



# Updated Integrated Tisza River Basin Management Plan

Annex 14. Catalogue of groundwater and  
integration measures evaluation – additional  
data and information



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# 1 Introduction

Data and information presented in this Annex provide additional data and information to those included in Chapter 6 for groundwater measures and Chapter 7 for horizontal, drought and water scarcity, plastic waste and climate change measures. Tisza countries reported measures based on templates that follow approach applied for development of the First Integrated Tisza River Basin Management Plan (1<sup>st</sup> ITRBMP) and other studies and background documents relevant for Tisza River Basin within the scope of International Commission for the Protection of the Danube River (ICPDR) Tisza Group and other ICPDR expert groups.

In the 1<sup>st</sup> ITRBMP measures are addressed with respect to Significant Water Management Issues within the TRB and in line with EU Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy). The Article 4 of the EU WFD addresses environmental objectives and underline significance of measures implementation, and Article 8 elaborate water bodies monitoring. According to article 11, paragraph 1 each Member State shall ensure the establishment for each river basin district, or for the part of an international river basin district within its territory, of a programme of measures, taking account of the results of the analyses required under Article 5, in order to achieve the objectives established under Article 4. Such programmes of measures may make reference to measures following from legislation adopted at national level and covering the whole of the territory of a Member State. Where appropriate, a Member State may adopt measures applicable to all river basin districts and/or the portions of international river basin districts falling within its territory.

## GWB's measures

Data and information summarized in this Annex for groundwater bodies (GWB's) measures are provided by Tisza countries based on template for data collection and datasets uploaded and verified on the ICPDR DanubeGIS relevant for GWB's quantitative and qualitative status in line with pressures. Comprehensive description of these measures for each country is provided in Chapter 2 of this document.

## Integration measures

In addition to the Danube River Basin wide agreed significant water management issues the ICPDR Tisza Group identified that integration of water quality and quantity issues are relevant for Tisza River Basin (TRB) and has to be considered during the preparation of the Integrated Tisza River Basin Management Plan. Recognising the importance of water quantity issues and its significant impacts on water quality, the ICPDR Tisza Group has developed an integrated approach taking into account water quality, water quantity-related issues and their interactions. As a result, the Tisza Group outlined visions and management objectives relevant for the agreed interlinked issues and identified measures which will have positive impacts on water quality and quantity and on aquatic ecosystems. These measures, visions and recommendations are based on data and information provided by Tisza countries and are elaborated in the first Integrated Tisza River Basin Management Plan– Chapter 8.5 (2011). *In summary, the TRB wide measures are firmly based on and were coordinated with the national programme of measures and with Danube River Basin wide measures.*

During the 2012 the ICPDR Tisza Group developed Template for TRB Integration measures and data and information on integration measures within the scope of JOINTISZA project are collected in line with this template. The integration measures reported by TRB countries within the scope of JOINTISZA project are summarized in Chapters 3, 4, 5 and 6 of this Annex.

## 2 TRB measures relevant for GWBs

This chapter summarises the measures that are planned for the 86(2010)/86 (2017) groundwater bodies of basin-wide importance. Detailed information on the relevant measures for each groundwater body will be provided in Annex 11. As stated in the Water Framework Directive (ANNEX VI, Part A and Part B) measures to be included within the programmes of measures for the groundwater are listed as:

**BM** - Basic measures - measures required under the following Directives:

- Bathing Water Directive 2006/7/EC, replaced the former Directive 76/160/EC.
- Birds Directive 79/409/EEC
- The Drinking Water Directive (80/778/EEC) as amended by Directive (98/83/EC)
- The Major Accidents Seveso-III-Directive (2012/18/EU)
- The Environmental Impact Assessment Directive (85/337/EEC)
- The Sewage Sludge Directive (86/278/EEC)
- The Urban Waste-water Treatment Directive (91/271/EEC)
- The Plant Protection Products Directive (91/414/EEC)
- The Nitrates Directive (91/676/EEC)
- The Habitats Directive (92/43/EEC)
- The Integrated Pollution Prevention Control Directive (96/61/EC)

**SM** - The following is a non-exclusive list of supplementary measures which Member States within each river basin district may choose to adopt as part of the programme of measures required under Article 11(4):

- Legislative, administrative, economic or fiscal instruments
- Negotiated environmental programmes
- Emission controls
- Codes of good practice
- Recreation and restoration of wetland areas
- Abstraction controls
- Demand management measures, inter alia, promotion of adapted agricultural production such as low water requiring crops in areas affected by drought
- Efficiency and reuse measures, inter alia, promotion of water-efficient technologies in industry and water-saving irrigation techniques
- Construction projects
- Desalination plants
- Rehabilitation projects
- Artificial recharge of aquifers
- Educational projects
- research, development and demonstration projects
- other relevant measures.

**OBM** - Other basic measures must be defined at the country level by local laws.

The need to ensure the proper integration of the various legal instruments is illustrated in the Figure II.1.

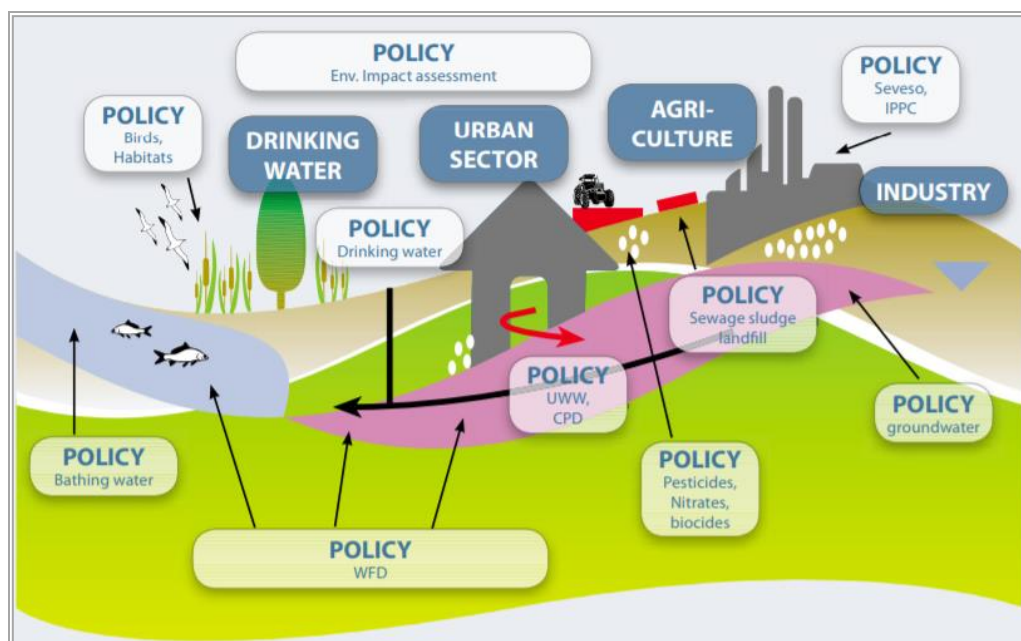


Figure II.1: Sectors covered by EU legal instruments that are directly or indirectly relevant to groundwater protection (UWW: urban wastewater – CPD: construction products directive – IPPC: integrated pollution prevention control). This list is not exhaustive, (Source: Groundwater Protection in Europe - The New GW Directive – Consolidating the EU Regulatory Framework

## GWBs programme of measures by TRB countries

### Ukraine

As stated in Ukrainian JOINTISZA Report for GWB's data collection Country Report the programme of measures for the water bodies at risk (like UA\_TIS\_GW\_4) and sensitive water bodies for pollution like alluviums will be included in the future River Basin Management Plans to be developed by 2024 based on the improved monitoring data.

### Romania

Romania updated information about measures for 11 GWB's. Data submitted in 2010 for measures followed poor quality status assessment for 2 GBW's, in 2017 there is one more GWB in the poor quality status. For these 3 GBW's following measures are reported in 2017:

- Reduce nutrient pollution from agriculture;
- Construction or upgrades of sewerage network in human agglomerations with less than 2,000 equivalent inhabitants,
- The measures in order to prevent failing of the good status were taken for all GWB's.

Statistics overview of submitted data is shown in the following Table II.1 and Figure II.2 and Figure II.3.

Table II.1: TRB Groundwater quality and quantity status assessment/measures in Romania 2010/2017

GWB Status/Measures	RO 2010		RO 2017	
	GWBs	measures	GWBs	measures
Quality Status	good	9	-	8
	poor	2	2	3
Quantitative Status	good	11	-	11
	poor	-	-	-



Figure II.2: Number of measures per GWBs quality status assessment changing from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Romania

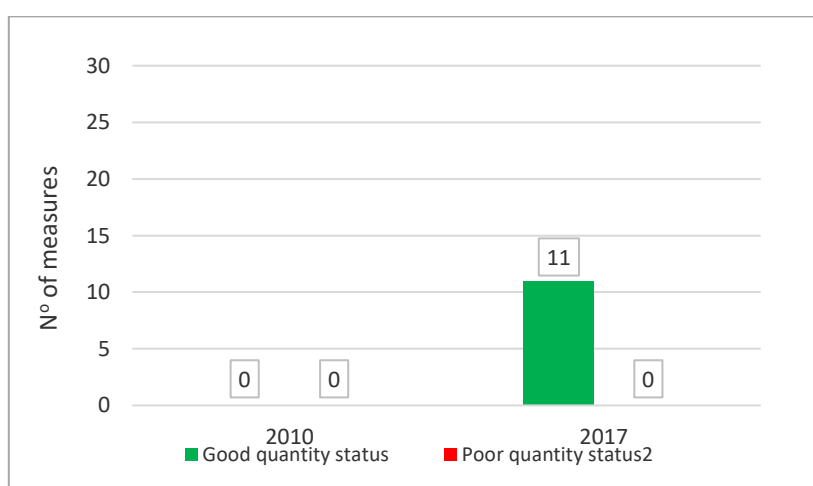


Figure II.3 Number of measures per GWBs quantity status assessment changing from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Romania

The Updated Danube River Basin Management Plan (2015) summarizes the measures for the groundwater bodies of basin-wide importance in the DRB and showing both the progress in implementation of the first DRBM Plan as well as the measures planned for the period 2015–2021.



