



Summary of the flood risk management proposed measures

Integrated Report for Tisza River Basin

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Abbreviations

APSFR	Areas with Potentially Significant Flood Risk
CBA	Cost-Benefit Analysis
EIA	Environmental Impact Assessment
EUR	Euro
EUSDR	EU Strategy for the Danube Region
EWA	European Water Association
FD	Floods Directive
FRMP	Flood Risk Management Plans
ICPDR	The International Commission for the Protection of the Danube River
GIES	General Inspectorate for Emergency Situations
MARD	Ministry of Agriculture and Rural Development
MCA	Multi-Criteria Analysis
MEWF	Ministry of Environment, Water and Forests
MH	Ministry of Health
MIA	Ministry of Internal Affairs
MNESR	Ministry of National Education and Scientific Research
MRDPA	Ministry of Regional Development and Public Administration
NARW	National Administration of Romanian Waters
NIHWM	National Institute of Hydrology and Water Management
NMA	National Hydrology Administration
NWRM	Natural Water Retention Measures
PFRA	Preliminary Flood Risk Assessment
RBA	River Basin Authority
RBD	River Basin Districts

Chapter1 Catalogue of potential measures

In order to facilitate the establishment of structural and non-structural measures, it has been used a catalogue of potential measures.

The measures proposed aim at five areas of action, closely related to the flood risk management cycle:

- **Prevention**
 - category of measure: legislative institutional, organizational measures and it includes measures like defining / improving the legal and technical framework for the implementation of Floods Directive, reviewing and updating flood risk management plans, coordinating territorial planning strategies with F.R.M.P. (in total 3 types of measures);
- **Protection**
 - categories of measures (examples: natural water retention measures - associated to watercourses, wetlands, and natural lakes, change or adaptation of land-use practices, structural protection measure – as new reservoirs development, development of diverting channels, local embankments, measures to increase population resilience, adaptation of the defence structures at the climatic changes, etc. (in total 11 types of measures);
- **Preparedness**
 - categories of measures (examples: measures regarding monitoring, forecasting and flood warning, activities of flood event preparedness exercise with interinstitutional participation, etc.); in total 4 types of measures;
- **Public Awareness**
 - one category of measures with the same name: measures to increase the awareness of the community and it includes adequate public activities of information and promotion of public participation, activities for education and training of the population; covers 2 types of measures;
- **Recovery**
 - categories of measures: emergency response actions, damage evaluation and recovery, improvement of post event documentation and analysis process, etc. (in total 3 types of measures).

There are 23 types of measures proposed; for each type of measure there are provided examples (the list not being exhaustive). This catalogue was very useful in defining at the level of River Basin Administrations the most relevant measures, in a unitary manner.

The measures (indicated in the Catalogue of measures) are classified into 3 categories depending on the level of implementation, as it follows:

- **measures implemented at national level** include measures with an essential role in flood risk management, which refer to current water sector legislation, those legislative provisions with impact in this domain (insurance scheme, legislative regulations of spatial and urban planning etc.) or which impose a system of best practices in order to reduce the negative effects of floods, studies, projects, programs, including know-how transfer and experience exchange in order to support implementation of the Flood Directive at catchment and national level, that also

involves cooperation between authorities at central level (in areas such as emergency management situations, meteorology, etc.);

- **measures implemented at the catchment level (River Basin Authority)** - are related with organizational and technical solutions whose effect aim to improve flood risk management across the whole territory of R.B.A.;
- **measures implemented/applicable at the level of A.P.S.F.R.** - are specific measures "located" either at the level of A.P.S.F.R. or, where appropriate, on the tributary or upstream catchment basin of the respectively sector, having in this situation an effect on sectors / areas with potential significant flood risk (A.P.S.F.R.).

Chapter 2 Flood risk management proposed measures

The program of measures in a river basin is based on structural and non-structural measures.

Structural measures have role of protecting, preventing and mitigating the effects of floods and are applied to reduce the flow of floods, maximum levels in the riverbed, the duration of floods, defending the goods and the population from the flood plain. But, structural measures are no longer considered to be the best solution for flood management, the non-structural measures and green infrastructure solutions is becoming more and more important from the moment of recognition their benefits.

Therefore, are recommended natural flood management measures, measures aimed at increasing the capacities of temporary storage of flood water and which, at the same time, can provide services for ecosystems. The concept developed at E.C. level is called Natural Water Retention Measures and represents support measures for green infrastructure.

According to the literature, non-structural measures are classified into two broad categories:

- measures of reducing flooding probability (reduction of the hazard): afforestation measures, practicing agricultural works perpendicular to the slope of the land, works to combat torrents and soil erosion, measures to avoid new constructions in the floodplain area etc.;
- measures to increase flood resilience: measures to raise community awareness, flood forecasting measures, emergency management measures and building regulation measures currently in floodplains.

The measures that can be taken are complex and require the involvement of several institutions, authorities and more "stakeholder" (the most important is the population).

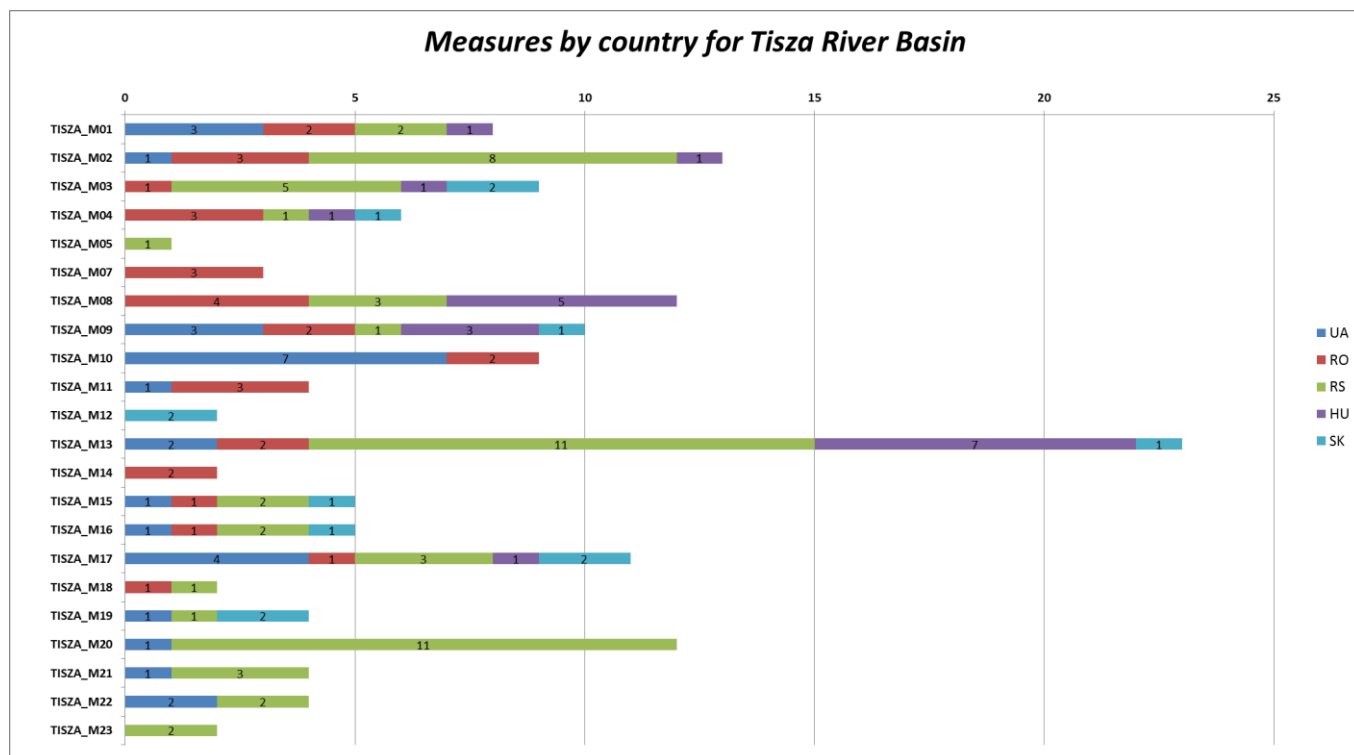
2.1. Proposed measures associated to flood risk management

Based on the *Catalogue of potential measures associated to flood risk management* that was agreed with all partners every country from Tisa River Basin has sent potential measures associated to flood risk management including the responsible authority and level of applications (see Table II.1). The result of the prioritization process at the each country level is presented in Annex 1.

