

A. EXECUTIVE SUMMARY

1. Water status management

1.1 Water status

Data and analyses of water status indicators suggest that the water resources in Croatia are subject to the impact of human activities. As a rule, human activities burden the environment, affecting the quality of individual environmental components. In the field of water, this is reflected in individual water quality elements deteriorating to a varying extent, and possibly even in a permanent adverse impact on water. An impact is a cumulative consequence of pollution in the aquatic environment which cannot always be easily interpreted in quantitative terms since there is no simple method to express complex impacts such as the disappearance of species, fragmentation of habitats and other similar long-lasting changes in the aquatic environment. The impact is deemed significant at those water bodies where water quality in terms of any quality element is reduced below the required standards, i.e. where the achievement of objectives for water protection and environmental protection in general is put into question. These are the water bodies for which appropriate measures have to be planned and taken in order to stop the negative processes and, if possible, restore the good status of water bodies.

According to the collected and analysed data, it is assessed that satisfactory (at least good or high and good) ecological status of surface waters hasn't been achieved at:

- ✓ Around 58% of the river water bodies in the total length of app. 8,440 km (or 66% of the total length of rivers with a catchment area > 10 km²);
- ✓ Around 54% (20) of the lake water bodies; and
- ✓ Around 55% of transitional water bodies and around 12% of coastal water bodies.

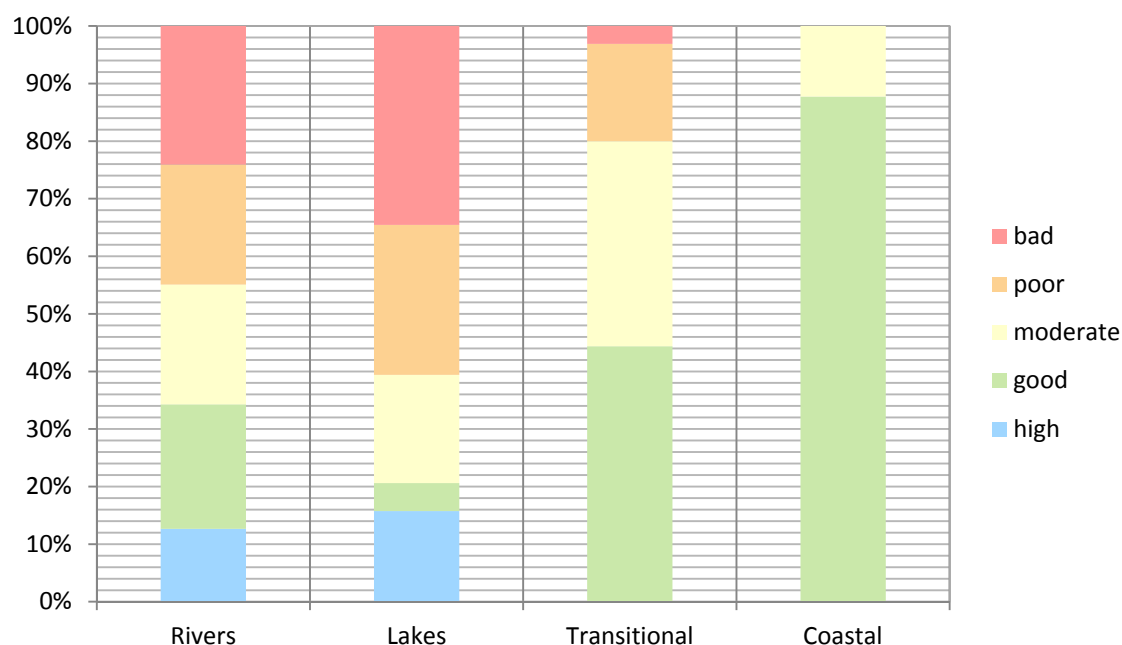


Fig. A.1 Assessed ecological status of surface water bodies (per WB length or surface area)

It is assessed that good chemical status of surface waters hasn't been achieved at:

- ✓ Around 8% of the total of 1,484 river water bodies (or slightly less than 10% of the total length of rivers with a catchment area > 10 km²);
- ✓ Around 15% of the total transitional water bodies and around 6% of coastal water bodies

It has to be noted that it has been identified that all lakes are in good chemical status.

