific' measures include – differences across FRMPs assessed, as seen in the United Kingdom; differences across types of measures, as seen in Romania where measures at APSFR level are specific but not those at higher levels; and Member States where only some specific information is provided on measures, as in Estonia.

Table 11 Objectives, measures - and their links

MS	***Objectives***	***Measures***	***Links between objectives and measures***
Cyprus	Specific	Specific	Link exists
Bulgaria	Specific	Specific	Link for one FRMP
Belgium	Specific	Partly specific	Link for Brussels FRMP only
Malta	Specific	Partly specific	Link clear only for one case
Sweden	Specific	Partly specific	Link exists
Finland	Partly specific	Specific	Some of the FRMPs provide links
Latvia	Partly specific	Specific	Link exists
Poland	Partly specific	Specific	Link exists
United Kingdom, the	Partly specific	Partly specific	Link exists
Lithuania	Specific	Specific	No clear link
Romania	Partly specific	Partly specific	No clear link
Denmark	Partly specific	Partly specific	Some of the municipal FRMPs provide links
Czech Republic, the	General	Specific	Link exists
Portugal	General	Specific	Link exists
Slovakia	General	Specific	Link exists
Hungary	General	Specific	No clear link
Germany	General	Partly specific	Link exists
Slovenia	General	Partly specific	Link exists
Austria	General	Partly specific	No clear link
Estonia	General	Partly specific	No clear link
Spain	General	Partly specific	No clear link
Italy	General	Partly specific	No clear link
Luxembourg	General	Partly specific	No clear link
Netherlands, the	General	General	Link exists
Croatia	General	General	No clear link
France	General	General	No clear link

Sources: Member State reporting and FRMPs.

As shown in the table, six Member States set specific objectives in their FRMPs, six set objectives with some specificity, meaning that they may lack location or targets or timescales, and 14 Member States set general objectives. In terms of measures, the FRMPs in 10 Member States present specific measures, those in 13 Member States report measures that are partly specific and those in three Member States present only general measures.

The FRMPs in more than half of Member States, 16, provide some sort of link between their measures and objectives (in all, eleven Member States, or some, five Member States, of the FRMPs assessed). In the United Kingdom, the Northern Irish FRMP assessed links each measure to one or more detailed objectives. Other examples are seen in some Finnish FRMPs, which have a description for each measure including for which objectives they contribute to and what flood protection benefits they bring; in one of these FRMPs, there is an analysis whether each measure contributes to the objectives directly or indirectly through flood protection benefits: for example, improved flood risk maps contribute indirectly to the public safety objective. One German FRMP assessed provides graphs showing the percentages of effectiveness of measures in relation to the four categories of adverse consequences listed in the Directive (i.e. consequences for human health, economic activity, environment and cultural heritage).

In some cases, Member States have indicated that further specificity concerning measures will be developed in separate plans: For example, Austria's national FRMP contains aggregated measures comprised of detailed projects and actions elaborated in plans prepared at APSFR level. Other Member States, e.g. Germany, indicated that these details would be prepared in the implementation phase.

In three Member States, general objectives are linked to specific measures. One example is Portugal, described in the box below. Another example is Slovakia, whose FRMPs provide an assessment of the potential impact of the existing and suggested protection measures in achieving objectives; however, as the objectives are general, it is not clear if or to what extent they will be achieved once measures are implemented.

Box 22 - Linking objectives and measures 1

The objectives set in **Portugal** are neither specific nor measurable. For example, four of the five FRMPs assessed present a nationally set objective to "improve resilience and reduce vulnerability in areas of possible flooding". The FRMPs do, however, contain some information on how the objectives are to be achieved, as the measures are formulated based on the objectives. The measures are devised

considering the following aspects: Harmful consequences to population, economic activities, cultural sites and protected environmental areas; geographical areas where these are or may be located; reducing the severity of flooding in the APSFRs.

The five FRMPs assessed include detailed information on measures, referring to their location (either the whole UoM or other more detailed locations), the implementation timeframe, the budget, the responsible entity and indicators for management. Almost all measures are specific and measurable. An annex contains tables where, for each measure, the strategic and operational objective it aims to tackle is identified. Although the measures are connected to the objectives, the indicators for the measures do not have quantified targets to be achieved and do not quantify how much measures can contribute to the fulfilment of objectives.

Of the 12 Member States that report some specificity in their objectives, three – Bulgaria (in one FRMP), Cyprus and Lithuania – report specific measures and nine have partially specific measures. The example of Cyprus is presented in the box below.

Box 23 - Linking objectives and measures 2

The FRMP in **Cyprus** has specific objectives setting out "what" and "where": The first objective aims to reduce the hazard of floods with a 20-year chance of occurrence in already developed areas and new areas under development. Each objective is then linked to two or more "priority action fields" that describe "how" each objective is to be achieved. Thus, the objectives are, for the most part, specific and measurable.

Further, for all 38 measures, the Programme of Measures indicates "what", "where", "how" and "when" for each measure: There is a detailed description of what each measure is aiming to achieve, where exactly, when and how is going to be implemented: the area and target year of implementation, the processes/technical methods to be used and the competent authorities in charge. Finally, each measure is clearly linked to an objective:

- 24 measures, all for protection, are linked to hazard reduction (63% of the total 38 measures);
- 11 measures (two prevention, one protection, five preparedness and three recovery and review) are linked to vulnerability reduction (29% of measures);
- Three measures (two prevention and one protection) are linked to the limitation of exposure to floods (8%)

Finally, the FRMPs in only three Member States provide some indication that the implementation of their measures would result in achieving the objectives: Indeed, this is seen, only partially, in three Member States. In Bulgaria, the FRMP for the West Aegean UoM (BG4000) reports information about the expected results and indicators for tracking both implementation progress and progress towards achieving the objectives of each measure. In Poland, the objectives do not include specific targets; however, background reports to the FRMP provide some explanation by how much many individual projects will contribute to objectives, for example, the expected increase in water retention on agricultural land. In Sweden, some of the FRMPs assessed set 'measure-oriented' objectives, such as the establishment of cooperation on flow regulation for smaller streams (found in the Falun FRMP); some set 'knowledge' objectives – for example, detailed information on flow levels that can lead to serious flooding consequences for cultural heritage (in the Karlstad FRMP). These objectives should be achieved when the related measures are carried out.

Overall, however, FRMPs lack clarity on how objectives would be met and if measures were sufficient to achieve objectives. For many Member States, objectives are not specific or measurable and often, the measures are not specific or measurable either. Further, less than half of Member States provide a link between objectives and measures in the FRMPs assessed.

8.4. Prioritisation of the measures

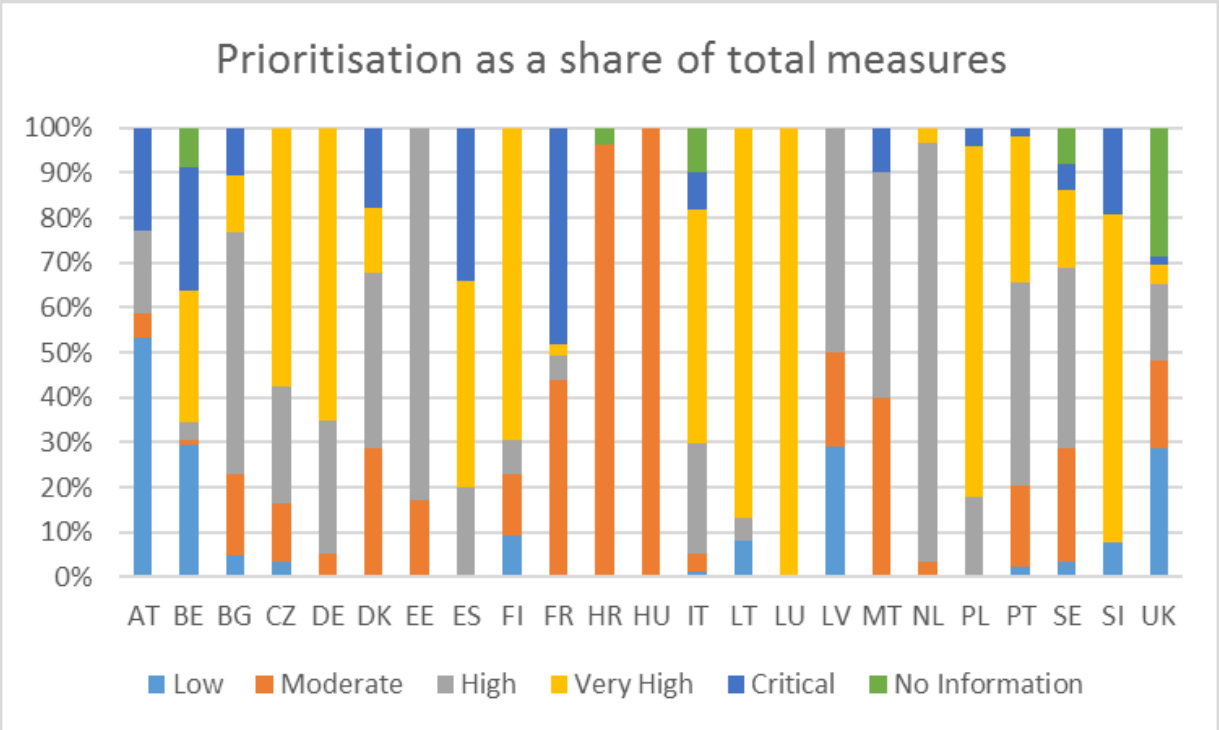
The Annex to the FD states that FRMPs should indicate the prioritisation of measures. Across the 23 Member States that reported on the priority of their measures on a five point scale[121], patterns varied (see Figure 13 below). In France, almost half of all measures are indicated as being of critical priority. Austria, Bulgaria and Spain indicated that over 20% of their measures were of critical priority, but others had smaller shares of critical priority measures. A set of eight Member States – the Czech Republic, Germany, Finland, Italy, Lithuania, Luxembourg, Poland and Slovenia – identified more than half of their measures as having "very high" priority. Another group, including Bulgaria, Estonia, Latvia, Malta and the Netherlands, indicated that more than half of their measures were of "high" priority.

[121] According to the FD's Reporting Guidance, Member States could either report on the priority on a five-point scale (low, moderate, high, very high, critical and no information) or report the timetable of their measures. Of the 26 Member States that reported, 23 provided information on the priority of their measures, and 11 of these also reported on the timetable. In addition, some Member States only assigned measures to three of these five levels of priority. For a few Member States, however, there were differences across UoMs, with some UoMs reporting information on priorities and others not.

Most of the Member States indicated that their measures fell into the higher categories of priority. Ten of the 23 Member States reporting on priority by means of a scale indicated more than 80% of their measures were in one the three highest categories of priority (critical, very high and high priority): The Czech Republic, Germany, Estonia, Italy, Lithuania, Luxembourg, the Netherlands, Poland, Slovenia and Spain. Another seven Member States indicated that between 50% and 80% of their measures were in one of these three categories: Belgium, Denmark, Finland, France, Malta, Portugal and Sweden.

Two Member States reported all measures with the same priority: Luxembourg as 'very high' and Hungary as 'moderate'. For Luxembourg, Member States authorities subsequently indicated that this was a reporting oversight. Hungarian authorities noted that all 46 measures are planned to be completed by 2021 with no specific prioritisation, and thus all were reported as moderate. Two Member States reported 90% or more of their measures in one category, Croatia as moderate priority and the Netherlands as high priority[122].

Figure 13 Prioritisation of measures reported by Member States



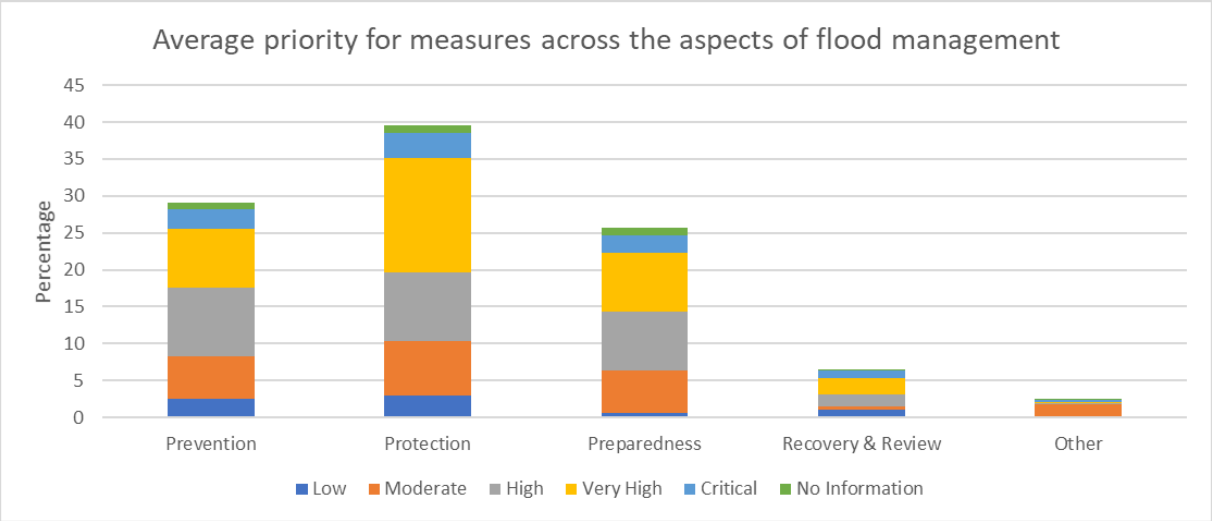
Source: WISE electronic reports 2016.

[122] In the Netherlands, flood prevention has the utmost priority, hence all measures have received at least priority "high", with the exception of one "medium" measure regarding a "water test" of spatial planning proposals via a consultative process.

Notes: Data shown for the 23 Member States that reported on the priorities of their measures (Cyprus, Romania, and Slovakia did not report on this, only on the timetable of their measures).

On average, 9% of the measures reported by each Member State were of critical priority; 32% were of very high priority; 28% of high priority, 21% of moderate priority and 8% of low priority. When looking at different aspects of flood management, the priorities assigned within prevention, protection and preparedness measures are roughly similar, while recovery and review measures were assigned lower priority (see Figure 14 below).

Figure 14 Priority of measures across the aspects of flood management



Source: WISE electronic reports 2016.

Notes: The figure shows shares by measure aspect and by level of priority: The total across all aspects (including "other") is 100%. Shares based on the average for each Member State. "No action" measures not included. The information is based on the 23 Member States reporting priorities for their measures (consequently, Cyprus, Romania and Slovakia are not included).

8.4.1. Methods for prioritisation

In about two-thirds of the Member States assessed (18[123] out of 26), the FRMPs or other documents provided information on the methods used for the prioritisation[124]. In all these cases, some sort of a multi-criteria assessment was used.

[123] For the United Kingdom, this was only the case for some of the FRMPs assessed.

[124] In both Cyprus and Romania information was not reported in the reporting sheets for each individual measure, but information from the FRMPs was used in this section.

Among these criteria, 13 of the 18 Member States used some assessment of the effectiveness of measures: In Bulgaria, one of the criteria is the "extent of problem solving", including how effective is the measure in achieving objectives; Germany and Cyprus also include the effectiveness of the measure in reaching overall and specific aims. Other Member States, including Latvia, Italy (for some of the FRMPs assessed), Belgium (Wallonia), and Slovakia, assessed the number of inhabitants, polluting facilities, cultural heritage sites or protected areas addressed by the measures. In England, public investments in flood and coastal risk management works identified based on Department for Environment Food & Rural Affairs (DEFRA) policy and Environment Agency guidance are prioritised.

Box 24 - A three-step process for prioritising measures

In the Walloon Region of **Belgium**, measures were prioritised in three steps: First, a multicriteria analysis of the measures; second, an analysis of the results of this prioritisation and, eventually, adaptation by stakeholders within technical committees by sub-basin; and third, validation of prioritization by the coordination team, the Transversal Floods Group (*Groupe Transversal Inondations*).

The multicriteria analysis took into consideration the following criteria:

- human health (number of people affected);
- economic activities at risks;
- synergies identified with other water management plans, including the RBMPs and plans for economic activities, e.g. transport on water and related infrastructure;
- environmental aspects (synergies or conflicts of interest) and
- cultural aspects.

Over half of the Member States that provided information on methods for prioritisation (11 of the 18) refer to an assessment of costs and benefits, including via CBA (see chapter 10 for further information on the consideration of costs and benefits). In Wales the cost-benefit analysis is included alongside the risk calculation from the Communities at Risk Register, a tool that considers a number of factors to indicate the most vulnerable communities at risk of floods. A similar number (nine of the 18) include a criterion that is related to the WFD: Austria refers to the relevance of measures for the WFD and Estonia refers more generally to beneficial links for the implementation of other EU legislation, in particular the WFD.

A few Member States – five[125] of the 18 Member States that refer to costs and benefits – include elements of feasibility: For example, Germany refers to 'implementability' as a criterion, including time, resources, planning process, financing and public acceptability; the United Kingdom (Scotland), Cyprus, Croatia, Poland and Portugal refer to the availability of finance. Among other criteria, only one Member State assessed, Austria[126], explicitly included adaptation to climate change among the criteria[127].

Several Member States indicated a link between the timetable and the prioritisation of measures: In four of Portugal's FRMPs, one of the criteria for the prioritisation of measures is for measures that can be undertaken during the current cycle. This was also seen in Luxembourg, where an aim was to present measures that could be implemented in the short term. In Belgium (Brussels region), an overall timetable of measures is linked to their priority: Priority 1 measures should be implemented in the first years of the Plan (2016-2017), Priority 2 measures in 2018-2019; and the implementation of Priority 3 measures should start by 2021 (2020-2021).

8.4.2. Timetable

Fourteen Member States reported on the timetable of their measures. For those Member States reporting information on the timetable of their measures, most measures are to be implemented within the current FRMP cycle, 2016 to 2021 (see Figure 15 below). A few Member States – including Belgium, Latvia and Sweden – reported measures as ongoing: these ongoing measures include early warning systems and administrative actions underway and without a completion date. Romanian FRMPs state that almost all measures should be implemented by 2021, but measures involving major works that start between 2016 and 2021 will only be completed by 2027, while in Malta, three measures are scheduled to be completed in 2017, 2018, and 2019 respectively, with the remaining seven measures to be continued throughout the 2nd cycle.

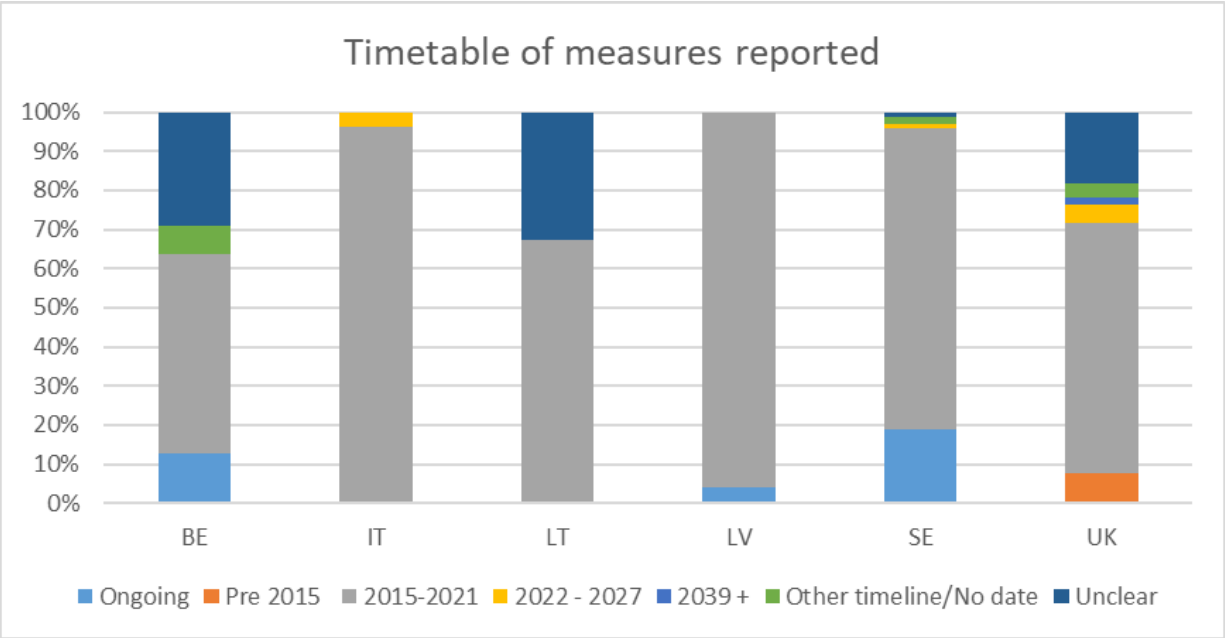
A small number of Member States reported both the priority of their measures and the timetable – Belgium, Lithuania and Sweden – and as noted above, all indicated that more than half of their measures were of critical priority.

[125] In the case of United Kingdom, only Scotland.

[126] Cyprus did not report the prioritisation of measures in the reporting sheet, however, the FRMP states that an initial assessment of measures was based on several criteria, including adaptation to climate change.

[127] Both Croatia's and Cyprus' FRMPs stated that climate change was considered as a criterion for the prioritisation of measures, however, neither of these Member States reported prioritisation in their reporting sheets.

Figure 15 Timetable reported for measures



Source: WISE electronic reports and expert elaboration.

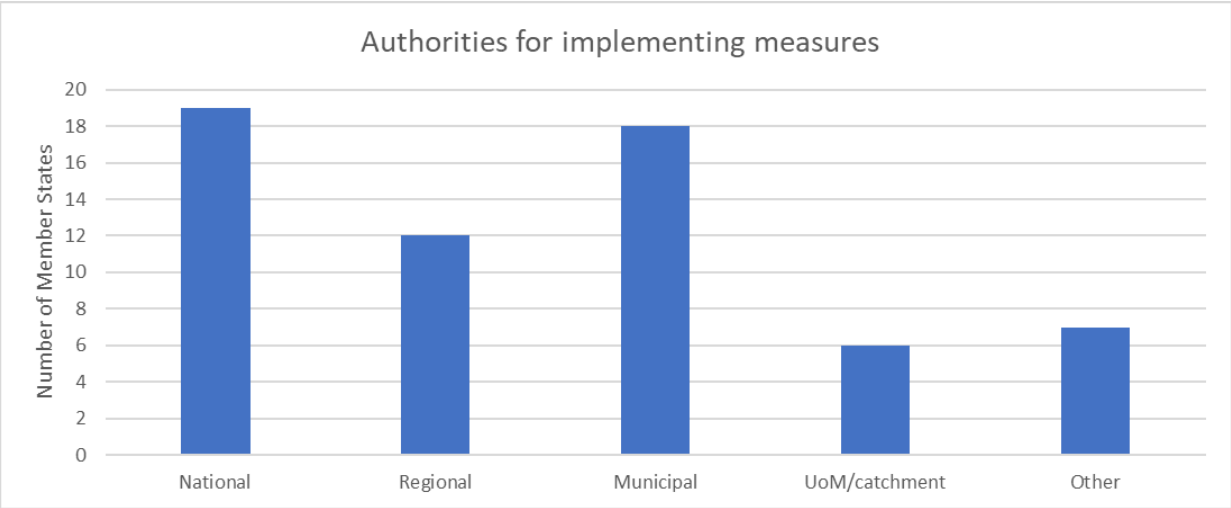
Notes: Fourteen Member States reported on the timetable of their measures. Of these, Romania and Cyprus both indicated 2016-2021 as the timetable for all measures; Slovakia, 2021; and for Estonia, Finland, Poland, Portugal, and Spain, no aggregation was possible due to the large number of different responses. For Italy, the figure only represents those Italian UoMs that reported information on the timetable of their measures.

8.5. Responsible authorities

MS were requested to report the authority responsible for each measure. The aggregated data show that in a majority of Member States where data is available[128], national and municipal authorities were responsible for measures (see Figure 16). Many Member States identified regional authorities, and a few identified specialised bodies such as civil protection authorities in Austria and Slovenia, local flood authorities (in the United Kingdom) and water companies. In Belgium, unclassified water courses are managed by local residents.

[128] Member States could report either the name of the responsible authority or the level of responsibility. Both were open fields; the entries were aggregated to the extent possible.

Figure 16 Authorities identified for the implementation of measures



Source: Member State reporting and FRMPs.

Notes: Regional authorities can include, depending on the Member State, provincial and district authorities. Catchment authorities refer to water management authorities below the UoM level. Member States also often reported more than one responsible authority.

Most Member States reported more than one responsible authority for their measures, in some cases reporting several authorities per measure: The box below presents the approach in Estonia. In Italy, another example, about two-thirds of measures are implemented by regional authorities, about one-sixth by municipalities and the remainder by others, including civil protection authorities, water service operators and (for about 1% of measures), national bodies; however, the number of measures assigned to the various types of authorities varies greatly across Italy's UoMs.

Box 25 - Authorities responsible for measures

In **Estonia**, each action has a main authority directly responsible for its implementation; for many actions, additional authorities support the main one. In most cases the main authority is either at national level – a Ministry or a public authority under a Ministry – or at municipal level. In few cases the implementing authority is the owner of a facility. As examples:

- Local municipalities are responsible for actions related to construction or restoration of public water supply systems, spatial planning and obligations and activities under the Building Act.
- For preparedness for emergency situations, each local municipality is the main authority and the Rescue Board (a national body that coordinates of emergency work and response, including for fires, floods and snow storms), the additional authority.

- For natural water retention measures such as buffer strips, in most cases the local municipality is the main authority and the land owner the additional authority.
- The national Environmental Inspectorate is the main authority for actions related to supervision of protection of environment and consequently for supervision of actions to address pollution risks from industrial plants and agriculture during floods.
- The Health Board is the main authority for a mapping action to establish and periodically update a list of enterprises in each APSFR that use, process or produce hazardous chemicals. The Environmental Board is the authority that supports this action.

