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Report on Evaluation of the Significant Water Management Issues and proposal of effective measures with respect to expected development in the future

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Disclaimer

This Report is based on data delivered by the Tisza River Basin countries as of July 2018. Data were incorporated in to the Danube GIS database as well as into questionnaires send out in December 2017.

Sources other than project partners have been clearly identified in this report.

This report has been elaborated in line with the methodology for the Danube River Basin Management Plan – Update 2015. A more detail level of information is presented in the national river basin management plans in the Tisza River Basin countries.

Data in this report has been dealt with, and is presented, to the best of our knowledge. Nevertheless, cannot be ruled out.

Contents

Chapter 1 Introduction

The report on **"Evaluation of the Significant Water Management Issues (SWMIs) and proposal of effective measures with respect to expected development in the future** has been prepared as a part of JOINTISZA project activities and should serve as a baseline for update of the Integrated Tisza River Basin Management Plan (update ITRBM Plan). Elements of the SWMIs (organic, nutrient and hazardous substances pollution and hydromorphological alterations) and their previous development, described in reports A 3.2 (Significant pressures relevant for the Tisza River Basin), as well as the Surface water status assessment (A 3.1) were utilised as base for selection of measures and their prioritisation, in accordance with national programmes of measures of Tisza countries. Estimation of development SWMIs in the future have been considered. Joint Programme of Measures (JPM) is structured according to the SWMIs. As in the case of pressure analysis, the ICPDR expertise in area of modelling and creation of spatial information were used based on the Danube GIS databases.

Other activities related to development of this report were focused to the collection and processing the actual information for evaluation of pressures from human agglomerations, industry, agriculture and hydromorphological alterations and other relevant sectors for each significant management issue. The organic, nutrient, hazardous substances pollution and hydromorphological pressures assessment followed the similar approach as in the case of the Danube River Basin Management Plan. The evolution by 2015 has been assessed based on questionnaires filled in by the Tisza River countries, project partners from Ukraine, Romania, Slovakia, Hungary and Serbia.

The additional relevant water management issues in the Tisza River Basin are water quantity issues (floods, excess water, drought and water scarcity, climate change). These issues are not the subject of this report according to the JOINTISZA project structure and relevant reports will be prepared in frame of Work packages 4 and 5.

The background documents as Integrated Tisza River Basin Management Plan (2011), Analysis of the Tisza River Basin (2007), the Danube River Basin District Management Plan (update 2015) and the others are given in the references.

Chapter 2 Joint Programme of Measures (JPM)

The JPM comes out from the Report on significant pressures relevant for the Tisza River Basin and the Report on the surface water status assessment and include, as a consequence, measures of basin-wide importance oriented towards the agreed visions and management objectives for 2021. It is based on the national programmes of measures, which shall be made operational by December 2018, and describes the expected improvements in water status by 2021.

Priorities for the effective implementation of national measures on the basin-wide scale are highlighted and are the basis of further international coordination. Some additional joint initiatives and measures on the basin-wide level that show transboundary character are presented as well. They are undertaken through the framework of the ICPDR.

The JPM is structured according to the Significant Water Management Issues (organic, nutrient and hazardous substances pollution and hydromorphological alterations). It follows the basin-wide management objectives for each SWMI in order to achieve the WFD environmental objectives. An important step towards the achievement of these objectives is the implementation of the JPM from the 1st ITRBM Plan 2011, implemented between 2009 and 2015. For each of the SWMIs information is provided on state of play with regard to the implementation of these measures (according to WFD Annex VII B. 3. and 4.). More detailed information can be obtained from the national RBM Plans.

The JPM represents more than a list of national measures as the effect of national measures on the Tisza basin-wide scale is also estimated and presented. Key findings and conclusions on identified measures and their basin-wide importance, as well as priorities regarding their implementation on the basin-wide scale, are summarised as part of the JPM. The implementation of the measures of basin-wide importance is ensured through their respective integration into the national programme of measures of each Danube country. A continuous feedback mechanism from the international to the national and sub-basin level and vice versa will be crucial for the achievement of the basin-wide objectives, in order to improve the ecological and chemical status of surface water bodies.

The SWMIs of organic, nutrient and hazardous substances pollution have been approached taking into account the specific inter-linkages between them. The basic principles of those inter-linkages are described. The conclusions on these three SWMIs but also hydromorphological alterations, serve as an important follow-up for the improvement of understanding of the linkages between respective TRB river loads and the ecologic response in the TRB. This improvement should be based upon additional monitoring results that will be available in the coming years.

The JPM does not address basic and supplementary measures (WFD Article 11(3) & (4)) separately. However, as the supplementary measures are of importance on the national level, they have been taken fully into account and are therefore indirectly reflected.

Chapter 3 Surface waters - rivers

3.1 Organic pollution

3.1.1 Vision and management objectives

The Tisza River Basin-wide vision for organic pollution is zero emission of untreated wastewaters into the waters of the Tisza River Basin District.

The following management objectives will be implemented by 2021 as steps towards the vision:

EU MS and Non-EU Member States:

- Further reduction of the organic pollution of the surface waters via urban waste water within the TRB by implementing the Urban Waste Water Treatment Directive (EU MS) and by constructing a specified number of wastewater collecting systems and municipal wastewater treatment plants (Non-EU MS).
- Further reduction of the organic pollution of the surface waters from the major industrial and agricultural installations by implementing the Industrial Emissions Directive (EU MS) and introducing Best Available Techniques at a specified number of industrial facilities (Non-EU MS).

3.1.2 Progress in implementation of measures from 1st ITRBM Plan

The Tisza countries committed themselves in the ITRBP that by 2015 at the latest – all discharges for untreated wastewater from agglomerations with >10,000 PE and from all major industrial and agricultural installations, through:

EU Member States:

- Implementation of the Urban Waste Water Treatment Directive (UWWTD).
  - Where required, construction and/or improvement of wastewater treatment plants according to the ICPDR Emission Inventory by 2015.
  - Increase in the efficiency and level of treatment thereafter when necessary.
- Implementation of the Sewage Sludge Directive (86/278/EEC) and IED (2010/75/EU), (IPPC Directive).
- Implementation of Industrial Emission Directive (2010/75/EU).
  - Improvement of wastewater treatment plants for major industrial and agricultural installations and implementation of best available technologies (BAT).
- Reduction of the total amount of organic pollutants discharged into the Tisza River system to levels consistent with the achievement of the good ecological status/chemical status/good ecological potential in the Tisza River Basin by 2015.

Non-EU Member States:

- Specification of the number of wastewaters collecting systems (connected to wastewater treatment plants) planned to be constructed or extended by 2015.
- Specification of the number of municipal and industrial wastewater treatment plants planned to be constructed by 2015 including: the specification of treatment level (secondary or tertiary treatment) and the specification of emission reduction targets.

The 1st ITRBM Plan included the measures that are legally required for EU Member States and other measures that are realistic to be taken by the Non-EU Member States have been considered.

Romania has designated all of its territory (including its coastal waters) as a sensitive area under the Article 5(8) of UWWTD, in order to protect the Black Sea environment against eutrophication. Accordingly, the entire Danube River Basin is considered a catchment area for the sensitive area under Article 5(5) of the UWWTD. This means that discharges from urban wastewater treatment plants situated in the Danube catchment area, including the Tisza River Basin, need to apply more stringent treatment from agglomerations >10,000 PE. These provisions were not applied to individual plants if it can be shown that the minimum percentage of reduction of the overall load in that area is at least 75% for total P and 75% for total N, under Article 5(4) of UWWTD.

The following assumptions for measures to be implemented by 2015 had been considered:

- EU Member States (Slovakia and Hungary, except Romania): Implementation of the UWWTD. For EU Member States that have already fulfilled Article 5(4) of UWWTD by 2005/2006, the same reported treatment levels for agglomerations >10,000 PE were considered.
- Romania (transition period for full UWWTD implementation: 31/12/2018) it was considered that all agglomerations >10,000 PE should be equipped with N and P removal (secondary and tertiary treatment). Further agglomerations 2,000-10,000 PE should be equipped with secondary treatment for 77% of the total biodegradable load.
- Non-EU Member States: the reported number Ukraine (14) and Serbia (4) of wastewater treatment plants with secondary treatment/more stringent treatment to be constructed by 2015.

The assessment of organic pollution in the 1st ITRMP showed that total of 1,088 agglomerations ≥2000 PE are located in the Tisza River Basin. Out of these, 22 agglomerations (4.693 million PE) are larger than 100,000 PE. The COD and BOD emissions to the environment (water and soil) from agglomerations (≥2,000 PE) in the Tisza River Basin were 230 kt/y and 129 kt/y respectively (reference year 2005/2006). But due to significantly differed basic data concerning the number of agglomerations in the basin it is problematic to compare those data with actual figures (985 agglomerations with a population equivalent more than 2,000) available based on the data reported by the Tisza River countries (reference year: 2011/2012), since the differences concerning the number of agglomerations is 103 agglomerations more as were assessed in the previous plan. This situation is a result of the rearrangement of agglomerations delineation in Romania and Hungary. Therefore, achieved progress is difficult to be quantified.

In the first management cycle significant investments have been made in the field of organic pollution control in the TRB resulting in reduction of organic pollution. The number of agglomerations for which waste water treatment plants have been/will be constructed, upgraded or extended, is indicated in Annex 1 on measures in urban waste water and industrial sectors.

Construction of urban waste water treatment plants with at least biological treatment and application of enhanced industrial technologies have contributed to a decrease of organic pollution. Sewer systems and urban waste water treatment plants have been constructed, upgraded or extended at almost 407 agglomerations (≥2,000 PE) by 2015. At additional 280 agglomerations waste water infrastructures are currently under construction/rehabilitation or planning, especially in the EU MS.

Construction of urban waste water treatment plants with at least biological treatment and application of enhanced industrial technologies have contributed to a decrease of organic pollution. Sewer systems and urban waste water treatment plants have been constructed, upgraded or extended at almost 412

agglomerations (≥2,000 PE) by 2015. At additional 280 agglomerations waste water infrastructure is currently under construction/rehabilitation or planning, especially in the EU MS.

3.1.3 Summary of measures of sub-basin-wide scale

In spite of the fact that the investments have been already made in the wastewater infrastructure, additional measures should be taken in the future. According to the presented assessments and the 9th Implementation Report on the implementation status and the programmes for implementation (as required by Article 17) of Council Directive 91/271/EEC concerning urban waste water[1], the new EU MS have a considerable delay in the implementation of the UWWTD mainly due to financial limitations. Another issue of concern is the lack of compliance in a significant number of agglomerations 2,000 and 10,000 PE.

The objectives of the 1st DRBM Plan as well as the 1st ITRBM Plan were related to the Accession treaty obligations of the new EU MS which were rather optimistic. Thus, the progress achieved is slower than it was originally planned and the objectives will probably be accomplished with a delay as the implementation of the respective measures is lagging behind in many countries. The transition period obtained by some EU MS for the implementation of the UWWTD requirements was considered as a funding prioritisation criterion (e.g. Romania: most agglomerations between 2,000 and 10,000 PE will be in line with the UWWTD provisions after 2015, with a transition period until 2018, and therefore the agglomerations with more than 10,000 PE have a higher priority).

Therefore, further development of the urban waste water sector is needed in the next management cycle to help achieving the TR basin-wide vision for organic pollution. Management activities are legally determined for the EU Member States (EU MS) through several EU directives. The UWWTD specifically focuses on the sewer system and waste water treatment system development. EU MS are obliged to establish sewer systems and treatment plants at least with secondary (biological) treatment or equivalent other treatment at all agglomerations with a load higher than 2,000 PE (also for agglomerations smaller than 2,000 PE appropriate treatment must be ensured).

Non-EU MS - Ukraine and Serbia also intend to make efforts to achieve significant improvements. They are going to construct a specific number of sewer systems and waste water treatment plants till 2021 that is realistically executable. Nevertheless, realistic planning of investments is needed in line with the WFD/DRBM Plan requirements and funding availability. Efforts should be made to reinforce the capacity of the countries to identify and prepare environmental investment projects and to foster the development of investment projects. Supporting Non-EU MS to find appropriate financial sources and to achieve progress is still a challenge in the Tisza River Basin and it should be further facilitated.

The situation of small agglomerations below 2,000 PE should also be addressed. Individual houses or small urban communities at whose scale construction of centralised conventional sewage collection and treatment systems is financially and/or technically disadvantageous should be equipped with appropriate small treatment facilities. Promotion of alternative decentralized treatment technologies in line with the national priorities and legislation should be further encouraged. These small-scale solutions should also be considered even for agglomerations above 2,000 PE, where construction of sewer systems and centralized treatment plants is not feasible therefore alternative methods (individual and other appropriate systems) are more reasonable and must assure the same level of environmental protection as centralised systems.

[1] http://ec.europa.eu/environment/water/water-urbanwaste/implementation/implementationreports_en.htm

Organic pollution stemming from industrial facilities and large farms should also be further addressed by the Tisza countries. For EU MS the Industrial Emissions Directive (IED, repealing inter alia the Integrated Pollution Prevention and Control Directive (IPPCD) by the 7th of January 2014) dictates that authorities need to ensure that pollution prevention and control measures at the major industrial units are up-to-date with the latest Best Available Techniques (BAT) developments. The industrial plants covered by the Directive must have a permit with emission limit values for polluting substances to ensure that certain environmental conditions are met. Application of BAT in the large industrial and agro-industrial facilities was mandatory in EU MS till the end of 2007, with a gradual transition period for some new EU MS. It is expected that all relevant facilities in the EU MS will meet the IED requirements according to the legal deadlines.

Reporting is also obligatory, information on these industrial facilities must be available for the public. For this purpose, emission data of facilities from different industrial sectors and over a certain capacity threshold have to be uploaded to the E-PRTR. Application of BAT is recommended for Non-EU MS, especially for some special industrial sectors, like chemical, food, chemical pulping and papermaking industry. For these sectors ICPDR elaborated supporting guidance documents that recommend appropriate BAT. These documents are planned to be revised and eventually updated or extended in the next management cycle. Implementation of other Directives like Nitrate Directive (ND) and Sewage Sludge Directive (SSD) that respectively concern the fate of nutrients and hazardous substances have also benefits for organic pollution reduction. Regulation of manure and sewage sludge application at agricultural fields positively affects the diffuse organic pollution as well reducing organic matter available at the fields for run-off and sediment transport. Similar regulatory actions are recommended for the Non-EU MS.