These measures was included in strategic documents elaborated by each country, most of all are from national FRMPs.

In the figure II.1 there is a graphical representation with the number of measures proposed by each country according to measure code types established in the catalogue of potential measures.

Figure no. II.1: Number of measures proposed by each country according to measure code types



Also, at the Tisza river basin are planning under preparation the future infrastructure projects related to flood protection that are composed by measures detailed in the Table II.1.

Table II.1: Catalogue of potential measures associated to flood risk management, filled with countries measures at Tisza river basin level

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
Prevention	Organizational measures (legislative, institutional ...)	M24	TISZA_M01	The definition of a legislative, organizational and technical framework for Floods Directive implementation	TISZA_RO_M01-1	Studies to estimate the impact of various categories of land use (land-use) on the hydrological regime;	High	M.E.W.F. / N.A.R.W. / R.B.A.	R.B.A.
					TISZA_RO_M01-2	Hydrological and hydraulic flood modelling studies for river basins and sub-basins	High	M.E.W.F. / N.A.R.W. / R.B.A.	R.B.A.
					TISZA_SK_M01-3			Ministry of Environment of the Slovak Republic	National
					TISZA_HU_M01-4	Flood Risk and Hazard mapping in Hungary (closed in 2015)	High	General Directorate of Water Management	National
					TISZA_RS_M01-5	Review and if necessary update of the Preliminary Flood Risk Assessment		Central authorities	National
					TISZA_RS_M01-6	Preparation of flood hazard and flood risk maps	High	Central authorities	Areas with potentially significant flood risk
					TISZA_UA_M01-7	<i>Interministerial consent procedure of the Ministry of Interior Affairs Order "On Approving the Methodology of the Preliminary Flood Risk Assessment" (by 2018)</i>	High	State Service of Emergency Situations	National
					TISZA_UA_M01-8	Development of the <i>Ministry of Interior Affairs Order "On Approving the Methodology of the Flood Risk and Flood Hazard Maps Development"</i> , submitted for the interministerial consent procedure (by 2018)	High	State Service of Emergency Situations	National
					TISZA_UA_M01-9	Development of the Cabinet of Ministers of Ukraine Resolution " <i>On Approving the Procedure for the Development of Flood Risk Management Plans</i> ", submitted for the interministerial consent procedure (by 2018)	High	State Service of Emergency Situations	National
		M24	TISZA_M02	Reviewing and updating plans for flood risk management	TISZA_RO_M02-1	PFRA Review and/or redefine / update APSFR (Areas with Potential	High	M.E.W.F. / N.A.R.W. / R.B.A.	R.B.A.

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						Significant Flood Risk)			
					TISZA_RO_M02-2	Updating hazard maps and flood risk maps, taking into account also the flash-flood, other mechanisms of floods, the effects of climate change, etc.	High	M.E.W.F. / N.A.R.W. / R.B.A.	R.B.A.
					TISZA_RO_M02-3	Review and update flood risk management plans on basin / sub-basin / national level	High	M.E.W.F. / N.A.R.W. / R.B.A.	R.B.A.
					TISZA_SK_M02-4			Ministry of Environment of the Slovak Republic	National
					TISZA_HU_M02-5	First review of Flood Risk and Hazard maps in Hungary (in progress) –ÁKK 2020	High	General Directorate of Water Management	National
					TISZA_RS_M02-6	Preparation of the Risk (hazard) assessment in accordance with the Law on Emergency Situations at all levels	High	Central authorities	National
					TISZA_RS_M02-7	Actualization/preparation of documentation for fluvial flood, excess inland water and ice defence	Medium	Central authorities	River Basin Authority
					TISZA_RS_M02-8	Actualization/preparation of documentation for the use and management of the regime of reservoir operation (including the flood water evacuation regime)	High	Central authorities	River Basin Authority
					TISZA_RS_M02-9	Actualization/preparation of technical documentation for the legalization of structures for flood protection, erosion and torrents control and for drainage	Medium	Central authorities	River Basin Authority
					TISZA_RS_M02-10	Actualization of standards and norms for maintenance of structures for protection from fluvial floods and excess inland waters and for the operational flood defense	Medium	Central authorities	National
					TISZA_RS_M02-11	Update/preparation of the cadastre of hydraulic structures	High	Central authorities	River Basin Authority
					TISZA_RS_M02-12	Maintenance and improvement of the Water Information System by	High	Central authorities	National

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						establishing connection with other information systems			
					TISZA_RS_M02-13	Increasing the efficiency of the inspection service	Medium	Central authorities	National
					TISZA_UA_M02-14	N/A as far as no plans are developed			
					TISZA_UA_M02-15	Development of plans for flood risk management According to UA-EU Association Agreement planned for 2022	Low	SAWR ¹	National
		M21	TISZA_M03	Coordination of territorial planning strategies (plans for development of planning at national, county and regional and urban plans (Regional/Urban/Zonal/Plans) with plans for flood risk management	TISZA_RO_M03-1	Registering of lands occupied by flood defence infrastructure in accordance with the legal provisions in the field of cadastre and real estate advertising	High	M.R.D.P.A., N.A.C.L.R., M.E.W.F., N.A.R.W., M.T., C.C.	R.B.A
					TISZA_SK_M03-2	Incorporation of delineated flood prone areas into spatial planning.		Ministry of Environment of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_SK_M03-3	Optimization of floodplains zoning with respect to existing infrastructure.		Ministry of Environment of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_HU_M03-4	Flood river bed management plans (in progress, the action plans in the <u>riverbed management plans are implemented after the law enforcement, which action is not depends on the water sector.</u>)	High	General Directorate of Water Management	National
					TISZA_RS_M03-5	Preparation of by-laws	High	Central authorities	National
					TISZA_RS_M03-6	Entering the boundaries of real and potential flood areas into spatial plans when defining the rules for	Medium	Local authorities	Local

¹ SAWR - State Agency of Water Resources of Ukraine (ASP)

