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TRB report on water quantity (water use and demand)

Deliverable 4.2.1

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Contents

Chapter 1 – Background and Introduction

The water resources of the Tisza River Basin are mainly used for public water supply, irrigation and industrial purposes, but also for other uses, such as agriculture, fishing, hydropower production, and recreation. The largest tributaries of the Danube River by catchment area are the Tisza River (157,186 km^2) and Sava River (97,713 km^2). Additionally, the population is higher in the Tisza River Basin (14 Million) than in the Sava River Basin (8.5 Million). In comparison with average discharge of the Sava River (1,559 m^3/s) Tisza River has only half of it (825 m^3/s). As a result, demand in water is higher in the Tisza River Basin, which raises concerns about the need to ensure a harmonised and sustainable water resource management in the Tisza River Basin. Furthermore, increase in extreme events (severe floods and draughts) in the recent years has adverse affects on water resources, ecosystems, human health, and economy within the region. Although the reserves of water are sufficient for current users, expected increase in water use accompanied with fluctuating climate may have adverse affects on water quantity.

As the main conclusion of the Tisza Analysis Report 2007 (TAR), the ***ICPDR Tisza Group identified that integration of water quality and quantity in land and water planning is an essential issue*** to be considered during the preparation of the Integrated Tisza River Basin Management Plan (ITRBM Plan).
The TAR 2007 identified three issues of concern for the integration of water quality and water quantity: floods and excess water, droughts and water scarcity, and climate change. Significant water management pressures and inter-linkages between water quality and quantity associated management issues within the Tisza River Basin are identified and presented schematically in the first ITRBM (Figure I.1).

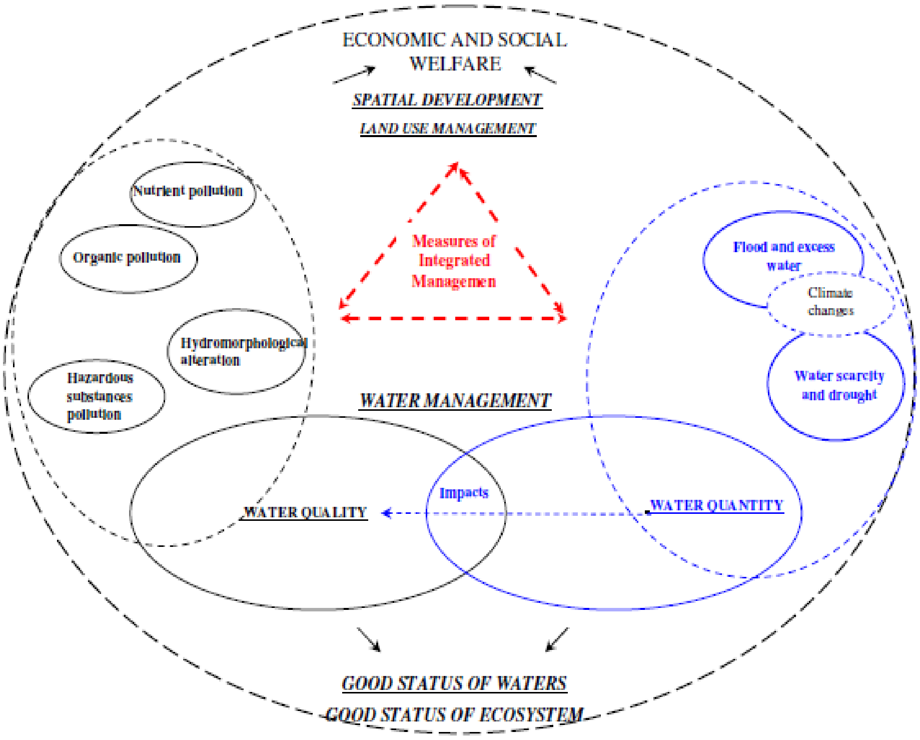


Figure I.1: Interlinkages between the water quality and quantity related management issues identified by the ICPDR Tisza Group

Data and information presented in this report are reported by Tisza countries based on template that follow approach applied for development of the First Tisza Analysis Report (TAR 2007) and other studies and background documents relevant for Tisza River Basin water quantity (present use and demand by the 2021) within the scope of International Commission for the Protection of the Danube River (ICPDR) Tisza Group and other ICPDR expert groups. With respect to Climate Change effects on water quantity management, in this report only relevant projects and studies TRB wide significant and Tisza countries specific are included. The comprehensive assessment will be included in the draft of the updated ITRBMP (JOINTISZA output 6.2). Relevant Climate Change TRB (countries specific) adaptation measures are elaborated in JOINTISZA deliverable 4.3.3: Catalogue of existing measures evaluation.

General info & approach used for data collection and evaluation

In the subsequent chapters 2-11 water use - PRESENT &DEMAND is based on following criteria:

- ***The last 3 years refer to period 2013-2015 (present water use) and***
- ***Total demand and consumption by 2021***

One report (template) per country

Consumptive use:

Water abstracted which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, or consumed by man or livestock. Water losses due to leakages during the transport of water between the point or points of abstraction and the point or points of use are excluded. Definition source: Joint OECD/Eurostat questionnaire 2002 on the state of the environment, section on inland waters.

For missing data/information:

Please provide expert judgement, or insert NA (not available) if it is not possible to provide expert judgment at the country level.

Decimal and thousands separators:

All numbers should be written in Great Britain/United States style for great numbers, namely: 1,000,000,00.00, to avoid any misunderstanding

Language

All documents should be in English, if you consider that some national document(s) relevant for water quantity issues should be appended, please provide translation. The same apply for maps.

GIS Data

It is necessary to provide the GIS data (shape files) for maps development (water supply systems, irrigation, etc) in a following way:

- WSS (number of users and source) the symbols for different ranges will be provided in final version of the template
- Irrigation the symbols for different ranges will be provided in final version of the template
- Fish ponds the symbols for different ranges will be provided in final version of the template
- Reservoirs the symbols for different ranges will be provided in final version of the template

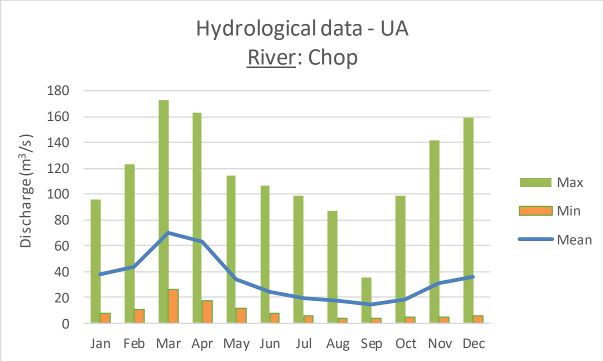
GIS data should be sent in the **WGS84/ETRS89** reference system or at least provide information about:

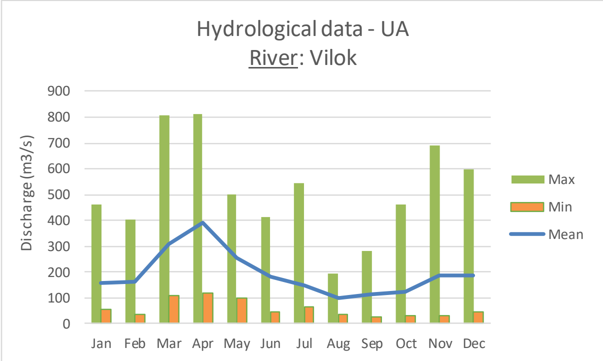
- Name of Reference System;
- Projection;
- Ellipsoid must be added.
- For point features provide position information in coordinates not in decimal notation (latitude and longitude).
- Please attach exported GIS maps (in digital formats such as .JPG or .TIFF).