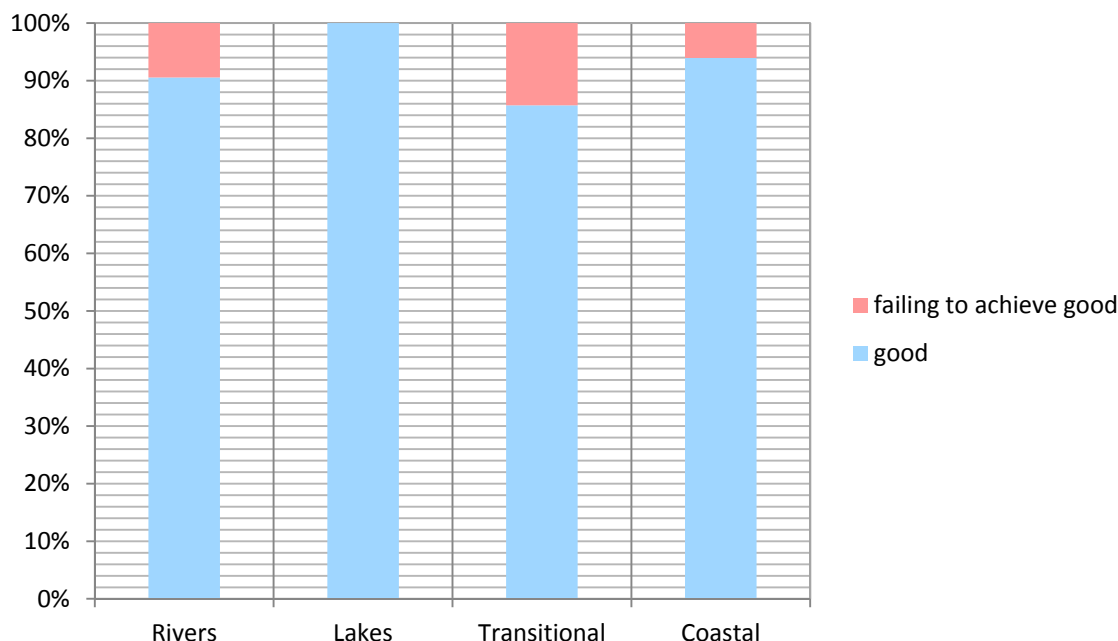


Fig. A.2 Assessed chemical status of surface water bodies (per WB length or surface area)

Results of the assessment show a better situation in terms of the chemical status of surface waters, even though the reliability of assessing the chemical status is relatively low due to the limited scope of monitoring. The monitoring fully adjusted to the water management needs started in 2015, which will significantly increase the reliability of analyses and assessment in the next planning period.

With a relatively low degree of certainty, the assessment of groundwater status shows a much more favourable situation. The following has been identified:

- ✓ In the Danube river basin district:
 - Poor chemical status of the Varaždin groundwater body (nitrates) and of the main water body HR204 of the Zagreb groundwater body (trichloroethane and tetrachloroethane identified with a high degree of certainty); and
 - All water bodies have good quantitative status.
- ✓ In the Adriatic river basin district:
 - Poor chemical status of the South Istria water body (nitrates) and of the Bokanjac-Poličnik water body (saltwater intrusion identified); and
 - Poor quantitative status identified only for the Bokanjac - Poličnik transitional water body (excessive abstraction). It has to be noted that excessive abstraction in the area of the South Istria groundwater body decreased when salt water appeared in the wells.

The projections of water status expected at the end of the first planning period (end of 2015) were obtained by simulation (rivers and lakes) and by assessing the impacts of water status improvement measures which have been implemented or are in implementation with the end of 2015 as the

completion date. The simulation shows small improvements in water quality compared to the status in 2012, which is not surprising in light of small improvements in making the planned measures operational. The analysis of the expected water status per individual quality elements shows that the existing problems in water protection remain unsolved. Only local changes compared to the existing status (in 2012) are possible related to changed loads from point sources at locations of implemented measures.

Water pollution is a very marked problem to be solved using a combined approach to water protection. Under such an approach, basic measures to control the sources of pollution have priority, and where so required by the status of the receiving water body, supplementary measures are proposed as well. The basic measures are defined by the regulatory framework and include the obligations assumed by Croatia during its process of accession to the European Union. When defining the Programme of Measures (PoM) for water status management in the periods 2016 – 2021 and 2022 – 2027, the starting assumption is that the remaining measures foreseen by the existing implementing plans and water protection programmes, in particular the measures to control the pollution from point and diffuse sources stemming from the EU legislation (Directive concerning urban wastewater treatment, Directive concerning integrated pollution prevention and control (IPPC) replaced by the Directive on industrial emissions (IED), Directive concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive), Directive on plant protection products), will be implemented within the defined deadlines. The starting point for the planning of supplementary measures is the status of water which can be expected after implementation of all the basic measures regardless of the time period of their implementation. The described planning approach has become operational by analysing two basic scenarios for pollution discharge control/reduction and by quantifying the impacts of such scenarios on the status of water:

- ✓ **Scenario 1** contains the basic measures for the control/reduction of emissions which will be implemented until the year 2021;
- ✓ **Scenario 2** builds on the same transposed legislation as Scenario 1 and implies its full implementation, regardless of the granted transition periods.

Pressures from water abstraction and/or re-routing are a problem occurring at a few water bodies.

The identified problems will be addressed using water abstraction control measures with which the volume of abstracted water should drop below 40% of the average long-term discharge, i.e. the water exploitation index needs to be restored to moderate.

The problem of hydro-morphological pressures from physical interventions has been identified at a significant number of surface water bodies. Longitudinal structures and interventions in the channel, on the banks and in the flood zone have been identified as the most frequent cause of hydro-morphological problems, alone or in combination with other hydro-morphological pressures, with their dominant purpose being flood defence and navigation. In a large number of cases these are both multi-purpose and multi-user structures.

Around a half of hydro-morphologically degraded rivers, i.e. 133 river water bodies, 9 lake water bodies, and 11 transitional and 4 coastal water bodies have been identified and designated as artificial or heavily modified water bodies, the restoration of which is not acceptable due to the adverse effects on the beneficial objectives served by the performed hydro-morphological alterations, i.e. because these objectives cannot be achieved by other, more environmentally friendly, options. Measures for partial mitigation of hydro-morphological degradations of the AWBs and HMWBs will be planned upon the definition of standards for the assessment of ecological potential of AWBs and HMWBs which take account of the essential hydro-morphological alterations supporting a defined purpose of a water body. In accordance with such standards, the type and scope of possible hydro-morphological improvements will be identified and the need to implement corresponding hydro-morphological measures will be defined.

For the remaining river water bodies with hydro-morphological status assessed as unsatisfactory, restoration measures are planned to be taken once the impact of the altered hydro-morphological elements on the status of aquatic ecosystems is checked through targeted biological investigations and the key hydro-morphological pressures that have led to the altered habitat conditions are identified. The selection of restoration measures should focus on improving the vital hydro-morphological quality elements.