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						constructing objects and using floodplains			
					TISZA_RS_M03-7	Delineation of water land	High	Central authorities	National, River Basin Authority
					TISZA_RS_M03-8	Registering water land in the land register	Medium	Local authorities	Local
					TISZA_RS_M03-9	Entering boundaries of water land into spatial plans	Medium	Local authorities	Local
					TISZA_UA_M03-10	N/A as far as no plans are developed			
Protection	Natural water retention measures - associated to watercourses, wetlands, natural lakes, in accordance with Directive 2000/60 /EC	M31	TISZA_M04	Measures to restore retention areas (flood plains, wetlands etc.)	TISZA_RO_M04-1	Creating new wetlands	High	M.E.W.F./ N.A.R.W. / R.B.A.	A.P.S.F.R.: 4, 16
					TISZA_RO_M04-2	Floodplain reconnection and restoration	High	M.E.W.F./ N.A.R.W. / R.B.A.	A.P.S.F.R.: 4
					TISZA_RO_M04-3	Renaturation of river banks (vegetative protection)	High	M.E.W.F./ N.A.R.W. / R.B.A.	A.P.S.F.R.: 4, 7, 16
					TISZA_SK_M04-4	Measures to reduce (decelerate) run-off from river basin into the water courses, to increase retention capability of river basin or to support natural accumulation of water in the suitable areas – measures at agricultural soils, in forests and urban areas <ul style="list-style-type: none"> operational erosion control measures (organization of land with respect to erosion control, agro-technical erosion control measures, biological erosion control measures), technical erosion control measures (erosion control trenches, terraces at hillslopes), technical forestry measures to influence interception and transpiration of forest vegetation, improvement of infiltration properties of forest soils, measures to decrease storm water 		Ministry of Environment of the Slovak Republic - water sector, Ministry of Environment of the Slovak Republic - nature protection sector, Ministry of Agriculture and Rural Development of the Slovak Republic, Ministry of Defence of the Slovak Republic, Self-government, Non-governmental organization	National/basin/APSFR

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						runoff, measures to control runoff and decrease water pollution (trenches and ditches, detention and retention ponds and reservoirs, retention soil filters, underground retention reservoirs).			
					TISZA_HU_M04-5	Natural rehabilitation of Takta channel between Kesznyéten and Tiszalúc. (Closed)	High	General Directorate of Water Management/ North-Hungarian Water Conservancy Directorate	Regional
					TISZA_RS_M04-6	Planning and application of measures for erosion control and natural water retention	High	Central authorities	River Basin Authority
	Change or adapt land use practices (partial recovery of ecosystem functions or structures modified by changing or adapting land use practices) in urban areas	M34	TISZA_M05	Natural water retention measures in urban areas	TISZA_RS_M05-1	Construction of new and reconstruction of existing drainage hydraulic structures	High	Central authorities	River Basin Authority
	Change or adapt land use practices (partial recovery of ecosystem functions or structures modified by changing or adapting land use practices), in agriculture	M31	TISZA_M06	Natural water retention measures by changing or adapting land use practices in agriculture	TISZA_M06	-	-	-	-

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
	Change or adapt land use practices (partial recovery of ecosystem functions or structures modified by changing or adapting land use practices) for forest management	M31	TISZA_M07	Natural water retention measures by changing or adapting land use practices in forest management	TISZA_RO_M07-1	Floodplain reconnection and restoration	High	Forest Guard, N.F.A. - Romsilva	A.P.S.F.R.: 16
					TISZA_RO_M07-2	Maintaining the forests area in catchments of A.P.S.F.R.	High	Forest Guard, N.F.A. - Romsilva	A.P.S.F.R.: 16
					TISZA_RO_M07-3	Maintaining and expanding forests in perimeter zones of reservoirs	High	Forest Guard, N.F.A. - Romsilva	A.P.S.F.R.: 17
	Other water retention measures	M33	TISZA_M08	Other measures to reduce water levels	TISZA_RO_M08-1	Measures to ensure the draining/drainage capacity	Lower, Medium, High	M.A.R.D. / N.A.L.I.	A.P.S.F.R.: 4, 7, 17
					TISZA_RO_M08-2	Increase the transit capacity of the river channel through local dredging and channel reprofiling	High	N.A.R.W. / R.B.A.	A.P.S.F.R.: 4, 7
					TISZA_RO_M08-3	Dykes relocation	High	M.E.W.F., / N.A.R.W. / R.B.A.	A.P.S.F.R.: 4, 1**
					TISZA_RO_M08-4	Restoration/Increasing of the retention volumes of existing reservoirs (permanent/temporary)	High	N.A.R.W. / R.B.A.	A.P.S.F.R.: 17
					TISZA_HU_M08-5	Vasarhelyi Plan: Development of floodplain in the Middle-Tisza (in progress). Target area: Szolnok-Csongrád Tisza river section. (in progress) - (KEHOP-1.4.0-15-2016-00014)	High	General Directorate of Water Management/Middle-Tisza District Water Directorate	Regional
					TISZA_HU_M08-6	Tisza floodplain: Improving the capacity of the riverbed in Middle-Tisza between Szolnok and Kisköre. (in progress) KEHOP-1.4.0-15-2016-00017)	High	General Directorate of Water Management/Middle-Tisza District Water Directorate	Regional
					TISZA_HU_M08-7	Development of the flood protection system in Tisza valley, Building the Flood protection dyke for the design water level in Middle-Tisza (in progress)	High	General Directorate of Water Management/Middle-Tisza District Water Directorate	Regional

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					TISZA_HU_M08-8	Development of the flood protection system in Tisza valley, Building the Flood protection dyke for the design water level in Upper-Tisza (in progress)	High	General Directorate of Water Management/ North-Hungarian Water Conservancy Directorate	Regional
					TISZA_HU_M08-9	Development of the flood protection system in Tisza valley, Building the Flood protection dyke for the design water level in Lower-Tisza (in progress)	High	General Directorate of Water Management/Lower-Tisza District Water Directorate	Regional
					TISZA_RS_M08-10	Construction of new and reconstruction of existing hydraulic structures for protection from fluvial floods	High	Central authorities	River Basin Authority
					TISZA_RS_M08-11	Maintenance of the capacity of the flood water channel	High	Central authorities	River Basin Authority
					TISZA_RS_M08-12	Rehabilitation works on flood protection structures, river training works and high water channel	High	Central authorities	River Basin Authority
		M32	TISZA_M09	Measures to improve retention capacity at the level of river basin by creating polders and small retention reservoirs (made in the upper part of the river basin)	TISZA_RO_M09-1	Creation of new polders; ensuring the functionality of existing polders	Lower	M.E.W.F., / N.A.R.W. / R.B.A.	A.P.S.F.R.: 4
					TISZA_RO_M09-2	Creation of new temporary small reservoirs	Lower, High	M.E.W.F., / N.A.R.W. / R.B.A.	A.P.S.F.R.: 4, 7, 16, 2**
					TISZA_SK_M09-3	Measures which reduce flood peak discharge – construction, maintenance, repair or reconstruction of water structures • dams and reservoirs, • dry or semi-dry reservoirs, polders, • bypass canals. Optimization of operational rules with respect to flood control and other purposes of reservoirs utilization.		Ministry of Environment of the Slovak Republic, Ministry of Defence of the Slovak Republic, Ministry of Transport, Construction and Regional Development of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_HU_M09-4	Development of Kisdelta flood control reservoir (closed)	High	General Directorate of Water Management/Körös District Water	Regional