A few FRMPs present a division of labour. In England (the United Kingdom), the Environment Agency is responsible for most protection measures while Lead Local Flood Authorities (local authorities given responsibilities for flood management) are responsible for the majority of recovery and review measures. In Portugal, the FRMPs for mainland UoMs explain that national authorities are responsible for larger, more expensive measures and local authorities for smaller measures.

In contrast, a few Member States indicate that a single authority is responsible for most measures: in Slovakia, the Ministry of Environment is responsible for 99% of all measures. In Malta, while the national Energy and Water Agency is responsible for all measures, the FRMP lists government bodies and stakeholders that would need to be engaged for each measure (see the box below).

Box 26 - Engaging government and other stakeholders in implementation

Malta's FRMP indicates, for each measure, the government and other stakeholders that would need to be involved in the process. For example, the measure "Modelling the impact of the National Flood Relief Project on flood hazard and risk in identified catchments" identifies eight government bodies, including: the Environment and Resources Authority; the Eco-Gozo Regional Development Directorate within the Ministry for Gozo; the Marine, Storm Water and Valley Management Unit within the Ministry for Transport and Infrastructure.

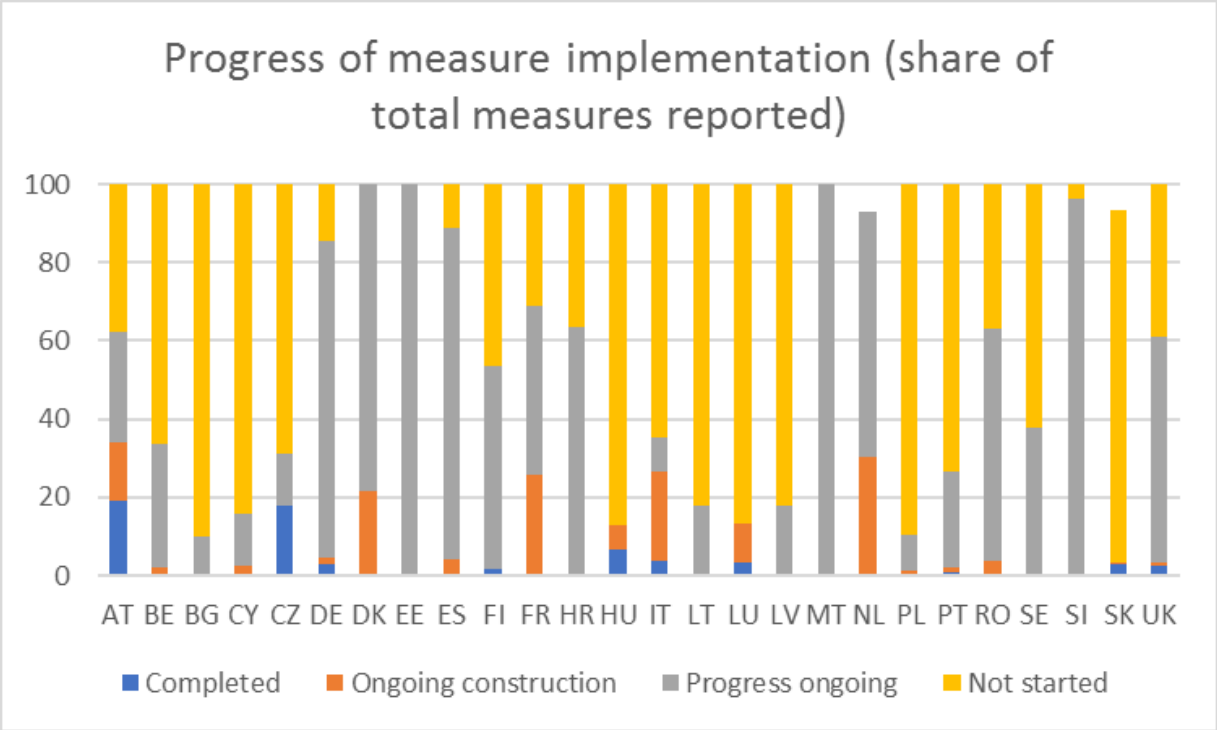
8.6. Progress of implementation

All 26 Member States assessed indicated the progress of implementation of their measures. On average, 49% of the measures in each Member State were reported as not started, closely

followed by 'progress ongoing', 42% of measures; a further 6% of the measures were reported as ongoing construction and 2% as completed[129].

The levels reported vary across the Member States. In eight Member States – Bulgaria, Hungary, Lithuania, Latvia, Poland, Slovakia, Luxembourg and Cyprus – over 80% of measures were reported as not started. For five others – Belgium, The Czech Republic, Portugal, Sweden and Italy – over 60% had not been started (see Figure 17 below). In contrast, 12 of the 26 Member States reported over half of their measures as either 'progress ongoing' or 'ongoing construction'[130].

Figure 17 Progress of implementation of measures



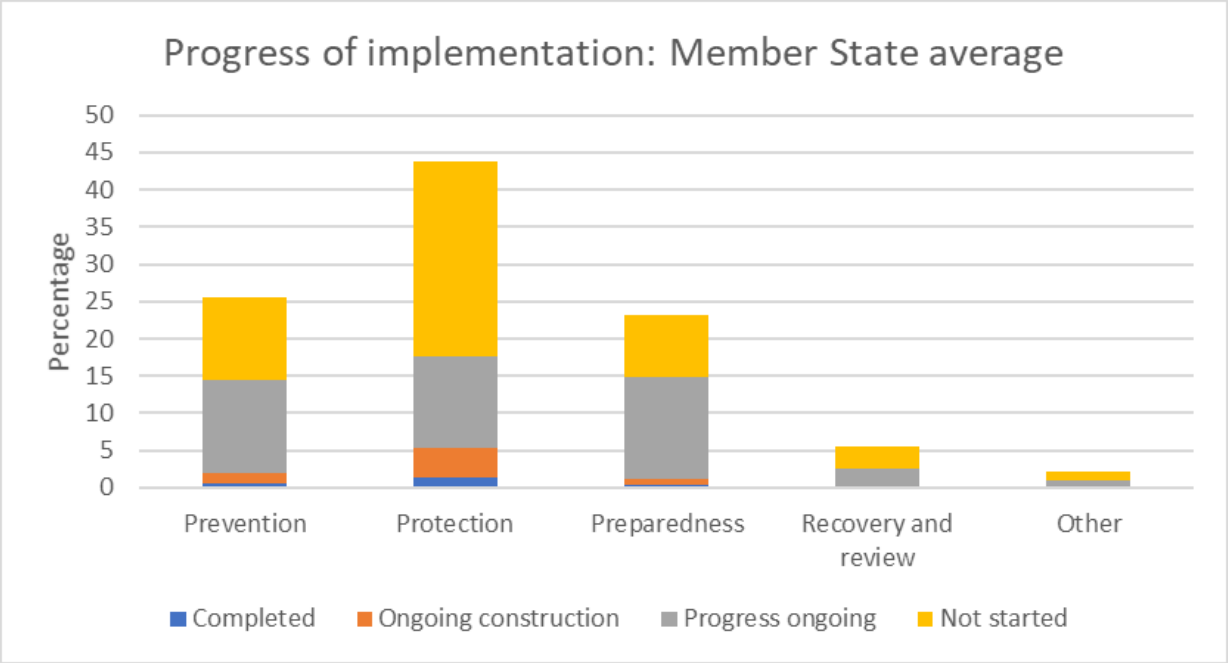
Source: WISE electronic reports.

[129] Many Member States reported in 2016, or in 2017, so these results should not reflect current (late 2018) progress.

[130] According to the Reporting Guidance for the FD, "Construction on-going" means the construction or building works have started but are not finalized"

Looking at the progress of measures by measure aspect (based on an average across Member States[131]), a somewhat larger share of 'preparedness' measures were in progress ongoing or ongoing construction compared to other aspects of flood risk management; a somewhat larger share of protection measures had not been started (see Figure 18).

Figure 18 Progress of implementation of measures by aspect of flood risk management



Source: WISE electronic reports 2016.

Notes: The figure shows shares by measure aspect and by progress of implementation: the total across all aspects (including other) is 100%. Shares based on the average for all 26 Member States. "no action" measures not included.

8.7. Measures taken under other Community Acts

In its Annex, the FD calls for FRMPs to include measures taken under other Community Acts, including the WFD, the EIA Directive[132], the SEA Directive[133] and the Seveso Directive[134]. 12

[131] For each Member State it was calculated which percentage of which measure aspect was completed, ongoing construction, progress ongoing, and not started. This was then averaged across all Member States – for example, an average of the percentage of all completed prevention measures, all completed protection measures, all completed preparedness measures etc.

[132] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment Text with EEA relevance (replacing Directive 85/337/EEC).

[133] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

of the 26 Member States assessed reported other Community Acts which were relevant to the reported measures. Of those Member States that did report this information, most referenced the WFD but not other Directives (see relevant section for more information on coordination with the WFD).

Member States provided further information in the FRMPs. Several Member States referred to the EIA and SEA Directives, mainly to note that some of their measures would undergo an EIA or that the FRMPs as a whole underwent an SEA procedure (see relevant section). FRMPs in eight of the 26 Member States assessed refer to the Seveso Directive: for example, in Germany, technical guidelines to address rainfall and flooding at Seveso installations had been developed. In Italy, two FRMPs assessed[135] include the protection of Seveso installations among their objectives and a third FRMP[136] sets out an indicator related to Seveso installations. Romania includes an indicator for its objective to minimise flood risks on potentially polluting sites (see section on objectives).

8.8. Inclusion of specific groups of measures

8.8.1. Spatial planning and land use

Article 191 of the Lisbon Treaty defines the objectives that Union policy on the environment shall contribute to, including preserving, protecting and improving the quality of the environment and protecting human health. According to Article 192 of the Treaty, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, decide what action is to be taken by the Union in order to achieve the objectives referred to in Article 191. Measures affecting town and country planning and land use are not exempted, however, there is a derogation from the ordinary legislative procedure and the Council should act unanimously[137].

The FD states that FRMPs should take into account spatial planning and land use and include 'the promotion of sustainable land use practices (Article 7(3)). The subject of spatial planning has been discussed in workshops organised by the WGF on two occasions as an element of

[134] Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC Text with EEA relevance.
[135] For the ITA RBD (Eastern Alps) and the Abruzzo and Sangro UoMs (ITI023 and ITR131).
[136] For the ITE RBD (Central Apennines).
[137] For the precise wording please see https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12008E191:EN:HTML and https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12008E192:EN:HTML

flood risk management. The following passages provide the summary of the two workshops' reference to spatial planning, which took place seven years apart. Comparing the two, one concludes there is progress, with gaps remaining.

"*…[I]t became obvious that there are gaps in coordinating land-use planning and flood risk management, caused chiefly by the assignment of responsibility to several parties, differing planning standards, and different legal bases. Changes in the legal situation (stronger legislative basis for spatial planning), better funding, as well as improved information, communication and cooperation were considered to be the key elements for success.*"[138]

"*Since 2007, several Member States improved their acts and rules, for increasing the coordination between spatial planning and flood risk management, but in the most of the countries, it is necessary to improve them, because there are still some gaps. The FRMPs include measures to improve this coordination, being one of the group of measures more important.*"[139]

The conclusion immediately above is supported by the findings of a survey conducted amongst the 28 Member States in 2016 where 12 Member States indicated that the FD had a positive impact on coordination in flood related spatial planning matters[140].

As a result, the FRMPs of all the Member States assessed[141] make reference to spatial planning and land use[142]; however, the extent of information varies and not all FRMPs include measures in this area.

In five of the 26 Member States assessed did the FRMPs provide information on the approaches used in current land use and spatial planning legislation to address flood risk. Examples include Luxembourg, where the national Water Law prohibits new building developments in flood risk areas. Latvia's FRMPs report that national legislation bans

[138] CIS WGF "Flood Management in Local Planning" workshop report, Bad Radkersburg/AT and Gornja Radgona/SI, April 2008, https://circabc.europa.eu/w/browse/1be90c02-9de4-4daa-a2ae-0546700c4567

[139] CIS WGF "Coastal Flooding and Spatial Planning" workshop report, 22 and 23 October 2015, Zurbano Palace Madrid, Spain, https://circabc.europa.eu/w/browse/b5450ce2-09b6-461b-88e2-647d21a9047b

[140] "Flood Risk Management in the EU and the FD's 1st Cycle of Implementation (2009-15), a questionnaire based report". This is a product of WGF 19's workshop (14-15 April 2016, Vienna, Austria), the document was endorsed by the EU Water Directors at their meeting in Malta in June 2017, available at: https://circabc.europa.eu/w/browse/ec110327-9521-468f-b6b8-cc32b1245c3c

[141] None of Malta's ten measures explicitly refer to spatial planning or land use for addressing flood risks. However, one measure includes spatial planning aspects – the adoption of Sustainable Urban Drainage Systems (SUDS) in planning.

[142] Different types of urban planning: https://www.mfe.govt.nz/publications/rma/building-competitive-cities-technical-working-paper/page6.html#footnote-80

construction in river flood plains with a 10% yearly probability of flooding. Slovenia's 2002 Water Law prohibits construction that would increase flood risks (though where urbanisation is allowed, protection and compensation actions must be taken).

Measures for spatial planning and land use were identified in the FRMPs of 23 of the 26 Member States reporting. The most common area for measures is for new spatial planning and land use restrictions or bans on construction in flood-risk areas: This is seen in 16 of the 23 Member States assessed that have spatial planning and land use measures. In some cases, this involves binding rules: As an example, all five Portuguese FRMPs assessed include a measure for the demarcation of areas of high probability of flooding (T = 20 years): in these areas, construction will be prohibited. In addition, adjacent zones corresponding to areas with a low probability of flooding occurrence (T – 100 years) will also be demarcated: Here, construction will be restricted. In other cases, the measures refer to guidance: For example, the FRMP for Falun in Sweden includes a measure to develop a guidance document for planning in proximity of flood-prone rivers.

In seven of the 26 Member States, FRMPs include measures to relocate economic activities and properties away from flood-risk zones: One example is in Poland (see the box below). FRMPs in four Member States include measures for the preparation of guidelines on spatial planning and land use in flood risk areas: Denmark, Italy, Poland and Spain. In Croatia, there is a measure for public education on the need for land-use restrictions and restriction of activities in flood prone areas.

Box 27 - Measures to relocate buildings and facilities from flood risk areas

The FRMPs in **Poland** include the following measures:

- Analysis of the possibility of removal, change of use and modernization of facilities located in the specific flood zones, along with the analysis of purchase options;
- Analysis of conditions for relocation of buildings from areas of particular flood threat;
- Plans for resettlement and purchase of properties located in specific areas;
- Development of a buy-out and resettlement program in areas particularly exposed to flooding;
- Analysis of land management behind flood embankments and in inter-embankment areas to prevent an increase of flood hazards.

8.8.2. Nature based solutions, including NWRM

The FD states the FRMPs shall take into account "*...areas which have the potential to retain flood water, such as natural floodplains…*" and that they may include the "*...improvement of water retention…*" (Article 7(3)). In the preamble, the FD asks FRMPs to "*consider where possible the maintenance and/or restoration of floodplains…*"

The information compiled from the Member States indicate that all 26 assessed[143] include the notion of nature based solutions or a subset of these, NWRM, in some or all of their FRMPs. The number of NWRM per Member States, however, varies significantly. At one end of the scale, NWRM make up about 90% of Luxembourg's 813 individual measures; Austria's FRMP states that NWRM are ongoing or planned in 96 APSFRs, completed in 32 APSFRs, and foreseen in the next implementation cycle in 200 APSFRs. Slovakia has included 520 measures under type M31 for natural flood management[144]: NWRM make up almost 40% of Slovakia's 1 413 measures, and opportunities for these types of measures were identified through modelling (see the box below).

Box 28 - Modelling to identify NWRM opportunities

In **Slovakia**, a theoretical analysis of the impact of measures was carried out for each APSFR. This modelling was used to identify sub-catchments with a potential for improved natural water retention using landscape and ecological measures, for example in agricultural areas and for forests.

The FRMPs present a range of nature based solutions. Plans in at least 11 Member States call for the restoration of natural river characteristics – in Bulgaria, for example, there are measures for the re-meandering of rivers. In at least three Member States, Bulgaria, Lithuania, and Romania (see the box below), measures include afforestation. Sustainable urban drainage systems (SuDS) are included in the FRMPs in Poland, Malta and the United Kingdom.

Box 29 - Nature based solutions

[143] In Cyprus a number of measures relate to water retention, however, the actual use of NWRM is limited or is not presented in an explicit way. In Malta, one measure includes NWRM aspects – the adoption of Sustainable Urban Drainage Systems (SUDS). In Sweden, spatial planning measures are only found in some FRMPs, notably, two that were not selected for assessment

[144] Protection Natural flood management / runoff and catchment management, Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc. and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water.

In **Croatia**, the national FRMP sets out measures for nature based solutions, including the incorporation of water retention and wetland areas in spatial planning, encouraging flood solutions involving wetlands, former floodplains, meadows and pastures and the restoration of alluvial forests, and promoting public awareness on natural water retention.

In **Romania**, the five FRMPs assessed all include nature based solutions related to forest management in flood risk areas. Several FRMPs include other types of nature based solutions, including the following:

- Creation of new wetlands (Someș-Tisa FRMP, RO9);
- Restoration of natural river banks (vegetative protection), Someș-Tisa FRMP
- Reconnection and restoration of flood plains (Someș-Tisa and Prut-Bârlad, RO11, FRMPs);
- Re-meandering of water courses (Prut-Bârlad FRMP).

Whereas some of the measures foresee investment in nature based solutions, others involve preparatory studies and related work. For example, Poland's FRMPs include measures to develop guidelines and the identification of 'priority areas for re-naturalisation in river valleys, with particular reference to wetlands'. At the same time, the FRMPs for both the Vistula and Oder UoMs in Poland note restrictions to the use of NWRMs, as existing infrastructure make it difficult to effectively use flood plains in the event of a flood.

Across all Member States, there was very little reference to ecosystem services – in Croatia's reporting sheet, there was reference in the context of taking such services into consideration during flood extent control as part of ecosystem-based disaster risk reduction.

8.8.3. Measures that consider nature conservation

The FD also states that FRMPs should consider nature conservation (Article 7(3)). To a great extent, nature based solutions (including NWRMs) address this area. In Spain, for example, the description of measures for river restoration refer specifically to Natura 2000 sites.

Beyond nature based solutions, however, few FRMPs assessed refer to measures that explicitly address nature conservation. One example is seen in Italy: The FRMP for Puglia and the Ofanto RB includes measures for the protection of vegetation and analysis of the impact of structural measures on the environment. In Belgium one FRMP assessed contains a flood risk measure where nature conservation is clearly stated: A measure on river restoration.

A few FRMPs explain how nature conservation issues are considered in the selection of measures: In Latvia, for example, the location and design of dykes was selected taking into account the location of Natura 2000 sites, the needs of animal migration and protection of flora and soil; the design will seek to integrate dykes into the natural landscape. In Sweden several FRMPs indicate that nature conservation was considered in the development of measures.

8.8.4. Measures concerning navigation and port infrastructure

The FD also calls for FRMPs to consider navigation and port infrastructure. Few FRMPs had measures that addressed this area: These were clearly seen in only five of the 26 Member States assessed, and even here, in few measures. In Estonia, for example, there is a specific action to prevent flood-related pollution originating from ports. Hungary's FRMP includes a measure for the reconstruction of a lock. In Belgium, one FRMP assessed stated that shipping on the river is taken into consideration, while another FRMP assessed does not include a specific measure on navigation, but has at least one measure that is related indirectly: Optimising the shipping canal in Brussels for receiving run-off water.

In other Member States, including Bulgaria, Denmark and Germany, measures to protect critical infrastructure may include ports and navigation. The plans in at least five Member States – Finland, the Netherlands Poland, Italy[145], and Spain – make a general reference to navigation and ports, but measures in this area where not identified.

8.8.5. Dredging

Dredging is not mentioned in the FD. It is considered in certain areas of the EU and elsewhere as a tool for flood control; in isolation, however, without considering the river basin wide situation in terms of sediments, it does not appear to address sustainably wider catchment flood risk. It can also have negative effects on the ecology of a river, e.g. through the removal of fish spawning sites, which puts at risk economically important species like the salmon. Consequently, dredging may negatively affect the potential for common benefits between the FD and the WFD (see section 9.10 below) and its use should be considered along other parameters.

[145] The FRMP for Puglia and Ofanto (ITR161I020) mentions port infrastructure among the factors considered. Italy also clarified that the FRMP for Puglia/Ofanto includes ports in the strategic infrastructure addressed for risk reduction. Within the analysis of the port infrastructure, actions for the reduction of coastal erosion are considered as a reduction factor of the risk of the flood from the sea.

The FRMPs in at least seven Member States include measures for dredging of rivers to increase the river channel capacity and its ability to convey water for flood alleviation purposes.

Examples are seen in Finland, where the FRMP for Kokemäenjoki contains two measures: "dredging of existing river channels in the centre of the port" and "mowing and dredging of the estuary of the Kokemäki river in Pihlavanlahti Bay". All five FRMPs assessed for Portugal include measures for dredging as part of a strategy for removing silt in river channels.

In a further six Member States, the FRMPs include measures that could potentially include dredging. In Bulgaria, for example, there are measures for cleaning river beds and ensuring the capacity and ability of the river channel to convey water. Similarly, in the Czech Republic, Hungary and Slovakia, there are measures to increase or maintain the river channel capacity. In Austria, it was subsequently explained that navigation, port infrastructure and dredging were implicitly incorporated into a national measure on maintenance of protection and mitigation measures, river maintenance. A measure on increasing the river channel capacity and its ability to convey water for flood mitigation in Germany (found in all UoMs) can be assumed to involve dredging.

8.8.6. Insurance and other economic instruments

The subject of disaster insurance, a way to share and transfer risk, has been considered at the EU level in the past. In 2013 a Green Paper on the insurance of Natural and Man-made Disasters was published and a public consultation took place[146]. More recently, in 2017, a study report titled "*Insurance of weather and climate related disaster risk: Inventory and analysis of mechanisms to support damage prevention in the EU*"[147] was published. One of the findings was that whereas on the whole (across extreme weather events), insurance at affordable rates is available in the countries studied[148], there is less success in providing incentives for risk reduction at the level of the policy holder. Build-back-better requirements, as a standard element of insurance contracts, is one of the recommendations put forward.

[146] http://ec.europa.eu/finance/consultations/2013/disasters-insurance/index_en.htm

[147] https://publications.europa.eu/en/publication-detail/-/publication/4f366956-a19e-11e7-b92d-01aa75ed71a1/language-en

[148] The countries studied were: Bulgaria, Denmark, Germany, Spain, France, Italy, Hungary, Austria, Poland, Romania, Sweden and the United Kingdom.

Although insurance is not mentioned in the FD[149], in more than half of the Member States assessed (15 out of 26), at least some FRMPs in each Member State include measures related to insurance. Relatively speaking, the number of measures in this area, however, appears to be small and information regarding the role of insurance is not provided consistently across the Member States.

Still, the FRMPs in several Member States refer to current national insurance systems: For example, the National Joint Insurance Compensation Agreement and the National Entity for Agrarian Insurance in Spain (the five FRMPs assessed refer only to insurance of agriculture, however). Several municipal FRMPs in Denmark mention the Danish Storm Council, a national insurance mechanism[150]. It was pointed out by Sweden and Belgium that insurance is a national competency, and thus is not covered in the FRMPs, which are prepared at a subnational level. In Belgium a national law on insurance (2014) gives insurance companies the right to refuse coverage for properties in flood risk zones

Some Member States included specific measures to set up or improve insurance schemes capable of providing cover for flood victims. In Austria, one measure mentions the development of insurance schemes that provide better coverage. In Germany as well, measures call for the development of insurance schemes, here specifically for the private and business sectors. In Lithuania, flood insurance is not currently available and the FRMP includes a measure to revise national legislation on flood damage compensation mechanisms. In the United Kingdom, the FRMP for the Neagh Bann UoM in Northern Ireland includes two measures: One is "to work with the insurance industry to assist them in introducing 'FloodRe' to NI to help address long term flood insurance affordability issues". In Portugal a Recovery measure foresees a national legislative proposal that will provide a framework for insurance in flood-prone areas. In Romania, there is one national level measure in each of the assessed FRMPs that is for the design of regulations regarding the insurance system for buildings situated in potential flooding areas[151], while in Slovenia, two projects for each sub-basin deal with establishing a scheme of subsidising of insurance premiums.

[149] In a survey carried out amongst the 28 Member States in 2016, seven Member States indicated that the introduction of the FD had an influence on insurance policy. Source: "Flood Risk Management in the EU and the FD's 1st Cycle of Implementation (2009-15), a questionnaire based report", available at: https://circabc.europa.eu/w/browse/ec110327-9521-468f-b6b8-cc32b1245c3c

[150] A national insurance scheme exists in France as well.

[151] A Romanian law already requires all owners of dwellings (natural or legal persons) to have insurance against earthquakes, landslides and floods. The law has been in force since 2010.

In few Member States – including Bulgaria, Cyprus, Luxembourg, and Slovenia[152] – FRMPs include measures to raise awareness of insurance schemes. The FRMP for Cyprus, for example, contains two measures: One to raise awareness of insurance, including in local authorities, and the other to promote the use of flood insurance.

The FRMPs in a few Member States identify insurance companies as possible funding sources: For example, in Estonia it is stated that these companies may fund flood relief actions. Finally, hardly any reference was found to other economic instruments for flood risk management. One example was found in Northern Ireland: a measure for a Homeowner Flood Protection Grant Scheme to support households and communities in enhancing the resistance of properties to flooding.

8.9. Monitoring progress in implementation

The Annex to the FD states that FRMPs should describe "*...the way in which progress in implementing the plan will be monitored*".