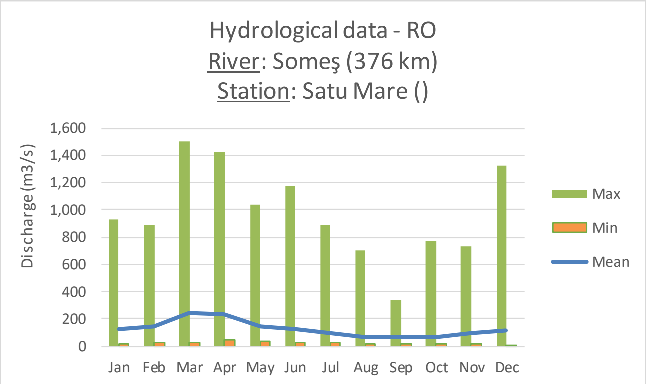
Chapter 2: TRB Water Resources – Surface Water: Discharge Data and Water Storage

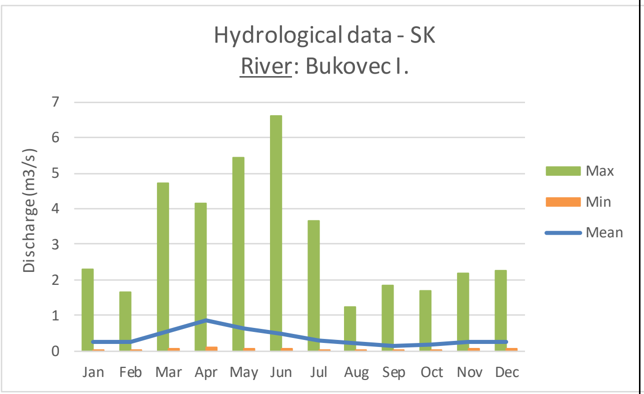
TRB Interannual Discharge data

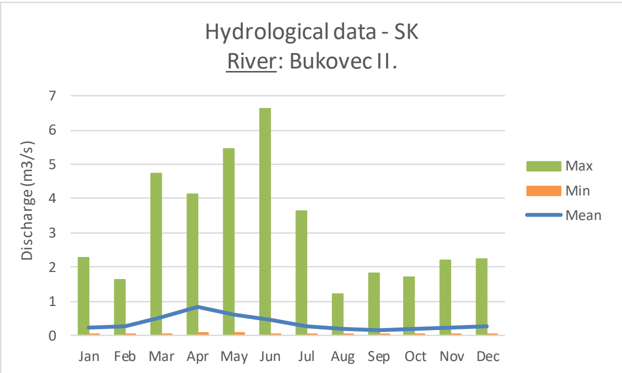
Figures bellow summarized interannual discharge data (mean, maximum and minimum values) based on data and information provided by Tisza countries.

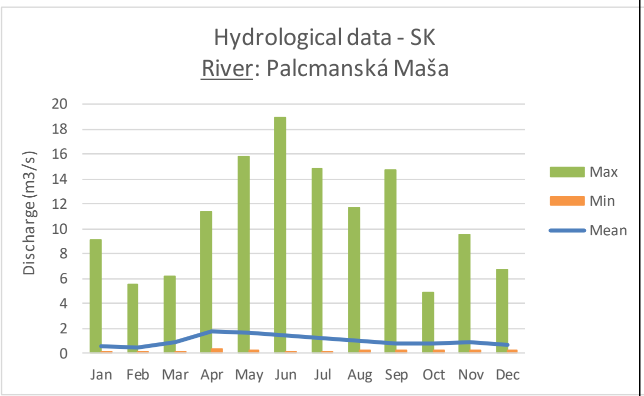

Hydrological data - UA
River: Chop
Discharge (m³/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

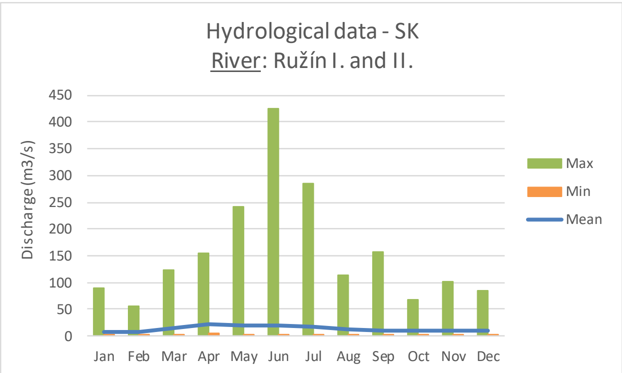

Hydrological data - UA
River: Vilok
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

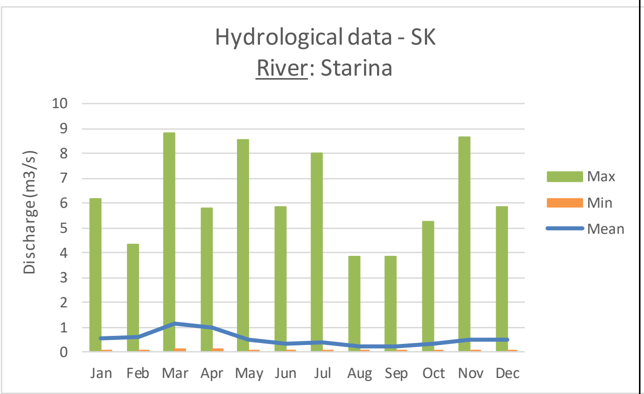

Hydrological data - RO
River: Someş (376 km)
Station: Satu Mare ()
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

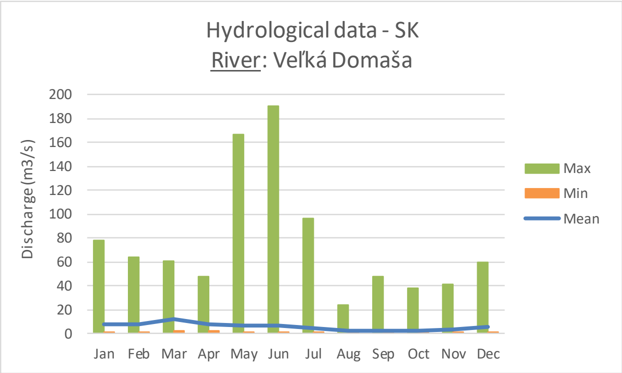

Hydrological data - SK
River: Bukovec I.
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

