



## Flood Protection Expert Group

# Sub-Basin Level Flood Action Plan - Velika Morava River Basin and Right Danube Tributaries between the Sava River Mouth and RS- BG Border -



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November, 2009

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## **1. INTRODUCTION**

In response to the danger of flooding and in line with its Joint Action Programme, the ICPDR decided in 2000 to establish the long-term Action Programme for Sustainable Flood Prevention in the Danube River Basin. The whole process was accelerated after disastrous floods in 2002 and resulted in adoption of the Action Programme at the ICPDR Ministerial Meeting on 13 December 2004.

The overall goal of the ICPDR Action Programme is to achieve a long term and sustainable approach for managing the risks of floods to protect human life and property, while encouraging conservation and improvement of water related ecosystems. Given the area, the complexity and the internal differences in the Danube River Basin, the Action Programme represents an overall framework, which needs to be specified in further detail for sub-basins. Therefore, the targets of the ICPDR Action Programme include preparation of flood action plans for all sub-basin in the Danube catchment area.

In September 2007 a Directive of the European parliament and of the Council on the assessment and management of flood risks (EFD) was adopted by the European Council. The aim of the Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive requires Member States to first carry out a preliminary flood risk assessment by 2011 to identify areas at risk of flooding. For such areas they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015.

As the ICPDR Action Programme was designed in full coherence with EFD the flood action plans for sub-basins are an important part of implementation of the EFD and they summarize the key actions towards preparation of the flood risk management plans. Therefore, the preparation of the flood action plans for sub-basins can be considered as an interim step in implementation of EFD.

This Document covers the Velika Morava sub-basin, as well as other large right-bank Danube tributaries in Serbia, from the Sava River to the border with Bulgaria (Mlava, Pek and Timok).

This Action plan is derived from Action plans prepared for Serbian and Bulgarian territories. It is foreseen that this planning document will be further refined as appropriate and necessary by the bilateral river commission.

## 2. CHARACTERISATION OF CURRENT SITUATION

### 2.1. Review and assessment of current situation

#### 2.1.1. Natural conditions

The most important characteristics of the main right tributaries of the Danube in this sub-basin (Velika Morava, Mlava, Pek and Timok) are described below.

The **Velika Morava** is the most significant of all right-bank tributaries of the Danube River (mouth at Danube km 1,105), which are covered by this report. The river basin is placed almost entirely at the Serbian territory, and includes mid, southern, and southeast parts of central Serbia. The total catchment area is 38,207 km<sup>2</sup>, and 95.9% is located within Serbia. Diverse terrain in this river basin comprises hilly and mountainous area (with altitude increasing towards southern and south-eastern borders of Serbia), as well as wide river valleys.

The **Velika Morava** is formed by the confluence of two rivers, the Južna Morava draining the south-eastern part of Serbia (catchment area of 15,696 km<sup>2</sup>, 92.7% in RS, the rest in Bulgaria) and Zapadna Morava draining the south-western part of Serbia (15,754 km<sup>2</sup>, 97.3% in Serbia, the rest in Montenegro).

Downstream of this confluence the Velika Morava River receives many tributaries within the total catchments area of 6,757 km<sup>2</sup>. The most significant left tributaries are: Lugomir (446 km<sup>2</sup>), Lepenica (625 km<sup>2</sup>), Jasenica (1,388 km<sup>2</sup>), Jezava (river basin area 692 km<sup>2</sup>), while the largest right tributary is the Resava (744 km<sup>2</sup>). After training works, which included 16 meander cut-offs, the length of the river was approximately 20% reduced and now is 181 km.

The **Južna Morava** originates from Binačka Morava and Preševska Moravica rivers. Significant left tributaries are: Veternica (515 km<sup>2</sup>), Jablanica (894 km<sup>2</sup>), Pusta Reka (590 km<sup>2</sup>), Toplica (2,217 km<sup>2</sup>), and the right ones: Vlasina (991 km<sup>2</sup>), Nišava (4,086 km<sup>2</sup>) and Moravica (613 km<sup>2</sup>). The Južna Morava also receives many small torrent tributaries along its 230 km long course.

