Groundwater Guidance

ICPDR IKSD

International Commission for the Protection of the Danube River

Internationale Kommission zum Schutz der Donau

4th Edition
2022
Final

//// Deutschland //// Österreich //// Česká republika //// Slovensko //// Magyarország //// Slovenija //// Hrvatska //// Bosna i Hercegovina //// Srbija //// Crna Gora //// România //// България //// Moldova ////

Table of contents

LIST OF USED ABBREVIATIONS

CIS	EU Common Implementation Strategy of the WFD
DBA	Danube Basin Analysis (WFD Article 5)
DG	Directorate General of the European Commission
DPSIR	Driver, Pressure, State, Impact and Response
DRB	Danube River Basin
DRBD	Danube River Basin District
DRBM Plan	Danube River Basin Management Plan
DRPC	Danube River Protection Convention
EC	European Commission
EU	European Union
GIS EG	GIS Expert Group (of the ICPDR)
GW	Groundwater
GWB	Groundwater Body or group of bodies of groundwater
GWD	Groundwater Directive (2006/118/EC)
GW TG	Groundwater Task Group (of the ICPDR)
ICPDR	International Commission for the Protection of the Danube River
ICPDR GWB	Transboundary Groundwater Body of Danube Basin-wide Importance
JDS	Joint Danube Survey
JPM	Joint Programme of Measures (WFD Article 11)
MS	Member State
QA, QC	Quality assurance, Quality control
RBD	River Basin District
RBMP	River Basin Management Plan
RBM EG	River Basin Management Expert Group (of the ICPDR)
RTD	Research and Technological Development
StWG	Standing Working Group (of the ICPDR)
SWMI	Significant Water Management Issues (WFD Article 14)
TNMN	Transnational Monitoring Network
TV	Groundwater Threshold Value
WFD	Water Framework Directive (2000/60/EC)
WG GW	CIS Working Group Groundwater (of the EC)

1. Introduction

1.1. ICPDR Groundwater Task Group

In October 2000, the EU Water Framework Directive (2000/60/EC, WFD) was adopted and came into force in December 2000. EU Member States (EU MS) should aim to achieve 'good status' in all bodies of surface water and groundwater by 2015, respectively by 2027 at the latest and to implement measures to prevent deterioration of the status of each water body. In the year 2006 the EU Groundwater Directive (2006/118/EC, GWD) entered into force, establishing a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. In 2014, Annex II of the GWD was amended by Directive 2014/80/EU. Currently not all Danube countries are EU MS and therefore not legally obliged to fulfil the WFD requirements. However, when the WFD was adopted in the year 2000, all countries cooperating under the Danube River Protection Convention (DRPC) decided to make all efforts to implement the Directive throughout the whole basin

The contracting parties of the DRPC, EU Member States and non-Member States, committed to make all efforts to draw up a co-ordinated international River Basin Management Plan (RBMP) for the Danube River Basin District (DRBD) and that the International Commission for the Protection of the Danube River (ICPDR) should serve as a common coordinating platform for the implementation of the WFD on a basin-wide scale.

During the data and information collection for the WFD Roof Reports for the DRBD many technical questions arose especially concerning the identification of transboundary groundwater bodies (GWBs) of basin-wide importance, bilateral agreements and harmonisation of the activities. Member countries of the ICPDR stated their need for a Drafting Group Groundwater to deal with groundwater related issues of basin wide concern.

The ICPDR Groundwater Task Group (GW TG) was established in 2004 and provided essential groundwater related input to WFD key products and prepared Danube-basin related assessments up to now. A lot of work on harmonisation has already been done and is still needed in the coming years, which should be covered and assisted by this guidance. Within the GW TG groundwater bodies of basin-wide importance were identified and the characterisation of GWBs, monitoring, status assessment and the joint programme of measures were coordinated and harmonised. Data and information relevant for the preparation of the reports required by the WFD have been collected and analysed and respective chapters for the reports were prepared. Experiences and best practice have been exchanged and relevant discussions at European level have been followed.

So far, the main outputs of the GW TG can be summarised as follows:

- Definition of criteria and identification of transboundary GWBs of basin wide importance.
- Development of guidelines for harmonised characterisation of GWBs and data collection and accomplishment of various data collections.
- Drafting of the groundwater related chapters and annexes to the:
    - Danube Basin Analysis Report (DBA) 2004 (WFD Article 5) and the update 2013.
    - Significant Water Management Issues (SWMI) in the DRBD 2007 (WFD Article 14) and the updates in 2013 and 2019.
    - Roof Report 2008 on monitoring (WFD Article 8).
    - Danube River Basin Management Plan (DRBM Plan) 2009 (WFD Article 13) and the updates 2015 and 2021.

  - Interim report on the implementation of the Joint Programme of Measures (JPM) 2012 and 2018
- Compilation and assessment of TNMN GW quality data 2011 and 2017.
- Contributions to the TNMN Yearbooks 2008, 2009 and 2015.
- Frequent data collection and analysis to underpin the importance of groundwater in drinking water supply in the DRB.
- Compilation of hazardous substances in groundwater (finalised 2020).
- Compilation of compliance regimes for assessing groundwater status and trends (finalised 2020).
- Data collection and analysis to highlight the importance of bank filtered water along the Danube (finalised 2014).
- Contribution to JDS3 and JDS4 (parallel monitoring of emerging substances in the Danube and in adjacent groundwater wells).
- Preparation of the ICPDR leaflet Groundwater – the river's invisible twin.
- Regular exchange of experience and best practice in the Danube countries (e.g., on status and trend assessment, groundwater dependent terrestrial ecosystems, groundwater associated aquatic ecosystems, priority and emerging substances, drinking water safeguard zones).
- Regular exchange of information on bilateral activities on GW management.
- Compilation of bilateral transboundary coordination activities between 2016 and 2020.
- Presentations of achievements of the GW TG and groundwater management under the ICPDR at various conferences and workshops (e.g., IWA Groundwater Specialists Conferences in Belgrade 2007, 2011 and 2016; 5th Regional Consultation under UNESCO-IHP on Groundwater Governance 2013).

Generally, there are two face-to-face meetings a year on expert level, dealing with up-to-date groundwater issues according to the work programme of the GW TG. Depending on the work programme, the frequency of meetings can be reduced to once per year (like in 2016 and 2018). During the pandemic situation from 2020 onwards, a series of meetings were held virtually via Zoom.

1.2. Scope of the Guidance

The GW TG decided that a guidance document, summarising the particular groundwater related activities according to the needs within the ICPDR framework, should further strengthen cooperation within the DRB by assisting in the harmonisation of the applied approaches. This document provides technical guidance on the selection and characterisation of GWBs of basin wide importance, on monitoring, on data reporting and aggregation procedures, on the presentation of risk, status and trends and on the reporting of the programmes of measures. This guidance documents the ways and forms of data exchange within the ICPDR TransNational Monitoring Network (TNMN) Groundwater, either when fulfilling the WFD reporting requirements or when contributing to the specific needs of the ICPDR e.g. for contributing to the TNMN Yearbook.

Due to the cyclic process of the WFD and GWD implementation and due to the increase of knowledge in time, this guidance is a living document being updated and completed according to the further development and agreements within the GW TG. Each edition – this is the fourth – is reflecting still valid and most recent developments, agreements and templates. Aspects which are no longer valid or have been revised are no longer included but can still be found in previous editions of the guidance. The first edition was published in 2008 (https://danubis.icpdr.org/document/7762) the second in 2010 (https://danubis.icpdr.org/document/9795) and the third, the previous guidance of 2016 is accessible via Danubis, the ICPDR Information System. (https://danubis.icpdr.org/document/15935).

The guidance intends to contribute to the following issues of coordination, harmonisation and exchange of experience:

- Bilateral coordination and bilateral agreements on approaches and principles in the transboundary GWBs and their continuous refinements.

- The (update of the) delineation of GWBs and the development of common conceptual models for each transboundary GWB (as a whole).
- Characterisation and assessment of impacts of human activities on the achievement of the environmental objectives (risk assessment, DBA).
- Coordination of monitoring activities including the exchange of related information and data (TNMN Groundwater).
- Approaches for considering groundwater associated aquatic ecosystems (GWAAE) and groundwater dependent terrestrial ecosystems (GWDTE) in the groundwater status assessment.
- Coordination of status and trend assessment for transboundary GWBs. Coordination in the establishment of groundwater threshold values.
- Establishment of a data flow of groundwater data to the ICPDR and data exchange between the member countries sharing a transnational GWB of basin-wide importance. At all stages emphasis should be put on QA and QC aspects.

This document is based on best practice gathered in the past and already existing information which are: the outcome of discussions, developed templates and products by the GW TG, ICPDR documents and reports, Common Implementation Strategy (CIS) guidance documents and technical reports, the WFD and the GWD. Moreover, further documents dealing with transboundary groundwater issues were considered e.g., UN/ECE-Report on Guidelines on Monitoring and Assessment of Transboundary Groundwaters. Since the process within ICPDR is among others driven by the implementation of the WFD across Europe, some issues may also be discussed at the European Commission (EC, DG ENV) level in the CIS Working Group Groundwater (WG GW) in parallel. Hence, respective results and other helpful information are taken into account in this guidance.

The guidance document shall support the achievement of the underlying **ICPDR visions for groundwater quality and quantity** which are still as follows (ICPDR, 2021):

- The ICPDR's basin-wide vision is that the emissions of polluting substances do not cause any deterioration of groundwater quality in the Danube River Basin District. Where groundwater is already polluted, restoration to good quality will be the ambition.
- The ICPDR's basin-wide vision is that the water use is appropriately balanced and does not exceed the available groundwater resource in the Danube River Basin District, considering future impacts of climate change.

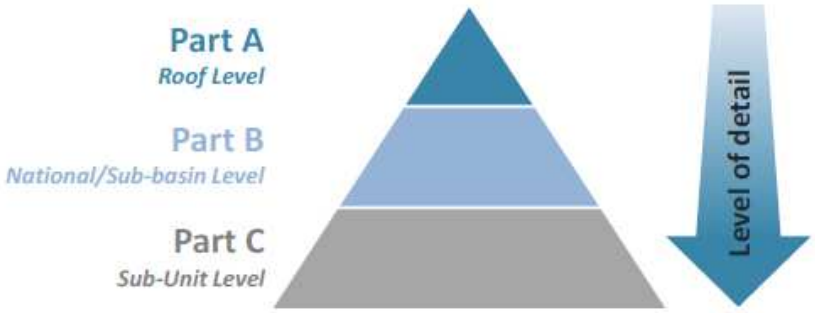
This guidance documents the results of the continuous harmonization and coordination process of groundwater management at the ICPDR level (level A, international river basin district) in the Groundwater Task Group as well as the data and information exchange between the countries and the ICPDR. This guidance document also serves as a starting kit to get familiar with the work of the Groundwater Task Group already performed and the goals achieved, and it provides a good demonstration of tools and approaches towards groundwater management in an international river basin.

2. WFD Implementation at DRBD level

Due to reasons of efficiency, proportionality and in line with the principle of subsidiarity, the management of the DRBD is based on the three levels of coordination (see Figure 1). According to this the WFD Article 5 analysis (river basin district characterisation and risk assessment), the RBM Plans and the programmes of measures are developed at three levels in the DRB. The information increases in detail from Part A to Part B and to Part C. The A-level reports are highlighting all relevant issues of basin-wide importance and are strongly based on findings and actions on the national/sub-basin level. Adverse overlaps and duplication of work are prevented; hence, the DRBM Plans should be read and interpreted in conjunction with the national RBM Plans.

1. Part A – International, basin-wide level, the Roof Level;
2. Part B – National level (managed through the competent authorities) and/or the international coordinated sub-basin level for selected sub-basins (Tisza, Sava, Prut, and Danube Delta);
3. Sub-unit level, defined as management units within the national territory.

Figure 1: Three levels of management for WFD implementation in the DRBD showing the increase of the level of detail from Part A to Part B and C



The reporting under the WFD follows a 6-year cycle. The first DBA was accomplished in 2004 and updated in 2013. Further updates of the DBA are no longer reported separately but within the RBM Plans. This is fully in line with the WFD reporting requirements under Article 15). From the year 2009 onwards RBM Plans are to be updated and published (after public consultation) every 6 years and the interim report on the status of the implementation of the Joint Programme of Measures (JPM) which is due from 2012 every 6 years (see Table 1).

Table 1: Reporting milestones of WFD River Basin Management Planning

	DRBM Plan	DRBM Plan update 2015	DRBM Plan update 2021
Danube Basin Analysis (DBA)	2004	2013	2021
Danube River Basin management (DRBM) Plan	2009	2015	
Interim report on the Joint Programme of Measures (JPM)	2012	2018	2024

2.1. Need for transboundary coordination

As river basin management under the WFD is focusing on river basins, transboundary aspects are of utmost importance. Hence, transboundary coordination is explicitly requested by the WFD in terms of the delineation of international river basins and river basin districts, the delineation and characterisation of transboundary GWBs, monitoring, the establishment of quality standards (groundwater threshold values) and the development and implementation of the programmes of measures. This chapter provides the relevant passages in the WFD and the GWD concerning transboundary coordination.

2.1.1. Coordination within RBDs (WFD)

WFD, Preamble

> *(35) Within a river basin where use of water may have transboundary effects, the requirements for the achievement of the environmental objectives established under this Directive, and in particular in all programmes of measures, should be **coordinated for the whole of the river basin district**. For river basins extending beyond the boundaries of the Community, Member States should endeavour to ensure the appropriate **coordination with the relevant non-member States**. This Directive is to contribute to the implementation of Community obligations under international conventions on water protection and management, notably the United Nations Convention on the protection and use of transboundary water courses and international lakes, approved by Council Decision 95/308/EC and any succeeding agreements on its application.*

WFD, Article 3 - Coordination of administrative arrangements within river basin districts

Article 3 of the WFD clearly expresses the need of coordination between Member States sharing an RBD and even with non-Member States coordination should be endeavoured to be established.

> *4. Member States shall ensure that the requirements of this Directive for the achievement of the environmental objectives established under Article 4, and in particular all programmes of measures are coordinated for the whole of the river basin district. For international river basin districts the Member States concerned shall together ensure this **coordination** and may, for this purpose, use existing structures stemming from international agreements. At the request of the Member States involved, the Commission shall act to facilitate the establishment of the programmes of measures.*
>
> *5. Where a river basin district extends beyond the territory of the Community, the Member State or Member States concerned shall endeavour to establish appropriate **coordination** with the relevant non-Member States, with the aim of achieving the objectives of this Directive throughout the river basin district. Member States shall ensure the application of the rules of this Directive within their territory.*

2.1.2. Characterisation (WFD)

Annex II, 2.3. - Review of the impact of human activity on groundwaters

> *For those **bodies of groundwater which cross the boundary** between two or more Member States or are identified following the initial characterisation undertaken in accordance with paragraph 2.1 as being at risk of failing to meet the objectives set for each body under Article 4, the following information shall, where relevant, be collected and maintained for each groundwater body: […]*

2.1.3. Groundwater Monitoring (WFD, GWD)

GWD, Preamble

*(16) In order to ensure consistent protection of groundwater, Member States sharing bodies of groundwater should **coordinate** their activities in respect of monitoring, […].*

WFD, Annex V, 2.2. - Monitoring of groundwater quantitative status

2.2.2 Density of monitoring sites

*[…] - for groundwater bodies within which groundwater flows **across a MS boundary**, ensure sufficient monitoring points are provided to estimate the direction and rate of groundwater flow across the Member State boundary.*

2.2.3. Monitoring frequency

*[…] - for groundwater bodies within which groundwater flows **across a MS boundary**, ensure sufficient frequency of measurement to estimate the direction and rate of groundwater flow across the Member State boundary.*

WFD, Annex V, 2.4. - Monitoring of groundwater chemical status

2.4.2 Surveillance monitoring

[…] Sufficient monitoring sites shall be selected for

- ***bodies which cross a MS boundary***

*[…] **Transboundary water bodies** shall also be monitored for those parameters which are relevant for the protection of all of the uses supported by the groundwater flow.*

2.1.4. Groundwater threshold values (GWD) and chemical status assessment

Common principles for establishing groundwater threshold values (TVs) and harmonization and coordination at setting such values within transboundary GWBs are the basis for comparable and harmonised assessments of groundwater chemical status and trend reversal.

GWD, Preamble

*(16) In order to ensure consistent protection of groundwater, Member States **sharing bodies of groundwater** should **coordinate** their activities in respect of monitoring, the setting of threshold values, and the identification of relevant hazardous substances.*

GWD, Article 3 –Criteria for assessing groundwater chemical status

2. Threshold values can be established at the national level, at the level of the river basin district or the part of the international river basin district falling within the territory of a Member State, or at the level of a body or a group of bodies of groundwater.

*3. MS shall ensure that, for bodies of groundwater shared by two or more MS and for bodies of groundwater within which groundwater flows across a MS's boundary, the establishment of threshold values is **subject to coordination between the MS** concerned, in accordance with Article 3(4) of Directive 2000/60/EC.*

*4. Where a body or a group of bodies of groundwater extends beyond the territory of the Community, the MS(s) concerned shall endeavour to **establish threshold values in coordination** with the non-MS(s) concerned, in accordance with Article 3(5) of Directive 2000/60/EC.*

At the 6th Groundwater Task Group Meeting[1] it was agreed that in the DRBM Plan for each transboundary GWB the status will be reported for each national part separately, applying relevant national groundwater threshold values. The process of future coordination/harmonization of TVs and of the status assessment is still mentioned in the Update 2015 of the DRBM Plan.

2.1.5. River Basin management Plans (WFD)

WFD, Article 13 – River basin management plans

> *2. In the case of an international river basin district falling entirely within the Community, Member States shall ensure coordination with the aim of producing a single international river basin management plan. Where such an international river basin management plan is not produced, Member States shall produce river basin management plans covering at least those parts of the international river basin district falling within their territory to achieve the objectives of this Directive.*
>
> *3. In the case of an international river basin district extending beyond the boundaries of the Community, Member States shall endeavour to produce a single river basin management plan, and, where this is not possible, the plan shall at least cover the portion of the international river basin district lying within the territory of the Member State concerned.*

2.1.6. Programme of measures (WFD)

WFD, Preamble

> *(33) The objective of achieving good water status should be pursued for each river basin, so that measures in respect of surface water and groundwaters belonging to the same ecological, hydrological and hydrogeological system are **coordinated**.*

[1] Minutes of the 6th Groundwater Task Group Meeting, Vienna, 10–11 April 2008

2.2. Transboundary Groundwater Bodies of Danube Basin-wide importance (ICPDR GWBs)

According to Article 2 of the WFD the term *groundwater* refers to all water that is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. An *aquifer* is a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater. Finally, a *body of groundwater* means a distinct volume of groundwater within an aquifer or aquifers.

Already in 2002[2] and 2003[3] workshops were dealing with questions concerning GWBs of Danube basin-wide importance to be dealt with at ICPDR level. An important recommendation of these workshops was the proposed setup of a Drafting Group "Strategy for the implementation of the WFD regarding transboundary groundwater issues". Finally in 2004 on the 13th of February the 1st meeting of the Drafting Group 'Groundwater' of the RBM EG of the ICPDR took place in Vienna[4] and the selection criteria for transboundary GWBs of basin-wide importance were defined and agreed.