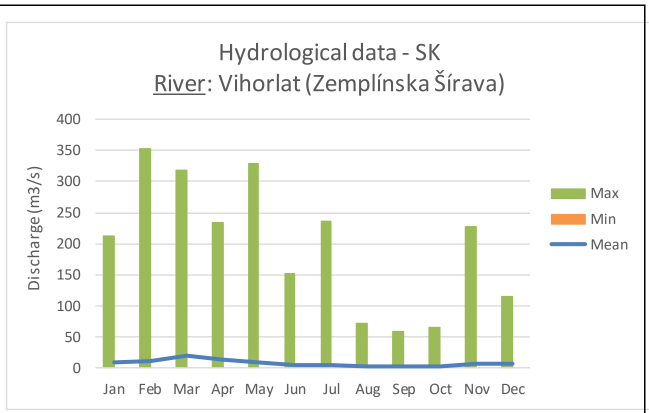

Hydrological data - SK
River: Bukovec II.
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

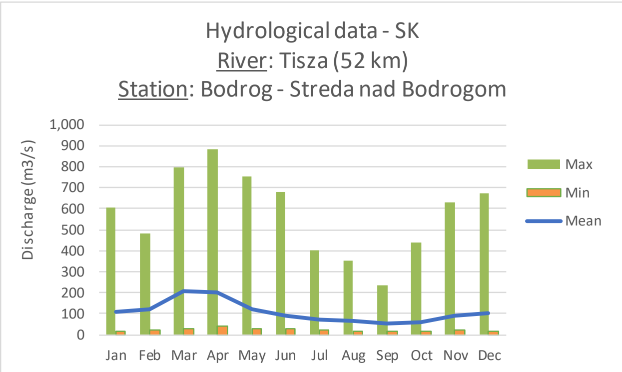

Hydrological data - SK
River: Palcmanská Maša
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

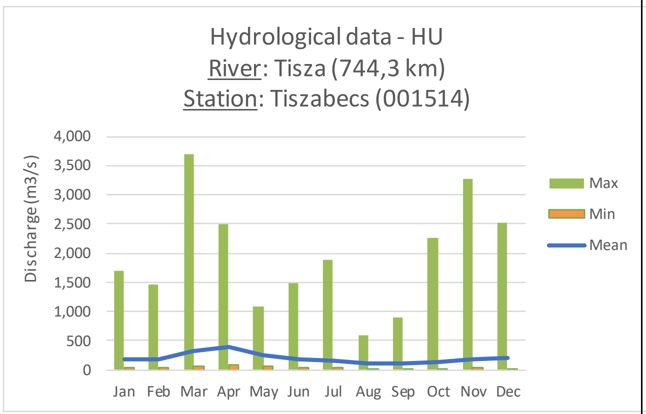

Hydrological data - SK
River: Ružín I. and II.
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

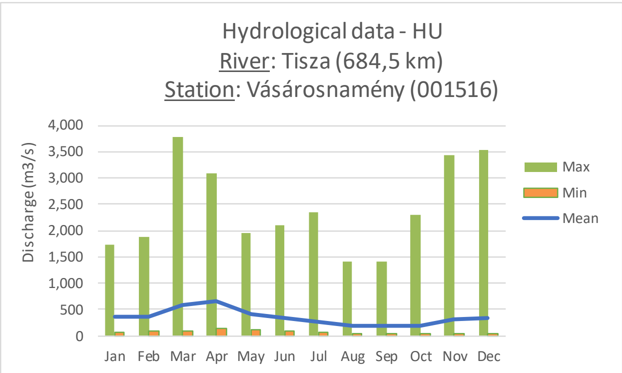

Hydrological data - SK
River: Starina
Discharge (m3/s)
Max
Min
Mean
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

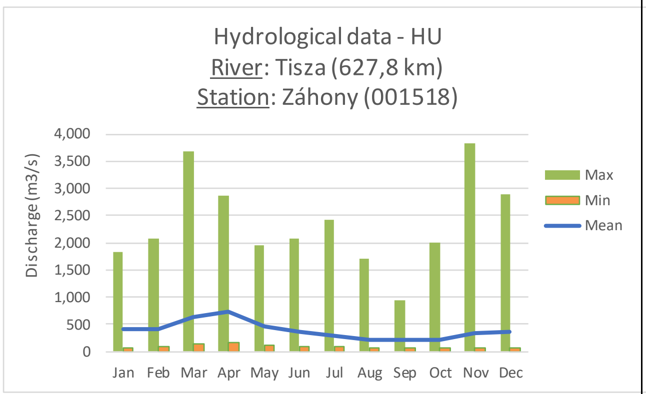

Hydrological data - SK
River: Veľká Domaša
Discharge (m3/s)
0 20 40 60 80 100 120 140 160 180 200
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

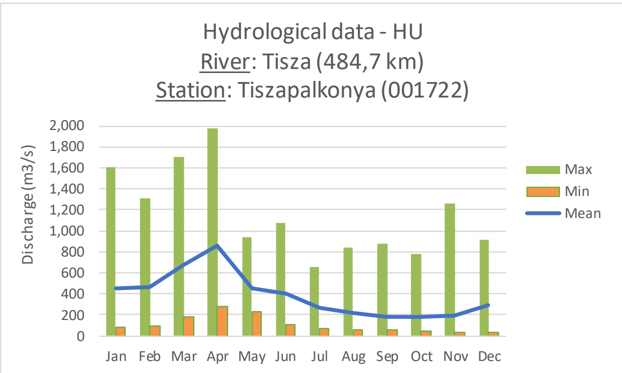

Hydrological data - SK
River: Vihorlat (Zemplínska Šírava)
Discharge (m3/s)
0 50 100 150 200 250 300 350 400
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

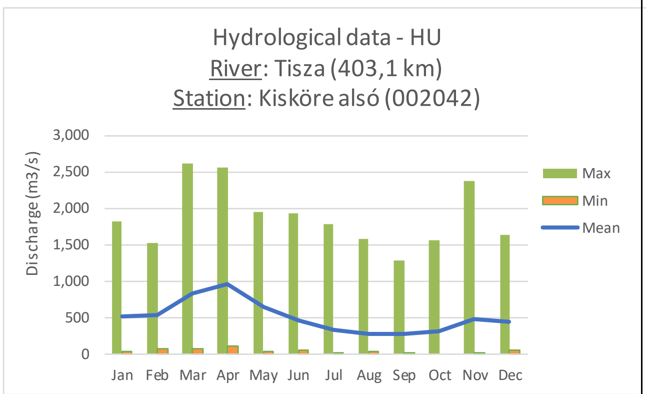

Hydrological data - SK
River: Tisza (52 km)
Station: Bodrog - Streda nad Bodrogom
Discharge (m3/s)
0 100 200 300 400 500 600 700 800 900 1,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

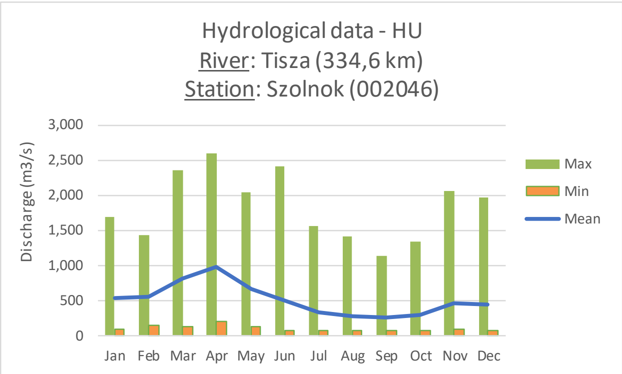

Hydrological data - HU
River: Tisza (744,3 km)
Station: Tiszabecs (001514)
Discharge (m3/s)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