The **Nišava River** and its tributary **Erma/Jerma** are transboundary rivers, originating in BG. The total **Nišava** catchment area is 4,086 km<sup>2</sup>, and about 73% is at the RS territory.

The **Zapadna Morava River** arises at the confluence of the Moravica (1,513 km<sup>2</sup>) and Djetinja (1,210 km<sup>2</sup>) rivers, and has 183 km long course. It receives many tributaries, but the most important by basin area (7,925 km<sup>2</sup>) and discharge (contributing 50%) is the Ibar River. The Ibar rises in the most eastern part of Montenegro, at very high mountains. The total length of the river is 280 km. The most significant tributaries are the Sitnica (coming from the Kosovo), Raška and Studenica. Other important direct tributaries of the Zapadna Morava are the Rasina (990 km<sup>2</sup>), Čemernica (629 km<sup>2</sup>) and Gruža (617 km<sup>2</sup>). It also receives many torrents.

The **Mlava River Basin** covers area of 1,904 km<sup>2</sup>, and has 122 km long course. In its upper part, it is confined in a gorge while the downstream part is flowing through a wide valley. Its mouth at km 1,092 of the Danube is under the influence of the Danube backwater.

The **Pek River** is 129 km long, and the catchment area is 1,230 km<sup>2</sup>. It joins the Danube at km 1,058.3, within the Iron Gate section of the Danube. The Pek drains an area of 1,230 km<sup>2</sup>.

The **Timok River** is the most downstream right tributary of the Danube in Serbia. Almost the entire catchment area (4,626 km<sup>2</sup>) is at the territory of Serbia, i.e. about 98% of the total area. In its lower section (from the confluence with the Danube to km 17.5), the Timok River flows

along the state border with Bulgaria. This section is characterized by an unstable and movable channel which causes change in the line of the state border. The Timok River (88 km long, direct catchment area 1,239 km<sup>2</sup>, mouth on the Danube km 845.5) originates at the confluence of two rivers:

- the Beli Timok (50 km long, total catchment area 2,155 km<sup>2</sup>), arising at the confluence of the Trgoviški Timok (533 km<sup>2</sup>) and the Svrljiški Timok (726 km<sup>2</sup>) rivers; and
- the Crni Timok (90 km long, catchment area 1,232 km<sup>2</sup>).

### 2.1.2. Hydrology

Rivers covered by this report belong to the rain-snow regime. Typically, there are two precipitation maximums, with frequent and intensive summer rainfalls (June), secondary autumn maximum (November), and generally dry winters. Typical for this climate is that more than 50% of yearly precipitation occurs during the warmer half of the year, and frequently induce floods. During the spring period runoff is produced by precipitation and melting of snow accumulated in mountainous regions.

High water regime of the watercourses differs depending on the catchment area size, precipitation pattern, topography, geology, vegetation cover, etc. Therefore, high waters differ by time of occurrence, maximum water level and discharge values, duration of a flood wave, intensity of a water level increase and fall, etc.

Table 1: Main hydrological characteristics

River	Profile	Chainage	Area	Average multi-annual discharge	Q <sub>1%</sub>
		km	km <sup>2</sup>	m <sup>3</sup> /s	m <sup>3</sup> /s
Velika Morava	Lj. Most	21.8	37,320	227.0	2,393
Južna Morava	Mojsinje	18.0	15,390	94.0	2,063
Nišava	Kalotina (BG)		267	1.7	
	Nis	21.8	3,974	31.0	988
Zapadna Morava	Jasika	20.5	14,721	109.0	1,781
Ibar	Lopatnica	26.5	7,818	63.0	1,324
Mlava	Bratinac	14.3	1,749	10.0	332
Pek	Kusice	7.0	1,220	9.0	334
Timok	Brusnik	38.4	4,155	29.0	1,091



Figure 1: River basins

### 2.1.3. Floodplains and flood defences

#### **Serbia**

Flood protection structures in the **Velika Morava River** basin have the length of approximately 1,200 km. It should be noted that some of the existing embankments need reconstruction as well as regular maintenance.