Also, in the Updated National Management Plan and in the updated RBMPs of the 4 RO sub-units located in the TRB, the measures planned to be implemented for reaching and maintaining the good status of the GWBs are part of the program of measures. Basic measures are applied to all water bodies, while additional measures are applied to water bodies at risk of not achieving environmental objectives.

The applied basic measures (under Article 11(3)(a)) are those required by the EU Directives, especially: Groundwater Directive (2006/118/EC); Urban Waste Water Treatment Directive – UWWTD (91/271/EEC); Plant Protection Products Directive (91/414/EEC); Nitrates Directive (91/676/EC); Sustainable Use of Pesticides (2009/128/EC); Biocide Directive (98/8/EC); Integrated Pollution Prevention Control Directive (96/61/EC) and Industrial Emissions Directive (2010/75/EU). In this respect, the basic measures are grouped as following:

- Measures for human agglomerations - building the drinking water and waste water infrastructures (especially the collection and treatment systems), as required by Drinking Water Directive, UWWTD and Sludge Directive, and increase of the wastewater collection and treatment efficiency and level thereafter
- Measures for industrial activities for reduction of industrial pollution, according to the IED permits and water management licenses requirements and application of BAT (IPPC and SEVESO installations)
- Measures for agricultural activities:
  - implementation of the provisions of Good Agriculture Practices Code and Action Programs - all territory approach under Nitrate Directive
  - construction of manure storage and wastewater storage facilities
  - farm advisory services
  - implementation of BAT
  - reduction of pesticide emissions – implementation of the National Action Plan for pesticides.

Other categories of measures are related to:

- Measures for the protection of water abstracted for drinking water (Article 7)
- Requirement for prior regulation of point source discharges liable to cause pollution
- Prohibition of direct discharge of pollutants into groundwater
- Any measures required to prevent significant losses of pollutants from technical installations and to prevent any significant and sustained upward trends in the concentrations of pollutants in groundwater
- Controls the abstractions of groundwater.

Taking into account that the main sources of groundwater pollution in Romania are human agglomerations without wastewater collection and treatment systems and agricultural activities (sources of diffuse pollution), it is essential to take all measures to eliminate or reduce the amount of pollutants reaching groundwater. The prevention of groundwater quality deterioration as well as the prevention of any increasing and significant upward trend in pollutant concentrations in groundwater must be achieved firstly by implementing the above measures. Also, the Water Law no. 107 of 1996, as subsequently amended and completed, prohibits direct discharges of pollutants into groundwater.

The implementation of basic and additional measures for human agglomerations, industrial and agricultural activities, part of the updated program of measures is on-going, continuing the application of measures which will lead to achieving and maintaining the good chemical status and maintaining the good quantitative status of GWBs (In Romania, all GWBs have achieved the good quantitative status).



Another important action relates to the potentially contaminated sites, in order to reduce the negative effects on groundwater resources, the National Environmental Protection Agency updated in November 2013 a national inventory of potentially contaminated sites based on data obtained from local public authorities. The Government approved (through a Governmental Decision) the National Strategy and the National Action Plan for the Management of Contaminated Sites in Romania, the application of which aims at diminishing the problems caused by soil and groundwater contamination, as well as the risks to human health and the environment. In the short term, by the end of 2015, the goal of the strategy was to set out the principles of managing contaminated sites; in the medium term, by 2020, the strategy aims to solve the problem of contaminated sites requiring urgent action and, in the long term, by 2050, the completion of the action.

### **GWBs quality**

From the analysis of pressures and impacts on groundwater bodies resulted that, due to the natural flow conditions and historical load with pollutants, 2 groundwater bodies (ROMU03 and ROMU20) from the Mureş Basin and groundwater body (ROBA01 Lovrin-Vinga) are at risk of not achieving good chemical status by 2021.

Contamination with nitrates was a key factor against achieving good chemical status of the 3 national GWBs of Tisza River Basin: ROBA01, ROMU03, ROMU20. According with the environmental objectives, it is essential to eliminate or reduce the amount of nitrates entering groundwater bodies. The programme of measures applied in order to reduce the effects of the agriculture activities is mandatory. In Romania, whole territory approach is applied for the protection of waters against pollution caused by nitrates from agricultural sources.

Prevention of deterioration of groundwater quality and of any significant and sustained upward trend in concentrations of nitrates in groundwater was planned to be achieved primarily through basic measures like the implementation of the requirements of the EU Nitrates Directive and the EU UWWTD (e.g. construction of collecting systems and improvement of the waste water treatment plant performance).

Nevertheless, it should be taken into account that due to the slow dynamics of the groundwater and the longer time needed for an efficient management of diffuse nutrient pollution (longer residence time of groundwater) the water quality impacts of any changes in agriculture induced by the implementation of the ND or BAP recommendations will not be instantly visible but after several years or even decades only.

Considering that the main use of groundwater is for drinking water, an essential measure is to ensure the protection areas for the drinking water abstraction through establish of safeguard zones and buffer zones according to the water legislation in force (Water Law 107/1996 modified and completed, GD 930/2005 and Order 1278/2011).

To prevent pollution of GWBs by hazardous substances from point source discharges liable to cause pollution, the following measures are applied:

- An effective regulatory framework ensuring prohibition of direct discharge of pollutants into groundwater;
- Setting of all necessary measures required to prevent significant losses of pollutants from technical installations;
- The prevention and/or reduction of the impact of accidental pollution incidents.

The measures addressing pollution of surface water bodies by nutrients and hazardous substances have a positive effect on the improvement of the chemical status of groundwater.

The principles and assessment of surface water pollution sources provide background information relevant to groundwater, due to the interconnection between the two water categories.

Other additional measures are related to the realization of research projects to assess the nature and quantity of pollutants in the soil and subsoil as well as the mechanisms of transfer and degradation through the underground environment. Mathematical models will be developed to track the time and space evolution of the pollutant concentration, estimating its natural degradation rate in groundwater.

The results of the research projects will allow the assessment of the time needed to achieve the environmental objectives through the implementation of the basic measures and / or the possibility of applying additional measures.

### GWBs quantity

All 11 national groundwater bodies included in the TRB are in good quantitative status. In this case, only measures to prevent the deterioration of the quantitative status are needed.

Over-abstraction of the water from the aquifers is avoided by sustainable groundwater management. According with the Water Framework Directive requirements it must be ensured that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction. In this respect, in Romania all abstractions of groundwater for all kind of water uses are authorized and controlled from the water management point of view, except abstractions less than 2 l/s used for individual drinking water purpose.

In order to protect the groundwater resource from quantitative point of view additional measures are foreseen to identify the areas where some phreatic aquifers are or may be affected by drought, by developing research studies and applying patterns to track aquifer levels in time and space.

### Slovakia

Slovakia submitted one more GWB (GWB code: SK200280FK\*) in 2017. GWB code: SK200280FK\* has area of approximately 3.049,8 km<sup>2</sup> but only one half of this groundwater body is situated in Tisza river catchment.

All 8 GWBs are in good quality and quantitative status. They don't have any measures planed. Based on data and information reported by Slovakia there are no changes in GWB's status assessment. All 8 GWB's are in good quality and quantitative status so they don't have any measures planed. Statistical overview is given in the following Table II.4 and Figures II.4 and II.5.

*Table II.2: TRB Groundwater quality and quantity status assessment/measures in Slovakia 2010/2017*

GWB Status/Measures		SK 2010		SK 2017	
		GWBs	measures	GWBs	measures
Quality status	good	7	-	8	-
	poor	-	-	-	-
Quantitative status	good	7	-	8	-
	poor	-	-	-	-

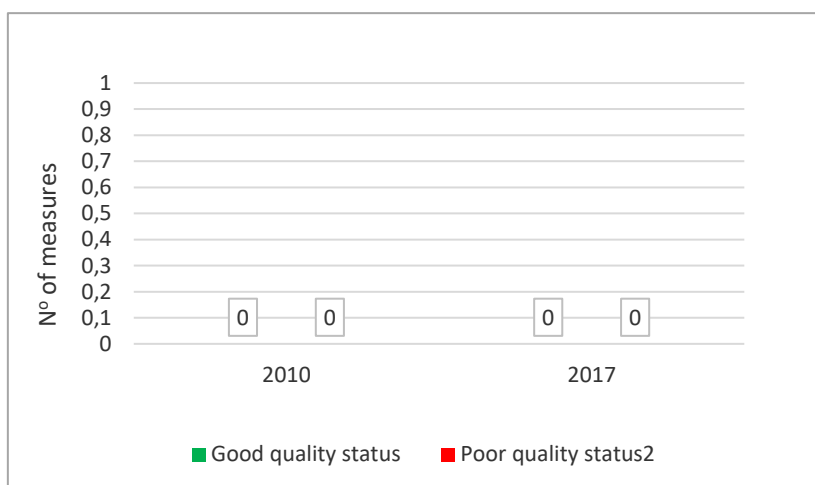


Figure II.4 Number of measures per GBWs quality status assessment changes from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Slovakia

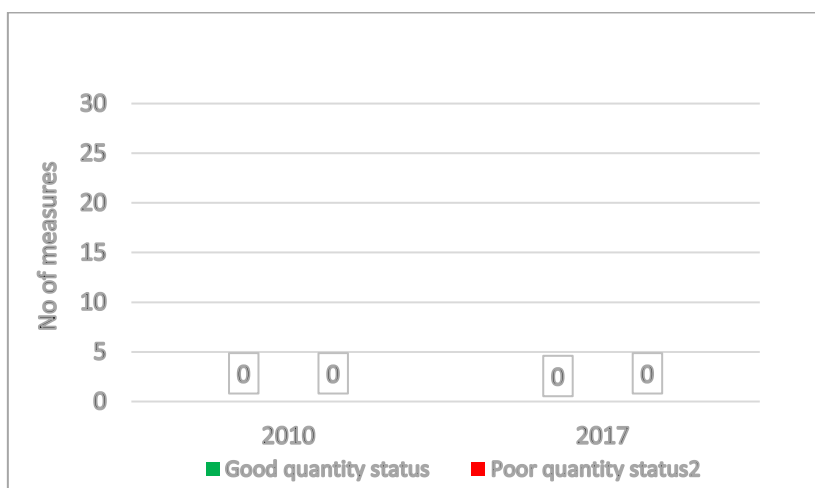


Figure II.5 Number of measures per GBWs quantity status assessment changing from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Slovakia

## Hungary

In 2017 Hungary reported 51 GWBs. Based on summary table (II.3) it is clear that measures are applied not just for GWBs with poor chemical/quantitative status, but also for those GWBs with good status.