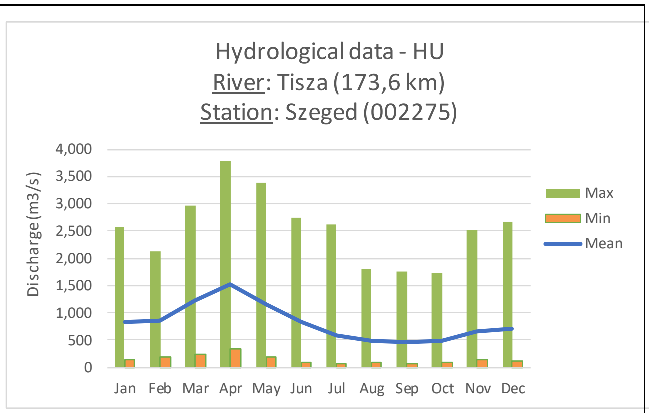

Hydrological data - HU
River: Tisza (684,5 km)
Station: Vásárosnamény (001516)
Discharge (m3/s)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

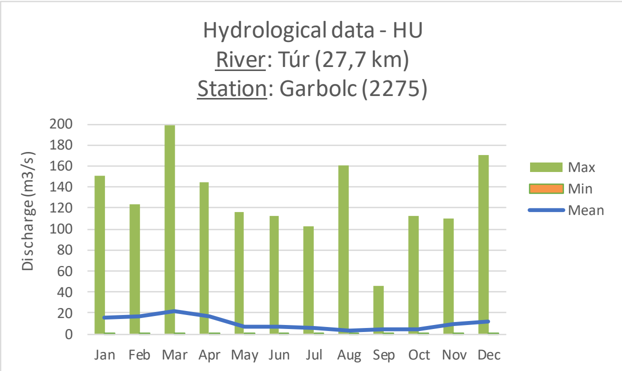

Hydrological data - HU
River: Tisza (627,8 km)
Station: Záhony (001518)
Discharge (m3/s)
0 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

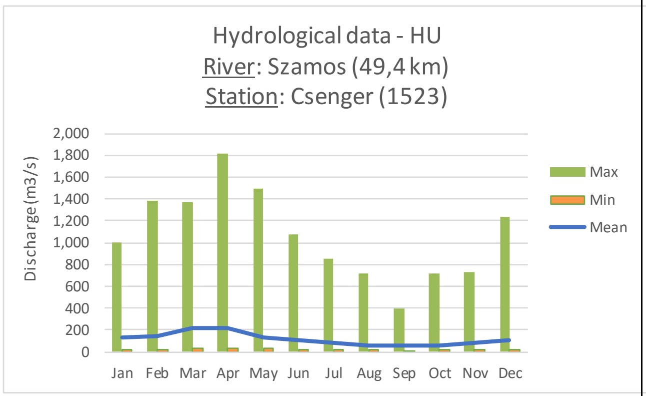

Hydrological data - HU
River: Tisza (484,7 km)
Station: Tiszapalkonya (001722)
Discharge (m3/s)
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

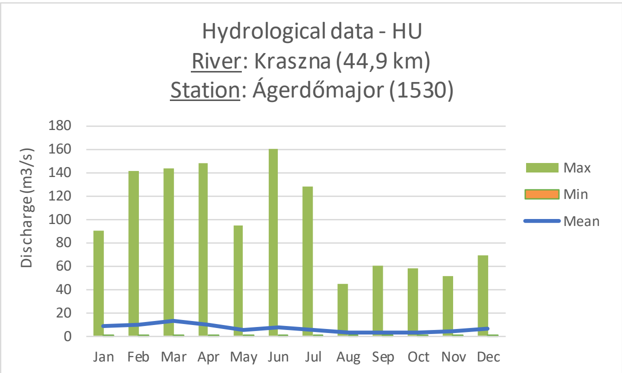

Hydrological data - HU
River: Tisza (403,1 km)
Station: Kisköre alsó (002042)
Discharge (m3/s)
0 500 1,000 1,500 2,000 2,500 3,000
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

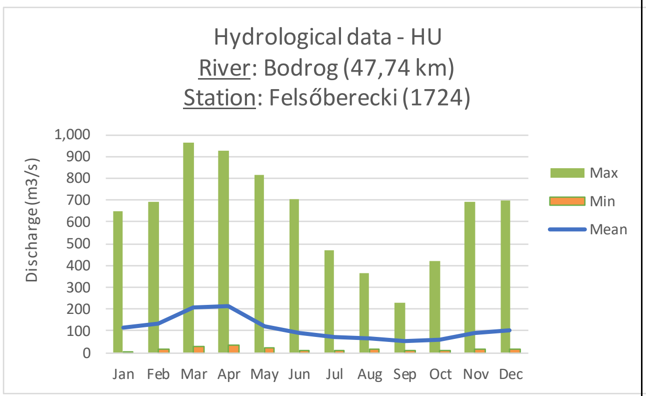

Hydrological data - HU
River: Tisza (334,6 km)
Station: Szolnok (002046)
Discharge (m3/s)
3,000
2,500
2,000
1,500
1,000
500
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

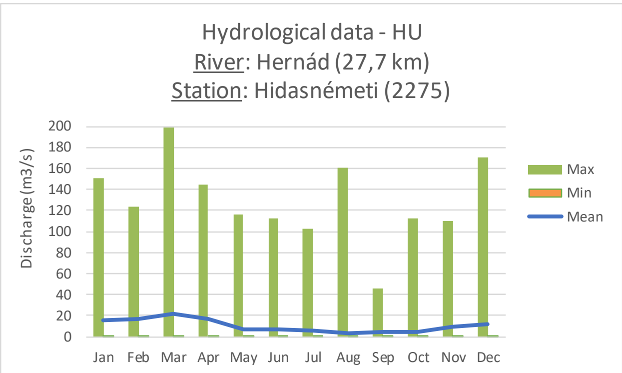

Hydrological data - HU
River: Tisza (173,6 km)
Station: Szeged (002275)
Discharge (m3/s)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

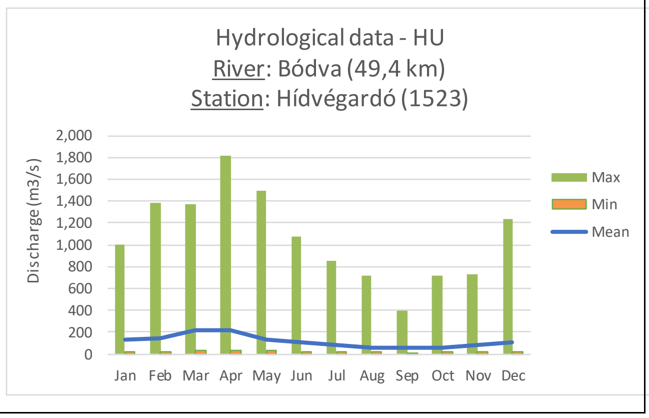

Hydrological data - HU
River: Túr (27,7 km)
Station: Garbolc (2275)
Discharge (m3/s)
200
180
160
140
120
100
80
60
40
20
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean