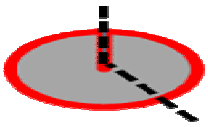
Definition: An ICPDR GWB is a transboundary GWB of Danube basin-wide importance. Importance is defined according to the following three criteria:

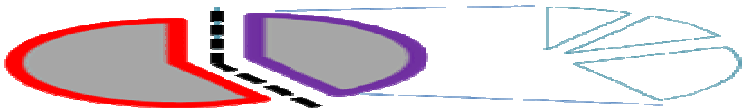
1. Important due to the size of the GWB which means an area > 4,000 km²; or
2. Important due to various criteria e.g., socio-economic importance, uses, impacts, pressures, interaction with aquatic eco-system.
3. The above-mentioned criteria and the nomination of a GWB need to be agreed bilaterally.

Other GWBs, even those with an area larger than 4,000 km², that are fully situated within one country of the DRBD are dealt with at the national level. The link between the GWBs of the ICPDR reports and the GWBs of the national reports is established by the national codes of the GWBs.

Bilateral and partly multilateral discussions resulted in the nomination of **12 transboundary GWBs of basin-wide importance**. In 2019[5] the ICPDR adopted the inclusion of the twelfth ICPDR GWB, shared by HU and SK. The characterisation of GWBs was finally updated in 2021 for the 3rd DRBM Plan. All 12 GWBs are listed in Table 2, Table 3 and illustrated in Figure 2.

Definition: Transboundary GWBs of basin wide importance (ICPDR GWBs) are divided into "**National Parts".** Only ICPDR GWBs and national parts of ICPDR GWBs are under the focus of the GW TG and TNMN Groundwater.





ICPDR GWB	National parts of an ICPDR GWB (also referred to as "Aggregated GWBs")	Individual national GWBs
Transboundary GWBs of basin wide importance (ICPDR GWBs) are divided into → *national parts of ICPDR GWBs*	The part of an ICPDR GWB which falls under the territory of a member country is called *national part of an ICPDR GWB.* If it consists of a number of individual national GWBs (or groups of GWBs) it is also called *aggregated GWB*.	The individual national GWBs are **not dealt with at ICPDR level**.

[2] 1st Workshop on Identification, Characterisation and Monitoring of GWBs for the Danube Countries, February 4-5, 2002 in Budapest.

[3] 2nd Groundwater Workshop on the Implementation of WFD in the Danube River Basin. May 12 and 13, 2003 in Budapest.

[4] Summary Report of the 1st Drafting Group Meeting

[5] At the Standing Working Group (StWG) meeting in June 2019

Table 2: Nominated transboundary GWBs of Danube basin-wide importance (ICPDR GWBs)

GWB	GWB name	Area [km²]	Nat. part	Nat. part name	National GWB Codes
GWB-1	Deep Thermal	5,900	AT-1	Deep Thermal	ATGK100158
			DE-1	Deep Thermal	DEGK1110
GWB-2	Upper Jurassic – Lower Cretaceous	24,374	BG-2	Upper Jurassic – Lower Cretaceous	BG1G0000J3K051
			RO-2	Upper Jurassic – Lower Cretaceous	RODL06
GWB-3	Middle Sarmatian - Pontian	22,308	MD-3	Middle Sarmatian - Pontian	MDPR01
			RO-3	Middle Sarmatian - Pontian	ROPR05
GWB-4	Sarmatian	5,495	BG-4	Sarmatian	BG1G000000N049
			RO-4	Sarmatian	RODL04
GWB-5	Mures / Maros	7,216	HU-5	Maros	HU_AIQ605 HU_AIQ604 HU_AIQ594 HU_AIQ593
			RO-5*	Mures	ROMU20 ROMU22
GWB-6	Somes / Szamos	2,493	HU-6	Szamos	HU_AIQ649 HU_AIQ648 HU_AIQ600 HU_AIQ601
			RO-6*	Somes	ROSO01 ROSO13
GWB-7	Upper Pannonian-Lower Pleistocene / Vojvodina / Duna-Tisza köze déli r.	28,959	HU-7	Duna-Tisza köze déli r.	HU_AIQ528 HU_AIQ523 HU_AIQ532 HU_AIQ487 HU_AIQ590 HU_AIQ529 HU_AIQ522 HU_AIQ533 HU_AIQ486 HU_AIQ591
			RO-7	Upper Pannonian-Lower Pleistocene	ROBA18
			RS-7	Vojvodina	RS_TIS_GW_I_1 RS_TIS_GW_SI_1 RS_TIS_GW_I_2 RS_TIS_GW_SI_2 RS_TIS_GW_I_3 RS_TIS_GW_SI_3 RS_TIS_GW_I_4 RS_TIS_GW_SI_4 RS_TIS_GW_I_7 RS_TIS_GW_SI_7 RS_D_GW_I_1 RS_D_GW_SI_1

GWB	GWB name	Area [km²]	Nat. part	Nat. part name	National GWB Codes
GWB-8	Podunajska Basin, Zitny Ostrov / Szigetköz, Hanság-Rábca	3,338	HU-8	Szigetköz, Hanság-Rábca	HU_AIQ654 HU_AIQ572 HU_AIQ653 HU_AIQ573
			SK-8	Podunajska Basin, Zitny Ostrov	SK1000300P SK1000200P
GWB-9	Bodrog	2,220	HU-9	Bodrog	HU_AIQ495 HU_AIQ496
			SK-9	Bodrog	SK1001500P
GWB-10	Slovensky kras / Aggtelek-hgs.	1,091	HU-10	Aggtelek-hgs	HU_AIQ485
			SK-10	Slovensky kras	SK200480KF
GWB-11	Komarnanska Kryha / Dunántúli-khgs. északi r.	3,900	HU-11	Dunántúli-khgs. északi r.	HU_AIQ558 HU_AIQ552 HU_AIQ564 HU_AIQ660
			SK-11	Komarnanska Kryha	SK300010FK SK300020FK
GWB-12	Ipel / Ipoly	344	HU-12	Ipoly	HU_AIQ583
			SK-12	Ipel	SK1000800P

Explanation to Table 2 and Table 3

GWB	ICPDR GWB code which is a unique identifier
GWB name	ICPDR GWB name
Nat. part	Code of national part of ICPDR GWB
Nat. part name	Name of national part of ICPDR GWB
National GWB Codes	National codes of the individual GWBs forming the national part of an ICPDR GWB.
Area [in km²]	Total area of the ICPDR GWB covering all countries concerned / Area of national shares in km²
Aquifer characterisation	Aquifer Type: Predominantly: **P** = porous/ **K** = karst/ **F** = fissured. Multiple selections possible. Main type should be listed first. Confined: **Yes** / **No** / **Partly**
Main use	**DRW** = drinking water / **AGR** = agriculture / **IRR** = irrigation / **IND** = Industry / **SPA** = balneology / **CAL** = caloric energy / **OTH** = other. Multiple selections possible.
Overlying strata	Indicates a range of thickness (minimum and maximum in metres)
Criteria for importance	If size < 4 000 km², criteria for importance of the GWB have to be named, they have to be bilaterally agreed upon.

Table 3: Transboundary ICPDR GWBs and brief characterisation

GWB	Nat. part	Area [km²]	Aquifer characteristics		Main use	Overlying strata [m]	Criteria for importance
			Aquifer Type	Confined			
GWB-1	AT-1	1,650	K	Yes	SPA, CAL	100–1,000	Intensive use
	DE-1	4,250					
GWB-2	BG-2	13,034	F, K	Yes	DRW, AGR, IND	0–600	> 4000 km²
	RO-2	11,340					
GWB-3	MD-3	9,662	P	Yes	DRW, AGR, IND	0–150	> 4000 km², GW use, GW resource
	RO-3	12,646					
GWB-4	BG-4	3,308	K	No	DRW, AGR, IND	0–10	> 4000 km²
	RO-4	2,187	F-P	Yes			
GWB-5	HU-5	4,989	P	No	DRW, IRR, IND	2–30	> 4000 km², GW resource, DRW protection
	RO-5	2,227					
GWB-6	HU-6	1,034	P	No	DRW, AGR, IRR	5–30	GW resource, DRW protection
	RO-6	1,459					
GWB-7	HU-7	7,098	P	No	DRW, AGR, IND, IRR	0–125	> 4000 km², GW use, GW resource, DRW protection
	RO-7	11,355		Yes			
	RS-7	10,506		No			
GWB-8	HU-8	1,152	P	No	DRW, IRR, AGR, IND	2–5	GW resource, DRW protection, dependent ecosystems
	SK-8	2,186					
GWB-9	HU-9	750	P	No	DRW,IRR	2–10	GW resource, DRW protection, dependent ecosystems
	SK-9	1,470		Yes			
GWB-10	HU-10	493	K	No	DRW, OTH	0–500	GW resources, DRW protection, dependent ecosystem
	SK-10	598	K, F				
GWB-11	HU-11	3,337	K	Yes	DRW, SPA, CAL	0–2,500	Thermal water resource
	SK-11	563	F, K				
GWB-12	HU-12	146	P	No	DRW, AGR	0–10	DRW protection, dependent ecosystems, GW resource
	SK-12	198					

[Source/Status: DRBM Plan Update 2021]

Figure 2: Transboundary Groundwater Bodies of Basin-Wide Importance (DRBM Plan – Update 2021 – Map 4)

2.3. Transboundary coordination

In total 19 countries share the DRB. All 14 countries sharing over 2,000 km² of the DRB (Table 2 and Figure 2), as well as the European Union, are Contracting Parties to the Danube River Protection Convention (DRPC) – nine of these 14 countries are EU Member States. Two EU Member States (Italy and Poland) and three non-EU Member States (Albania, Macedonia and Switzerland) are not Contracting Parties (share below 2,000 km²) and therefore not considered.

Table 4 shows all 14 countries which are Contracting Parties – the blue shaded are EU Member States. The matrix indicates common borders (white and yellow cells); common share of the 12 ICPDR GWBs is marked in yellow, including the number of bi(tri-)laterally shared GWBs.

Table 4: The 14 countries which are Contracting Parties to the DRPC with the indication of common borders (white and yellow cells) and common share of ICPDR GWBs (number of GWBs)

	AT	BA	BG	CZ	DE	HR	HU	MD	ME	RO	RS	SI	SK	UA
AT					1									
BA														
BG										2				
CZ														
DE	1													
HR														
HU										3	1		5	
MD										1				
ME														
RO			2				3	1						
RS							1							
SI														
SK							5							
UA														

Note: AT…Austria, BA…Bosnia and Herzegovina, BG…Bulgaria, CZ…Czech Republic, DE…Germany, HR…Croatia, HU…Hungary, MD…Moldova, ME…North Macedonia, RO…Romania, RS…Serbia, SI…Slovenia, SK…Slovak Republic, UA…Ukraine.

At each meeting of the GW TG the participating countries report about the main bilateral activities with the neighbouring countries in the DRBD. Chapter 8 summarises all bilateral harmonisation activities in the management of the 12 ICPDR GWBs since the publication of the 2nd RBMP in 2015.

2.4. Danube Basin Analysis (DBA) – WFD Article 5

Article 5 of the WFD requires the characterisation of each RBD, a review of the impact of human activity on the status of surface waters and on groundwater and an economic analysis of water use. The first analysis had to be established four years after the entry into force of the WFD and updated at the latest by the end of 2013 and then every six years thereafter.

According to the technical specifications set out in Annex II of the WFD, an initial characterisation has to be carried out for all GWBs to identify their uses and to identify the degree to which they are at risk of failing to meet the environmental objectives under Article 4 of the WFD (Annex II 2.1). Surveillance monitoring shall supplement and validate the impact assessment procedure. Sufficient monitoring points are needed in GWBs identified at risk and in GWBs which cross a Member State boundary (Annex V 2.4.2).

Following this initial characterisation, Member States have to carry out further characterisation of all GWBs identified as being at risk to establish a more precise assessment of the significance of such risk and to identify any measures required under Article 11 (Annex II 2.2). Additionally, for all GWBs at risk and for all GWBs which cross the boundary between two or more Member States, there is a need to collect, where relevant, additional information focusing mainly on quantitative aspects such as the location of groundwater abstraction points serving more than 10 m^3 a day or more than 50 persons, the abstraction rates, direct discharges to groundwater etc. (Annex II 2.3).

For each GWB at risk of failing to meet the objectives the cause of this failure (i.e., the pressure or combinations of pressures) must be investigated, operational monitoring is needed, groundwater threshold values have to be established and appropriate measures need to be implemented.

At EU level, guidance is available (EC 2004 and EC 2010) on the generic elements of risk assessment for groundwater and on tools to assist and contributing to a harmonization of approaches and procedures like the use of conceptual models and their specific implementation under the WFD.

2.4.1. Presentation/Reporting at ICPDR level

In Article 15.2 the WFD specifies the separate reporting of the first DBA within three months after its completion – four years after the WFD entered into force. Thereafter, all updates need to be reported as part of the DRBM Plans. ICPDR prepared a DBA report 2004 and a DBA update report 2013 and then decided in 2017[6] to no longer elaborate such separate update reports but to ensure a timely preparation of the data collection and the comprehensive integration of the respective information within the corresponding DRBM Plans. Hence the collection of data and the presentation of the results of the DBA according to Article 5 of the WFD are integrated within the DRBM Plan preparation process (see chapter 2.5), covering: the characterisation of all nominated ICPDR GWBs, the identified significant pressures, the results of the impact and risk assessment and the established groundwater threshold values.

The recent impacts and risk assessment was elaborated for the time horizon 2027, which is the target date for the 3rd WFD management cycle and therefore of key relevance for the elaboration of the Joint Programme of Measures (JPM) which is part of the DRBM Plan Update 2021.

The risk assessment is performed on national criteria both for quality and quantity, hence the approaches are different. As a consequence, the result of the risk assessment may differ for the national parts of an ICPDR GWB. The detailed information is to be found in the Part B (national level) reports

[6] At the 15th StWG meeting on 8-9 June 2017

2.5. Danube River Basin Management (DRBM) Plan – WFD Article 13

According to the WFD, every 6 years a River Basin Management Plan is to be produced for each RBD. In the case of an international RBD, Member States shall ensure coordination with the aim of producing a single international RBM Plan. In case a river basin is extending beyond the boundaries of the Community, Member States shall endeavour to produce such a report. The content of a RBM Plan is laid down in Annex VII of the WFD.

At EU level, groundwater specific guidance is available on monitoring (EC 2007) and on status and trend assessment (EC 2009).

According to the stratified approach of 3 level reports which supplement each other (see beginning of chapter 2), the content of the DRBM Plan (level A) is giving relevant summary information for the GWBs of basin wide importance on:

- the significant pressures causing poor status of the GWBs,
- the WFD monitoring networks and the chemical and quantitative status of the GWBs,
- the related impacts on these GWBs,
- the joint measures implemented in order to reach good status.

Detailed information, in particular on all GWBs in the Danube basin, is to be found in the Part B (national level) reports.

In order to comply with these requirements and by considering the reporting sheets developed by the EC, the GW TG discussed about the scope and the details of the level A reporting, about harmonising the provided information and on templates that should be used for information collection and exchange within the group (see chapter 2.5.3).

2.5.1. Status and trends assessment

The WFD and the GWD specify the requirements and criteria on the assessment of the groundwater chemical and quantitative status and on the assessment of trend and trend reversal of concentrations of polluting substances. While giving a frame, WFD and GWD are leaving room for interpretation to the EU Member States.

The legal bases as well as guidance for their interpretation are comprehensively described in CIS Guidance document No 18 on Groundwater Status and Trend assessment (EC 2009). The guidance recommends six different tests (Figure 3) which were derived from the WFD environmental objectives, and it summarises the classification tests and the corresponding testing elements (Table 5).

Figure 3: Overall procedure of classification tests for assessing groundwater status (EC 2009)

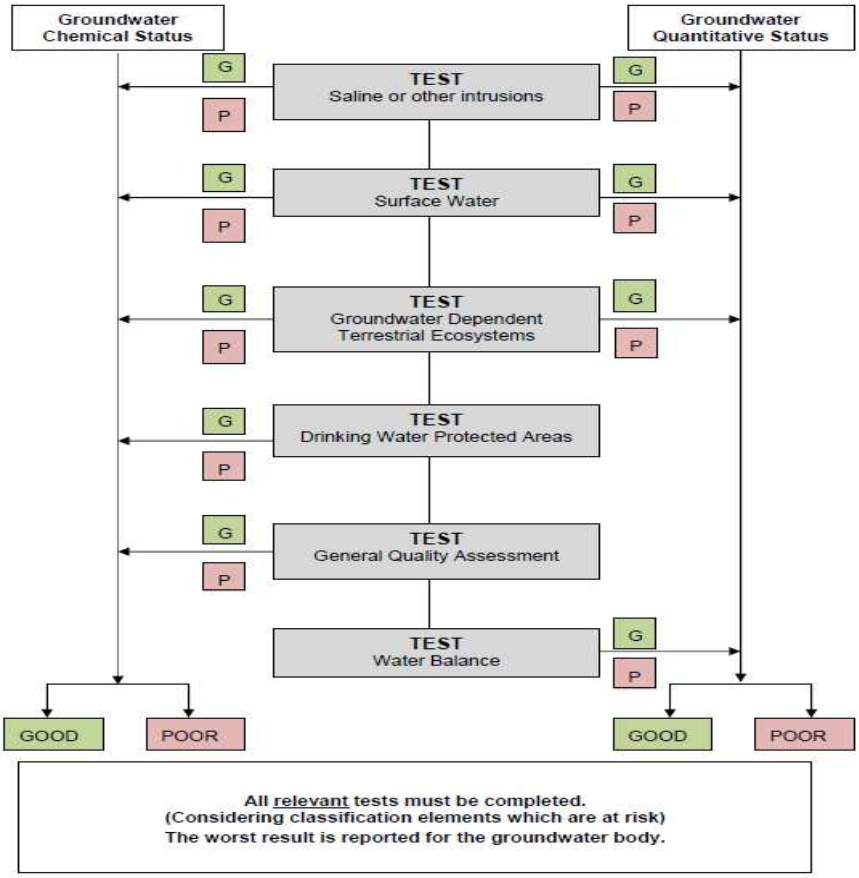
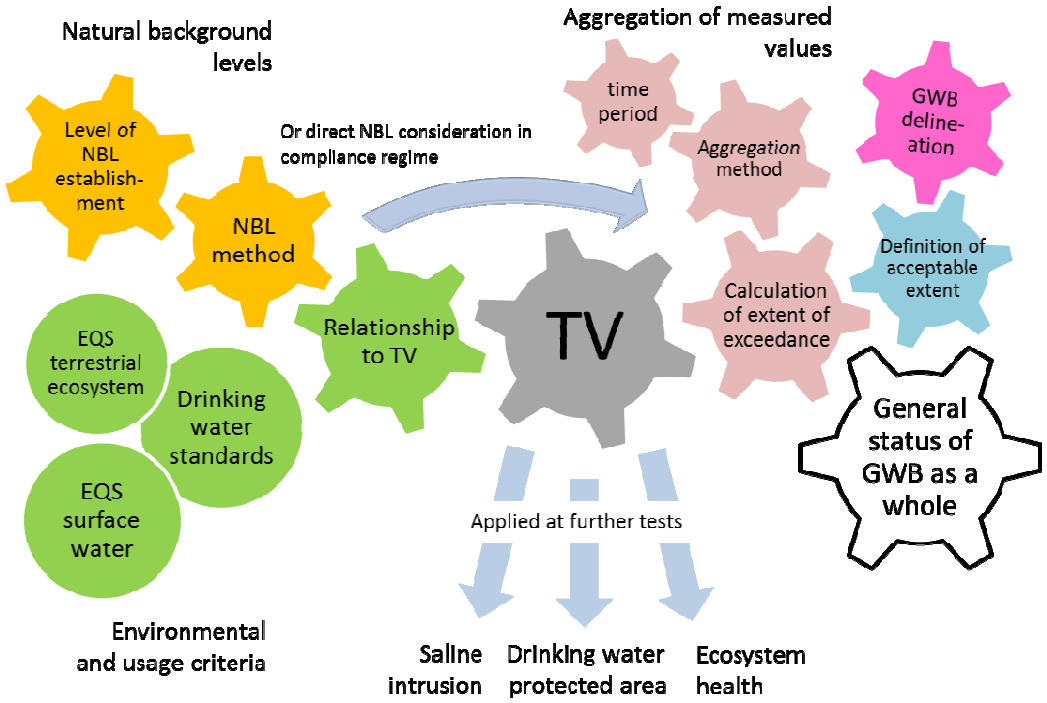


Table 5: Summary of classification tests and corresponding status testing elements (EC 2009)

Classification Element	Classification Test	Elements of testing			
		Data aggregaton	Extent of exceedance	Location of exceedance	Confidence
No significant impairment of human uses (GWD Article 4(2)(c) (iv))	General assessment of chemical status of the groundwater body as a whole.	✓	✓		✓
No significant environmental risk from pollutants across a groundwater body. (GWD Article 4(2)(c) (i) and Annex III 3).					
No Saline or other Intrusions (WFD Annex V 2.3.2)	Saline or other intrusion	✓	✓	✓	✓
No significant diminution of surface water ecology. (WFD Annex V 2.3.2)	No significant diminution of surface water chemistry and ecology due to transfer of pollutants from the GWB	✓		✓	✓
No significant diminution of surface water chemistry. (WFD Annex V 2.3.2)					
No significant damage to GWDTE. (WFD Annex V 2.3.2)	No significant damage to GWDTE due to transfer of pollutants from the GWB	✓		✓	✓
No deterioration in quality of waters for human consumption (GWD Article 4(2)(c) (iii)) and Annex III 4)	Meet the requirements of WFD Article 7(3) - Drinking Water Protected Areas	✓		✓	✓

Based on the WFD and on CIS Guidance Document No 18, the EU Member States elaborated detailed methodologies tailored to their needs and the natural conditions. Hence, the developed methods are country specific and not uniform throughout Europe taking regard of the many different elements and their interdependencies in different ways (see Figure 4).