For the Member States assessed, many FRMPs provide some information on the monitoring processes to be followed, though for many the description is not detailed. In some Member States, such as Croatia, it is not clear if monitoring is specifically for FRMP progress, or if it is integrated into WFD/RBMP monitoring.

The FRMPs in at least 12 Member States nonetheless describe *indicators* to be used in monitoring: this is seen, for example, in Bulgaria (see the box below) and Lithuania. In Italy, the FRMP for the Central Apennines sets out a list of indicators to be used, while other Italian FRMPs assessed do not. In Slovenia, seven steps of implementation for each construction project is set out, however, non-construction measures do not have clear targets and/or indicators. In France, several FRMPs explain that indicators to follow the implementation of the Plan will be identified early in the implementation cycle on the basis of the indicators set out in the national strategy for flood risk management (the strategy identifies a set of indicators to be used to follow the progress of its implementation and that of the FRMPs and lower-level plans that address flood risk)

Box 30 - Indicators to track measures

In **Bulgaria**, an Annex of the West Aegean FRMP (BG4000) provides two types of indicators for

[152] As well as an operational objective in the Walloon FRMPs in Belgium.

each measure:

- Indicators for tracking the progress of implementation (e.g. number of initiatives, number of normative documents, number of inspections) and
- Indicators for tracking progress towards achieving the objectives (e.g. fewer number of people impacted by floods, improved administrative capacity for FRM, better protection for the life and health of the population in APSFRs, better protection of critical infrastructure or environment).

The FRMPs in at least eight Member States [153] set out quantitative *baselines* for monitoring progress: This is the case in Spain, where baselines include, as an example, kilometres of coastline already mapped for flood risk. In Romania, the expected value for the year 2021 was established for each monitoring indicator, which is compared to the reference year 2015.

While only about one-third of Member States referred to a baseline in their FRMPs, the PFRA and FHRM results of the 1st cycle could be used to identify or develop a baseline (e.g. in terms of population or cultural heritage already effectively protected from a 100-year flood)[154]. This approach will be followed in the Czech Republic (see the box below). In Luxembourg, the FHRMs are referred to as baselines against which the FRMP and its measures will be assessed, while in Slovenia the results of the PFRA are used as the baseline. In Poland, although there is not a specific reference to the FHRMs, the baseline is determined based on the level of flood protection prior to the development of the FRMP.

Box 31 - Using FHRMs to assess the effectiveness of FRMP measures

In **the Czech Republic**, the effectiveness of measures under the FRMPs will be evaluated in all APSFRs through an analysis of FHRMs at the end of the flood risk management planning period. The original FHRMs will be used as the baseline. The analysis will consider the following criteria: 1) change in areas at unacceptable risk, 2) change of the number of population at unacceptable risk, 3) change of the number of constructions (objects) at unacceptable risk, 4) individual assessment of vulnerable objects, 5) change of the number of updated municipal flood action plans, 6) change of the number of local urban plans (or change in their quality), 7) change in the number of flood warning sites, 8) change of the number of the municipalities with flood warning systems.

[153] In the case of Denmark, this was for most of the FRMPs assessed.

[154] Austria, for example, subsequently explained that the baseline will be the status in 2015, the date of the first FRMP. Progress will be assessed against the state of the implementation and against the FHRMs.

A few FRMPs indicate the *timeframes* for progress monitoring reports – for example in Slovenia, a report is to be published every two years, while in Flanders (Belgium) a monitoring programme is executed on a yearly basis[155]. In Italy, some FRMPs state that yearly monitoring reports, drawing on information provided by regional bodies are produced. In Romania, progress is reported annually to the Inter-Ministerial Council for Waters. In the Netherlands, the FRMP explains that regional water authorities and national water authorities have to report on the progress of their tasks (once a year) and on the progress of large programmes (twice a year). The Dutch Delta Commission makes a yearly report on progress under the Delta Programme. In Sweden, the FRMPs are monitored on a yearly basis.

Other Member States, including Estonia and Lithuania, refer to monitoring points in the middle and end of the FRMP cycle, while Croatia requires the competent authority to report on the implementation of the FRMP after the first half of the planning period and in the next FRMP. In Belgium reporting is done in 2017 and 2019. In both Latvia and Luxembourg, on the other hand, monitoring timeframes are set on the basis of individual measures.

In terms of actors, several FRMPs state that the *competent authority* for the implementation of measures is responsible for monitoring progress. In Finland, flood groups that bring together public bodies and private stakeholders will contribute to monitoring. In Malta it is stated in the report sheets that an Inter-Ministerial Committee on Water will be established to monitor the implementation of both WFD and FD measures. While the responsibilities of the Committee are outlined, it is not explained how the progress is measured or evaluated. In Belgium (Flanders) the Water Execution Programme is a monitoring body responsible for annual monitoring of progress while in Brussels the Brussels Institute for Environmental Management coordinates and monitors overall progress on the FRMP annually, measuring both progress of the planned days of the project, and financial progress.

At least three Member States (Bulgaria, Denmark and Slovenia)[156] indicate that the monitoring report would be published online. Slovenia's FRMP also indicates that monitoring reports are subject to a simplified public consultation process.

[155] Flanders informed it monitors progress qualitatively (not started, on-going…), quantitively (if possible) and financially.

[156] Information portals on monitoring are found in Finland, Denmark, and Luxembourg.

8.10. Financing of measures

8.10.1. Costs of measures

An important factor in the success of the implementation of the programme of measures is the availability of funding to support the investments required.

Estimates of the costs of flood measures were available for about half of Member States assessed (see Table 12[157] below), though in many cases this information does not cover all FRMPs or all measures. In several Member States (for example Belgium), cost information is available in sources other than the FRMPs – for example, websites dedicated to the Programme of Measures. For the 14 Member States where estimates are (partly) available, the costs range from EUR 19 million in Cyprus to EUR 2.8 billion in Poland.

Table 12 Total costs reported for FRMP measures

Member State	**Costs reported for:**		**Total costs reported** (national currency and approximate value in Euros)	**Notes**
	Structural measures	**Non-structural measures**		
Belgium	✓		EUR 40 million	Information for two FRMPs, including investment costs but not operational costs.
Bulgaria	✓	✓	BGN 627 million (EUR 320 million)	Information available for 3 out of 4 FRMPs.
Cyprus	✓	✓	EUR 19 million	Costs for 20 measures – remaining 18 measures mostly have no cost.
Croatia	✓		HRK 4.6 billion (EUR 598 million)	Cost for 2013-2022 for infrastructure construction.
The Czech Republic	✓		CZK 14 347 million (EUR 280 million)	For "concrete" measures, mainly construction measures
Finland	✓	✓	EUR 472 million	Investment costs for 99 measures
Hungary	✓		HUF 183 billion (EUR 580 million)	Preliminary costs for 26 out of 47 measures
Italy	✓	✓	EUR 3 781 million	Costs for three of five FRMPs assessed: Eastern Alps (ITA), Ofanto/Puglia (ITR161I020), and Sardinia (ITR201). Sardinia gave information on structural measures only.
Latvia	✓	✓	EUR 203 million[158]	
Poland	✓	✓	PLN 11 650 million (EUR 2 800 million)	Costs for the majority of measures reported.
Portugal	✓	✓	EUR 176 million	Costs for the five FRMPs assessed.

[157] Table for illustration only: European Commission's own calculations on the basis of FRMPs assessed and Member State reporting.
[158] Based on information provided by Latvia.

Member State	Costs reported for:		Total costs reported (national currency and approximate value in Euros)	Notes
	Structural measures	Non-structural measures		
Slovenia	✓	✓	EUR 540 million	
Slovakia	✓	✓	EUR 400 million	
UK (N. Ireland)	✓	✓	GBP 145 million (EUR 129 million))	Cost for one UoM.

Sources: Member State reporting and FRMPs.
Notes: Unless otherwise indicated, the costs reported include both investment and operational costs.

Box 32 - A detailed breakdown of measure costs

In the FRMP for Neagh Bann in **Northern Ireland** (UKGBNIIENB) a detailed breakdown of the costs is given in the FRMP:

Prevention (2% of total cost): costs of Rivers Agency's liaison with planning authorities regarding new development: These are the estimated costs for the provision of flood risk management advice to the government and local councils;

Protection (95% of total cost): costs of measures in Rivers Agency's Capital Works Programme; costs associated with Rivers Agency's proposed operation of the Homeowner Flood Protection Grant Scheme; costs associated with Stakeholder Groups formed to address the requirements of the FD; costs associated with drainage maintenance; costs associated with drainage and flood risk management activities by "Transport Northern Ireland"; costs associated with drainage and flood risk management activities by "Northern Ireland Water"; costs associated with drainage and flood risk management activities in the Northern Ireland Department of Regional Development (DRD) 'Living with Water' Programme;

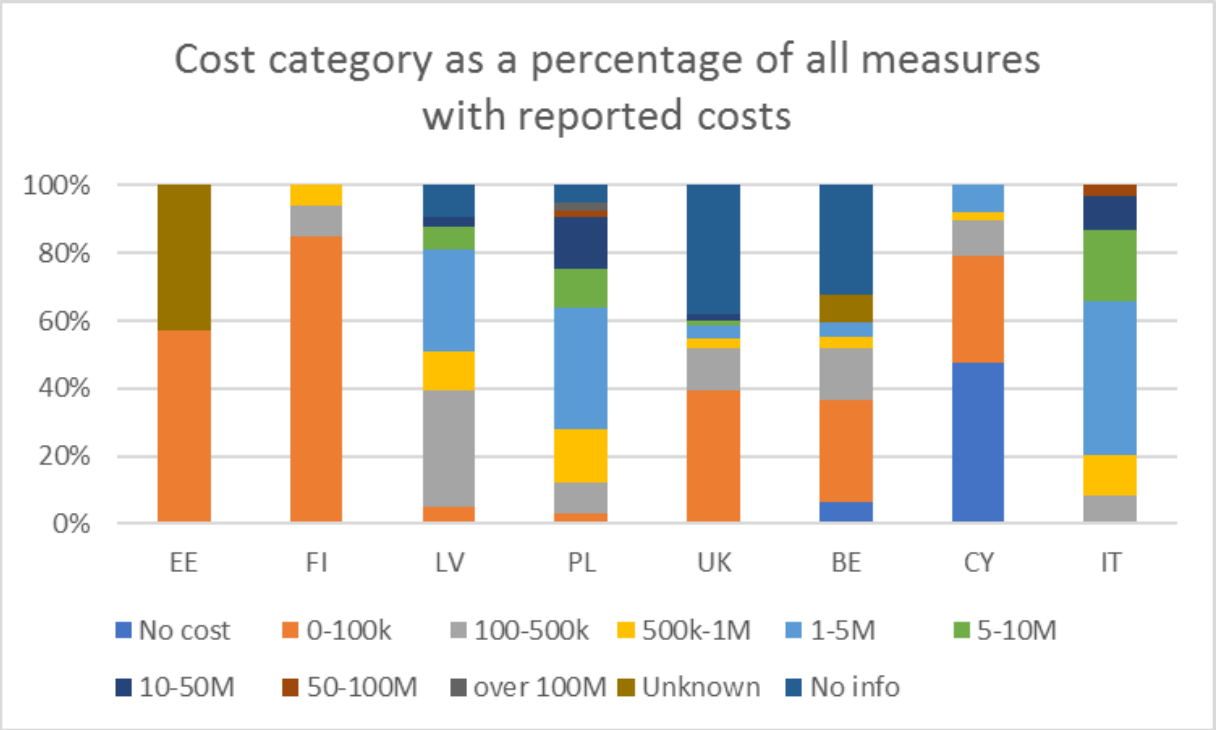
Preparedness (3% of total cost): costs associated with Rivers Agency's provision of Emergency Planning Expertise, Flood Warning, Information and Awareness activities.

A number of FRMPs indicated cost estimates would be reviewed during the implementation of the measures: Slovenia's FRMP, for example, explains that the costs of new construction measures were estimated via expert judgement and will be assessed in the project planning phase.

Several Member States – including Finland, Luxembourg, Portugal, Cyprus, and Spain – indicated that some measures were not allocated specific budgets as they are considered core activities of the competent authorities. In Finland, for example, this includes permitting

processes and land use planning; in addition, costs assumed to be carried by landowners as part of their own regular activities or legal obligations were not budgeted.

Figure 19 Reported costs for individual measures, by category



Source: WISE electronic reports 2016, 2017.
Notes: "Unknown" was used when the Member States reported that the cost is "unknown". "No info" was used when the Member States did not report any information for that specific measure.

Eight of the 26 Member States that reported provided information on the costs for each measure[159] (see Figure 19 above). Most measures reported cost EUR 100,000 or less. The breakdown nonetheless varies across the Member States: For example, in Italy the percentage of measures costing between one to five million euros (45% of all measures with reported costs) is far larger than the percentage costing between zero and EUR100 000 (<1%).

While little information is available on the distribution of costs among the aspects of flood risk management, it appears that these vary significantly, both across Member States as well as among FRMPs within a single Member States. In Portugal, the share of total cost each FRMP allocated to prevention measures ranged from 0-53%; for protection measures, 35-99%; for preparedness measures, 27-68%; and for recovery measures, from 0-28%. Large ranges were also seen among the FRMPs assessed in Spain.

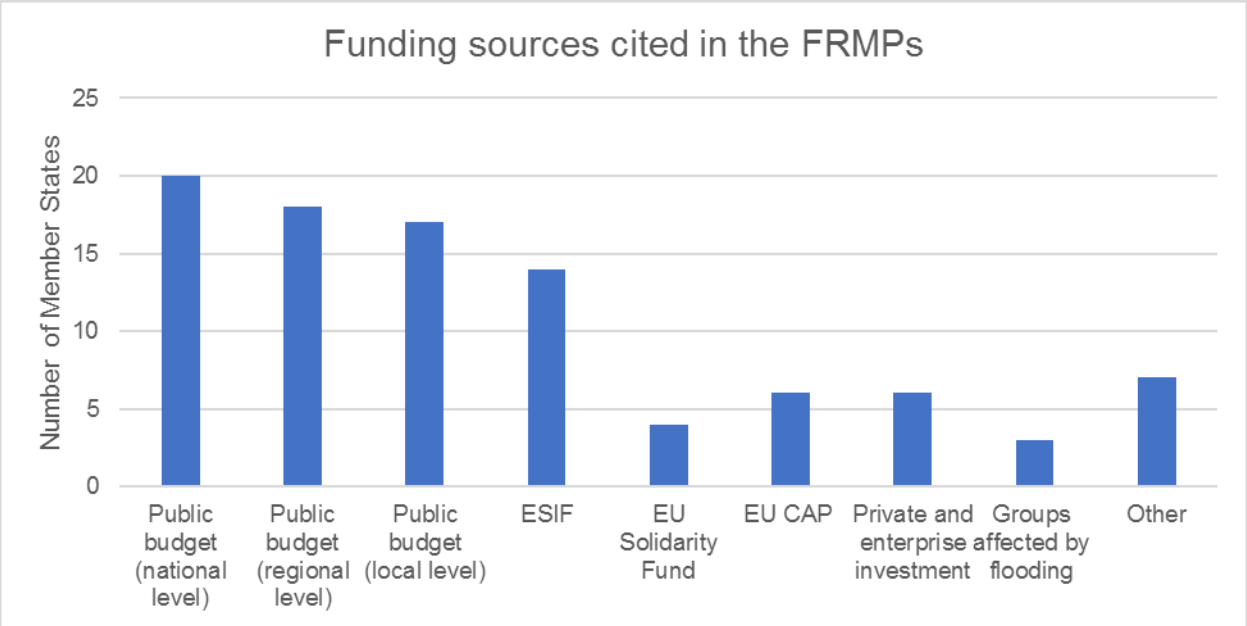
[159] This reporting was optional and even in the Member States in the graph, not all measures had cost information reported.

8.10.2. Funding sources

In 23 of the 26 Member States[160], most of the FRMPs assessed identified funding sources for measures (see Figure 20 below); however, in many cases the FRMPs make only a generic reference, identifying possible funding mechanisms rather than making budgetary commitments.

MS's own government budgets – whether at national, regional and local levels - were cited most frequently: Each of these levels was identified in more than two-thirds of the Member States whose FRMPs provided funding information. In addition, three Member States mentioned dedicated government funding instruments: The *Hochwasserschutzprogramm*, a fund in Germany jointly managed by Federal States and the Federal Government; the Delta Fund in the Netherlands and the National Water Fund and Climate Fund in Slovenia.

Figure 20 Funding sources for measures



Sources: Based information available from the assessment of FRMPs in 26 Member States.

Notes: No clear information was found for France[161] and Luxembourg, and these Member States are thus not represented in the figure.

In 15 Member States, Cohesion Policy Funds were indicated: these include the European Regional Development Fund and the Cohesion Fund as well as the European Social Fund (the latter was cited only in the FRMPs assessed for two Member States, Spain and Portugal).

[160] In Malta the information on costs was found in the RBMP, into which the FRMP is integrated.

[161] In France FRMPs are implemented via the PAPI (*Programmes d'actions de prévention des inondations)*, which in turn are financed in large part from a national fund dedicated to risk prevention.

FRMPs in two Member States – Portugal and Slovakia – indicate that EU funds are expected to provide a large share of resources for FRMP investments: In Slovakia, Cohesion Policy co-financing is envisaged for most measures.

The European Solidarity Fund was cited by five Member States.[162][163] The Common Agricultural Policy was cited by six Member States.

Private and enterprise sources, including groups potentially affected by flooding, were cited in FRMPs in six Member States[164]. In Denmark, for example, several municipal FRMPs indicate that companies potentially affected by flooding, including water and electric utilities, are expected to finance measures. In the United Kingdom, the water utility and the national rail infrastructure operator are indicated as sources of funding in the two Scottish FRMPs assessed.

Finally, other sources were cited in six[165] Member States: Poland's FRMPs, for example, indicated international development banks including the European Investment Bank as a potential source; while Croatian FRMPs refer to a loan from the Development Bank of the Council of Europe and water charges collected by Croatian Water, the water entity under the umbrella of the ministry. Bulgaria referenced EMEPA[166] and irrigation system enterprises. Both Austria and Malta identified the EU LIFE Programme as a funding source, with the latter also identifying EU Horizon 2020 projects.

In Bulgaria, the FRMPs raise the prospect that the identified resources might be insufficient to cover estimated costs. Similarly, Slovenia's FRMP states that only EUR 400 million is likely to be available from financing sources, meaning that not all measures – whose total costs were estimated at EUR 530 million – would be covered in the follow up to the 1st FRMP. In the two English FRMPs assessed, it was stated that measures do not all have secured funding and are not guaranteed to be implemented. Instead, money is allocated to Risk Management Authorities based on government policy that gives the highest priority to the areas at highest risk.

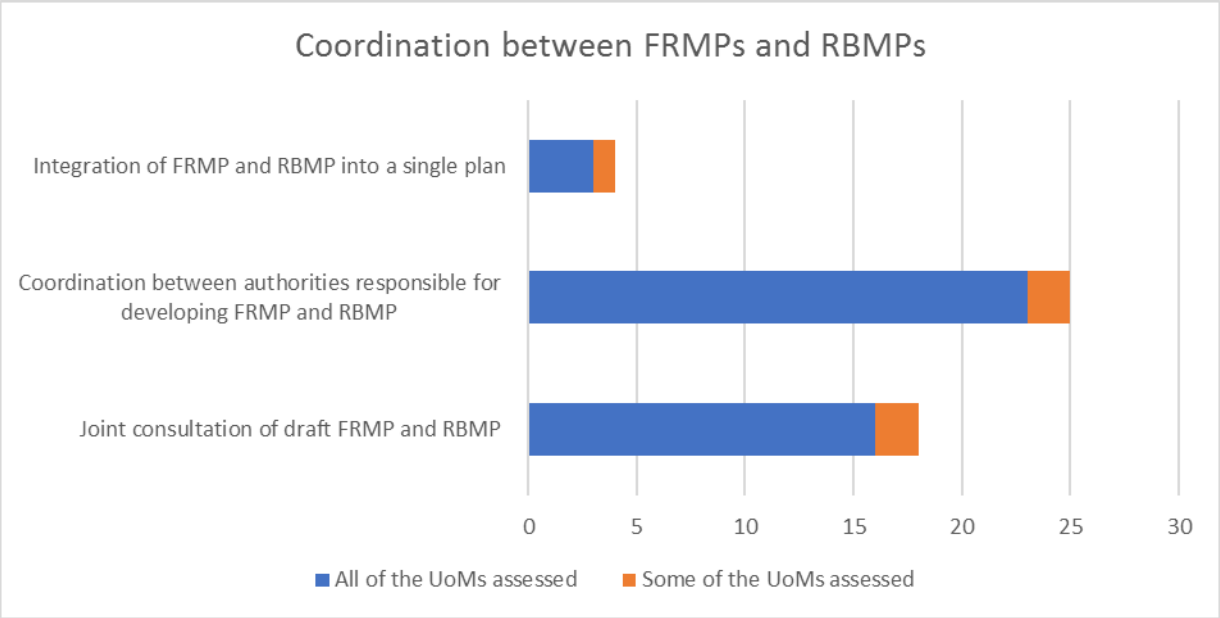
[162] In addition to these five Member States, Austria informed that in case of major flood disasters, funding of measure type M20 (Sofortmaßnahmen) can be supported by the EU Solidarity Fund. To illustrate, in Austria, the EU Solidarity Fund was mobilised for the enormous flood damages in the years 2002, 2005 and 2013.
[163] This fund was set up to respond to major disasters in the EU, including floods.
[164] Austria, Germany, Estonia, Spain, Poland, and the United Kingdom.
[165] The FRMPs in Lithuania do not define what is meant by "other".
[166] The Bulgarian Enterprise for Management of Environmental Protection Activities.

8.11. Coordination with the WFD

8.11.1. Developing the FRMPs and RBMPs

In the majority of Member States and UoMs assessed, separate FRMPs and RBMPs were prepared (see Figure 21 below).

Figure 21 Coordination between FRMPs and RBMPs



Source: Member States reporting under the FD and the WFD; FRMPs.

There are nevertheless few exceptions. In Croatia and in the Flanders and Brussels Regions of Belgium, a single plan was prepared for both FRMPs and RBMPs. In Malta as well, a single plan was prepared, with the FRMP presented as an annex of the RBMP. In Lithuania, while separate plans were prepared, measures from both the FRMPs and the RBMPs were integrated into the Water Sector Development Programme 2017-2023, although it should be noted that the Programme includes only limited text from each plan. In the Czech Republic, separate FRMPs and RBMPs were prepared at UoM level (consequently, the Czech Republic is not included in the figure among the Member States with integrated plans); however, integrated plans were prepared at a lower, sub-basin level, addressing both RB management and flood risk management[167].

[167] The Czech Republic indicated three levels of plans: those for international UoMs (level A), for national UoMs (level B) and sub-basins within the UoMs (level C); the Czech Republic reported the level B plans to WISE but not the level C plans.

Despite this diversity, almost all Member States have designated UoMs under the FD which correspond to the RBDs designated for the WFD (with the exception of Italy and Romania). In the United Kingdom, for example, this extends to sub-basins (catchments).

In addition, in nearly all the Member States assessed, the same authorities prepare both the FRMP and the RBMP. Among the exceptions is Northern Ireland, where different authorities prepare the two types of plans but have continuous engagement through an interdepartmental steering group and via local Flood Forums; another is Sweden, whose Water Authorities prepared the RBMPs while county administrations prepared the FRMPs.

In other Member States, it is often stated in the FRMPs that coordination is carried out between the two authorities. In Slovenia, for example, the FRMPs and RBMPs are prepared in the same authority but by different teams. In both Italy and the United Kingdom, this depends on the UoM (and in the case of the United Kingdom, the country).

In more than half of the Member States assessed, it was reported that consultation of the draft FRMP and draft RBMP were carried out together. In Bulgaria, for example, national law requires the public consultation for both plans to be run in parallel. Some Member States carried out joint stakeholder engagement activities for the two Plans. In Estonia, for example, consultations within the Commission for RB Management, which brings together government bodies, national experts and water service companies, addressed both the FRMPs and RBMPs.[168]

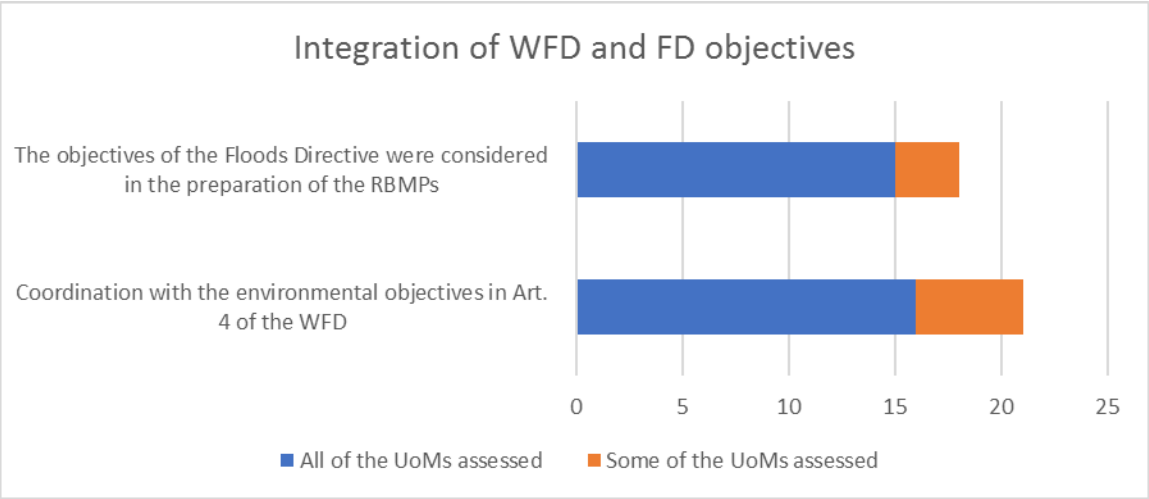
In another example of linked work, joint SEAs were undertaken for the RBMPs and FRMPs in three out of the five UoMs assessed in Spain.