Table II.3: TRB Groundwater quality and quantity status assessment/measures in Hungary 2010/2017

GWB Status/Measures	HU 2010		HU 2017		
	GWBs	measures	GWBs	measures	
Quality Status	good	38	1	43	43
	poor	6	6	8	8
Quantitative Status	good	32	-	29	27
	poor	12	12	22	20

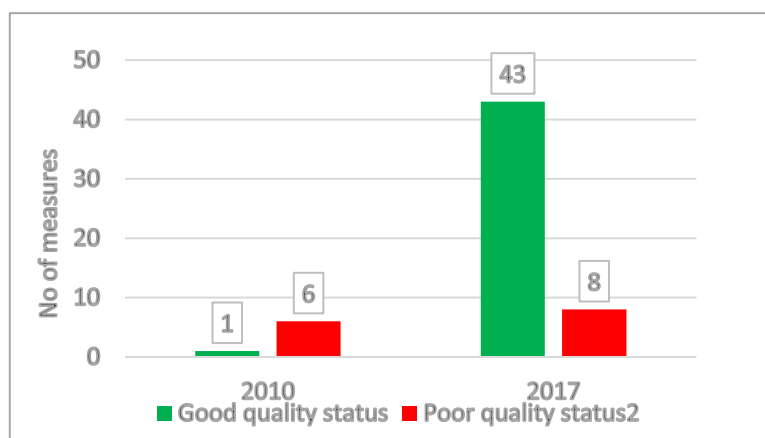


Figure II.6: Number of measures per GBWs quality status assessment changes from the 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Hungary

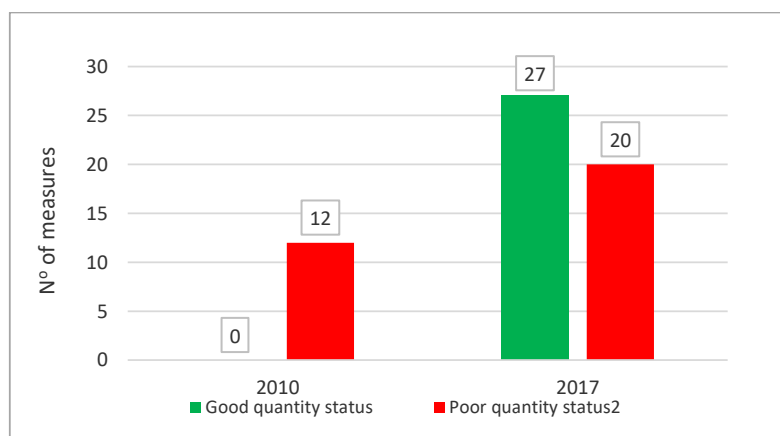


Figure II.7: Number of measures per GBWs quantity status assessment changes from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Hungary

Table II.3 and Figures II.6 and II.7 indicate increase in number of measures reported in 2017 in comparison to the 1<sup>st</sup> ITRBMP:

- For GWBs in poor status assessment either quality or quantity only 1 GWB has no measures planned;
- For GWBs in good status assessment either quality or quantity only 4 GWB has no planned measures.

Also, Hungary reported (Act4\_3\_Measures\_GWB\_Quality HU) in detail list of measures improving the chemical status of GWBs:

- Completed in 2015 and the impact of which is expected by 2021 and
- Measures completed in 2021 and continuously.

## GWBs quality

### Measures to reduce diffuse pollution

#### Measures to reduce groundwater contamination by nutrients from agricultural sources

These measures are mainly related to the Nitrates Directive and to the Regulation on the Common Agricultural Policy of vulnerable zones: specifically, on arable lands and orchards on WBs at poor status due to diffuse nitrate pollution. In Hungary Government Regulation

123/1997 (VII.18.) sets rules on the application and control of nutrient use in the protection zones of water resources.

### **Measures to reduce the pesticide pollution from agricultural sources**

Restrictions on the use of pesticides in the existing Hungarian legislation are appropriate, and it must be enforced especially on the drinking water resources protective zones.

### **Implementation of the Waste Water Treatment Program**

- Development of sewerage and sewage treatment as implementation of the Waste Water Treatment Program will continue using the financing mechanism of the Environmental and Energy Efficiency Operational Program (KEHOP-2.2),
- Establishing sewage network or individual wastewater treatment for agglomerations not currently included in the Waste Water Treatment Program.
- Improvement of the connection rate to the sewage network, especially on the drinking water resources protection zones.
- Reconstruction of sewage networks, especially on the drinking water resources protection zones.

### ***Measures to reduce of point source pollutions***

- Reduction of connections of rainwaters to the sewerage system, particularly in sensitive areas of surface and groundwater. This measure is particularly important on open karstic groundwater bodies, especially in the drinking water resources protection zones.
- Remediation of contaminated sites - According to authorities' data, in the TRB 24 contaminated areas effect drinking water hydrogeological protective zones, out of which the remediation of 23 is already completed, or is ongoing. In the area of endangered water resources the remediation of contaminated sites will be completed until 2021.
- Controlling and reducing disposal and emissions of pollutants related to mining activities – the review of explosion methods of limestone quarries.
- Establishment, maintenance and monitoring of new landfills of communal waste with appropriate technical protection, especially on hydrogeological protection zones of groundwater resources. The existing Hungarian legislation is appropriate; its enforcement has to be carried out.
- Elimination of illegal rubbish dumps, control and fining of dumping on the water resources protective zones. The existing Hungarian legislation is appropriate; its enforcement has to be carried out.
- Modernization of livestock holdings according to the EU Nitrate Directive. The farmers had to provide proper storage for the liquid and solid livestock manure on nitrate sensitive areas, until 22 December 2015. Measures: construction of appropriate manure storages, control of the implementation, and monitoring of sites. Financing mechanism: Rural Development Program resources.
- Measures to control, reconstruct or eliminate improperly constructed wells - inventory of unauthorized wells, modification of legislation.

### ***GWBs quantity***

#### **Controls (register, review, modification and authorisation) of groundwater abstraction**

- Detailed modelling to determine quantitative limits on groundwater extraction
- Review of water abstractions

**Exploration of alternative groundwater resources-** Review of perspective drinking water resources

**Modification of the excess water drainage system, restoration of the base flow ecological flow, modification of the drainage system.** Modification of the drainage systems over shallow porous water bodies of the TRB is necessary. Development of multi-purpose water management systems, halting the decline of groundwater levels. Financing mechanism: Environmental and Energy Efficiency Operational Program (KEHOP-1.3.0).

**Water retention measures on arable lands to increase infiltration and reduce runoff.** It is particularly important in settlements located on karstic water bodies.

**Regulation of recharge augmentation of groundwaters**

**Regulation of abstractions due to mining and use of water** – Utilising a higher proportion of mine water extracted for dewatering two lignite mines: as drinking water, as ecological flow, or for other water supply purposes.

**Specific measures to improve the status of nature protection areas, including special regulation of abstractions, impoundments and water supply systems to meet the needs of nature conservation.**

**Serbia**

According to data and information reported by Serbia there are no changes in GWBs status assessment for all 14 GWBs, so the programme of measures for this planning period remains the same. For the 7 deep GWBs that are in risk of exceeding good quantitative status still the same measures are in place. Statistical overview is presented in the Table II.4 and Figure II.8 and Figure II.9.

*Table II.4: Groundwater quality and quantity status assessment/measures in Serbia 2010/2017*

GWB Status/Measures	RS 2010		RS 2017		
	GWBs	measures	GWBs	measures	
Quality Status	good	14	-	14	-
	poor	-	-	-	-
Quantitative Status	good	7	-	7	-
	poor	7	7	7	7



*Figure II.8 Number of measures per GWBs quality status assessment changes from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Serbia*

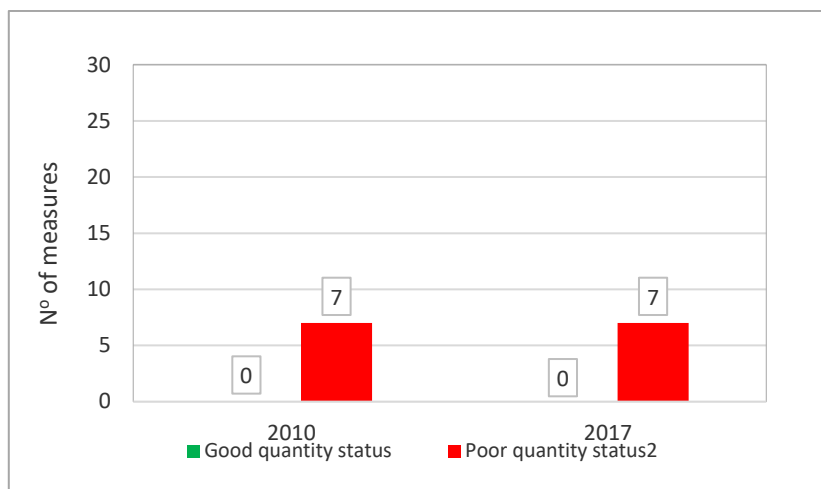


Figure II.9 Number of measures per GBWs quantity status assessment changes from 1st ITRBMP (2010) to draft updated ITRBMP (2017) in Serbia

## 3 TRB integration - horizontal measures reported (by 2021)

In addition to horizontal measures included in Updated ITRBMP Table VII.3 The horizontal measures relevant for TRB reported by TRB countries are presented. TRB countries additional information

### Ukraine

**International coordination** implementation is on-going at the level of the Plenipotentiaries with neighbouring Tisza countries as well as in frame of ICPDR. The list of agreements is as follows:

- Agreement between government of Ukraine and government of Slovak Republic on issues of water management in boundary waters – June 15, 1994
- Agreement between the Government of the Republic of Hungary and the Government of Ukraine on water management issues related to frontier waters – November 11, 1997
- Agreement between the Government of Ukraine and the Government of Romania on co-operation in the field of water management on transboundary waters – September 30, 1997.