1.2 Programme of Measures

In the period 2016 – 2021, 260 different measures are planned for implementation in order to achieve at least good water status. A detailed list of measures is presented in Chapter C.5: Summary Programme of Measures, systematized according to the Ordinance on the content of the River Basin Management Plan (Official Gazette 74/13)¹. The number of measures systematized according to activities to which they refer and the bodies leading the activities is presented in tabular form below.

The Programme of Measures for the period 2016 – 2021:

- ✓ Implementation of 138 basic measures planned;
- ✓ Implementation of 116 additional measures planned related to the protection of protected areas or special water protection areas, with the measures for additional protection intended for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection representing their most significant part (98); and
- ✓ Implementation of 8 supplementary measures proposed on the water bodies for which it is assessed that the water protection objectives (at least good water status) will not be achieved after implementation of all the basic measures (in the planning period 2022 – 2027).

Furthermore, no measures and activities are planned in the period 2016 – 2021 related to:

- ✓ Basic measures to control the other significant impacts on water status, in particular the hydro-morphological status (5.2.8); and
- ✓ Additional measures to protect water resources intended for human consumption or reserved for such purposes in the future (5.3.1.)

A large number of measures that need to be implemented in the planning period concern all the users (activities). However, the largest number of measures concern the reduction of human pressures on the status of water and the reduction of pressures to water as the result of flood defence activities.

It is noted that the PoM also contains the measures resulting from the Plan's strategic environmental impact assessment (marked with an S in the chapter Summary Programme of Measures).

It is planned that 151 measures will be implemented through the PoM of the Marine Strategy. This concerns primarily the measures to reduce pressures from water pollution and to reduce hydro-morphological pressures, and additional protection measures for protected areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection.

¹ Article 13 and Annex VII of the Water Framework (2000/60/EC)

Tab. A.1 Measures also implemented through the PoM planned within the Marine Strategy

Basic measures	5.2.1. Measures to recover the costs of water services	3
	5.2.2. Drinking water protection measures	4
	5.2.3. Water abstraction control measures	9
	5.2.4. Groundwater recharge control measures	
	5.2.5. Measures to control point sources of pollution	27
	5.2.6. Measures to control diffuse sources of pollution	2
	5.2.7. Measures to control and reduce hydro-morphological pressures to water	14
	5.2.8. Measures to control other significant impacts on water status, in particular on hydro-morphological status	
	5.2.9. Measures to ban direct discharge of pollution to groundwater	8
	5.2.10. Measures to eliminate and reduce pollution with priority substances	5
	5.2.11. Measures to prevent accidental pollution	5
	Total basic measures	77
Additional measures	5.3.1. Waters intended for human consumption or reserved for such purpose/s in the future	
	5.3.2. Water suitable for the life of freshwater fish and water suitable for shellfish	5
	5.3.3. Areas for bathing and recreation	6
	5.3.4. Sensitive areas, basins of sensitive areas	1
	5.3.5. Areas prone to pollution with nitrates from agriculture, vulnerable areas	1
	5.3.6. Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection	57
	5.3.7. Proposed update of the Register of Protected Areas	
	Total additional measures	70
Supplementary measures	5.4.1. Supplementary measure to harmonize water monitoring	
	5.4.2. Supplementary measures to control point and diffuse sources of pollution	4
	Total supplementary measures	4
TOTAL		151

Hrvatske vode is in charge of implementation of more than 65% of all the measures, either directly or as a coordinating body. Implementation of 11% of the measures is the responsibility of the ministry in charge of water management. Responsibility over the implementation of the remaining app. 20% of the measures is shared by all the other institutions or, directly, water users.

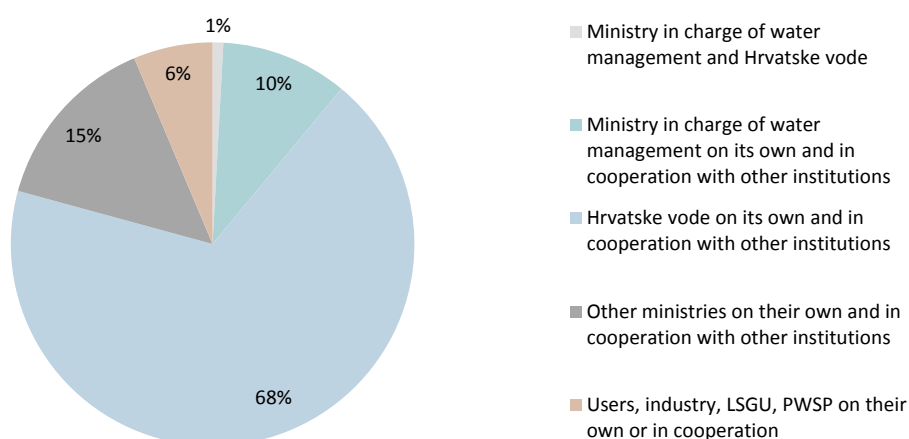


Fig. A.3 Responsibilities over implementation of water status management measures

Tab. A.2 Overview of water status management measures foreseen by the PoM, categorized according to the activities to which the measures refer