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
								Directorate	
					TISZA_HU_M09-5	Development of Mályvád flood control reservoir (closed)	High	General Directorate of Water Management/Körös District Water Directorate	Regional
					TISZA_HU_M09-6	Vasarhelyi Plan: Building of flood protection system in Upper-Tisza: Tisza-Túr reservoir. (in progress)	High	General Directorate of Water Management/Upper-Tisza District Water Directorate	Regional
					TISZA_RS_M09-7	Planning to preserve and expand existing and establish new retention areas	High	Central authorities	River Basin Authority
					TISZA_UA_M09-8	Construction of 6 retention reservoirs at rivers Chorna Tisza, Lazeschina, Bila Tisza, Kisva, Rypynka and Irshava. Total volume in condition of 0,5% probability – 60,8 mln. m3	High	SAWR/Tisza BUVR ²	River basin
					TISZA_UA_M09-9	Construction of 19 retention reservoirs at rivers Tereblya, Tereshur, Bystra, Golyatinka, Chehovets, Mala Osava, Metova, Goverla, Bogradn, Khustystya, Latorica, Dusina, Svalyavka, Stara, Dryk, Velya, Tsygan, Ublya and Turystya. Total volume in conditions of 0,5% probability – 139,4 mln. m3	High	SAWR/Tisza BUVR	River basin
					TISZA_UA_M09-10	Construction of 3 polders near Vary village, Beregivsky rayon, Vilok village Vynogradiv rayon and Shalanky village, Vynogradiv rayon. Total area – 2988 ha	High	SAWR/Tisza BUVR	River basin
		M35	TISZA_M10	Measures to improve retention capacity at the level river basin by increasing the safety of existing large dams / increasing the attenuation capacity of	TISZA_RO_M10-1	Increasing the safety of existing hydraulic structures (rehabilitation: upgrading, retrofitting measures to limit infiltrations, etc.)	High	M.E.W.F./ N.A.R.W./ R.B.A.	A.P.S.F.R.: 4; 7; 3**
					TISZA_RO_M10-2	Carrying out maintenance works for	High	N.A.R.W./ R.B.A.	A.P.S.F.R.:

² BUVR – Tisza river basin authority (ASP)

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
				reservoirs towards projected capacity		the safe operation of existing hydraulic structures and related equipment (e.g. maintenance and repairs etc.)			4;
					TISZA_SK_M10-3			Ministry of Environment of the Slovak Republic	National/basin/APSFR
					TISZA_UA_M10-4	Reconstruction of the right side dam at Tisza from Badalovo village to Vary village, Beregovsky rayon Total length – 9,6 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-5	Reconstruction of left-side dam at Tisza from Tekovo village to Getenya village, Vynogradivsky rayon Total length – 9,6 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-6	Reconstruction of dams at channels of Batar drainage system to protect villages Nove Klinove, Chepa, Velyka Palad, Bobove, Divychne, Vynogradiv rayon Total length – 70,6 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-7	Reconstruction and construction of the dams in Mizhgirrya, Kolochava, Synevir, Negrovets, Soyma, Mizhgirsky rayon Total length – 21,5 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-8	Reconstruction of dams at Tisza and Shopurka in Velyky Bychkiv, Rakhiv rayon Total length — 7,6 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-9	Reconstruction and construction of dams at Teresva rivers to protect Teresva, Dubove and Ust-Chorna and Bilovarsti, Dobryanske, Ternovo, Vilhivtsi, Neresnytsya, Ganychi, Kalyna, Krasna, Tyachiv rayon Total length – 19,6 km	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level
					TISZA_UA_M10-10	Reconstruction and construction of the right side dam at Tisza to protect Tyachiv, Bushtyno, Teresva and Solotvyno and Grushevo and Nyzhnya	High	SAWR/Tisza BUVR	Areas with potentially significant flood risk level

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
		M33	TISZA_M11	Structural protection measures (planning and accomplishing)		Apsha, Tyachiv rayon Total length – 13,5 km			
					TISZA_RO_M11-1	Creation of new permanent reservoirs to mitigate flood waves	Lower, High	M.E.W.F. / N.A.R.W / R.B.A.	A.P.S.F.R.: 16; 4**
					TISZA_RO_M11-2	Bed stabilization measures - recalibration river beds, parapets, retaining walls, river bank defences, stabilizing the river bed	Lower, High	M.E.W.F. / N.A.R.W / R.B.A.	A.P.S.F.R.: 4; 7; 16
					TISZA_RO_M11-3	Protection measures along the river stretches through local embankments	High	M.E.W.F. / N.A.R.W / R.B.A.	A.P.S.F.R.: 16; 5**
					TISZA_SK_M11-4			Ministry of Environment of the Slovak Republic - water sector, Ministry of Environment of the Slovak Republic - nature protection sector, Ministry of Agriculture and Rural Development of the Slovak Republic, Ministry of Defence of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_UA_M11-5	Planning and indicators are stated in the Law of Ukraine "On approval of the National Targeted Program for Water Management Development and the Environmental Rehabilitation of the Dnipro River Basin for the period till 2021" ³	Medium	SAWR	River basin
	Measures for increasing population resilience	M34	TISZA_M12	Measures for increasing resilience of population (Implementation and adaptation of protection	TISZA_SK_M12-1	Mobile flood protection barriers.		Ministry of Environment of the Slovak Republic, Ministry of Transport,	National/basin/APSFR

³ <http://zakon3.rada.gov.ua/laws/show/4836-17/page>

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
				measures at multiple objectives - buildings, constructions)				Construction and Regional Development of the Slovak Republic, Self-government	
					TISZA_SK_M12-2	Measures which protect land from inundated „inner waters“ – installations (equipment) for pumping the „inner waters“		Ministry of Environment of the Slovak Republic, Ministry of Agriculture and Rural Development of the Slovak Republic, Self-government	National/basin/APSFR
	Inspection measures and maintenance of watercourses and of the hydraulic flood defence infrastructure	M35	TISZA_M13	Surveillance, behaviour monitoring, expertise, strengthening interventions, rehabilitation and maintenance of watercourses and hydraulic flood defence infrastructure	TISZA_RO_M13-1	Maintenance of existing flood protection infrastructure	High	N.A.R.W / R.B.A.	A.P.S.F.R.: 4; 7
					TISZA_RO_M13-2	Water courses riverbeds maintenance and bottlenecks, obstacles removal from water courses	High	N.A.R.W / R.B.A.	A.P.S.F.R.: 4; 7
					TISZA_SK_M13-3	Measures which protect land from inundated water of water courses – technical river training works, flood protection dykes, walls, embankments, other linear flood protection structures. Measures to ensure adequate flow capacity of the channels of water courses – maintenance of river channels and their vegetation, removal of deposits. Reconstruction or maintenance of bridges to enhance their capacity during floods.		Ministry of Environment of the Slovak Republic, Ministry of Transport, Construction and Regional Development of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_HU_M13-4	Vasarhelyi Plan: Reconstruction of hydraulic structures (in progress)	High	General Directorate of Water Management	National
					TISZA_HU_M13-5	Development of flood control system in downtown of Szeged (closed)	High	General Directorate of Water Management/Lower-Tisza District Water Directorate	Regional
					TISZA_HU_M13-6	Complex development of the 11.06	High	General Directorate	Regional

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						flood control section defensive ability, Target area: Left bank of the Tisza and the Maros River from the Serbian border to the Romanian border. (closed)		of Water Management/Lower-Tisza District Water Directorate	
					TISZA_HU_M13-7	Development of flood control system in Fekete-Körös valley. (closed)	High	General Directorate of Water Management/Körös District Water Directorate	Regional
					TISZA_HU_M13-8	Development of flood control system in Szolnok area (closed)	High	General Directorate of Water Management/Middle-Tisza District Water Directorate	Regional
					TISZA_HU_M13-9	Developing the right bank side of river Bodrog flood protection system in Ronyvazug (protection of south part of Sátorajáújhely) (closed)	High	General Directorate of Water Management/North-Hungarian Water Conservancy Directorate	Regional
					TISZA_HU_M13-10	Development of the flood protection system in Hármas-Körös (Körösug) area. KEOP-2.1.1/2F/09-2010-0006 (Closed)	High	General Directorate of Water Management/Middle-Tisza District Water Directorate	Regional
					TISZA_RS_M13-11	Monitoring and inspection of flood protection structures	High	Central authorities	River Basin Authority
					TISZA_RS_M13-12	Maintenance of flood protection structures	High	Central authorities	River Basin Authority
					TISZA_RS_M13-13	Monitoring and inspection of drainage structures	High	Central authorities	River Basin Authority
					TISZA_RS_M13-14	Maintenance of drainage structures	High	Central authorities	River Basin Authority
					TISZA_RS_M13-15	Monitoring and inspection of high water channel	High	Central authorities	River Basin Authority
					TISZA_RS_M13-16	Operational flood defence in accordance to the General and Action flood defence plans	High	Central authorities	River Basin Authority
					TISZA_RS_M13-17	Operational ice defence in accordance to the General and Action flood	High	Central authorities	River Basin Authority