With respect to **incentives** Ukrainian part of the Tisza is by two-thirds is mountainous, so existing land plots which could be used for agriculture are highly valuable. However, at present, there is no legal scheme of long-term compensation to land users. At present, there are three potential projects on dry polders, which can be implemented if long-term compensation schemes become operational:

- Planned dry polder in Borzhava valley in village Bereznyky (Svalyava rayon). It was not implemented because of the denial of land owners to provide land for the polder.
- Planned dry polder at Irshavka in village Zagattya (Irshavsky rayon). It was not implemented because of the denial of land owners to provide land for the polder.
- Planned dry polder at Chetfolvo-Vary. It was not implemented because of the denial of land owners to provide land for the polder.



**Communication and consultation:** In 2017, the Ministry of Ecology and Natural Resources of Ukraine adopted the order “On Approval of the Standard Regulation on the Basin Councils”. Now it is planned to establish the basin councils and to start conduct relevant consultations.

## Romania

**International coordination:** Participation of Romania to the works of the International Commission for the Protection of the Danube River (ICPDR) mainly is achieved through permanent Expert Groups (EG) and task groups in place, that are respectively coordinated by a technical expert from the ICPDR Secretariat. Under ICPDR umbrella, it is facilitated cooperation between the Romania and the Danube countries on issues requiring transboundary coordination, cooperation with other international organizations where appropriate, coordination platform for the basin-wide implementation of the EU Directives (mainly WFD, Flood Directive). Also, in 2004 the representatives of the five Tisza countries (Ukraine, Romania, Slovakia, Hungary and Serbia) signed the Memorandum of Understanding to develop a River Basin Management Plan for the Tisza River. This plan supports sustainable development of the region. The Tisza countries agreed to prepare a sub-basin plan called Integrated Tisza River Basin Management Plan (ITRBM). This plan has been approved in April 2011 and integrates issues on water quality and water quantity, land and water management, floods and droughts. Romania has **signed bilateral agreements** with neighboring countries, both before and after the Water Framework Directive (WFD) publication. The EU WFD requires more intensive international cooperation and concrete improvements in terms of water status. There are in place bilateral agreements addressing water management with the neighboring countries (HU, BG, RS, UK and MD) with bilateral Commissions and sub-commissions and groups on specific issues, mainly related to water quality, flood and ice defense, water resources management and hydrometeorology, and river basin management. The collaboration with Republic of Serbia is based on the “Agreement between Popular Republic of Romania and the Federative Republic of Yugoslavia regarding the hydraulic problems on hydraulic systems and rivers on the border or crossed the by state border” signed in Bucharest on April 7, 1955. Presently, there is under negotiation the new agreement text between the Government of Romania and Government of Republic of Serbia regarding cooperation in the transboundary waters sustainable management field. In 1997 the Government of Romania has signed a “Bilateral agreement with the Government of Ukraine on cooperation in transboundary waters management field”. This agreement has signed in Galati and was ratified in 1999. In 2003, the “Agreement between the Government of Romania and the Government of the Republic of Hungary on cooperation for the protection and sustainable use of the border waters” was signed. This agreement promotes cooperation between the two countries for the protection and sustainable use of transboundary rivers and groundwater bodies and also for aquatic ecosystems protection. The transboundary waters agreements developed by Romania with its neighbors are based on integrated water management principles promoted by the WFD and its daughter directives. Therefore, besides the achieving of environmental objectives required by the WFD, the bilateral agreements contain important aspects related to: information and data exchange for the integrated water resources management, water resources management during floods and droughts, development of bilateral projects which are equally implemented by the states, coordinated development and operation of water management infrastructure both for ensuring the necessary water resources and for the floods protection.

**Incentives:** Regarding the development of appropriate long-term compensation schemes, financial compensation is granted from the state budget in case of flood control breaches through a Governmental Decision.

**Communication and consultation:** Public participation and consultation activity (generally defined as public involvement in decision-making in the planning process) is based on methodological guidance

developed at national level through the adaptation of the "Public Participation" Guide developed within the Joint Implementation Strategy of the WFD and the Public Participation Strategy for the Danube River Basin District, a strategy endorsed by the ICPDR in June 2003. The main pillar for consulting and informing the public at the basin and local level is represented by the River Basin Committee, which operates on the basis of a Governmental Decision (Government Decision No 270/2012) and which includes all stakeholders, water users and NGOs, relevant at river basin level.

## Slovakia

**International coordination:** Continuation of this measure is based on Memorandum of Understanding signed by all ministers during ministerial meeting held in Ukraine on April 11, 2011. In the MoU the relevant ministers expressed wish to continue in cooperation towards the implementation of the Integrated Tisza River Basin Management Plan supporting the sustainable development of the region.

**Incentives:** Compensation schemes for land owners in the event that their land is used for wider water management purposes, such as flood protection, improving natural values, water retention are not in place. Proceed according to current legislation

**Communication and consultation:** The cross-sectorial working group for definition of NiD vulnerable zones was established.

## Hungary

**International coordination:** - Continuation of this measure is based on Memorandum of Understanding signed by all ministers during ministerial meeting held in Ukraine on April 11, 2011. In the MoU the relevant ministers expressed wish to continue in cooperation towards the implementation of the Integrated Tisza River Basin Management Plan supporting the sustainable development of the region.

### **Incentives**

**Planning ongoing:** Compensation schemes for agricultural land owners implementing WFD related measures (e.g. buffer zones, reduction of fertilizer use, water retention, etc.)

**Implementation is ongoing:** Horizontal measures/incentives are in the HU RBMP 2015 as follows:  
Technical measures (land use changes, NWR):

- Restoration and/or enlargement of floodplains by land-use changes
- Water supply to oxbow lakes, sidearm or wetlands on the floodplain
- Change of the cropping pattern (conversion of arable land into grassland, forest or wetland)
- Drinking water protection measures beyond the regulation (alternative solutions, land-use change, encourage good practice, arrangement with land-users)
- To reduce sediment and contaminant leaching with grassing, planting trees, terrace for sloping areas, infiltration surfaces, constructed wetlands, isolation
- Modification of the excess water drainage system
- Modification of the irrigation system
- Control of water discharges from valley dammed reservoirs
- Modification of water allocation to ensure ecological flow
- Water retention measures on arable lands to increase infiltration and reduce runoff
- Water retention with reservoirs in hilly areas (storm water reservoirs on creeks or in permanent reservoirs)
- Water retention with reservoirs in plain areas or in the excess water drainage system by impoundments at bay-like widened sections
- Measures to improve quantitative status of waters in line with the EU Natura 2000 Directives

- Specific hydro-morphological measures to improve the status of nature protected areas, including special regulation of abstractions, impoundments and water supply solutions to meet the needs of nature conservation.

*Administrational measures:*

- Controls (register, review, modification and authorisation) of fresh surface water abstraction and impoundment
- Supplementary regulation of water uses (e.g. termination, legalization of illegal water abstractions).

*Technical efficiency measures:*

- Water efficient methods of crop production (type of crops, irrigation technology, energy efficiency)
- Reduction of technological and network losses
- Use of water-saving devices
- Water-saving solutions for industrial water supply
- Measures for time shared allocation of surface water resources - committed resource shared in time
- Measures for new allocation of surface water resources - institutional development to establish trading market for water resource quotas.

*Economic measures:*

- Measures to implement the cost recovery principle for water services from households
- Development of reconstruction financing strategy for Water Utility Services
- Development of the institutional and financial (fee regulation) framework for rainwater harvesting in urban areas
- Review of regulation on water resources fee (VKJ) to provide adequate incentives for users in all sectors to use water resources efficiently
- Institutional reform of the water allocation system to ensure resource costs recovery
- Measures to implement the cost recovery principle for water services in agriculture - regulation on fees of water allocation for agriculture
- Development of incentives pricing for stormwater management (drainage system).

*Measures on advisory possibilities, research:*

- Advisory services on water-saving cultivation methods, irrigation
- Research, development, innovation.

*Monitoring measures:*

- Improvement and operation of monitoring and water information systems
- Review of plans for self-monitoring, enforcing self-monitoring.

The above listed measures are taken into account by projects generated on the Tisza catchment. All measure types are ongoing at the end of 2021.

**Completed** Compensation schemes for agricultural land owners - implementing protection measures in Natura 2000 areas (many of the water related)- operating within the area of emergency reservoirs.

**Communication and consultation:** Horizontal measures are consulted in cross-sectoral working groups with agriculture, and nature protection.

## Serbia

Regarding **international coordination** Republic of Serbia is involved in all activities within the ICPDR Tisza Group and all other ICPDR expert groups. Bilateral cooperation between Republic of Serbia and neighboring countries in the TRB (Hungary and Romania) exists more than 60 years:

- **Bilateral cooperation between RS and Hungary** is based on the Agreement between the Government of the People's Republic of Hungary and the Government of Federal People's Republic of Yugoslavia on water management issues, signed in Belgrade in 1955. The Agreement binds the parties thereto to review and jointly resolve all issues, measures, and activities related to flood and ice control; obligates coordinated management and operation of structures and equipment; requires the Committee, set up pursuant to the Agreement, to generate joint flood and ice control rules. In 1998, the Committee adopted new Rules for external and internal flood and ice control related to border or cross-border watercourses and hydro-technical systems in sectors of joint interest to RS and HU, as well as rules on hydrologic cooperation, which also has an important function in the domain of flood control. The new bilateral agreement based on fruitful past cooperation and EU legislation is in preparation.
- **Bilateral cooperation between RS and Romania** is based on the Agreement between the Government of Romania and the Government of the Federal Republic of Yugoslavia on hydro-technical issues from the hydro-technical systems and watercourses on the boundary or crossing the state boundary, signed in Bucharest in 1955. The parties agreed to review and jointly resolve all issues, measures, and activities related to flood and ice control; each party on its territory and the parties jointly along the border should adequately maintain riverbeds, hydro-technical systems, structures, and installations etc. The Joint Flood Control Rules for border or cross-border watercourses and hydro-technical systems were approved in 1971. Timely dissemination of hydro-meteorological information of significance for flood and ice control, as well as information on flood control phases and any accidents, is also an obligation under the Joint Flood Control Rules. The new bilateral agreement based on fruitful past cooperation and EU legislation is in preparation.

## 4 TRB Integration measures: solid plastic waste TRB countries additional information

### Ukraine

#### *Education and awareness raising measures*

Such measures are conducted permanently, also with the Danube Day.