Figure 4: Relevant elements in the groundwater compliance regime



Chapter 9 provides an overview of all key elements of the compliance regimes for assessing groundwater chemical and quantitative status and for assessing trends and trend reversal, which were applied in the countries and documented in the national RBM Plans of 2015 of the DRBD[7]. The inventory is based on the information that was reported by EU Member States through WISE (Water Information System Europe) and it was validated and completed by the members of the GW TG.

This overview allows for comparing different approaches, enabling harmonisation and exchanging experiences on different approaches taken within the DRBD.

2.5.2. Groundwater status presentation at level A

As decided by the GW TG, the result of the status assessment is solely given for the whole national part of an ICPDR GWB. If a national part of an ICPDR GWB consists of several individual national-level GWBs then *poor status* in one national-level GWB (aggregated GWB) is decisive for characterising the whole national part of an ICPDR GWB as having *poor status* (one out all out).

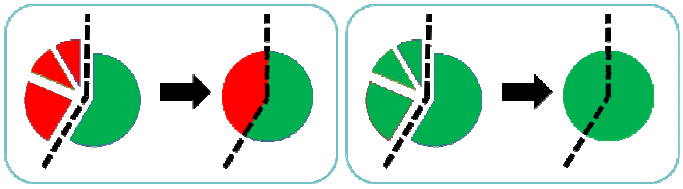
At the 7th Meeting of the GW TG in October 2008 the issue of **confidence** was discussed. To indicate the diversity of different status results of individual GWBs within *aggregated GWBs* a concept of *aggregation confidence levels* was developed by the ICPDR. The reason of introducing these specific confidence levels for the DRBM Plan was the need to distinguish between the cases where all

[7] For Bulgaria and Slovak Republic, the information already refers to the RBMP of 2021.

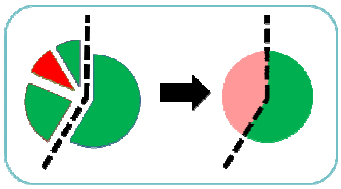
individual GWBs in an *aggregated GWB* have the same status (high confidence) or not (medium confidence) or whether the assessment is based on the risk assessment data (low confidence) – the concept is illustrated in Figure 5. Information about the WFD-related confidence levels of status assessment for the individual national (non-aggregated) GWBs can be found in the national plans and in WISE. The *aggregation confidence* for the whole national part of an ICPDR GWB is illustrated in maps.

Figure 5: Aggregation confidence levels for groundwater

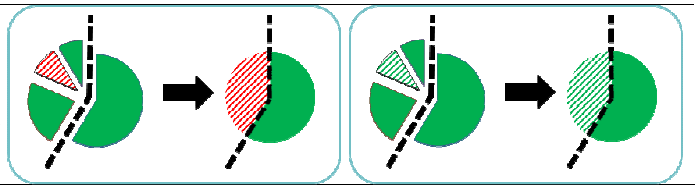
High confidence
Good or poor status
1.) Status assessment is based on WFD compliant monitoring data.
2.) If the national part of an ICPDR GWB (the aggregated GWB) is formed by more than one GWB or groups of GWBs, **all** have the same status.



Medium confidence
Poor status
1.) Status assessment is based on WFD compliant monitoring data.
2.) If the national part of an ICPDR GWB is formed by more than one GWB or groups of GWBs, **not all** have the same status.



Low confidence
Good or poor status
- The status assessment of at least one individual GWB is based on risk assessment data.



[Status of discussion: 7th Meeting of the GW TG in October 2008, slightly reworded at the 20th GW TG meeting in March 2015]

2.5.3. Procedures for data provision and data exchange

For the preparation of a DRBM Plan a series of templates was developed within the GW TG to allow for collecting data in a harmonised way. The tables/templates are usually discussed at the GW TG meetings at the beginning of each data collection period and adjusted based on the lessons learned.

As far as possible, the tables are pre-filled by information from the most recent DRBM Plan and DBA Report. Information might need to be updated as size of GWBs, characteristics, pressures and methodologies might have changed and countries are asked to check, update or add the requested data and information in track change mode.

The update of a DRBM Plan needs information on the following topics. The most up-to-date templates for data collection are attached in the Annex and links are given in brackets.

Most of the templates need to be completed for each individual national part of an ICPDR GWB.

- GWB characterisation
  - Nominated transboundary GWBs of Danube basin wide importance and initial characterisation (Table 6)
  - Further characterisation of the ICPDR GWBs (changes since previous report) (Table 7)
- Groundwater monitoring
  - Number of sampling stations and density per GWB (Table 8)
  - Parameters and monitoring frequency for surveillance monitoring (Table 9)
- Groundwater risk
  - Risk information on groundwater quality and quantity (Table 10 and Table 11)
  - Reasons for risk of failing good groundwater chemical and quantitative status (Table 12 and Table 14)
  - Groundwater threshold values and basis of establishment (DW standards, EQS, NBL, relationships) (Table 16 and Table 18)
  - Significant pressure types causing a risk of failing good status (Table 17)
- Groundwater status assessment
  - Status information on groundwater quality and quantity (Table 10 and Table 11)
  - Reasons for failing good groundwater chemical and quantitative status (Table 13 and Table 15)
  - Description of status assessment methodologies (Table 18)
  - Significant pressure types causing the failure of good status (Table 17)
  - Exemptions and year of achievement of good status. (Table 10)
- Trend assessment
  - Description of trend and trend reversal assessment methodologies (Table 18)
  - Results of trend and trend reversal assessment (Table 10)
- Programme of measures
  - GWBs at poor status and implemented measures – overview and detailed description (Table 19 and Table 20)

2.5.4. GIS data

In addition to the templates prepared by the GW TG, the IMGIS Expert Group also elaborated GIS templates for data collection. The collection of data via the GIS templates allows for automatic display of the data in the maps of the DanubeGIS and for the preparation of the maps used in the ICPDR reports.

The GIS Server is located at: http://www.danubegis.org/expert/ where all the templates, the submitted GIS data and maps are accessible for authorized experts.

The templates relevant for collecting data and information on GWB characterisation, monitoring, pressures, impacts, risk, status and exemptions are called ‘GWBody’, ‘GWBodyAggr’ and ‘GWStn’. The detailed content of the templates is explained in the related code list.

Note: In case of an update of GIS data, close cooperation between the national GW expert (GW TG members) and the national IMGIS expert (IMGIS EG member) is needed.

In general, the respective data need to be prepared by the GW expert and forwarded to the national IMGIS expert who is responsible for the upload of the respective templates to the ICPDR GIS Server.

2.6. Interim Report on progress in the implementation of the Joint Programme of Measures

Programmes of Measures are part of each RBMP. As the DRBM Plan is focusing on the "roof level" of the whole DRB, the so-called Joint Programme of Measures (JPM) therein is focusing on measures of basin-wide importance.

According to Article 11(7) of the WFD an interim report from the EU Member States to the EC is due within three years of the publication of an RBMP describing progress in the implementation of the planned programme of measures.

2.6.1. Presentation at level A

Even though the WFD does not require an internationally coordinated interim report for the whole basin (Level A), the Ministers of the Danube countries asked the ICPDR in the Danube Declaration of 2010 to coordinate such an interim report (2012 Interim Report), describing progress in the implementation of the JPM and the national programmes of measures by the end of 2012.

While the 1st report in 2012 was detailed with almost 90 pages, the 2nd report of 2018 looked completely different, forming a printed publication of about 20 pages including 10 key messages relevant for a broader public. One of the key messages (chapter 6) was devoted to the protection of groundwater briefly describing the challenges, the importance of groundwater in the drinking water supply and an exemplary overview of various measures implemented in the Danube countries. Exemplary best-case-measures ('lighthouse projects') from Hungary and Germany completed the overview.

2.6.2. Procedures for data provision and data exchange

For the recent JPM report of 2018 the underlying information was collected informally, and no data collection template was used. Based on the key message and the introductory text - jointly agreed and formulated by the members of the GW TG - the countries provided data and information underpinning the key message.

The collected groundwater information was then compiled and the groundwater contribution to the report was finally discussed and agreed upon at GW TG meetings.

2.7. Hazardous substances in groundwater

In 2020 an overview of the significant presence of hazardous substances in the GWBs of the DRBD was compiled. Significant means that a substance either causes risk of failing good groundwater chemical status or poor chemical status according to the RMBPs of 2015. Several of the identified substances are also listed as priority substances for surface waters under Directive 2013/39/EU (EQSD), which allows for making direct comparisons of their presence and the significance of their presence in groundwater and in surface waters and for potential interrelationships.

The inventory is described in detail in chapter 10 and covers all GWBs in the EU part of the DRBD (11 of 19 countries, 79% of the whole DRBD) and it is not restricted to the twelve ICPDR GWBs of basin wide importance. The information was extracted from WISE[8].

8 https://tableau.discomap.eea.europa.eu/t/Wateronline/views/WISE_SOW_gwPollutant/GWB_gwPollutant_Europe?:embed=y&:showAppBanner=false&:showShareOptions=true&:display_count=no&:showVizHome=no

2.8. Data gaps – Differences – Need for harmonisation

The Danube countries use a broad spectrum of different methodologies for the delineation and characterisation of GWBs, monitoring, the assessment of the chemical and quantitative status, the establishment of threshold values, trend and trend reversal assessment. Despite there being overall coordination facilitated by the ICPDR Groundwater Task Group, further harmonisation of the national methodologies is still needed. Data gaps and inconsistencies are still available in the collected data, resulting in uncertainties in the of data interpretation.

To achieve a harmonisation of data sets for transboundary GWBs, there is a need for intensive bi- and multilateral cooperation. In addition, the interaction of groundwater with surface water or directly dependent ecosystems needs further attention for which technical guidance is elaborated at European level.

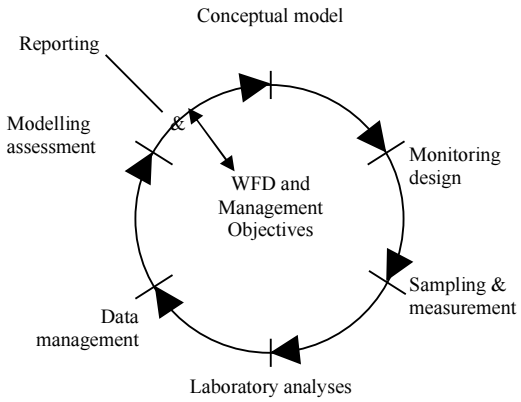
3. TNMN Groundwater

The "Transnational Monitoring Network" (TNMN) of the ICPDR was launched in 1996, primarily focussing on surface waters. The transnational groundwater management activities in the DRBD started in February 2002 and were triggered by the WFD. Finally, 12 transboundary GWBs are identified as being of basin-wide importance. In 2009, monitoring of the ICPDR GWBs was decided to be an integral part of the TNMN and therefore all WFD monitoring sites in these GWBs are TNMN sites.

For reporting of groundwater monitoring data under the TNMN a six-year cycle is foreseen, which is in line with the reporting requirements under the WFD. The TNMN has to meet the requirements of the WFD and the ICPDR. Monitoring networks should be at high standards.

Regarding the WFD, reporting on the monitoring network is foreseen according to Article 8 and the results of monitoring are essential components within the RBMP. The monitoring programme includes both quantitative and chemical (quality) monitoring and shall provide the necessary information to assess groundwater status, to identify trends in pollutant concentrations, to support GWB characterisation and the validation of the risk assessment, to assess whether drinking water protected area objectives are achieved and to support the establishment and assessment of programmes of measures and the effective targeting of economic resources. WFD monitoring programmes had to be operational since 22nd December 2006.

Monitoring follows a cyclic procedure and each step in this process needs proper attention and the consideration of integrated and verifiable quality assurance and quality control in order to produce reliable and comparable monitoring data.[9]



Monitoring results reported to ICPDR will be the basis for the preparation of the TNMN Yearbook.

The first rounds of TNMN groundwater data collection happened in 2009 and 2016 and it is foreseen to perform the second round in 2022, after the publication of the 3rd DRBM Plan.

[9] Guidance Document No. 15: Groundwater Monitoring. (2007).

3.1. Monitoring strategies and network design – following the requirements of the WFD

To design a monitoring network different criteria have been applied by the countries to select appropriate sites. Important criteria are aquifer type and characteristics (porous, karst and fissured, confined and unconfined groundwater) and the depth of the GWB since deep GWBs are more difficult and costly accessible than shallow GWBs. For deep GWBs the flexibility in the design of the monitoring network is very limited. The flow direction was also taken into consideration by some countries as well as the existence of associated drinking water protected areas or ecosystems (aquatic and/or terrestrial).

The monitoring sites must be reviewed on a regular basis to ensure that they provide representative information and data on groundwater quality and quantity and fully support the risk and status assessment process.

3.1.1. Transboundary aspects of groundwater monitoring

With respect to groundwater the WFD requests information on the chemical and quantitative status of groundwater. Specific provisions concern those bodies of groundwater, which cross the boundary between two or more Member States (see also chapter 2.1.3). For the ICPDR this concerns the identified 12 ICPDR GWBs.

With the view of establishing a basin wide coherent monitoring approach, bilateral agreements should be reached on monitoring strategies (i.e., sampling procedures, network design etc.) and principles, which require coordination of conceptual model development, the exchange of data and QA and QC aspects (in line with the requirements of Article 13(2) WFD).

According to Annex V 2.4 WFD the provisions for surveillance monitoring require sufficient monitoring sites to be selected for bodies which cross a Member State boundary and transboundary GWBs to be monitored for those parameters, which are relevant for the protection of all uses, supported by the groundwater flow.

Data from the surveillance monitoring programme are also useful for characterising GWBs, validating the risk assessment, defining natural background and assessing trend developments within the GWB. This will enable future changes in conditions to be assessed, reference data to be acquired and typologies to be investigated.

According to Annex V 2.2 WFD the quantitative monitoring network shall be designed so as to provide a reliable assessment of the quantitative status of all GWBs or groups of bodies of basin-wide importance including an assessment of the available groundwater resource. For GWBs within which groundwater flows across a Member State boundary, it has to be assured that sufficient monitoring points and sufficient frequency of measurement are provided to estimate the direction and rate of groundwater flow across the Member State boundary.

3.1.2. Selection of parameters

3.1.2.1. Chemical monitoring

In addition to the mandatory parameters listed in the WFD, the selection of parameters depends on the characterisation of a GWB and on the results of the risk assessment - considering existing water quality data and local expert knowledge. In special cases very specific parameters might need to be monitored, depending on the particular characteristics of the groundwater body (e.g., deep thermal artesian groundwater bodies).

Parameters such as temperature and a set of major and trace ions are not formally requested by the WFD but may be helpful to validate the risk assessment and the development/validation/improvement of conceptual models. Generalised land use and land cover categories can be used as a basis for the initial selection of parameters. An in-depth analysis of land use/cover and the nature and approximate amounts of chemicals being used should be made in cooperation with competent local administrations/experts in order to identify potential pollutants.

Additional indicators of anthropogenic contaminants typical of land use activities in the area and with a potential to impact groundwater might also be required on an infrequent basis for validating the WFD risk assessments and to check for any new identified pressure turn up to be relevant.

For the selection of parameters, also the provisions of Annexes I and II of the GWD have to be considered. Selective determinants (e.g., heavy metals and relevant basic radio nuclides) would be needed for assessing natural background concentrations.

Transboundary water bodies shall also be monitored for those parameters, which are relevant for the protection of all of the uses supported by the groundwater flow (see chapter 2.1.3).

In addition, it is recommended to monitor the water level at all chemical monitoring points in order to describe (and interpret) the 'physical status of the site' and to help interpreting (seasonal) variations or trends in chemical composition of groundwater.

Helpful information can be found in the CIS Guidance Document No 15 (EC, 2007) which was elaborated within WG GW.

The following core set of determinants was agreed by the GW TG[10] to be monitored and reported within TNMN groundwater:

- Mandatory by the WFD
  - dissolved oxygen,
  - pH-value,
  - electrical conductivity,
  - nitrate,
  - ammonium,
- Further recommended:
  - temperature and
  - a set of major (trace) ions.

[10] 3rd Meeting of the ICPDR Groundwater Task Group on 25–26 September 2006 in Vienna.

3.1.2.2. Quantity monitoring

The WFD requires only GW-levels, but it was recommended by the GW TG to monitor the following parameters for the purposes of quantitative assessment of groundwater:

- Groundwater levels in boreholes or wells (only this parameter is mentioned in the WFD, the other parameters are recommended as supportive);
- Spring flows;
- Flow characteristics and/or stage levels of surface water courses during drought periods (i.e., when the flow component directly related to rainfall can be neglected and discharge is sustained substantially by groundwater);
- Stage levels in significant groundwater dependent wetlands and lakes.
- Optional: water abstraction

3.1.3. Frequency of groundwater monitoring

The amount and frequency of monitoring should be determined by the data needed to determine risk and status, and where necessary to support the design and assessment of the programme of measures.