Embankments along the Velika Morava River were constructed within a longer time period, most of them from 1956 to 1978. However, there is a large variation in used material and construction technology, as well as the design flood return period (varies from 100 to 20 years). In general, level of flood protection is satisfactory, with respect to both embankment

height and stability. Characteristics of flood defences on the Velika Morava tributaries also show large variation, concentrating mostly on settlements and arable lands.

There are 22 existing retentions and reservoirs which are used for the attenuation of flood waves. Some of them are large (volume exceeding  $10 \cdot 10^6 \text{ m}^3$ ) multi-purpose reservoirs with reserved volume for flood control, while the others were built only for flood control.

There are continuous both sides flood protection lines along the **Mlava River**, 100 km long in total, including backwater levees along the tributaries.

Along the **Pek River** there are both bank levees in the zone of the Danube backwater influence and local short levees for the protection of several settlements.

Along the **Timok River** there are levees near the Trnovac village (3.8 km long along the right bank and 3.2 km along the left bank), near the Bregovo (3.65 km at the left side) and along the left bank within the zone of the Jasenica confluence (8.5 km).

### **Bulgaria**

On Bulgarian territory there are flood protection structures along the Nishava River in the city of Godech.

#### **2.1.4. Characterisation of land uses and known risks**

In general, the hilly and mountainous parts of Serbia host smaller settlements, while larger cities, industry, and infrastructure (network of roads, railways, etc.) are located in river valleys and floodplains.

#### **2.1.5. Conditions of flood forecasting and warning**

##### **Serbia**

Republic Hydrometeorological Service of Serbia is charged to monitor, measure, collect and analyse hydrologic and meteorological data. The Service is also providing relevant information and forecast from domestic and foreign territories to all the flood defence participants. Data are collected on 27 gauges of the Velika Morava, Mlava, Pek and Timok in Serbia.

##### **Bulgaria**

National Institute of Meteorology and Hydrology at BAS (Bulgarian Academy of Science) is the main body carrying out scientific research and operational activities in the field of meteorology and agrometeorology and also implements a real time monitoring and collection of hydrological data. The guiding principles of these activities, especially the operational ones, are the Technical Regulations of the World Meteorological Organization, where NIMH is the official representative of Bulgaria.

#### **2.1.6. Institutional and legal framework**

##### **Serbia**

Protection against harmful water effects are regulated by the “Water Law” (Official Gazette of the Republic of Serbia, 46/91). The Law arranges proceedings and measures for flood and ice protection, as well as protection from torrents and erosion.

The participants involved in flood defence are:

- Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia – Republic Directorate for Water;



- Public Water Management Company “Srbijavode” – Belgrade;
- Local water management companies;
- Republic Hydrometeorological Service of Serbia.

Responsibilities of participants are determined in the General Flood Defence Plan and the Annual Plan for Flood Defence. These plans are prepared only for watercourses with the existing flood protection structures. For other areas endangered by floods, local community appoints flood protection measures and proceedings. Also companies whose properties are endangered prepare special flood protection plans.

The flood and ice control actions are organized and carried on in three phases, depending on the hazard degree: preparation, regular and emergency defence. Phases of defence are defined in the Annual Plan for Flood Defence, in relation to the river stage on the adjacent gauging station.

Spatial plans relevant for the sub-basins are:

- Spatial Plan for the Republic of Serbia (OG RS, 13/96) – strategic development act for period until 2010;
- Spatial Plans of municipalities. Many municipalities (Figure 1) within the sub-basins don't have spatial plan adopted so far. Existing plans as a rule lack data on potential or actual flood areas.

## **Bulgaria**

Water Act regulates the ownership and management of water within the territory of the Republic of Bulgaria as a national indivisible natural resource and the ownership of the water development systems and facilities.

Water management at the national level is implemented by the Minister of Environment and Water.

Under the Ministry, as its regional structure, the Danube River Basin Directorate (DRBD) is responsible for integrated water management at river basin level aiming to achieve good ecological status and to ensure sustainable water use.