3.1.4 Future development scenarios

Baseline scenario by 2021

EU MS: The baseline scenario assumes the establishment of public sewer systems at all agglomerations with population equivalents more than 2,000 and connection of these agglomerations to urban wastewater treatment plants with appropriate technology through the implementation of the UWWTD in line with the agreed national objectives. Taking into account that the Black Sea coastal waters are considered as sensitive area under Article 5 of this Directive the appropriate technology is defined as secondary treatment for agglomerations below 10,000 PE and more stringent treatment for agglomerations above 10,000 PE. Alternatively, the latter provision has not to be necessarily applied for each individual plant if the overall load reduction of the EU MS is at least 75% for both, total N and total P. Introduction of appropriate treatment at agglomerations with PE less than 2,000 is also assumed according to the UWWTD requirements (small agglomerations with existing sewer systems). The first priority is to upgrade the treatment technology at agglomerations above 10,000 PE by 2021, all EU MS will comply with the obligations of the UWWTD by 2021.

Non-EU MS: Construction/upgrading of a specific number of wastewaters collecting systems and municipal wastewater treatment plants (with specified treatment technology) is assumed in line with the national prioritisation which can be accomplished (Table III.1).

Table III.1: Number of agglomerations in Non-EU MS where waste water collecting systems and treatment plants will be constructed or upgraded by 2021

	Primary treatment	Secondary treatment	Tertiary treatment

Agglomerations	12	5	2
PE concerned	76,987	75,117	55,808

Midterm Scenario

In addition to the baseline scenario this scenario assumes completed implementation of the UWWTD in all EU MS and P removal for all agglomerations above 10,000 PE in the Non-EU MS.

Vision Scenario

This scenario goes beyond the midterm scenario. It assumes that the full technical potential of wastewater treatment regarding the removal of organic material and nutrients is exploited for both, the EU and Non-EU MS. The scenario assumes that agglomerations above 10,000 PE are equipped with N and P removal, whereas all agglomerations below 10,000 PE are equipped with secondary treatment.

3.1.5 Estimated effect of measures on the sub-basin-wide scale

Maps on the above described scenarios for urban waste water sector are presented in Map 1-3 showing the envisaged future infrastructural developments in sewerage and waste water treatment technology. The change in the connection rates of the basin-wide waste water load (PE) to different collection and treatment systems is shown in Figure III. 1. Towards the vision scenario, the amounts of unconnected and untreated PE are gradually decreasing to zero. In the next management cycle about 10.8 million PE will be connected to treatment plants, but still 702,056 PE will be not collected and not treated.

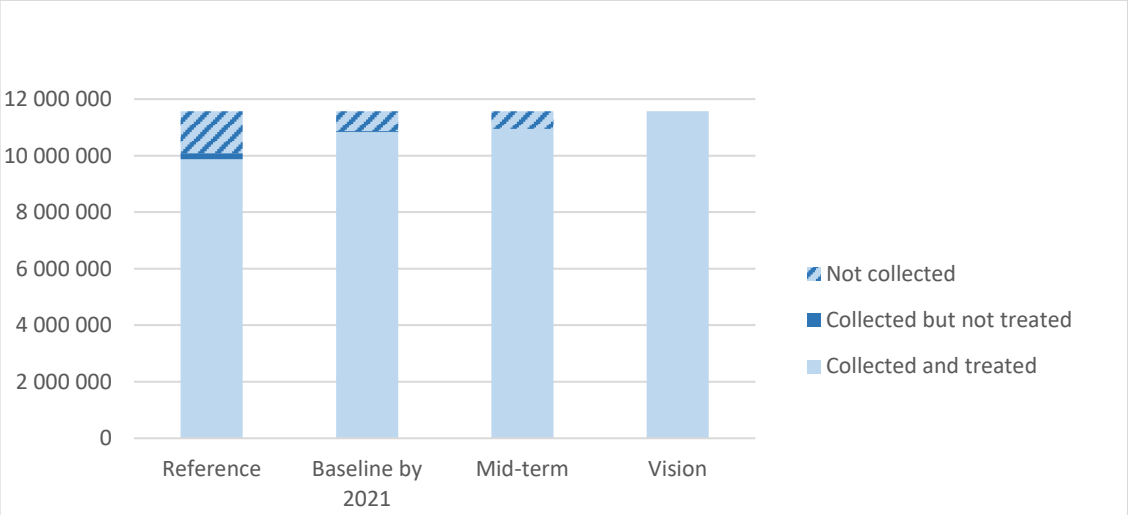

Figure III.1 Waste water load (PE) of the agglomerations according to future scenarios

Estimated impacts of the baseline scenario on BOD and COD emissions are presented in Figure III. 2. Besides discharges directly entering surface waters (12,595 tons BOD per year, 37,220 tons COD per year) the emissions released to soil and groundwater via not collected waste water and collected but not treated are also remarkable for the reference status (21,545 tons BOD per year, 41,3 tons COD year).

The baseline scenario by 2021 estimates that emissions via uncollected waste water will significantly decrease due to the construction of sewer systems. This would raise the inputs of surface waters through connection to treatment plants and the subsequent concentrated discharges. However, as the treatment levels will be more enhanced resulting in higher removal rates, the overall surface water emissions will also decline. Some 59.2% (BOD) and 52% (COD) decrease in the surface water discharges is expected. This reduction is calculated for the EU MS where the UWWTD will be fully implemented. Despite the progress expected the baseline

scenario will probably not ensure the full achievement of the WFD environmental objectives by 2021 as a number of agglomerations will not have appropriate collection and treatment system established in all the TRB countries mainly in non-EU MS. Total BOD and COD emissions released to the environment would be reduced according to the vision scenario by about 88.2% and also about 78.4%, respectively.

According to the mid-term scenario not collected and not treated fluxes will gradually decrease towards the vision (no uncollected and untreated waste water) due to the further developments, particularly in the non-EU MS. Despite the high connection rates to treatment plants the surface water emissions will also drop by 33.4% (BOD) and 16.8% (COD) in comparison to the reference status due to the enhanced elimination efficiency for organic substances.

Total BOD and COD emissions released to the surface waters would be reduced according to the vision scenario by about 56.6% and also about 21.24%, respectively.

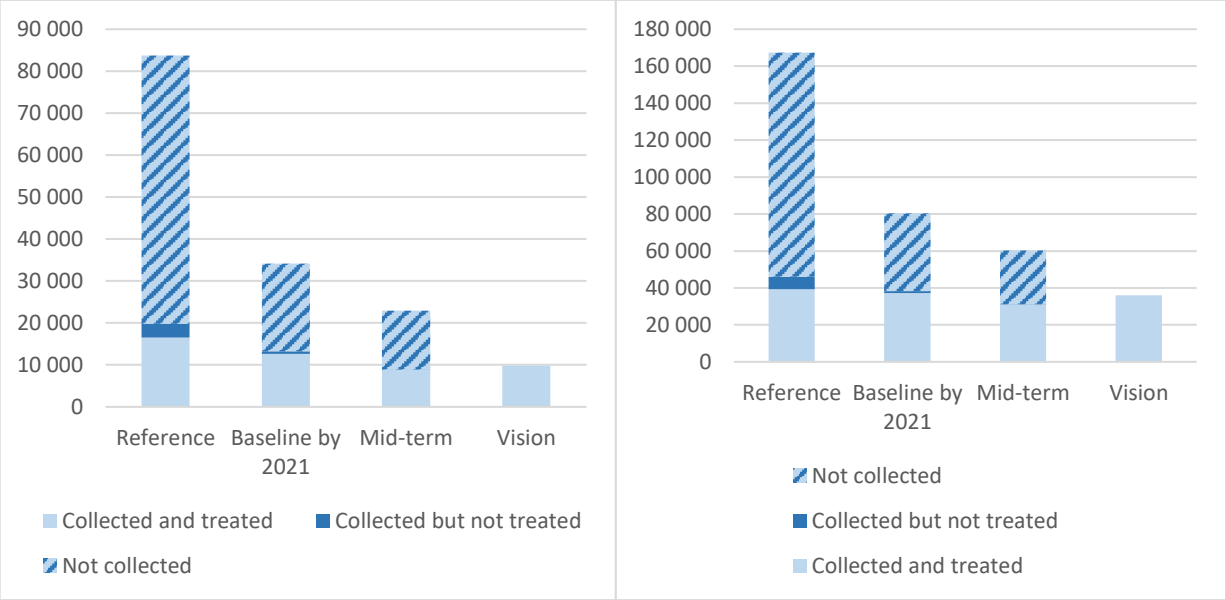

Figure III.2 BOD (left) and COD (right) emissions via urban waste water according to future scenarios (expressed in tons per year)

3.2 Nutrient pollution

3.2.1 Vision and management objectives

The Tisza River Basin-wide vision for nutrient pollution is the balanced management of nutrient emissions via point and diffuse sources in the entire Tisza River Basin so that neither the waters of the Tisza River Basin, the Danube River Basin or the Black Sea – via the Tisza River Basin – are threatened or impacted by eutrophication.

The following management objectives will be implemented by 2021 as steps towards the vision:

EU MS and Non-EU Member States:

- Further reduction of the total amount of nutrients entering the Tisza River and its tributaries and the nutrient loads transported into the Danube and the Black Sea.
- Further reduction of the nutrient point source emissions by the implementation of the management objectives described for organic pollution as they address the nutrient pollution as well.
- Further reduction of the nitrogen pollution of the ground and surface waters by the implementation of the EU Nitrates Directive according to the developed action programs within the designated vulnerable zones or the whole territory of the country (EU MS).
- Ensuring sustainable agricultural production and soil nutrient balances and further reduction of the diffuse nutrient pollution by implementation of basic and cost-efficient supplementary agro-environmental measures linked to the EU Common Agricultural Policy (EU MS) and by implementation of best management practices in the agriculture considering cost-efficiency (Non-EU MS).
- Further decrease of the phosphorus point source pollution by implementation of the EU Regulation on the phosphate-free detergents (EU MS) and by reduction of phosphates in detergent products (Non-EU MS).

3.2.2 Progress in implementation of measures from 1st ITRBM Plan

In 2004 the Tisza countries adopted the Tisza Declaration[2] in the framework of the ICPDR Ministerial Meeting and agreed that in the coming years they would aspire "to reduce the total amount of nutrients entering the Tisza and its tributaries to levels consistent with the achievement of good ecological status in the Tisza River and to contribute to the restoration of an environmentally sustainable nutrient balance in the Black Sea".

The following management objectives were foreseen by 2015 in the 1st ITRBM Plan, for both EU and Non-EU Member States:

- Reduction of the total amount of nutrients entering the Tisza and its tributaries to levels consistent with the achievement of the good ecological/chemical status in the Tisza River Basin by 2015.
- Reduction of discharged nutrient loads in the Black Sea Basin to such levels that permit the Black Sea ecosystems to recover to conditions similar to those observed in the 1960´s.
- Reduction of phosphates in detergents, preferably by eliminating phosphates in detergent products.
- Implementation of the management objectives described for organic pollution with additional focus on the reduction of nutrient point source emissions.
- Implementations of best environmental practices (BEP) regarding agricultural practices for reduction of diffuse sources.
- Create baseline scenarios of nutrient input by 2015 taking the preconditions and requirements of the Tisza countries (EU Member States and Non-EU Member States) into account.
- Definition of basin-wide, sub-basin and/or national quantitative reduction targets (i.e. for point and diffuse sources) taking the preconditions and requirements of the Tisza countries into account.

The evaluation of SWMIs indicates that the measures to control point source emissions include nutrient removal at urban waste water treatment plants (all treatment plants under construction or planned at agglomerations above 10,000 PE in the EU Member States contain tertiary treatment technology), enhanced treatment technologies at industrial facilities and application of P-free detergents in consumer laundry sector (see Annex 1 on measures in urban waste water and industrial sectors) have been partially implemented.

In the agricultural sector, action programs are implemented or under implementation within the designated Nitrate Vulnerable Zones (NVZ) or action programs are implementing over the whole national territory to

[2] ICPDR Document IC 089: The Danube Basin – Rivers in the Heart of Europe (Danube Declaration), 2004 (www.icpdr.org).

prevent nitrate pollution of water bodies, as in Romania. In addition, measures under the Codes of Good Agricultural Practice are voluntarily implemented outside the zones. Moreover, a set of BAPs are applied on agricultural farms linked to the EU Common Agricultural Policy (CAP) and other national programmes (see Annex 4 on measures in agricultural sector).

Upgrading waste water treatment plants with nutrient removal technology at agglomerations above 10,000 PE, application of phosphate-free detergents and enhancement of best agricultural practices in agriculture are current measures being implemented to reduce nutrient pollution. All recently constructed treatment plants in the EU MS with a design capacity above 10,000 PE have tertiary treatment technology.

To prevent nitrate pollution of water bodies NVZs have been designated in the EU MS. The whole territory approach has been applied in Romania.

3.2.3 Summary of measures of sub-basin-wide scale

The measures under implementation have been contributing to the reduction of nutrient inputs into surface waters in the TRB but further efforts are still needed. Continuation of measures implementation in urban waste water, industrial, market production and agricultural sectors is necessary in the next management period. As the point source pollution for nutrients and organic substances are highly interlinked their regulation is partially ensured by the same measures to be implemented. In the EU MS, the UWWTD requires more stringent removal technology than secondary treatment if the recipient water body is sensitive to eutrophication or the catchment in which a particular urban waste water treatment plant is located belongs to a sensitive water body. Since the Black Sea was significantly suffering from eutrophication and the receiving coastal areas have been designated as a sensitive area under the UWWTD, more stringent treatment technology than secondary treatment is needed at least at the medium-sized and large agglomerations as dissolved nutrients (especially phosphorus) from urban sector are primarily responsible for surface water and coastal sea eutrophication. According to the UWWTD waste waters from agglomeration with a load higher than 10,000 PE in the EU MS of the TRB have to be subject to tertiary treatment (nutrient removal) or a reduction of at least 75% in the overall load of total phosphorus and nitrogen entering all urban waste water treatment plants has to be achieved.

The EU MS in the TRB obtained different implementation period depending on the date of accession to the EU and specific situation in particular country. More stringent technology is strongly suggested for the Non-EU MS as well in order to ensure a consistent development strategy in waste water sector.

The implementation of the IED in the EU MS and BAT recommendations in Non-EU MS can significantly reduce industrial and agricultural point source nutrient pollution.