3.1.3.1. Chemical monitoring

The selection of appropriate monitoring frequency should generally be based on the conceptual model and, in particular, the characteristics of the aquifer and its susceptibility to pollution pressures. Sampling for operational monitoring must be continued until the GWB is determined with adequate confidence, to be no longer at poor status or at risk of being at poor status and there is adequate data to demonstrate a reversal of trends.

Sampling frequency and sample timing at each monitoring location should furthermore consider:

- Requirements for trend assessment;
- Whether the location is up-gradient, directly below, or down-gradient of the pressure. Locations directly below a pressure may require more frequent monitoring;
- The level of confidence in the Article 5 risk assessments, and changes in the assessments over time;
- Short-term fluctuations in pollutant concentrations, e.g., seasonal effects. Where seasonal and other short-term effects are likely to be encountered, it is essential that sampling frequencies and timings are adjusted (increased) accordingly and that sampling takes place at the same time(s) each year, or under the same conditions, to enable comparable data for trend assessment, accurate characterisation and status assessment; and
- Land use management patterns, e.g., the period of pesticides or fertilizer application. This is especially important for rapid flow systems like karstic aquifers and/or shallow GWBs.

3.1.3.2. Quantity monitoring

Frequency of monitoring predominantly depends on the characteristics of the water body and the monitoring site respectively. Sites with significant annual variability should be monitored more frequently than sites with only minor variability. In general, monthly monitoring will be sufficient for quantity monitoring where variability is low but daily monitoring would be preferred (particularly when measuring flows). The frequency should be revised as knowledge of the aquifer response and behaviour improves and in relation to the significance of any changes in pressures on the GWB. This will ensure that a cost-effective programme is maintained.

3.1.4. Procedures for data aggregation and reporting - for the purpose of the TNMN Yearbook

Reporting of monitoring data is not foreseen under the WFD.

For the purpose of reporting to the ICPDR for the TNMN Yearbook the GW TG agreed[11] to collect aggregated data for each national part of ICPDR GWBs. The agreed six-year reporting cycle which is foreseen under the TNMN is in line with the reporting requirements under the WFD. This will allow for making any relevant statement on significant changes of groundwater status for the ICPDR GWBs. A possibility of annual reporting of groundwater status was considered (as part of future TNMN Yearbooks) but it was concluded that the slow character of changes in groundwater quality in response to the emerging pressures makes the added value of annual reporting questionable. Moreover, an informative note on the regular reporting on the groundwater status within the DRBM Plan can be included in each TNMN Yearbook to provide public with a complete overview of the ICPDR monitoring activities.

As discussed in the GW TG[12], reporting for TNMN purposes covers information and data on:

- Groundwater chemical and quantity risk and status and in case of poor status or risk, the particular reason for failure (taken from the most recent DBA or DRBM Plan).
- Aggregated quality data on the level of GWBs for selected parameters:
  - Electrical conductivity, ammonium, nitrate;
  - Parameters characterising the GWB; and
  - Parameters causing risk or poor status

All aggregated data are based on the arithmetic mean values per monitoring point for a reference year. The following statistical key-values are collected for each national share of an ICPDR GWB: Minimum, Mean, Maximum, Standard deviation, 10-, 25-, 50-, 75-, 90-Percentile.

The procedure for aggregating data is:

1. calculate the annual arithmetic mean for each monitoring point for the reference year; and
2. calculate the statistics for each national part of an ICPDR GWB, based on these site values.

For collecting chemical monitoring data, a template (Table 21) was developed within the GW TG. The template is usually discussed at the GW TG meetings at the beginning of each data collection period and adjusted based on the lessons learned. The template needs to be completed for each individual national part of an ICPDR GWB.

[11] 3rd Meeting of the ICPDR Groundwater Task Group on September, 25–26 2006 in Vienna

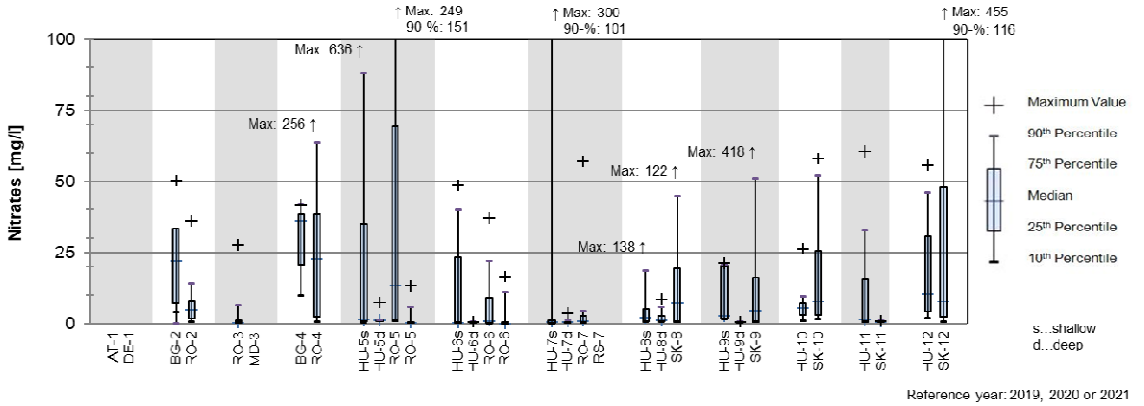
[12] 11th Meeting of the ICPDR Groundwater Task Group on October, 21–22 2010 in Budapest

3.1.5. Presentation at ICPDR level

The collected data are compiled and presented in the TNMN Yearbook in the form of box-plots, grouping the single national parts of ICPDR GWBs together. Figure 6 shows an example assessment for nitrate in 2015. The assessment will not only present the status but also the temporal development since the first assessment in 2009.

These results are accompanied by an overview of status and risk which is taken from the DRBM Plan.

Figure 6: EXAMPLE: ICPDR GWBs – Nitrate concentrations in groundwater in 2021



3.2. GW contribution to TNMN Yearbook

GW TG decided to prepare and provide contributions to the TNMN Yearbook in order to highlight the importance respectively even the existence of groundwater in the DRB and to provide public with a complete overview of the ICPDR monitoring activities. The contributions consist of both thematic highlights selected by the GW TG and the presentation of the status of groundwater by aggregated data which are reported to the ICPDR every six years according to the provisions laid down in chapter 3. However, in case that any significant changes in status of monitored GWBs will occur, the GW TG will consider publishing this in the TNMN Yearbook. Similarly, the results of targeted studies on groundwater quantity and quality will be published therein.

3.3. Joint Danue Survey – JDS

The key purpose of Joint Danube Surveys (JDS) is to produce reliable and comparable information on carefully selected elements of water quality for the length of the Danube River, including its major tributaries. Four JDSs have been previously conducted - in 2001, 2007, and 2013 - and the fourth of its kind, JDS4, took place throughout 2019. https://icpdr.org/main/activities-projects/joint-danube-survey

While main attention is given to surface aquatic ecosystems, minor attention is also dedicated to groundwater. Well ahead of a JDS the members of the GW TG decide upon the way of participation at the survey, they nominate appropriate groundwater monitoring sites and they propose substances which should be focused at.

During **JDS2** ^{222}Rn data were collected to identify potential locations with significant groundwater inputs and also to examine mixing between the Danube and its tributaries. Although ^{222}Rn in natural waters can be affected by geology and other factors, elevated ^{222}Rn values have been shown to be an effective indicator of groundwater discharges in rivers and along coastal zones. The ^{222}Rn data suggested that groundwater inputs to the river were largest in the Upper Danube and only small along the Middle and Lower Danube.

The results and further information is found at: https://icpdr.org/main/activities-projects/joint-danube-survey-2

During **JDS3** more attention was given to the links between groundwater and surface water and the pollution by emerging pollutants using the synergies created by parallel monitoring activities in groundwater and surface water. Focus was given primarily to the bank filtered water and the groundwater bodies along the Danube.

Samples were taken from ten groundwater sites near the Danube and a set of 49 compounds was analysed which comprised benzotriazoles, artificial sweeteners, betablockers, lipid-lowering drugs, nonsteroidal anti-inflammatory drugs, cytostatic drugs and other pharmaceuticals, iodinated X-ray contrast media (X-RCM), the stimulant caffeine and the preservative salicyclic acid. Moreover, drug metabolites clofibric acid, 4-acetylaminoantipyrine and 4-formylaminoantipyrine (AAA and FAA) were included.

The results and further information is found at: http://www.danubesurvey.org/jds3/results

During **JDS4** seven groundwater monitoring sites along the Danube River were sampled and the results were compared to the concentrations detected at the closest Danube sites to identify any kind of interaction. The seven GW-sites are supposed to be more or less interconnected with the water from the Danube River through bank filtration.

A huge number of substances were analysed by a wide range of analytical methods. Finally in total 286 pesticide substances, pharmaceuticals, drugs, artificial sweeteners, industrial substances, isotopes, dissolved organic matter and rare earth elements, which are usually not monitored within standard monitoring programmes, were detected in either groundwater or in a Danube monitoring site closest to a monitored GW-site.

The results and further information is found at: http://www.danubesurvey.org/jds4/

4. Importance of GW in the DRB

4.1. Importance of GW in drinking water production

In 2009[13], the GW TG agreed to collect information on the share of groundwater for drinking water production in the DRB. The main objective of this activity is to compare and highlight the importance of groundwater in the DRB by the example of drinking water production.

4.1.1. Procedures for data provision and data exchange

The following principles were agreed:

- Data on total drinking water abstraction from fresh surface water and fresh groundwater is collected at the national level and at the level of the DRBD - main emphasis lies on the DRBD level. Additionally, data on percentage/amount of population served by drinking water from groundwater or surface water should be provided, as far as available.
- It was decided - in contradiction to the OECD questionnaire - that bank filtered water is considered as groundwater, which better reflects the current practice of accounting in the Danube member countries.

The template for harmonized data collection is attached in the Annex as Table 22.

Data collection and assessment is a living process. Updates, corrections and additional data/countries are always welcome which is reflected by a respective agenda point at each GW TG meeting.

4.1.2. Presentation at ICPDR level

Since 2014 the data collection is almost complete, as data currently cover 14 Danube countries and 99.8% of the whole DRBD in terms of area. Figure 7 shows the share of groundwater for drinking water production in the country parts which belong to the DRBD and Figure 8 indicates the distribution of shares on a map.

It was agreed by the GW TG that the underlying figures are not going to be published, except the displayed percentages.

[13] 8th Meeting of the ICPDR Groundwater Task Group on March, 19–20 2009 in Zagreb

Figure 7: Share of groundwater for drinking water production in the Danube River Basin (2021)

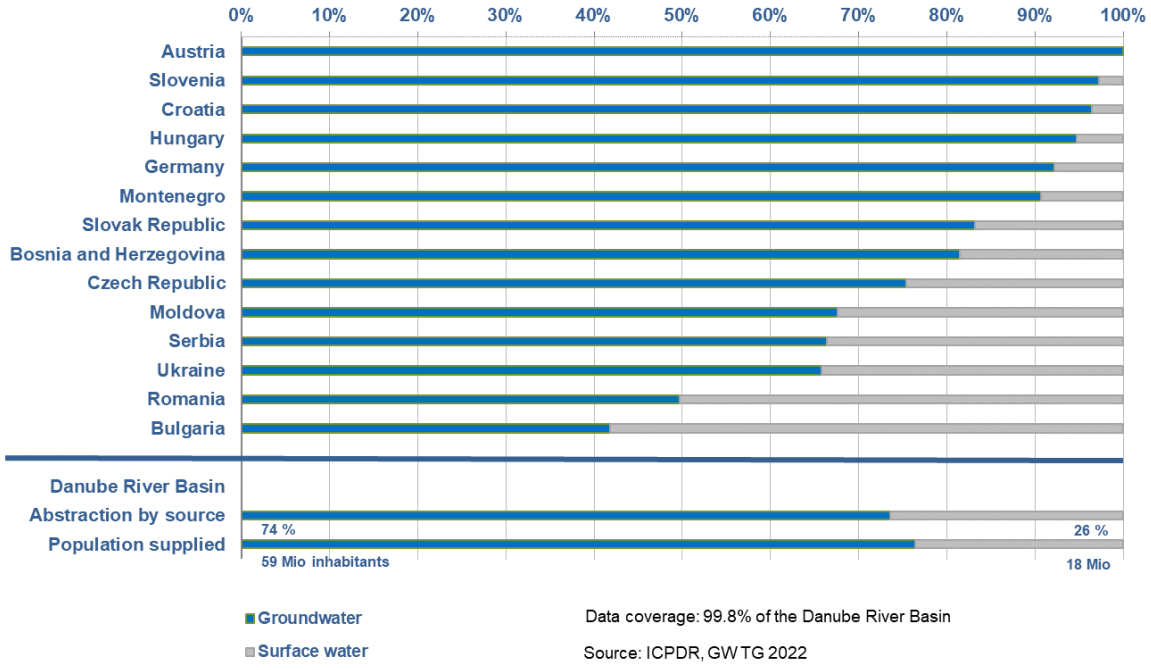


Figure 8: Use of groundwater for drinking water production in the Danube River Basin (2022)

4.2. Abstraction of bank-filtered water

The connection between surface water and groundwater is frequently utilised in the form of abstracting bank filtered water for drinking water purpose, making use of the natural purification and filtration properties of the underground along the pathway from the river to the abstraction well.

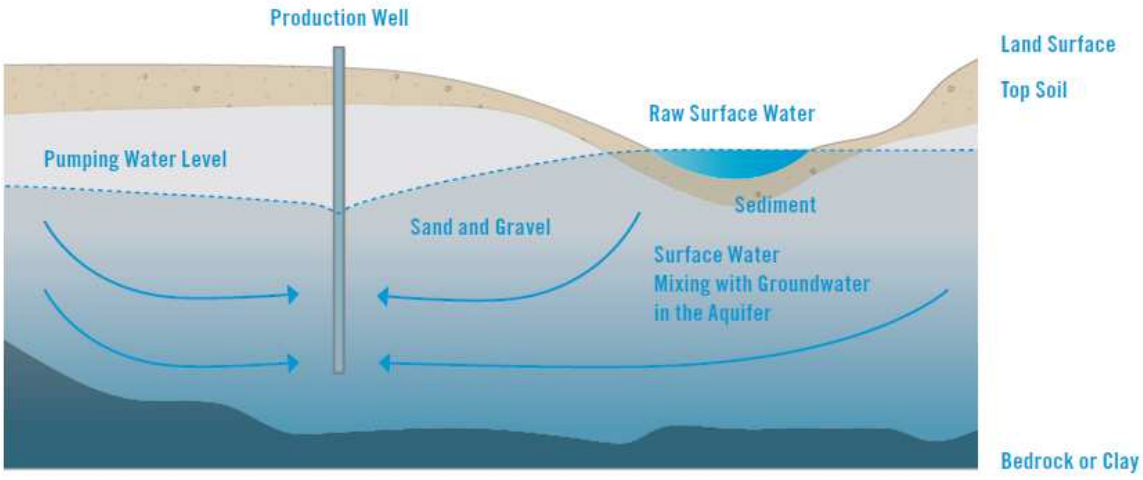
Hence, the GW TG agreed to collect information about the most important locations of abstractions of bank filtered water in the Danube River Basin.

4.2.1. Procedures for data provision and data exchange

Agreed definition of bank filtered water

Bank filtered water source: groundwater source close to the surface water from which the rate of the abstracted water produced by the water production wells originates significantly from the surface water recharge

Figure 9: Schematic sketch of a riverbank filtration abstraction (ICPDR, 2015)



It was agreed to follow a stepwise approach and in the first step, the **focus of the inventory** shall be:

- along the river Danube only,
- abstracted water is also used for drinking water purposes, and
- either at least 50.000 inhabitants (or 3.65 Mio m³/year) are supplied (see key-value for recalculation), or
- the 5 largest abstractions of bank filtered water in a country.

The **key value** for re-calculation between the number of consumers and the amount of consumption was agreed with **200 l/capita/day** as an average specific value.

Only existing data should be provided, no new data have to be generated.

The data collection happened in 2011/2012 with the template which is attached as Table 23.

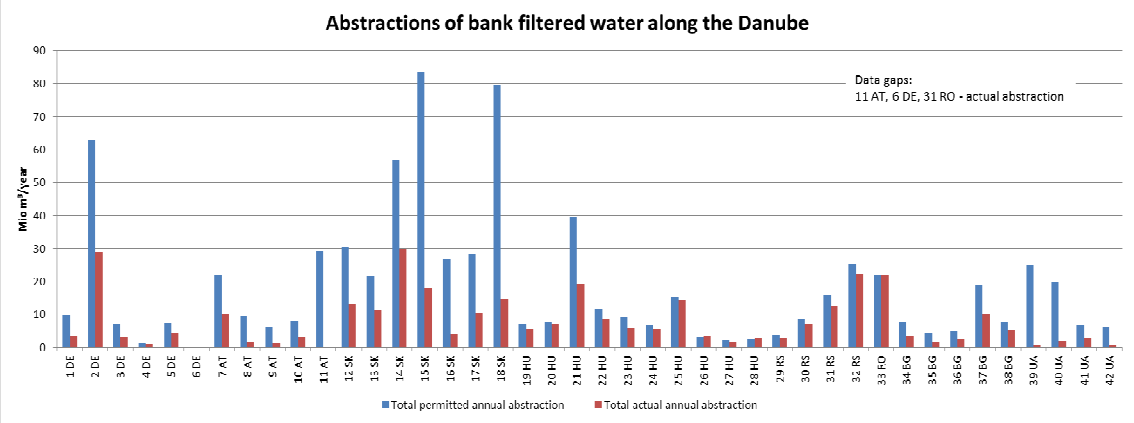
Based on the experience gathered in this first step, the GW TG might agree extending this inventory in a second step to the whole Danube River Basin.