The state policy related to activities involving operation, construction, remodelling and modernization of water development systems and facilities is implemented by:

- the Minister of Regional Development and Public Works: in respect to protection against water-related damage and loss within the boundaries of settlements;
- the Minister of Agriculture and Food: in respect to protection against water-related damage and loss beyond the boundaries of settlements;
- the Minister of Economy and Energy: in respect to hydro-power systems and projects;

The policy related to activities involving operation, construction, remodelling and modernization of water development systems and facilities constituting municipal property shall be implemented by the competent municipality mayor.

Protection against water-related damage and loss covered herein shall be operational and permanent.

Operational protection is implemented against flooding, ice accumulation and ice action, and water-related natural disasters, and shall be directed by Ministry of Interior – the Civil Protection.

Operational protection shall be implemented in accordance with an emergency response plan. Emergency plans shall be drafted by the owners or users of water development systems and hydraulic-engineering facilities.

Permanent protection shall include:

1. construction and maintenance of dikes and other hydraulic-engineering facilities and protective structures;
2. establishment and maintenance of monitoring, forecasting and warning systems;
3. regulation of the groundwater level in the event of a hazardous raising or lowering thereof;
4. activities for protection of drainage basins against water erosion;
5. maintenance of the hydraulic conductivity of river beds.

The hydraulic-engineering facilities and protective herein shall be maintained by the owner or user thereof.

The Executive Environment Agency (ExEA) is another body of the Ministry of Environment and Water which carries out monitoring functions on the territory of the whole country and develops and maintains of the National Monitoring System of Environment and information about state of environmental components. The Agency also is a national referent centre in the frame of the European Environment Agency and in this respect it deals with collecting, processing and reporting information as well as makes analyses and assessments.

Civil Protection Service Directorate is a structure under the Ministry of Interior and implements the state policy in this frame. The main activities of Civil Protection Service are directed towards protection of the population, the national economy, the material and cultural values. The Service organizes and conducts life-saving and urgent emergency-reconstruction activities in case of disasters occurring and also has the responsibility to collect data about disasters and accidents, including floods, to advice on prevention activities and to solve resulting consequences for the human life and environment.

### **2.1.7. Recent awareness of flooding**

The Nišava and Erma/Jerma river basins experienced catastrophic flood in 1948, the Velika Morava River in 1965 and 1977, while some parts of the Južna Morava River watershed were affected in 1988. After the longer low-flow period, frequent high flows were again registered recently, on smaller watercourses only. For example, in summer 1999 high flows occurred on smaller watercourses within Velika Morava and Zapadna Morava watersheds. Also in spring 2006, rapid snowmelt induced floods in many parts of the Velika Morava River basin, as well as extremely high number of landslides.

## **2.2. Review and assessment of the predictable long term developments**

### **2.2.1. Possible impacts on a current flood protection level**

The most significant impacts on safety of flood defence system are:

- ***Trend of flood level increase*** (due to natural or anthropogenic factors as disconnection of floodplains, heightening of levees, construction in floodplains, deforestation, etc.). Under influence of new structures or works, characteristics of design flood could be changed.
- ***Ill-timed coincidence*** of flood waves along these rivers and their final recipient – the Danube.
- ***Climate change.***

## 2.2.2. Summary of existing national plans and ongoing programs

### Serbia

- **Ongoing structural flood protection projects**
  1. Local flood protection projects;
  2. Anti-erosion and torrent control projects.
- **Ongoing non-structural flood protection projects**
  1. The project between the Swedish Rescue Services Agency (SRSA) and the Serbian Directorate for Water: “Development of a first draft Flood Risk Management Plan for Tamnava River Basin, Serbia”. Through the implementation of the Flood Directive, this project will strengthen the capacity of the Serbian institutions in charge of flood defence. Insight in project results and their practical implementation will broaden other stakeholders’ knowledge related to flood risk.
  2. EU financed project “Preparation of a Water Management Information System for the Republic of Serbia” (WMIS - EuropeAid/121208/D/SV/YU - Project N° 05SER01/05/004) is presently in a final phase. This project will provide efficient tools for managing the information and data and support water management activities on a country-wide basis.