The measures implemented in the urban waste water sector might have short-term negative impacts if establishment of public sewer systems is not accompanied with adequate nutrient removal technology before discharging into the recipients. Simple collection and concentrated discharge of waste water without sufficient tertiary treatment usually cause higher nutrient pollution of surface water bodies than dispersed smaller waste water discharges from septic tanks that percolate into groundwater and reach surface waters via base flow.

Application of phosphate-free detergents in laundry is a great example for source control by reducing phosphorus inputs from laundry waste water. Introduction of phosphate-free detergents is considered to be a fast and efficient measure to reduce phosphorus emissions into surface waters. For the large number of settlements smaller than 10,000 PE the UWWTD does not legally require phosphorus removal. Reduction of phosphate in detergents could have a significant influence on decreasing phosphorus loads in the TRB, particularly in the short term before all countries have built a complete network of sewers and waste water

treatment plants. The ICPDR has been highly supporting the introduction of the phosphate-free detergents in the Danube countries which committed themselves at ministerial level to initiate the introduction of a maximum limit for the phosphate content of the consumer detergents. The Detergents Regulation[3] has recently been put into force for consumer laundry and will be applicable for automatic dishwashing on the 1st of January 2017. It prescribes limitations on the phosphate contents of a detergent dose in a laundry/dishwashing cycle. The Regulation has to be implemented in all EU MS and similar efforts are either already in progress or recommended to be made in Non-EU MS.

Diffuse pathways based on the updated database of the former MONERIS setup (2nd DRBMP) for the Tisza River Basin resulted in higher TN emissions. TP emissions remained almost constant. Although spatial patterns of nutrient emissions remained similar, in certain regions differences were identified due to the updated datasets of land use, soil loss and N surplus. The updated database and the new modelling approaches resulted in average total emissions of 95 kt/yr TN and 4.7 kt/yr TP for the Tisza catchment. Therefore, implementation of measures addressing land management is also important.

According to the assessments of the recent Implementation Report of the Nitrates Directive[4] additional actions are needed to reduce and prevent pollution of the ground waters and in terms of extending NVZs designation and reinforcing action programmes in order to avoid eutrophication. Countries should intensify their efforts to identify and implement measures to meet the environmental objectives of the WFD and to reduce nutrient pollution particularly via diffuse pathways from agriculture. To support the elaboration of basin-wide management strategies with the ultimate aim to reduce nutrient loads of surface waters large scale nutrient emission estimations and scenario analyses are of particular importance (using assessment tools such as the MONERIS model). Despite the comprehensive analyses conducted to trace the nutrient fluxes within the basin there is a need to fill knowledge gaps regarding the linkages between nutrient emissions and their impacts, especially the Black Sea ecosystem responses to Danube nutrient loads. In addition, better understanding is necessary on the economic drivers and future development of the agriculture.

A key set of measures to reduce nutrient inputs and losses related to farming practices and land management has been identified as appropriate management tools to be applied in agricultural areas. Agricultural nitrogen pollution of ground and surface water is regulated by the ND in the EU MS. It requires designation of NVZs that are hydraulically connected to waters polluted by nitrate or sensitive for nitrate pollution or alternatively, to apply the whole territory approach. In the zones (or over the whole territory) the amount of nitrate that is applied on agricultural fields in fertilizer or manure is limited and the application is strictly regulated through action programmes with basic mandatory measures. The most vital measures which have to be implemented are the maximum applicable amount of manure, the time periods when fertilizer application is prohibited, the required storage capacity for manure and the specific conditions under which fertilization is banned (e.g. on high slopes, in buffer strips and under unfavourable weather conditions). Moreover, codes of good agricultural practices are also recommended to be respected outside the NVZs on voluntary basis to ensure low nitrogen emissions entering the groundwater and river network. As phosphorus plays important role at eutrophication of surface waters, enhanced attention is necessary to pay alto to reduction of P loses.

A set of measures related to the concept of BAP is also suggested to be adopted in the entire Tisza Basin. The concept has been applied to different extent among the countries to manage inter alia diffuse nutrient emissions that is partly covered by the ND for nitrate pollution in the EU MS. It concerns appropriate land

[3] Regulation (EU) No 259/2012 of the European Parliament and of the Council of 14 March 2012 amending Regulation (EC) No 648/2004 as regards the use of phosphates and other phosphorus compounds in consumer laundry detergents and consumer automatic dishwasher detergents.

[4] European Commission (2013): Report from the Commission to the Council and the European Parliament on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2008–2011.

management activities (source and transport control measures) that are able to prevent, control and minimize the input, mobilization and transport of nutrients from fields towards water bodies. Measure implementation usually involves both the compulsory actions and voluntary measures that are acceptable for the farming community and subsidized or compensated via regional/state funds. They cover a wide range of measures cultivation methods (restricted crop rotation, catch crops, green manure crops), land use changes (maintenance of grasslands, buffer strip allocation), soil conservation (erosion control techniques, ensuring proper soil coverage, maintenance of humus content in topsoil, maintenance of tile drainage systems) and additional natural water retention measures (wetlands, grass filters and grassed waterways). Hydromorphological and flood protection measures (e.g. restoration and conservation of wetlands and floodplains, establishment of riparian buffer zones) provide with positive impacts on nutrient retention adjacent water courses. They also affect land use by replacing croplands with e.g. wetlands or disconnect agricultural fields from water bodies that prevent direct emissions. Efforts are needed to ensure available financial instruments and to appropriately finance agricultural measures.
Past experience with the implementation of the ND and application of agri-environmental measures have clearly demonstrated the need for financial support also out of the CAP. Nevertheless, countries should make use of the CAP-Reform. The EU CAP provides a multi-pillar financing mechanism to help farmers to overcome the challenges of soil and water quality, biodiversity and climate change. CAP subsidies consist of direct payments linked to compliance with compulsory measures upon basic standards (cross-compliance including statutory management requirements, good agricultural and environmental conditions and “greening”) and voluntary agri-environmental and innovation measures under the rural development programmes. Measures under greening are related to environmentally friendly farming practices including crop diversification, maintenance of permanent grassland and conservation of areas of ecological interest.

The critical area concept is an emerging approach in several countries that aims to find technically and economically feasible measures. It considers that management activities should focus on those areas where the highest emissions come from and where the highest fluxes from land to water probably are transported. Targeting management actions to these critical fields can provide cost-efficiency (high river load reduction at minimal implementation costs and area demand). Nevertheless, it should be considered that due to the longer time necessary for an effective management of diffuse nutrient pollution (longer residence time of groundwater, stored nutrients in bottom sediment of reservoirs) the water quality impacts of any changes in agriculture induced by the implementation of the ND or BAP recommendations will probably not be instantly visible but after several years or even decades only.

3.2.4 Future development scenarios

Urban waste water sector

Baseline scenario by 2021

It concerns the complete implementation of the UWWTD in the EU MS for agglomerations above 10,000 PE and implementation of the related commitments in the Non-EU MS.

Midterm Scenario

This scenario describes implementation of the UWWTD in EU MS and P- removal for agglomerations above 10,000 PE in Non-EU MS.

Vision Scenario

It assumes establishment of N and P removal technology for all agglomerations above 10,000 PE and secondary treatment for all agglomerations below 10,000 PE in all countries.

Detergents sector

Baseline scenario by 2021

Full implementation of the Regulation on phosphate-free detergents in EU MS (laundry and dishwasher) is expected. Partial introduction of the P-free laundry detergents is assumed in Non-EU MS.

Mid-term/Vision Scenario

Introduction of phosphate-ban for laundry and dishwasher detergents is expected in all countries.

Agricultural sector

Baseline scenario by 2021

A set of basic measures and best agricultural practices are expected based on the most realistic estimates of the countries for future agricultural development in the agricultural sector and implementation of measures foreseen by the countries. In EU MS the measures are in compliance with the ND the requirements of the CAP first pillar and also include agri-environmental measures supported by the CAP rural development programmes. In Non-EU MS a bunch of best agricultural practices is expected to be implemented. The baseline scenario was developed from a questionnaire initiated by the ICPDR and covers land use change, improved wastewater treatment, and changes in agricultural activities. It also considers an increase of buffer strips in nitrate vulnerable zones (NVZ) and inhabitant-specific TP emissions such as 1.6 g TP / PE and day in UA.

Intensification Scenario

This scenario assumes an intensification of agricultural activities resulting in an annual surplus of minimum 55 kg/ha/yr and a P balance of 5 kg/ha/yr. The implemented measures are identical to the Baseline scenario.

Vision Scenario

Vision scenario assumes moderate N surpluses of 15 kg/ha/yr and P balances of 1 kg/ha/yr, respectively. Furthermore, a combination of measures aiming on the reduction of nutrient losses (100% connection to sewers and WWTP in agglomerations, buffer strips for steep slopes, soil protection on steep slopes, expansion of NVZ, no TP emissions laundry and dishwashers) and land-use changes are included.

3.2.5 Estimated effect of measures on the sub-basin-wide scale

Urban waste water sector

Likewise, the organic pollution, higher connection rates and introduction of higher level technologies at treatment plants will result in decreasing nutrient emissions via urban waste water (Figure III.3 and Figure III.4). In line with the baseline scenario, about 8 million PE (at 202 agglomerations above 10,000 PE) will be additionally connected to tertiary treatment providing with high nutrient elimination rates. Regarding nitrogen, not collected and not treated emissions will be substantially lower by 2021, however it is expected for the surface water emissions amount of TN should be nearly same as for reference year and presents 8,264 t/year as well as for phosphorus, surface water emissions is estimated 1,114 t/year.
Total emissions released to the environment via urban waste water discharges are expected to decline by 37% (TN) and 42% (TP). Despite the significant progress expected the baseline scenario will probably not ensure the full achievement of the WFD environmental objectives by 2021.

Additional future scenarios represent further reduction of emissions as the measures will address higher proportion of agglomerations. The mid-term scenario estimates slightly increasing surface water emissions for N but decreasing releases for P (only P-removal is applied in non-EU MS above 10,000 PE). For the vision scenario 33.4% (TN) and 16.8% (TP) decrease is estimated for the surface water emissions in comparison to the reference status, whilst total emissions will reduce by 49% and 61.6%, respectively.

The simulated smaller decrease for N indicates that N-removal at urban waste water treatment plants above 10,000 PE cannot substantially reduce the N emissions at the basin-wide level. Introduction of a detergent ban in the non EU MS still has a great reduction potential to reduce the national P emissions.

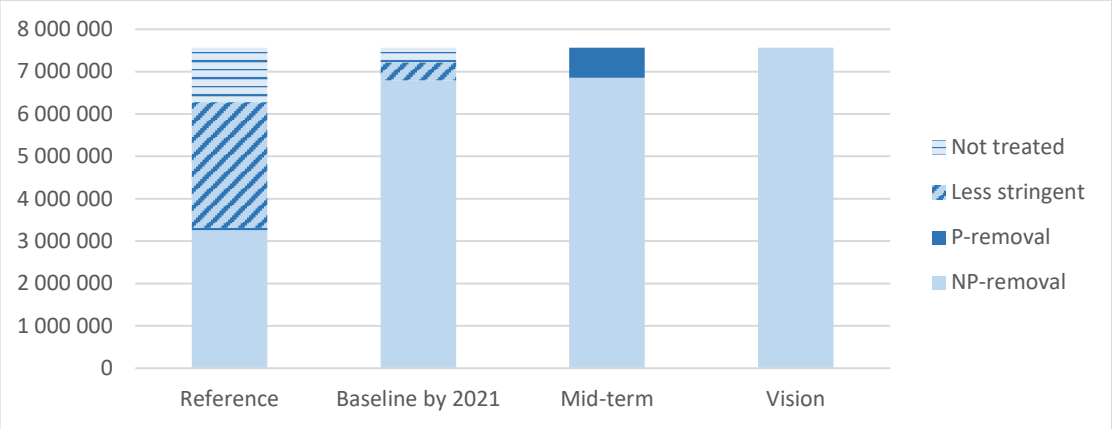

Figure III. 3 Waste water load (PE) of agglomerations above 10,000 PE according to future scenarios

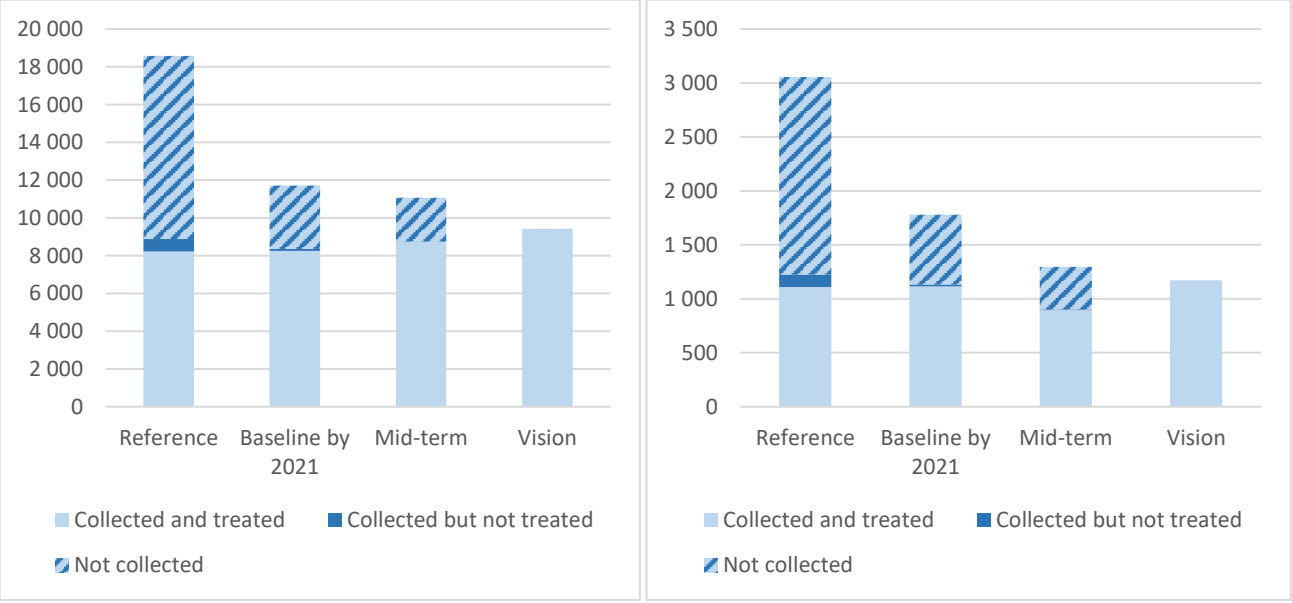

Figure III. 4 TN (left) and TP (right) emissions via urban waste water according to future scenarios (expressed in tons per year

Agriculture

Results of the scenario analysis for agriculture are presented in Figure III.5. With regard to assumed land use type areas in defined four scenarios (including so called intensification scenario with nutrient surplus to be

+55 kg N/ha and +5 kg P/ha and vision scenario with nitrogen surplus +25 kg N/ha of agricultural land), it can be stated that agriculture will remain the sector which has dominant share on total TN emissions (52.59% at reference 2012, 55.46% at baseline 2021, 52.40% at vision and 71.57% at intensification scenarios).
In the case of total P emissions, despite the urban sector has highest share (in comparison to agriculture) especially at reference 2012, baseline scenario 2021 and intensification scenarios (e.g. 46.70%, 46.00% and 42.94% respectively), in the case of vision scenario is position changed and the share of agriculture on total P emissions slightly dominates (41.50% in agriculture share in comparison to 40.60% in urban sector). It is necessary to mention that intensification scenario is not real in upcoming years (e.g. up to 10 years). From practical view more, interesting information represents the TN and TP emissions per land unit (hectare or square kilometre). Significant decrease of TN and TP emissions are recorded mainly in urban sector (see Figure III.6). Spatial distribution of the emissions according to the baseline scenario is shown in Map 4-6 (Nitrogen)) and Map 7-9 (Phosphorus).