8.11.2. Relationship with WFD Objectives

In the majority of the Member States assessed – 21 out of the 26 – FRMPs refer to coordination with the environmental objectives set out in Article 4 of the WFD in all or at least some of the UoMs assessed (see Figure 22 below). Austria's FRMP, for example, states that WFD objectives must not be endangered and have priority over FD objectives. On the other hand, in 18 Member States, the objectives of the FD were considered in the preparation of the RBMPs in all or at least some of the UoMs assessed (based on reporting of RBMPs under the WFD).

[168] In addition, Austria informed that a joint brochure and a joint roundtable on water issues were used to launch the consultation process for both its FRMP and RBMP.

Figure 22 Integration of objectives in RBMPs and FRMPs



Source: Member States reporting under the FD and the WFD; FRMPs.

Moreover, in at least nine Member States, the FRMPs describe measures in terms of their WFD objectives: For many of these FRMPs, measures are assessed to determine whether they impact on WFD objectives (see the example below from Poland). Germany, for example, categorised its flood measures on three levels: those that support implementation of the WFD; those that are neutral or not relevant; and those that might lead to a conflict with implementation of the WFD. Some FRMPs in Italy, such as the Plans for the Po and for the Eastern Alps, also categorised flood measures along these lines.

Box 33 - Assessing the impact of FRMP measures on WFD objectives

In **Poland,** the FRMPs indicate that the biological and hydromorphological quality elements under the WFD were considered in the analysis of the impacts of the FRMPs on WFD objectives. Hydromorphological elements considered include: Quantity and dynamics of water flow, connections with groundwater bodies, river continuity, morphological conditions: river depths, width variation, structure and composition of river beds, coastal zone structure. The FRMPs also indicate that opportunities for fish passages for flood structures were analysed.

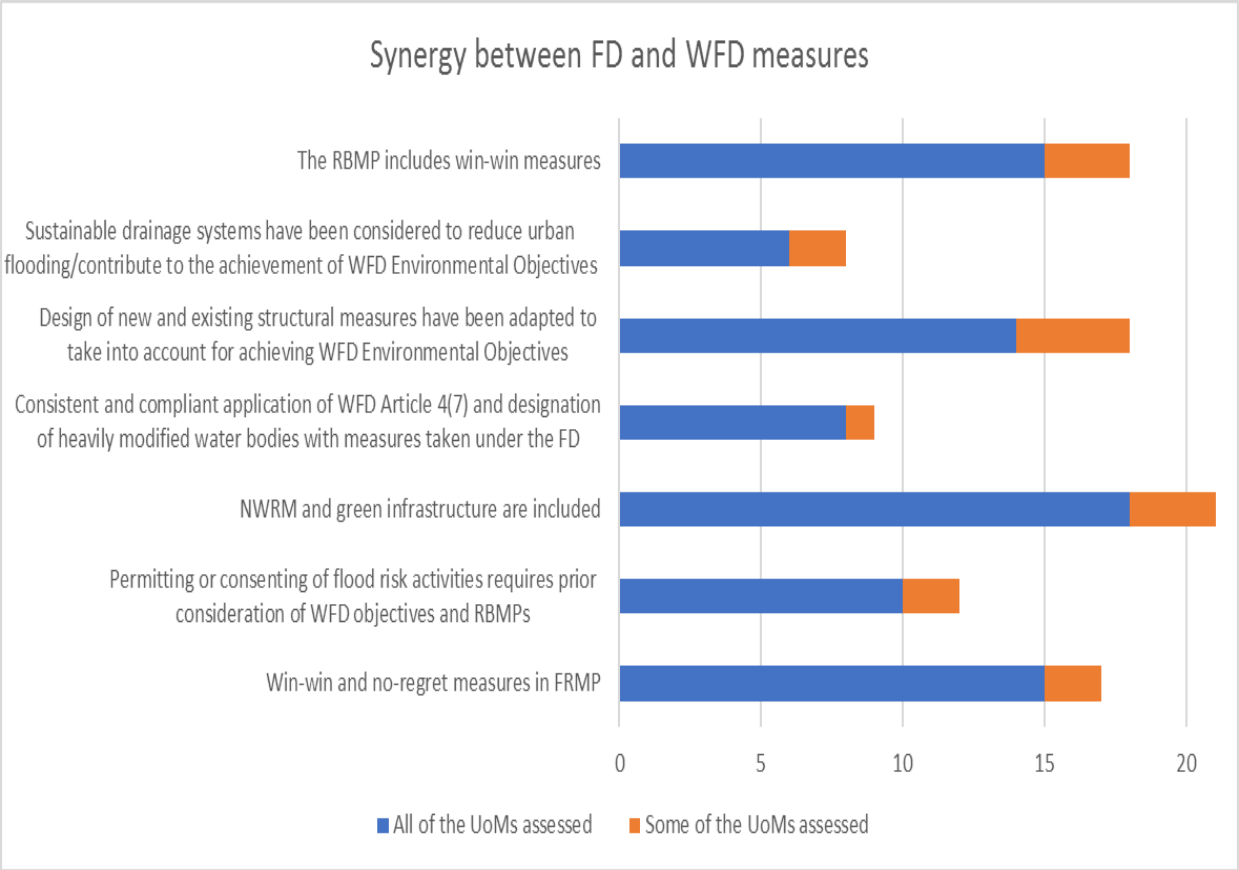
8.11.3. Synergies between FRMP and RBMP measures

In several areas, FRMP measures can support WFD objectives. Moreover, synergies between FRMPs and RBMPs can include:

- Consistent application of WFD Article 4(7) and designation of heavily modified water bodies due to measures under the FD, e.g. flood defence infrastructure;
- The design of new and existing structural measures, such as flood defences, storage dams and tidal barriers, have been adapted to take into account achieving WFD Environmental Objectives;
- The use of sustainable drainage systems, such as the construction of wetland and porous pavements, have been considered to reduce urban flooding and also to contribute to the achievement of WFD Environmental Objectives;
- The RBMP PoM includes win-win measures in terms of achieving the objectives of the WFD and FD, drought management and NWRMs;
- Permitting or consenting of flood risk activities (e.g. dams, dredging, flood defence construction) requires prior consideration of WFD objectives and RBMPs.

The figure below shows how these actions were applied in the FRMPs assessed.

Figure 23 Synergies between FRMP and RBMP measures



Source: Member States reporting under the FD and the WFD; FRMPs.

Looking at coordination overall, a number of Member States carried out efforts across all aspects of FRMP and RBMP preparation: one example is Germany, described in the box below.

Box 34 - Coordination of FRMPs and RBMPs

Germany carried out an intensive coordination of its FRMPs and RBMPs. Aspects included: joint consultation, coordination between competent authorities, coordination of objectives and measures. The FRMPs also contain assessments of the interactions between measures under the FD and the objectives of the WFD. As noted above, Germany assessed its FRMP measures in terms of their level of support for WFD objectives. Coordination with local authorities and authorities from other departments (than those responsible for floods) took place with relevant stakeholders when developing both plans.

8.12. Summary of good practice and areas for further development

8.12.1. Good practices

Across the Member States there were a number of good practices. To begin with, several Member States clearly linked their measures to the objectives in all or some of the FRMPs assessed. For example, Slovakia provided a comprehensive assessment of the potential impact of the existing and suggested protection measures in achieving the FRMP objectives.

Secondly, some Member States such as Bulgaria and Estonia included specific detail on their measures, including location, cost and responsible authority. The FRMPs for a few Member States such as Poland provided estimated costs for all measures as well as indications of main sources of funding.

Several Member States provide clear information in their FRMPs with respect to monitoring the progress of the measures in relation to the objectives and for tracking the implementation of the measures. In Spain (for the five FRMPs assessed) progress in the implementation of planned measures is tracked via monitoring indicators, including quantitative baselines and targets. In Bulgaria, the FRMP for the West Aegean (BG4000) defines two separate indicators per planned measure - one for tracking implementation progress and one for tracking progress towards achieving the objectives. Interestingly, Denmark and Slovenia indicate that they will include an element of public transparency and consultation with respect to monitoring the implementation of measures. Specifically, in one Danish municipality (Norddjurs) there are

plans to have a public log where the public can follow the implementation of measures and in Slovenia, monitoring will be carried out every two years and will include a public consultation process.

The prioritisation of measures was addressed well by a number of Member States. In Italy, for example, the FRMPs provided details of the prioritisation processes including the criteria used.

With respect to co-ordination of measures with the WFD and integration with RBMPs, three areas of good practice can be observed 1) with respect to co-ordination of plans and consultation and 2) processes for assessing the relationship between measures in FRMPs and RBMPs and 3) presence of win-win measures for both Directives.

Nearly all Member States included nature based solutions (including NWRMs); a few, including Austria and Luxembourg, planned a high number of such measures. A range of approaches are seen: Bulgaria's FRMPs, for example, include several types of NWRMs: the re-naturalisation of rivers and river beds; re-meandering of rivers, and afforestation of areas along rivers, coasts and dams. Malta refers to the introduction of sustainable urban drainage systems.

Almost all Member States included measures on spatial planning and land use in their FRMPs: For example, all of Germany's FRMPs assessed have measures to control building and development in floodplains. In many, as in France, the measures call for the integration of flood risks into spatial plans.

While few Member States addressed insurance in their plans, good practices can be seen in Lithuania and Portugal, both of which include measures for the national framework for flood insurance. Bulgaria, Cyprus, Luxembourg, and Slovenia's FRMPs include measures to raise awareness of insurance schemes.

8.12.2. Areas for further development

A key aspect requiring attention and seen in many FRMPs was a lack of clarity on how objectives would be met and if measures put forward were indeed sufficient to achieve objectives. This is related in part to the fact that for many Member States, objectives are not specific or measurable (see section 7) and often, the measures are not specific or measurable either. Further, only about half of Member States provide a link between objectives and measures in their FRMPs, for example by identifying which objectives each measure

contributes to. Few FRMPs identify indicators or other mechanisms that would show if the implementation of measures will lead to the achievement of objectives, or a baseline against which to measure their impacts. Considering that these were the first FRMPs and that there is a requirement to assess progress towards the achievement of objectives set from the second FRMPs onwards, the evidence cannot be conclusive, but it is suggestive and points to difficulties in assessing progress come 2021.

With respect to costs there was a lack of or incomplete cost information in many Member States. Several Member States lacked information on funding sources as well. For a number of countries, the methodology for prioritisation of measures was not clear or not provided.

In terms of links with the WFD, some Member States made unclear or no links between the FD's and the WFD's measures, others made limited links.

There was a lack of detail on nature based solutions (including NWRMs) in a few FRMPs. Very few FRMPs provide information on how nature conservation was addressed in their measures, though nature based solutions should have positive impacts on nature.

On the basis of the discussion in chapter 8, the following recommendations can be made for the preparation of the second FRMPs:

- Member States should seek to exhaust possibilities for specific and measurable details on their measures and should clearly link measures to objectives in their FRMPs. Where possible, FRMPs should also present indicators or other mechanisms to show how the implementation of measures supports the achievement of objectives.

- Member States should provide a baseline against which impacts are measured in their FRMPs. This information will help to ensure that measures' progress towards reaching the objectives set is monitored.

- Member States should provide in their FRMPs more concrete information on the estimated costs of the measures and sources of funding.

- Member States should strengthen the links between the FRMPs and the RBMPs where the two Directives intersect.

- Member States should seek to identify further opportunities to use nature based solutions for flood risk management.

- Member States should assess whether encouraging economic instruments (possibly including insurance) that promote flood risk reduction are relevant to their particular situation and mix of measures.

9. Consideration of costs and benefits and use of CBA

The FD states that "*Flood risk management plans shall take into account relevant aspects such as costs and benefits….*" (Article 7(3)). The Annex on FRMPs goes on to list, among the components to be included in the Plans, "*when available… a description of the methodology… of cost-benefit analysis used to assess measures with transnational effects*" (which effects may extend geographically wider than the location of the measure itself, or of the relevant APSFR), indicating this analysis is particularly valuable in a transboundary context. The Directive's Annex also calls on FRMPs to describe the prioritisation of measures: An analysis of costs and benefits of measures could be an important consideration both in their selection as well as their prioritisation.

This section reviews the information gathered from Member States' reporting and from the FRMPs assessed on approaches to consider the costs and benefits of the measures set out in their FRMPs, including their use of CBA.

9.1. Overview of the consideration of costs and benefits in FRMPs

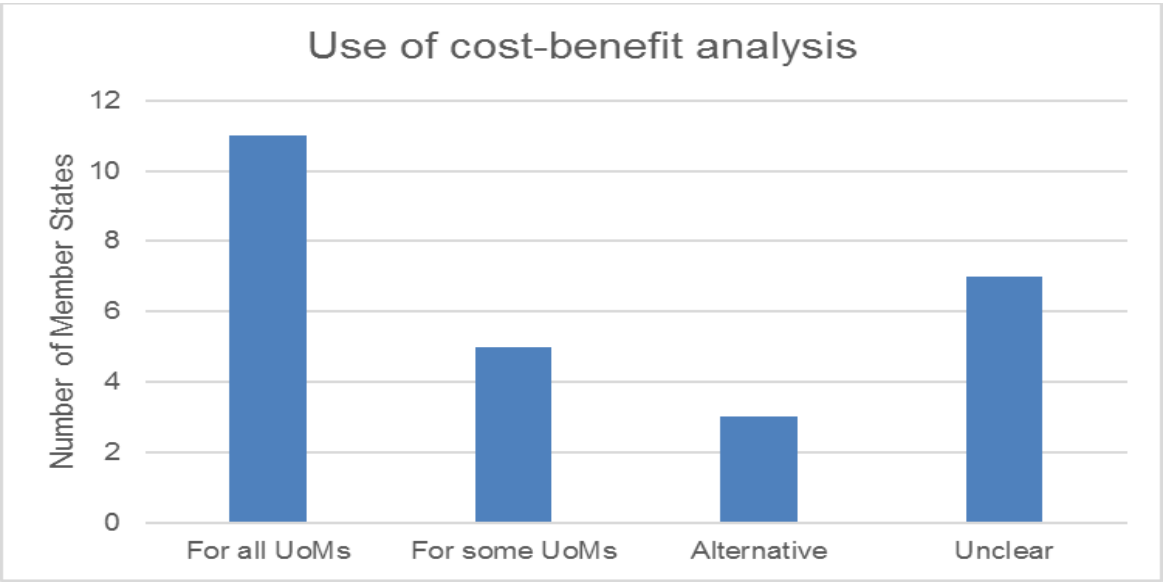
A majority of the Member States assessed, 19, have made some analysis of costs and benefits of their measures. Among the 19, fewer, 11 out of 26 of the Member States assessed used a CBA in all UoMs assessed (see Figure 24 below). A further five of the 19 Member States indicated the use of CBA for some of their FRMPs, in some cases referring to cost-effectiveness rather than cost-benefit analysis. In Portugal, for example, the FRMP for Azores (PTRH9) includes "the cost-effectiveness of measures" among its objectives, and the FRMP for Madeira (PTRH10) provides a cost-effectiveness assessment for one measure. In Italy, a reference to CBA is found in three of the five FRMPs assessed, though the information provided was limited for some: For the Eastern Alps (ITA), for example, economic analysis is one of the four criteria used for prioritisation, though details on the approach are not provided in the Plan. The FRMP for Puglia and Ofanto (ITR161I020), on the other hand, discusses costs and benefits (see the box below).

Not all FRMPs provided a summary of results from CBA: For example, no information was found for two of Bulgaria's four FRMPs, nor in two of the five Italian FRMPs assessed.

Box 35 - Assessing costs and benefits in the FRMP

In **Italy**, the FRMP for Puglia and Ofanto provides an overview of the costs of measures to be financed by the Puglia Region and presents estimates of the costs of floods for three sectors: urban/residential, industry and agriculture. The Plan also notes that recent and historical floods have high costs in terms of transport infrastructure and also in terms of lives (the reporting sheet notes impacts on human health and lives are difficult to quantify in monetary terms and are not included in the cost estimates.) The Plan indicates that damage costs will be further estimated in the implementation of the Plan itself.

Figure 24 Number of Member States reporting the use of cost-benefit analysis or alternative approves for measures



Source: Member States reporting and FRMPs.
Note: Cyprus uses a cost-benefit analysis for construction measures and an alternative system for non-construction measures. As Cyprus has one UoM, it is counted in the category 'all UoMs'. Slovenia's FRMP and French authorities state that a CBA is to be done at project level; both have been included in the first category "for all UoMs".

Three of the 19 Member States that made some analysis of costs and benefits presented alternative approaches: Both Austria and Luxembourg indicated that expert judgement was used to rate the cost-effectiveness of measures on a simple scale (in Austria, the scale had three levels: very high, high and even, i.e. neutral, cost-effectiveness). The Czech authorities

clarified that a full CBA was not used, although an expert assessment of costs and benefits was carried out for at least a set of measures.

Information on the use of CBA was unclear in seven Member States. Latvia and Sweden[169], for example reports the use of CBA but no information on where and how it was applied, or on its results, was found in the FRMPs. In Germany, the use of CBA or the methodologies applied were not found in the FRMPs assessed (CBA is applied at the project level), while in Malta, it was subsequently clarified by the Maltese authorities that a holistic economic assessment was carried out as part of the analysis of FRMP and RBMP measures. For Spain, while all five FRMPs assessed refer to CBA as a criterion for selecting and prioritising measures, the reference is always brief, and no further details were found, nor evidence of the results of a CBA exercise. In the Netherlands cost benefit analysis was carried out as part of the preparation of the National Water Plan, details are lacking on the methodology and outcomes in the FRMP. In Croatia, a CBA methodology was developed but apparently was not used for the FRMP (it will be used for the revision of the separate Multi-annual programme for the construction of regulation and protection water facilities and amelioration facilities.)

9.1.1. Measures assessed with CBA

When looking at the 19 Member States where a CBA or an alternative method was indicated, more than one third – seven Member States – reported that it was used for all measures (see Figure 25 below) in at least some UoMs. This includes Austria and Luxembourg, which employed a simplified approach to cost-effectiveness analysis based on expert judgement. In Lithuania, it is reported that CBA was used for measures across all four aspects (protection, prevention, preparedness and recovery & review); however, CBA was not carried out for NWRMs due to methodological difficulties (see also below)[170].

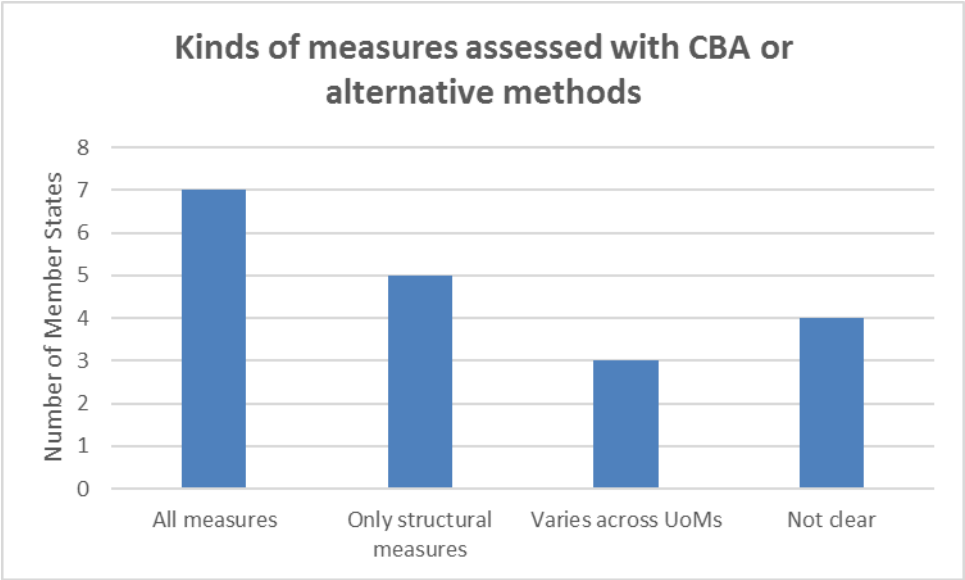
Five Member States indicated that CBA was only used for structural measures. In many cases, as in Finland, it appears that CBA is used mainly for structural measures that are construction projects, i.e. “grey infrastructure”, rather than NWRMs or other nature-based approaches (“green infrastructure”). In Estonia, however, both grey and green infrastructure were assessed. In Slovenia and France, CBA was not carried out during the preparation of the FRMP itself; rather, it is used at project level - in France it is not clear which types of measures are subjected

[169] In the Swedish guidance document on how to produce the FRMP, costs and benefits are seen as voluntary basis, except for the international plan for the APSFR Haparanda, which is an area shared with Finland. Sweden also noted that in the Vännäs FRMP (not among the five assessed here), the most cost-effective measures have been prioritised, and in particular low or no cost measures were considered in this FRMP.

[170] Despite this, Lithuania was still categorised as “all measures” in the graph below.

to a CBA, but in Slovenia, the focus appears to be on structural measures. In Romania, a multi-criteria analysis with cost-benefit elements was used for most measures at APSFR level. However, it was not used for non-structural measures deemed necessary for flood management, nor those measures with major environment benefits, as these measures are considered to be a high priority, regardless of the results of such an analysis.

Figure 25 Measures assessed with CBA and alternative methods



Source: Member State reporting and FRMPs.

Note: Based on the 19 Member States that used CBA (or alternative analysis) in some or all of their UoMs – out of the 26 Member States assessed.

In three Member States, the application of CBA varies across the UoMs assessed. Italy is one, mentioned above. The second is the United Kingdom: in the Neagh Bann UoM in Northern Ireland, the FRMP mentions that maintenance and capital programmes are evaluated using cost-benefit criteria; the Severn FRMP indicates that in Wales, the prioritisation of all measures considers costs and benefits; in Scotland, the FRMPs assessed state that all measures are appraised for their costs and benefits (including potential economic benefits and non-monetary impacts on the community and the environment). In Denmark, the third Member States, two municipalities assessed used CBA for the prioritisation of measures. In the municipal FRMP for Odense Fjord, costs were calculated for all proposed measures. In the municipal FRMP for Aabenraa, costs for a levee and some technical infrastructure (pumps and sluices) were calculated. In both cases, only investment costs appear to have been considered.

In four Member States (Belgium, The Czech Republic, France, and Portugal), information was not found to understand if CBA was applied to all measures or only some.

9.2. Overview of the methodologies applied

Across the 19 Member States that applied some form of CBA (or related analysis), twelve[171] provided clear indications of the methodology used. In nearly all these cases, a national approach had been developed. One example is Bulgaria, described in the box below.

Box 36 - Cost-Benefit Analysis methods

Bulgaria's national methodology was based on EU guidance for investment projects financed under Cohesion Policy[172]. Bulgaria further developed this approach for application to structural projects for floods: A national catalogue of measures provides estimates of the costs of the measures (investment and operational costs); benefits were estimated based on the damages avoided by the projects, calculated for different assets (including homes, infrastructure and land). Costs and benefits were calculated for three flood scenarios (20, 100 and 1000-year floods), based on information in Bulgaria's FHRMs[173]. In Bulgaria, results were presented in terms of economic net present value (ENPV), economic rate of return (ERR) and benefit-to-cost ratio (B/C) – these indicators were also used in Poland (see the next box).

As in Bulgaria, several other Member States indicate that costs were estimated based on both investment and operational costs – this was the case for Cyprus[174], Hungary and Slovenia, for example.

A few Member States refer to the benefits part of the CBA in terms of protection of health, the environment and cultural heritage in flood events. In Slovenia, benefits are calculated in terms of reduction of damage to the health of people, environment, cultural heritage and the economies of the affected areas. Slovakia's methodology considers a broad range of damages

[171] Detailed information was found for Bulgaria, Finland, Hungary, Lithuania, Luxembourg, Poland, Slovenia, Slovakia and Cyprus. Some information was found for Denmark, Estonia and Romania. Information for Croatia was provided subsequently by the Croatian authorities, however, no information was to be found in the FRMP or in the reporting sheets.

[172] European Commission, Guide to Cost-Benefit Analysis of Investment Projects: Economic Appraisal Tool for Cohesion Policy 2014-2020 (prepared by Davide Sartori et al), 2014. Available at: http://ec.europa.eu/regional_policy/en/information/publications/guides/2014/guide-to-cost-benefit-analysis-of-investment-projects-for-cohesion-policy-2014-2020

[173] In Bulgaria's Danube UoM (BG1000), only the 100-year scenario was used.

[174] Cyprus' methodology concerned the cost-effectiveness analysis.

avoided in its calculation of the benefits of flood investments, including cultural heritage sites, potential pollution loads from IPPC and Seveso installations. In Poland, the avoidance of both material and intangible losses were included in the benefit calculations (see the box below).

Among the FRMPs that provided information on CBA methodology, the time frame used in the calculations varies. Hungary and Cyprus, for example, reported using a 30-year planning timeframe; Poland, a 50-year time frame; in Slovakia the lifetime of a measure was considered to be 100 years.

Box 37 - Cost-benefit analysis

In **Poland** the analysis period covered 2015 to 2064. First, an analysis of investment and operational costs was carried out, followed by an analysis of social costs and benefits. The following social benefits were included: flood losses avoided as a result of investments, avoided intangible losses calculated in the amount of 40% of material losses, induced economic benefits. The reduction of flood losses was calculated as the difference between the losses without investment and with investment (after completion). Based on the hydrological model, the surface of floods was simulated for various flow values with a defined probability of occurrence: 10%, 1% and 0.2%. The values of flood losses were based on national scale. These values were indexed for inflation (based on values appropriate for a given category of land use in previous years).

The method used is based on the calculation of average annual flood losses (AAD). On the basis of the cost-benefit analysis, the following economic performance indicators were calculated: economic net present value (ENPV), economic rate of return (ERR) and benefit-to-cost ratio (B/C).