	5.2.1. Measures to recover the costs of water services	5.2.2. Drinking water protection measures	5.2.3. Water abstraction control measures	5.2.4. Groundwater recharge control measures	5.2.5. Measures to control point sources of pollution	5.2.6. Measures to control diffuse sources of pollution	5.2.7. Measures to control and reduce hydro-morphological pressures to water	5.2.8. Measures to control other significant impacts on water status, in particular on hydro-morphological status	5.2.9. Measures to ban direct discharge of pollution to groundwater	5.2.10. Measures to eliminate and reduce pollution with priority substances	5.2.11. Measures to prevent accidental pollution	5.3.1. Waters intended for human consumption or reserved for such purpose/s in the future	5.3.2. Water suitable for the life of freshwater fish and water suitable for shellfish	5.3.3. Areas for bathing and recreation	5.3.4. Sensitive areas, basins of sensitive areas	5.3.5. Areas prone to pollution with nitrates from agriculture, vulnerable areas	5.3.6. Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an objective	5.3.7. Proposed update of the Register of Protected Areas	5.4.1. Supplementary measure to harmonize water monitoring	5.4.2. Supplementary measures to control point and diffuse sources of pollution	Total
	Basic measures											Additional measures						Supplementary measures			
Population	19	14	17	3	24	3	2	No measures foreseen	8	2	5		5	2	1	No measures foreseen	57	2		2	166
Agriculture	6	2	18	3	10	10	14		5	5	2		6	1			56			3	142
Climate change	3		15	3	10		2		5	2	2		5	1			53			2	103
Hydropower	3		15	3	10		14		5	2	2		6	1			54			2	117
Energy – other	3		15	3	10		2		5	2	2		5	1			53			2	103
Fisheries and aquaculture	3		15	3	10		2		5	2	2		6	1			56			2	107
Flood defence	3		15	3	10		15		5	2	2		6	1			86			2	150
Forestry	3	1	15	3	10		2		5	2	2		5	1			53			2	104
Industry	3		15	3	14		2		8	3	5		5	2			56			3	119
Tourism and recreation	3		15	3	10		2		5	2	2		5	5			56			2	110
Transport	3		16	3	10		15	5	3	2		6	1		54			2	120		
Other																		4		4	
Total number of measures by chapter	22	17	21	3	27	13	16	1	8	5	5	1	7	6	1	1	98	2	4	4	262
	138											116						8			

Tab. A.3 Overview of water status management measures foreseen by the PoM, categorized according to the institutions in charge of their implementation

		5.2.1. Measures to recover the costs of water services	5.2.2. Drinking water protection measures	5.2.3. Water abstraction control measures	5.2.4. Groundwater recharge control measures	5.2.5. Measures to control point sources of pollution	5.2.6. Measures to control diffuse sources of pollution	5.2.7. Measures to control and reduce hydro-morphological measures to water	significant impacts on water status, in particular on hydro-morphological	5.2.9. Measures to ban direct discharge of pollution to groundwater	5.2.10. Measures to eliminate and reduce pollution with priority substances	5.2.11. Measures to prevent accidental pollution	5.3.1. Waters intended for human consumption or reserved for such purposes in the future	5.3.2. Water suitable for the use of freshwater fish and water suitable for shellfish	5.3.3. Areas for bathing and recreation	5.3.4. Sensitive areas, basins of sensitive areas	5.3.5. Areas prone to pollution with nitrates from agriculture, vulnerable areas	where the maintenance or improvement of the status of water	5.3.7. Proposed update of the Register of Protected Areas	5.4.1. Supplementary measure to harmonize water monitoring	5.4.2. Supplementary measures to control point and diffuse sources of pollution	Total
No measures foreseen									1				1									2
Ministry in charge of water management, Hrvatske vode												1					1					2
Ministry in charge of water management	On its own	5	2	6		1	1					1				1						17
	Ministry in charge of culture																		1			1
	Ministry in charge of environment					1																1
	Ministry in charge of agriculture		1				3															4
	Ministry in charge of agriculture, Ministry in charge of environment, Ministry in charge of health									1												1
	Ministry in charge of water management total	5	3	6		2	4			1	1				1				1			24
Hrvatske vode	On its own	8	6	10		14	1	7		5	2	2		4	2			38		4	3	106
	Croatian Public Health Institute		1																			1
	Croatian Agency for Environment and Nature																	2				2
	Croatian Agency for Environment and Nature, LSGU, Counties														2							2
	User							1														1
	Ministry in charge of culture																		1			1
	Ministry in charge of the sea, Ministry in charge of agriculture																	1				1
	Ministry in charge of agriculture			1		1	1															3
	Ministry in charge of nature, Croatian Agency for Environment and Nature, Ministry in charge of forests, Hrvatske šume																	1				1
	Ministry in charge of forests				3	1				1												5
	Ministry in charge of forests, Hrvatske šume						1	1										1				3
	Hrvatske vode total	8	7	11	3	16	3	9		6	2	2		4	4			43	1	4	3	126