### Bulgaria

- **Ongoing structural flood protection projects**
  1. Local flood protection projects;
  2. Local erosion control projects.

## 3. TARGET SETTINGS

### 3.1. Serbia

Implementing criteria from the Water Management Master Plan of the Republic of Serbia, and taking into account the actual flood protection conditions and problems (especially the size of flood prone areas and possible damages) the long term flood protection strategy in Serbia will comprise:

- The existing layout of flood protection structures remains the same, while the following is planned:
  - Regular maintenance of the flood protection structures, according to criteria, standards and norms;
  - Reconstruction or/and construction of the flood protection structures to decrease flood hazard.
- Gradual and broad implementation of non-structural flood protection measures (as upgrade of the flood forecasting and warning procedures; introduction of flood maps into spatial plans, etc.).
- International cooperation in flood management with Bulgaria (Nišava and Timok rivers) and Montenegro (the Ibar River).

### **3.1.1. Regulation of land use and spatial planning**

- Target 1. Spatial plans of municipalities contain flood hazard maps (both for potentially and actually flooded areas) and flood risk maps.
- Target 2. Limitations related to land use in flood prone areas are defined.

### **3.1.2. Reactivation of former, or creation of new, retention and detention capacities**

- Target 1. Large multipurpose reservoirs are used for flood attenuation.
- Target 2. Protection of densely populated areas by new detention capacities (small single or multipurpose reservoirs). Planned at small tributaries, upstream of populated areas.

### **3.1.3. Structural Flood Defences**

- Target 1. Provide flood protection of first-order priority areas (protection of flood cells with more than 20,000 inhabitants, large and significant industrial and other facilities)
- Target 2. Provide flood protection of second-order priority areas (protection of areas with 5,000 to 20,000 inhabitants, medium industrial and other facilities, significant drainage and irrigation systems or water-supply sources).
- Target 3. Provide adequate measures for sediment management and torrent control. Apply anti-erosion watershed management and torrent control measures with optimal combination of biological measures (forestation, forest melioration, pasture melioration, etc.), bio-technical measures (contour trenches, terraces etc.), and technical measures (check dams and river-bed training). Apply controlled sand and gravel excavation to preserve channel conveying capacity and flow regime.
- Target 4. Provide permanent preparedness of the flood defence system.

### **3.1.4. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)**

The non-structural measures (encompassing institutional, preventive, corrective and other measures) should be given an appropriate role in flood control and mitigation. Main activities should be tied to:

- Preventive and operative tasks (setting up or improving the data base on natural events and protection system characteristics, modification of the existing plans for flood coping practices, adoption of reservoir operational rules, development/improvement of flood forecast and warning system);
- Regulative and institutional measures (zoning of floodplains, floodplain management policy, construction standards etc.);
- Managerial and technical education, as well as public awareness building.

All these tasks will be tied together within the Flood risk management plan.

- Target 1. Reduce flood risk
- Target 2. Introduce principles of EU Floods directive

- Target 3. Build capacity of professionals and institutions responsible for flood management
- Target 4. Upgrade flood monitoring, forecast and warning
- Target 5. Introduce regulations for emergency situations response (natural disasters)
- Target 6. Prepare Flood risk management plan
- Target 7. Improve awareness of stakeholders on floods
- Target 8. Update/build scientific base for flood management
- Target 9. Improve international cooperation in flood management

## **3.2. Bulgaria**

### **3.2.1. Regulation of land use and spatial planning**

- Target 1. Landscape development plans and spatial plans respect flood hazard maps and flood risk maps

### **3.2.2. Technical Flood Defences**

- Target 1.** Improve structural flood protection of towns and municipalities

### **3.2.3. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)**

- Target 1. Enhance flood forecast service.
- Target 2. Introduce principles of EU Floods Directive.
- Target 3. Build capacity of professionals and institutions responsible for flood management.
- Target 4. Improve international cooperation.
- Target 5. Inform the public about the causes of floods and improve awareness and preparedness to avoid detrimental effects.