As noted above, Austria and Luxembourg used a simplified cost-effectiveness approach based on expert judgement. In Austria, each measure description has a qualitative estimation of the cost-effectiveness of the measure. For example, for Austrian measures under type M01 (EU measure type M21[175]), the following assessment is provided: “As the costs of this measure are relatively low, and the associated reduction in risk potentially very high, it can be assumed that the cost-effectiveness is usually very high”. In Luxembourg, a similar approach considered several factors such as: Economic costs and benefits, effectiveness in terms of achieving WFD objectives, implementation feasibility and expected flood risk reductions and improvements in the risk management.

[175] Prevention, Avoidance, Measures to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation.

9.2.1. Consideration of multi-benefits from measures

Measures can have multiple benefits beyond those related to their immediate aims. This is the case in particular for nature-based solutions (such as afforestation, room for the river and wetlands restoration measures): In addition to benefits for flood protection, these can increase a range of other ecosystem services such as enhancement of biodiversity, provision of food and raw materials, and enhancement of recreation opportunities[176], but also potentially prevent other disasters such as mud- or landslides. Multi-benefits of measures can exist in other areas as well: For example, preparedness measures for flood protection may also improve preparedness for other natural hazards, such as forest fires.

Relatively few indications were found that multi-benefits were considered. In some of Denmark's municipal FRMPs, the provision of recreation benefits alongside flood risk reduction efforts is considered. In Luxembourg and Cyprus, as noted above, the cost-effectiveness assessment considered WFD objectives, and thus the ecological and chemical status of water bodies. Also in Bulgaria, synergies between FD measures and WFD objectives were considered. In the case of Hungary, it was reported that the FRMP considered multi-benefits; however, no details were found in the plan itself.

9.2.2. Consideration of the transnational effects of measures in CBA

The Annex to the FD states that FRMPs should describe the methodology for CBA of measures with transnational effects when available. The assessment of FRMPs, however, found only one example where CBA was used in this context for a specific measure, in Finland's FRMP for the Tornionjoki catchment (see the box below).

Box 38 - Bilateral coordination on mapping, objectives and measures

The lower Tornio or Torne River forms part of the border between **Finland** and **Sweden**. Coordination between the Finnish Tornionjoki catchment (FIVHA6) and the Swedish Torne River UoM (SE1TO) has covered the preparation of FHRM maps, supported via a joint Interreg project (see section 7) and objectives (see section 8). CBA was used in a transboundary context: A measure for flood protection walls in the city of Tornio was assessed for impacts on the city of Haparanda in Sweden, just across the Torne River.

[176] European Commission (DG Regional and Urban Policy), The Guide to Multi-Benefit Cohesion Policy Investments in Nature and Green Infrastructure (prepared by IEEP and Milieu Ltd), 2013. Available at: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/guide_multi_benefit_nature.pdf

A great number of FRMPs noted that there were no transboundary measures, and for this reason transnational effects have not been considered. This approach, however, would not have captured possible transnational effects stemming from national measures. In Poland, transnational effects were assessed as negligible in most cases.

9.3. Summary of good practice and areas for further development

Among **good practice**, a key result is that some form of consideration of costs and benefits – both the use of CBA as well as simpler approaches – was made in over two-thirds of the Member States assessed. A number of Member States, such as Poland and Slovakia, provided a clear overview of the methodology used for CBA. While not all Member States used a comprehensive CBA approach, Austria, The Czech Republic, and Luxembourg applied a simple method based on expert judgement.

Among the **areas for development**, not all Member States provided clear information on the CBA methodologies applied and their results; in several cases the FRMPs assessed do not describe clearly how CBA results have been used in the selection or prioritisation of measures.

One notable area for development is that only one case has been identified (and only for one measure) where a CBA was used to assess measures with transnational effects. This is indeed notable given the many transboundary RBDs/UoMs in Europe.

In addition, few examples were found where CBA included multi-benefits. Such benefits are expected especially for NWRMs, and in several Member States that used CBA, this was not carried out for such measures but only for “grey infrastructure” construction measures.

On this basis, the following recommendations can be made for the preparation of the second FRMPs:

- Member States should consider a more systematic consideration of costs and benefits, where possible via the use of CBA. These methods should be integrated into the selection and prioritisation of measures, to promote cost-effective paths for efficient flood risk management.

- A review of potential transnational effects of FRMP measures (even if the measures themselves do not cross borders), supported through CBA, should be carried out, for example in the context of international RB commissions, to ensure

that these effects are considered in the selection and prioritisation of measures.

- It may be useful to further explore and identify methods for multi-benefits and for the CBA of nature based solutions at EU level. Developing expertise in this area will reinforce the overall CBA approach.

10. Consideration of the likely impacts of climate change

The EU's 2013 Climate Change Adaptation Strategy[177] underlines the importance of addressing flood risks due to climate change, highlighting the role of the Directive in doing so. The evaluation of the 2013 EU Strategy on adaptation to climate change concluded in November 2018 that as a policy instrument the strategy has succeeded in focusing decision-makers on the need to prepare for climate hazards[178]. The FD in turn underlines that climate change leads to greater "*likelihood and adverse impacts of flood events*" (preamble, recital 2). The Directive therefore calls on Member States to address climate change in the PFRAs and the FRMPs and to address likely climate change impacts on the occurrence of floods in the reviews of their FRMPs (Article 14(4)) – consequently, the consideration of climate change impacts will become mandatory with the second cycle of FRMPs.

The economic costs of flooding in Europe have increased significantly since the 1970s, and the changing climate has played a role in this trend[179]. Greater flood risks are forecast in coming decades, in particular in northern and north-western Europe. A recent review by the EEA underlined that modelling of the effects of climate change on river water flooding indicates major differences across Europe: increases in flooding are projected in parts of France, northern Italy as well as the Balkans and Carpathian regions; some other areas, however, may see decrease in flooding. On the other hand, mean sea levels are expected to rise in coming decades, as are increases in the intensity of storm surges: these factors are expected to increase the frequency of seawater flooding across EU coastlines[180]. Most recently, the October 2018 report of the Intergovernmental Panel on Climate Change (IPCC) "Global Warming of 1.5°C" mentioned that human exposure to increased flooding is projected to be substantially lower at 1.5°C as compared to 2°C of global warming, although projected changes create regionally differentiated risks. The report reminds that the differences in the risks among regions are strongly influenced by local socio-economic conditions.[181]

[177] See https://ec.europa.eu/clima/policies/adaptation/what_en (under review at the time of drafting this report)
[178] https://ec.europa.eu/clima/news/europe-ready-climate-impacts-commission-evaluates-its-strategy_en
[179] Other key factors include development within floodplains.
[180] From EEA, Climate change adaptation and disaster risk reduction in Europe: Enhancing coherence of the knowledge base, policies and practices, EEA Report No. 15/2017
[181] Technical summary: http://www.ipcc.ch/report/sr15/

10.1. Integration of climate change in the PFRA and FHRM stages

Looking back, the EU Overview Report on the PFRA assessment found that 17 Member States, out of 23 that were assessed, considered climate change in their assessments of flood risk. Seven Member States did not consider climate change, and there was no information for the remaining five Member States[182,183]. Subsequently, the EU Overview report[184] on the development of the FHRMs found that 16 out of 27 Member States assessed took climate change into account. The two reports noted different approaches compared to the PFRA stage for a few Member States: For example, Estonia, Hungary and Spain considered climate change in the PFRA stage but not the FHRM stage, while Ireland did not consider climate change for its PFRA but did for the FHRMs.

10.2. Addressing climate change in the FRMPs

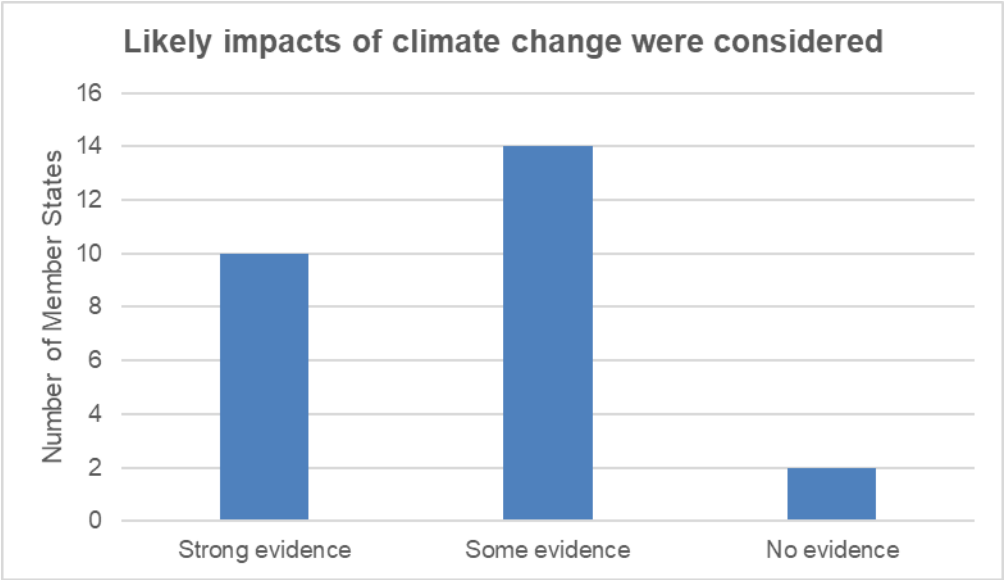
Information from Member States reporting and from the FRMPs assessed found that a high share of Member States considered at least some aspects of climate change: as shown in Figure 26 below, the FRMPs of ten Member States provided strong evidence that climate impacts were considered; those for 14 Member States provided some evidence (out of FRMPs assessed in 26 Member States).

[182] One Member State had not reported, four had applied Article 13.

[183] European Commission, European Overview Assessment of Member States' reports on PFRA and Identification of Areas of Potentially Significant Flood Risk (drafted by WRc et al), 2015, Table 18.

[184] European Commission, EU overview of methodologies used in preparation of Flood Hazard and Flood Risk Maps (drafted by WRc et al), 2015.

Figure 26 Consideration of climate change in FRMPs



Source: Member State reporting and FRMPs.

An example of strong evidence is seen in Denmark, where most of the municipal FRMPs assessed refer to links with municipal climate change mitigation and adaptation plans. In Estonia, each FRMP includes a chapter dedicated to climate change and how its impact has been addressed, starting from the PFRA stage.

Member States providing some evidence including those where only a small share of the FRMPs assessed considered climate change. In Finland, one FRMP (for the Kalajoki catchment areas in FIVHA4) includes adaptation among its objectives. This category also includes Member States where brief information is provided on climate impacts but little description on how climate is considered in measures. For a few Member States, the discussion of climate is brief and general. In Cyprus it is stated that the FRMP is reviewed periodically and updated if necessary, taking into account the likely effects of climate change in relation to the occurrence of floods.

10.2.1. Reference to national climate change adaptation strategies

Although many FRMPs consider potential impacts of climate change on flooding, less than half refer to the national adaptation strategies prepared by Member States under the EU Adaptation Strategy[185]. In eight of the 26 Member States – Austria, Cyprus, Estonia, Croatia,

[185] https://ec.europa.eu/clima/policies/adaptation/what_en

Hungary, Malta[186], Poland and Slovakia – all FRMPs assessed referred to such national strategies; in a further six Member States - Belgium, Bulgaria, Italy, Portugal, Spain and the United Kingdom – some but not all FRMPs assessed had such references; and no references were found in the FRMPs of the remaining 12 Member States (see Figure 27 below).

The FRMPs that do make such references describe the adaptation strategies in quite different terms. In some cases, there is only a brief citation. For example, the Austrian FRMP states that all measures in the FRMP are in line with the recommendations in the strategy. For Bulgaria, Spain and Portugal, on the other hand, FRMPs indicate their aim to develop synergies with adaptation strategies. In Slovakia, FRMPs state that some measures are taken from the national adaptation strategy. It is worth noting that in Italy, the SEA carried out for one FRMP included an analysis of the National Climate Change Adaptation Strategy.

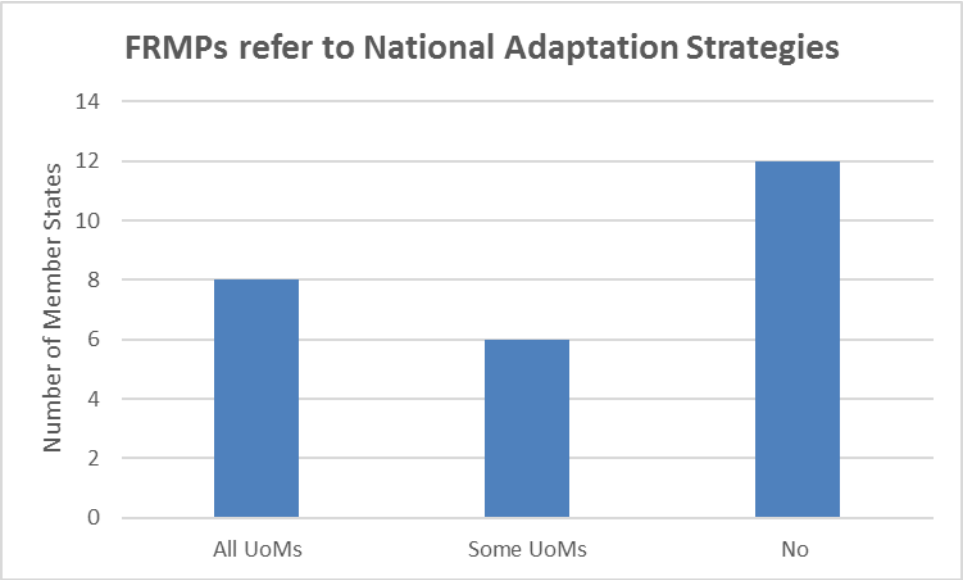
Most but not all Member States had published national adaptations strategies before their FRMPs were established. In six Member States, however, the national strategy had not yet been adopted in late 2015 (the deadline to establish FRMPs): Bulgaria, Croatia, Cyprus, Estonia, Latvia and Slovenia[187] [188]. Nonetheless, the Estonian and Cyprus FRMPs refer to a draft of the national strategy, as does one of the four Bulgarian FRMPs.

[186] In Malta the reference to the national climate adaptation strategy is in the Second Water Catchment Management Plan, but not in the Annex that is the FRMP.

[187] Estonia's and Slovenia's national adaptation strategies were since adopted: https://climate-adapt.eea.europa.eu/countries-regions/countries

[188] In Sweden the Swedish National Strategy for climate Change Adaptation was adopted in the first half of 2018. However, a 2009 report was referenced by several FRMPs (not assessed in this study).

Figure 27 References to National Climate Change Adaptation Strategies



Source: Member States reporting and FRMPs.

The lack of reference to the national adaptation strategies in almost half of the Member States is a finding that requires attention, given concerns that climate change will affect flooding patterns in many Member States and that these policy documents address national adaptation. Equally, future versions of national adaptation strategies should draw from the findings of FRMPs so that synergies are exploited.

10.2.2. Presentation of potential climate impacts

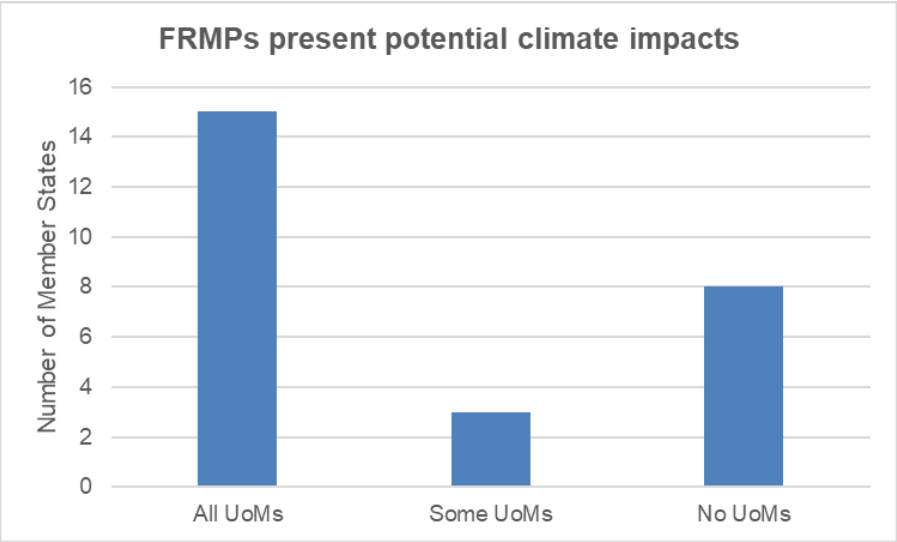
In just over half of the Member States considered, 15 out of 26[189], the FRMPs provide at least a short discussion of potential impacts of climate change on flood events (see Figure 28). These Member States consider a potential shift in the occurrence (or intensity) of extreme events and/or changes in the main source of flooding.

For three Member States, information is provided for only some of the UoMs[190]. In Italy, for example, reporting to WISE briefly refers to future climate impacts in the Mediterranean area, but only one of the five FRMPs assessed mentions possible climate impacts (Italy's reporting to WISE states that climate issues will be addressed in the next cycle of FRMPs).

[189] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Estonia, Finland, Croatia, Hungary, Lithuania, Luxembourg, the Netherlands, Poland, Slovakia, and the United Kingdom.
[190] Bulgaria, Italy, and Sweden.

Of those Member States that did not present the potential climate impacts, two (Latvia and Portugal) did not consider climate change in the FRMPs assessed. In Austria, Denmark[191], Lithuania, Romania, Spain, and Slovenia, although impacts were not discussed, the FRMPs include measures that address climate change. Indeed, in Spain and Austria the uncertainty concerning climate change was highlighted, with measures designed to investigate the possible impacts further.

Figure 28 FRMPs that present potential climate impacts



Source: Member States reporting and FRMPs.

The table below provides a summary of the main impacts of climate change on flooding identified in the FRMPs. It should be underlined that this table represents a brief summary of the information presented in the plans, which draw on a range of national and international studies, and not on the underlying research. Poland's FRMPs, for example, cite a number of sources including an FP6 project, ENSEMBLES[192], on climate modelling for Europe, as well as a catchment-level study in Poland.

[191] In Denmark climate change scenarios are often set out in the Flood Risk Maps or municipal climate change adaptation and mitigation plans rather than the FRMPs (although the FRMPs do refer to these documents).
[192] http://ensembles-eu.metoffice.com/

Table 13 Information provided in FRMPs regarding climate impacts on flood risks

Member State	Increase	Decrease	No change	Notes
Belgium	✓			More summer precipitation, prolonged winter precipitation, more heavy rainfall will increase occurrence of flooding.
Bulgaria	✓	✓		Extreme rainfall might increase risk of flash floods; spring floods might decrease
Croatia				Less summer precipitation, less precipitation in certain areas, more precipitation in others, steady trend of sea level rise
Cyprus	✓			Increase in occurrence of extreme flooding events and decrease in annual precipitation.
The Czech Republic			✓	High uncertainty across studies but overall no major changes expected
Estonia			✓	
Finland				Shift predicted from spring floods to those in summer, autumn and winter
France	✓			Sea-level change.
Germany	✓		✓	Increased flooding expected in Weser UoM (DE4000); no change in Rhine[193] (DE2000); increased seawater flooding expected due to sea level rise
Italy	✓			Increase in extreme meteorological events (e.g. flash floods) and seawater flooding expected
Luxembourg	✓			Increase in river floods (potential for fluvial flooding)
Malta	✓		✓	Increase in heavy rainfall leading to flooding, and long-term, sea-level rise is expected. A change of storm surges is not anticipated.
The Netherlands	✓			Extreme weather events are expected to be more frequent due to climate change
Poland	✓	✓		Greater risks related to intense rainfall, but floods from snowmelt should decrease
Sweden	✓			Increased water levels in lakes could increase/aggravate fluvial floods, and pluvial floods may become more significant.
Slovakia				Not clear, but more irregular precipitation patterns expected
The United Kingdom	✓			Increase in heavy rain and other weather extremes

Source: Member States reporting and FRMPs.
Note: Member States whose FRMPs do not discuss changes in flooding due to climate change are not included. In several Member States, the impacts listed were not found in all FRMPs assessed.

The FRMPs vary in terms of the extent of information they present on climate impacts. As mentioned above, the FRMPs of 15 Member States assessed discuss the expected impact of future climate change; another three Member States discuss the impacts in only some of the

[193] Specifically, the FRMP for North Rhine Westphalia.

FRMPs assessed[194]. Several Member States, such as Poland, provide detailed information and references, while others provide only brief notes on potential climate impacts.

Fourteen Member States include timeframes for the scenarios - the remaining six[195] did not provide specific timeframes of scenarios. All Member States identified as having "strong evidence" in the section above included timeframes, however, it is worth noting that Belgium, Bulgaria, Finland, and Luxembourg all were identified as having "some evidence" but did include qualitative timeframes in at least some FRMPs.

The time frame presented in the Plans varies (see the table below). Most common are scenarios for 2050, seen in five Member States, and scenarios for 2100, cited in six Member States. For most of the Member States that discussed climate scenarios, their FRMPs presented climate scenarios for at least two time frames.

In a few Member States, approaches varied across the FRMPs assessed: in the United Kingdom, for example, the Neagh Bann FRMP in Northern Ireland presents information for 2030 and 2100 scenarios; the FRMP prepared for the English part of the Solway Tweed UoM discusses a range of time frames from 2025 to beyond 2100; and the Scottish flood risk management strategies assessed refer to 2080 scenarios.

Table 14 Time frame of climate scenarios discussed in the FRMPs

	2030	**2050**	**2070/2080**	**2100**
Belgium (Brussels)	✓	✓	✓	
Bulgaria				✓
Croatia	*	*	✓	✓
Cyprus	✓	-		*
Estonia	✓			✓
Germany		✓		✓
Finland		✓		✓
France				*
Luxembourg		✓		
The Netherlands		✓		✓
Poland	✓		✓	
The United Kingdom	**	**	**	**

[194] The Latvian reporting sheets refer to studies on climate change impacts, however, climate change was not taken into account in the FRMPs, and thus Latvia is not included in this count.

[195] Austria, Czech Republic, Hungary (scenarios are instead set out in the Second Climate Change Strategy), Italy, Sweden, and Slovakia.

Source: Member States reporting and FRMPs.

** For Croatia, Cyprus and France, the time frames indicated represent an approximation: in Cyprus scenarios were developed for a period of 20, 50, and 100 years, however, the baseline was not clear (although 2007 is the end of the historical time period used for the model); in Croatia, the timeframes are the periods 2011-2040, 2041-2070, and 2071-2099; in France one FRMP makes reference to year 100. ** For the United Kingdom, different scenarios presented across the FRMPs.*

10.3. Climate change adaptation measures

The EU Adaptation Strategy underlines the importance of mainstreaming adaptation to climate change throughout EU and Member States policies and investments. Key actions identified in the Strategy include climate-proofing investments and ensuring more resilient infrastructure including green infrastructure[196].

A few Member States – including Cyprus, Estonia, Germany and Finland – indicated that adaptability to climate change was a factor in the design and prioritisation of measures. In Denmark, some measures were designated as having a high priority for implementation as they were derived from municipal climate change mitigation and adaption plans.

The FRMPs in a few Member States described methods to check the effectiveness of measures in the face of climate change scenarios. In Estonia, actions under the FRMPs were assessed for their climate sensitivity (see the box below). In Germany, LAWA (the national working group on water and floods) carried out a climate-proofing check of all measure categories, to assess their adaptability to a changing climate. This work did not, however, cover single measures.

In the United Kingdom, two of the five FRMPs assessed – those for the English part of the Solway Tweed UoM (UK02) and for the Severn (UK09) – state that allowances for climate change will be built into flood risk management works: for example, the Severn FRMP refers to larger foundation walls and raising flood defences. The Severn FRMP states that climate change will be addressed by strengthening infrastructure inspection and maintenance. In Germany, the FRMPs for the Danube (specifically, the Bavaria FRMP in UoM DE1000) and Schlei Trave UoM (DE9610) state that a safety margin of 0.5m is added when planning dykes to deal with the possible impacts from climate change.

Box 39 - Assessing measures for their sensitivity to climate impacts

[196] European Commission, An EU Strategy on adaptation to climate change, COM(2013) 216 final, 2013.

In **Estonia**, the specific actions (i.e., single projects) were assessed for their climate sensitivity. The FRMPs note that climate sensitivity was assessed more thoroughly for construction actions, especially when compared to administrative and advisory actions, due to the short-term nature of the latter. Actions determined to have high climate sensitivity include: improving flood protection of existing sewage treatment plants by constructing protective walls or elevating the surface in areas prone to flooding, improving protection of drinking water systems (wells and bore wells, pumping stations, water pipes) from flooding and addressing pollution risks to drinking water during flood events. In addition, NWRMs are usually categorised as being highly climate-sensitive, due to the long timeframes indicated for them (up to 100 years).

10.4. No-regret measures to address climate change

The FRMPs in several Member States identified measures that address climate change with a no-regret approach.

One area for such measures is **natural water retention measures (NWRMs)**. In the United Kingdom, the FRMPs for Solway Tweed and Severn (cited above) both state that identifying locations to work with natural processes can help improve resilience to climate change. Poland's FRMP for the Oder (PL6000), there is a single measure to increase water retention in forests includes the analysis of retention in connection with the adaptation of forests and forestry to climate change. In Slovakia the FRMPs highlight that afforestation measures and water retention measures, including the construction of reservoirs, are appropriate tools for minimising the impacts of climate change on the likelihood and potential adverse consequences of flooding.

In general, NWRM are nature-based solutions that can help to adapt to climate change by preserving or restoring ecosystems[197]. As noted in section 6, many FRMPs refer to NWRM among their measures, more than those that identified the role of NWRMs in addressing climate change.

The FRMPs across several Member States s – including Bulgaria, Croatia, France, Germany, Italy, Luxembourg, Romania and Spain – refer to measures to further **study** climate change. The FRMPs in Germany mention that several studies have been commissioned, for example, to link climate modelling to flood risk management.