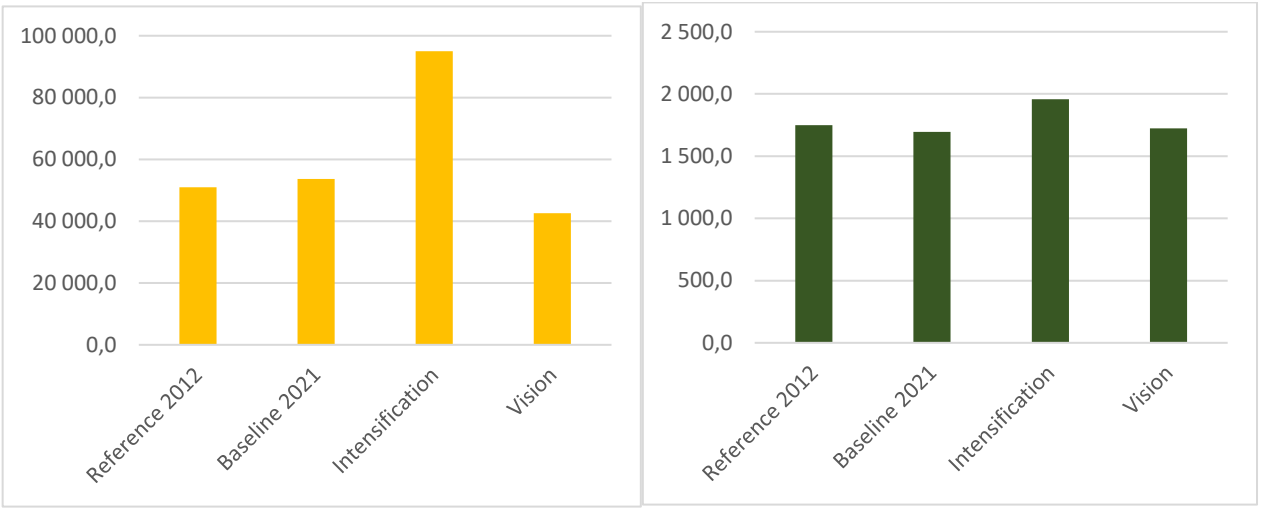

Figure III.5 TN (left) and TP (right) emissions via agriculture according to future scenarios (expressed in tons per year

Figure III.6 Overview of changes according to scenarios TN [kg/ha] (left) and TP [kg/km^2] (right)

3.3 Hazardous substances pollution

3.3.1 Vision and management objectives

The Tisza River Basin-wide vision for hazardous substance pollution is that there is no risk or threat to human health and to the aquatic ecosystem of the waters in the Tisza River Basin as well in the Danube River Basin District and Black Sea waters are not impacted by discharges of the Tisza River.

The following management objectives will be implemented by 2021 as steps towards the vision:
EU MS and Non-EU Member States:

- Closing knowledge gaps on the hazardous substances of the Tisza basin relevance.
- Further elimination/reduction of the amount of hazardous substances entering the Tisza and its tributaries (EU MS: by implementing the Environmental Quality Standards Directive).
- Further reduction of the point source emissions by the implementation of the management objectives described for organic pollution as they address the hazardous pollution as well.
- Further reduction of the diffuse pollution of agricultural chemicals by implementation of supplementary measures linked to EU Common Agricultural Policy, implementing the Sewage Sludge Directive and the Pesticides Directive (EU MS) and by implementation of best management practices in the agriculture (Non-EU MS).
- Ensuring the safe application of chemicals (EU MS: by implementing inter alia the Plant Protection Products Directive, the REACH Regulation and the Biocides Regulation).
- Minimisation of the risk of accidental pollution events by using enhanced technologies and putting in place appropriate safety measures (EU MS: by implementing the Seveso, Mining Waste and Industrial Emission Directives, Non-EU MS: by fulfilling the obligations/adopting recommendations of the UNECE Convention on the transboundary effects of industrial accidents).

3.3.2 Progress in implementation of measures from 1st ITRBM Plan

The 1st ITRB Plan highlights the measures of basin-wide importance in the waste water, industrial and agricultural sectors to be implemented in order to reduce and/or eliminate the hazardous substances discharges into the surface water bodies. Enhancing waste water treatment and industrial technologies, phasing out certain substances from the market products and promoting sustainable use of sewage sludge and pesticides in the agriculture are the most important measures recently being implemented (see Annex 1 Measures in urban waste water and industrial sectors and Annex 4 Measures in agricultural sector). In addition, the TRB countries have taken significant steps in order to improve the situation concerning the information gap on hazardous substances pollution (see Annex 2 Summary on elaboration of inventories on priority substances emission, discharges and losses and Report on significant pressures relevant for the TRB). Prioritisation of the emerging pollutants, data collection on the major point sources releasing hazardous substances and accident risk analysis of the industrial and contaminated sites are those on-going activities which can provide more detailed information on the existence, sources and fate of hazardous substances in the TRB.

Improving waste water treatment and industrial technologies, regulating market products and application of chemicals and an elimination of knowledge gaps on hazardous substances via emission inventories are the most important current activities to address hazardous substances pollution. National inventories on priority substances emissions that are currently being compiled by the countries will deliver substantial information on the emission sources.

3.3.3 Summary of measures of sub-basin-wide scale

In spite of the fact that the substantial progress has been achieved in many aspects of the hazardous substances pollution the state-of-the-art knowledge needs to be improved and the implementation of measures should be proceeded in the future to appropriately manage the problem. Measures to address

hazardous substances releases should be further implemented in various fields. Appropriate treatment of urban waste water and application of BAT in the industrial plants and large agricultural farms are elementary measures and can significantly contribute to the mitigation of hazardous contaminations. Implementation of the UWWTD and IED in EU MS is also highly beneficial for the reduction of hazardous substances pollution. In Non-EU MS the considerable efforts to be made in order to develop and improve the waste water sector and industrial technologies will have also positive effects on water quality related to hazardous substances pollution. Nevertheless, the conventional treatment technologies do not provide with appropriate removal for many of the emerging chemicals. More enhanced technologies such as activated carbon filters or ozonisation can more effectively eliminate these substances therefore introduction of the fourth treatment level might be considered by the TRB countries in the future.

The EQSD[5] interconnected with the WFD intends to regulate water pollution of priority substances by setting up EQS values for the priority substances and mandating to phase out priority hazardous substance emissions and to reduce priority substances releases for water dischargers. Reporting on emissions, discharges and losses of these substances is also obligatory. Other EU legal documents like the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH[6]), the Plant Protection Products Regulation, the Biocidal Products Regulation[7]) or the Pesticides Directive[8]) aim to minimize the release of chemicals in order to protect human health and environment. For instance, they lay down rules for the authorisation of products containing dangerous chemicals and regulating their placing on the market, enforce substitution or exclusion of certain substances, ensure the safe application of products containing dangerous chemicals and prescribe emission limits for the hazardous substances.

The progressive development of the urban waste water sector increases the quantities of sewage sludge that requires disposal. The SSD (currently being assessed whether a revision is needed) seeks to encourage the use of sewage sludge in agriculture and simultaneously regulates its use in such a way as to prevent harmful effects on soil, vegetation, animals and human beings. Detailed recording is required on the circumstances of sewage sludge application in agriculture and a set of limit values for concentrations of heavy metals in sewage sludge intended for agricultural use and in sludge-treated soils is assigned. Therefore, implementation of the SSD helps to avoid hazardous substances pollution by restricting the application of contaminated sludge to agricultural fields. Management actions similar to those of the EU MS are recommended for the Non-EU MS. Sustainable pesticide usage in the agriculture can also be managed by some BAP measures that are on-going activities in both EU and Non-EU MS.
To avoid major accidental pollution events, EU MS are obliged to implement the Seveso[9] and the Mining Waste Directives[10]). Operators of the facilities/mines under the umbrella of the Directives have to develop a safety management system, provide safety reports and information for the public and elaborate emergency plans for both, the internal and surrounding areas of the establishments. Moreover, Parties of the UNECE

5 Directive on Environmental Quality Standards (Directive 2008/105/EC).

6 Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC), No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

7 Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC.

8 Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

9 Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC.

10 Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC.

Convention on the transboundary effects of industrial accidents[11]) have to fulfil the obligations of the Convention. It aims to prevent accidents and to mitigate their effects if required and also promotes active international cooperation regarding accident risk mitigation.

Further efforts are needed to identify which priority substances and other emerging chemicals are of basin wide relevance. Moreover, limited information is recently available on the emission sources contributing to hazardous substances contamination of the surface waters. This information gap should be narrowed. Compilation of the basin-wide inventory on discharges, emissions and losses have to be continued in a comparable and coordinated way and develop a strategy to improve and harmonize the approach for the elaboration of the inventory. In particular the lack of high quality monitoring data on priority substance discharges from waste water effluents has to be addressed by e.g. specific sampling campaigns prior to the update of the inventories. This will ensure to have a consistent picture on the point sources of the relevant hazardous substances.

Appropriate control of accidental pollutions is essential in order to mitigate adverse effects of hazardous substances spills. The Danube countries have made efforts in order to ensure effective and quick responses to transboundary emergency cases. The Accident Emergency Warning System (AEWS) was developed to timely recognise emergency situations. It is activated if a risk of transboundary water pollution exists and alerts downstream countries with warning messages in order to help national authorities to put safety measures timely into action. The AEWS has been operated, maintained and enhanced by the ICPDR Secretariat. In addition, activities on accident risk prevention should be continued in order to appropriately mitigate accidental pollution risk. Regular update of a basin-wide catalogue of hazardous industrial, abandoned and mining sites is an important future task to be accomplished. Besides identifying the most important potential accident hot-spots the ICPDR should ensure that a proper platform for information exchange and know-how transfer is provided for the countries to facilitate risk management in the identified priority industrial fields and recommend particular preventive measures to be implemented. This can be supported by flagship projects and workshops with an active involvement of the ICPDR.

3.3.4 Estimated effect of measures on the sub-basin-wide scale

Due to the lack of reliable information on the sources of hazardous substances pollution a detailed assessment on the effects of measures to be implemented cannot be performed. Achievement of the WFD environmental objectives might not be possible by 2021 due to the existing knowledge gaps although measures to be implemented in the next management cycle will improve the situation.

3.4 Hydromorphological alterations

The pressure analysis shows that surface waters of the TRB are impacted by hydromorphological alterations to a significant degree. Interruption of river continuity and morphological alterations, disconnected adjacent wetlands/floodplains, hydrological alterations and future infrastructure projects may impact water status and are therefore addressed as part of the JPM.

Measures addressing different hydromorphological alterations, planned to be implemented by 2015, were included in the JPM of the 1st ITRB Plan. The following chapters inter alia outline progress in the implementation of these measures. The starting point for the assessments is the measures which were indicated in the JPM of the 1st ITRB Plan, updated with information on the finally agreed measures in the national programs of measures and progress in measures implementation. Information on the implementation

[11] United Nations Economic Commission for Europe (2013): Convention on the Transboundary Effects of Industrial Accidents.

status is based on the assessments of the 2012 data provided by the TRB countries into ICPDR database which was updated with latest information for the reference year 2015. In case delays in the implementation are observed, different reasons were indicated, including the lack of financial resources, difficulties in solving issues related to ownership questions, next to the need for further assessments. Further detailed information for each country can be obtained from Annex 5. The ongoing implementation of measures provides the opportunity to monitor the effectiveness of measures (e.g. the performance of fish migration aids) as well as the effects on water status (e.g. of reconnecting wetlands and floodplains). Exchange of experiences will be useful towards reaching more cost-effective programs of measures in the future.

Furthermore, measures which are planned to be implemented on the basin-wide scale by 2021 are summarised for each hydromorphological component. In cases where countries share river stretches it is likely that some hydromorphological components (river and habitat continuity interruption, hydrological alterations) include double-counts. This is because the information has been reported separately by the Tisza countries which might in some cases not be bilaterally harmonised. However, as already outlined in the 1st ITRBM Plan the discrepancy between the results of the analysis and the factual values without double-counts is estimated to be low. For cases where countries reported separately for shared river stretches further harmonisation efforts are needed in the future.

3.4.1 Interruption of river continuity and morphological alterations

3.4.1.1 Vision and management objectives

The Tisza basin-wide vision for hydromorphological alterations is the balanced management of past, ongoing and future structural changes of the riverine environment, that the aquatic ecosystem in the entire Tisza River Basin functions in a holistic way and is represented with all native species. This means in particular, that anthropogenic barriers and habitat deficits do not hinder fish migration and spawning any specified migratory species are able to access the Tisza River and relevant tributaries.