Hydrological data - HU
River: Szamos (49,4 km)
Station: Csenger (1523)
Discharge (m3/s)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean


Hydrological data - HU
River: Kraszna (44,9 km)
Station: Ágerdőmajor (1530)
Discharge (m3/s)
180
160
140
120
100
80
60
40
20
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean


Hydrological data - HU
River: Bodrog (47,74 km)
Station: Felsőberecki (1724)
Discharge (m3/s)
1,000
900
800
700
600
500
400
300
200
100
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean


Hydrological data - HU
River: Hernád (27,7 km)
Station: Hidasnémeti (2275)
Discharge (m3/s)
200
180
160
140
120
100
80
60
40
20
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean


Hydrological data - HU
River: Bódva (49,4 km)
Station: Hídvégardó (1523)
Discharge (m3/s)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Max
Min
Mean

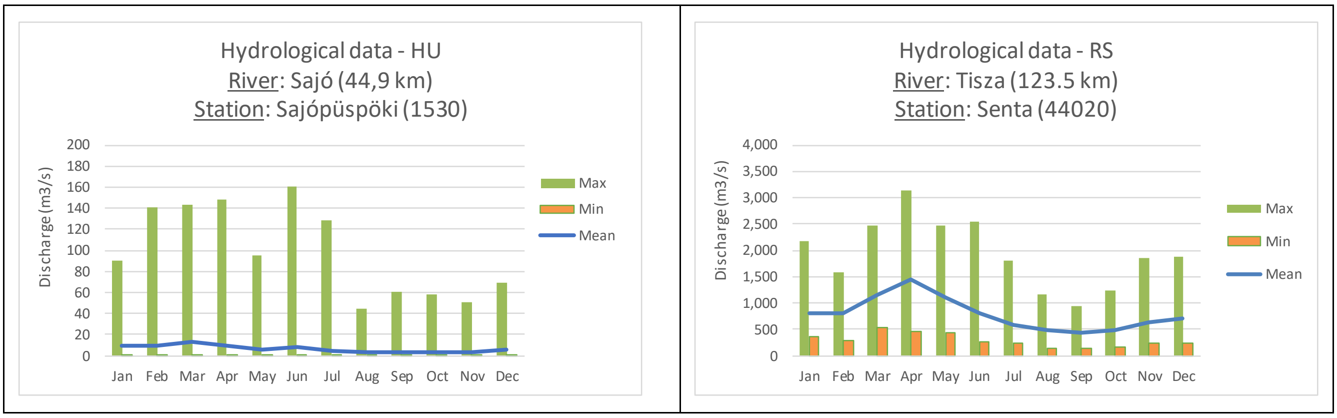


Figure II.1: TRB interannual discharge data figures

Detailed interannual data tables are presented in Annexes 5 and 6 of this report.

Annual TRB minimum , mean and max annual discharges data sets for hydrological stations depicted in Figure II. 2 are included in Annex 1.

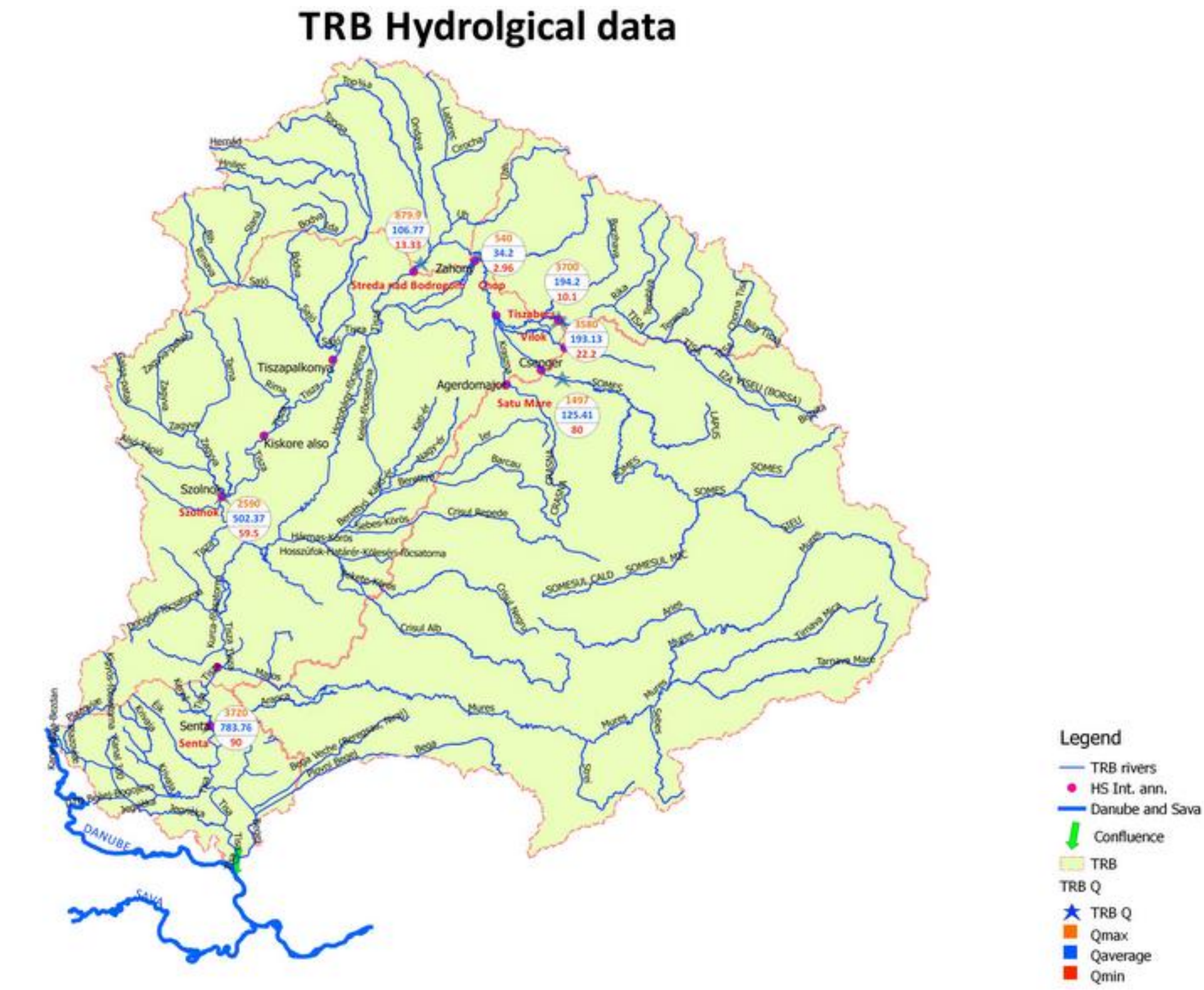


Figure II.2: Spatial distribution of TRB hydrological stations reported by Tisza countries for annual discharges

TRB water storage – reservoirs data and information

Total number of reservoirs within the TRB is 125 scattered over the basin. The greatest number is located in Romania 77, followed by 23 in Hungarian share of TRB, 9 in Ukraine and Serbia and 7 in Slovakia.
With respect to volume there are 91 reservoirs with water storage ≤ 10 million cubic meters (Mm^3) with total volume of 241.57 Mm^3. The Table II.1 and Figure II.1 outline synthesis with respect to this volume. The full list of all reservoirs with volume ≤ 10 Mm^3 is included in the Annex 3 .