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						defence plans			
					TISZA_RS_M13-18	Operational defence from excess inland water in accordance to the General and Action flood defence plans	High	Central authorities	River Basin Authority
					TISZA_RS_M13-19	Provision of machinery, equipment and tools for companies engaged in operational flood defence	High	Central authorities	River Basin Authority
					TISZA_RS_M13-20	Equipping the emergency situation headquarters	High	Central authorities	National
					TISZA_RS_M13-21	Equipping specialized flood response units	High	Central authorities	National
					TISZA_UA_M13-22	Establishment of riparian protection strips along rivers and ponds (100% of the rivers) (See National Targeted Program for Water Management Development)	Medium	Tisza BUVR	River basin
					TISZA_UA_M13-23	Cleaning and regulating riverbeds and ponds Total length – 40 km (See National Targeted Program for Water Management Development)	Medium	Tisza BUVR	Areas with potentially significant flood risk level
	Adapting of the existing defence structures at climate change conditions	M35	TISZA_M14	Adapting of the construction, infrastructure and existing defence structures in terms of climate change	TISZA_RO_M14-1	Heightening of embankments / existing defence	Medium / High	M.E.W.F. / N.A.R.W. / R.B.A.	A.P.S.F.R.: 16; 17;20; 23
					TISZA_RO_M14-2	Optimizing exploitation of reservoirs to increase retention / mitigation capacity	High	M.E.W.F. / N.A.R.W. / Hidroelectrica S.A., M.E.C.B.E., M.E., other holders	R.B.A.
					TISZA_SK_M14-3			Ministry of Environment of the Slovak Republic	National/basin/APSFR
Public awareness	Measures to increase community awareness	M43	TISZA_M15	Activities regarding adequate public information and promotion of the public participation	TISZA_RO_M15-1	Information activities for the public awareness on flood risk (including local health and hygiene) and operative preventive measures to be taken in an emergency	High	M.E.W.F./ M.I.A. (G.I.E.S),/ M.R.D.P.A./ N.A.R.W./ M.A.R.D./ M.H.	R.B.A.
					TISZA_SK_M15-2	Awareness-raising about flood risk, possible flood protection measures,		Ministry of Environment of the	National/basin/APSFR

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						general public input into increasing flood protection at local level.		Slovak Republic, Self-government, Ministry of Defence of the Slovak Republic, Ministry of Agriculture and Rural Development of the Slovak Republic, Ministry of Transport, Construction and Regional Development of the Slovak Republic, Ministry of Interior of the Slovak Republic	
					TISZA_RS_M15-3	Public availability of flood hazard maps and flood risk maps through Water Information System	Low	Central authorities	River Basin Authority
					TISZA_RS_M15-4	Media campaigns and promotions	Medium	Central authorities	National
					TISZA_UA_M15-5	Planned for 2022 after Flood Risk Management Plans will be developed	Low	Tisza BUVR	River basin
		M43	TISZA_M16	Education / training activities of the population	TISZA_RO_M16-1	Prepare children, pupils and students from pre-university and higher national education by theme dedicated to emergency situations (including floods) included in school curricula; The functioning of student in the field of civil protection "With my life defending life"; Preparing students in information and training centers of I.G.S.U.; Preparing the personnel with responsibilities in the field of emergency management (central and local public authorities and economic operators) in training centers of I.G.S.U.	High	M.E.W.F. / N.A.R.W. / M.I.A. (G.I.E.S) / M.N.E.S.R.	R.B.A.
					TISZA_SK_M16-2	Presentation of flood hazard and flood risk maps, flood management		Ministry of Environment of the	National/basin/APSFR

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
						plans. Raising public awareness. Training campaigns focused at flood preparedness among municipalities.		Slovak Republic, Self-government, Ministry of Defence of the Slovak Republic, Ministry of Agriculture and Rural Development of the Slovak Republic, Ministry of Interior of the Slovak Republic	
					TISZA_RS_M16-3	Introduction of flood related issues into schools	Low	Central authorities	National
					TISZA_RS_M16-4	Education of the population on protection of watercourses from pollution	Low	Central authorities	National
					TISZA_UA_M16-5	Planned for 2022 after Flood Risk Management Plans will be developed	Low	Tisza BUVR	River basin
Preparedness	Preparedness measures /Improvement preparedness to reduce the adverse effects of floods	M41	TISZA_M17	Measures for monitoring, forecasting and flood warning	TISZA_RO_M17-1	Improvement of monitoring/forecasting and warning/alarm systems	High	N.M.A., N.A.R.W. – R.B.A., M.I.A. (G.I.E.S), N.I.H.W.M, Local authorities	R.B.A.
					TISZA_SK_M17-2	Upgrade and enhancement of national flood forecasting and warning services by building new monitoring system (radar and precipitation stations) and new forecasting models for more water gauge stations. Strengthening cooperation in the field of flood forecasting and warning – Danube basin-wide, international and bilateral agreements and systems.		Ministry of Environment of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National
					TISZA_SK_M17-3	Information about flood event and warning between neighbouring countries based on bilateral commissions. Using the outputs of EFAS - flood warning system among Danube's countries.		Ministry of Environment of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
					TISZA_HU_M17-4	Development of plant management and monitoring network system in Tisza (in progress)	High	General Directorate of Water Management/ District Water Directorates	Regional
					TISZA_RS_M17-5	Improvement of the system of hydro-meteorological monitoring, forecast and early warning	High	Central authorities	National
					TISZA_RS_M17-6	Improvement of the alarm systems and systems for issuing timely warning to population at risk	High	Central authorities	National
					TISZA_RS_M17-7	Upgrade of the international exchange of meteorological and hydrological data on the operational flood defence	High	Central authorities	National
					TISZA_UA_M17-8	Improve flood monitoring and forecasting system Number of established and operational measuring devices - 1120 pcs	Medium	Zakarpattya Hydrometeorological center	River basin
					TISZA_UA_M17-9	Reconstruction and enlargement of the existing hydrometeorological system of monitoring (AIBC-Tisza-2), further development of informational, GIS based decision-making and systems of floods modelling	High	Zakarpattya Hydrometeorological center / Tisza BUVR	River basin
					TISZA_UA_M17-10	Undertaking preliminary flood assessment (according to UA-EU Association Agreement- by 2018)	High	SAWR	National
					TISZA_UA_M17-11	Preparation of flood hazard maps and flood risks maps (according to UA-EU Association Agreement- by 2020)	Medium	SAWR	National
		M42	TISZA_M18	Development / reviewing of the flood defence plans in correlation with other emergency situation management plans (GIES-	TISZA_RO_M18_1	Review of the flood defence plans	High	M.E.W.F., N.AR.W., N.I.H.W.M., M.I.A (G.I.E.S.), C.C.E.S., L.C.E.S., N.M.A.	R.B.A.
					TISZA_SK_M18_2			Ministry of	National