#### **River clean-up actions to installing collection and recycling facilities**

Zakarpattya has **Strategy of Waste Management** developed: which envisages separate collection, sorting and waste recycling. The strategy proposes that the 13 rayons in the Oblast are divided into four distinct sub-regions (Uzhgorod, Mukachevo, Vinogradiv, and Tiachiv) because the sharing of waste management facilities is the most efficient approach. The technological basis for the strategy can be summarised as:

- Organised municipal waste collection on the territory of the whole region;
- Construction of four regional landfills in Uzhgorod, Mukachevo, Vinogradiv, and Tiachiv rayons;
- Construction of two transfer stations in Mijgiryia and Rahiv rayons;
- Separate collection of recyclable waste will be organised in all main settlements in all main settlements of the districts, and in settlements with population exceeding 3000 residents;

- Four sorting facilities will be established in Uzhgorod, Mukachevo, Vinogradiv, and Tiachiv which will receive the separately collected waste. An additional glass sorting line is envisaged at the sorting facility in Uzhgorod where separately collected glass waste will be treated according to the demands of glass recycling plants; and
- The progressive establishment of centralised composting sites in every district.

**The strategy proposes that an inter-municipal association is formed at the regional level for managing the new waste management system and, indeed, for coordinating waste management activities throughout Zakarpattya Oblast.** The total investment cost of the proposed waste management options over a 14-year investment period (2013-2026) is UAH 1,261 million. This is equivalent to UAH 255/tonne of the total waste generated over this period. The operational costs rise from UAH 26 million in 2014 to 104 million in 2026. The operational cost cash flow is equivalent to UAH 262/tonne of waste generated over the assessment period. At present, there are 44 centres of separate collection of recyclables (paper, PET, glass and metal), but they do not cover the whole territory of the Oblast. Also there are no centres of hazardous waste collection (batteries, lamps etc.). In Yanoshi (Beregovsky rayon), at present the plant on sorting and mechanical processing of solid communal waste with the capacity 20 thousand per year, which makes 70% from the total amount of waste, generated in the rayon. Planned actions:

- At present, a new scheme of planning of Beregovsky rayon is planned, where new zones of landfills will be planned.
- In 2018-2019 it is planned to construct waste processing plant in Pistryalovo village (Mukachevo rayon).
- There are also discussions to construct a plant to conserve, sort and recycle (without right to burn) in Tyachiv.
- There is a feasibility study on construction of waste sorting plant with the capacity up to 100 tons per year.

However, at present no funding is envisaged for it. Moreover, a new national waste management strategy is being approved and most probably, Zakarpattya Waste Management Strategy should be revised and amended according to the new national Strategy.

## Romania

- Under the umbrella of public participation, the ICPDR pursues a range of activities. These include also environmental education, awareness raising and outreach. Also at national, basin and local level there many projects, campaigns and activities done by the authorities and NGOs addressing people, especially children having as main objective the education and awareness on waste (including plastics) and the value of the clean water for environment and human health. For example, **national and local events are organized under the umbrella ICPDR slogan “Get active for a cleaner Danube!”** which symbolizes the importance of the public involvement in the Danube River basin protection and conservation, at different locations, in all Romanian river basins. Through the River Basin Committees, there are organized special dedicated meetings for Danube Day and Water Day celebrations. Another important campaign is “Let’s do it!”, where yearly the NARW its River Basins Authorities together with other local authorities and NGOs organise clean up actions along the water courses.
- Within the activities carried out by the National Administration “Apele Romane” (NARW), the activity of maintenance of water courses is periodically carried out in the minor river beds, in the established perimeters of the river and reservoirs and those related protected zones. This activity includes a set of measures and engineering works in order to ensure the stability of the river beds, **but also to ensure the sanitation of the water stretches by cleaning the solid – plastic waste. In case of reservoirs, according to the regulation provisions and operational**

***rules of the reservoir, approved by NARW, the administrator of the reservoir has the responsibility for the management of the wastes that has reached the surface of the lakes, thus having the obligation to take all measures for their collection and disposal.***

- In Romania there is in force specific national legislation related to implementation of the preventive measures for reduction of the generated waste quantities, such as: Law no. 211/2011 on wastes regime with further amendments, Law no. 249/2015 concerning the management of the packages and waste packages, Ministerial Order no. 1281/ 2005 regarding the establishment of the ways to identify the containers for different types of wastes in order to apply the selective wastes collecting. According to national legislation the measures for selective wastes collecting, including the solid plastic wastes, and compliant disposal and recycling of the wastes can contribute to reduction and limitation of water pollution with solid plastic wastes and micro-plastics. Also the National Strategy for Waste Management, the National Plan for Waste Management and regional and local Plans for Waste Management are the basis planning for the implementation of the EU waste management policy in Romania. There are included action plans with specific activities and measures planned for the 2018 – 2025 period such as: increasing the national selective collection level to 52% until 2020, building compliant waste disposal facilities and closing the non-compliant ones, increasing the number and capacities of the waste sorting and treatment facilities etc.

## Hungary

After joining the EU in 2004, Hungary made significant efforts and developed good practices for the protection against solid waste pollution. The country established waste collection facilities and initiated campaigns and rallies for manually collecting plastic bottles and other solid waste.

Regional waste management systems were composed to manage the waste collection facilities in the areas of small settlements and selective waste collection was introduced in towns and villages along the Tisza River.

***Education and awareness raising measures*** Education and awareness raising process is ongoing on multiple channels. State supported actions like “TeSzedd!” (*‘Collect Yourself!’* <http://szelektalok.hu/teszedd/>) and civil actions like PET Kupa (*PET Cup* - <https://petkupa.hu/eng/>) as best practices contribute to a better ecological status of rivers and their environments.

As an example, 190 000 participants collected 2 857 tons in the 4 days-long ‘TeSzedd!’ action in 2016, and the PET Cup of 2018 resulted in 10 tons of solid (plastic) waste collected on the Tisza floodplain. The Hungarian Ministry of Foreign Affairs and Trade as EU Strategy for the Danube Region Priority Area 4 (Water quality) and 5 (Environmental risks) coordinator organized an international roundtable discussion during the Danube Day in 2018. On the 6<sup>th</sup> PET Cup in 2018 the Ministry also financed the participation of the JOINTISZA international boat, which won the plastic waste collection race. The success of the crew (composed by experts from 8 countries of 4 continents) not only made the PET Cup international, but it was reported among others by the United Nations Environment Program on its [webpage](#). EUSDR PA4 experts also participated the Danube Day 2018 event in the Transcarpathian Region to raise awareness.

The National Federation of Hungarian Anglers (MOHOSZ) as a key-actor pays a great attention to fight against littering in the riverbanks’ area.

### ***River clean-up actions to installing collection and recycling facilities***

***In the Upper-Tisza region several hundred waste dumps and illegal landfills are mapped containing several million tons of waste that poses a risk on downstream countries like Hungary. In Hungary no solution, but only symptomatic treatment can be done with the collection of the waste transported through the border following heavy rainfalls. After floods, solid plastic waste is***



accumulating on the floodplain area (deteriorating the environment of Ramsar sites and National Park areas) and at dams. Regional water management directorates, as territorial state agencies are responsible for collecting the waste from rivers, from riverbanks' areas and from floodplains of their operational areas. Nevertheless, their human capacities and financial resources are limited to tackle the present amount of waste transported by the Tisza River. 69 of such harmful events were reported between 2004 and 2017. Since 2004 the 50 bottle/min pollution intensity was exceeded 35 times along the Tisza, 12 times along the Szamos and 1 time along the Kraszna rivers.

In the Hungarian Upper and Middle Tisza Region thousands of working hours were spent to collect the waste arriving mostly from the upstream countries. The amount of the collected waste in 2017 was more than 3000 m<sup>3</sup>. After a selective way of waste collection, the greatest part of the waste was transferred by different technologies of recycling.

Because the Hungarian government did not expect short-term changes in transboundary solid waste pollution the plastic waste issue has recently been addressed by a government decision of 2117/2017. (XII 28.). The Government Decision is focusing on the management of municipal waste arriving from the Upper Tisza and ensures the funds to the related investment planning.

The first Hungarian microplastic monitoring campaign was carried out in 2017 along the Tisza river providing baseline data on the related pollution.

In 2018 it is planned to establish a complex waste treatment system for PET bottles removal. The system consists of monitoring stations in Ukraine; on board thermo camera; waste introduction technique with ships; temporary storage and disposal. Based on a consent of the Hungarian and Ukrainian Governments the establishment of 4 stations would come true by end of 2019. The development costs around 4 million €.

## Serbia

- **Implementation is ongoing** - Waste management law (Official Gazette of the RoS 88/10), National Strategy for waste management for the planning period 2010 – 2019, Environmental protection Law, relevant bylaws and polices, regional and local plans for waste management development, etc.
- **Completed** – "Let's Clean Serbia", initiated by the Ministry of Environment and Spatial Planning (started in 2009 and terminated in 2012). Among the other activities, clean up of the rivers and streams banks and installing of the containers for the plastic waste collection, particularly in rural areas along the rivers and streams, were accomplished within the Serbia. In addition, the intensive awareness campaign was run at the national level.

## 5 TRB integration measures: draught and water scarcity TRB countries additional information

### Ukraine

**Collection of more precise information on irrigation and groundwater depletion is needed on the future uses:** because of permanent reorganization of the geological service in Zakarpattya Oblast, reforms in agricultural sector and lack of coordination and reporting of the groundwater users, there is no system of the monitoring of groundwater depletion. In the past, each user needed to fill a special reporting form on groundwater use 7 GP, but it was cancelled. The reporting of the water used for irrigation is provided only by water users, who applied for the special water use permit, whereas the majority of individual farmers do not provide any reporting.



**With respect to Changes in agricultural practices the following have been started:**

- Shift to drop irrigation;
- Scientific approach to land use (analysis of soils, introducing organic fertilizers, surveys of groundwater levels);
- Installation of automatic hydrometeorological warning stations to protect the harvest against unfavourable weather conditions (significant precipitation, hails), in frame of bilateral agreement on transboundary water management and cooperation with HU regional water administration (FETIVIZIG);
- Restoration of gardening and vineyards;
- Early vegetables growing;
- Agricultural tourism;
- Growing of exotic animals (ostriches, deer, quails), exotic fruits kiwi (Storozhnitsya); persimmons (Kholmovets) and restoring of traditional animal husbandry (water buffalo and sheep breeding); and
- Organic agriculture.