Table II.1: Outline of TRB reservoirs with volume ≤ 10 Mm^3 per Country

Tisza Countries	UA	RO	SK	HU	RS
Number of reservoirs	9	48	1	24	9
Percentage of reservoirs per country	10.0	53.33	1.11	26.67	9.89
Volume per country Mm3	17.703	132.465	2.19	72.665	23.45

As presented in Figure II.3 45 (approximately 50 %) reservoirs with volume ≤ 10 Mm^3 are multipurpose.

With respect to reservoirs with single purpose, all 26 reservoirs that serve only for flood protection are located in Romanian share of TRB, and 2 with flood retention purpose only are in Hungary. Nine reservoirs for irrigation are within Serbian share of TRB and 1 is in Hungary. Reservoirs for hydropower generation are located in Romania (5), and those for WS are located in Romania and Hungary, 1 and 2, respectively.

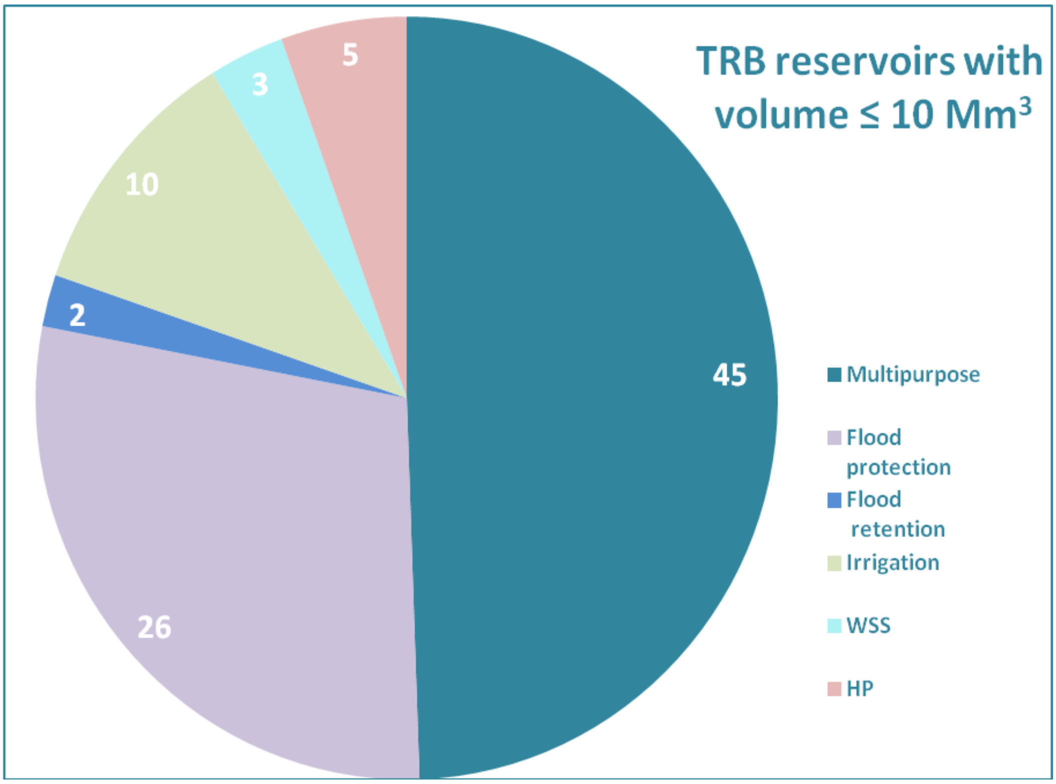


Figure II.3: Number of reservoirs with volume ≤ 10 Mm^3 within the TRB

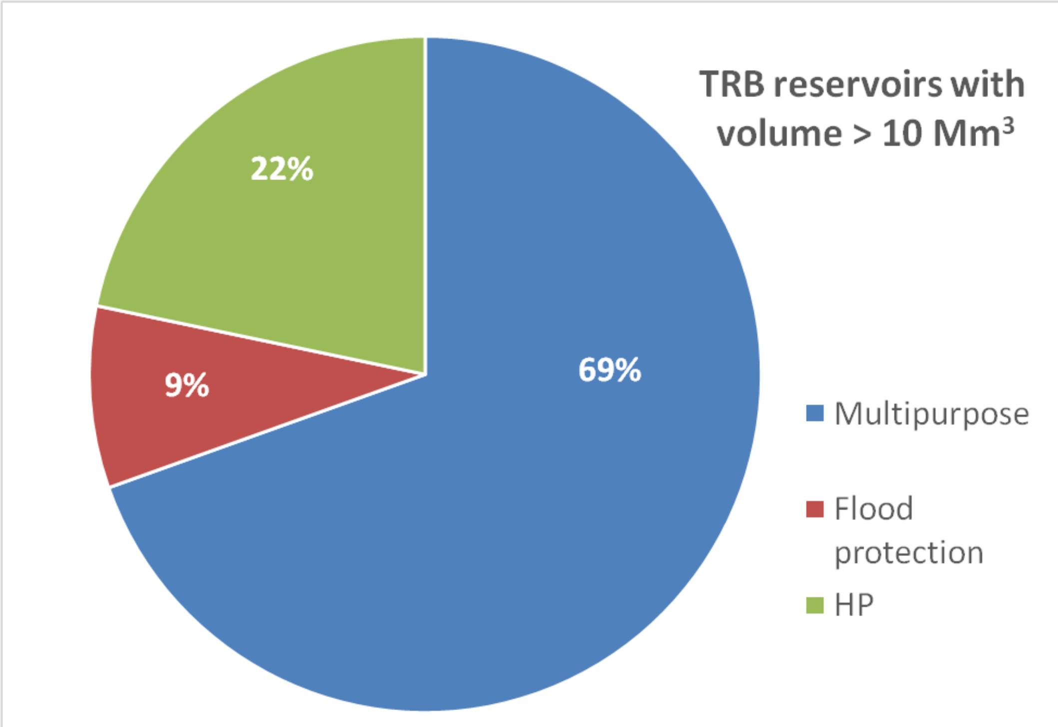


Figure II.4: Percentage of reservoirs with volume > 10 Mm³ within the TRB

Remarks regarding the reservoirs provide by Ukraine are following:

- All water reservoirs in Tisza basin (Ukraine) were built in 1950-1960s and are very silted (silting covers around 30-40%)
- Volume and area of water reservoir are mentioned for operational regime (normal banked-up water level).
- Water reservoirs “Gorbok”, “Zaluzh”, “Mochilo” and “Fornosh” belong to one irrigation system “Chorny Mochar”.
- All water reservoirs in Tisza basin have complex use, except Tereblya-Rikska HPP, which is used only for hydropower.
- Water reservoir of Tereblya-Rikska HPP belong to sub-basins of two rivers: Tereblya (water in-take) and Rika (discharge from water reservoir).