#### 4. MEASURES TO ACHIEVE TARGETS

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
<b>4.1. Regulation on land use and spatial planning</b>							
RS	<b>Target 1: Spatial plans of municipalities contain flood hazard maps and flood risk maps</b>	Defining water estate	Administrative	MAFWM-RDW, PWMC SV		Continuous	
		Introduction of flood maps into spatial plans of municipalities	Administrative	MESP			
	<b>Target 2: Limitations related to land use in flood prone areas are defined</b>	Preparation of instructions for limitations on land use	Administrative	MAFWM-RDW, MESP			
		Land use limitations applied	Administrative	LRSG			
BG	<b>Target 1: Landscape development plans and spatial plans respect flood hazard maps and flood risk maps</b>	Landscape development plans respect flood-hazard maps and flood-risk maps	Technical	MRDPW, MAF, EAF		Continuous	
		Introduction of flood maps into development and spatial plans of municipalities	Administrative	MRDPW		Continuous	
<b>4.2. Reactivation of former, or creation of new, retention and detention capacities</b>							
RS	<b>Target 1: Large multipurpose reservoirs are used for flood attenuation</b>	Preparation of Operation manual	Technical	PWMC SV, EPS, OTHER		Continuous	
	<b>Target 2: Protection of densely populated areas by new detention capacities (small single or multipurpose reservoirs)</b>	Design and construction	Technical	PWMC SV		Started	
		Preparation of Operation manual	Technical	PWMC SV			Only in case of reservoirs, not for retentions.
<b>4.3. Structural flood defences</b>							

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
RS	<b>Target 1: Provide flood protection of first-order priority areas</b>	Carry out reconstruction or construction of flood protection structures	Technical	PWMC SV		Continuous	Protection of flood cells with more than 20,000 inhabitants, large and significant industrial and other facilities. Required safety level for a certain area depends on technical, economic, ecologic, social, political and other criteria, conditions and limitations and may be changed in time.
	<b>Target 2: Provide flood protection of second-order priority areas</b>	Carry out reconstruction or construction of flood protection structures	Technical	PWMC SV		Continuous	Protection of areas with 5,000 to 20,000 inhabitants, medium industrial and other facilities, significant drainage and irrigation systems or water-supply sources. Required safety level for a certain area depends on technical, economic, ecologic, social, political and other criteria, conditions and limitations and may be changed in time.
	<b>Target 3: Provide adequate measures for sediment management and torrent control</b>	Apply anti-erosion watershed management and torrent control measures	Technical	PWMC SV, PCSŠ, LRSG		Continuous	Optimal combination of biological measures (forestation, forest melioration, pasture melioration, etc.), bio-technical measures (contour trenches, terraces etc.), and technical measures (check dams and river-bed training).
	<b>Target 4: Provide permanent preparedness of the flood defence system</b>	Maintenance of flood protection structures	Technical	MAFWM-RDW, PWMC SV, LRSG, OTHER		Continuous	According to specific standards and norms.
		Maintenance of erosion and torrent control structures	Technical	MAFWM-RDW, PWMC SV, PCSŠ, LRSG, OTHER		Continuous	According to specific standards and norms.
		Maintenance of dams, retention basins and reservoirs used for flood protection	Technical	MAFWM-RDW, PWMC SV, EPS, OTHER		Continuous	According to specific standards and norms.