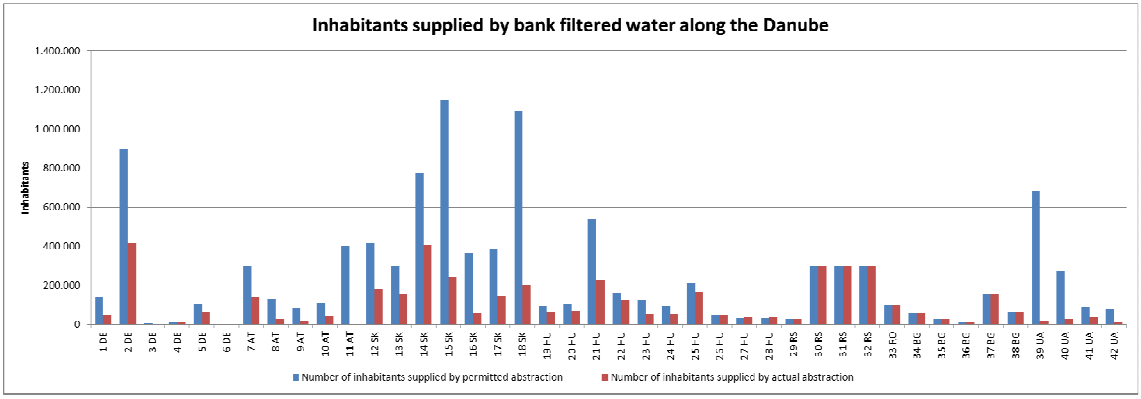
4.2.2. Presentation at ICPDR level

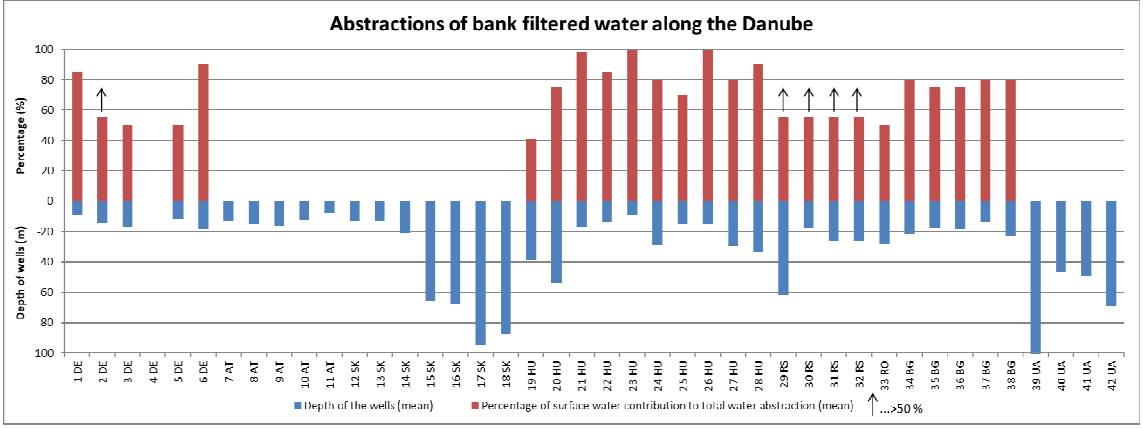
Eight Danube countries reported in total 42 most important and largest bank filtration abstractions along the Danube River. The compiled data demonstrate that about four Mio inhabitants are actually served, and an additional five Mio people could be served (considering the permitted annual abstractions).

Due to security reasons Romania provided only summary data for their most important bank filtration abstractions.

It was agreed in the GW TG that the detailed figures are not going to be published, but only aggregated, compiled information.







5. Link to European Legislation and EC-activities

The comprehensive website of the DG Environment of the European Commission (http://ec.europa.eu/environment/water/index_en.htm) provides abundant information about all aspects of EU water legislation and its implementation.

The most important sites regarding River basin Management are:

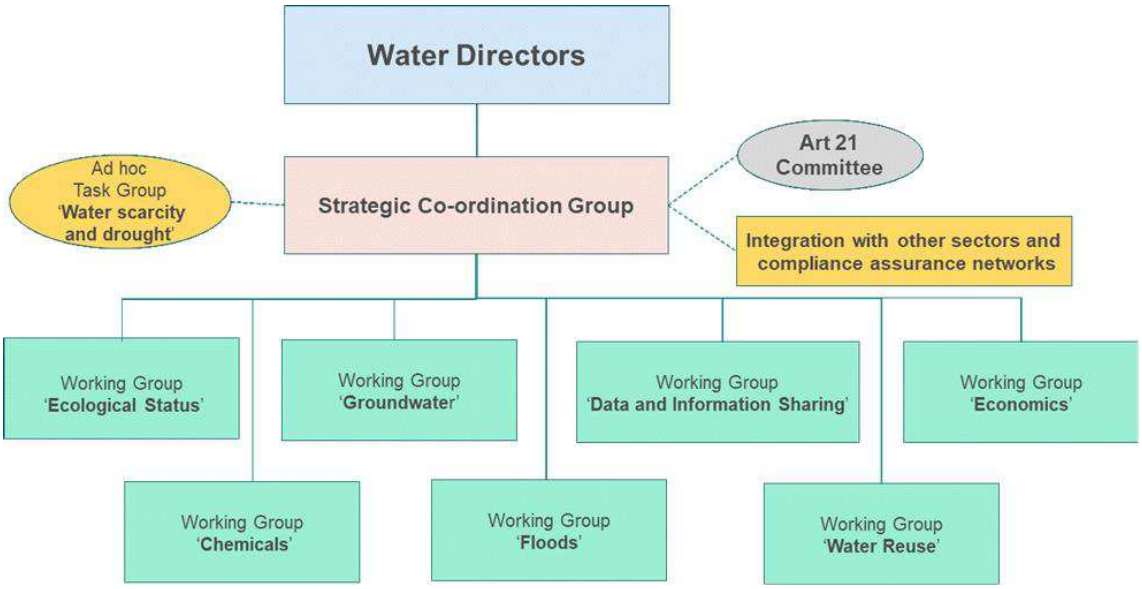
- Water Framework Directive (http://ec.europa.eu/environment/water/water-framework/index_en.html)
- Groundwater Directive http://ec.europa.eu/environment/water/water-framework/groundwater/framework.htm
- Common Implementation Strategy http://ec.europa.eu/environment/water/water-framework/objectives/implementation_en.htm
- CIS Guidance and thematic Documents http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm https://circabc.europa.eu/w/browse/a3c92123-1013-47ff-b832-16e1caaafc9a
- CIRCABC http://ec.europa.eu/environment/water/water-framework/iep/index_en.htm
- European Commission reports on the implementation of the WFD and the GWD http://ec.europa.eu/environment/water/water-framework/impl_reports.htm
- A Blueprint to Safeguard Europe's Water Resources (2012) http://ec.europa.eu/environment/water/blueprint/index_en.htm
- WISE – Water Information System for Europe https://water.europa.eu/freshwater

5.1. Common Implementation Strategy

In order to address the challenges of the WFD in a co-operative and coordinated way, the MS, Norway and the Commission agreed on a Common Implementation Strategy (CIS) for the WFD. Furthermore, the Water Directors stressed the necessity to involve stakeholder, NGOs and the research community in this joint process as well as to enable the participation of Candidate Countries in order to facilitate their cohesion process. The main aim of this strategy is to ensure the coherent and harmonious implementation of the directive through the clarification of a number of methodological questions enabling a common understanding to be reached on the technical and scientific implications of the Water Framework Directive. In this framework, working groups or ad hoc expert groups carry out activities under the umbrella of a Strategic Coordination Group (SCG) composed of Member States and representatives of stakeholder organisations under the supervision of the European Commission and EU Water Directors (see Figure 10).

Since the first phase of this joint process, a number of guidance documents were prepared, and these documents were tested in Pilot River Basins across Europe. All guidance documents are available for download at the EC website.

Figure 10: Common Implementation Strategy (CIS) of the WFD for mandate period 2022-2024



[Source: WFD CIS Work programme for 2022–2024]

5.2. Working Group 'Groundwater' – WG GW

Within the framework of the CIS a technical Working Group on Groundwater (WG GW) was established. Its original mission was to help the European Commission in the development phase of the Groundwater Directive proposal, which took place in 2002–2004. The aim of the group then evolved in exchange of information and experiences on groundwater issues as they related to the WFD (e.g., characterisation, risk assessment, monitoring, chemical status and trends, programmes of measures). The members of the working group share information and experiences via different means such as workshops, technical reports and guidance documents which gather participants' experiences.

All documents prepared under WG GW are publicly accessible at CIRCABC:

https://circabc.europa.eu/ui/group/9ab5926d-bed4-4322-9aa7-9964bbe8312d/library/b1a3fb16-0308-479a-8b6d-0c056b6890e4?p=1&n=10&sort=modified_DESC

5.2.1. Groundwater relevant CIS Guidance and other Documents

The following CIS Guidance Documents and Technical Reports are strongly related to groundwater and provide help and best practice experiences in the implementation of the WFD and GWD (http://ec.europa.eu/environment/water/water-framework/groundwater/activities.htm):

CIS Guidance Documents:

- Guidance Document N° 15 on Groundwater Monitoring
- Guidance Document N° 16 on Groundwater in Drinking Water Protected Areas
- Guidance Document N° 17 on Direct and indirect inputs in the light of the Directive 2006/118/EC
- Guidance Document N° 18 on Groundwater Status and Trend Assessment
- Guidance Document N° 26 on Risk Assessment and the Use of Conceptual Models

CIS Technical Reports:

- Technical Report N° 1 on Groundwater Trends
- Technical Report N° 2 on Groundwater Characterisation
- Technical Report N° 3 on Groundwater Monitoring
- Technical Report N° 4 on Groundwater Risk Assessment
- Technical Report N° 5 on Groundwater Management in the Mediterranean
- Technical Report N° 6 on Groundwater Dependent Terrestrial Ecosystems
- Technical Report N° 7 on the Recommendations for the Review of Annexes I-II of the Groundwater Directive 2006/118/EC
- Technical Report N° 8 on Methodologies used for Assessing Groundwater Dependent Terrestrial Ecosystems
- Technical Report N° 9 on Groundwater Associated Aquatic Ecosystems

Other CIS documents

- Technical Report on Voluntary Groundwater Watch List Concept & Methodology (2019)
- Technical Report on Threshold Value Variability Analysis (2019)
- Technical Report on Groundwater Quality Trend and Trend Reversal Assessment (2020)
- First List Facilitating Annex I and II Review Process of the Groundwater Directive (Endorsed V2.1 -June 2019)
- Voluntary Groundwater Watch List (Endorsed V3.1 - June 2019)
- Report summarising the results of the questionnaire on better consideration of drinking water resource protection in river basin management planning (2019)

6. Literature

EC (2003): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 2. Identification of Water Bodies.

EC (2003): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 3. Analysis of Pressures and Impacts.

EC (2003): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 7. Monitoring under the Water Framework Directive.

EC (2004): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Groundwater risk assessment. Technical report on groundwater risk assessment issues as discussed at the workshop of 28th January 2004.

EC (2007): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 15. Guidance on Groundwater Monitoring.

EC (2007): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 16. Groundwater in Drinking Water Protected Areas.

EC (2007): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 17. Preventing and Limiting Direct and Indirect Inputs.

EC (2008): Groundwater Protection in Europe. The new Groundwater Directive – Consolidating the EU regulatory framework. Groundwater Brochure.

EC (2009): Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 18. Groundwater Status and Trend Assessment.

EC (2010): Common Implementation Strategy for the Water Framework Directive (2000/60/EC) Guidance Document No. 26. Risk Assessment and the Use of Conceptual Models for Groundwater.

ICPDR (2005): The Danube River Basin District. River basin characteristics, impact of human activities and economic analysis required under Article 5, Annex II and Annex III, and inventory of protected areas required under Article 6, Annex IV of the EU Water Framework Directive (2000/60/EC). Part A – Basin-wide overview, (WFD Roof Report 2004), 18 March 2005.

ICPDR (2007): Summary Report to EU on monitoring programmes in the Danube River Basin District designed under Article 8 of the EU Water Framework Directive (2000/60/EC). Part II: Status report: Towards the development of groundwater monitoring in the Danube River Basin – Basin-wide overview, (WFD Roof Report 2007), 18 March 2007.

ICPDR (2009): Danube River Basin Management Plan. Part A – Basin-wide overview.

ICPDR (2013): Interim Overview: Significant Water Management Issues in the Danube River Basin District. Document number IC 178.

ICPDR (2014): The 2013 Update of the Danube Basin Analysis Report. Document number IC 183.

ICPDR (2015): Groundwater – the river's invisible twin.

ICPDR (2021 Joint Danube Survey 4 Scientific Report

Liska, Igor (Ed.) (2015): The Danube River Basin. The Handbook of Environmental Chemistry. Springer-Verlag GmbH Germany

UN/ECE Task Force on Monitoring & Assessment (2000): Guidelines on Monitoring and Assessment of Transboundary Groundwaters. Work Programme 1996 – 1999. Lelystad, Netherlands. http://www.unece.org/env/water/publications/documents/guidelinesgroundwater.pdf

UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes *done at Helsinki on 17 March 1992:*
http://www.unece.org/env/water/partnership/part63.htm#632

7. Templates for data collection and data exchange

7.1. Templates MS Word and MS Excel based

For the preparation of the DBA Report and the DRBM Plan various templates were developed, discussed and agreed within the GW TG. They are used for both, collecting and exchanging information and data between the member countries and the ICPDR and for presenting the information in the related reports. The following templates are used for (Red entries in tables are only examples):

Danube River Basin Management Plan

- Table 6: TEMPLATE: Nominated transboundary GWBs of Danube basin wide importance (and initial characterisation)
- Table 7: TEMPLATE: Further characterisation of the ICPDR GWBs
- Table 8: TEMPLATE: Number of monitoring stations and density per GWB
- Table 9: TEMPLATE: Parameters and frequency for the surveillance monitoring program
- Table 10: TEMPLATE Groundwater QUALITY: Risk and Status Information of the ICPDR GWBs over a period of 2013 to 2027
- Table 11: TEMPLATE Groundwater QUANTITY: Risk and Status Information of the ICPDR GWBs over a period of 2013 to 2027
- Table 12: TEMPLATE: Groundwater QUALITY: Risk 2021 - Reasons for risk of failing good groundwater chemical status in 2027 for the ICPDR GWBs.
- Table 13: TEMPLATE: Groundwater QUALITY: Status 2021 - Reasons for failing good groundwater chemical status in 2021 for the ICPDR GWBs.
- Table 14: TEMPLATE: Groundwater QUANTITY: Risk 2021 - Reasons of risk of failing good groundwater quantitative status in 2027 for the ICPDR GWBs.
- Table 15: TEMPLATE: Groundwater QUANTITY: Status 2021 - Reasons of failing good groundwater quantitative status in 2021 for the ICPDR GWBs.
- Table 16: TEMPLATE: Summary table: Groundwater threshold values
- Table 17: TEMPLATE: Significant pressures on the ICPDR GWBs
- Table 18: TEMPLATE: Methodologies for status and trend assessment of the ICPDR GWBs
- Table 19: TEMPLATE: GWBs at poor status in 2021 or at risk and the implemented measures
- Table 20: TEMPLATE: Detailed description of groundwater measures

TNMN Groundwater quality data

- Table 21 : TEMPLATE: Groundwater Chemical Data

Groundwater for drinking water production

- Table 22: TEMPLATE: Collection of data on the share of groundwater in the drinking water production.

Bank filtered water abstraction

- Table 23: TEMPLATE: Abstractions of bank filtered water along the Danube

Table 6: TEMPLATE: Nominated transboundary GWBs of Danube basin wide importance (and initial characterisation)

Transboundary GWB	Nat. part	National GWB Codes	Area [km²]	Area [km²]	Aquifer characterisation		Main use	Overlying strata	Criteria for importance
					Aquifer Type	Confined			
GWB-1:	AT-1	ATGK100158	5,900	1,650	K	Yes	SPA, CAL	100–1000	Intensive use
Deep Thermal	DE-1	DEGK1110		4,250					

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Explanation to Table 6

Transboundary GWB	ICPDR GWB code which is a unique identifier and the name
Nat. part	Code of national parts of ICPDR GWB
National GWB Codes	National codes of the individual GWBs forming the national part of a transboundary GWB of Danube basin wide importance.
Area [in km²]	Whole area of the transboundary GWB covering all countries concerned / Area of national parts in km²
Aquifer characterisation	Aquifer Type - Predominantly: **P** = porous/ **K** = karst/ **F** = fissured. Multiple selections possible. Main type should be listed first. Confined: **Yes** / **No** / **Partly**
Main use	**DRW** = drinking water / **AGR** = agriculture / **IRR** = irrigation / **IND** = Industry / **SPA** = balneology / **CAL** = caloric energy / **OTH** = other. Multiple selections possible.
Overlying strata	Indicates a range of thickness (minimum and maximum in metres)
Criteria for importance	If size < 4 000 km², criteria for importance of the GWB have to be bilaterally agreed and listed.

Table 7: TEMPLATE: Further characterisation of the ICPDR GWBs

GWK-1	National parts	**AT-1** **DE-1**	At risk for each national GWB? (yes/no)	
			Chemical (substance)	Quantity
List of individual GWBs forming the national part (national code incl. country code)	AT	ATGK100158		
	DE	DEGK1110		
Description/Characterisation of the ICPDR GWB	***Please consider:*** *Criteria for delineation, geological overview, GW use, impacts, pressures, interaction with aquatic ecosystems, criteria for selection as 'important'*			
Description of methodology for estimating the risk of failure to achieve the good status in *20XX (end of plan period).*	***Please consider:*** *approach and criteria for both quality and quantity Information on how far trend assessments were considered Information whether changes of pressures (incl. climate change) were considered.*			
Description how climate change was considered as pressure in the risk assessment.				
Description of the significant pressures and polluting substances				
GWB identified as being at risk of failing to meet the objectives under Art. 4 – and comments Which individual GWB is at risk?				
Lower objectives identified according to Art. 4 and Annex II 2.4 and 2.5				
Gaps and uncertainties in the underlying data				

[Source/Status: DBA 2013], Red entries are examples

Table 8: TEMPLATE: Number of monitoring stations and density per GWB

Transboundary GWB	Nat. part	Area [km²]	CHEMICAL			Associated to		QUANTITY			Associated to	
			Sites	km²/ site	Sites bilaterally agreed for data exchange	Drinking water protected areas	Eco-systems	Sites	km²/ site	Sites bilaterally agreed for data exchange	Drinking water protected areas	Eco-systems
GWB-1 Deep Thermal	AT-1	1,650	4	413	-	-	-	3	550	-	-	-
	DE-1	4,250	4	1063	-	-	-	4	1063	-	-	-
	Σ	**5,900**	**8**	**738**				**7**	**843**			

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Explanation to Table 8

Transboundary GWB	ICPDR GWB code which is a unique identifier and the name
Nat. part	Code of national parts of ICPDR GWB
Area	Area of the whole transboundary ICPDR GWB covering all countries concerned and of the national parts of the ICPDR GWB in km².
CHEMICAL / QUANTITY	
Sites	Number of monitoring sites – Reference year *(indicate per country)*
km²/site	Area in km² represented by each site – Reference *(indicate per country)*
Number of sites bilaterally agreed for data exchange	Number of monitoring sites for which transboundary data exchange is bilaterally agreed.
Associated to	
Drinking water protected areas	Number of monitoring sites associated to drinking water protected areas
Ecosystems	Number of monitoring sites associated to ecosystems

Table 9: TEMPLATE: Parameters and frequency for the surveillance monitoring programme

	AT/DE	BG	RS	HU	MD	RO	SK
Transboundary GWB	1	2, 4	7	5 – 12	3	2– 7	8 – 12
CHEMICAL (with estimation of frequency)							
Oxygen				1/6; <1/a			
pH-value				>1/a*			
Electrical conductivity				>1/a*			
Nitrate				>1/a*			
Ammonium				>1/a*			
Temperature				>1/a*			
Further parameters, e.g. major ions				x			
operational				x			
QUANTITY (with estimation of frequency)							
GW levels/well head pressure				x			
spring flows				x			
Flow characteristics							
Extraction (not obligatory)							
Reinjection (not obligatory)							

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Remarks:

Transboundary GWB:	Code of transboundary GWB of Danube basin wide importance
>1/a:	More than 1 per year
x:	Parameter is measured
*…	In the starting year

Table 10: TEMPLATE Groundwater QUALITY: Risk and Status Information of the ICPDR GWBs over a period of 2013 to 2027

GWB	Nat. part	Danube RBM Plan 2015							Danube RBM Plan 2021						
		Chemical Status 2015	Status Pressure Types 2015	Significant upward trend (parameter)	Trend reversal (parameter)	Risk 2013→2021	Risk Pressure Types →2021	Exemptions from 2021	Chemical Status 2021	Status Pressure Types 2021	Significant upward trend (parameter)	Trend reversal (parameter)	Risk 2019→2027	Risk Pressure Types →2027	Exemptions (Year of achievement)
GWB-1	AT-1 / DE-1	Good	-	-	-	-	-	-	Good	-	-	-	-	-	-

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

'-' means 'No' / 'not applicable'

Table 11: TEMPLATE Groundwater QUANTITY: Risk and Status Information of the ICPDR GWBs over a period of 2013 to 2027

GWB	Nat. part	Danube RBM Plan 2015					Danube RBM Plan 2021				
		Quantitative Status 2015	Status Pressure Types 2015	Risk 2013→2021	Risk Pressure Types →2021	Exemptions from 2021	Quantitative Status 2021	Status Pressure Types 2021	Risk 2019→2027	Risk Pressure Types →2027	Exemptions (Year of achievement)
GWB-1	AT-1 / DE-1	Good	-	-	-	-	Good	-	-	-	-

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

'-' means 'No' / 'not applicable'

Explanation to Table 10 and Table 11

GWB	ICPDR GWB code which is a unique identifier.	
Nat. part	Code of national shares of ICPDR GWBs	
Danube RBM Plan 2015	**Danube RBM Plan 2021**	
[Chemical/Quantitative] Status 2015	**Status 2021**	**Good / Poor / Unknown**
Status Pressure Types 2015	**Status Pressure Types 2021**	Indicates the significant pressures causing poor status in 2015. **AR** = artificial recharge, **DS** = diffuse sources, **PS** = point sources, **OP** = other significant pressures, **WA** = water abstractions
Significant upward trend (parameter)	**Significant upward trend (parameter)**	Indicates for which parameter a significant sustained upward trend has been identified.
Trend reversal (parameter)	**Trend reversal (parameter)**	Indicates for which parameter a trend reversal could have been achieved.
Risk 2013→2021	**Risk 2019→2027**	**Risk** / - (which means 'no risk')
Risk Pressure Types →2021	**Risk Pressure Types →2027**	Indicates the significant pressures causing risk of failing to achieve good status in 2021. **AR** = artificial recharge, **DS** = diffuse sources, **PS** = point sources, **OP** = other significant pressures, **WA** = water abstractions
Exemptions from 2021	**Exemptions (Year of achievement)**	Indicates the year by when good status is expected to be achieved.