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
				General Inspectorate for Emergency Situations)				Environment of the Slovak Republic, Ministry of Interior of the Slovak Republic	
					TISZA_RS_M18-3	Development of protection and rescue plans in emergency situations at all levels	Medium	Central authorities, county council, local authorities, with coordinating/ subordinating authorities or under their authority	Regional, local
				Simulation exercises activities involving interinstitutional parties	TISZA_SK_M19_1	Emergency flood equipment response measures – strengthening flood response capacities, improvement of cooperation between different sectors, institutions and professionals involved in flood management.		Ministry of Environment of the Slovak Republic, all legal persons and natural persons	National/basin/APSFR
					TISZA_SK_M19_2	Strengthening of operational cooperation among the emergency response authorities in the international Danube basin, improvement of interoperability.		Ministry of Environment of the Slovak Republic, all legal persons and natural persons	National/basin/APSFR
					TISZA_RS_M19-3	Simulation exercise of response during floods	Low	Central authorities	National
					TISZA_UA_M19-4	Regularly using AIMS Tisza	Medium	Tisza BUVR	River basin
				Providing the human, financial and materials needed in emergency situation and stimulating the voluntary	TISZA_SK_M20-1			Ministry of Environment of the Slovak Republic, Ministry of Defence of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_RS_M20-2	Preparation of the General Flood Defence Plan	High	Central authorities	National
					TISZA_RS_M20-3	Preparation of the annual Flood Defence Action Plan	High	Central authorities	National
					TISZA_RS_M20-4	Review of the criteria for defining the flood defense phase	Medium	Central authorities	River Basin Authority
					TISZA_RS_M20-5	Bilateral cooperation	High	Central authorities	National

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
					TISZA_RS_M20-6	Regional cooperation	High	Central authorities	National, River Basin Authority
					TISZA_RS_M20-7	Development of the communication plan for participants in flood defense	High	Central authorities	National
					TISZA_RS_M20-8	Resolvment of property relations in the process of legalization of existing hydraulic structures and construction of new ones	Medium	Central authorities	National, River Basin Authority
					TISZA_RS_M20-9	Data exchange between the institutions responsible for flood protection	High	Central authorities	National, River Basin Authority
					TISZA_RS_M20-10	Capacity building of experts and competent institutions	High	Central authorities	National, River Basin Authority
					TISZA_RS_M20-11	Capacity building of local self-governments for participation in flood defense	Medium	Local authorities	National, River Basin Authority
					TISZA_RS_M20-12	Information exchange and coordination of flood protection activities during an emergency	High	Central authorities, county council, local authorities	National, River Basin Authority
					TISZA_UA_M20-13	In all situations of emergency	High	Tisza BUVR / Zakarpattya Hydrometeorological Service / Oblast Service of Emergency Situations	Areas with potentially significant flood risk level
Response and Recovery/ Reconstruction	Post event recovery measures	M51	TISZA_M21	Response actions in case of emergency situations	TISZA_SK_M21-1			Government, Ministry of Environment of the Slovak Republic, Ministry of Transport, Construction and Regional Development of the Slovak Republic, Ministry of Defence of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_RS_M21-2	Protection and rescue	High	Central authorities, local authorities	Local

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
					TISZA_RS_M21-3	Health and psychological support to the population	Contingently – as a response to flood events	Central authorities	National
					TISZA_RS_M21-4	Coordination of services that deal with the elimination of consequences of floods	Contingently – as a response to flood events	Central authorities	National
					TISZA_UA_M21-5	In all situations of emergency	High	Tisza BUVR / Zakarpattya Hydrometeorological Service / Oblast Service of Emergency Situations	Areas with potentially significant flood risk level
		M51	TISZA_M22	Damage assessment and restoration	TISZA_SK_M22-1			Ministry of Environment of the Slovak Republic, Ministry of Transport, Construction and Regional Development of the Slovak Republic, Ministry of Defence of the Slovak Republic, Ministry of Interior of the Slovak Republic, Self-government	National/basin/APSFR
					TISZA_RS_M22-2	Rehabilitation works of importance for flood protection (bridges, gaps, landslides,...)	Contingently – as a response to flood events	Central authorities, local authorities	Local
					TISZA_RS_M22-3	Renovation and state aid after floods	Contingently – as a response to flood events	Central authorities	National
					TISZA_UA_M22-4	In all situations of emergency	High	Oblast Service of Emergency Situations	Areas with potentially significant flood risk level
		M53	TISZA_M23	Documentation and Analysis	TISZA_SK_M23-1			Government, Ministry of Environment of the	National/basin/APSFR

Field of action ¹	Measure Category	Code Type as E.C. ²	Code Type as Tisza River Basin	Type of measure	Code of Measure	Measures	Priority (high, medium/low)	Responsible Authority ³	Level of application ⁴
								Slovak Republic	
					TISZA_RS_M23-2	Preparation of a flood event study, review and proposal of the concept of flood risk management	Contingently – as a response to flood events	Central authorities	River Basin Authority
					TISZA_RS_M23-3	Promotion of wider use of flood insurance policies	Contingently – as a response to flood events	Central authorities	National
					TISZA_UA_M23-4	In all situations of emergency	High	Oblast Service of Emergency Situations	Areas with potentially significant flood risk level

¹ Filed of action represent the areas of action closely linked to the flood risk management cycle

² Codes of measures proposed by the European Union, *Technical support in relation to the implementation of the floods directive (2007/60/EC) – A user guide to the floods reporting schemas*, version 5.1, December 20133

³ Central authorities (ministries), county council, local authorities, with coordinating/subordinating authorities or under their authority

⁴ National/River Basin Authority/Areas with potentially significant flood risk level

4; 7; 16; 17; 20; 23 APSFR number represents the current number of the APSFR in Romania, presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*

1** APSFR number represents the APSFR river Fizeş – downstream locality Doclin, which is a supplementary APSFR according to the list presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*, selected in this stage due to the effect that measure proposed have on downstream.

2** APSFR number represents the APSFR river Valea Roşie-downstream locality Roşie, which is a supplementary APSFR according to the list presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*, selected in this stage due to the effect that measure proposed have on downstream.

3** APSFR number represents the APSFR river Iad-downstream confluence with Dasor, which is a supplementary APSFR according to the list presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*, selected in this stage due to the effect that measure proposed have on downstream.

4** APSFR number represents the APSFR river Crişul Pietros-downstream confluence with Valea Mare Cărpinoasa, which is a supplementary APSFR according to the list presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*, selected in this stage due to the effect that measure proposed have on downstream.

5** APSFR number represents the APSFR river Bărzava-downstream confluence with Bărzăviţa river, which is a supplementary APSFR according to the list presented in Annex III.9 of *Flood issues and climate changes Integrated Report for Tisza River Basin*, selected in this stage due to the effect that measure proposed have on downstream.

2.2. Synthesis of the proposed measures

Following the analysis of the measures proposed for flood risk management in the Tisza river basin by the partner project countries, the most important / relevant types are:

- **Rehabilitation and maintenance of hydraulic flood defence infrastructure**

Europe has an aging water infrastructure so the need for investment in water infrastructure is high and it has many reasons: deterioration of existing infrastructure, spatial planning development, need for upgrading infrastructure in order to meet new standards or to consider the new emerging developments.

Upgrading of existing infrastructure in order to meet new standards and development can't be on detriment of maintenance of the latter and vice versa!⁴ Most of the central and east European countries benefit from an infrastructure developed long before the 90's so there is a real need of investments on rehabilitation and maintenance of hydraulic flood defence infrastructure.

- **Review of 1st FD cycle and integration of the results**

Since we are at the beginning of a new FD implementation cycle, Tisza river basin riparian countries will focus in the next period on the review and updating the methods and results used during the 1st FD implementation cycle, in each of the 3 stages. Legislative framework will benefit from the results obtained during the 1st FD cycle and some of the territorial planning strategies will have to be updated according to flood hazard and flood risk maps.