	5.2.1. Measures to recover the costs of water services	5.2.2. Drinking water protection measures	5.2.3. Water abstraction control measures	5.2.4. Groundwater recharge control measures	5.2.5. Measures to control point sources of pollution	5.2.6. Measures to control diffuse sources of pollution	5.2.7. Measures to control and reduce hydro-morphological measures to water	significant impacts on water status, in particular on hydro-morphological	5.2.9. Measures to ban direct discharge of pollution to groundwater	5.2.10. Measures to eliminate and reduce pollution with priority substances	5.2.11. Measures to prevent accidental pollution	5.3.1. Waters intended for human consumption or reserved for such purpose/s in the future	5.3.2. Water suitable for the use of freshwater fish and water suitable for shellfish	5.3.3. Areas for bathing and recreation	5.3.4. Sensitive areas, basins of sensitive areas	5.3.5. Areas prone to pollution with nitrates from agriculture, vulnerable areas	where the maintenance or improvement of the status of water	5.3.7. Proposed update of the Register of Protected Areas	5.4.1. Supplementary measure to harmonize water monitoring	5.4.2. Supplementary measures to control point and diffuse sources of pollution	Total
Ministry in charge of environment						1															1
Ministry in charge of environment, Ministry in charge of agriculture					1																1
Ministry in charge of nature																	3				3
Ministry in charge of nature, Croatian Agency for Environment and Nature																	2				2
Ministry in charge of forests		1																			1
Ministry in charge of forests, Hrvatske šume																	1				1
Ministry in charge of agriculture		1				2											1				4
Ministry in charge of agriculture, Croatian Centre for Agriculture, Food and Rural Affairs, Institute for Soil and Preservation of Land										1											1
Ministry in charge of agriculture, Agricultural Extension Service										1										1	2
Ministry in charge of transport																	1				1
Ministry in charge of spatial planning, LSGU																	1				1
Industry					1																1
PWSP	8	1	1		1	1															12
PWSP, industry											1										1
PWSP		2																			2
LSGU,PWSP	1	2			5																8
LSGU,PWSP, industry					1				2												3
LSGU, counties														1							1
User			3			2	7						3	1			46				62
TOTAL	22	17	21	3	27	13	16	1	8	5	5	1	7	6	1	1	98	2	4	4	262

2. Flood risk management

2.1 Flood hazard and risk assessment

Large highland regions with heavy rainfall, wide valleys of lowland watercourses, increasingly frequent extreme weather events that should be taken into consideration within the context of climate change, big towns and valuable assets in the areas potentially at risk, and partially insufficiently developed protective systems, all make Croatia rather vulnerable to floods. Flood risk management is an approach² based on the concept on reduction/limitation of flood hazard on the one side, but also reduction of vulnerability, sensitivity/exposure to floods.

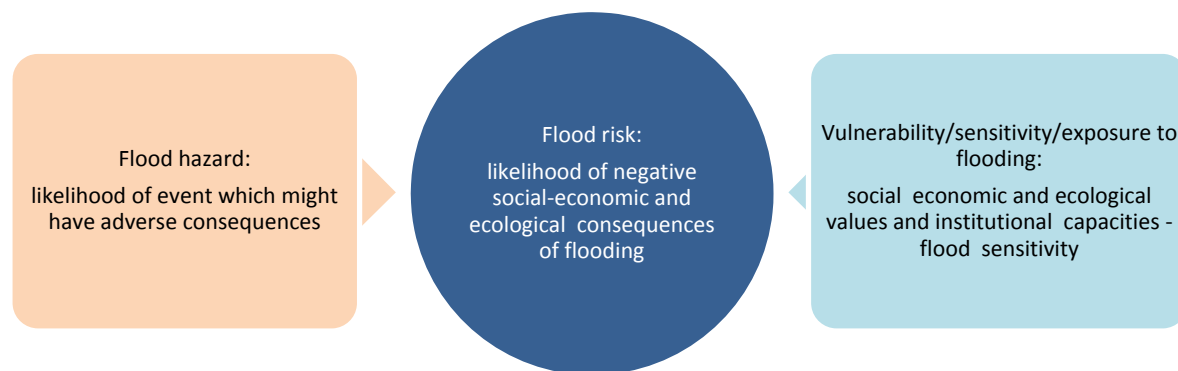


Fig. B.4 Concept of flood risk as interrelation between flood hazard and flood sensitivity

Preliminary flood risk assessment has identified areas with significant flood risks, i.e. areas with potentially significant flood risks have been determined. Total surface of identified areas in the Republic of Croatia amounts to 29 772 km² out of which more than 64% are areas with potentially significant flood risk that belong to the Danube river basin district. About 8% of areas that have been assessed as areas with significant flood risk refer to international water bodies and are mostly located in the Danube river basin district. Flood risk management in such areas should be conducted in accordance with provisions of protocols and agreements regulating the management of international issues.

In areas where preliminary assessment established significant flood risk, flood hazard maps have been prepared (high probability, medium probability and low probability of occurrence).

² Flood risk management is an approach that was adopted into Croatian legislation by transposing the Directive on the assessment and management of flood risks (2007/60/EC).