[197] European Commission, EU policy document on NWRM, Technical Report - 2014 – 082, 2014.

Two FRMPs mention working with **insurance**: the Severn FRMP (UK09) refers to a measure that involves working with the insurance industry to make the best use of risk information under a changing climate. The Adaptation Strategy calls for promoting insurance and other financial products for resilient decision-making[198]; as noted in section 6, however, very few measures in the FRMPs address the insurance sector. The FRMP in Cyprus contains two measures for insurance (see section 8.7.6 above), both of which make reference to climate change.

The FRMPs in only one Member State refer to addressing climate change via **land use planning**: several Finnish FRMPs include land use planning measures such as updating building sites at low elevations at risk of flooding so as to take into account climate change impacts on flood levels.

In several cases, FRMPs refer to climate change measures set out in other plans and strategies: In Estonia, measures to address flood risks in the face of climate change were included in the Implementation Plan of the Climate Change Adaptation Strategy (approved 2017). In Poland, the National Strategy for Adaption to Climate Change also includes such measures, especially with regard to reducing pollution risks in flood-prone zones.

10.5. Summary of good practices and areas for further development

In terms of **good practices**, the FRMPs in several Member States provided a clear overview of potential climate change impacts on flooding. In a few Member States, methods to assess the adaptability or sensitivity of measures (climate proofing) to climate change were used, including for the prioritisation of measures. Some Member States, including Germany, Cyprus and the United Kingdom, have incorporated climate change in the design of measures. A few Member States identified specific measures that would address climate impacts in a no-regret manner.

With regard to **areas for further development**, many Member States did not provide strong attention to climate change – for several, the FRMPs hardly address the issue; however, it should be noted that the FD requires increased attention to climate change impacts from the second cycle onwards (starting already at the PFRA stage). Still, at the same time it is reasonable to expect that preparation in this area (based on existing knowledge) will have started in the Member States prior to the second cycle, i.e. during the first cycle (or even

[198] European Commission, "An EU Strategy on adaptation to climate change", COM(2013) 216 final, 2013.

earlier). It would be equally reasonable to expect that ongoing work would be referred to in the first FRMPs, as was the case for some Member States.

References to national adaptation strategies were found in only about half of the FRMPs, suggesting that opportunities for synergies on actions for adaptation are not being exploited adequately. Moreover, relatively few examples of measures to study climate impacts on flooding at the regional level were seen across the Plans assessed.

Given that the FRMPs in most Member States did not address climate change in depth, it is expected there shall be greater attention to this issue in the next planning cycle, as per Article 14 of the FD.

On this basis, the following recommendations can be made for the preparation of the second FRMPs:

- A greater degree of harmonisation, ideally at the RB level, could support Member States in addressing climate change flood related uncertainties in their FRMPs: It should be useful to identify and review across RBs districts and regions, common scenarios and carry out research on climate impacts for Member States to consider in the preparation of their Plans by e.g. making appropriate use of EU modelling tools such as those available through the Copernicus Climate Change Service[199].

- Member States should ensure coordination between their FRMPs and national adaptation strategies.

Member States should indicate in their second-cycle FRMPs where specific adaptation measures are taken and to what extent mainstreaming has taken place in the design of measures.

[199] https://climate.copernicus.eu/

Part B. International coordination within the framework of the Floods Directive

11. Overview of international cooperation for flood risk management in the EU

There is long standing bilateral or multilateral cooperation established between the Member States in the area of water management that predates the introduction of the WFD and the FD. Next to the assessment of the 1st FRMPs under the FD, a desk-based assessment of this cross-border cooperation was carried out on the basis of (1) the transboundary RB level international FRMPs (iFRMP) and (2) the national FRMPs, to ascertain how the FD has influenced this cooperation, and with a view to making recommendations towards further reinforcing it. The findings of this assessment are therefore constrained by the choice of the aspects examined (which align to the aspects assessed for the national FRMPs) and by the amount of information contained in the reviewed documents.

Part 2 of the FRMP European Overview presents an assessment of the application of the Directive at the iRBD/iUoM level. It aims to provide a view from the outside, thus supporting the implementation of the Directive by River Commissions and Member States s (and non-EU countries) over future implementation cycles. A series of fact sheets for the international RBs is provided separately and describes co-operation in more detail.

The overview is based on the information reported by Member States to the WISE, previous national and EU overview reports on PFRA and FHRM published by the European Commission[200] and the national and international Flood Risk management Plans (FRMP and iFRMPs).

27 RBs were chosen for the assessment (see Table 16 for an overview). RBs shared with Greece (five iRBDs) and Ireland (three iRBDs) could not be assessed due to the delayed reporting. In addition, RBs shared between Lithuania-Latvia-(Russia)-(Belarus) (three iRBDs), one basin shared between Italy and France[201] and four iRBDs shared between Sweden-Norway were not assessed.

[200] Available under http://ec.europa.eu/environment/water/flood_risk/overview.htm

[201] Italy has applied Art 13(1)(b) for all UOMs and no PFRA reporting was carried out. Italy clarified that a Memorandum of Understanding was signed in 2013 ("Protocollo d'intesa transfrontaliera per il bacino idrografico del fiume Roja e dei suoi affluenti") with the aim of carrying out international coordination

11.1. Main elements of the FD related to international issues

Member States shall coordinate their flood risk management practices[202] in shared RBs, including with third counties, and shall in solidarity not undertake measures that would increase the flood risk in neighbouring countries. Member States should take into consideration long term developments, including climate change, as well as sustainable land use practices in the flood risk management cycle. Article 8 of the FD requires that Member States shall ensure coordination with the aim of producing one single iFRMP, or a set of FRMPs coordinated at the level of the iRBD or iUoM.

11.2. Types of international coordination

According to the type of coordination mechanism that has been established by the Member States in the different iRBDS/iUOM, four main categories have been identified in the context of this assessemnt[203]:

a) **Category 1 RBs** which are iRBDS/iUOMs with (a) formal international agreement(s), an international coordinating body and an iFRMP produced by this international body;

b) **Category 2 RBs** which are iRBDS/iUOMs with (a) formal international agreement(s), an international coordinating body, but no iFRMP;

(c) **Category 3 RBs** which are iRBDS/iUOMs with (a) formal international agreement(s), but no international coordinating body and no iFRMP;

d) **Category 4 RBs** which are iRBDS/iUOMs with no formal international agreement, no international coordinating body and no iFRMP.

An overview of the identified categories is given in Table 15.

Table 15 Different types of international co-ordination in relation to the Flood Directive

Category	Formal international	International coordinating	IFRMP produced

activities under Directives 2000/60/EC (the WFD) and 2007/60/EC (the FD). In addition, several Interreg projects were launched in the last years one of which "Concert-Eaux" is still ongoing. In addition, the FRMP LIGURIA UOM, which is included in the Northern Apennines RBMP approved by Decree of the President of the Council of Ministers on 27th of October 2016, contains information on the above described activities.

[202] See Article 5(2), Article 7(1), Article 7(4), Article 8 and Annex A.II(3) of the Directive.

[203] Other categories might exist, but have not been identified in the context of this assessment.

	agreement	body	
1	Yes	Yes	Yes
2	Yes	Yes	No
3	Yes	No	No
4	No	No	No

The assessment suggests that despite the absence of river basin commissions, there is notable cooperation between Germany and Denmark, Sweden and Finland, Latvia and Estonia and Spain and Portugal.

The map in Annex 4 shows the RB assessed.

Table 16 List of selected iRBDs/iUoM for which an assessment was carried out

Category	International RBs	Riparian EU Member States /*Non-EU countries*
Category 1	Danube[204]	Austria, Bulgaria, The Czech Republic, Germany, Croatia, Hungary, Italy, Poland, Romania, Slovenia, Slovakia *Non-EU countries: Switzerland, Albania, Bosnia and Herzegovina, Serbia, Ukraine, Moldova, Montenegro, FYROM*[205]
	Elbe	Austria, The Czech Republic, Germany, Poland
	Rhine	Austria, Belgium, Germany, France, Italy, Luxembourg, The Netherlands *Non-EU countries: Switzerland, Liechtenstein*
	Meuse	Belgium, Germany, France, Luxembourg, The Netherlands
	Odra	The Czech Republic, Germany, Poland
	Scheldt	Belgium, France, The Netherlands
Category 2	Duero/Douro	Spain, Portugal
	Guadiana	Spain, Portugal
	Miño/Minho	Spain, Portugal
	Tagus (Tajo/Tejo)	Spain, Portugal
	Isonzo/Soča	Italy, Slovenia
	Dniester/Dnistr/Nistru	Poland *Non-EU countries: Moldova, Ukraine*
	Ems	Germany, The Netherlands
	Tornio/Torne	Finland, Sweden
	Teno/Tana	Finland *Non-EU* countries: *Norway*[206], *Russia*

[204] Within the Danube an additional sub-catchment FRMP for the Sava is under development.
[205] Former Yugoslav Republic of Macedonia.
[206] Norway is not implementing the FD.

Category	International RBs	Riparian EU Member States /*Non-EU countries*
Category 3	Garonne/ (Cantabrico Oriental)	France, Spain
	Garonne/ (Ebro)	France, Spain
	Vistula	Poland, Slovakia, Lithuania *Non-EU countries: Ukraine, Belarus*
	Pregolya	Poland, Lithuania *Non-EU countries: Russia*
	Torne Bothanian Bay	Finland, Sweden *Non-EU countries: Norway*
	Vidaa/Wiedau[207]	Denmark, Germany
	Krusaa/Krusau[208]	Denmark, Germany
Category 4	Po	Italy, France *Non-EU countries:* Switzerland
	Gauja/Koiva	Estonia, Latvia
	East Estonia	Estonia, Latvia *Non-EU countries: Russia*
	Kemijoki[209]	Finland *Non-EU countries: Norway, Russia*
	Teno/Tana	Finland *Non-EU countries:* Norway, Russia
	Nemunas/Nieman/Nemaa n/Nyoman	Lithuania, Poland *Non-EU countries: Russia, Belarus*
	Schlei Trave	Germany, Denmark
	Eider	Germany, Denmark
	Eastern Alps (Adige)	Italy *Non-EU countries:* Switzerland

It should be noted that the categories might differ from the categories applied under the WFD's equivalent assessment because of different agreements made for the management of flood risk.

The table below lists those RBs where no assessment was carried out due to absence of information through FD implementation channels for the national parts of the RBs.

[207] The transboundary rivers shared by Denmark and Germany are the Vidaa/Wiedau and the Krusaa/Krusau rivers. Vidaa-Krusaa is part of the Eider and Schlei/Trave RBD in Germany, and make up the whole of the iRBD in Denmark (Internationalt Vanddistrikt DK4).

[208] See footnote above.

[209] Finland clarified that only a very small part of the RB is in Russia (2,9%) and an even smaller part in Norway. These parts are very sparsely populated small upstream catchments with only a very little human or hydrological impact on the Kemijoki RB. In addition, no flood risk issues have been identified in these parts from the work of the Finnish-Russian transboundary commission.

Table 17 List of iRBDs/iUoM for which an assessment was not carried out

International River Basin	Riparian EU Member States /Non-EU Member States
Shannon/North Eastern	The United Kingdom, Ireland
Neagh Bann	The United Kingdom, Ireland
North Western	The United Kingdom, Ireland
Drin	Greece *Non-EU countries: Albania, FYROM*
Aoos/Vjosa	Greece *Non-EU countries: Albania*
Nordland	Sweden *Non-EU countries: Norway*
Troendelag	Sweden *Non-EU countries: Norway*
Bothanin Bay	Sweden *Non-EU countries: Norway*
Skagerrak and Kattegat	Sweden *Non-EU countries: Norway*
Lielupe	Lithuania, Latvia
Venta	Lithuania, Latvia
Daugava	Lithuania, Latvia *Non-EU countries: Russia, Belarus*
Mesta-Nestos	Bulgaria, Greece
Struma-Strymonas	Bulgaria, Greece
Central Macedonia	Greece *Non-EU countries: FYROM, Serbia*

11.3. Overview of international cooperation and coordination frameworks

11.3.1. Overview of international coordinating bodies, international agreements or conventions

For all Category 1 and 2 RBs that were part of the assessment, international coordinating mechanisms are in place. For the Category 1 RBs, International Commissions have been set up that are coordinating the work for the entire iRBD among riparian countries. All coordinating bodies have a specific working group that addresses flood management.

For the Category 3 RBs international cooperation is mainly based on a number of agreements. Hence, coordination is performed by the different governing bodies or working groups based on the international agreements, but few information on the nature of the tasks performed is available. An overview of international coordinating mechanisms can be found in Annex 5.

In the **Po** RB coordination activities have only been carried out for to the SEA of the Italian FRMP: Institutional representatives of France and Switzerland were consulted with regards to the cross-border portions of the Po basin. No further known coordination activities have been put in place for the preparation of the Italian FRMP (IT) in the Po.

The **Eastern Alps** FRMP (IT) explains that, for the international RBD Adige, due to the limited territorial extension (only 1.09% of its surface is in Switzerland) and the absence of particular issues related to the management of flood risks, no agreement has been signed between the two states, nor the development of a shared plan was necessary. Slovenia reported only international coordination activities in relation to the **Danube** and the **Sava** RBs but not in relation to the **Eastern Alps**.

In the cases of the **Gauja/Koiva** RB and the **East Estonia** RB no information was reported in the national FRMPs (EE, LV) or WISE regarding any kind of international cooperation[210].

For the **Nemunas/Nieman/Neman/Nyoman** RB little information was reported by Poland, where it is stated that no APSFR were identified and no iFRMPs were prepared.

The **Kemijoki** RB is shared between Finland, Norway and Russia. According to information provided by Finland to WISE, there is no international coordination in place as no flood risk issues have been identified[211].

11.3.2 Financial resources for joint co-operation

For all Category 1 RBs it is not clear if financial resources for joint cooperation (other than for the functioning of the international commissions) have been made available by the participating Member States. The iFRMPs do not provide any information on whether there is financing for joint activities and projects. In the iFRMP of the Danube it is indicated which financial instruments are planned to be used for joint cooperation.

[210] Estonia and Latvia informed that an agreement was signed on 24/10/2003 between the Ministry of Environment of the Republic of Latvia and the Ministry of the Environment of the Republic of Estonia on co-operation in protection and sustainable use of trans-boundary watercourses. The agreements provided for the establishment of groups of experts from the competent authorities which convene regularly to exchange information and to coordinate issues important for the development of the RBMP and the FRMP. Latvia and Estonia also informed that there are no trans-boundary flood risk areas (APSFR) within the Gauja/Koiva RB Estonia informed that there are no trans-boundary flood risk areas within the East Estonia RB. Therefore, there are no transboundary flood hazard and risk maps, nor flood risk management plans.

[211] Finland informed that only a very small part of the RB is in Russia (2,9%) and an even smaller part in Norway. These parts are very sparsely populated small upstream catchments with only a very little human or hydrological impact on the Kemijoki RB. In addition, no flood risk issues have been identified in these parts from the work of the Finnish-Russian transboundary commission.

Similarly, for the Category 2 RBs no information is available on whether financial resources for joint cooperation have been made available. There is also no information on the financing for joint activities and projects[212]. Only for the **Duero** RB one measure (M24: Elaboración de estudios de mejora del conocimiento sobre la gestión del riesgo de inundación – Preparation of studies to improve flood risk management knowledge) refers to the costs of international cooperation, but no costs are specified.

Finally, also for the six Category 3 RBs it is not clear if financial resources for joint cooperation have been made available. There is also no information on the financing for joint activities and projects. Only for the **Vistula** RB it is stated that there are no investment activities in the **Vistula** RB that could have cross-border effects. Countries in the **Vistula** RB (also those outside the EU) are being kept informed about any activates/projects carried out or planned in this RB during the bilateral commission meetings.

As there is in general little information about financing related to the implementation of measures in transboundary RBs, the level of commitment and ambition to reduce flood risk and impacts on a common basis, with this particular aspect in mind as an indicator, remains unclear.

11.4. Conclusions from previous phases of the flood risk management cycle in transboundary RBs

Article 4 of the FD requires Member States to undertake a PFRA for each RBD, UoM or the portion of an iRBD or iUoM lying within their territory.

11.4.1 International coordination of risk assessment

Articles 4 and 5 of the FD require Member States to coordinate the PFRA and to identify areas of potentially significant flood risk (APSFR) for each iRBD, or iUoM or portions thereof lying within their territory.

For all Category 1 RBs a coordination of the PFRA at international level has taken place.

In the **Danube** RB an updated version of the APSFR map published in the PFRA report in 2011 was developed. Especially the determination of transboundary APSFR was coordinated.

[212] Slovenia informed of the Slovenian-Italian VISFRIM strategic flood risk reduction project in the Isonzo/Soca RB which includes many common flood risk reduction activities. https://www.ita-slo.eu/sites/default/files/Graduatorie_strategici_lestivce_strateski_Ita-Slo_05_2018.pdf

Transboundary APSFRs were defined by the ICPDR's Flood Protection Expert Group as any area (in the transboundary reach of a river) that has been assigned as transboundary APSFR by at least one country. The assignment was discussed then further at the bilateral level. If the transboundary character of an APSFR is regarded as not yet agreed by one country, this is shown on the map. For a river crossing a border, the area of common interest is assigned as a transboundary APSFR. The extent of this area of common interest has to be agreed by the neighbouring countries. The ICPDR agreed that two scenarios (medium and low probability) are relevant for the level of the iRBD. Only fluvial flooding was considered.

In the **Rhine** RB, the PFRA has been coordinated on the international level by the ICPR including an updating of the Interactive Rhine Atlas of 2001, now available as interactive Rhine Atlas 2015. The iFRMP also provides maps of APSFRs for the whole Rhine RB including transboundary APSFRs. A special report on the identification of APSFRs within the whole RB is available. There is no information on which sources of flooding were considered.

For the **Meuse** RB, the iFRMP states that each of the bordering countries has developed its risk assessment, but for water bodies crossing the borders bilateral coordination has taken place. A map with APSFRs in the iRBD is presented in the iFRMP together with a table that shows the transboundary waters and gives some basic information on how the coordination between the countries was organised. Only fluvial flooding was considered.

In the **Elbe** RB, the risk assessment was coordinated through the working group under the Elbe Commission. Austria and Poland have not identified APSFRs within the Elbe, but Germany and the Czech Republic did. The iFRMP states that there was a workshop held between the Czech Republic and Germany to discuss and compare methodologies for the PFRA. While the methodologies themselves were not coordinated during their development, the results of the methodologies – i.e. the identification of APSFRs – were compared to ensure that the different methodologies nevertheless resulted in the same areas, which they did. It is unclear whether the sources of flooding considered in the transboundary flood risk areas are the same between the Czech Republic and Germany. The iFRMP states that in the Czech Republic fluvial floods caused by regional precipitation were taken into account whereas flooding from heavy rain leading to flash floods is only locally important and has not resulted in the designation of APSFRs and that groundwater causing floods was not taken into account. In Germany, generally, coastal and fluvial floods were taken into account. Other types of flooding have not been considered as significant.

The iFRMP for the **Odra** RB states the Member States have exchanged the necessary information to carry out the risk assessment and to produce the relevant maps. However, the detailed risk assessment was different in the countries and is described separately for each Member State. Furthermore, the potential adverse consequences of future floods considered in the different Member States are different. No transboundary APSFRs were identified.

In the **Scheldt** RB the PFRAs were based on national approaches, but Member States have exchanged information through the international commission during the preparation of the PFRA. Transboundary APSFRs were identified. The iFRMP includes a description of the commonalities and differences between countries' PFRA. The sources of flooding that were considered in the PFRA depend on the geography of the regions. The Netherlands, France and the Flemish region of Belgium have considered sea water flooding and river flooding. France has also discussed surface run-off and groundwater flooding in one section, but no run-off flood risk was calculated. In the Belgium region of Brussels river flooding, groundwater flooding, surface run-off, and pluvial flood risks have been analysed, while in the region of Wallonia river flooding and surface run-off were taken into account.

In the four **Spanish/Portuguese** Category 2 RBs it is not clear whether the risk assessment has been coordinated on an international level as no specific information is provided in the national FRMPs (Spain, Portugal). Only for the **Guadiana** RB, three transboundary APSFRs were identified according to the national reports: Two fluvial APSFRs (ES040_EXT_019 (Guadiana X) & ES040_AND_001 (Guadiana XI)) and one coastal APSFR (ES040_AND_008), but no joint flood risk map has been drawn up. There is no information on whether the sources of flooding considered in the common APSFRs are the same.

For the **Isonzo/Soča** RB, during a meeting of the Permanent Bilateral Commission for Water Management, flood hazard and flood risk maps already prepared and available for the respective parts of the iRBD were presented[213]. The text of the FRMP (Italy) explains that the measures to manage flood risk were subject to coordination rather than the risk assessment itself. No transboundary APSFRs were identified. The same applies to the **Dniester/Dnistr/Nistru** RB.

For the **Ems** RB, the document on international coordination states that the methodologies used in both Member States are different, but coordination and data exchange during the risk assessment has happened and the results are comparable. In Germany the sources of flooding

[213] Slovenia informed that in a meeting of the Permanent Bilateral Commission for Water Management in 2012 information exchange on the PFRA and the harmonisation of APSFR's in the RB took place. http://www.statika.evode.gov.si/fileadmin/vg_komisije/SLO-IT-zasedanje_december%202012.pdf

that were considered are fluvial and coastal flooding, while the Netherlands considered fluvial, pluvial, coastal flooding and flooding from artificial water bearing infrastructure. The transboundary APSFRs that were identified are Haren-Rütenbrock-Kanal and the Ems Estuary.

The coordination of the risk assessment in the **Torne** RB is summarised in Appendix 6 of the FRMP for Haparanda. There is no information on how the coordination was performed, but the results of the coordination are given[214]. No transboundary APSFRs were identified.

Flood risk in **Teno/Tana** RB has been jointly assessed between Finland and Norway and it is very low or even non-existent and no APSFR has been designated. The Finnish-Norwegian Transboundary Water Commission has also acknowledged the low flood risk in the area and the cooperation is presently focusing on other aspects such as implementation of the WFD and fisheries.

For the Category 3 RBs only very limited information on international coordination or transboundary APSFRs is available. For the **Garonne-Eastern Cantabrian** RB no information on any international coordination of the risk assessment was provided. Transboundary APSFRs were identified, but the information provided in the national FRMPs (Spain, Portugal) is not matching. According to the Spanish FRMP (ES017) there are two transboundary APSFRs (Irún-Hondarribia and regatas Ugarana y Lapitxuri), while the French FMP (FRF) identifies one shared APSFR, the Basque coastline. The sources of flooding that are considered are not entirely overlapping for the two Member States. In the Garonne-Cantabrico RB the Spanish FRMP (ES017) mentions that fluvial and marine flooding were considered, while in the French FRMP (FRF) it is stated that overflows of watercourses, marine submersions, urban or agricultural runoff, rising groundwater, rising mountain torrents and ruptures or failures of hydraulic structures are taken into account. No further information is available for any of the other Category 3 RBs.

An overview on where transboundary flood risk areas have been identified is provided in the table below.

[214] Finland informed that in addition, a joint report on the PFRA was prepared in 2011 and the coordination is briefly described in the national FRMPs.

Table 18 Overview on whether transboundary APSFRs have been identified for the iUOM/iRBD

Category	iRBD	Transboundary APSFRs identified for the iRBD/iUOM	
		Yes	No
Category 1	Danube	x	
	Rhine	x	
	Meuse	x	
	Elbe	x	
	Odra		x
	Scheldt (Escaut)	x	
Category 2	Duero/Douro		x
	Guadiana	x	
	Miño/Minho		x
	Tagus/Tajo/Tejo		x
	Isonzo/Soča/Soca		x
	Dniester/Dnistr/Nistru		x
	Ems	x	
	Tornio/Torne		x
	Teno/Tana		x
Category 3	Garonne (Cantabrico)	x	
	Garonne (Ebro)		x
	Vistula		x
	Pregolya		x
	Schlei/Trave		x
	Eider		x

11.4.2. Conclusions of the PFRA phase for the entire international UoM/RBD

For only a part of the RBs the conclusions of the PFRA are presented for the entire iRBD/iUOM, namely for three of the Category 1 RBs, none of the Category 2 RBs and for three of the Category 3 RBs. Table 19 below provides an overview.

Table 19 Overview of whether results of the PFRA were presented for the entire IRBD/iUoM or not

Category	iRBD	Conclusions of PFRA presented for the entire iRBD/iUOM	
		Yes	No
Category 1	Danube	x	
	Rhine		x (maps, no conclusions)
	Meuse		x (maps, no conclusions)
	Elbe		x
	Odra	X	
	Scheldt (Escaut)	X	
Category 2	Duero/Douro		x
	Guadiana		x
	Minho/Lima		x
	Tagus/Tajo		x
	Isonzo/Soča		x
	Dniester/Dnistr/Nistru		x
	Ems		x (maps, no conclusions)
	Tornio/Torne		x
	Teno/Tana		
Category 3	Garonne (Cantabrico)	x (but only included in the Spanish FRMP)	
	Garonne (Ebro)		x
	Vistula		x
	Pregolya		x
	Vidaa/Wiedau	x	
	Krusaa/Krusau	x	

11.4.3. Conclusions of the FHRM phase for the entire international UoM/RBD

The FD (Article 6) does not specify which probabilities should be considered for the different flooding scenarios except for floods with a medium probability where a return period of ≥100 years should be considered.

While in most RBs medium probabilities refer to a return period of ≥100 years, for the scenarios addressing low and high probability flooding large differences exist. Table 20 gives an overview of scenarios considered in the different iRBDs (in case different scenarios were used at Member States level, ranges of return periods are specified).