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 12: TEMPLATE: Groundwater QUALITY: Risk 2021 - Reasons for risk of failing good groundwater chemical status in 2027 for the ICPDR GWBs.

GWB	GWB Name	National part	Year of risk assessment	'at risk' of failing in 2027	Which parameters cause risk	Failed general assessment of GWB as a whole	Saline or other intrusions	Failed achievement of WFD Article 4 objectives for associated surface waters	Significant damage to GW dependent terrestrial ecosystem	WFD Art 7 drinking water protected area affected

'-' means 'No', [Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 13: TEMPLATE: Groundwater QUALITY: Status 2021 - Reasons for failing good groundwater chemical status in 2021 for the ICPDR GWBs.

GWB	GWB Name	National part	Year of status assessment	Chemical Status 2021	Which parameters cause poor status	Failed general assessment of GWB as a whole	Saline or other intrusions	Failed achievement of WFD Article 4 objectives for associated surface waters	Significant damage to GW dependent terrestrial ecosystem	WFD Art 7 drinking water protected area affected
				good / poor	*parameter*	*Yes / - / Unknown (parameter)*	*Yes / - / Unknown (parameter)*	*Yes / - / Unknown (parameter)*	*Yes / - / Unknown (parameter)*	*Yes / - / Unknown (parameter)*
GWB-1	Deep GWB – Thermal Water	AT-1	2020	Good	-	-	-	-	-	-
		DE-1	2020	Good	-	-	-	-	-	-

'-' means 'No', [Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 14: TEMPLATE: Groundwater QUANTITY: Risk 2021 - Reasons of risk of failing good groundwater quantitative status in 2027 for the ICPDR GWBs.

GWB	GWB Name	National part	Year of risk assessment	'at risk' of failing in 2027	Exceedance of available GW resource	Failed achievement of WFD Article 4 objectives for associated surface waters	Significant damage to GW dependent terrestrial ecosystem	Uses affected (drinking water use, irrigation etc.)	Intrusions detected or likely to happen due to alterations of flow directions resulting from level changes

'-' means 'No', [Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 15: TEMPLATE: Groundwater QUANTITY: Status 2021 - Reasons of failing good groundwater quantitative status in 2021 for the ICPDR GWBs.

GWB	GWB Name	National part	Year of status assessment	Quantitative status 2021	Exceedance of available GW resource	Failed achievement of WFD Article 4 objectives for associated surface waters	Significant damage to GW dependent terrestrial ecosystem	Uses affected (drinking water use, irrigation etc.)	Intrusions detected or likely to happen due to alterations of flow directions resulting from level changes
				good / poor	*Yes / - / Unknown*	*Yes / - / Unknown*	*Yes / - / Unknown*	*Yes / - / Unknown If yes, which?*	*Yes / - / Unknown*
GWB-1	Deep GWB – Thermal Water	AT-1	2020	Good	-	-	-	-	-
		DE-1	2020	Good	-	-	-	-	-

'-' means 'No', [Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 16: TEMPLATE: Summary table: Groundwater threshold values

		GWB-1	GWB-2		GWB-3	GWB-4		GWB-5		GWB-6		GWB-7		GWB-8		GWB-9		GWB-10		GWB-11		GWB-12	
Parameter	**unit**		**BG-2**	**RO-2**	**RO-3**	**BG-4**	**RO-4**	**RO-5**	**HU-5**	**HU-6**	**RO-6**	**HU-7**	**RO-7**	**HU-8**	**SK-8**	**HU-9**	**SK-9**	**HU-10**	**SK-10**	**HU-11**	**SK-11[3]**	**HU-12**	**SK-12**
Ammonium	mg/l		0.4487	0.5	6.4	0.38	0.7	0.5–1.9	2–5	2–5	0.5–1.3	2–5	6.4	1–2	0.26	2–5	0.30	0 .5	0.27	0.5		2	0.90
AOX	µg/l								20	20		20		20		20		20		20		20	
Arsenic	µg/l		7.6	10	10	7.7	10	40		-	10				6		6		5.5				6
Benzene	µg/l			10	10		10	10			10		10		0.8		0.8		0.8				0.8
Cadmium	µg/l		3.8	5	5	3.9	5	5	5	5	5	5	5	5	3.0	5	3.0	5	2.7	5		5	2.9
Chloride	mg/l		189	250	250	188.75	250	250	250-500	250	250	250	250	250	135.8-137.3	250	147.4	250	131.8	250		250	135.7
Chromium	µg/l		38.875		50	38.25		50			50		50		26		27		25				26
COD Mn	mg O2/l		3.975			3.8625																	
Conductivity	µS/cm		1640.625			1713.6			2500-4000	2500		2500-4000		2500		2500		2500		2500		2500	
Copper	µg/l		152.7		100	150.1		100			100		100		1001-1002		1004		1001				1003
Cyanides	mg/l		0.04			0.04																	
Iron total	mg/l		0.1607			0.15									0.125-0.135		0.150		0.105				0.150
Lead	µg/l		8.1	10	10	7.6	10	10–20	10	10	30–70	10	10	10	6.5-7.0	10	9.0	10	5.5	10		10	7.0
Manganese	mg/l		0.038			0.038									0.030		0.030		0.027				0.100
Mercury	µg/l		0.8	1	1	0.8	1		1	1	1	1	1	1	0.7-0.8	1	0.7	1	0.6	1		1	0.6
Nickel	µg/l		15.05		20	15.5	20	20			20		20										
Nitrates[2]	mg/l		38.5			39.87												25		25–50			
Nitrites	mg/l		0.3801	0.5	0.5	0.375	0.5	0.5			0.5		0.5		0.26		0.26		0.26				0.26
Phenols	µg/l							2			2		4										
Phosphates	mg/l		0.3805	0.5	1.4	0.3798	0.5	0.5–0.6			0.5		1		0.22		0.22		0.24				0.24
Orthophosphate	mg/l								2–5	0.5–2		1–5		1		1–2		0.25		0.25		2	
Sodium	mg/l		156.75			158.25									104.5-105.8		111.0		52.3				119.8
Sulphates	mg/l		192	250	250	189	250	250	250–500	250	250	250–500	250	250	148.9–157.6	250	167.4	250	167.6	250		500	140.8
Tetrachloroethylen	µg/l		7.5*	10	10	7.5*	10	10	10	10	10	10	10	10	7.5*	10	7.5*	10	7.5*	10		10	7.5*
Trichlorethylene	µg/l		*	10	10	*	10	10	10	10	10	10	10	10	7.5*	10	7.5*	10	7.5*	10		10	7.5*
Zinc	mg/l		0.777		5	0.7537	5	5			5		5										
Pesticides total**			0.375			0.375																	

*...7.5 for Tetrachloroethylen + Trichlorethylene; [2] the quality standards for nitrates (50 mg/l) and for pesticides (0.1 for individual pesticides and relevant metabolites and 0.5 for total pesticides) are not mentioned in the table. [3]…The criterion for evaluating the chemical status of geothermal GWB is the stability of the chemical composition

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 17: TEMPLATE: Significant pressures on the ICPDR GWBs

This template is used for information collection for both reports, for the DBA report and for the DRBM Plan. It intends to compare current situation with the previous one and depending on the report for which this template is used, the previous information is prefilled, either from the DBA or the DRBM Plan. ([Source/Status: draft DRBM Plan Update 2021], Red entries are examples)

Code of ICPDR GWB		*GWB-12*
National part of ICPDR GWB (nationally aggregated part)		*HU-12, SK-12*

Significant Pressures for Groundwater	**Status pressure types** 2021				**Risk pressure types** 2019→2027			
	Chemical Yes/-		**Quantity** Yes/-		**Chemical** Yes/-		**Quantity** Yes/-	
	HU	SK poor	HU	SK	HU	SK risk	HU	SK
Point sources	-				-			
Leakages from contaminated sites								
Leakages from waste disposal sites (landfill and agricultural waste disposal)								
Leakages associated with oil industry infrastructure								
Mine water discharges								
Discharges to ground such as disposal of contaminated water to soak ways								
Other relevant point sources (specify below)								
Diffuse Sources		**Yes**				**Yes**		
due to agricultural activities		x				x		
due to non-sewered population		x						
Urban land use								
Other significant diffuse pressures (specify below)		x						
Water abstractions			-				-	
Abstractions for agriculture								
Abstractions for public water supply								
Abstractions by industry								
IPPC activities								
Non-IPPC activities								
Abstractions by quarries/open cast coal sites								
Other major abstractions (specify below)								
Artificial recharge								
Discharges to groundwater for artificial recharge purposes								
Returns of groundwater to GWB from which it was abstracted (e.g. for sand and gravel washing)								
Mine water rebound								
Other major recharges (specify below)								
Other significant pressures	-		-		-		-	
Saltwater intrusion								
Other intrusion (specify below)								

Description of other significant pressures than those selected above.	SK: other anthropogenic pressure - unknown

Table 18: TEMPLATE: Methodologies for status and trend assessment of the ICPDR GWBs

GWB-1	National parts	**HU-12** **SK-12**	Status 2021 for each national GWB?	
			Chemical (substance)	Quantity
List of individual GWBs forming the whole national parts (national code incl. country code)	HU	HUAIQ583	Good	Good
	SK	SK1000800P	Poor (NO_3, SO_4, PO_4)	Good

Description/Characterisation of the ICPDR GWB	
Description of **status** assessment methodology.	***Chemical Status:*** *Description of methodology for assessing chemical status. How were exceedances of Quality Standards or TVs taken into account?* ***Quantitative Status:*** *Description of methodology for assessing quantitative status.* *Changes since 2009?*
Groundwater threshold value relationships	*Which receptors were considered (e.g. drinking water, terrestrial ecosystems…).* *How were NBL and EQS (environmental quality standards, drinking water standards) considered in the TV establishment?*
Verbal description of the **trend** assessment methodology	
Verbal description of the **trend reversal** assessment methodology	

Threshold values per GWB

	Pollutant / Indicator	*TV (or range) [unit]*	*NBL (or range) [unit]*	*Level of TV establishment (national, RBD, GWB)*	*Related to risk in this GWB [yes/-]*

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Table 19: TEMPLATE: GWBs at poor status in 2021 or at risk and the implemented measures

(Red entries are examples)

DRBD-GWB		GWB-5		
National part		5-RO	5-HU	5-HU
Poor status (Chem or Quant)		Chem	Chem	Quant
Risk (Chem or Quant)		Chem	Chem	Quant
Basic Measures (BM) – Article 11(3)(a)				
BM-01	BathingWater			
BM-02	Birds			
BM-03	DrinkingWater	MO		
BM-04	Seveso			
BM-05	EnvironmentalImpact			
BM-06	SewageSludge			
BM-07	UrbanWasteWater	CO	MO	
BM-08	PlantProtectionProducts		MO	
BM-09	Nitrates	MO	MO	
BM-10	Habitats			
BM-11	IPPC			
Other Basic Measures (OBM) – Article 11(3)(b-l)				
OBM-20	CostRecoveryWaterServices			
OBM-21	EfficientWaterUse			
OBM-22	ProtectionWaterAbstractions		MP	
OBM-23	ControlsWaterAbstraction			MP
OBM-24	RechargeAugmentationGroundwater			
OBM-25	PointSourceDischarge			
OBM-26	PollutantsDiffuse		MP	
OBM-27	AdverseImpact			
OBM-28	PollutantDirectGroundwater			
OBM-29	SurfacePrioritySubstances			
OBM-30	AccidentalPollution			
Supplementary Measures (SM) – Article 11(4)&(5)		MO	MP	MP

[Source/Status: draft DRBM Plan Update 2021], Red entries are examples

Please insert: MC…Measure implementation completed by end of 2020, **MO**…Measure implementation on-going after the end of 2020, **PO**…Construction planning on-going after end 2020, **CO**…Construction on-going after end 2020, **MN**…Measure implementation not started by end 2020, **MP**…Measure implementation not started by end 2020, implementation of measure is planned.

Table 20: TEMPLATE: Detailed description of groundwater measures

This template is to be completed for all national parts of ICPDR GWBs at poor status and at risk.

Following details on all relevant measures are requested:

- description of the measure,
- responsible authority,
- quantitative information by appropriate indicators (number of measures/projects and costs).

GWB Code	Size [km²]	Pressures		Status/Risk		Measures		Exemptions
		Chemical	Quantity	Chemical	Quantity	Chemical	Quantity	
GWB-5 HU-RO	7,216	DS	WA	Poor, Risk (RO, HU)	Poor, Risk (HU)	BM, OBM, SM	OBM, SM	2027+ (HU) 2027 (RO)
MC - Measure implementation completed by the end of 2020								
MO - Measure implementation on-going after the end of 2020								
PO - Construction measure planning on-going after the end of 2020								
CO - Construction of measure on-going after the end of 2020								
MN - Measure implementation not started by the end of 2020, MP - implementation of measure is planned.								

(Red entries are examples)

Status of implementation of all key measures is indicated in the following way:

MC **Measure** implementation **Completed**
Implementation of measure is estimated to be completed by the end of YYYY

MO **Measure** implementation **On-going**
Implementation of measure is on-going after the end of YYYY.
(Involving administrative acts, diffuse pollution, advisory services, research etc.)

PO **Construction** Measure - **Planning On-going**
Planning of construction measure is on-going after the end of YYYY.
(Involving construction or building works)

CO **Construction** Measure - **Construction On-going**
Construction of measure is on-going after the end of YYYY.
(Involving construction or building works)

MP **Measure** implementation **Not Started** by the end of YYYY
Implementation of measure is planned

MN **Measure** implementation **Not started**
Implementation of measure is estimated of not having started by the end of YYYY

YYY…reference year. As agreed, one year before the finalisation of the plan.

Table 21 : TEMPLATE: Groundwater Chemical Data

CODE of national part of ICPDR GWB	reference year (2021 is preferred)	Parameter & unit	Threshold value or TV range	Number of sites	Number of sites > TV in reference year	Number of sites > TV in 2009	Minimum	Arithmetic mean value	Standard deviation	Maximum	10 Percentile	25 Percentile	50 Percentile	75 Percentile	90 Percentile
Example HU-5	2015	nitrates (mg/l)		70	15	17 of 42	0.8	57.5	32.9	133.8	18.3	36.1	53.6	76.8	104.2

Name of column / row	Description
CODE of national part of ICPDR GWB	CODE of national part of ICPDR GWB (e.g. AT-1)
reference year	The reference year of monitoring data should be YYYY
Parameter & unit	**Provide the name of the parameter (in English) together with the unit e.g.:** nitrates (mg/l) **Please provide data for the following parameters** - Nitrates (mg/l) - Ammonium (mg/l) - Electrical Conductivity (µS/cm) - Parameters causing risk or poor status - Parameters necessary for characterising the GWB
Threshold value (TV) or TV range	Groundwater threshold value or groundwater quality standard. Could be 1 single value or a range.
Number of sites	Number of groundwater monitoring points in the GWB
Number of sites > TV in reference year	Number of groundwater monitoring points in the national part of ICPDR GWB that are exceeding the groundwater threshold value (or quality standard) by the arithmetic mean value. (This information is also subject to WISE reporting.)
Number of sites > TV in 2009	Number of groundwater monitoring points in the national part of ICPDR GWB that are exceeding the groundwater threshold value (or quality standard) by the arithmetic mean value. For comparison reasons it would be highly appreciated to provide these figures for the last reporting.
Minimum	Basis of the assessment are the annual arithmetic mean values per sampling site
Arithmetic mean	Basis of the assessment are the annual arithmetic mean values per sampling site
Standard deviation	Basis of the assessment are the annual arithmetic mean values per sampling site
Maximum	Basis of the assessment are the annual arithmetic mean values per sampling site
10 Percentile	Basis of the assessment are the annual arithmetic mean values per sampling site
25 Percentile	Basis of the assessment are the annual arithmetic mean values per sampling site
50 Percentile	Basis of the assessment are the annual arithmetic mean values per sampling site
75 Percentile	Basis of the assessment are the annual arithmetic mean values per sampling site
90 Percentile	Basis of the assessment are the annual arithmetic mean values per sampling site

Table 22: TEMPLATE: Collection of data on the share of groundwater in the drinking water production.

DRINKING WATER	Annual drinking water abstraction by source (Mio. m³) Population served with drinking water by source (Mio. inhabitants)					
Country:	Country Level			DRB Level		
Austria	Mio m³ abstracted	Mio inhabitants supplied	reference year of data/estimation	Mio m³ abstracted	Mio inhabitants supplied	reference year of data/estimation
Total drinking water abstraction **from fresh surface water** (Public water supply + Private households)						
Total drinking water abstraction **from fresh groundwater** (Public water supply + Private households)						
Total drinking water abstraction **from surface and groundwater** (Public water supply + Private households)						

Definitions and tables are based on the OECD / Eurostat Questionnaire on Inland Waters 2008
Definitions were amended according to the recent TG GW Meeting in Regensburg (river bank infiltration)

FRESH SURFACE WATER

Water which flows over, or rests on the surface of a land mass, natural watercourses such as rivers, streams, brooks, lakes, etc., as well as artificial watercourses such as irrigation, industrial and navigation canals, drainage systems and artificial reservoirs. Sea-water, and transitional waters, such as brackish swamps, lagoons and estuarine areas are not considered fresh surface water and so are included under NON FRESHWATER SOURCES.