The following management objectives will be implemented by 2021 as steps towards the vision:

EU MS and Non-EU Member States

- Construction of fish migration aids and other measures at existing migration barriers to achieve/improve river continuity in the Tisza River and in respective tributaries to ensure self-sustaining[12] native species populations and specified other migratory fish populations.
- Specification of number and location of fish migration aids and other measures to achieve / improve river continuity in each country.
- New barriers for fish migration imposed by new infrastructure projects will be avoided; unavoidable new barriers will incorporate the necessary mitigation measures like fish migration aids or other suitable measures already in the project design according to BEP and BAT.
- Restoration, conservation and improvements of river morphology, habitats and their connectivity for self-sustaining native species populations and other type-specific fish populations in the Tisza

[12] Populations that are maintaining a group size, age structure and genetic heterogeneity through natural reproduction and recruitment that is sufficient to ensure the long-term stability of the population without external support measures.

River and the respective tributaries, also contributing to the improvement of other aquatic biological quality elements.

- Specification of location and extent of measure for the improvement of river morphology, which will be implemented by each country.

3.4.1.2 Progress in implementation of measures from 1st ITRBM Plan

The measures on river continuity for fish migration which were planned to be implemented in the 1st ITRB Plan:

- By 2015 to ensure fish migration, such as the construction of fish migration aids. As of 2009, 228 interruptions of river and habitat continuity were located in the Tisza River Basin.
- For 49 river continuity interruptions in Romania, no measures were needed at water body level, because these water bodies (where 1 or more interruptions are located) already achieve their environmental objectives (good ecological potential for HMWB and good ecological status for natural ones).
- By 2015, 39 measures will be implemented, and 84 measures are subject to exemptions according to WFD Article 4(4). There was no measure indicated for 76 interruptions.
- As for the Danube Basin, the numbers indicate that most restoration measures will not be taken until the second and third WFD cycle.
- Consequently, 160 interruptions of river continuity will remain impassable for fish migration by 2015 and good ecological status and good ecological potential might not be ensured.

Compared to data which was provided for the 1st ITRBM Plan, a significant number of barriers which were reported actually do not meet the criteria for the pressure assessments. This is because in 2009 e.g. also river bed stabilization structures for flood risk management like ramps of limited height were reported as barriers equipped with functional fish migration aids. Since these structures do not cause a hindrance for fish migration, this issue has been clarified in the updated data set which was used for the assessments in this report. Due to this reason the total number of barriers is differing from the number reported in the 1st ITRBM Plan.
Out of the 179 barriers reported by the countries 29 was equipped until 2015 with functional fish migration aids. 130 barriers will remain a hindrance for fish migration as of 2015 and are currently classified as significant pressures. For 20 of the remaining barriers it is still necessary to determine whether fish migration is possible or they were reported to be located outside of the fish area.

3.4.1.3 Summary of measures of sub-basin-wide importance

3.4.1.3.1 Interruption of river continuity for fish migration

The TRB rivers with catchment areas > 1,000 km^2 include crucial living and spawning habitats, vital to the life cycles of fish species. The overall goal of river continuity restoration is free migration routes (including also migration facilities where the case is expected) for the TRB rivers with catchment areas > 1,000 km^2, as this will be crucial for achieving and maintaining good ecological status/potential for the future. However, due to the results of the objective setting undertaken at the national level (related to the application of WFD Article 4(5)), some restoration measures might not be implemented. In general, all fish species of the TRB are migratory, however, the importance of migration for the viability of fish populations varies considerably among them. Differences exist in terms of migration distances, direction (upstream, downstream, lateral), spawning habitats, seasons and the life stage for which migration takes place. TRB migration requirements are more relevant in lowland rivers than in headwater fish communities.

Figure III. 7 and Map 10 illustrate that, as of 2015, 131 interruptions of river and habitat continuity are located in the TRB (1 of which is located in the Tisza River). By 2021, 27 fish migration aids are planned to be constructed in the TRB that should ensure the migration of all fish species and age classes according to best available techniques. 104 interruptions will remain in 2021 but 48 measures to restore river continuity interruptions are planned to be implemented after 2021 (WFD Article 4(4)). In 49 cases no measures are not necessary since WBs have already achieved GES/GEP. No measures are yet indicated for 7 continuity interruptions as well as measures to be implemented according to WFD Article 4(5).

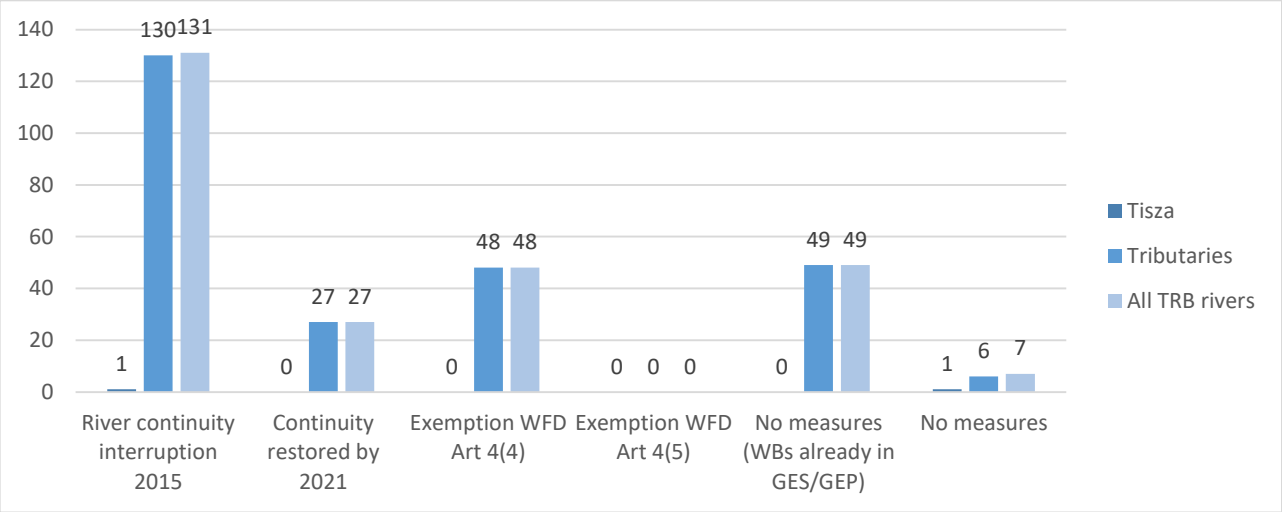

Figure III.7 Measures on river continuity for fish migration by 2021 and exemptions

In the TRB 180 barriers for fish migration were reported by the countries in 2015 out of them 29 were passable by fish and 20 barriers were outside of fish areas. More detailed information regarding measures on river continuity for fish migration by 2021 and exemptions for each country can be obtained from Table III.4 and Map 10.

Table III. 4 Measures on river continuity for fish migration by 2021 and exemptions for each country

Country	Barriers 2015	Passable by fish 2015	Outside of fish area	River continuity interruption 2015	Contin. restored by 2021	Exempt. WFD Art 4(4)	Exemption WFD Art 4(5)	No measures (WBs already in GES/GEP	No measures
UA	1			1					1
RO	86	11	20	55	2	4		49	
SK	59	10		49	19	26			4
HU	32	8		24	6	18			
RS	2			2					2
Total	**180**	**29**	**20**	**131**	**27**	**48**	**0**	**49**	**7**
Tisza	3	2		1			0		1
Tributaries	177	27	20	130	27	48	0	49	6

Table III. 5 indicates that in total river continuity will be restored in 17 water bodies until 2021, while 74 water bodies will remain affected out of a total number of 237 water bodies in the TRB.

Table III. 5 Number of river water bodies affected and restored for fish migration by 2021

	Total number of WBs	WBs affected by continuity interruptions by 2021	WBs restored for continuity by 2021

TRB tributaries	220	73	17
Tisza River	17	1	0
All TRB rivers	237	74	17

3.4.1.3.2 Alteration of river morphology

Deterioration of the natural river morphology influences habitats of the aquatic flora and fauna and can therefore impact water ecology. Morphological alterations can inter alia be caused by bed and bank reinforcement for erosion control, the modification of the river channel dimension (cross and long section, planform) or by river substrate manipulation like the removal of silt and gravel. Aggregated information on water body level on the measures planned to be implemented until 2021 for the improvement of river morphology is summarised as follows.

As illustrated in Figure 8 and Map 12, out of the total 237 river water bodies, the river morphology was in good GES/GEP by 2015 for 102 water bodies no measures are necessary for the achievement of GES/GEP. Morphological measures are planned to be implemented for 5 water bodies until 2021 in territory of HU belonging to the TRB. Exemptions according to Art. 4(4) are applied for 50 water bodies and therefore measures are planned to be taken at a later stage. No measures will be applied according to (Art. 4.5), respectively no measures were yet indicated for 51 water bodies. Further details on the planned measures and exemptions on the country level is provided in Table III.6. For 29 water bodies it is still unknown whether measures are necessary or will be implemented. The possibilities for morphological measures implementation until 2021 is considered as a challenge. This since success in measures implementation often depends on the results of negotiations between authorities, land owners and communities. Morphological measures can also be taken on a voluntary basis or combined with flood protection measures. The exact location for the measures or concrete possibilities for implementation are therefore often still unknown at this stage.

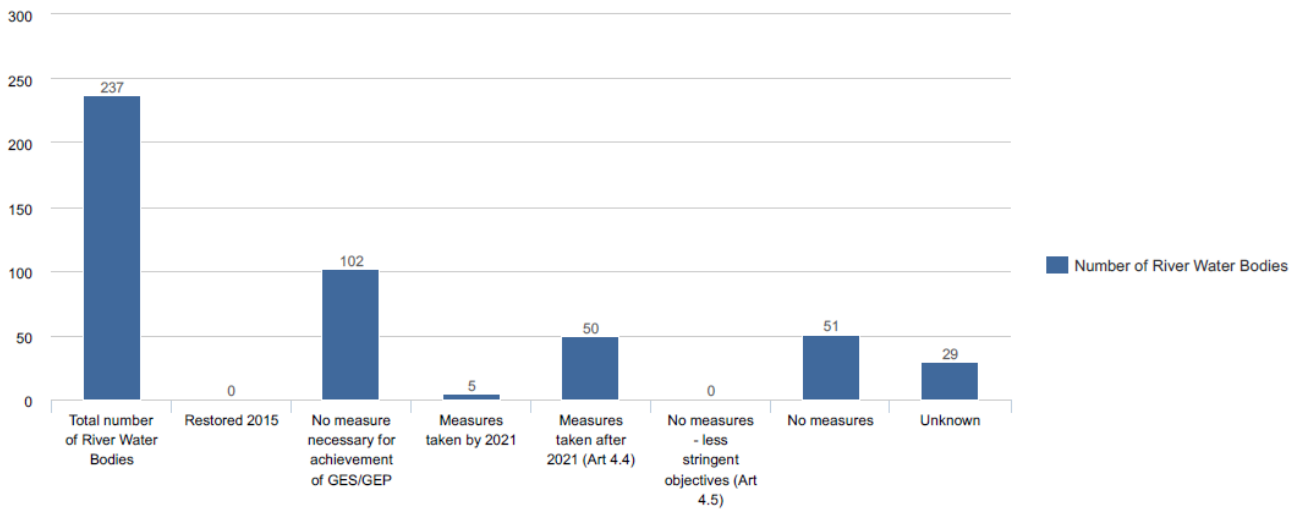

Figure III. 8 Number of water bodies with measures for the improvement of river morphology by 2021 and exemptions

Table III. 6 Number of water bodies with measures for the improvement of river morphology by 2021 and exemptions for each country

Country	Number of WBs	Restored by 2015	No necessary measures for achievement of GES/GEP	Measures taken by 2021	Exemption WFD Art 4(4)	Exemption WFD Art 4(5)	No measures	Unknown
UA	30						24	6
RO	101		76		2			23
SK	31		11		20			
HU	48		15	5	28			
RS	27						27	
Total	**237**	**0**	**102**	**5**	**50**	**0**	**51**	**29**

3.4.1.4 Estimated effect of measures on the basin-wide scale

Further progress will be made in the restoration of river continuity for fish migration. By 2021, 27 fish migration aids are planned to be constructed in the TRB that should ensure the migration of all fish species and age classes according to best available techniques. 104 interruptions will remain in 2021 but 48 measures to restore river continuity interruptions are planned to be implemented after 2021 (WFD Article 4(4)). In 49 cases no measures are not necessary since WBs have already achieved GES/GEP. No measures are yet indicated for 7 continuity interruptions as well as measures to be implemented according to WFD Article 4(5).

With regard to river morphology, restoration measures are planned to be taken in 5 water bodies and further measures are planned in 50 water bodies for the period after 2021. For a considerable number of water bodies, no measures are yet planned or it is currently unknown whether measures are needed or planned to be implemented. Further assessments will be required to clarify this issue.

In summary, the planned restoration measures for establishing river continuity and to improve the morphological conditions and habitats are expected to contribute towards the improvement of water status by 2021 and beyond. This will in particular be the case for the biological quality elements directly sensitive to these types of pressures, including benthic invertebrates and fish.

3.4.2 Disconnected adjacent wetlands/floodplains

3.4.2.1 Vision and management objectives

The TRB´s basin-wide vision is that floodplains/wetlands in the entire TRB are reconnected and restored. The integrated function of these riverine systems ensures the development of self-sustaining aquatic populations, flood protection and reduction of pollution in the TRB.

The following management objectives will be implemented by 2021 as steps towards the vision:

<u>EU MS and Non-EU Member States</u>

- Protection, conservation and restoration of wetlands/floodplains to ensure biodiversity, the good status in the connected river, flood protection, pollution reduction and climate adaptation by 2021.
- Specification of number, location and area of wetlands/floodplains that will be reconnected and restored after 2021 by each country.
- Ensuring exchange with relevant experts on the implications of the measures for sustainable flood risk management.

- An inventory, priority ranking and steps for implementation will be developed for the restoration and reconnection of lost floodplains and wetlands along the Tisza River and its tributaries, taking the effects on biodiversity, flood risk management, nutrient reduction, water retention and climate adaptation into account.
- Implementation of the "no net-loss principle".

3.4.2.2 Progress in implementation of measures from 1st ITRBM Plan

The measures on the reconnection of adjacent wetlands/floodplains which were planned to be implemented by 2015, represented 2,651 ha, along with 17,306 ha of wetland areas identified in 2009 with potential for reconnection, were expected to be reconnected in the Tisza Basin Rivers. According to the application of the Article 4(4), 10 wetlands (1,662 ha) will be reconnected in Slovakia and an additional 12,993 ha in Ukraine after 2015 (within the second and third river basin management cycles).