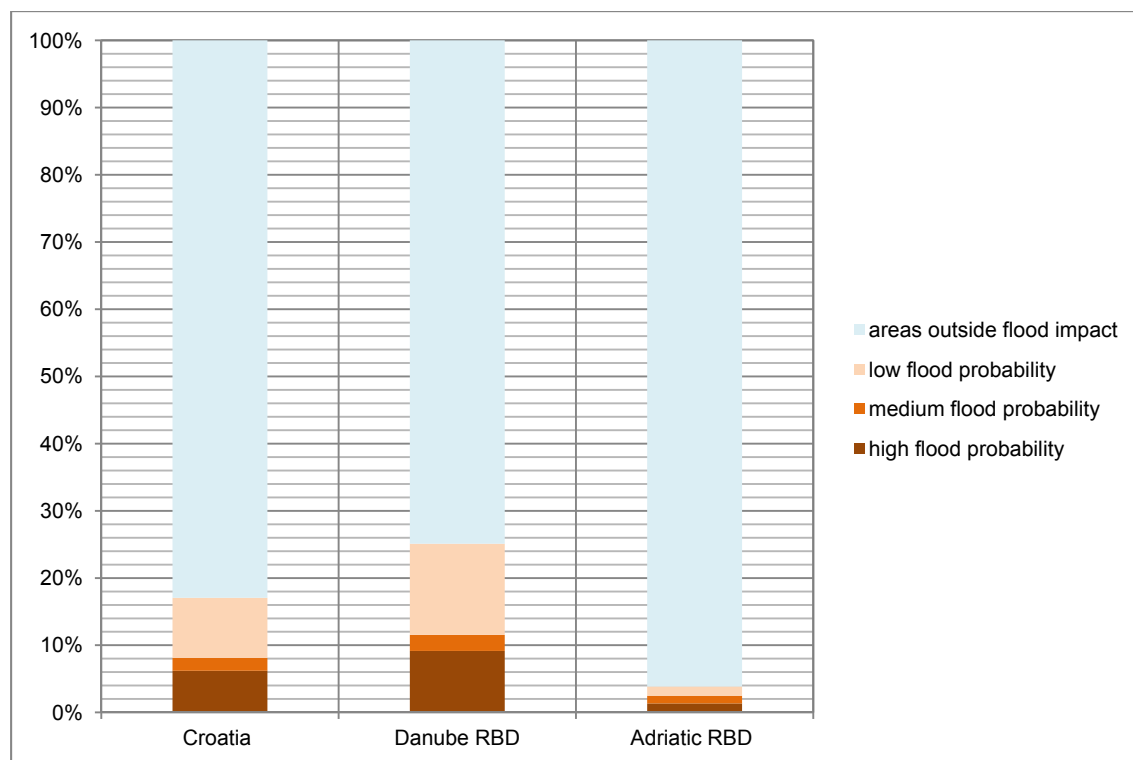


Fig. B.5 Distribution of potentially flooded surfaces according to flood probability

Flood risk maps contain the following data:

- ✓ number of potentially affected inhabitants per agglomerations;
- ✓ facilities with significant numbers of more vulnerable population, such as hospitals, schools, preschools, senior citizen homes,
- ✓ economic activities and land cover within flood plains grouped in several categories (inhabited areas, economic activity areas, sports and recreation areas, intensive agriculture, other types of agriculture, forests, etc.),
- ✓ infrastructural facilities (water intake structures, airports, railway and bus terminals, substations, railways tracks, embankments, highways, other roads etc.),
- ✓ protected areas (national parks, protected natural values, bathing areas, etc.) and
- ✓ potential significant polluters (large plants, waste disposal sites and waste water treatment plants etc.) and
- ✓ cultural heritage and sights (UNESCO areas).

Analysis of flood risk maps can determine certain differences in the use of flood plain spaces. For example with regard to medium probability of flooding:

- ✓ Even though the number of potentially affected inhabitants is evenly distributed according to river basin districts it can be concluded that they live in a smaller number of larger settlements in the Adriatic River Basin District, which can be seen in the proportionally larger number of kindergartens (typical for larger settlements) when compared to the number of schools (evenly distributed even in smaller settlements).
- ✓ 55% of potentially flooded surfaces of settlements and over 80% of totally flooded agricultural surfaces are located in the Danube River Basin District.
- ✓ Out of the total 23 registered waste disposal sites that are potentially exposed to medium probability floods a significant majority (over 85%) is located in the Danube River Basin District. Situation is similar when it comes to transport corridors (roads and railways).
- ✓ Potentially flooded areas of economic activity are evenly distributed according to river basin

districts, noting that a slightly larger number of potentially affected large industrial plants (60%) are located in the Danube River Basin District.

Setting up flood protection system that ensures acceptable flood risk in the entire territory of the Republic of Croatia potentially affected by floods is an objective that can be realized through gradual implementation of a number of activities and measures under the competence of water management institutions, even though other institutions are also involved in the implementation. Flood risk management that aims at reducing flood risk, i.e. reducing flood risk to an acceptable level, is in principle based on activities/measures that can be divided into 4 categories: flood reduction, reduction of flood sensitivity (sensitivity to damage caused by flooding), reduction of flood impact, resource preservation – of natural flood plains.

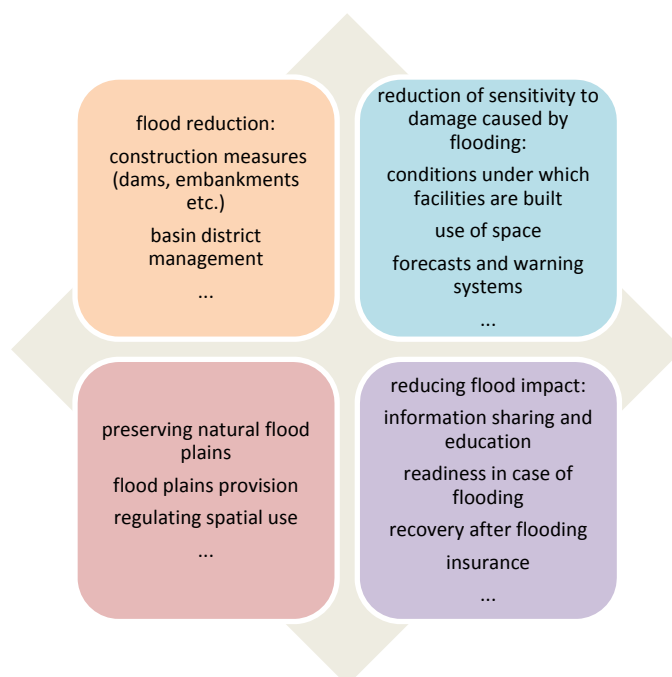


Fig. B.6 Basic groups of measures/activities in reducing flood risks

2.2 Programme of measures (PoM)

In the period 2016-2021 the implementation of 53 different measures is planned in order to achieve flood risk management objectives. Detailed description of measures is stated in Chapter D.5 Summary Programme of measures. Please find below a tabular presentation of the number of measures according to activities they refer to and according to bearers of activities.