Figures II.5 and II.6 depict spatial distribution of TRB reservoirs with respect to volume and purpose, respectively and TRB reservoirs comprehensive tables are included in the in Annex 4 of this report.

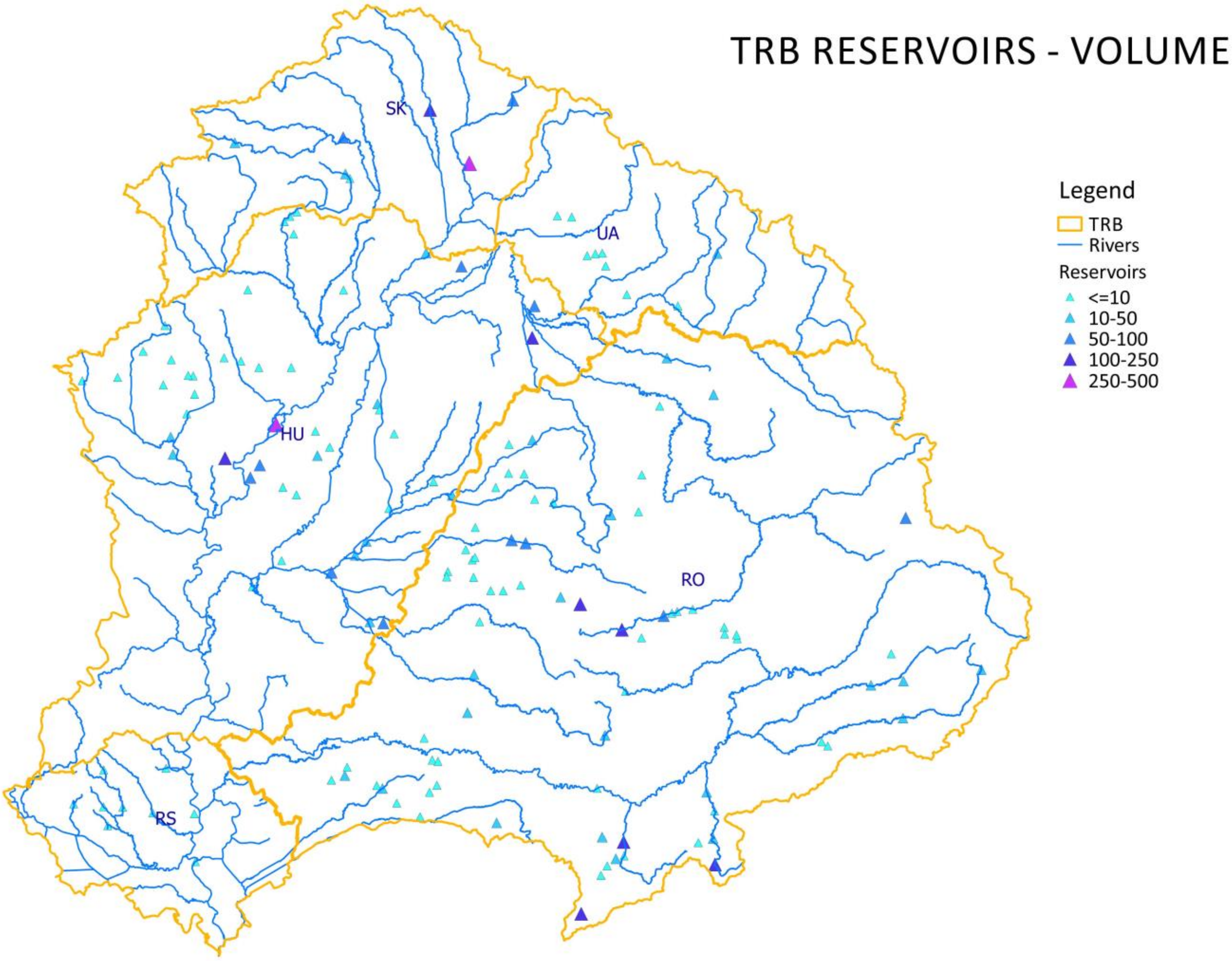


Figure II.5: TRB reservoirs spatial distribution with respect to volume

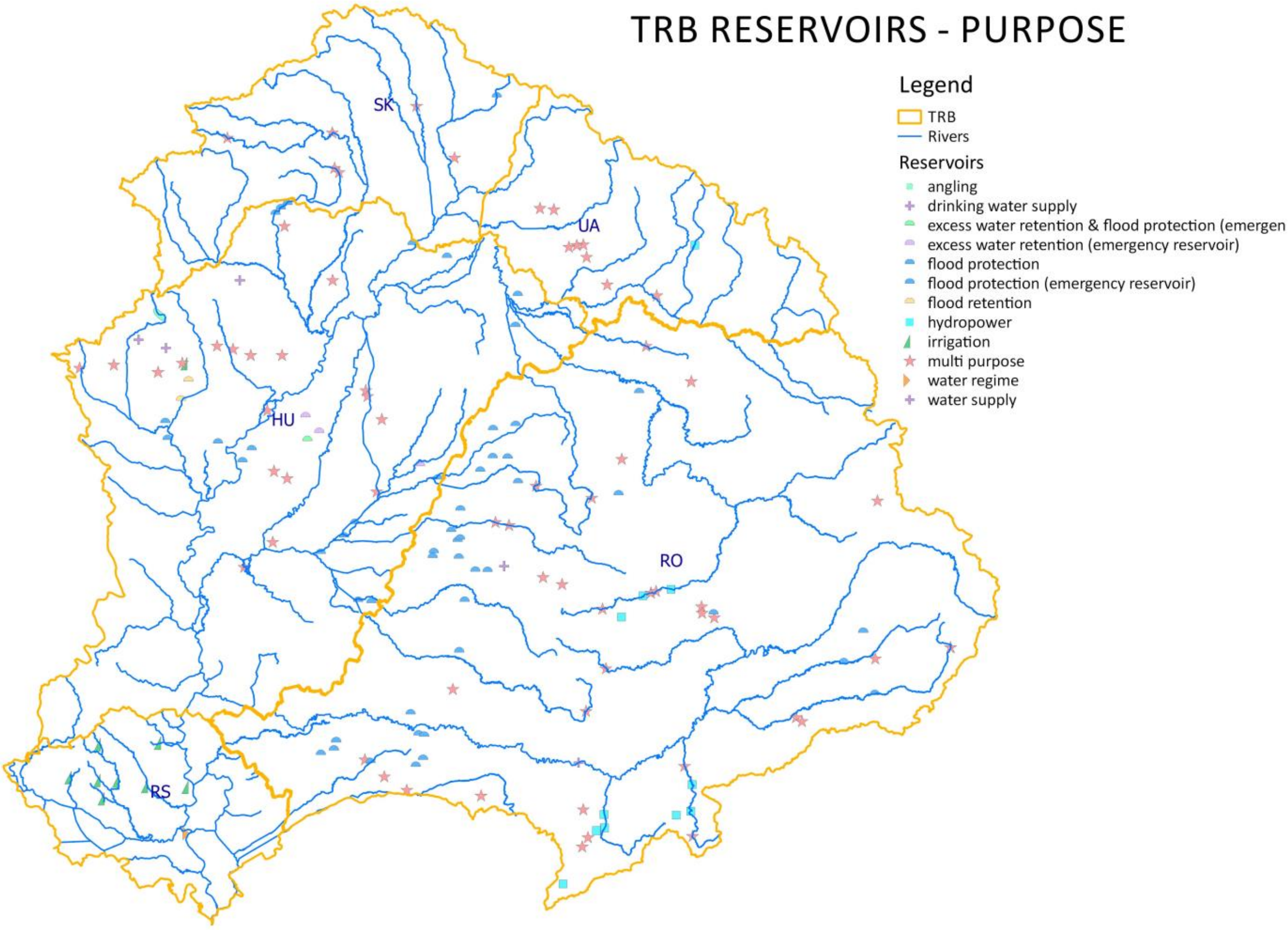


Figure II.6: TRB reservoirs spatial distribution with respect to purpose

Chapter 3 – TRB water use and demand: Irrigation

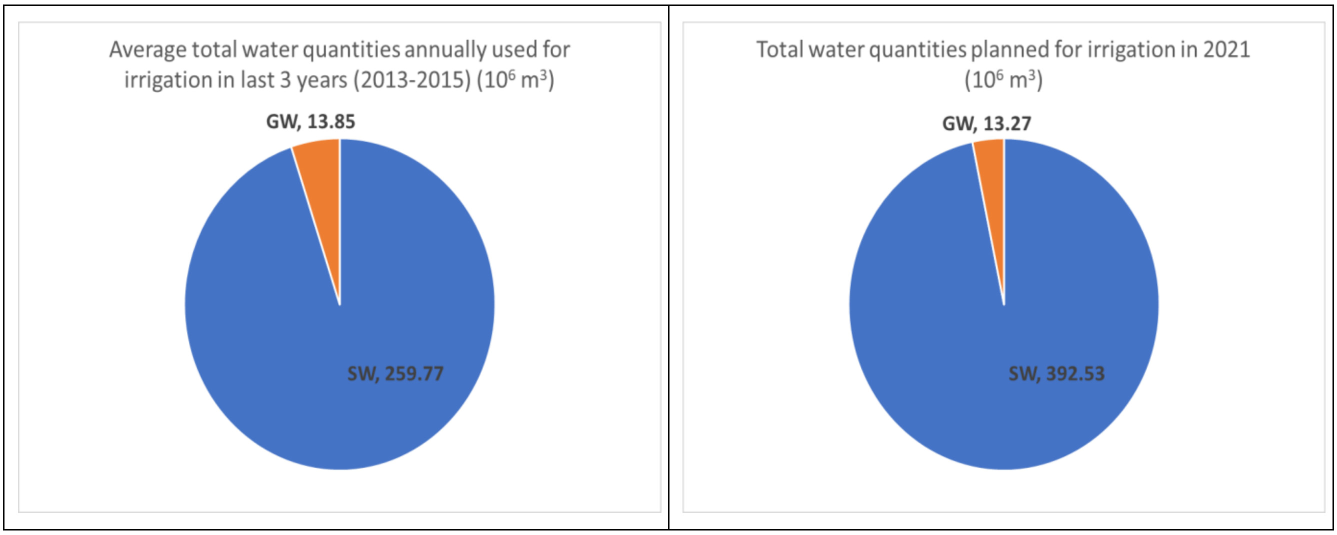


Figure III.1: TRB water source for water use and demand – Irrigation