Based on the updated database in total **16,333 ha** wetlands/floodplains have been identified to have a reconnection potential in the Tisza River Basin and out of 208 WBs 8 WBs (2 WBs of the Tisa River and 6 WBs in TRB tributaries) are having a reconnection potential beyond 2015. The implementation status is presented in Table III. 7 and Annex 5 is referring to the status by the end of 2015.

Table III. 7 Progress in implementation of measures on reconnecting adjacent wetlands/floodplains

Measures to be implemented by 2015	Implementation status				
Indicated in the 1st ITRBM Plan	Not started	Planning on-going	Construction on-going	Completed Partially re-connected	Completed Totally re-connected
Number of adjacent wetlands/floodplains					
10	9	0	0	0	1
Area of adjacent wetlands/floodplains					
2,651 ha	2,644	0	0	0	7 ha

3.4.2.3. Summary of measures of sub-basin-wide importance

Wetlands/floodplains play an important role in the ecological integrity of riverine ecosystems and are of significant importance when it comes to ensuring/achieving good ecological status of adjacent water bodies (see Report on significant relevant for the TRB chapter 2.1.4.2)
The approach chosen for the JPM to protect, conserve and restore wetlands is a pragmatic one, taking into account a background of wetland loss. The TRB countries provide information on:

- national wetlands/floodplains > 100 ha with a potential to be reconnected to the adjacent river;
- respective reconnection measures to be undertaken by 2021 or beyond regarding WFD Art. 4(4).

Figure III. 9 and Map 11 illustrate that from the 16,333 ha of wetland areas which were identified with potential for reconnection, only 7 ha are already reconnected by 2015. An area of 1,655 ha is planned to be reconnected after 2021. For 12,993 ha no measures were yet indicated and for 1,678 ha it is still unknown whether measures will be implemented. Table III.8 further below provides more detailed information for each the TRB country.

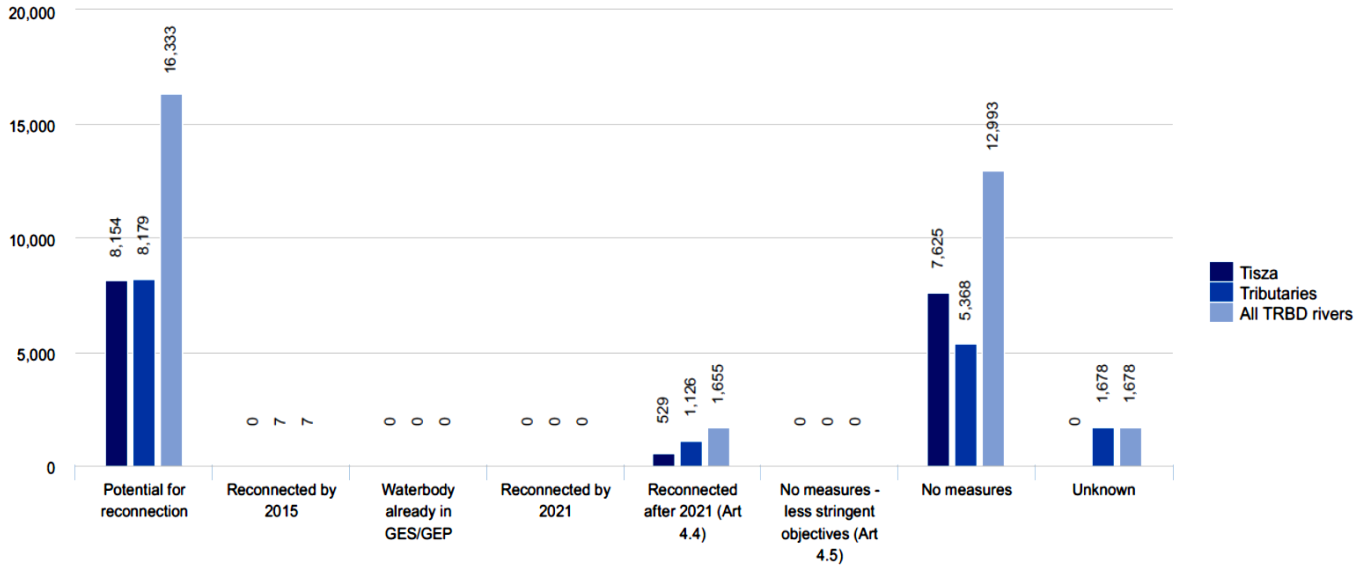

Figure III.9 Measures for the reconnection of wetlands/floodplains by 2021 and exemptions [ha]

Table III. 8 Measures on the reconnection of wetlands/floodplains by 2021 and exemptions for each country [ha]

Country	Potential for reconnection 2015	Reconnected by 2015	Reconnected by 2021	Reconnected after 2021 (art. 4.4)	No measures (Art. 4.5)	No measures	Unknown
UA	12,993	0	0	0	0	12,993	0
RO	-	-	-	-	-	-	-
SK	1,662	7	0	1,655	0	0	0
HU	-	--	-		-	-	-
RS	1,678	0	0	0	0	0	1,678
Total	16,333	7	0	1,655	0	12,993	1,678

3.4.2.4 Estimated effect of measures on the sub-basin-wide scale

In the period between 2009 and 2015 only 7 ha of wetlands/floodplains have been reconnected, and their hydrological regime improved respectively. Measures until 2021 are not planned. In an area of 1,655 ha measures are planned to be taken after 2021 in line with provision of the WFD Art. 4.4.

Detailed analysis on the potential for reconnection, the establishment of an inventory, prioritisation and investigations on the different implications, what is planned to be accomplished until 2021 in coordination with the implementation of the EU Floods Directive, will help to gain further clarity on the estimated effects on the basin-wide scale.

3.4.2.5 Case study

Under JOINTISZA project the Case study on “The evaluation of the implementation and results of the four Water Management Projects carried out along the Tisza River” has been developed by WWF Hungary in cooperation with experts from all TRB countries.

The evaluation is concerned the following projects:

- Sustainable use and management rehabilitation of flood plain in the Middle Tisza District (LIFE03 ENV/H/000280).
- Floodplain management at River Tisza – based on LIFE00NAT/A/7051 project.
- Complex flood control and revitalization development of flood basin in the Bereg area (EEOP-2.1.1-2009) and the development of landscape management infrastructure in Bereg and in the area of the Bereg flood-reducing reservoir (KEHOP-1.3.0-15-2015-00004).
- Rehabilitation of Öreg-Túr Phase I. - II.

These projects were implemented between 2004 and 2014, so that for three of the four projects even the five-year maintenance period had passed. Therefore, it was possible to assess what measures were maintained and under what conditions after the mandatory maintenance period. By evaluating the projects from this aspect, some new and interesting conclusions were reached. On the basis of the evaluation, it is possible to get a picture of the measures implemented. Based on this, observations and suggestions can be formulated, which ones' application at strategic level might be justified. For more details see Annex 7.

3.4.3 Hydrological alterations

3.4.3.1 Vision and management objectives

The TRB´s basin-wide vision for hydrological alterations is that they are managed in such a way, that the aquatic ecosystem is not influenced in its natural development and distribution.

The following management objectives will be implemented by 2021 as steps towards the vision:

EU MS and Non-EU Member States

- **Impoundments:** Most of the impounded water bodies are designated to be heavily modified and the good ecological potential (GEP) has to be achieved. Due to this fact the management objective foresees additional measures on the national level to improve the hydromorphological situation in order to achieve and ensure the GEP, e.g. improvement of river morphology in the head sections of the reservoir.
- **Water abstractions**: Discharge of an ecological flow, ensuring that the biological quality elements are in good ecological status respectively good ecological potential, and the flow requirements for protected species and habitats are met.
- **Hydropeaking:** Although only some of the water bodies in the TRB are affected by hydropeaking and are designated to be heavily modified, the good ecological potential (GEP) has to be achieved. Therefore, the management objective foresees measures on the national level to improve the situation to achieve and ensure the GEP. Hydropeaking and its effect on water status is a very complex issue. Therefore, further respective investigations and scientific studies are needed.
- Specification of measures addressing hydrological alterations that will be implemented by 2021 by each country

3.4.3.2 Progress in implementation of measures from 1st ITRBM Plan

Overall 39 measures were expected to be taken by 2015 to improve impacts on water bodies caused by hydrological alterations. Some 27 measures were subject to WFD Article 4(4) and therefore the implementation of those measures was planned after 2015. Regarding the water abstractions identified 26 water abstractions, improvement was planned for 14 cases by 2015 and 8 water abstractions are subject to exemption according to Art 4(4). No measures have been indicated for two cases.

Impoundments

Out of the total 76 impoundments, no measures have been indicated for 30 cases, and 26 impoundments were subject of according to Art 4(4). Improvement was expected for 20 impoundments by 2015. By 2015 only in Romania one measure was reported as planning -on going (see Table III.9 and Annex 5).

Table III.9 Progress in implementation of measures on impoundments

Number of measures to be implemented by 2015	Implementation status				
Indicated in the 1st ITRM Plan	Not started	Planning on-going	Not started on-going	Construction on-going	Constructed
20	0	1	0	0	0

Only one case of hydropeaking in Romania with an effect on a Hungarian water body (Sebes Koros, WB number HUAEP953) have been reported. The water body affected by hydropeaking should be designated as heavily modified and good ecological potential has to be achieved. Therefore, the *management objective* included the measures on the national level to improve the situation to achieve and ensure this potential. Hydropeaking and its effect on water status is a very complex issue, and further respective investigations and scientific studies are needed.

3.4.3.3 Summary of measures of sub-basin-wide importance

As shown by the pressure analysis and status assessment, hydrological alterations impact the status of water bodies (see Report on significant water management issues relevant for the TRB Chapter 2.1.4.3). Impoundments and water abstraction remain key pressures that require measures on the basin-wide scale. In the following, the planned measures for each category of hydrological alteration are outlined. The information is also illustrated on Map 13 in aggregated form on water body level. The map shows in which water bodies measures addressing hydrological alterations are planned. This can be a combination of different measures addressing different hydrological pressure types. More detailed information on each measure can be obtained from Annex 5.

Impoundments

In total, 78 impoundments are located in the TRB rivers, 4 of them in the Tisza River itself. 60 WBs are already in GES/GEP. For 4 impoundments restoration measures are planned to be implemented by 2021 and for 11 after 2021 as part of the third RBM cycle (Art. 4(4)). No measures will be applied according to the WFD (Art. 4(5)) and no measures were yet indicated for 3 impoundments (see Figure III.10). Table 10 further below provides more detailed information for each the TRB country.

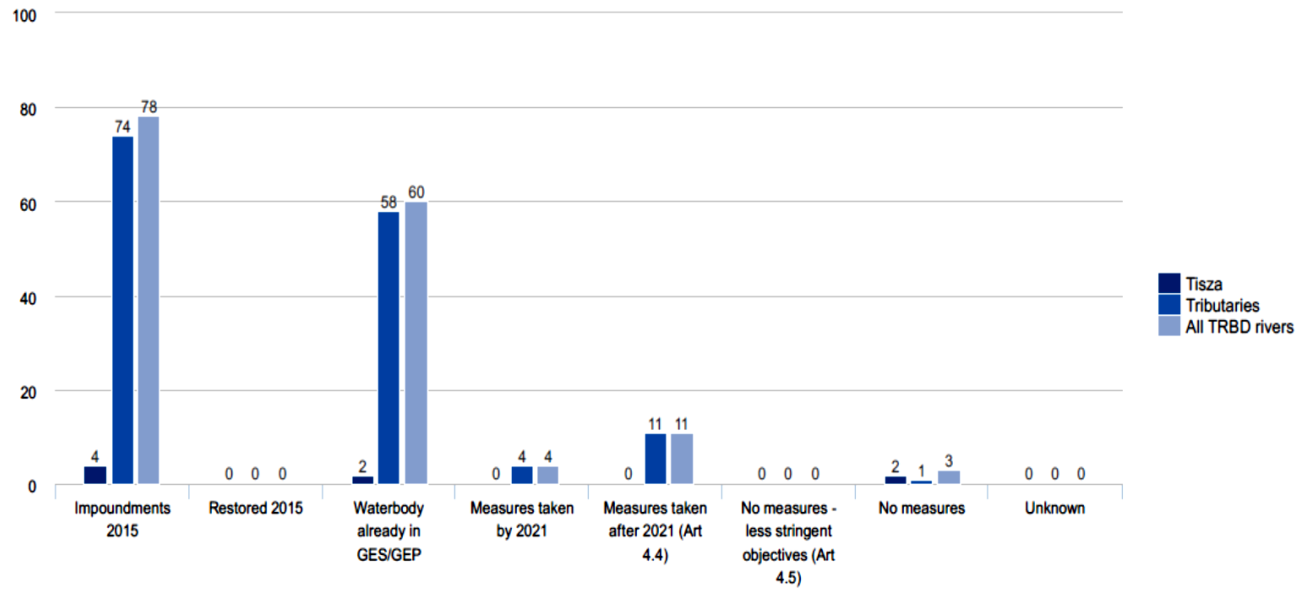

Figure III. 10 Measures for the improvement of impoundments by 2021 and exemptions

Table III. 10 Measures on impoundments by 2021 and exemptions for each country

Country	Impound-ments 2015	Restored 2015	WBs already in GES/GEP	Measures 2021	Exemption Art (4.4)	Exemption Art (4.5)	No measures	Unknown
UA		0				0		0
RO	40	0	34	4	2	0		0
SK	9	0			9	0		0
HU	26	0	26			0		0
RS	3	0				0	3	0
Total	**78**	**0**	**60**	**4**	**11**	**0**	**3**	**0**

Water abstraction

33 cases of significant water abstractions were identified in the TRB (out of them 3 abstractions are located in the Tisza River itself) for all abstractions, ecological flow requirements for the achievement of GES/GEP have already been achieved in 2015. Therefor no restoration measures are planned to be implemented by 2021 and after 2021 as part of the third RBM cycle (Art. 4(4)) (see Figure III.11). Those water abstractions are located in Romanian (29) and Hungarian (4) territory of the TRB. Table III.11 further below provides more detailed information for each Tisza country.