FRESH GROUND WATER

Fresh water which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quality for at least seasonal use. This category includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. For purposes of this questionnaire, ground water includes springs, both concentrated and diffused, which may be subaqueous. For purposes of this ICPDR TG GW questionnaire (based on agreement in Regensburg), bank filtration (induced infiltration of river water through bankside gravel strata (by pumping from wells sunk into the gravel strata to create a hydraulic gradient) with the intention of improving the water quality) is included under fresh groundwater.

MIO INHABITANTS SUPPLIED

Approximate number of inhabitants (in Mio) supplied with drinking water by the different sources - by fresh surface water, fresh groundwater and total.

Table 23: TEMPLATE: Abstractions of bank filtered water along the Danube

No.	Element	Unit	Code	Example	
1	Code of location			ATBF42135L	
2	Name of location			Linz	
3	Country			Austria	
4	River			Danube	
5	River km	[km] (from–to)		2135.17	
6	Side of river bank	L = left, R = right, B = both, I = island		L	
7	Code of associated GWB			ATGK100038	
8	Reference year of data	[YYYY]		2010	
9	Total **permitted** annual abstraction	[Mio m³/year]	Fo…original figure, Ca…calculated, Es…estimated, U…unknown.	3.65	Fo
10	Total **actual** annual abstraction	[Mio m³/year]	Fo…original figure, Ca…calculated, Es…estimated, U…unknown.	2.847	Fo
11	Number of inhabitants supplied by **permitted** abstraction		Fo…original figure, Ca…calculated, Es…estimated, U…unknown.	50,000	Ca
12	Number of inhabitants supplied by **actual** abstraction		Fo…original figure, Ca…calculated, Es…estimated, U…unknown.	39,000	Ca
13	Number of production wells/galleries			3	
14	Depth of the wells (or range)	[m] (from–to)		7.2–9.5	
15	Percentage (or range of %) of surface water contribution to total water abstraction	[%] (from–to)	Es…estimated, Mo…modelled, Is…isotope data, U…unknown.	45	Es
	Travel time between river and abstraction [days] (or range)	[days] (from–to)	Es…estimated, Mo…modelled, U…unknown.		U
16	Parameters in raw water not in compliance with national DW standards			E-coli, ammonium	
17	Treatment			Yes, ozonisation	
18	Type of abstraction	Pe…Permanent, Oc…Occasional		Oc	

Explanation to Table 23

Name of column / row	Description
Code of location	A unique identifier for the identification of a bank filtered water abstraction. The code should start with the **ISO country code** (e.g. AT, DE, HU, etc) and **BF** for bank filtered water. [E.g. ATBF…….].
Name of location	A unique name of the location of the bank filtered water abstraction.
Country	Name of the country
River	Identification of the river where the abstraction is situated. For this data collection the river is the **Danube** and the template is pre-filled.
River km	Identification of the river km (internationally agreed) where the abstraction is situated. This can also be indicated as a range (from–to). E.g.: the river km of the Danube starts counting at the mouth to the Black Sea.
Side of river bank	At which side of the river bank is the abstraction located. [L = left, R = right, B = both, I = island].
Code of associated GWB	In the case, that the abstraction is located in an associated (WFD) groundwater body. The code of the GWB should start with the ISO country code.
Reference year of data	Reference year of the information/data.
Total **permitted** annual abstraction [Mio m³/year]	Can be calculated by applying the key value of 200 l/capita/day. Please indicate whether this is 'original' figure or calculated from supplied capita by key value, estimated or unknown. [Fo…original figure, Ca…calculated, Es…estimated, U…unknown].
Total **actual** annual abstraction [Mio m³/year]	Can be calculated by applying the key value of 200 l/capita/day. Please indicate whether this is 'original' figure or calculated by from supplied capita key value, estimated or unknown. [Fo…original figure, Ca…calculated, Es…estimated, U…unknown].
Number of inhabitants supplied by **permitted** abstraction	Can be calculated by applying the key value of 200 l/capita/day. Please indicate whether this is 'original' figure or calculated from abstraction data by key value, estimated or unknown. [Fo…original figure, Ca…calculated, Es…estimated, U…unknown].
Number of inhabitants supplied by **actual** abstraction	Can be calculated by applying the key value of 200 l/capita/day. Please indicate whether this is 'original' figure or calculated from abstraction data by key value, estimated or unknown. [Fo…original figure, Ca…calculated, Es…estimated, U…unknown].
Number of production wells/galleries	The number of production wells or galleries where water is abstracted.
Depth of the wells (or range)	Depth of the well(s) in m. Could be indicated as a single figure or as a range.
Percentage (or range of %) of surface water contribution to total water abstraction	Percentage (or a range of percentages) of the surface water contributing to the overall water abstracted. Please indicate whether this % is based on estimations or result of model calculation or isotope measurement (deuterium, oxygen 18 etc.). [Es…estimated, Mo…modelled, Is…isotope data, U…unknown].
Travel time between river and abstraction [days] (or range)	Travel time is a decisive factor for the assessment of the vulnerability of the abstraction and the need for treatment. [Es…estimated, Mo…modelled, U…unknown].
Parameters in raw water not in compliance with national DW standards	Which quality parameters **in the raw water** do not comply with the national drinking water standards?
Treatment	Is treatment implemented? [yes/no] If yes: which kind of treatment?
Type of abstraction	Type of abstraction [Pe…Permanent, Oc…Occasional]

7.2. GIS Templates

The respective GIS templates relevant for GW issues were elaborated by the GIS Expert Group:

- GWBody
- GWBodyAggr
- GWStn

The templates are available for download at http://www.danubegis.org (after login) under "Templates"

The detailed content of the templates is explained in the related code lists.

The templates need(ed) to be submitted to DANUBIS by the national GIS experts in close cooperation with the groundwater experts (GW TG members) who are mainly responsible for the groundwater related content.

GIS data should be sent in the reference system of WGS84/ETRS89 or at least information about: 1. Name of Reference System, 2. Projection, 3. Ellipsoid must be added.

8. Bilateral Transboundary Coordination 2016–2020

The twelve ICPDR GWBs are shared by 8 different countries: Austria, Bulgaria, Germany, Hungary, Moldova, Romania, Serbia and Slovak Republic.

The information below summarises all bilateral harmonisation activities in the management of the 12 ICPDR GWBs for the period of 2016 to 2020.

Countries	**Austria – Germany**	**GWB-1**
There are no changes in GWB delineation. At the end of 2016 the upgrade of the mathematical and hydrogeological model for GWB-1 started which is expected to last until 2021/2022. Threshold values for the GWB-1 quality assessment are planned to be developed jointly and this needs developing a methodology which is completely different from that applied for shallow GWBs. Considerations are being made to elaborate common criteria for assessing chemical status together with Germany. The same process for quantitative status will be started after the models will be completed.		

Countries	**Bulgaria – Romania**	**GWB-2, 4**
A bilateral meeting in 2015 was organized in order to harmonization of the two transboundary groundwater bodies for the elaboration of the DRBMP-updates 2015. During this meeting, both parties presented the methodology applied for the transboundary GWBs and the results obtained. Parties agreed to have a practical exchange of monitoring data on transboundary groundwaters and fixed the templates format for this purpose. In 2016 a bilateral meeting took place and the working group on RBM Plans reviewed the established bilateral GWB monitoring network (in terms of monitoring sites, frequency and parameters) which is subject to bilateral data exchange. Romania had no intention to change the GWB delineation. In the frame of the JOINTISZA project the Tisza RBMP update was produced in 2019 which includes groundwater elements. There is regular (annual) data exchange between Romania and Bulgaria.		

Countries	**Moldova – Romania**	**GWB-3**
In 2016 Moldova received the boundaries of the groundwater bodies in Romania and delineated their groundwater bodies based on the Romanian GWBs. There is no bilateral coordination between Moldova and Romania on groundwater aspects.		

Countries	**Hungary – Romania**	**GWB-5, 6, 7**
A bilateral meeting took place in 2015. In the frame of the JOINTISZA project the Tisza RBMP update was produced in 2019 which includes groundwater elements. Bilateral discussion about monitoring data as well as annual bilateral data exchange is ongoing. The data are exchanged via a website.		

Countries	**Hungary – Slovak Republic**	**GWB-8, 9, 10, 11, 12**
Bilateral harmonization of GWBs is ongoing; In 2016 Slovakia suggested the nomination of a new GWB of basin-wide importance on the Ipel River as the 12th ICPDR GWB. Hungary supported this nomination. In 2019, the transboundary commission adopted the proposal of creating the new GWB-12 on Ipel/Ipoly and adopted the thermal Hungarian GWB as an additional part of GWB-11. In 2020, the bilateral harmonization and characterization of GWB-12 was completed. In 2017 a new bilateral expert group on WFD was established. In 2018, the transboundary water committee discussed an increased water abstraction from the transboundary karstic GW body. Slovakia also participates in the JOINTISZA project There is a regular data exchange in the frame of the bilateral transboundary commission (twice per year). In 2018, Hungary delivered data from 126 GW monitoring stations to Slovakia		

Countries	**Hungary – Serbia**	**GWB-7**
In 2016, a bilateral agreement was signed but no further activity on groundwater took place under this agreement. In 2017, two meetings were held, and it was agreed that Serbia prepares a groundwater data exchange template and submits it to Hungary for comments. Three-year groundwater data is planned to be exchanged every 3 years. The possibility of collecting historical data (2003–2013) is explored as well. The adoption of the programme is foreseen in 2018. In 2017, a groundwater flow model was under discussion, and it was agreed to continue working on the improvement of this model. Project funds are searched to support this activity, which covers all transboundary GWBs. Since 2018, bilateral cooperation exists. At the meeting, the joint programme for data exchange was finally harmonized and in 2019 it was adopted. Regular exchange of data will be carried out in future, based on a 3-year period. In 2020 a meeting will be held to discuss how to continue the bilateral cooperation.		

Countries	**Romania – Serbia**	**GWB-7**
In 2018 a water management agreement was under development. In 2019 two meetings took place. A joint programme for data exchange has been adopted. A new agreement on transboundary waters was approved in 2020 replacing the agreement of 1954. This new agreement now also covers groundwater. After entering into force, a regulation on the exchange of information will be elaborated.		

9. Compliance regime for assessing groundwater status

9.1. Chemical status assessment

In the assessment of groundwater chemical status the following elements need to be considered:

- the relevant environmental objectives,
- the need for data aggregation,
- the extent of an exceedance,
- criteria for assessing groundwater chemical status (groundwater quality standards and threshold values)
- the natural background levels for naturally occurring substances.

The legal basis as well as guidance for their interpretation are comprehensively described in CIS Guidance document No 18 on Groundwater Status and Trend assessment [EC, 2009]. The specifications in the WFD and GWD leave room for interpretation to the EU Member States and the following chapters will give an overview of the national approaches taken in the countries of the Danube River Basin District.

9.1.1. Environmental objectives

The assessment of chemical groundwater status needs to consider all relevant environmental objectives and guidance N°18 recommends the implementation of the related status tests.

In almost all countries of the DRB damage to terrestrial ecosystems, diminution to aquatic ecosystems and damage to actual and future legitimate uses and functions of groundwater have been taken into consideration (Table 24). This is also reflected in the application of the corresponding status tests as described in CIS Guidance document N°18 [EC, 2009].

Table 24: Considered environmental objectives and applied chemical status assessment tests

Country	Which environmental objectives have been considered in chemical status assessment	Which status tests (CIS Guidance No 18) have been performed
Austria	1, 2, 3, 4	1, 2, 3, 4, 5
Bulgaria	1	1
Croatia	1, 2, 3, 4	1, 2, 3, 4, 5
Czech Republic	2	
Germany	1, 2	
Hungary	1, 2, 3, 4	1, 2, 3, 4, 5 Saline intrusion test carried out within the quantitative status assessment
Romania	1, 2, 3	1, 2, 3, 5
Serbia		
Slovak Republic*	2, 3	1, 3, 5
Slovenia	1, 2	

*…referring to the RBMP 2021

Explanation to Table 24:

Considered environmental objectives	The assessment of chemical groundwater status needs to consider all relevant environmental objectives. The following environmental objectives are laid down by the WFD and have to be considered, if they are relevant: 1. Damage of GW dependent terrestrial ecosystems 2. Diminution of associated aquatic ecosystems 3. Uses and functions 4. Saline intrusion
Applied status tests (CIS Guidance No 18)	The following status tests have been described in CIS Guidance No 18 and elaborated based on the provisions of the WFD and GWD. 1. General Quality Assessment (GQA) Test (at GWB scale) 2. GW dependent terrestrial ecosystems Test 3. Surface water Test 4. Saline and other intrusion Test 5. Drinking Water Protected Area Test

9.1.2. Data aggregation

Data aggregation in the Danube River Basin is mainly done by the arithmetic mean but the number of years considered in the aggregation varies from 1–5 years (Table 25).

Table 25: Data aggregation method

Country	Aggregation method	Number of years considered	Period (years) considered in the data aggregation
Austria	Arithmetic mean	3	2012–2014
Bulgaria*	Arithmetic mean	4	2017–2020
Croatia	Arithmetic mean	5	2009–2013
Czech Republic			
Germany			
Hungary	Median value	3	2010–2012
Romania	Arithmetic mean	3	2017-2019
Serbia			
Slovak Republic*	Arithmetic mean for each site, Kriging mean for the whole GWB	2	2017–2018**
Slovenia			

*…referring to the RBMP 2021. **…2017–2018 for GQA test, 2013–2018 for Surface water test and 2008–2017 for Drinking water Protected Area test.

9.1.3. Extent of exceedance

According to Article 4 GWD a groundwater body is of good status when groundwater quality standards (GW-QSs) or groundwater threshold values (TVs) are not exceeded at any monitoring point. Where a GW-QS or TV has been exceeded at one or more monitoring points appropriate investigation, with appropriate aggregation of monitoring results, is needed to estimate the extent of the groundwater body (in terms of volume or spatial area) having an annual arithmetic mean concentration of a pollutant higher than a GW-QS or TV (Paragraph 3 of Annex III of the GWD).

In the countries of the Danube River Basin the extent of exceedance is mainly calculated on the basis of the represented area of the monitoring sites and in few cases by the number of monitoring sites. The acceptable extent of exceedance, where a GWB is still characterised as of good chemical status, ranges from 20–50% of the area respectively the number of sites.

Table 26: Calculation of the extent of exceedance and criteria for acceptable extent of exceedance in %

Country	Method to calculate/estimate the extent of exceedance	Criterion for acceptable extent of exceedance %
Austria	Method 1 (number of sites)	50
Bulgaria	Method 2 (area)	20
Croatia	Method 2 (area)	30
Czech Republic	Other	
Germany	Method 2 (area)	
Hungary	Method 1 (number of sites), Other: For diffuse pollution exceedance is calculated using a weighted sum based on the proportion of monitoring objects, land use categories and GWB (infiltration) area. The proportion (%) of the number of exceeding monitoring sites in each land use category is weighted by the proportion (%) of the land use area to the total area of GWB or groups of GWBs. TA*RA + TB*RB + TC1*RC1 + TC*RC + TD*RD = Rvt A = settlement, B = agricultural area, C1 = forest, C2 = pasture-land, D = industrial area, vt = total GWB, T = proportion (%) of the "active recharge area" of the given land use area within the GWB, R = proportion of sites exceeding TVs within the given land use area of the GWB. For DW Protected Areas, exceedance is calculated using Method 1 which has been extended, and only those GWBs were considered as having poor chemical status where the total amount of the annual production of the well(s) which exceeded TVs reached 3.5% of the total annual production from the given GWB.	20
Romania	Method 2 (area)	20
Serbia		
Slovak Republic*	Method 2 (area)	20
Slovenia	Method 1 (number of sites)	

*…information referring to the RBMP 2021.

Explanation to Table 26

Method to calculate/estimate the extent of exceedance	For the calculation of the extent of exceedance three main options approaches could be applied: **Method 1**: Proportion (%) of the number of monitoring sites exceeding a GW quality standard or TV compared to the total number of monitoring sites in the whole GWB **Method 2**: Proportion (%) of total area of a GWB represented by sites exceeding a GW quality standard or TV compared to the total area of the GWB. **Method 3**: Proportion (%) of total volume of a GWB represented by sites exceeding a GW quality standard or TV compared to the total volume of the GWB
Criterion for acceptable extent of exceedance %	The acceptable extent of exceedance where the GWB is still considered as of good chemical status, for the general GWB test.

9.1.4. Groundwater threshold values

Groundwater threshold values (TVs) have been established mainly at national level but also frequently at the level of individual GWBs. In all countries, that provided information, drinking water standards are the basis of the derivation of threshold values, but also EQS derived for ecosystems. NBLs have been mostly considered within the TV establishment and for the relationship between criteria values (CVs) and TVs the approaches are different, either influenced by the level of NBLs compared to CVs and by the application of safety margins.

Table 27: Elements and criteria considered in the establishment of groundwater threshold values.

Country	Scale of setting TVs	Elements considered	CVs considered	Relation between CV and TV	Consideration of NBLs	Bilateral coordination of TVs
Austria	National	2, 3	DWS, EQS	TV = 90% of DWS (100% for pesticides)	Method 2	with DE, HU, SI
Bulgaria*	GWB	3	DWS	CV<NBL: TV=NBL CV>NBL: TV=NBL + Ktv* (CV-NBL). Ktv between 0 and 1	Method 1	Yes
Croatia	Regional, National RBD, GWB	1, 2, 3, 4	DWS, EQS	CV ≤ NBL: TV = CV CV ≥ NBL: TV = 75% DWS	Method 1	Unknown
Czech Republic	National	2, 3			Method 2	no transb. GWB
Germany	National	1, 2, 3			Method 1	Yes
Hungary	National; (GWB for NO3, NH4,	1, 2, 3	DWS, EQS	TV = NBL + ε, TV = α*CV	Method 1	Unknown

Country	Scale of setting TVs	Elements considered	CVs considered	Relation between CV and TV	Consideration of NBLs	Bilateral coordination of TVs
	Cl, SO4, EC)					
Romania	National (for benzene, TRI and PER). GWB (all other TVs)	3	DWS, EQS	NBL<CV: TV=CV NBL>CV: TV = NBL x 1.2*	Method 1	Unknown
Serbia						
Slovak Republic**	mainly GWB (PER national)	2, 3	DWS, EQS	TV = (NBL+CV)/2 TV = CV=AF*EQS TV = 0.75*DWS TV = NBL	Method 1	No
Slovenia	National	3			Method 3	Unknown

* .. This coefficient of 1.2 was chosen by RO to consider that the 90-percentile was used as the criterion for derivation of NBL, so at least 10 % of the wells would show exceedances if TV = NBL. The coefficient would also consider possible errors during sampling, conservation and lab analysis.