The largest number of measures is implemented under items 2 and 3 of the Programme. These categories primarily include measures of flood hazard reduction whose implementation is the primary flood defence task. Other measures that have to be implemented and other activities are the same for all activities and mostly refer to activities related to investments in reducing flood susceptibility/exposure³, reducing potential damage i.e. strengthening flood resilience.

³ „sensitivity“ to flooding

Tab. B.4 Overview of flood risk management measures envisaged by the Programme of measures categorized according to activities measures refer to

	1. Measures of improving flood risk management	2. Implementation measures for flood risk reduction	3. Strengthening capacities and implementing preventive preparation activities, immediate measures of regular and emergency flood defence, as well as activities after the end of regular flood defence	4. Measures of flood risk reduction through public involvement	Total
Population	6	9	1		16
Agriculture	6	9	1		16
Climate changes	6	9	1		16
Hydro power	7	9	1		17
Energy – other	6	9	1		16
Fisheries and aqua- culture	6	9	1		16
Flood defence	16	19	11	7	53
Forestry	6	9	1		16
Industry	6	9	1		16
Tourism and recreation	6	9	1		16
Transport	6	9	1		16
TOTAL	16	19	11	7	53

Over 80% of foreseen flood risk management measures are implemented by Hrvatske vode independently, and about the remaining 17% in cooperation with other institutions or users themselves. Only 3% of foreseen measures are implemented or coordinated by the ministry in charge of water management independently or in cooperation with other institutions.

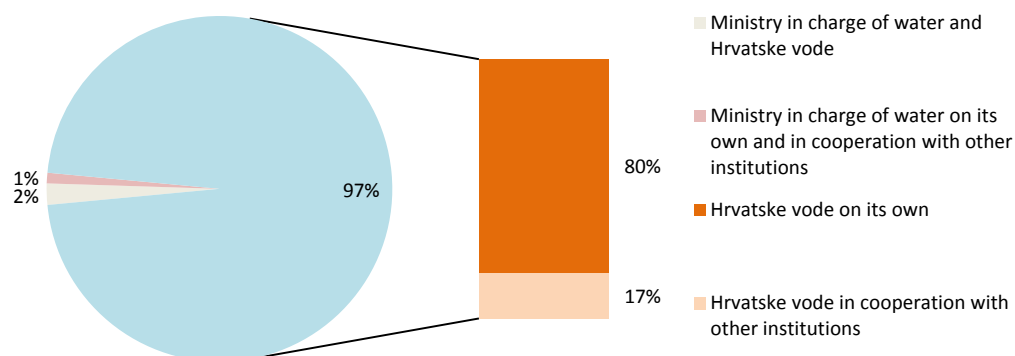


Fig. B.7 Overview of competences over the implementation of flood risk management measures

Tab. B.5 Overview of flood risk management measures foreseen by the PoM categorized according to institutions in charge of their implementation

		1. Measures of improving flood risk management	2. Implementation measures for flood risk reduction	3. Strengthening capacities and implementing preventive preparation activities, immediate measures of regular and emergency flood defence, as well as activities after the end of regular flood defence	4. Measures of flood risk reduction through public involvement	Total
Ministry in charge of water management, Hrvatske vode		4				4
Ministry in charge of water management	Independently	1				1
	Ministry in charge of power management	1				1
	Ministry in charge of water management, in total	2				2
Hrvatske vode	Independently	6	16	2		24
	National Protection and Rescue Directorate	2				2
	Meteorological and Hydrological Service			1		1
	Meteorological and Hydrological Service, National Protection and Rescue Directorate			2		2
	Meteorological and Hydrological Service, Hrvatska elektroprivreda			2		2
	Local self-government units (LS-GU)				2	2
	LS-GU, National Protection and Rescue Directorate				2	2
	LS-GU, Ministry in charge of environment				1	1
	LS-GU, Ministry in charge of nature, Croatian Agency for Environment and Nature (HAOP)				1	1
	LS-GU, Ministry in charge of physical planning				1	1
	Users	1				1
	Ministry in charge of culture			1		1
	Ministry in charge of environment		1	1		2
	Ministry in charge of environment, Ministry in charge of nature, HAOP			1		1
	Ministry in charge of nature		1			1
	Ministry in charge of nature, HAOP	1				1
	Ministry in charge of physical planning		1			1
	Ministry in charge of forestry, Hrvatske šume			1		1
	Hrvatske vode in total	10	19	11	7	47
TOTAL		16	19	11	7	53

3. Conclusion

Water status management –Insight into the efficiency of gradual implementation of basic measures related to the achievement of established water protection objectives is gained through simulation of Scenario 1 and Scenario 2. Measures refer to control of point and diffused sources of pollution and their impacts on the improvement of physical--chemical and chemical elements of water quality are assessed.

Indicators of expected water statuses after partial and complete implementation of basic measures show that their impacts are very limited and that almost all existing problems remain unsolved. Even though implemented measures have reduced total pressure on waters, this reduction is not fully aimed at water bodies under the heaviest pressure. Local water status can deteriorate in individual cases, in smaller receiving bodies. In most cases this happens in sites where new wastewater collection systems are constructed in which locally diffused pollution is concentrated in one discharge without appropriate treatment level. Nutrient pollution remains the largest environmental problem.

For water bodies estimated that they will not achieve good water status after implementation of basic measures, it is recommended that supplementary measures are planned and implemented. Selection of supplementary measures and proscribing the obligation to implement these measures shall occur after investigative monitoring and detailed analysis of water statuses verify the effects of basic measures for all pollution sources that affect the status of these water bodies.