Some of the main issues that will be addressed during the next years are related to integration of flash floods analysis in the methodologies and studies that will support the implementation of FD and in the same time countries will try to take into account the impact of climate change over the flood risk.

- **Monitoring, forecasting and flood warning**

In the integrated or total flood warning system approach, all components need to be improved if the ultimate aim of minimising risks to people and property is to be achieved (e.g. Emergency management Australia 1999; Andryszewsky et al. 2005). Post event reviews, continuous development of technologies and the need to adapt to the new challenges (e.g. Flash flood forecast and warning) leads to a countries effort to develop the monitoring, forecasting and flood warning systems.

- **Involvement, information and education of the public**

Public involvement plays an important role in the implementation of all the water related directives, since water it's the most precious resource of our planet. By involving members of the public in the implementation process of all water related directives, and Floods Directive into detail, it becomes more relevant the people's needs and concerns related to the subject that we are addressing. Informing the public about the results achieved during the implementation of the directive raises the confidence into state public institutions and increase also the public awareness. Involvement of the public contributes to development of

⁴ Aging water infrastructure in Europe, Almut Bonhage, *EUREAU Secretary General 9th EWA Brussels Conference*

different easily to follow and understandable communication platforms that supports the information transfer.

Proper information and education of the public contributes to understanding of the technical language and how the communities act before, during and after a flood event takes place.

2.3. Common synergies of the proposed measures

Analysing the measures proposed by each riverine Tisa country it is notice that there is already a common thinking to reduce the flood risk and to increase the level of protection for population. Thus, the common goals to which they reach after, are:

- increase the storage of capacity in Tisza river basin - creating polders and small retention reservoirs made in the upper part of tributary river basin, increasing the safety of existing large dams and increasing the attenuation capacity of reservoirs towards projected capacity in the upper Tisza river basin,
- involve the public in elaboration of different plans,
- increase degree of monitoring, forecasting and flood warning, etc.

Also, the potential measures proposed by each country have taken into account the link with EUSDR targets⁵ that have been validated in the meeting of National Coordinators and Priority Area Coordinators held in Bratislava on 23 May 2016.

These measures contributes to achievement of EUSDR targets, but due to the fact that the present document it is a report dedicated to potential measure that will contribute to flood risk mitigation at the Tisza river basin level, not all of the targets can benefit from the proposed measures and the link between them is presented in the table below (table II.2).

Table II.2: Link between proposed measures for flood risk management and EUSDR targets

Priority Area of EUSDR	Targets of EUSDR	Field of action	Type of measure for flood risk management
Priority Area 5 "To manage environmental risks"	Provide and enhance continuous support to the implementation of the Danube Flood Risk Management Plan – adopted in 2015 in line with the EU Floods Directive – to achieve significant reductions of flood risk events by 2021, also taking into account potential impacts of climate change and adaption strategies	Prevention	The definition of a legislative, organizational and technical framework for Floods Directive implementation
			Reviewing and updating plans for flood risk management
Priority Area 6 "To preserve biodiversity, landscapes and the quality of air and soils"	Enhance the work on establishing green infrastructure and the process of restoration of at least 15% of degraded ecosystems, including soil, in order to maintain and enhance ecosystems and their services by 2020 in the Danube Region and to improve air quality	Protection	Measures to restore retention areas (flood plains, wetlands etc.)
			Natural water retention measures in urban areas
			Natural water retention measures by changing or adapting land use practices in forest management
			Other measures to reduce water levels
			Measures to improve retention capacity at the level of river basin by creating polders and small retention reservoirs (made in the upper part of the river basin)
Priority Area 9 "To invest in people and skills"	Contribution to ensuring inclusive education and training and promoting inclusive labour markets, equal opportunities and non-discrimination as well as the promotion of civic competences and lifelong learning opportunities for all	Protection	Education / training activities of the population
	Contribution to increased quality and efficiency of education, training and labour market systems	Protection	Providing the human, financial and materials needed in emergency situation and stimulating the voluntary

⁵ <http://www.danube-region.eu/about/our-targets>

Priority Area of EUSDR	Targets of EUSDR	Field of action	Type of measure for flood risk management
Priority Area 10 "To step up institutional capacity and cooperation"	The UPDR helps to generate, through the exchange of information and the support, on all levels of cooperation, for 25% of UPDR stakeholder organisations at least one Urban Danube Project, furthering the aim of better spending	Protection	Development / reviewing of the flood defence plans in correlation with other emergency situation management plans (GIES- General Inspectorate for Emergency Situations)
	80 % of participating countries involve the national, regional and local authorities and CSOs through annual National (provincial) EUSDR consultations in cooperation with the National Coordinators of the EUSDR	Protection	Simulation exercises activities involving interinstitutional parties

The potential measures associated to the flood risk management proposed in this document are part of the Joint Programme of Measures for Tisza river basin and this one will have a bigger contribution to achievement of EUSDR targets.

Annex 1

Measure proposal and prioritization process by country: Ukraine

Ukraine's measures are based on the following documents:

- Current plans of the *Tisza basin authority*
- *The National Targeted Program for Water Management Development and the Environmental Rehabilitation of the Dnipro River Basin* for the period till 2021 (№ 4836-VI)⁶ (chapter "Comprehensive flood control scheme in the Tisza river basin in Zakarpatska oblast")
- Resolution of the Cabinet of Ministers of Ukraine of 25 February 2015 №132 "On approval of developed by the State Emergency Service of Ukraine plans to implement some legislative acts of the EU"⁷ and *amendments to it*.

It is worth to mention that these documents do not mention the prioritization of the measures. At present the prioritization methodology is in the process of development, as a part of the approximation to the EU Flood Directive.

The prioritization presented at this report is based on the following criteria:

High priority is assigned to the following:

- construction projects to implemented to *Tisza Basin Authority* to prevent flood prone settlements;
- the measures aimed to approximate to the *EU Flood Directive* with the deadline by 2018 and in this way to implement *EU-Ukraine Association Agreement*;
- the measures related to the emergency actions in case of flooding.

Medium priority is assigned to the following:

- measures stated in the *The National Targeted Program for Water Management Development and the Environmental Rehabilitation of the Dnipro River Basin* for the period till 2021 (№ 4836-VI). Because of its underfunding it is not worth to expect them to implement during the current year;
- the measures aimed to approximate to the *EU Flood Directive* with the deadline by 2020.

Low priority is assigned to the following:

- *the measures* aimed to approximate to the *EU Flood Directive* with the deadline.

Measure proposal and prioritization process by country: Romania

The measures are proposed by each River Basin Administration based on a catalogue of potential measures and there are proposed at three levels of applicability: national, river basin authority and APSFR.

The proposition of a measure for a certain area ("located" either at the A.P.S.F.R. level or, as the case may be, on the tributaries or in the upstream basin of the respective sector but which have an effect on sectors / areas with significant potential flood risk) is made taking into account the feasibility of the measure from technical and economical point of view, but also analyzing the impact of the measure over human health, environment, and cultural heritage. Thus the measures are scored taking all those criteria's into account, and the selection is based on the final score of the measure.

⁶ <http://zakon3.rada.gov.ua/laws/show/4836-17/page>

⁷ http://www.kmu.gov.ua/document/247983992/Dir_2007_60.pdf

Through MCA is evaluated based on scoring, the benefit of each measure reference to the objectives of flood risk management, from the economic, social, environmental and cultural heritage perspective. Multi-criteria analysis with elements of cost-benefit is used to prioritize the measures proposed. But not all the proposed measures are the subject of prioritization. A series of measures are considered to be necessary and mandatory in our country coordinated flood risk management planning process and some of them are **permanent/continue activities**.