**…referring to the RBMP 2021

Explanation to Table 27

Scale of setting TVs	Groundwater threshold values (TVs) can be set at: - national level, - RBDs level or - GWB level.
Elements considered	The determination of TVs should be based on the extent of interactions between groundwater and associated aquatic and dependent terrestrial ecosystems and the actual and potential legitimate uses of groundwater. Within the overview below, the figures represent the following elements: 1. Protection of GW dependent terrestrial ecosystems 2. Protection of associated aquatic ecosystems 3. Uses and functions 4. Saline or other intrusion
CVs considered	Depending on the receptors and uses of groundwater, the setting of TVs considers relevant criteria values (CV) e.g.: - DWS…Drinking Water Standards, - EQS… Environmental Quality Standards, - IS…Irrigation Standards etc.
Relationship between CV and TV	Member States have to provide information on the relationship between TVs and the environmental quality objectives and other standards for water protection that exist at national, Community or international level

Consideration of NBLs	Member States have to provide information on the relationship between TVs and in the case of naturally-occurring substances, the observed background levels (NBL). The following main methods of consideration have been applied: **Method 1:** NBLs have been considered in TV establishment **Method 2:** NBLs have been considered in the status assessment but not in TV establishment **Method 3:** not considered.
Bilateral coordination of TVs	Member States shall ensure that, for GWBs shared by two or more Member States and for GWBs which groundwater flows across a Member State's boundary, the establishment of TVs is subject to coordination between the Member States concerned

9.1.5. Methodologies for establishing natural background levels (NBL)

The following chapters explain the methodologies which were developed and applied by the individual countries in deriving natural background levels (NBL) for those substances which are naturally occurring.

Austria

The calculation is based on 2.5 Mio monitoring data from 2,571 monitoring sites for 26 parameters from 1997-2017. NBL have been calculated for 52 geological classes with more or less uniform geochemical properties. They have been delineated all-over Austria by a 2-step approach:

1. identification of deviating values (outliers) by checking the distribution of monitoring data in probability nets. Deviations might indicate geological anomalies or pollution.
2. NBL range is between 10% and 90%-percentile.

Finally, the geological units have been intersected with GWBs

Bulgaria

The NBL were established for each GWB as a result of the project report 'Assessment of the natural hydrochemical background of the substances composition of groundwater in Bulgaria" (GEOFUND V-402), 1998.

The report summarizes the NBL establishment of the macro- and micro component composition, the total mineralization and the total hardness of the groundwater. The statistical data sets from chemical data consist of data from GW samples outside the ore fields in Bulgaria

The main part of the chemical analyses is from the hydrochemical mapping in scale M 1:25 000, performed by the former Committee of Geology, alone or in combination with the geological mapping of the country in the period up to 1960, before the industrialization of the country.

The results of the analysis of 11,800 water samples outside to ore deposits and areas of hydrothermal change and tectonic disturbances have been used. The samples include analyses of waters from springs, wells and small streams, close to their springs. Small streams are the main objects of study in the mountainous parts of the country and wells the main sampling points in the plain areas of the country. The springs are dominant sampling sites in the middle mountainous and hilly areas.

The analyses were processed on the basis of the lithology of the aquifers / layers / cracked or karstic areas in eleven groups of lithology types:

- Deposits formed by weathering, clayey sands and clays of different ages.

- Marls, siltstones
- Quartz sandstones, arc sandstones, sandstones, conglomerates, shales, etc.
- Flysch formations
- Groundwater in carbonate rocks, including those in the limestones and dolomites of the Middle Triassic / in the structures of North-Western and Central Northern Bulgaria, etc./, the Sarmatian deposits, etc.
- Alluvial deposits, alluvial-prolluvial deposits.
- Loess, loess-like deposits and loess gravels.
- Volcanogenic-sedimentary formations
- medium acid magmatic and metamorphic rocks
- Basic and ultrabasic magmatic and metamorphic rocks.

The maps are compiled on a lithological principle on the Geological Map of Bulgaria in Scale 1 : 500,000. The modal contents, representing in fact the NBL of the individual substances, were plotted on each map sheet (from the sheets in S 1: 200000) on the respective geological environment. For the areas for which there are not enough data allowing correct statistical processing, where possible and appropriate, the contents determined for groundwater, formed under similar hydrogeological conditions were accepted as NBL. The values of substances contents are combined in different intervals, as the boundaries of these intervals coincide with the boundaries of the geological bodies. A solid line outlined the high confidential values, and broken line outlines the presumed boundaries. Areas for which no data are available and the NBL cannot be determined by any other method are left as white spots. The outlined areas have been coloured, with more intense colours corresponding to higher values of parameters .

NBLs are available for Ca, Mg, SO_4, Cl, HCO_3, Total hardness, Cu, Pb, Zn, As, Fe, F, Al, Mn, Cr, Co, V, J, Ag, Ni, Na, K. The NBLs were determined for each hydrogeological classes (5 classes) in the 90th percentile and 50th percentile (median) of the statistical sample.

Croatia

NBLs for all the main parameters listed in Annexes I and II of the GWD were determined for each GWB, in particular on the basis of the data from GW chemical monitoring programs and raw water of springs or pumping sites for water supply system.

Exceptionally, NBL for parameters sensitive to changes in oxidation and reduction conditions in the water environment (nitrates) was determined especially for areas where oxidative conditions or reductive conditions prevail.

The following methods of IT-iterative 2σ technique and IFR-calculated distribution function were used to determine the background values. If it was not possible to apply the above methods, then it was possible to apply a simplified approach in accordance with Annex 1b of the GWD. In the above-mentioned cases, the NBL were set at intervals of μ ±2 standard deviation (SD) or median ±2 median absolute deviation (MAD). If there was no data at all for a GWB in accordance with point 1c) of the Annex to the GWD, it was possible to use the NBL derived in another GWB that had the same type of aquifer.

Hungary

NBLs were defined as 90 % percentile of 2000–2012 unpolluted data, for GWB or groups of GWB. When large number of data was available the 95% percentile was taken.

Romania

NBLs were derived following a detailed national methodology based on EU guidance document "Groundwater Chemical Status and Threshold Values, version 2.0 (25-10-07)" and on BRIDGE project recommendations. For each groundwater body the results of all available chemical analyses from the monitored wells were chronological ordered, including the technical data obtained from the wells construction (extended database).

All samples have been checked for errors in ion-balance and also using correlation between sum of anions and measured conductivity. All samples identified as not reliable were removed, as follows:

- samples with ionic balance not correct (error > 10 %);
- samples with unknown depth;
- samples not adequate with the aquifer typology;
- samples with NaCl concentration > 1000 mg.

The time series for each parameter were transformed in median values and the wells with anthropogenic inputs were excluded in two steps using the following criteria:

- wells with Cl > 200 mg/l
- wells with NO3 > 10 mg/l

NBL were calculated as the 90-percentile of the parametric values in the remaining wells. Where applying "chlorides" and "nitrates" criteria less than 20 wells remained, NBL were calculated as the 50-percentile in all the wells (without applying "chlorides" and "nitrates" criteria).

Where chlorides concentrations are naturally high (salt diapires presence, lagunar conditions of sedimentation), only the "nitrates" criteria were used for exclusion of the anthropogenic influenced wells and the results were verified calculating the 50-percentile in all the wells.

The obtained NBL for each GWB were analysed and validated considering lithological and hydrogeological characteristics of the aquifers.

TVs were established comparing NBL with the national DWS and EQS. In Romania the drinking water standard is the Law no.458/2002 on drinking water quality, amended by Law no.311/2004, entirely transposing Drinking Water Directive 98/83/EC. The standard for surface water quality is laid down in the Ministerial Order no. 161/2006 for the approval of the "Norms on quality classification of surface waters in order to establish the water bodies status". Having in mind that hydraulic connections between groundwater and surface waters were not enough studied, Annex II.A of GWD provisions, and groundwater relevant uses, the DWS were chosen as reference values for comparison.

Following, two cases were registered:

- NBL< DWS, where TV was established as having the same value as DWS;
- NBL > DWS, where TV was established using the small addition, multiplying NBL by a coefficient E=1.2. This coefficient was chosen given the fact that in the national methodology the 90-percentile was used as the criterion for derivation of NBL, so at least 10 % of the wells would show exceedances if TV = NBL, and also considering possible errors during sampling, conservation and analyse of groundwater samples.

Validation of TV values for each groundwater body was done considering lithological and hydrogeological characteristics of the aquifers.

Slovak Republic

Background values are established at GWB level. Methodology: 2σ iterations for the treatment of outliers until normal distribution, then NBL = median+2σ or NBL = upper interval+2σ, depending on geochemical analysis. For the Quaternary GWB, the so-called geochemical approach was taken which consisted in the selection of a monitoring object with minimal anthropogenic influence on groundwater. The selection criterion was not to exceed any component (cation, resp. anion) of

groundwater by half the value of the drinking water standard. Another criterion was depth of perforated borehole section greater than 30 m. Backgrounds were calculated for comparison values of macro-elements of groundwater of pre-quaternary GWB, representing source water for alluvial and terraced groundwater circulation. The resulting background values for quaternary and pre-quaternary GWB were determined on the basis of hydro-geochemical review of statistical and geochemical approach for the following groundwater components: Na, K, Ca, Mg, Sr, PO_4, HCO_3, Fe, Mn, Cr, Cu, Se, As, Cd, Pb, Hg, NH_4, NO_3, F, Cl and SO_4.

The NBL was determined and used to derive the TV. An updated list of the TV established for each GWB was published in the amended Regulation of the Government of the Slovak republic no.282/2010 Coll. For the GWB where the NBL was higher than the TV due to natural hydro-geological reasons, the TV was set up as TV = NBL.

Czech Republic, Germany, Serbia, Slovenia

No Information was provided/found on the methodology for deriving NBLs.

10. Hazardous Substances in Groundwater

10.1. Objectives

The aim of this document is to give an overview of the significant presence of hazardous substances in the groundwater water bodies (GWB) of the Danube River Basin District (DRBD). Significant means that these substances either cause failing of good groundwater chemical or the risk of failing good status according to the River Basin Management Plans of 2015.

Several of these identified substances are also listed as priority substances for surface waters under Directive 2013/39/EU (EQSD), which allows for making direct comparisons of their presence and the significance of their presence in groundwater and in surface waters and for potential interrelationships.

10.2. Coverage and limitations of the inventory

This inventory covers all GWBs in the DRBD and is not restricted to the twelve ICPDR-GW-bodies of basin wide importance. The information was extracted from WISE[14].

This inventory is only focusing on the EU part of the DRBD (11 of 19 countries) as within the River Basin Management Plans (RBM Plans) EU Member States have to systematically and periodically report on the groundwater chemical status and the risk whether the good groundwater status cannot be achieved.

The EU part of the DRBD covers approximately 79% of the whole DRBD.

This inventory of hazardous substances in groundwater is based on the electronic reports under the RBM Plans of 2015 and considers:

- all substances which were reported to cause poor chemical status in groundwater bodies; and
- all substances which were reported to cause risk of failing good chemical status.

10.3. Summary of inventory

Overall, 170 of 871 (~20%) GWBs in the EU part of the DRBD (in 8 of 11 Danube EU Member States) are in poor chemical status and 76 GWBs in 6 EU Member States are at risk of failing good chemical status, according to the 2nd RBMPs reported to WISE.

In the following tables the surface water priority substances under the EQSD are indicated with an asterisk *.

Hazardous substances: In total, 65 GWBs (~7%) are failing good chemical status due to 48 different hazardous substances and 14 GWBs are assigned at risk of failing good status. The 48 hazardous substances can be distinguished into 7 metals, 10 PAHs and 31 pesticide substances and metabolites (Table 28). 38 of the 48 hazardous substances are identified in only one Member State (Czech Republic).

14 https://tableau.discomap.eea.europa.eu/t/Wateronline/views/WISE_SOW_gwPollutant/GWB_gwPollutant_Europe?:embed=y&:showAppBanner=false&:showShareOptions=true&:display_count=no&:showVizHome=no

Surface water priority substances (which is a subset of the above-mentioned hazardous substances)**:** In total, 24 GWBs (~3%) are failing good chemical status due to 17 surface water priority substances and 6 GWBs are assigned at risk of failing good status by 3 substances. These 17 surface water priority substances are 4 metals, 8 PAHs and 5 pesticide substances and metabolites.

The overall overview of the number of EU Member States and groundwater bodies where the groundwater chemical status is poor or at risk is given in Table 28. Details are provided for the hazardous substances and the surface water priority substances. The detailed overviews for each individual substance are provided in Table 30 and Table 31.

Table 29 lists all ten hazardous substances (1 priority substance) which were causing poor status in 2015 in more than two EU Member States.

Table 28: Number of GWBs and EU Member States where groundwater chemical status is poor or at risk due to hazardous substances and due to surface water priority substances according to the EQSD (referring to RBMPs of 2015)

	Poor status		At risk	
Substance group	Member States	Groundwater bodies	Member States	Groundwater bodies
Overall overview	8	170	6	76
Hazardous substances	**8**	**65**	**3**	**14**
Metals	3	24	3	8
PAH	2	19	2	7
Pesticides	6	58	2	4
Priority substances	**2**	**24**	**1**	**10**
Metals	1	11	1	4
PAH	1	11	1	6
Pesticides	2	12	-	-

Table 29: Hazardous substances which are causing poor status in more than two EU Member States

Hazardous substance	PS*	EU Member States	Groundwater bodies
Atrazine		4	26
Arsenic		2	7
Bentazone		2	4
Chlortoluron		2	2
Desethylatrazine		2	31
Desethylterbuthylazine		2	8
Isoproturon	*	2	2
Metolachlor		2	5
Terbuthylazine		2	6
Tetrachloroethylene		2	9

PS…substance is listed as surface water priority substance in the EQSD (Directive 2013/39/EU)

Table 30: Number of EU Member States and groundwater bodies in poor status or at risk due to hazardous substances in the Danube River Basin District.

Hazardous substance	PS*	EU MS	GWBs	
		Poor or Risk	Poor	Risk
Metals				
Aluminium		1	11	
Arsenic		2	7	2
Cadmium	*	1	7	
Chromium		1	2	2
Lead	*	1	8	1
Mercury	*	1	4	3
Nickel	*	1	2	
Metals Total		**3**	**24**	**8**
PAH				
Benzene	*	1	2	
Benzo(a)pyrene	*	1	6	6
Benzo(b)fluoranthene	*	1	4	
Benzo(g,h,i)perylene	*	1	9	
Benzo(k)fluoranthene	*	1	4	
Indeno(1,2,3-cd)pyrene	*	1	9	
Naphthalene	*	1	2	
Tetrachloroethylene		2	9	1
Trichloroethylene		1	5	
Trichloromethane	*	1	1	
PAH Total		**2**	**19**	**7**

PS substance is listed as surface water priority substance in the EQSD (Directive 2013/39/EU)

Hazardous substance	PS*	EU MS	GWBs	
		Poor or Risk	Poor	Risk
Pesticides				
Acetochlor		1	1	1
Acetochlor ESA		1	10	
Acetochlor OA		1	8	
Alachlor ESA		1	21	
Anthracene	*	1	3	
Atrazine		4	26	
Azoxystrobin		1	1	
Bentazone		2	4	
Bromacil		1	3	
Chloridazon		1	3	
Chlortoluron		2	2	1
Deisopropyldeethylatrazine		1	1	
Desethylatrazine		2	31	
Desethylterbuthylazine		2	8	
Desisopropylatrazine		1	4	
Dicamba		1	8	
Diuron	*	1	1	
Fluoranthene	*	1	7	
Hexazinone		1	3	
Hydroxyterbuthylazine		1	1	
Isoproturon	*	2	2	
MCPA		1	1	
Metolachlor		2	5	1
Metolachlor ESA		1	15	
Metolachlor OA		1	2	
Prometryn		1	1	
Propazine		1	2	
Propiconazole		1	1	
Simazine	*	1	4	
Terbuthylazine		2	6	1
2-4 D		1	1	1
Pesticides Total		**6**	**58**	**4**

Table 31: Number of GWBs in the DRBD in poor chemical status or assigned at risk due to hazardous substances per EU Member State.

		Number of EU MS		Number of GWBs																			
				AT (130)		BG (50)		CZ (54)		DE (170)		HR (20)		HU (185)		RO (143)		SI (18)		SK (98)		Total (871)**	
Pollutant	PS	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk
Metals																							
Aluminium		1						11														11	
Arsenic		2	2					5	1											2	1	7	2
Cadmium	*	1						7														7	
Chromium		1	1			2	2															2	2
Lead	*	1	1					8	1													8	1
Mercury	*	1	1					4	3													4	3
Nickel	*	1						2														2	
Metals Total		**3**	**3**			**2**	**2**	**20**	**5**											**2**	**1**	**24**	**8**
PAH																							
Benzene	*	1						2														2	
Benzo(a)pyrene	*	1	1					6	6													6	6
Benzo(b)fluoranthene	*	1						4														4	
Benzo(g,h,i)perylene	*	1						9														9	
Benzo(k)fluoranthene	*	1						4														4	
Indeno(1,2,3-cd)pyrene	*	1						9														9	
Naphthalene	*	1						2														2	
Tetrachloroethylene		2	1					8												1	1	9	1
Trichloroethylene		1						5														5	
Trichloromethane	*	1						1														1	
PAH Total		**2**	**2**					**18**	**6**											**1**	**1**	**19**	**7**
Pesticides																							
Acetochlor		1	1					1	1													1	1
Acetochlor ESA		1						10														10	
Acetochlor OA		1						8														8	
Alachlor ESA		1						21														21	
Anthracene	*	1						3														3	
Atrazine		4						7		17				1				1				26	
Azoxystrobin		1								1												1	

		Number of EU MS		Number of GWBs																			
				AT (130)		BG (50)		CZ (54)		DE (170)		HR (20)		HU (185)		RO (143)		SI (18)		SK (98)		Total (871)**	
Pollutant	PS	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk	Poor	Risk
Bentazone		2						1		3												4	
Bromacil		1								3												3	
Chloridazon		1						3														3	
Chlortoluron		2	1					1												1	1	2	1
Deisopropyldeethylatrazine		1		1																		1	
Desethylatrazine		2						9		22												31	
Desethylterbuthylazine		2						1		7												8	
Desisopropylatrazine		1								4												4	
Dicamba		1						8														8	
Diuron	*	1								1												1	
Fluoranthene	*	1						7														7	
Hexazinone		1						3														3	
Hydroxyterbuthylazine		1						1														1	
Isoproturon	*	2						1		1												2	
MCPA		1								1												1	
Metolachlor		2	1					1	1	4												5	1
Metolachlor ESA		1						15														15	
Metolachlor OA		1						2														2	
Prometryn		1						1														1	
Propazine		1								2												2	
Propiconazole		1								1												1	
Simazine	*	1								4												4	
Terbuthylazine		2	1					2	1	4												6	1
2-4 D		1	1					1	1													1	1
Pesticides Total		**6**	**2**	**1**				**30**	**3**	**24**				**1**				**1**		**1**	**1**	**58**	**4**
Hazardous substances – Total		**8**	**3**	**1**	**-**	**2**	**2**	**33**	**10**	**24**		**-**	**-**	**1**		**-**	**-**	**1**	**-**	**3**	**2**	**65**	**14**

PS…substance is listed as surface water priority substance in the EQSD (Directive 2013/39/EU)

** the total number of GWBs includes also the 3 GWBs in the Polish part of the Danube RBD, which are of good chemical status and therefore not listed in this table. There is no GWB identified in the Italian part of the DRBD.