Table 20: Ranges of different return periods used in the iUOM/iRBD for the three flooding scenarios (in years)

Category	iRBD	Return period for low probability flooding	Return period for medium probability flooding	Return period for high probability flooding
Category 1	Danube	100-1 000	100	no info
	Rhine	no info	100	no info
	Meuse	100-1 000	100	10-30
	Elbe	200-1 000	100	5-25
	Odra	200-500	100	5-25
	Scheldt (Escaut)	100-10 000	25-300	10-30
Category 2	Duero/Douro	500-1 000	100	10-20
	Guadiana	500-1 000	100	10-20
	Miño/Minho	500-1 000	100	10-20
	Tagus/Tajo	500-1 000	100	10-20
	Isonzo/Soča	300- 500	100	10-30
	Dniester/Dnistr/Nistru	No information		
	Ems	200-1 000	100-300	10-30
	Tornio/Torne	250-10 000	100	2-50
	Teno/Tana	250-1000	100	20
Category 3	Garonne (Cantabrico)	500-1 000	100-300	10-30
	Garonne (Ebro)	500-1 000	100-300	10-30
	Vistula	500-1 000	100	5-50
	Pregolya	no info	no info	no info
	Vidaa/Wiedau	200	100	10
	Krusaa/Krusau	200	100	10

11.4.4. Joint FHRMs for the transboundary APSFRs

Article 6 of the FD requires Member States to prepare FHRMs. For all Category 1 RBs joint FHRMs were developed. For the **Danube** RB, detailed information on those maps is provided in the iFRMP. These maps refer to the different categories human health, economic activities and environment, but not to cultural heritage[215]. For the other Category 1 RBs, only the information that common maps are available is provided, but not of the probabilities used for their preparation. For the Category 2, Category 3 and Category 4 RBs no joint maps exist, with the exception of the **Ems** RB.

11.4.5. Potential adverse consequences shown in iFRMPs

Only for two of the Category 1 RBs, the **Danube** and the **Elbe**, some of the adverse consequences associated with flooding are presented in the iFRMPs.

[215] Cultural heritage will be added in the second cycle.

In the **Danube** RB, there are at least 936 000 people affected by floods with a high probability, at least 3 721 000 people affected by floods with medium probability and at least 6 734 000 people affected by floods with low probability. In relation to economic activities approximately 29 000 km^2 of agricultural areas are potentially affected by low probability floods. A significant share of the urban areas is potentially affected by low probability floods in Austria, Bosnia and Herzegovina, Slovakia and The Czech Republic, while the largest urban area potentially affected by low probability floods is in Hungary (783 km^2). The iFRMP also provides some numbers that relate to the risk to the environment, e.g. numbers of Integrated Pollution Prevention and Control[216] (IPPC) and Seveso Directive[217] installations affected by floods that could cause pollution and drinking water and recreational areas that are at risk of flooding. Floods with high probability affect 146 installations and 241 drinking water and recreational water areas, floods with medium probability affect 337 installations and 413 drinking water and recreational water areas and floods with low probability affect 617 installations and 796 drinking water and recreational water areas in the Danube RB.

In the **Elbe** RB 323 942 people may be affected by low probability floods in the Czech Republic and 1.57 million in Germany, 103 104 by medium probability floods in the Czech Republic and 377 039 in Germany and 26 232 by high probability floods in the Czech Republic and 104 380 in Germany. General economic areas at flood risk are only specified for medium probability floods with 103 areas in the Czech Republic and 235 in Germany. Risks to the environment are specified for affected Pollutant Release and Transfer Register[218] (PRTR) systems. For cultural heritage sites affected, specific sites are listed but are not linked to probability scenarios. Five sites are mentioned in Germany and two are mentioned in the Czech Republic.

Information on adverse consequences associated with floods is not available for any of the Category 2, Category 3 and Category 4 RBs.

[216] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075

[217] Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0018

[218] http://prtr.eea.europa.eu/#/home

11.5.Joint objectives and measures for flood risk management

11.5.1. Setting of joint objectives in iUoMs/iRBDs

The FD foresees that the FRMP for each UoM sets objectives for the management of flood risks within the areas covered by the Plan. The objectives should focus on reducing the adverse consequences of flooding to human health, the environment, cultural heritage and economic activity.

In most Category 1 RBs common objectives for flood risk management have been established on the international level.

For the **Danube** RB, the ICPDR has agreed upon the following objectives for flood risk management with the Member States: Avoidance of new risks, reduction of existing risks, strengthening resilience, raising awareness and the solidarity principle. These objectives focus on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity and address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the Danube RB. The objectives are not quantified and are in line with the ones established nationally by the riparian Member States.

Similar joint objectives have been established for the management of flood risk at the international level of the **Rhine** RB. The iFRMP for the Rhine details the different objectives as follows: avoid new, unacceptable, risks; reduce existing risks to an acceptable level; reduce adverse consequences during a flood event and reduce adverse consequences after a flood event. In Annex 4 of the iFRMP there is an assessment that shows how the different objectives are reflected at the Member States level. The assessment shows that the general targets of flood risk management on the national and international level are the same in the whole basin.

In the **Meuse** RB the joint objectives for flood risk management have been established by the five Member States. The objectives are defined at strategic level and operational levels. The strategic level objectives which are listed in the iFRMP are:

- Joint and efficient responsibility based on the solidarity principle: The aim is to determine the most appropriate level so as not to take higher-level measures which can be implemented more efficiently at the local level;

- Solidarity in the case of flooding;
- Proportionality of measures: Creation of a prioritization program, if possible on the basis of a CBA.

The three operational objectives, which were derived based on the national objectives defined by the five Member States, are:

- Effective international coordination of measures with transboundary effects;
- Improvement of the flood forecasting and warning;
- Improve flood risk knowledge.

The iFRMP for the **Elbe** RB details the different objectives as defined by the Czech Republic and Germany. Whereas they do not appear to have been commonly developed, the objectives set by the Czech Republic and Germany are very similar. In the Czech Republic the most important objective is to reduce the risk to inhabitants due to floods, as well as reduce risk on economic activities, cultural and historical areas, taking into account the precautionary principle. Three general objectives were set: 1) Prevent the emergence of new risks and to reduce the size and areas with an unacceptable risk; 2) Reduce flood risk and 3) Improve the precaution of inhabitants, the resilience of buildings, infrastructure, economic and other activities against the negative effects of floods. In Germany, four general objectives were set at national level: 1) Avoid new risks in flood risk areas; 2) Reduce existing risks in flood risk areas; 3) Reduce the adverse effects during a flood and 4) Reduce the adverse effects after a flood.

For the **Odra** RB, the iFRMP includes a table with joint objectives for the management of flood risk at the international level which are then further detailed into sub-targets. There is no clear description how the joint objectives have been agreed on. The general objectives are: 1) Avoid new risks; 2) Reduction of existing risks;(3) Reduction of adverse consequences during a flood event and 4) Reduction of adverse consequences after a flood event. The objectives are the same for all countries of the ICPO.

The objectives set in the iFRMP for the **Scheldt** RB were based on a comparison between the objectives set in the national plans and are shared objectives. They focus on: 1) strengthening transboundary cooperation for the planning and monitoring of measures with a transboundary

impact; 2) improving information sharing on floods and flood warning and 3) improving knowledge exchange to support decisions. The iFRMP notes also that all Member States and regions mainly aim to reduce the number of fatalities and economic damage, but also have objectives for the protection of habitats, with attention to the maximum conservation of associated protected habitats and species.

From the situations described above, it becomes evident that all Category 1 RBs, except the Scheldt and Meuse, have largely similar objectives (particularly the Danube and the Rhine, but also in some RBs classified into other Categories), even if they are phrased in somewhat different ways. This could a reflection of riparian countries being members of more than one river commissions:

- avoidance of new risks,
- reduction of existing risks and
- reduction of adverse consequences.

For the Category 2 RBs joint objectives for the management of flood risk at the international level have not been established in the four **Spanish/Portuguese** RBs. For the **Isonzo/Soča** RB at the meeting of the Permanent Bilateral Commission for Water Management held in Miren (Slovenia) in October 2014, the state of implementation of the FD was discussed and the participants noted that both parties had common objectives and decided to coordinate their implementation. However, no more explicit information is provided on these objectives. It is therefore assumed that the objectives they refer to are those defined at the national level: To reduce the potential negative consequences that floods may have on human health, the environment, cultural heritage and economic activity. No information for the **Dniester/Dnistr/Nistru** and the **Teno/Naatamo/Paatsjoki** RBs is provided. For the **Ems** RB, the iFRMP (Germany, the Netherlands) details the different objectives as follows: a) avoid new, unacceptable, risks; b) reduction of existing risks to an acceptable level; c) reduction of adverse consequences during a flood event and d) reduction of adverse consequences after a flood event. The national objectives are the same, but they are described in much more detail.

For the **Torne** RB, objectives for flood risk management were compared for the Finnish and Swedish parts and are mostly the same. These include for instance informing the general public about flood risk and how one can prepare for a flood with a return period of 50-100 years. In the Tornio FRMP (Finland) also Haparanda's (Sweden) objectives are presented and

similarities and differences are shown in a table.

For none of the Category 3 RBs, joint objectives for the management of flood risk at the international level have been established. For the **Garonne-Ebro** and the **Garonne Cantabrico** RBs , according to information provided to WISE by France, 'an identification of cross-border issues is to be carried out, which will be followed by the establishment of useful contacts and cooperation', meaning coordination of objectives has not yet taken place, but is to happen in the future.

For the **Vidaa/Wiedau** and the **Krusaa/Krusau** RBs, objectives have been set. They are: (a) avoid new, unacceptable, risks; (b) reduction of existing risks to an acceptable level; (c) reduction of adverse consequences during a flood event and (d) reduction of adverse consequences after a flood event.

11.5.2. Planned joint and/or coordinated measures for the achievement of joint objectives

Almost for all Category 1 RBs joint coordinated measures were defined. Only for the **Odra** RB no joint measures are specified in the iFRMP. Only for two of the Category 2 and 3 RBs, the **Isonzo/Soča** and the **Ems**, joint measures were defined. An overview of the joint measures in each iRBD is given in Table 21.

Table 21 Joint coordinated measures in the different iRBDs/iUOM

Nr.[219]	Description	Danube	Rhine	Meuse	Elbe	Scheldt	Isonzo/Soca	Ems
M11	No Action, no measure is proposed to reduce the flood risk in the APSFR or other defined area.							
M21	Prevention, Avoidance, Measure to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation.		x		x			
M22	Prevention, Removal or relocation, Measure to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and/or of lower hazard.				x	x		
M23	Prevention, Reduction, Measure to adapt receptors to reduce the adverse consequences in the event of a		x		x	x		

[219] Numbering according to 'A User Guide to the Floods Reporting Shemas' (Technical support in relation to the implementation of the FD (2007/60/EC)), see: http://cdr.eionet.europa.eu/help/Floods/Floods_603_2016/resources/User%20Guide%20to%20the%20Floods%20schema%20v6.0.pdf

Nr.[219]	Description	Danube	Rhine	Meuse	Elbe	Scheldt	Isonzo/Soca	Ems
	flood actions on buildings, public networks, etc...							
M24	Prevention, Other prevention, Other measure to enhance flood risk prevention (may include, flood risk modelling and assessment, flood vulnerability assessment, maintenance programmes or policies etc...).	x	x		x	x		
M31	Protection Natural flood management / runoff and catchment management, Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water	x	x		x	x	x	
M32	Protection, Water flow regulation, Measures involving physical interventions to regulate flows, such as the construction, modification or removal of water retaining structures (e.g., dams or other on-line storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime		x		x	x		
M33	Protection, Channel, Coastal and Floodplain Works, Measures involving physical interventions in freshwater channels, mountain streams, estuaries, coastal waters and flood-prone areas of land, such as the construction, modification or removal of structures or the alteration of channels, sediment dynamics management, dykes, etc.		x		x	x		
M34	Protection, Surface Water Management, Measures involving physical interventions to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or though sustainable drainage systems (SuDS)		x		x	x		
M35	Protection, Other Protection, Other measure to enhance protection against flooding, which may include flood defence asset maintenance programmes or policies		x		x	x		
M41	Preparedness, Flood Forecasting and Warning, Measure to establish or enhance a flood forecasting or warning system	x	x	x	x	x	x	x
M42	Preparedness, Emergency Event Response Planning / Contingency planning, Measure to establish or enhance flood event institutional emergency response planning		x		x		x	x
M43	Preparedness, Public Awareness and Preparedness, Measure to establish or enhance the public awareness or preparedness for flood events	x	x				x	
M44	Preparedness, Other preparedness, Other measure to establish or enhance preparedness for flood events to							

Nr.[219]	Description	Danube	Rhine	Meuse	Elbe	Scheldt	Isonzo/Soca	Ems
	reduce adverse consequences							
M51	Recovery and Review (Planning for the recovery and review phase is in principle part of preparedness), Individual and societal recovery, Clean-up and restoration activities (buildings, infrastructure, etc), Health and mental health supporting actions, incl. managing stress Disaster financial assistance (grants, tax), incl. disaster legal assistance, disaster unemployment assistance, Temporary or permanent relocation, Other				x			
M52	Recovery and Review, Environmental recovery, Clean-up and restoration activities (with several sub-topics as mould protection, well-water safety and securing hazardous materials containers)				x			
M53	Recovery and Review, Other, Other recovery and review Lessons learnt from flood events Insurance policies				x			
M61	Other	x	x	x		x	x	x

There is no information in most iFRMP/FRMPs regarding timing of the implementation of measures. For the **Rhine** RB, for some of the measures, in particular those measures aimed at lowering the water levels, a timeframe is given with an implementation deadline until 2020. For the **Isonzo/Soča** RB the FRMP states that transboundary measures will be implemented in the first phase (2016-18) and the second phase (2019-21).

11.5.3. Joint principles for defining and prioritising measures

In many Category 1 RBs joint principles for defining measures have been agreed on at the international level.

For the **Danube** RB, Annex 2 chapter 7 of the iFRMP lists transboundary projects supporting the iFRMP. Several projects or project proposals/ideas presented as transboundary projects were developed by the ICPDR and/or the EU Strategy for the Danube Region (EUSDR, Priority Area-PA 5 - Environmental Risks[220]) and they shall, i.a.:

- reflect the objectives and priorities set in iFRMP;

[220] https://www.danubeenvironmentalrisks.eu/

- have a transboundary character;

- help to implement the measures listed in the Annex.

There is no ranking or prioritization of these projects, as they are all considered as supportive to the implementation of the iFRMP. In selecting the measures for this Plan, the priority was given to measures with downstream effect (according to Article 7(4)) of the FD, such as natural water retention, warning systems, reduction of risk from contaminated sites in floodplain areas, or exchange of information. The top priority was given to NWRM (water retention and giving more space to rivers) but the importance of the structural measures was also recognized.

In the **Rhine** RB, the Member States have agreed upon the following approach for the planning and implementation of measures:

- Regional or local measures which are known not to have any transboundary effects will be planned and implemented regionally/local;

- For regional measures with transboundary effects there will first be an exchange of information at a bilateral level or within river commissions for sub-basins, as for example the Moselle (Sarre). Eventually, these measures must be coordinated on a bilateral or trilateral level in order to find joint solutions;

- The measures with regional effects mentioned under the second point above might also cause supra-regional effects. Therefore, such measures must at the same time be included in the mutual exchange of information within the ICPR. Due to this approach, measures with transboundary effects are coordinated throughout the RB. The effect of planned measures must be determined in common. Aspects of cost-effectiveness may be taken into account;

- Enhancement of national or regional agreements targeted at keeping floodplains free of all uses; exchange on these activities within the ICPR.

The afore-described approach is applicable to measures such as creating retention areas, dike relocation, room for the river and measures regulating discharges, the construction or strengthening of dikes, etc. Joint principles for prioritising measures on an international level are mentioned in the iFRMP. The iFRMP lists a set of concrete joint measures that seem to be

a high priority for all Member States and aim at: (i) international coordination of measures (ii) improving the exchange of information and access to information; (iii) improving flood forecasting and warning systems and at (iv) implementing measures aimed at lowering the water levels. The iFRMP states also that for the coordination of measures with supra-regional effects aspects of cost-effectiveness may be taken into account but no further information is provided.

For the **Meuse** RB, a joint principle in planning and implementing measures was defined by one of the objectives on the international level - the 'Proportionality of measures', i.e. the creation of a prioritization program for measures. It is stated that a ranking of measures was performed considering the mobilized human, technical and financial resources of all stakeholders and the expected benefits.

Also, in the **Elbe** RB there are common principles for defining groups of measures. The individual measures in each group are nationally defined. Each group of measures describes the principles behind their selection. It is unclear whether there are common principles for prioritising measures.

In the **Odra** RB there are joint principles for defining and prioritising measures, which relate to two transnational projects and the agreed 'flood protection program 2004'. In the latter a list of priority actions/measures has been agreed on, which is the basis for the joint work. Actions and priorities are indicated in the national FRMPs, taking into account international agreements, such as the Polish-German agreement. There is no information in the iFRMP on whether a cost-benefit analysis was used in the prioritisation and planning of measures with a transboundary effect.

The iFRMP of the **Scheldt** RB does not state that common principles for defining measured were adopted. A categorisation of measures (protection, prevention, preparedness and recovery) is presented, but it is not clear whether this classification was used in the planning of individual regions/MS. The iFRMP also highlights which criteria are relevant for multi-lateral discussions. France, Brussels/Belgium and Wallonia/Belgim were still in the process of preparing their programme of measures (PoM) when the iFRMP was prepared which is why the relevant chapter of the iFRMP ought to be updated once the national PoMs are finished and available. The Netherlands and Flanders/Belgium mainly use cost-benefit analysis and a maximum reduction of loss of lives to prioritise measures. There is no explanation of how measures with a transboundary effect were prioritised.

The assessment of the Category 1 RBs points at initial attempts to prioritise measures. It will be a challenge to assess progress at a later stage, as hardly any information on monitoring the implementation is provided in the iFRMP. It can be assumed this will be the task of the various expert groups.

11.5.4. Cost benefit assessments for transboundary measures

The FD suggests that cost-benefit analysis is used to assess measures with transnational effects.

For all Category 1 RBs there is no information in the iFRMPs on whether a RB-wide cost-benefit analysis was used in the prioritisation and planning of measures with a transboundary effect.

For almost none of the Category 2 RBs was information found on joint principles for prioritising measures or on the use of cost benefit analysis. The exception appears to be the **Isonzo/Soča** RB, where the key joint principle for defining and prioritising measures is to coordinate the methodology for the evaluation of their costs and benefits, but no further information is provided.

For none of the Category 3 RBs information on the use of a cost-benefit analysis for prioritising measures is provided.

It is unclear why CBAs are not widely used in the transboundary context as suggested by the Directive. The possibilities should be investigated by the expert groups set up by the river commissions (or explained in the iFRMPs) as they might relate e.g. to methodological challenges or to different approaches between countries that could not be reconciled in the first cycle.

11.5.5. Solidarity principle applied at the international level

Article 7(4) of the FD states that: '*In the interests of solidarity, flood risk management plans established in one Member State shall not include measures which, by their extent and impact, significantly increase flood risks upstream or downstream of other countries in the same River Basin or sub-basin, unless these measures have been coordinated and an agreed solution has been found among the Member States concerned in the framework of Article 8*.'

For all Category 1 RBs the respective iFRMPs refer to the solidarity principle. However, in most cases not very detailed information is provided on how the principle was applied in practice.

The iFRMP of the **Danube** RB states that the solidarity principle has been applied in the basin: The ICPDR agreed that the measures with positive downstream effects shall have the key priority at the basin-wide level planning of joint measures. The Plan states that to avoid the negative downstream effects, the national legislation shall contain provisions stipulating that FRMPs shall not include measures which, by their extent and impact, significantly increase flood risks in other countries.

For the **Rhine** RB, the iFRMP restates Article 7(4) of the FD. However, it remains unclear how this principle is applied in practice.

The iFRMP of the **Meuse** RB also restates Article 7(4) of the FD. The solidarity principle is also one of the joint objectives for the management of flood risk at the international level that have been established by the five Member States. However, also here it remains unclear, how this is handled in practice.

For the **Elbe** and the **Odra** RBs, the iFRMPs state that Article 7(4) has been applied in the basin and that the relationship between up and downstream countries plays an important role in flood risk management within the basin. No information is provided on how this was applied in practice.

For all Category 2 RBs it is not clear whether the solidarity principle has been applied. Spain and Portugal refer to the importance of the principle in the national FRMPs, but for all except one of the RBs (in the **Tagus** the principle of Article 7(4) is reiterated) no further information is provided. In the FRMP for the Eastern Alps (Italy), Article 7(4) is not mentioned. No information is provided for the **Dniester/Dnistr/Nistru,** the **Tornio/Torne** and the **Ems** RBs.

All FRMPs related to the Category 3 RBs, cite the principle of solidarity as reflected in Article 7(4)), the practice of it is unclear.

11.6. Consideration of climate change in transboundary RBs

Article 4(2)(d) of the FD requires that Member States, depending on their specific needs, to already in the first cycle consider the impact of climate change. Further, Article 14 stipulates

that the impacts of climate change and long-term developments on the occurrence of floods shall be considered from the second cycle reviews and updates.

The level of detail provided regarding climate change is varying for the different iRBDs. While there has been a clear effort to take climate change into account in some of the iRBDs, in others the iFRMP states that it will be taken into account in the future. In general, it can be stated that consideration of climate change is more developed in those basins where an international body has been established.

Table 22 Climate change considerations in the iRBD Category 1

International River Basin	Climate change considered at the iRB level
Danube	yes
Rhine	yes
Meuse	yes
Elbe	yes
Odra	yes
Scheldt	no

The specific chapter on climate change in the iFRMP of the **Danube** RB for instance focuses on what regional scenarios have been developed and the effects on measures. The information on the effects on measures does not specify whether such effects were taken into account in the planning of measures or establishing of objectives. However, a link to the Danube Climate Adaptation Study developed in 2012 is established. This link is rather general but it is stressed that adapting flood risk management to climate change issues has to be included in the next FRMPs.

For the **Rhine** RB more information related to climate change is provided in the iFRMP. The iFRMP has a specific chapter on how climate change was taken into account in the flood risk assessment. Aspects covered are: a) impacts of climate change for the Rhine catchment and b) climate change effects on measures of flood risk management. The chapter first lists basin wide impacts from climate change based on a common assessment and the effects on flood risk management measures. Also, following the instructions of the 15th Conference of Rhine Ministers, the ICPR has drafted a strategy to adapt to climate change. However, it remains unclear if these scenarios are used on the national level. While climate change is not mentioned in establishing objectives for the iFRMP, the plan is linking selected measures to climate change and several of the common measures relate to climate change issues. Many of the common measures described that are going to be implemented range among no-regret and win-

win measures. They also have a positive effect on changes of the water balance brought about by climate change.

For the **Meuse** RB, the joint summary of the IMC states that Member States have started to work on joint flow patterns based on national climate scenarios. There is no information regarding whether climate change was considered in the setting of objectives or in the selection of measures.

The chapter on the PFRA of the iFRMP of the **Elbe** RB has a specific sub-section on how climate change was taken into account in the assessment. The chapter first lists climate research projects that have been carried out in the last years within the Elbe region. Some of these projects are regional or national but the GLOWA project mentioned looked at the Elbe region as a whole. The chapter also states that a under the Elbe Commission a document was produced summarizing the previous research, including conclusions. It is not clear, however, if this resulted in the same climate scenario being used amongst the riparian countries. The chapter on establishing objectives does not mention climate change.

For the **Oder** RB, the chapter on the PFRA of the iFRMP has as well a specific sub-section on how climate change was taken into account in the PFRA for each Member State. It focuses on what regional scenarios have been developed in each Member State and shows that no common approach was used so far. It is not clear whether the potential effects of climate change on the risk of flooding have been taken into account when setting objectives.

The iFRMP of the **Scheldt** RB highlights that climate change should be taken into account in the future. So far, the Netherlands and Belgium/Flanders have taken climate change into account in their territories when setting objectives. Climate change was not considered in the setting of joint objectives or in the planning of joint measures.

For the Category 2 RBs, even less information is provided. For the **Spanish/Portuguese** RBs there is no information if climate change has been considered as an international coordination issue. Spain refers to previous studies existing on water availability reduction (however not much linked to flood risk), and explains that further studies will be undertaken, while Portugal refers to the fact that such studies will be undertaken by 2018 only. For the **Isonzo/Soča** RB, the FRMP for **Eastern Alps** (Italy) states that, in line with Article 14 of the FD, the impact of climate change on the occurrence of floods and their effect will be evaluated when reviewing the plan. The review will take into consideration the Italian National Climate Change Strategy which has been adopted on 16 June 2015. In the **Ems** RB, climate change is not addressed in

the coordination document (Germany, the Netherlands), but in the national FRMPs information is provided. In the **Tornio/Torne** RB, it is not clear if climate change was considered as an issue for bilateral coordination.[221]

Climate change has been considered in parts of five of the international Category 3 RBs, within the national contexts.

11.7.Monitoring progress in implementing the iFRMP

According to the FD, Member States are required to provide information on the way in which progress towards implementing the identified measures will be monitored (Annex, part A.II.1). However, the assessment showed that monitoring is in general not agreed upon at an international level. In most iFRMP there is no information on a joint monitoring, exceptions are the **Danube** and the **Meuse** RBs where the working groups are responsible for the joint monitoring. For the Category 2 RBs, for the **Isonzo/Soča** RB progress in the implementation of the common measures was discussed in 2016; in the **Ems** RB common monitoring measures were defined. None of the national FRMPs that correspond to Category 3 RBs provide information on the joint monitoring of measures at the international level.

11.8.Public consultation in transboundary RBs

Article 10 of the FD requires public consultation process related to the FRMP. The level of public consultation on the joint/international FRMP varies in the different iRBDs. For some of the Category 1 RBs extensive public consultation was performed and a well planned joint /transboundary communication strategy seems to be in place such as for the **Danube**, the **Rhine**, the **Elbe** and the **Odra** RBs, while for most of the other RBs, almost no public consultation took place. For the **Meuse** and the **Rhine**, the iFRMP was published online on the websites of the river commissions. The iFRMP of the **Scheldt** (Escaut) and **Meuse** clearly states that public consultation is seen as a responsibility of the Member States.