This kind of measures are the **nonstructural ones**, that are referring at legislative, technical, methodological, organizational field, NWRM category, public information/consultation/ education/ training measures, etc. So, they are **a priori considered as having high priority** from the beginning.

Prioritisation of the measures is being done based 4 stages:

- Stage 0 - Assessment (weighting) of the flood risk management objectives, at the level of each APSFR according to the potential consequences categories (in the event of medium 1% flood scenario)
- STAGE 1 - Assessment based on score of each flood risk management measure performance, for each of the 9 objectives of flood risk management.
- STAGE 2 - Assessment of the benefits of each flood risk management measures for each of the 9 flood risk management objectives.
- STAGE 3 - Estimated cost of the measure (in Euro) and assignment of a score
- STAGE 4 - Prioritization of flood risk management measure based on the benefit score / cost score ratio

Based on the proposed measures major Integrated Projects were developed in order to reduce the risk of flooding in an extended area on the territory of an RBA

Identification at RBA level of the major integrated projects was performed on the basis of an analysis which took into account the main localities / groups of localities potentially affected, located in the 1% flood band, as well as the main measures with a significant risk reduction effect on floods (the most relevant measures in terms of flood risk reduction) in the respective localities.

Measure proposal and prioritization process by country: Slovak Republic

In the past there have been experiences with the application of CBA on the level of each concrete flood protection measure/project in Slovakia. For each relevant project proposal also appropriate assessment according Art. 6.3 and Art. 6.4 of Habitat Directive and assessments according requirements of EIA Directive had to be proceeded.

According the national legislation the flood damage on the assets is defined as estimation of costs based on the usual prices in the affected region, which are necessary to spend on restoration of damaged assets into the initial status before flood event.

For the purpose of the measures prioritization in the first cycle (2015) of Flood Risk Management Plans, the national methodology for the evaluation of flood damages for implementation, operation and maintenance of flood protection measures and their economic benefits was prepared by Slovak national Working Group on Economics, and then amended and adopted by the Slovak national Working Group on Floods in January 2014. The ranking of measures is based inter alia on their efficiency indices, which are calculated as the ratio between the estimated avoided potential flood damages and the estimated overall costs (for preparation, land purchase, implementation, operation and maintenance) of a given measure during its lifetime. The lifetime period of the flood protection measures/structures equals to 100 years in Slovakia.

The efficiency index is used as one out of several criteria in the process of prioritization of measures. Prioritization of flood protection measures proposed to achieve the objectives of Flood Risk Management

Plan up to 2021, mainly according to the urgency of their implementation, has been carried out on the basis of the following criteria:

- number of affected population with Q100,
- number of economic facilities in the floodplain when Q100,
- number of objects IPPC, SEVESO, contaminated sites, and other objects that could cause during flooding an extraordinary deterioration of water quality and extraordinary threat of water quality in the floodplain when Q100,
- number of objects of cultural heritage or of cultural monuments and historic sites in the floodplain when Q100,
- number of measures in river basin management plans proposed for the implementation in the frame of measures of flood risk management plans (measures to mitigate or eliminate impact of hydro-morphological pressures),
- total avoided damage in EUR,
- total costs for implementation of measures of the flood risk management plans in EUR,
- efficiency index of measures of the flood risk management plans.

Based on the above mentioned criteria the prioritization of measures was carried out according to the urgency of measures implementation within the territory of the Slovak Republic and ten hydrological sub-basins designated on the territory of the Slovak Republic belonging to two river basin districts (RBD), the Danube RBD and the Vistula RBD. Each of criteria was assessed individually, also cumulative effect of flood protection measure protecting more than one geographical area (e. g. dry polder) was taken into account.

Based on the criteria assessment, the score was allocated to each of proposed measures. All the proposed measures have been ranked according the score. Based on the results of prioritization process the list of measures has been compiled which are proposed to be implemented up to 2021. Next the technical feasibility of realization of proposed measure up to 2021 was assessed. If it is technically unfeasible, than the measure is proposed for realization after 2021. The total volume of expected costs of measures must not exceed the amount of funds planned for the implementation of measures of the Flood Risk Management Plans by 2021.

Finally, all the proposed flood protection measures were divided into three priority groups:

1. Measures proposed in geographical areas of highest importance according FRMP;
2. Measures proposed in geographical areas of medium importance according FRMP;
3. Measures proposed in geographical areas of least importance according FRMP.

The methodology for prioritization of flood protection measures is part of the Flood Risk Management Plans.

Measure proposal and prioritization process by country: Hungary

Hungarian measures are based on the following documents:

- **Flood Riverbed Management Plans:** The negative process taking place in riverbed caused higher flood levels and decreased our flood protection facilities. This fact and high cost of flood protection developments needed to improvement of the conveyance capacity of the flood bed. Making of the flood riverbed management plans specify Act LVII of 1995 on water management and the preparation of the planning ordered by the 83/2014. (III.24.) government regulation. The aims of the flood riverbed management plans are reducing flood levels, keeping or repairing capacity of riverbed and ensure the flood protection safety. The flood riverbed management plans are made for 67 river section. In the plans determined in flood perspective primary, secondary, temporary, and dead zones in the flow. The technical content of the flood riverbed management plan documentation has been completed. The registration of the flow zones into the parcel numbers is in progress. The action

plans in the riverbed management plans are implemented after the law enforcement, which action is not depends on the water sector.

- **Flood Risk Management Plan:** On the basis of highly scientific method the values had been recalculated for all the approximately 2800 km main river sections in 2013-2014 and the new longitudinal profiles were legally adopted on 1st of January 2015. The new 'MÁSZ' is based on statistically determined discharge value and represents the actual conditions of the riverbed with numerical modelling. The update is obligatory in every 6 years or after a remarkable event. The Flood risk management plans and measures cover all aspects of the management of risk from the flood hazards. The risk managements measures are reduce the risk of flooding, reduce the sensitive of land use to flooding.
- **New Vasarhelyi programme:** 30 flood control reservoirs, 6 of them built in Vasarhelyi programme (721 million m³). In the Körös valley operating 5 reservoirs with a volume of 386 million m³. The flood control reservoirs situated along the rivers and the part of the flood control system. Local flood peak reducing effect. Planned reservoir is Tisza-Túr reservoir.

Measure proposal and prioritization process by country: Serbia

Proposal of the measures and their prioritization in Republic of Serbia are defined in the Draft Flood Risk Management Plan for the territory Republic of Serbia (2017). The prioritization process at the country level is based on judgement of expert and institutions responsible for flood risk management.

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Partners: General Directorate of Water Management, Hungary | Global Water Partnership Central and Eastern Europe, Slovakia | International Commission for the Protection of the Danube River | Ministry of Water and Forests, Romania | Ministry of Foreign Affairs and Trade, Hungary | National Administration "Romanian Waters", Romania | National Institute of Hydrology and Water Management, Romania | Public Water Management Company "Vode Vojvodine", Serbia | Regional Environmental Center for Central and Eastern Europe, Hungary | The Jaroslav Černí Institute for the Development of Water Resources, Serbia | Water Research Institute, Slovakia | World Wide Fund for Nature Hungary

Associated Partners: Interior Ministry, Hungary | Republic of Serbia Ministry of Agriculture and Environmental Protection - Water Directorate | Secretariat of the Carpathian Convention (SCC), Austria | State Agency of Water Resources of Ukraine | Tisza River Basin Water Resources Directorate, Ukraine