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Purchase and repair of machinery, tools, materials, equipment and communications	Technical	MAFWM-RDW, PWMC SV		Continuous	According to specific standards and norms.
		Rehabilitation of weak points at levees	Technical	PWMC SV		Continuous	
BG	<b>Target 1: Improve structural flood protection of towns and municipalities</b>	Building and reconstruction of flood protection structures in towns and villages	Technical	MRDPW, Municipalities,		Continuous	
		Maintenance of the existing flood protection structures and sustainable river-bed	Technical	MRDPW, MAF, Municipalities		Continuous	
<b>4.4. Non-structural measures (preventive actions, capacity building of professionals, raising awareness and preparedness of general public)</b>							
RS	<b>Target 1: Reduce flood risk</b>	Implementation of operative flood defence measures	Technical/ Organizational	PWMC SV, LRSB		Continuous	
	<b>Target 2: Introduce principles of EU Floods directive</b>	Preparation and adoption of new Water Law	Legal/ Administrative	Republic of Serbia, MAFWM-RDW		2009	
		Preparation of bylaws according to new Water Law	Legal/ Administrative	MAFWM-RDW		2010	
	<b>Target 3: Build capacity of professionals and institutions responsible for flood management</b>	Regular upgrade of General and Annual Flood Defence Plans for the Republic of Serbia	Administrative	MAFWM-RDW		continuous	State level – increased efficiency of operative flood defence.
		Preparation and regular upgrade of General and Annual Flood Defence Plans for municipalities	Administrative	LRSB		continuous	Municipality level – increased efficiency of operative flood defence.
		Characterisation of current situation	Technical	MAFWM-RDW, PWMC SV		2009	



Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Update/preparation of technical documentation for all existing flood protection structures (incl. data on water estate)	Technical	PWMC SV			
		Update/preparation of flood defence manual	Technical	MAFWM-RDW		2010	
		Preparation of bylaw for establishment and management of cadastre of water structures	Administrative	MAFWM-RDW		2009	
		Preparation of cadastre of flood protection structures	Technical	PWMC SV, LRSB		Continuous	
	<b>Target 4: Upgrade flood monitoring, forecast and warning</b>	Improvement the system of automated weather and gauging stations	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	Measured data available to relevant services in real time.
		Improvement the system of hydrological and weather forecasting	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	Introduction of the latest technologies in forecasting. Forecasts available to relevant services through WMISS and by other IT.
		Improvement of alarm systems and systems for issuing timely warning to population at risk	Technical/ Organizational	RHMSS, MAFWM-RDW		Continuous	
	<b>Target 5: Introduce regulations for emergency situations response (natural disasters)</b>	Preparation of strategic, tactical and operative disaster management plans for catastrophic flood	Technical/ Organizational	MAFWM-RDW, PWMC SV, MI, LRSB			- Criteria for declaration of an emergency; - Information routes; - Methods of public warning; - Evacuation routes; - Preparedness of public services.
		Training exercises	Public participation	PWMC SV, LRSB, MI		Continuous	- Organizing operations of the police and fire fighting forces as during floods; - Organizing evacuation of population; - Organizing life (medical services, and emergency recovery).

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
	<b>Target 6: Prepare Flood risk management plan</b>	Preliminary flood risk assessment	Scientific	MAFWM-RDW		2010	Activities started. Required harmonization with neighbouring countries.
		Preparation of methodology for flood risk mapping	Scientific/ Technical	MAFWM-RDW		2010	Standard hydrological and hydraulic models should be revised or new should be developed for computation of reference high water levels. Also, methodology for digital mapping should be developed according to standard specifications. The following results/conclusions will be used: - Common position on flood risk mapping (ICPDR); - Flood risk project; - Tamnava project (Swedish Rescue Service and MAFWM-RDW).
		Adoption of bylaw on methodology for flood risk mapping	Administrative	MAFWM-RDW		2011	
		Preparation of flood hazard maps	Scientific/ Technical	MAFWM-RDW, PWMC SV		2013	
		Preparation of flood risk maps	Scientific/ Technical	MAFWM-RDW, PWMC SV		2013	
		Preparation of draft Flood risk management plan	Technical / Organizational	MAFWM-RDW, PWMC SV		2014	Support: Tamnava project (Swedish Rescue Service and MAFWM-RDW).
		Public information and consultation on draft Flood risk management plan	Public participation	MAFWM-RDW, PWMC SV		2014-2015	Flood risk management plan and Flood risk maps should be discussed in public. The results, benefits and consequences of preparation of the flood risk maps as a legal act should be presented to a broad public.