For the **Danube** RB, the ICPDR pursues a range of activities with regard to public participation. These include: 1) public information such as the development of technical public documents and general publications (e.g. the quarterly magazine Danube Watch); 2) environmental education, awareness raising and outreach (e.g. the annual river festival Danube

[221] Finland and Sweden informed that climate change was included as a topic in joint projects at the PFRA and FHRM phases. These activities will be strengthen in the 2nd cycle.

Day or the teacher's kit Danube Box) and 3) public consultation activities directly linked to the development of a RBMP and a FRMP. Public consultation for the development of the iFRMP, was done in two main steps, in which comments from the public were collected 1) on a timetable and work programme including public consultation measures and on 2) on the draft management plan. The opportunity to participate in each of these steps was promoted through the ICPDR network. For the consultation on the draft iFRMP, a comprehensive approach was chosen that aimed at stakeholder groups with differing degrees of involvement in water management issues. To ensure the highest possible transparency, all comments requesting changes or additions in the draft iFRMP were collected and processed by the relevant ICPDR expert or task group. A final report was published alongside with the final management plan in December 2015.

The draft of the first iFRMP for the **Rhine** RB (part A[222]) was published on the ICPR website[223] on the 22nd of December 2014 and was thus available for public participation and consultation. This online consultation was done in parallel to that of the draft of the second iRBMP according to the WFD. This was also the case in most EU-MS of the Rhine catchment. ICPR observers such as NGOs are being involved from the start in the drafting through their participation in the working groups. Further, during the six months iFRMP online consultation period, the ICPR received statements and requests for adaptation of the draft.

In the **Elbe** and **Odra** RBs public consultation international workshops on the FRMP took place. International Forums for both rivers were held to inform the public on the current state of play of both the WFD and the FD. Summaries of the results of the PFRA for the two international basins made available to the public. All documents, including the draft FRMPs and the risk maps were published on the websites of the Elbe and Odra Commissions. Additionally, for the Elbe an international Elbe Forum on the International FRMP and the International RBMP was held, while for the Odra an international Conference on the implementation of the WFD and the FD was organised.

For none of the Category 2 RBs a joint/transboundary communication strategy has been developed. However, some public consultation of the national FRMPs at the international level has taken place for the **Spanish/Portuguese** catchments. In the finish FRMP for the **Tornio/Torne** RB, the FRMPs for the Tornio/Torne River includes a table showing several

[222] Part A equals catchment areas larger than 2,500 km².
[223] www.iksr.org

meetings and workshops where the flood risk management work has been presented and many of these events have been joint events[224].

For the Category 3 RBs, no iFRMP exists, so generally no joint/transboundary communication strategy has been developed.

11.9. Cross-cutting issues with the Water Framework Directive

According to Article 9 of the FD the development of the FRMPs is to be carried out in coordination with that of the RBMPs under the WFD, including on how the environmental objectives of the WFD have been taken into account in the FRMPs. Both the WFD and the FD require public participation.

For all Category 1 RBs the development of the iFRMPs was done in consultation with the iRBMP. This is reflected in the iFRMP and the iRBMP. The information provided in the iFRMPs for each iRBD is summarized below.

For the **Danube** RB, the iFRMP was developed in consultation with the WFD and since the ICPDR is responsible for both, the overall coordination of the implementation of the FD and the WFD in the Danube RB a good prerequisite for maximum use of mutual synergies exists. Some examples of win-win measures are stated in the iFRMP. To produce the PFRA several ICPDR Contracting Parties used data that they had collated as part of the WFD process to assist with their contribution to the overall PFRA for the Danube. Furthermore, the ICPDR has produced a plan to meet the requirements of the WFD and FD.

For the **Rhine** RB, the iFRMP states that as far as measures are concerned, possible synergies with the environmental targets of the WFD will be enhanced and the environmental effects of measures liable to cause a deterioration of the ecological status of water bodies will be reduced to a minimum. Annex 8 of the iFRMP shows possible synergies between measures of the FD and measures of the WFD. In most riparian countries of the Rhine, public involvement concerning the draft of the first FRMP was done in parallel to that of the draft of the second RBMP.

For the **Meuse** in the Annex of the iFRMP an overview over potential synergies between measures under the FD and objectives of the WFD is provided. Measures are judged based on

[224] In the Finish FRMP the summary of the Plan also exists in Swedish, Mäenkieli and in Northern Sami language (for the indigenous Sami people)

whether they support WFD's objectives, whether they are not relevant for the WFD objectives or whether they are in conflict with WFD objectives.

According to the iFRMP, the measures planned in the **Elbe** RB were aligned with those under the WFD and the implementation of both Directives was coordinated, in particular regarding the improvement of efficiency, information exchange and synergies in achieving the environmental objectives of the WFD. Measures were grouped into three categories: Measures that support the objectives of the WFD, measures that cause conflicts, and measures that are no relevant to the WFD. Similar to the Elbe, the iFRMP of the **Odra** RB has also been developed in consultation with the WFD. Measures of the FD were coordinated with those under the WFD to maximise synergies, to ensure information exchange and to ensure that WFD objectives are met. For both, the Elbe and the Odra it is stated that detailed information can be found in the national Plans.

For the **Scheldt** RB the iRBMP states that the measures listed in the iFRMP were screened with respect to their positive/negative effect on the WFD. Further it states that the reporting for the WFD and the FD is already integrated in the RBMP of Flanders and Brussels, while Wallonia, the Netherlands and France continue to report in two separate Plans. It is planned that the International Scheldt Commission will have a role in coordinating measures that have a transboundary impact.

For the Category 2 RBs information on the coordination with the WFD is only provided for two RBs. For the **Garonne-Cantabrico** RB and for the **Isonzo/Soča** RB. Both cases concern coordination meetings of technical experts on synergies between the FRMPs and the RBMPs.[225]

For the Category 3 RBs no information on how the FRMPs were coordinated with the RBMPs on the international level was provided.

[225] The inventory of measures in the FRMP of the Eastern Alps (Italy) indicates for each measure whether there can be a synergy with the RBMP measures and whether the measure is also adopted in the RBMP (win-win situation). The inventory of measures in the Slovenian FRMP indicates for each measure whether there can be a synergy, potential conflict or no interaction with the RBMP measures.

Recommendations for transboundary cooperation in the framework of the FD

Based on the assessment of international coordination within the framework of the FD, the following recommendations can be made:

- iRBD/iUoM falling into Category 1 should strengthen their efforts towards further development of common methodologies and approaches wherever possible. The implementation of measures that create clear transboundary wins should be highlighted in the iFRMPs; as well as using cost benefit analyses more widely with a view to investing resources in the RBs more efficiently;

- iRBD/iUoM currently falling into Categories 2, 3 and 4 should aim to upscale their coordination; the most advanced amongst them should consider developing an iFRMP, that is based as far as possible on a joint risk assessment;

- For all iRBD/iUoM cooperation with countries outside the EU should continue and opportunities for reinforcing this cooperation should be sought;

- All FRMPs with transboundary relevance should provide more detailed information on their international coordination activities, so more lessons learned can be drawn and shared with other RBs in order to trigger EU wide learning and demonstrate the value added to the citizens benefitting from it;

- While for medium probabilities in most basins a 100-year return period is applied, low and high probabilities vary widely. Wherever possible, low and high probabilities should be streamlined to reinforce a common understanding of the flood risks;

- Numbers on the potential adverse consequences of flooding at the basin level (e.g. households potentially impacted) should be provided in jointly elaborated documents. This will underline the exposure levels and will provide focus;

- In the second cycle, climate change considerations should be integrated in the setting of objectives and in the prioritisation of measures;

- The priority criteria for the implementation of measures should be further detailed and efforts should be made to ensure that these internationally agreed priorities are also reflected on the national level as appropriate;

- Monitoring of the implementation of common measures. or measures with transboundary impact, should be more widely established at the international level in order to build shared knowledge and increase appreciation amongst authorities and citizens.

- For those iRBDs which have not carried out a public consultation of their iFRMP, their Plans should be subject to public consultation at the national level to allow for additional views, increase ownership and the understanding of the international dimension of the flood risk;

- The link with iRBMPs could be strengthened. This would lead to hydro-morphological measures planned under the iFRMP aligned with Article 4(7) of the WFD, but also promoting the role of nature based solutions as flood prevention measures and measures to reach good ecological status;

Annex 1 Member State FRMPs assessed

The table on the following pages lists the national FRMPs assessed.

As noted in section 4, the assessment covered up to five FRMPs in each Member State. Where Member States prepared a higher number of FRMPs, five of these plans were chosen for assessment[226]. The choice was based on the following criteria: First, to capture different methods used (for example in Member States with a federal structure where regions or other administrative units followed different approaches); second, to capture different types of flood risks; and third, to include national plans in UoMs that are part of international UoMs.

Member State	FRMPs assessed (UoM code and name of FRMP)
Austria	AT1000 : Danube AT2000: Rhine AT5000: Elbe
Belgium	BEEscautSchelde_BR: Scheldt (Brussels region) BEMaas_VL: Meuse (Flanders region) BESchelde_VL: Scheldt (Flanders region) BERhin_RW: Rhine (Walloon region) BEEscaut_RW: Scheldt (Walloon region)
Bulgaria	BG1000: Danube BG2000: Black Sea BG3000:East Aegean BG4000: West Aegean
Cyprus	CY001: Cyprus
Croatia	HRC: Danube HRJ: Adriatic
The Czech Republic	CZ1000: Danube CZ5000: Elbe CZ6000: Oder
Denmark	DK1: Holstebro DK1: Abenraa DK1: Odense & Kerteminde DK2: Slagelse DK2: Hvidovre
Estonia	EE1: West-Estonian EE2: East-Estonian EE3: Koiva
Finland	FIVHA2: Kymijoki-Gulf of Finland: Hamina and Kotka coastal area FIVHA3: Kokemäenjoki-Archipelago Sea-Bothnian Sea: Kokemäenjoki catchment FIVHA4: Oulujoki-Iijoki: Kalajoki catchment FIVHA5: Kemijoki: Kemijoki catchment FIVHA6: Tornionjoki

[226] A selection of FRMPs was made in the following Member States: Belgium, Denmark, Finland, France, Germany, Italy, Portugal, Romania, Spain, Sweden and the United Kingdom.

Member State	FRMPs assessed (UoM code and name of FRMP)
France	FRA: Scheldt, Somme and coastal waters of the Channel and the North Sea FRC: Rhine FRD: Rhone and Coastal Mediterranean FRF: Adour, Garonne, Dordogne, Charente and coastal waters of Aquitaine FRL: La Réunion
Germany	DE5000: Elbe DE9610: Schlei Trave DE4000: Weser DE2000 Rhine UoM: North Rhine Westphalia DE1000 Danube UoM: Bavaria
Hungary	HU1000: Danube
Italy	ITA: Eastern Alps RBD ITE: Central Apennines RBD ITI023: Sangro interregional basin (joint FRMP with ITR131, Abruzzo Region) ITR161I020: Puglia Region and the Ofanto River interregional basin ITR201: Sardinia Region
Latvia	LVDUBA: Dauguva LVGUBA: Gauja LVLUBA: Lielupe LVVUBA: Venta
Lithuania	LT1100: Nemunas LT2300: Venta LT3400: Lielupe LT4500 : Dauguva
Luxembourg	LU000: Rhine
Malta	MTMALTA: Malta
The Netherlands	NLEM: Ems NLMS: Meuse NLRN: Rhine NLSC: Scheldt
Poland	PL1000: Danube PL2000 : Vistula PL3000 : Swieza PL4000 : Jarft PL5000 : Elbe PL6000 : Oder PL6700 : Ucker PL7000 : Pregolya PL8000: Nemunas PL9000 : Dniestr
Portugal	PTRH3: Douro PTRH4A: Vouga, Mondego and Lis PTRH5A: Tagus and West Rivers PTRH9: Azores PTRH10: Madeira
Romania	RO5: Buzău–Ialomiţa RO6: Dobrogea-Litoral RO9: Somes-Tisa RO11: Prut-Bârlad RO1000: Danube
Slovakia	SK30000FD: Vistula SK40000FD: Danube
Slovenia	SI_RBD_1: Danube SI_RBD_2: Adriatic
Spain	ES017: Eastern Cantabrian

Member State	FRMPs assessed (UoM code and name of FRMP)
	ES080: Jucar ES014: Galician Coast ES060: Andalusian Mediterranean Basins ES110: Balearic Islands
Sweden	SE1: Bothnian Bay (Älvsbyn SE1A8932) SE2: Bothnian Sea (Falun SE2A6504) SE3: North Baltic Sea (Stockholm SE3A0336) SE4: South Baltic Sea (Kristianstad SE4A2980) SE5: Skagerrak and Kattegat (Karlstad SE5A5704)
The United Kingdom	UK01: Clyde and Loch Lomond (in UK01, Scotland) UK02: Solway (in the Scottish part of UK02, Solway Tweed) UK02: Solway Tweed (for the English Part of UK02) UK09: Severn UKGBNIIENB: Neagh Bann

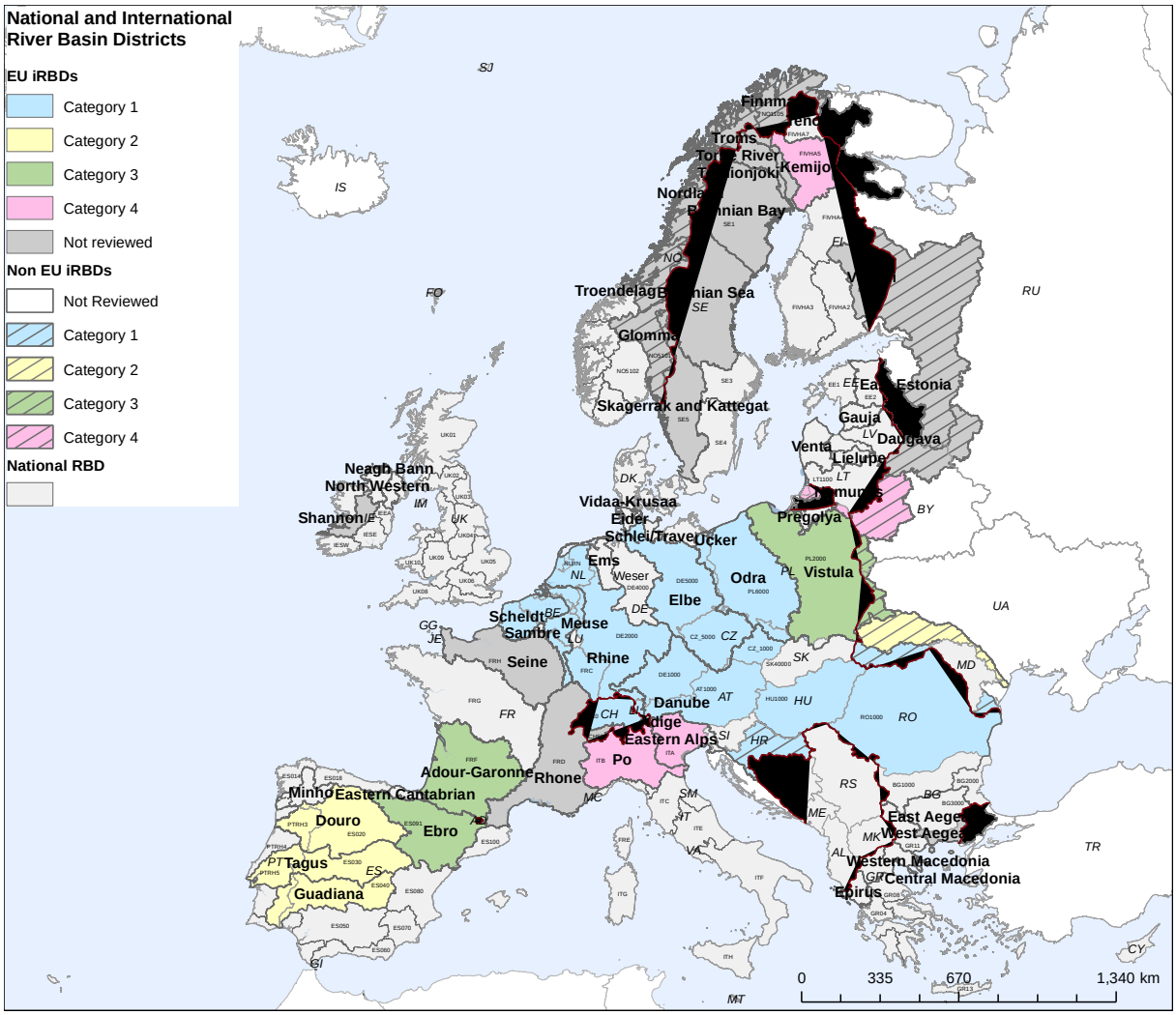
Annex 2 Overview of measures by aspect

	No Action		Prevention		Protection		Preparedness		Recovery and review		Other		Grand Total
	Aggregated	Individual	Aggregated	Individual	Aggregated	Individual	Aggregated	Individual	Aggregated	Individual	Aggregated	Individual	
AT			4 301		5 474		3128		2346				15 249
BE		2	92	80	37	369	40	25	13	8	2		668
BG			25	35	15	38	16	45	9	11	1	4	199
CY				4	5	21		5		3			61
CZ			14	1	26	5	15						38
DE			6 795		7 519		7 638		2612		459		25 023
DK			5		8		14		1				28
EE			44		3		20		3				70
ES			325	2	228	176	347	11	271	3			1 363
FI				98		142		127		88			455
FR	3		13	300	18	137	6	175	4	47	6	81	107
HR			20		9		42		2		34		46
HU			2		41		3						10 064
IT			3 291	211	3 017	1 549	1 536	36	385	23	15	1	61
LT			20		17		20		4				883
LU			11	7	18	805	15	1	1		25		96
LV			7	43		38	8						10
MT		1		5				4					116
NL			12		68		28		8				2 484
PL				158		2171		88		67			299
PT			46	5	39	54	97	13	41	4			52
RO			122	4	390	2327	231	16	48				1 413
SE			103	59	16	25	85	52	4	2	2		9 888
SI			20		18		10		4				3 138
SK			6		14	1 381	6		6				348
UK	1	43	111	2867	84	3 275	139	3 127	19	127	4	91	790

Annex 3 List of measure aspects and types

	No Action
M11	No Action, No measure is proposed to reduce the flood risk in the APSFR or other defined area,
	Prevention
M21	Prevention, Avoidance, Measure to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation
M22	Prevention, Removal or relocation, Measure to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and/or of lower hazard
M23	Prevention, Reduction, Measure to adapt receptors to reduce the adverse consequences in the event of a flood actions on buildings, public networks, etc...
M24	Prevention, Other prevention, Other measure to enhance flood risk prevention (may include, flood risk modelling and assessment, flood vulnerability assessment, maintenance programmes or policies etc...)
	Protection
M31	Protection Natural flood management / runoff and catchment management, Measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and / or storage, enhancement of infiltration, etc and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water.
M32	Protection, Water flow regulation, Measures involving physical interventions to regulate flows, such as the construction, modification or removal of water retaining structures (e.g., dams or other on-line storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime.
M33	Protection, Channel, Coastal and Floodplain Works, Measures involving physical interventions in freshwater channels, mountain streams, estuaries, coastal waters and flood-prone areas of land, such as the construction, modification or removal of structures or the alteration of channels, sediment dynamics management, dykes, etc.
M34	Protection, Surface Water Management, Measures involving physical interventions to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or though sustainable drainage systems (SuDS).
M35	Protection, Other Protection, Other measure to enhance protection against flooding, which may include flood defence asset maintenance programmes or policies
	Preparedness
M41	Preparedness, Flood Forecasting and Warning, Measure to establish or enhance a flood forecasting or warning system
M42	Preparedness, Emergency Event Response Planning / Contingency planning, Measure to establish or enhance flood event institutional emergency response planning
M43	Preparedness, Public Awareness and Preparedness, Measure to establish or enhance the public awareness or preparedness for flood events
M44	Preparedness, Other preparedness, Other measure to establish or enhance preparedness for flood events to reduce adverse consequences
	Recovery & Review
M51	Recovery and Review (Planning for the recovery and review phase is in principle part of preparedness), Individual and societal recovery, Clean-up and restoration activities (buildings, infrastructure, etc), Health and mental health supporting actions, incl. managing stress Disaster financial assistance (grants, tax), incl. disaster legal assistance, disaster unemployment assistance, Temporary or permanent relocation , Other
M52	Recovery and Review, Environmental recovery, Clean-up and restoration activities (with several sub-topics as mould protection, well-water safety and securing hazardous materials containers)
M53	Recovery and Review, Other, Other recovery and review Lessons learnt from flood events Insurance policies
	Other
M61	Other

Annex 4 Map of iRBD for which an assessment was carried out



Annex 5 Overview of international coordinating mechanisms

Category	iRBD	International Coordinating Body/ International Coordinating Mechanism	Means of coordination
Category 1	Danube	International Commission for the Protection of the Danube River (ICPDR)	Expert Group 'Flood Protection' (FP EG)
	Rhine	International Commission for the Protection of the Rhine (ICPR)	Working Group 'Flood'
	Meuse	International Meuse Commission (IMC)	Working Group 'Flood management'
	Elbe	International Commission for the Protection of the Elbe (ICPER)	Working Group 'Flood management'
	Odra	International Commission for the Protection of the Odra (ICPO)	Working Group 'Flood management'
	Scheldt (Escaut)	Internatioal Scheldt Commission (ISC)	Working Group 'PA7b'
Category 2	Duero/Douro	Albufeira Convention	Infrastructure and Flood Security Working Group
	Guadiana	Albufeira Convention	Infrastructure and Flood Security Working Group
	Miño/Minho	Albufeira Convention	Infrastructure and Flood Security Working Group
	Tagus (Tajo/Tejo)	Albufeira Convention	Working Groups on Hydrological Information, Planning and Information Exchange
	Isonzo/Soča/Soca	Italian-Slovenian Commission for the hydroeconomy	No permanent working group
	Dniester/Dnistr/Nistru	Agreement between the Government of Ukraine and the Government of Poland on Cooperation in the Field of Water Management in Frontier Waters (signed in 1996). This agreement established the Ukrainian-Polish Commission. Agreement between the Government of the Republic of Moldova and the Government of Ukraine on the joint management and protection of the cross-border waters in 1994.	Ukrainian-Polish Working Group on flood control regulations and drainage
	Ems	Managed through close cooperation between the German Federal States of Lower Saxony and North Rhine-Westphalia and the Netherlands as well as with the German Federal Government No international coordinating body but supporting document on international coordination developed in addition to the three national FRMPs (DE, NL)	Two working groups: a) an international coordination group and b) an international governance group which also deals with flood management

	Tornio/Torne	Coordinated by the Swedish Civil Contingencies Agency, the Ministry of Agriculture and Forestry in Finland and the Finnish-Swedish Border Commission Finland-Sweden Intergovernmental Agreement of 2010 with the objective to inter alia prevent flood and environmental accidents for the Torne River.	Non-permanent working groups are in place. The Swedish Finnish River Commission can arrange meetings and working facilities for the working groups.
	Teno/Tana, Nataamo/Neiden, Pasvloa/Paatsjoki/Pasvik	Coordinated by the Finnish-Norwegian Transboundary Water Commission and the Finnish-Russian Transboundary Commission.	
Category 3	Garonne/ Cantabrico Oriental	Agreement of Toulouse (established between Spain and France in February 2006) FRMP (ES017) includes a specific annex on international cooperation, which details all issues regarding this topic	No working group
	Garonne/Ebro	Agreement of Toulouse (established between Spain and France in February 2006) -under this convention it was agreed to make independent plans, and to hold technical meetings for coordination, but no further details on these meetings are provided Joint Commission of the Lanós Lake and the Upper Garonne Joint Commission are also in place, but no activities are reported. Spanish FRMP (ES091) refers to technical meetings, but no further details are given	No working group
	Vistula	Convention on the Protection and Use of Transboundary Watercourses and International Lakes (17 February 2000) Agreement between Poland and Slovakia on Water Management in Border Countries (14 May 1997) Agreement between Poland and the Ukraine on cooperation in the field of water management in border waters (10 October 1996) Agreement between Poland and Belarus on cooperation in the field of environmental protection (20 May 1992) Agreement between Poland and Lithuania on cooperation in the field of border water use and protection (7 June 2005) International cooperation in the area of particular water regions is carried out under the statutory tasks and	Group R - for flood prevention measures, regulation of border watercourses, water supply, land improvement, planning and hydrogeology; HyP Group - for hydrology and flood protection, dealing among others among other exchanges and control of hydrometeorological information, performing flow measurements on boundary profiles; Ukrainian-Polish Working Group on flood control regulations and drainage

		concentrates on cooperation in border waters (Slovakia, Ukraine, Lithuania, Belarus) and other cooperation in the field of water management. This cooperation is also based on the arrangements for mutual cooperation in the implementation of the EU water policy. For the Vistula River Basin, information exchange with Slovakia takes place within the framework of the Polish-Slovak Border Water Commission and the Polish-Ukrainian Border Water Commission. At present negotiations are underway on the draft agreement between Poland and Belarus on cooperation in the field of water management in border waters.	
	Pregolya	International cooperation is coordinated by the National Water Management Board in Poland and based on two formal international agreements: one with Lithuania (7 June 2005) and one with Russia (first signed 17 July 1964 under the USSR and automatically renewed every 5 years). National FRMPs (LT, PL) exist, but no iFRMP was prepared.	No working group
	Vidaa/Wiedau	Signed bilateral joint declaration on cooperation between Denmark and Schleswig Holstein	
	Krusaa/Krusau	Signed bilateral joint declaration on cooperation between Denmark and Schleswig Holstein	