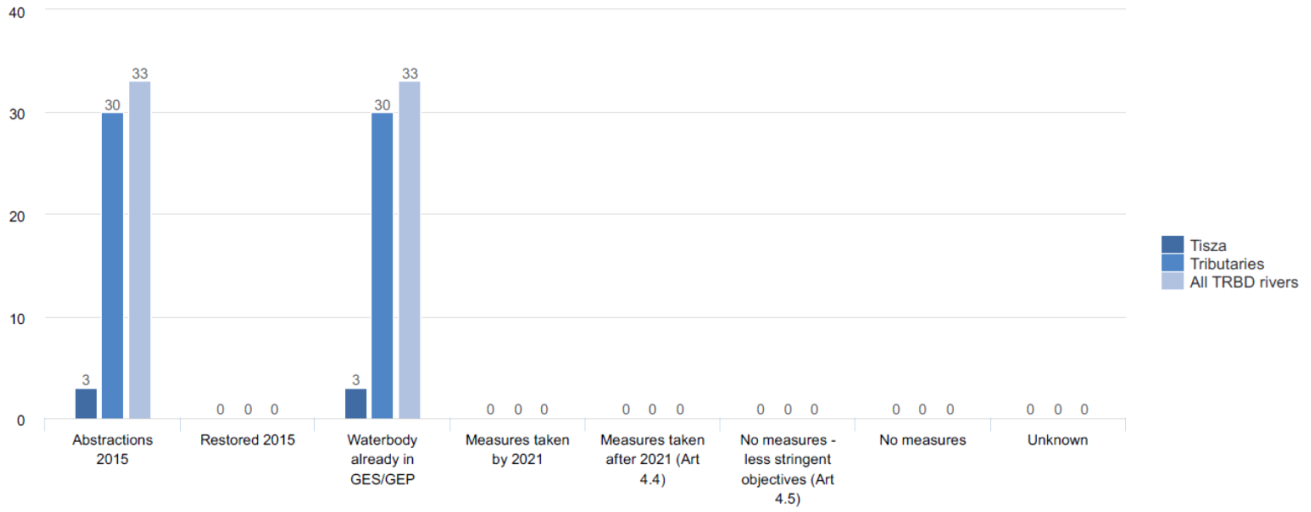

Figure III. 11 Measures on water abstractions by 2021 and exemptions FIGURE 57

Table III. 11 Measures on water abstractions by 2021 and exemptions for each country

Country	Abstraction 2015	Restored by 2015	WBs already in GES/GEP	Measure 2021	Exemption (Art. 4.4)	No measures (Art. 4.5)	No measures	Unknown
UA	-	-	-	-	-	-	-	-
RO	29	-	29	-	-	-	-	-
SK	-	-	-	-	-	-	-	-
HU	4	-	4	-	-	-	-	-
RS	-	-	-	-	-	-	-	-
Total	33	-	33	-	-	-	-	-

Hydropeaking

Only one case of hydropeaking was identified in the TRB, in Hungary. This situation allows Hungary to apply WFD 4.4 exception, based on "technical infeasibility" and undoubtedly, further cross-border negotiations could be started in order to find the best possible measures (in the Romanian national RBMP).

3.4.3.4 Estimated effect of measures on the sub-basin-wide scale

4 measures are planned until 2021 on impoundments, and a further 11 measures are planned after 2021 (Art. 4.4) for the achievement of GES/GEP 7 on impoundments and one on hydropeaking.

Although the exact effect of the measures on the basin-wide scale is difficult to be assessed, further improvement of water status can be expected, i.a. by improving river morphology. Monitoring in combination with measures implementation and further research is expected to further clarify the effects of the measures on the basin-wide scale.

3.4.4 Future infrastructure projects

3.4.4.1 Vision and management objectives

The Tisza basin-wide vision for future infrastructure projects is that they are conducted transparently using best environmental practices and best available techniques throughout the Tisza River Basin, so that impacts on or deterioration of the good status and negative transboundary effects are fully prevented, mitigated or compensated.

The following management objectives will be implemented by 2021 as steps towards the vision:
EU Member States and Non-EU Member States:

- Conduction of a Strategic Environment Assessment and/or Environmental Impact Assessments in conjunction with the EU Water Framework Directive requirements.
- New infrastructure projects should be planned and conducted to ensure that water status is not deteriorated. Deterioration should only be allowed in exceptional cases and following the requirements as set in WFD Article 4(7).
- Pre-planning procedures should be conducted with stakeholder participation to ensure that impacts are avoided and the best environmental option is chosen for new infrastructure projects.
- Application of recommendations for the implementation of best environmental practices and best available techniques which were developed for inland navigation and sustainable hydropower.
- Improvement of ecological status in case of new flood risk management measures, and improvement of ecological situation in case of required refurbishment/maintenance/reconstruction of existing structures by making best use of synergies.

3.4.4.2 Progress in implementation of measures from 1st ITRBM Plan

In order to prevent and reduce basin-wide and transboundary effects from future infrastructure projects in the TRB, the development and application of BAT and BEP is crucial. For new infrastructure projects, it is of particular importance that environmental requirements are considered as an integral part of the planning and implementation process, besides the involvement of stakeholders right from the beginning.

In the 1st ITRBM Plan 28 projects were officially planned or in preparation, and 3 projects were ongoing. The types of projects included the flood protection levee built to design flood level plus security height; construction of a flood level mitigation reservoir at the middle Tisza Valley (Nagykunság); construction and rehabilitation of an emergency reservoir for Tisza River floodplain between Szolnok and Kisköre. Of the future infrastructure projects, 91% were for flood protection. Projects were also planned for water supply and hydropower issues, as well as for other reasons to a small extent. Out of the 28 projects in Hungary, 7 cases of transboundary impacts were indicated.

3.4.4.3 Summary of measures of sub-basin-wide importance

The pressure analysis concludes that 12 FIPs have been reported for the TRB. 9 of them are located in the Tisza River itself. All these projects are related to flood protection and are located in Romania (9) and Hungary (3). All FIPs (until 2021) including brief descriptions (if provided) are compiled in Annex 6.

For 2 FIPs, SEAs have been performed during the planning process. Further, EIAs have already been performed for 4 FIPs and are intended for another 7 FIPs also 7 FIPs are expected to have a transboundary impact. 4 FIPs are expected to provoke deterioration of water status, for which exemptions according to WFD Article 4(7) are applied.

The management objectives include precautionary measures (best environmental practices and best available techniques) that should be implemented to reduce and/or prevent impacts on water status. For new infrastructure projects, it is of particular importance that environmental requirements are considered as an integral part of planning and implementation right from the beginning of the process. In the framework of the ICPDR, respective guidance has been developed in this regard for inland navigation (Joint Statement) and hydropower (Guiding Principles). Both documents describe respective processes in detail and the organisation of regular meetings to facilitate the follow-up discussions will help the exchange of experiences for practical application. The management objectives also indicate precautionary measures with regard to sustainable flood risk management.

3.4.4.4. Estimated effect of measures on the sub-basin-wide scale

Planning and implementing FIPs in a sustainable and integrated manner is a key issue, besides taking measures on already existing hydromorphological pressures. Integrating environmental legal requirements from the beginning in the planning processes will be fundamental for securing water status. It can be estimated that the already ongoing and planned further measures on inter-sectoral cooperation in the frame of the ICPDR will have a significant positive effect on the basin-wide scale in case properly implemented and reflected at the national level.

Chapter 4 Surface waters - lakes

In the whole Tisza River Basin there were four heavily modified lake water bodies designated as basin wide importance belonging to Hungary. Only two of them have been assessed in the period of 2009-2012. **Csaj lake** is the smallest one with moderate ecological potential. Chemical status was not. Lake assessed due to data gaps. **Tisza, the largest lake**, has good and above ecological potential, however the environmental quality standards were exceeded for the priority pollutants which resulted to failing of good chemical status for the reference period (see table below).

Table IV.1 An overview of lakes water bodies in the TRB

LWB name	LWB code	LWB character	Area [km^2]	Ecological potential	Chemical status
Hortobágyi lakes	HUAIG967	HMWB	16,48	unknown	unknown
Csaj lake	HUAIH054	HMWB	10,23	moderate	unknown
Szegedi Fehér lake	HUAIH127	HMWB	14,48	unknown	unknown
Lake Tisza	HUANS560	HMWB	120,83	good and above	failing

Based on the Hungarian RMPs following measures are included into JPM relevant for the TRB:

Hortobágyi lakes (HUAIG967)

Foreseen measures until 2021:

- Water-type specific maintenance of bed and vegetation: dredging, flushing;
- Maintenance of vegetation in the riparian zone.

Csaj lake (HUAIH054) and Szegedi-Fehér lake (HUAIH127)

Both fish ponds were constructed in previous sodic basins with intermittent lakes. Besides fish farming bird migration/bird habitat considerations are also important factors in the lakes.
Foreseen measures until 2021 are as follows:

- Water-type specific maintenance of bed and vegetation: dredging, flushing;
- Maintenance of vegetation in the riparian zone;
- Modification of the excess water drainage system (in case of Csaj lake and surrounding channels).

Lake Tisza (HUANS560)

Foreseen measures until 2021:

- Modification of operation of dams/weirs to decrease impact of damming and water level regulation;
- One-time removal of accumulated sediment and overgrown vegetation from rivers and lakes;
- Maintenance of vegetation in the riparian zone.

Diffuse pollution

In order to eliminate the impact of the diffuse pollution on water quality of lakes, the following measures are proposed:
Basic measures:

Measures on Lake Tisza and Hortobágyi lakes are foreseen until 2021, on Csaj lake and Szegedi-Fehér lake until 2027):

- General rules to reduce nutrient pollution from agriculture, limitation of nutrient usage on arable lands and plantations;
- To reduce sediment and contaminant leaching with grassing, planting trees, terrace for sloping areas, infiltration surfaces, constructed wetlands, isolation;
- Modernization of livestock holdings according to the EU Nitrate Directive (Hortobágyi lakes, Csaj lake, Lake Tisza);
- To filter excess water drained from agricultural areas prior to discharge into the recipient (filtering field) (Csaj lake).

Supplementary measures:

- Agri-environmental payments under Rural Development Program (RDP) to ensure nutrient management based on soil test and planning on arable lands (Csaj lake);
- Change of the cropping pattern (conversion of arable land into grassland, forest or wetland) (Csaj lake, Szegedi-Fehér lake);
- Agri-environmental measures under RDP on plain areas to reduce contaminant leaching (e.g. planting hedges, deep ploughing);
- Creation of riparian buffer strips: grassing or implementation of agro-forestry methods (harmonization of coastal zone rehabilitation, flood protection and maintenance of beds) (Csaj lake, Szegedi-Fehér lake);
- Best practices of grazing and pasture forage management. (Csaj lake).

Chapter 5 Conducting the Drivers-Pressures-State-Impact-Response (DPSIR) approach for the Update of ITRBM Plan

The Update of ITRBM Plan is determined by the requirements of the WFD and related to the Drivers-Pressures-State-Impact-Response (DPSIR) Framework, which provides an overall mechanism for analysis and response (Figure V. 1)[13]

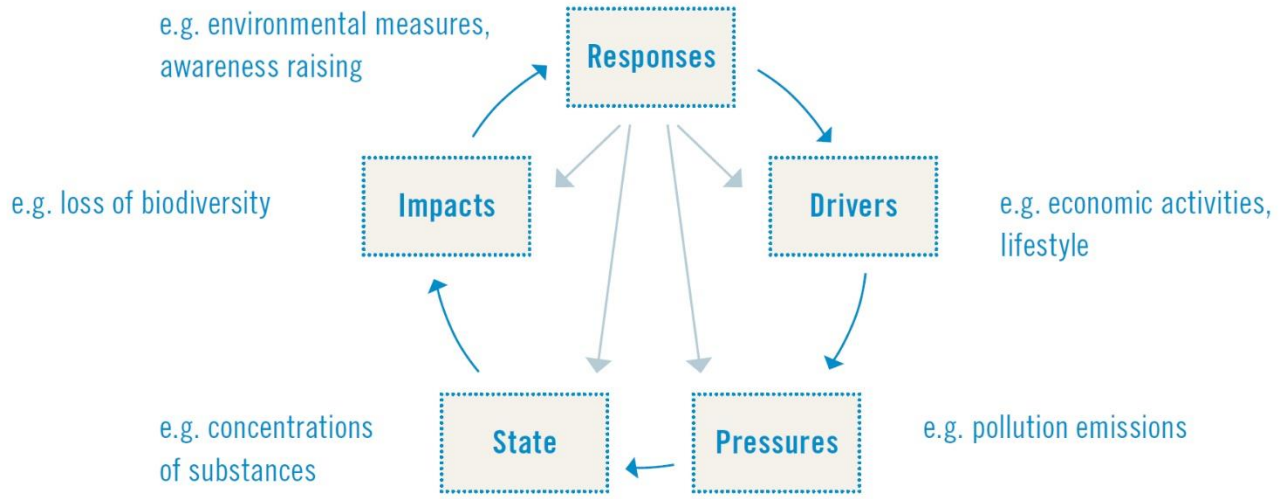

Figure V. 1 DPSIR approach according to the European Environment Agency (EEA)

The individual elements of the DPSIR Framework are addressed in the Update of ITRBM Plan. A more comprehensive picture on driving forces is available with the expected growth of specific sectors (i.e. hydropower, inland navigation, biomass, agriculture and industries). Therefore, a potential increase of pressures can be anticipated in case such developments are not undertaken in a sustainable manner, considering climate change. For obtaining a clear picture more detailed data and analysis will be required, however, existing information is useful for decisions on the need to strengthen inter-sectoral approaches.

With the updated pressures assessment, the key factors on the basin-wide scale influencing water status are largely identified. Further improvement of the data base, data harmonisation efforts and closing of knowledge gaps is to be continued.

Hence, pressures which impact water status and the reasons for failing to achieve the environmental objectives are largely known. Measures will be further implemented to reduce these pressures and to improve status. However, assessing the expected improvement of water status due to measures implementation is still posing a challenge and the measures are not always directly linked to the status of water bodies on the basin-wide scale. For instance, assessments on the expected reduction of organic emissions or nutrient loads are available, whereas making predictions on the improvement of water status, is still considered as difficult. Gaining a better understanding on these linkages will in particular become relevant once basic measures are

[13] ICPDR: The Danube River Basin District Management Plan –Update 2015
http://www.icpdr.org/main/sites/default/files/nodes/documents/drbmp-update2015.pdf

implemented and supplementary measures going beyond the legal requirements might be required for achieving good status.

Similar challenges are faced in the quantification of expected improvements of water status due to hydromorphological measures implementation. This also due to the fact that water bodies are often subject to multiple pressures, including for instance hydromorphological alterations and in addition different sources of pollution.