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Bring into force Flood risk management plan	Administrative	MAFWM-RDW		2015	
	<b>Target 7: Improve awareness of stakeholders on floods</b>	Introduction of flood insurance	Administrative				
		Introduction of water management issues into schools	Public participation			Continuous	From elementary school to university.
		Preparation of flood leaflet, film, TV broadcasts etc.	Public participation				
	<b>Target 8: Update/build scientific base for flood management</b>	Preparation of studies and design	Scientific	All		Continuous	
	<b>Target 9: Improve international cooperation in flood management</b>	Bring into force bilateral agreements with Bulgaria and Montenegro and establish bilateral commissions	Legal	Republic of Serbia		2010	
		The Velika Morava River basin wide on-line flood related meteorological and hydrological data exchange	Administrative	Republic of Serbia + RHMSS, bilateral commissions		2010	Improvement and formal agreement.
		The Velika Morava River basin wide on line operative flood defence information exchange	Administrative	Republic of Serbia + bilateral commissions		2010	Improvement and formal agreement.
	<b>BG</b>	<b>Target 1: Enhance flood forecast service</b>	Improving flood forecasts and gauging stations	Technical			Continuous
Information service			Administrative			Continuous	
<b>Target 2: Introduce principles of EU Floods Directive</b>		Preparation and adoption of new or amendment of the existing Water law					
		Preliminary flood risk assessment	Scientific/ Technical			2010	
		Preparation of flood hazard maps	Scientific/ Technical			2013	

Country	Targets	Measures	Type of intervention	Institution in charge	Costs (k€)	Deadline	Comment
		Preparation of flood risk maps	Scientific/ Technical			2013	
		Preparation of Flood risk management plans	Administrative	MoEW, DRBD			
	<b>Target 3: Build capacity of professionals and institutions responsible for flood management</b>	Proficiency courses, meetings for exchange knowledge, seminars	Administrative	Ministries		Continuous	
		Developing alert and operational plans	Administrative	Municipalities		Continuous	
		Improvement of coordination between different authorities in case of floods	Organizational	State		Continuous	
	<b>Target 4: Improve international cooperation</b>	Intensifying international cooperation in flood management	Administrative	State		Continuous	
	<b>Target 5: Inform the public about the causes of floods and improve awareness and preparedness to avoid detrimental effects</b>	Presentation of flood risk management plans to the public	Information	MoEW, DRBD		2015	
		Training activities, publishing informational brochures etc.	Administrative	MoEW, DRBD, Municipalities, CPSD		Continuous	

## Annex 1

### List of competent authorities responsible for preparation and implementation of the Action Plans

Country	Name of institution	Abbreviation	Address
RS	Ministry of Agriculture, Forestry and Water Management – Republic Directorate for Water	MAFWM-RDW	Bulevar umetnosti 2a 11070 Novi Beograd
	Ministry of Environment and Spatial Planning	MESP	Nemanjina 11 11000 Beograd
	Public Water Management Company “Srbijavode”	PWMC SV	Bulevar umetnosti 2a 11070 Novi Beograd
	Republic Hydrometeorological Service of Serbia	RHMSS	Kneza Višeslava bb 11000 Beograd
	Electric Power Industry of Serbia	EPS	Pop Stojanova 2a 11000 Beograd
	Public Company “Srbijašume”	PCSŠ	Bul. Mihajla Pupina 113 11070 Novi Beograd
	Ministry of the Interior	MI	Bul. Mihajla Pupina 2 11070 Novi Beograd
	Local and regional self-government units	LRSG	
	Other water and land users	OTHER	
BG	Ministry of regional development and public works	MRDPW	Kiril and Metodiy 17-19 1202 Sofia
	Ministry of Agriculture and Food	MAF	Hristo Botev blvd. 55 1040 Sofia
	Executive Agency of Forestry	EAF	Hristo Botev blvd. 55 1040 Sofia
	Minister of Environment and Water	MoEW	Maria Louiza Blvd 22 1000 Sofia
	Danube River Basin Directorate	DRBD	Maria Louiza Blvd 22 1000 Sofia
	Civil Protection Service Directorate	CPSD	Shesti Septemvri 29 1000 Sofia