**Reduction of leakage rates**

The current leakage rates are high because of outdated infrastructure. The worst situation is with Mukachevo WWTP, where water losses are up to 70%. The Ukrainian standards adopted during Soviet Union were as follows: 30% of leakage is acceptable.

At present, with new policy of the water pricing (significant increase) the measures are being developed to reduce leakages and relevant financial losses. To solve these problems the EUSDR Priority Area 4 (To restore and maintain the quality of waters) has worked on it since 2015.

**Improving irrigation efficiency**

The efficiency is increased due to the fact, that more and more farmers use drop irrigation.

**Romania**

- Related to **Establishment of common indices to define droughts**, at the national level, NIHWM's research into drought phenomena consists of documenting, analyzing and interpreting hydrological data on low flows, reviewing and establishing of certain indicators for the assessment of the severity degree of hydrological drought. Studies emphasize the adoption of indicators most appropriate to the areas surveyed, as well as to the fact that drought indicators are not an end in themselves but a means of identifying, analyzing and evaluating drought.
- Studies about the knowledge of the **low flow parameters** and, implicitly, the study of hydrological drought events have always existed within the NIHWM, however, in the case of **multi-scalar drought indices approach**, research studies have been carried out since 2011. Until now, the methodology for assessing hydrological drought events based on multi-scalar indices and the methodology regarding low flow indicators have been applied on several river basins (sub-units) located in Romania. In the TRB, the methodologies have been applied at Crisul Alb river sub-basin. Becoming a basic requirement for many issues in hydrology, ecohydrology and water resources management in the context of climate change, a preliminary assessment of the hydrologic drought phenomenon based on a multi-scalar drought index and low flow indices was made in 2017 for the 57 hydrometric stations on Romanian rivers (national level) over the period 1970 - 2015. Both of the drought indices and low flow may constitute a starting point to elaborate good quality studies for low flow management and drought prevention, e.g. guidelines for the management of low flow and drought prevention.
- **Related to the water scarce areas identified for the Tisza Basin**, within the National Institute of Hydrology and Water Management a research study (Identification for national main potential of water scarcity areas in the current regime and the perspective of climate change)

was done in 2015. Based on the analysis of the multi-annual average water volume and the water surface evaporation it was concluded that for the RO part of the TRB, the water scarcity is not a major issue.

- **Regarding the precise information on irrigation, groundwater depletion and Improving irrigation efficiency:**
  - Within its activity NARW pursues the water demand, abstraction and discharge at the level of each river basin. Yearly the water balance is carried out at the level of each river basin and structured based on population, industry, agriculture (including irrigation) and energy. Water abstraction and discharge is monthly assessed and registered at the level of each water user from each river basin. According to the economic and financial mechanism in water management field a contribution for using the water resource is applied for each water user (including irrigation) based on abstracted water volume.
  - According to the "National Program for the Rehabilitation of the Main Irrigation Infrastructure in Romania", rehabilitation of the main irrigation infrastructure is being pursued, which will lead to an increase of the efficiency of the pumping stations, elimination of the losses of water through infiltration from the irrigation channels. Investments in secondary irrigation infrastructure in line with the *Irrigation Investment Strategy* are envisaged. The provisions of the National Irrigation Infrastructure Rehabilitation Program of Romania, are included in River Basin Management Plan, contributing in this way to water saving and lowering the costs associated with water consumption
  - The water policy in terms of irrigation from groundwater is to not authorize for this purpose abstraction from deep aquifers due to the strategic character of this resource. Regarding the depletion of groundwater, the impact on the quantitative status of the related WB is assessed each time when a new user requires a permit in this way.
- **The changes in agricultural practices** applied at the national level are included in the national „Guideline on good agricultural practices for mitigation of the climate changes effects on agriculture” approved by Ministerial Order no. 1170/2008 with further amendments ([http://www.icpa.ro/documente/ADER%20511\\_ghid.pdf](http://www.icpa.ro/documente/ADER%20511_ghid.pdf)). The guideline contents measures to mitigate the climate changes effects on agriculture related to land uses, crops, water uses in agricultures, soil fertilization, animal breeding, and uses of renewable green energy in agriculture. Also as results of the World Bank project “Romania Climate Change and Low Carbon Green Growth Program” (co-financed by the European Regional Development Fund, [www.opera-clima.ro](http://www.opera-clima.ro) ) there were planned certain measures on adequate climate-resilient policies and adaptation measures taken for agriculture sector based on diagnosis analysis and modelling of the measures effects. Most of the measures will be implemented until 2021 and these refer to: rehabilitation and modernization of irrigation systems, encourage windbreaks and soil management to reduce soil erosion, promoting renewable energy sources, promoting crop rotation and organic farming, improving good farming practices, improving awareness of climate change and the need for adaptation and strengthening policy and institutional capacity to support the implementation of the measures.
- **Reduction of leakage rates** consist in supporting the implementation and assuring the necessary investments in the public water services sector in order to reduce the water leakages by transport and distribution of drinking water. In present the rate is around 50% (maximum) and until 2025 is planned to be reduced to 20-25%. Also the irrigation systems need rehabilitation for reduction of the water leakages having in view the protection and non-deterioration of the quantitative status of the water bodies. For the next European financial period (2014-2020) it will be financed the investments in irrigations according to requirements of art. 46 of the Regulation 1303/2013 on support for rural development by the European

Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005).

■ **Regarding Coordinated approach to water allocation and the application of economic incentives or tools such as water pricing:**

The economic and financial mechanism in water resource management field includes various incentive tools for:

- Ensuring rational consumption and sustainable water resource management;
- Reducing emissions of the pollutants in the water resources.

Legislative requirements regarding the allocation of the water resource for different users are based on:

- Calculation of water balance in characteristic sections in order to meet the water demand for all users (households, industry, energy production, irrigation, aquaculture) within the river basin, including the downstream users ;
- NARW applies a system of penalties and bonuses as specific incentives tools in the field of water use and quality protection of the water resource

Penalties are applied for:

- Exceeding the abstracted flow or volume provided in the regulations acts
- Exceeding in the restriction period of the abstracted flow or volume provided in the Water Restriction Action Plan
- Using the water resource in other purpose than it is provided in the Regulation act;
- Exceeding the maximum concentrations provided in the regulation.

■ **Regarding the methodologies used to establish national minimum ecological flows**

- Methodology for “Assessment of ecological flow” has been established based on CIS Guidance 31 Ecological flows in the implementation of the Water Framework Directive.

The Methodology is based on the following principles: defining the ecological flow according to the typology (mountain, hill, plain); the habitat need of the dominant fish species corresponding to each typology; natural dynamics of the hydrological regime taken it will be applied for natural WBs and HMWB. The application of the ecological flow rates established on the basis of the methodology will take into account both the technical feasibility and the socio-economic effect of the measure. In this context, the establishment and implementation of the measures will be based on a technical and economic analysis, taking into account the technical feasibility of the measures, as well as the analysis of the disproportionality of the costs related to the measures as part of the cost-benefit analysis.

- **Comparable national approaches to monitor and report groundwater abstraction to ensure the better management and regulation of groundwater resources:** in Romania all abstractions of groundwater for all kind of water uses are authorized and controlled from water management point of view, except abstractions less than 2 l/s used for individual drinking water purpose. **Also, within its activity NARW pursues the groundwater demand and abstraction at the level of each river basin. Yearly the water balance is carried out** at the level of each river basin and structured based on population, industry and agriculture.

## Slovakia

- Globally, Slovakia is taking part in DRIDANUBE project, which contributes to implementing Integrated Drought Management Programme (IDMP) in Central and Eastern Europe. In 2015 Slovakia joined Czech project Intersucho, which is aimed on monitoring different types of droughts. Slovak Hydrometeorological Institute developing our own system for monitoring

droughts, which uses three worldwide recommended indexes (SPEI, SPI and CMI). The surface water quantity in Slovakia is annually evaluated in balance profiles and results are published in the yearbook “Water balance of surface water quantity”, which enables to get insight into water scarcity in some regions in concrete year. This also applies to groundwater.

- **Water balance** of surface water quantity in the network of balance profiles is evaluated (in average per year and also in monthly step) and published every year. In Slovak territory of the Tisza river basin there exist 52 balance profiles. The results are published in a yearly report “Water balance of surface water quantity”, which includes also a map. This also applies to groundwater.
- **Future water demand for irrigation** was estimated in the frame of Tisza Case Study on Agriculture and Water Management – Slovak Republic carried out in July 2012.
- Recently, in harmony with EC requirements, farming in **NiD vulnerable** zones in Slovakia was modified in national Fertilizer Act No. 136/2000 Coll. in wording of Act No. 394/2015 Coll. Additionally, in 2017 were revised also vulnerable zones (Governmental regulation No. 174/2017 Coll.).
- **Specific measure was not proposed.** This activity is carried out by water supply company and is ongoing based on available finances
- The Reconstruction of irrigation systems is/will be supported via RDP SR 2014-2020. Detail real situation is unknown. **Improving efficiency of irrigation system** depends on economic situation of the irrigators, price of irrigated water and available water. Improvement of irrigation efficiency is actual especially at orchards and vegetable production.
- **Allocation of water resources** is strictly coordinated at the national level in Slovakia. The water pricing policy has a long history and fulfils the role of economic tools as an incentive to use the water effectively in compliance with requirements of the Article 9 of the WFD.
- Respecting criteria of **minimum flow is obligatory** at permitting process for new constructions.
- No measures in respect to **minimum ecological flow** were proposed in national river basin sub-units situated in Tisza river basin.
- The national approach to **monitor and report groundwater abstraction** is regulated by the Water Act No. 364/2004 Coll. as amended. Abstraction of groundwater is paid above the stipulated limit 15 000 m<sup>3</sup> a year or 1250 m<sup>3</sup> a month.