Ongoing monitoring efforts together with measures implementation and updated pressures assessments provide the opportunity to further strengthen the understanding on the inter-linkages between the different elements of the DPSIR approach for the upcoming WFD implementation cycle.

Chapter 6 Key conclusions for surface water

The key conclusions focus on aspects of water management and the implementation of the WFD at the basin wide scale. Complementary information on the specific actions taking place at the national level can be obtained from the national river basin management plans.

Organic pollution

- 985 agglomerations with size ≥ 2,000 PE is situated in the TRB. Urban waste water load presents 11,568,886 PE. 783 of these agglomerations are small-sized settlements having a PE between 2,000 and 10,000, 185 are middle-sized agglomerations (between 10,000 and 100,000 PE) whilst only 17 have a PE higher than 100,000.
- At basin scale, the urban waste water sector generates about 19,750 tons per year BOD and 46,000 tons per year COD discharges into the surface water bodies of the Tisza Basin (reference year: 2011/2012).
- The direct industrial emissions of organic substances total up to ca. 2,000 tons per year COD for the reference year (2012). This means overall COD emissions of approximately 48,000 tons per year, out of which 96% are released by the urban waste water sector.
- 22% of the BOD surface water emissions came via urban waste water stem from agglomerations with existing sewer systems but without treatment. Taking into account that these agglomerations represent only 3% of the total PE of the basin, implementation of measures for a relatively small proportion of the agglomerations can result in substantial progress. However, about 40% of the agglomerations (representing 26% of the PE) have no collection systems which should be constructed together with appropriate treatment in the future.
- According to the baseline scenario, about 8 million PE (at 202 agglomerations above 10,000 PE) will be additionally connected to tertiary treatment providing with high nutrient elimination rates.

Nutrient pollution

- At basin-wide scale 8,862 tons per year TN and 1,224 tons per year TP for the reference period (2009–2012) are emitted into the surface waters from the waste water collection and treatment facilities 11% (TN) and 12% (TP) of the emissions can be linked to untreated waste water discharged directly into the recipients and about 3% of the nutrient releases stem from plants having mechanical treatment, whilst the proportion of the waste water treatment plants with secondary treatment is 45% (TN) and 52% (TP).). Some 14% (TN) and 12% (TP) of the nutrient emissions are discharged from plants with advanced technologies for nutrients removal.
- Regarding the pollution sources, agriculture and urban water management are responsible for the majority of the nutrient emissions indicating the necessity of appropriate measures to be implemented in these sectors.
- Similarly, to organic pollution, the total point source emissions are influenced by collected and untreated waste water discharges being responsible for 11% (TN) and 12% (TP) of the total point source emissions. Besides this, enhanced treatment of the existing plants at agglomerations above 10,000 PE (202 agglomerations) has great potential to reduce nutrient emissions concerning more than 8 million PE in total.
- According to the baseline scenario, about 8 million PE (at 202 agglomerations above 10,000 PE) will be additionally connected to tertiary treatment providing with high nutrient removal rates. Regarding nitrogen, not collected and not treated emissions will be substantially lower by 2021, however expected total TN load to surface waters should not change significantly compare to the reference year. Calculated load for TN is 8,264 t/year for phosphorus is 1,114 t/year.
- Total emissions released to the environment via urban waste water discharges are expected to decline by 37% (TN) and 42% (TP). Despite the significant progress expected the baseline scenario will probably not ensure the full achievement of the WFD environmental objectives by 2021.

- The updated database of the former MONERIS setup (2nd DRBMP) for the Tisza river basin resulted in an increase in TN emissions. TP emissions remained almost constant. Although spatial patterns of nutrient emissions remained similar, in certain regions differences were identified due to the updated datasets of land use, soil loss and N surplus. The updated database and the new modelling approaches resulted in average total emissions of 95 kt/yr TN and 4.7 kt/yr TP for the Tisza catchment.
- There are differences between modelling results and observed loads TN emissions in the TRB. Based on the MONERIS model 95 kilotons total N emissions in the TRB were calculated, but only 40 kilotons observed loads at the Tisza mouth, which indicates either a high denitrification rate (over 50%, probably due to longer residence time in the Tisza river network) or substantially overestimated total emissions (and GW emissions). It is proposed to carried out the further investigations on both, modelling and monitoring to prove the pathway and source apportionment of the emissions and to initiate further validate the MONERIS model (e.g. cross-validation, pathway validation).
- Share of the sources (land uses) in the overall TN and TP emissions in the Tisza shows that the highest share of TN emissions comes from arable land. Urban area represents the second most important source of TN emissions. Forest area is significant especially in the case of Ukraine (51.0%), Romania (30.6%), and Slovakia (24.4%). In the case of TP, the highest emissions come from urban area followed by arable land. Forest area, similarly as in the case of TN emissions, is significant especially in Ukraine (28.8%), Romania (18.2%) and Slovakia (16.4%).
- With regard to assumed land use type areas in defined four scenarios (including so called intensification scenario with nutrient surplus to be +55 kg N/ha and +5 kg P/ha and vision scenario with nitrogen surplus +25 kg N/ha of agricultural land), it can be stated that agriculture will remain the sector which has dominant share on total TN emissions (52.59% at reference 2012, 55.46% at baseline 2021, 52.40% at vision and 71.57% at intensification scenarios).
- In case of total P emissions, the urban sector has the highest share compared to agriculture especially in the reference year of 2012, according to the baseline scenario of 2021 and intensification scenarios (e.g. 46.70%, 46.00% and 42.94% respectively). In spite of this pattern by vision scenario share of agricultural TP emissions slightly dominates compared to urban sector (41.50% of TP loads originates from agriculture, while 40.60% is from urban sector).

Hazardous substances pollution

- Tisza countries have taken important steps to fill the existing data gaps in the field of hazardous substance pollution. The recent investigations on priority and other hazardous substances have provided essential information on the relevance of these substances resulting in a much clearer picture on the pollution problem (relevant substances and their magnitude) than ever before. The elaboration of an inventory of emissions, discharges and losses of the priority hazardous substances can help to close information gaps on the sources. TRB countries are collecting data on the existing industrial and contaminated sites that might be at potential risk to cause accidental pollution triggered by operation failures or natural disasters like floods.
- Based on the scarce information available on the hazardous substances emissions, 33 compounds have been found with reported releases from industrial facilities. Out of these substances eight organic pollutants, eight heavy metals, three pesticides, eleven chlorinated organic substances and three inorganic pollutants have been identified.
- Improving waste water treatment and industrial technologies, regulating market products and closing knowledge gaps on hazardous substances via emission inventories are the most important recent activities to address hazardous substance pollution.
- In spite of the substantial progress achieved in many aspects of the hazardous substance pollution the state-of-the-art knowledge needs to be improved and the implementation of measures should be proceeded in the future to appropriately manage the problem. Further efforts are needed to identify which priority substances and other emerging chemicals are of basin-wide relevance. Compilation of the basin-wide inventory on discharges, of the priority and priority hazardous substances have to be continued.

- In particular, diffuse emissions should be addressed by regionalized pathway modelling for which targeted research activities should be developed to get a better understanding on inputs and fluxes of hazardous substances in the Tisza basin. To support these activities further information on in-stream concentrations and river loads via improved regular monitoring (enhanced devices and higher sampling frequency) and specific sampling campaigns (e.g. to sample point source effluents) are needed.
- Enhancing the urban and industrial waste water technologies, application of best agricultural practices, progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances releases and improving safety conditions at industrial sites should be continued.
- Regular update of a basin-wide catalogue of hazardous industrial, abandoned and mining sites should be further accomplished. Besides identifying the most important potential accident hot-spots the ICPDR should ensure that a proper platform for information exchange and know-how transfer is provided for the countries to facilitate risk management in the identified key priority industrial fields and recommend particular preventive measures to be implemented.

Hydromorphological alterations

- Some measures have been taken by the Tisza countries by 2015 to improve river continuity, reconnecting wetlands/floodplains and on hydrological alterations for the improvement of water status. Further measures will be taken until 2021 to address hydromorphological alterations. However, a significant number of respective pressures will still remain and good ecological status/potential will not be achieved for all water bodies by 2021.
- In many cases an extension of the deadline after 2021 to achieve good ecological status/potential (WFD Article 4.4) will be applied.
- Further significant efforts in the next RBM cycle (2021-2027) will be necessary to address the pressures from all hydromorphological components. Ensuring the exchange on methodological aspects regarding hydromorphology will be important for reaching further harmonised and comparable approaches throughout the basin. For further specifications, see below.

Interruption of river continuity and morphological alterations

- Further progress will be made in the restoration of river continuity for fish migration. By 2021, 27 fish migration aids are planned to be constructed in the TRB that should ensure the migration of all fish species and age classes according to best available techniques. 104 interruptions will remain in 2021 but 48 measures to restore river continuity interruptions are planned to be implemented after 2021 (WFD Article 4(4)). In 49 cases no measures are not necessary since WBs have already achieved GES/GEP. No measures are yet indicated for 7 continuity interruptions as well as measures to be implemented according to WFD Article 4(5).
- With regard to river morphology, restoration measures are planned to be taken in 5 water bodies and further measures are planned in 50 water bodies for the period after 2021. For a considerable number (80) of water bodies, no measures are yet planned or it is currently unknown whether measures are needed or planned to be implemented. Further assessments will be required to clarify this issue.
- In summary, the planned restoration measures for establishing river continuity and to improve the morphological conditions and habitats are expected to contribute towards the improvement of water status by 2021 and beyond. This will in particular be the case for the biological quality elements directly sensitive to these types of pressures, including benthic invertebrates and fish.
- Although the exact effect of the measures on the basin-wide scale is difficult to be assessed, further improvement of water status can be expected, i.a. by improving river morphology. Monitoring in combination with measures implementation and further research is expected to further clarify the effects of the measures on the basin-wide scale.

Disconnected adjacent wetlands/floodplains

- In the period between 2009 and 2015 only 7 ha of wetlands/floodplains have been reconnected, and their hydrological regime improved respectively. Measures until 2021 are not planned. In an area of 1,655 ha measures are planned to be taken after 2021 in line with provision of the WFD Art. 4.4.
- Detailed analysis on the potential for reconnection, the establishment of an inventory, prioritisation and investigations on the different implications, what is planned to be accomplished until 2021 in coordination with the implementation of the EU Floods Directive, will help to gain further clarity on the estimated effects on the basin-wide scale.

Restoration of hydrological alterations

- In total, 78 impoundments are located in the TRB rivers, 4 of them in the Tisza River itself. 60 WBs are already in GES/GEP. For 4 impoundments restoration measures are planned to be implemented by 2021 and for 11 after 2021 as part of the third RBM cycle (Art. 4(4)). No measures will be applied according to the WFD (Art. 4(5)) and no measures were yet indicated for 3 impoundments.
- Concerning water abstraction, no restoration measures are planned to be implemented by 2021 and after 2021 as part of the third RBM cycle (Art. 4(4) since for all water abstractions (33), ecological flow requirements for the achievement of GES/GEP have already been achieved in 2015.
- Only one case of hydropeaking was identified in the TRB, in Hungary. This situation allows Hungary to apply WFD 4.4 exception, based on "technical infeasibility" and undoubtedly, further cross-border negotiations could be started in order to find the best possible measures (in the Romanian national RBMP).

Future infrastructure projects

- 12 FIPs have been reported for the TRB. 9 of them are located in the Tisza River itself. These all projects are related to flood protection and are located in Romania (9) and Hungary (3).
- For 2 FIPs, SEAs have been performed during the planning process. Further, EIAs have already been performed for 4 FIPs and are intended for another 7 FIPs also 7 FIPs are expected to have a transboundary impact. 2 FIPs are expected to provoke deterioration of water status, for which exemptions according to WFD Article 4(7) are applied.
- Integrated planning approaches are need to be further enhanced and continued, taking environmental requirements into account from the beginning in order to prevent and/or reduce impacts on water status.

Abbreviations

AEWS	Accident Emergency Warning System
ARS	Accidental Risk Spots
BAT	Best Available Techniques
BAP	Best Agricultural Practice
BEP	Best Environmental Practices
BLS	Baseline Scenario
BOD	Biological Oxygen Demand
CAP	Common Agricultural Policy
COD	Chemical Oxygen Demand
DBA	Danube Basin Analysis 2004
DRB	Danube River Basin
DRBD	Danube River Basin District
DRBM Plan	Danube River Basin District Management Plan
DRPC	Danube River Protection Convention
EG	Expert Group
EIA	Environmental Impact Assessment
EPER	European Pollutant Emission Register
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive (2013/39/EU)
EU MS	EU Member State(s)
FD	EU Flood Directive (2007/60/EC)
FIP	Future Infrastructure Projects
Non EU MS	Non EU Member State(s)
EU WFD	European Water Framework Directive
GDP	Gross Domestic Product
GEP	Good Ecological Potential
GES	Good Ecological Status
GVA	Gross Added Value
GW	Groundwater
GWBs	Groundwater bodies
HMWB	Heavily Modified Water Bodies
ICPDR	International Commission for the Protection of the Danube River
IED	Industrial Emissions Directive (2010/75/EU)
ITRBM Plan	Integrated Tisza River Basin Management Plan
JAP	Joint Action Programme
JPM	Joint Programme of Measures
LWB	Lake Water Body
MONERIS	Modelling Nutrient Emissions in River Systems
MS	Member State(s)
ND	Nitrates Directive (91/676/EEC)
NVZ	Nitrate Vulnerable Zones
PRTR	Pollutant Release and Transfer Register
RDP	Rural Development Program
RBM	River Basin Management
SEA	Strategic Environmental Assessment
SSD	Sewage Sludge Directive (86/278/EEC)
SWMI	Significant Water Management Issue
TAR	Tisza Analysis Report - 2007

TNMN	Transnational Monitoring Network
TOC	Total Oxygen Demand
TN	Total Nitrogen
TP	Total Phosphorus
TRB	Tisza River Basin
UNDP/GEF	United Nations Development Program / Global Environment Facility
UNEP CC	United Nations Environment Programme - Carpathian Convention Interim Secretariat
UWWTP	Urban Wastewater Treatment Plant
UWWTD	Urban Waste Water Treatment Directive
WB	Water body
WFD	Water Framework Directive (2000/60/EC)
WWF	World Wide Fund for Nature
WWTP	Wastewater Treatment Plant

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