Flood risk management – With direct investment in measures aimed at the reduction of flood hazard and flood risk that are supposed to include about 1 500 000 inhabitants, a large part of activities are planned to be implemented also with regard to reducing flood vulnerability, i.e. flood sensitivity. In the part that refers to flood hazard reduction it is imperative to select solutions that are an efficient combination of construction measures and measures of the so-called “green infrastructure” (preserving natural retarding basins, wetlands, wide flood retention areas along river courses etc.). The measure that foresees the harmonization of the program of flood risk management measures with regional planning documents has a significant influence on the reduction of flood risk in the part that refers to the reduction of flood exposure.

Water infrastructure development measures– Investments into the development of water infrastructure as the most significant investment part of the programme of water status management measures and the program of flood risk management measures are elaborated in detail in the following documents:

- ✓ The multi-annual Programme of construction of water supply and wastewater structures – in October 2015 the Government of the Republic of Croatia passed the Decision on the passing of Multi-annual Programme of construction of water supply and wastewater structures (Official Gazette, No. 117/15), which, according to Article 37 Paragraph 1 of the Water Act, was prepared by Hrvatske vode (measures: C.5.2.2. (12) Drinking water protection measures and C. 5.2.5. (14) Control measures for point sources of pollution) and
- ✓ The multi-annual Programme of construction of water regulation and protection facilities and facilities for basic amelioration drainage - in October 2015 the Government of the Republic of Croatia passed the Decision on the passing of Multi-annual Programme of construction of water regulation and protection facilities and facilities for basic amelioration drainage (Official Gazette, No. 117/15), which, according to Article 37 Paragraph 1 of the Water Act, was prepared by Hrvatske vode (measure D.5. (41) Strengthening of capacities and implementation of preventive preparation activities, immediate

measures of regular and emergency flood defence, and activities after the end of regular flood defence.).

Important parts of both multi-annual programmes were transposed into River Basin Management Plan 2016 – 2021. The procedure of strategic environmental impact assessment was conducted for both programmes. Estimated amounts of infrastructure development investments:

- ✓ For total compliance of public water supply systems that supply water to more than 50 individuals, i.e. that deliver more than 10 m³ in order to meet drinking water standards in the amount of 6.4 billion HRK (measure C.5.2.2 (12)),
- ✓ For total compliance of discharged urban wastewater for all agglomerations larger than 2 000 PE with required wastewater emission standards in the amount of 21.9 billion HRK, and
- ✓ For reduction of flood risk for all inhabitants for which preliminary flood risk assessment established that they are located in a very high risk area, and for 30% of inhabitants who are located in high risk area (measure D.5. (41)) in the amount of 4.6 billion HRK.

were used in economic analysis whose aim was to determine the participation of individual water users in the recovery of environment and resource costs (ERC) as a basis for assessment of their capacities to develop infrastructure and secure operation and maintenance in the way as to maintain proscribed standard of service, i.e. standard of water use/protection.

Economic analysis – Water service cost recovery indicators show a relatively satisfactory level of cost recovery, especially in the case of current level of cost recovery (75%) which was achieved through the implementation of valid water policy measures. Estimates of cost recovery rate that include internal (present) environmental and resource costs of the programme of basic measures, i.e. external environmental and resource costs (69%, i.e. 65%) show weaker results. Indicators show significant improvement when we observe provisions collected in the name of obligatory water fees as “income” made by water service users in a river basin district, by which public water service providers’ costs are cross-subsidized. In this way the subsidization of costs (construction of new systems) incurred by public water service providers is significantly reduced, thus increasing total cost recovery rates (97% - current water service cost recovery rate, 88% - recovery rate that includes both internal (present) environmental and resources costs of the programme of basic measures, i.e. 83% -water service cost recovery rate that includes both external environmental and resource costs).

Analysis of participation of significant water environment users in the recovery of ERC indicates that for the implementation of the programme of measures from the River Basin Management Plan 2016-2021 (i.e. to cover current ERC) are internalized to a high percentage. Here it is emphasized that the high level of cost internalization also includes a high level of respect for the polluter/user pays principle. Actually there is a high level of direct participation by sources of water pressure in covering costs related to the implementation of the Programme of measures (Nitrate Directive/agriculture, Industrial Emissions Directive/industry). **Urban development (population) is subsidized to a certain degree due to non-affordability of covering environmental and resource costs, i.e. non-affordability of future water price for population after a period of intensive investments and implementation of water and wastewater directives.** Certain improvements are required in order to secure external costs coverage required for the implementation of the Programme of measures from the River Basin Management Plan 2022-2027.

Monitoring efficiency and impact of the implementation of the Programme of measures falls within the competence of Hrvatske vode who are obliged to report on the implementation progress:

- ✓ After the first half of planning period,
- ✓ Within the framework of the Report on significant water management issues, and
- ✓ Within the framework of the River Basin Management Plan 2022-2027.

The report is based on monitoring indicators agreed/harmonized with institutions in charge of implementing measures. Please note the following:

- ✓ Implementation of control measure for point sources of pollution and implementation of drinking water protection measures are also monitored within the framework of monitoring the implementation of the multi-annual Programme of construction of water supply and wastewater structures for which a special system of indicators has been developed (see Chapters 5.2.2. and 5.2.5.), and
- ✓ Implementation of flood risk reduction measures is monitored also within the programme of monitoring the implementation of the multi-annual Programme of construction of water regulation and protection facilities and facilities for basic amelioration drainage for which a special system of indicators has been developed (see Chapter D.5).

have been harmonized with the reporting needs of institutions participating in co-financing the implementation of these two multi-annual programmes.