## Hungary

- **Establishment of common indices to define droughts and to get a better insight of water scarcity across the Tisza Basin** Szeged University developed drought indices which are applied in the water management sector during growing season. Indices were developed to identify the water lack (HD10 index) (based on soil moisture and stress factor), the meteorological water lack (relevant for the given day), water stress index (that takes into account the effects on plants of extreme lack of precipitation and warm periods. The indices are calculated for predefined areas;
  - **Maps with water scarce areas identified for the Tisza Basin** based on the predefined areas actual maps can be prepared during drought. Long term maps are available;
  - **Collection of more precise information on irrigation and groundwater depletion is needed on the future uses:**
- IG: The study of 2014 is under revision. Results are expected for 2018.
- CO: Future irrigation water demand was assessed during 2014 with the aim to assess irrigation needs. Also, assessment of realization was done in a study, based on technical and water quantity aspects.
- **Changes in agricultural practices:** refer to horizontal technical measures in Chapter 3 Hungary
  - **Reduction of leakage rates:** refer to horizontal technical measures in Chapter 3 Hungary

- **Improving irrigation efficiency:** refer to horizontal technical measures in Chapter 3 Hungary, the reconstruction of irrigation systems is supported via RDP 2014-2020.
- **Coordinated approach to water allocation and the application of economic incentives or tools such as water pricing:** refer to economic measures in Chapter 3 Hungary, See economic measures above. Process is ongoing on multiple channels regarding agriculture sector.
- **Overview of the methodologies used to establish national minimum ecological flows to be prepared (to lead to agreement on comparable limits and approaches to managing low-flow situations):** Ecological minimum flows (e-flows) are established for all Hungarian RWBs. These e-flows are relevant only during extreme low flow periods. A series of e-flow values are to be established, depending on hydrological and biological conditions. for each month of the year.
- **Establishment of comparable national approaches to monitor and report groundwater abstraction to ensure the better management and regulation of groundwater resources:** the national approach to monitor and report groundwater abstraction is regulated by the law about water management 1995 LVII.

## Serbia

- **Establishment of common indices** to define droughts and to get a better insight of water scarcity across the Tisza Basin: included in the Serbian Water Management Strategy (2017)
- **Other relevant:** Study- Water resources balance in soil to analyse total water budget and define measures to combat droughts at the national level, for the whole territory of Serbia, and TRB share in country is included
- Collection of **more precise information on irrigation and groundwater depletion** is ongoing at the country level.

## 6 TRB integration measures: climate change

Based on ICPDR Climate Change Adaptation Strategy (2012), Climate change is scientifically confirmed worldwide, *inter alia*, by the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup>. Despite ambitious international climate protection objectives and activities, adaptation to climate change impacts is urgently needed. Water, together with temperature, is in the centre of the expected changes. Due to the fact that water is a cross-cutting issue with major relevance for different sectors, water is the key for taking the required adaptation steps. In the Danube River Basin, climate change is likely to cause significant impacts on water resources and can develop into a significant threat if the reduction of greenhouse gas emissions is not complemented by climate adaptation measures.

Framework for CC adaptation integration in the Danube River Basin Management Plans and Integrated Tisza River Basin Management Plans, are EU WFD (and its daughter directives) and EU Floods Directive (2007/60/EC). However, other policies such as the Water Scarcity and Droughts EU Policy and the EC's White Paper on Adaptation are important building blocks for adaptation. In this chapter, short overview of the TRB countries activities that relevant for CC adaptation and water management are provided. In the updated ITRBMP measures presented here will be blended with other measures reported in JOINTISZA technical work packages (3,4,5,6) that are relevant for CC adaptation and integration measures within the TRB.

## Ukraine

The concept of implementation of the state policy in the field of climate change for the period till 2030 was adopted by the Cabinet of Ministers of Ukraine in 2017. According to this document, climate change adaptation strategy should be developed by 2020 and cover period from 2021 to 2030.



## Romania

Having in view the provisions of the EU Strategy on Adaptation to Climate Change, Romania elaborated the **National Strategy on Climate Change 2013-2020** (<http://www.mmediu.ro/categorie/schimbari-climatice/1>) which was approved by Governmental Decision no. 539/2013.

In 2015 there was finalized the **National Action Plan to implement the national strategy on climate change and economic growth based on low-carbon economy for the period 2016-2020** (<http://www.mmediu.ro/articol/mmap-pune-la-dispozitia-publicului-planul-de-actiune-2016-2020-privind-schimbarile-climatice/1126>), as result of project co-financed by European Fund for Regional Development and Operational Programme for Technical Assistance 2007-2013.

The strategies and action plan include adaptation orientation and type of measures on water sector at national, regional and local level, such as:

- Re-assessment of the water resources for all river basins and sub-basins under the context of climate changes:
  - Increasing the multi-annual regulating capacity of the river basins;
  - Limitation of the groundwater uses to water supply for households in the zones where the over-exploitations of the groundwaters can lead to an high drying up of the aquifers;
  - Increasing the water use efficiency in agriculture and implementation of technological measures for crop adaptation to drought and water scarcity;
  - Optimizing the land use management;
  - Extending the national forests fund (including forest buffers) and afforestation of the versants against propagation of the floods;
  - Reduction of the leakages on drinking water distribution network and on sewage network (from 50% to 20% in 2025) by developing and regionalizing the drinking water supply and sewerage systems, rehabilitation and re-design of the water and waste-water infrastructures;
  - Planning the activities at local and regional activities in order to cope with the periods with heat waves, etc;
  - Promoting the integrate informational system on climate change adaptation
  - Development specific researches on climate change adaptation as technical support for planning decision.

In the National Action Plan to implement the national strategy on climate change 2016-2020, the prioritization of the adaptation and mitigation measures included in the National Strategy of Climate Change were done according to the analyze of the benefits, costs and associated risks.

Thus, the priority mitigation actions are focusing on planning and implementation of the measures to reduce the greenhouse gases from the water and wastewaters sectors and increasing the energetic efficiency of the systems. Also the priority adaptation actions are oriented to the reduction of the flood risk and water scarcity.

A part of above actions and measures already started and it were included in the process of elaboration of the updated River Basins Management Plans. In the planning cycle these will be developed and integrated having in view the level of priority and availability of the data and information.

Within the Action Plan of National Climate Change Strategy there are foreseen action related to researches for achieving risk reduction of water scarcity objective. National Institute of Hydrology and Water Management is involved in research related to impact of climate change on water.

The studies reported by Romania that address CC adaptation included in the Romanian report on integration measures are included in JOINTISZA deliverable 4.2.1: TRB Report on water quantity.

Within the Action Plan of National Climate Change Strategy there are foreseen action related to researches for achieving risk reduction of water scarcity objective. National Institute of Hydrology and Water Management is involved in research related to impact of climate change on water.

In the last years, for various river basins in Romania, **a series of complex studies have been carried out on the estimation of the impact of climate change on water resources and on the maximum flow in the analyzed basins. The used methodology was based on the following stages: Hydrological model selection; Hydrological model calibration; Establishment of the climate change scenario; Long-term flow simulation using the hydrological model; Analysis of the study results.**

The study of the effect of climate change on water resources and on maximum discharges in a river basin was based on two long-term hydrological simulations, each for a period of 30 years, the first simulation being carried out for the reference period 1971÷2000 and the second for the next period 2021÷2050.

The input data in the hydrological model were the precipitation and temperature series resulting from the processing of data obtained from climatic simulations using the REMO regional model (simulations that are available in National Institute of Hydrology and Water Management (as a result of the FP6 CLAVIER Project collaboration). To estimate the effect of climate change on water resources, the flow simulation at monthly time step was done using the WatBal hydrological model. This model consists of two main components. The first is the water balance component, which uses continuous functions to describe water movement in a conceptualized river basin and the second one is the component that allows computing of the potential evapotranspiration using the Thornthwaite method.

**The methodology used was applied to 20 river basins in Romania: Vișeu, Iza, Tur, Someș, Mureș, Timiș-Bega, Bega-Veche, Bârzava, Moravița, Caraș, Nera, Radimna, Berzasca, Cerna, Jiu, Olt, Vedea, Argeș, Ialomița and Siret, the surface of which represents 71.63 % of the of the Romanian territory. Some of them are located within the TRB (Vișeu, Iza, Tur, Someș, Mureș, Bega, Bega-Veche).**

Discharge series, with a monthly time step, resulting from the two long-term simulations, were analyzed comparatively in order to identifying the changes in the monthly, seasonal and annual discharge regime.

To estimate the effect of climate change on maximum discharges, the flow simulation at 6-hour time step was done using the CONSUL hydrological model. This deterministic mathematical model allows simulation of flow in both small and large complex river basins, which are divided into homogeneous units (sub-basins). The model allows the calculation of flow hydrographs on sub-basins, their routing and composition on the main river and tributaries.

**The methodology used was applied to 8 river basins in Romania: Crișul Repede, Crișul Negru, Crișul Alb, Mureș, Jiu, Olt, Ialomița and Siret, the surface of which represents 53.0 % of the Romanian territory. Four river basins (Crișul Repede, Crișul Negru, Crișul Alb and Mureș) are located with the RO part of the TRB.** Discharge series, with a 6 hours' time step, resulting from the two long-term simulations, were analyzed comparatively in order to identifying the changes in the maximum monthly, maximum multiannual and maximum with different probabilities of exceeding, as well as the distribution of annual maximum discharges over the year. Another research study mentioned in the Action Plan of National Climate Change Strategy and performed with the National Institute of Hydrology and Water Management is "Identification for national main potential of water scarcity areas in the current regime and the perspective of climate change". Some details are presented Chapter 5 – Drought and water scarcity measures (by 2021) - Maps with water scarce areas identified for the Tisza Basin.



## Slovakia

In Slovakia an ad-hoc inter-ministerial working group has been established with the aim to develop – National adaptation strategy on climate change. The ad-hoc WG coordinates Ministry of the Environment of SR. Last update 2014. Next planned update 2018.

The measure : **STATUS OF CLIMATE CHANGE ADAPTATION STRATEGIES AND GUIDELINES AT NATIONAL LEVEL** (status of the adaptation process) includes the analysis and assessment of possible climate change impacts on different sectors in Slovakia was dealt within the project "Climate Change Impacts and Possible Adaptation Measures in Different Sectors" (Dôsledky klimatickej zmeny a možné adaptačné opatrenia v jednotlivých sektoroch), implemented in 2009 - 2011. The output of the project is the final report that contains the analysis and the proposal of appropriate adaptation measures including economic analyses of potential impacts on GDP and employment. The Slovak Republic also has a wide range of sectoral strategies and action plans addressing the adaptation issues, but they do not take sufficiently into account the mutual synergies and cross-sectoral aspects. The first more comprehensive document in this field, which attempts to link the scenarios and possible climate change impacts with the proposals of appropriate proactive adaptation measures in the widest possible range of fields and sectors, is **THE STRATEGY ON ADAPTATION OF THE SLOVAK REPUBLIC TO THE ADVERSE EFFECTS OF CLIMATE CHANGE" (STRATÉGIA ADAPTÁCIE SR NA NEPRIAZNIVÉ DÔSLEDKY ZMENY KLÍMY) APPROVED IN 2014 THE SLOVAK GOVERNMENT RESOLUTION NO. 148/2014. THIS DOCUMENT WAS UPDATED IN 2018.** The strategy considers the following to be a priority:

- dissemination of information and knowledge on adaptation issues at all levels of governance as well as for the general public;
- strengthening the institutional framework for adaptation processes in the Slovak Republic;
- preparation and development of comprehensive risk assessment methodologies regarding the climate change from the national to local level; development and application of methodologies for economic assessment of adaptation measures of macroeconomic impacts;
- development and implementation of a tool for the selection of investment priorities based on the assessment of the cross-sectoral aspects of adaptation measures.

Adaptation planned in the field of water management includes the following:

- for floods - measures to: reduce runoff from the river basin, reduce the maximum flood discharge, risk assessment;
- for droughts - measures for reasonable use of water resources;
- monitoring.

## Hungary

***Status of climate change adaptation strategies and guidelines at national level (status of the adaptation process):***

As a result of the review of the first Strategy (2008) in 2013 the draft second National Climate Change Strategy for 2014-2025 with a vision for 2050 was developed. It is currently still under the approval process of the Government. Based on the Paris Agreement necessary revision and amendment was carried out on the document.

***The second National Climate Change Strategy*** contains among others the National Adaptation Strategy which aims to reduce risks related to climate change and climate security, to mitigate damages and to present potential awareness raising activities concerning climate change preparation and adaptation.

**Water-related action lines in the Strategy:**

- Short-term: water retention measures, actions resulted from WFD, review of land use, water-saving irrigation and water uses, reduction of flash flood risk, in-depth analyses of changing water regime and hydrology, risk mapping of flooding, wastewater management, development of adaptation measures, indicator systems;
- Mid-term: water retention in water management, flood plain landscape management, navigation under changing climate, prediction of water demands, developing monitoring systems, reaching good qualitative and quantitative status of waters by 202;
- Long-term: full integration of CC adjusted water management in international cooperation and foreign policy.

## Serbia

Serbia *is involved in development of the strategies and guidelines under the ICPDR auspices.*

Climate change adaptation programme was developed under the Initial Nation Communication of the Republic of Serbia (submitted to the UNFCCC in 2010).

In addition, South East European climate change framework action plan for adaptation was adopted in November 14, 2008. through Joint Statement signed by the Ministries responsible for environment of the Republic of Albania, Bosnia and Herzegovina, the FYR of Macedonia, Montenegro and the Republic of Serbia. In the Republic Hydrometeorological Service of the Republic of Serbia Virtual Regional Climate Change Center for adaptation was established by the Join Statement.

UNESCO Category 2 Centre: "Water for Sustainable Development and Adaptation to Climate Change", located at the "Jaroslav Cerni" Institute for the Development of Water Resources, Belgrade, Serbia.

Institutions from Serbia participate in great number of implemented and ongoing projects that address Climate and Global changes (land use, socio-economic) and in some of them adaptation measures are addressed. The full list of projects is provided in the JOINTISZA deliverable 4.2.1 TRB report on water quantity.

*In the Second national communication*, underlined vulnerability assessment and adaptation in hydrology and water resources, agriculture and forestry, based on the fact that these sectors were identified as the most vulnerable and important in the Initial National Communication.

In line with vulnerability assessment the adaptation measures for water and other sectors are proposed.

*Climate change measures relevant for water sector included in the Second national communication*, Table 6.8 (Submitted on the ICPDR Danubius, December 2016) are based on vulnerability assessment. The proposed measures are divided in 4 main categories:

- **Risk reduction** - the more specific groups of adaptation measures that address water use measures (e.g., Application of best available techniques in irrigation and cooperation with upstream countries -bilateral commissions, ICPDR, etc. with respect to water quantity), water quality (e.g., best available techniques applied for diffuse sources of pollution that mainly originate from the agriculture), protection against the adverse effects of water (e.g., development of flood protection plans for international rivers and large river basins – Danube, Tisza, etc ), and multipurpose measures (e.g., increase in water storage capacity);
- **Policy and legal framework** (e.g., water management strategy, RBMPs, other planning documents);
- **Monitoring and research** (e.g., improving monitoring and other non-structural measures to combat droughts, etc.); and

- **Capacity building and public awareness** (e.g., improvement of coordination/ harmonized activities of institutions and organizations in charge at local, regional and national level, etc).

*For all proposed adaptation measures the classes are assigned in the following way:*

- No regrets - NR;
- Low regrets - LR; and
- Techno-economic analyses required – TEAR.

*In relation to the time required for implementing the measure they are classified based on following criteria:*

- Short term-ST;
- Medium term-MT;
- Long term-LT; and
- Continuous long term – CLT.

## 7 Conclusions

This Annex provides additional data and information relevant for following measures within the TRB:

- GWBs programme of measures;
- TRB Integration measures - Horizontal;
- TRB Integration measures - Solid Plastic Waste;
- TRB Integration measures - Draught and Water Scarcity;
- TRB Integration measures - Climate Change.

### GWBs's measures

In Ukraine, there are no status assessment and resulting measures. Although Slovakia reported additional GWB in comparison with the First ITRBMP all GWBs are in good chemical and quantitative status. With respect to quantitative status, Romania reported no change for all 11 TRB GWBs in comparison to the First ITRBMP, namely all of them are in a good status. On the other hand, number of measures for GWBs chemical status increased in this reporting period from 8 to 9. Hungary reported additional 7 GWBs relevant for TRB. Based on country data, there are measures for both GWBs with good and poor chemical status. With respect to quantitative status, there is evidence that number with GWBs with good status decreased that generate increase in number of measures. There are 2 more GWBs in poor chemical status and associated measures in comparison with the former reporting period and 10 more GWBs with poor quantitative status in comparison with the first planning period, while number of measures increased from 12 to 20. The number of GWBs in Serbia are the same as it was reported in the First ITRBMP, 7 for poor quantitative status.

In summary, there is increase in number of TRB GWBs measures in later period, from 8 to 61, and from 8 to 54, for qualitative and quantitative status within the TRB, respectively.

### TRB integration measures

As presented in Chapters 3- 6, all Tisza countries reported on integration measures. For each category of integration measures, i.e., horizontal, solid plastic waste, draught and water scarcity and climate change implementation criteria are assigned, and additional information are provided at the country level.

- Majority of horizontal measures are identified as PG (planning ongoing) and IG (implementation ongoing), only Romania characterized them as on going, while Ukraine and Serbia assigned not started (NS) criterion for incentives (ITRBMP Update Table VII.3);
- Solid plastic waste measures are mainly characterized IG, only Romania reported completed for all measures (ITRBMP Update Table VII.5);
- Measures that address drought and water scarcity within TRB (ITRBMP Update Table VII.5) include 10 subcategories and for majority of them criteria IG or CO are assigned in Romania, Slovakia and Hungary. In Ukraine and Serbia, 50% and 30% of subcategories are identified as not started, in a given order. For measure relevant for development of GW model to assess depletion criterion NA are assigned for Romania, Slovakia and Hungary.
- Climate Change measures are not reported based on criteria assigned for other horizontal measures. In *Ukraine*, Climate Change adaptation strategy is planned to be developed by 2020 and cover period 2021- 2030 and in *Slovakia* the National adaptation strategy on CC was updated in 2014, and next update is planned for 2018. *Romania* developed National Strategy on Climate Change 2012-2020 and National Action Plan for the implementation of strategy. The full list of relevant measures is included in chapter 6 of this document. In addition, the National Institute of Hydrology and Water Management is involved in research that address CC impact on water. In the last years, for various river basins in Romania, a series of complex studies have been carried out on the estimation of the impact of climate change on water resources and on the maximum flow in the analysed basins. The used methodology was based on the following stages:
  - Hydrological model selection;
  - Hydrological model calibration;
  - Establishment of the climate change scenario;
  - Long-term flow simulation using the hydrological model;
  - Analysis of the study results.

In **Hungary** the Second National CC strategy (Draft) for period 2017-2020 with vision for 2050, and approval process by the Government is ongoing. This document includes National adaptation strategy. The measures proposed with respect to time horizon are short -term, mid-term and long term. Adaptation measures are from river basin multi-annual regulation capacity increasing, GW use limitation by households in zones where over -exploitation is observed to land use management optimization and extension of the national forest fund. **Serbia** developed the Second national communication to UNFCCC and based on vulnerability assessment proposed measures that contribute o water sector adaptation to CC are divided in 4 main categories (Risk reduction, policy and legal framework, monitoring and research, and capacity building and public awareness). For all proposed measures following classes are assigned: No regrets, Low regrets and techno-economic analyses required, and with respect to time horizon required for implementation the adaptation measures are categorized in the following way: short-term, medium term, long term and continuous long term.

## Abbreviations

TRB	Tisza River Basin
ICPDR	International Commission for the Protection of the Danube River
UNFCC	The United Nations Framework Convention on Climate Change
RBMP	River Basin Management Plan
ITRBMP	Integrated Tisza River Basin Management Plan

## References

The First Integrated Tisza River Basin Management Plan

EU Water Framework Directive

The ICPDR CC adaptation strategy

ICPDR DanubeGIS

Data and information reported by Tisza countries:

### Ukraine:

Datasets available on the ICPDR DanubeGIS

Ukraine\_JoinTisza template for GWB data collection\_Act.4.1.xls

JOINTISZA Report for GWBs data Ukraine.doc

Country report on measures\_Act.4.3

### Romania:

Datasets available on the ICPDR DanubeGIS

Romanian\_JoinTisza template for GWB data collection\_Act.4.1.xls

JOINTISZA Report for GWBs data Romania.doc

Country report on measures\_Act.4.3

### Slovakia:

Datasets available on the ICPDR DanubeGIS

Slovak\_JoinTisza template for GWB data collection\_Act.4.1.xls

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JOINTISZA Report for GWBs data Serbia.doc

Country report on measures\_Act.4.3



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