Table III.1: TRB water use and demand – irrigation summary table

JOINTISZA - IRRIGATION	UA	RO	SK	HU	RS	Summary
Average areas annually irrigated in last 3 years (ha)	600	1353.33	66.33	94006	40000	136025.66
Average total water quantities annually used for irrigation in last 3 years (10^6 m^3)	0.10**	8.41	0.09	192	73.02	273.62
Planned areas for irrigation in 2021 (ha)	1200	2723	15086	120000	100000	239009
Total water quantities planned for irrigation in 2021 (10^6 m^3)	0.3	5.5	6	234	160	405.8

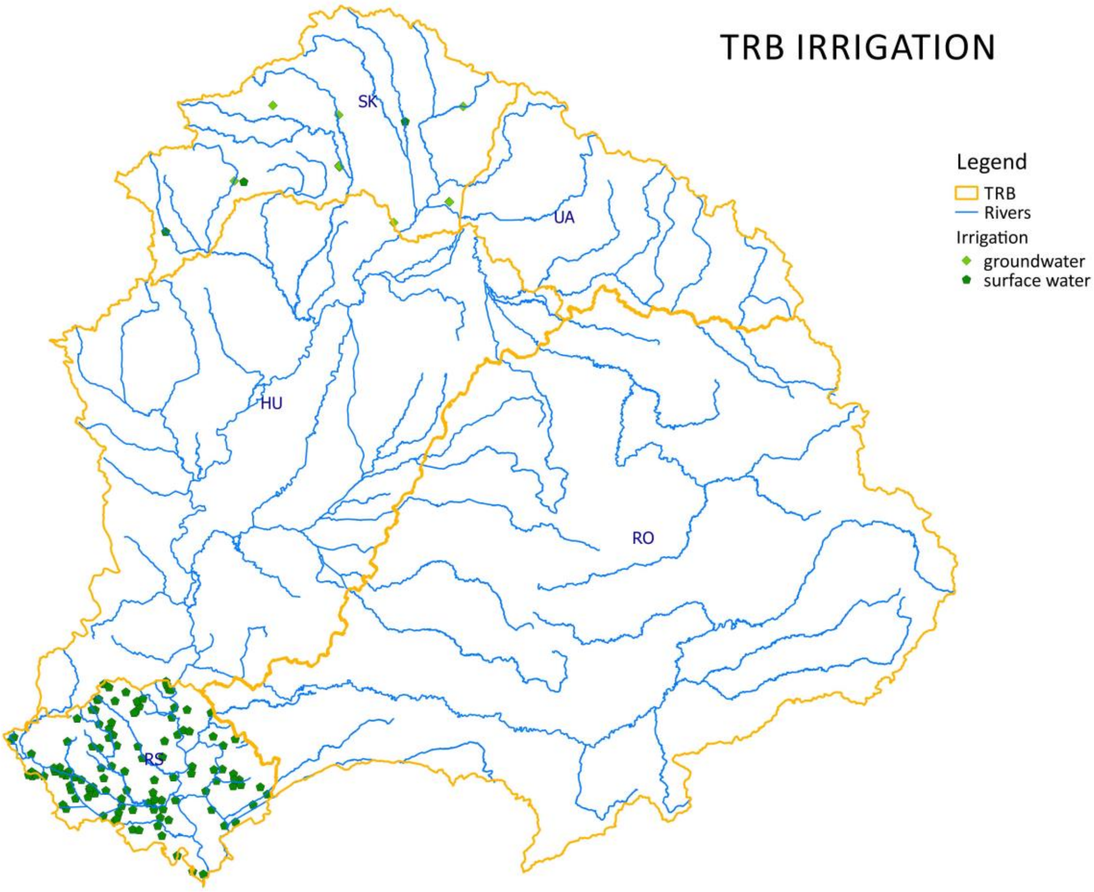
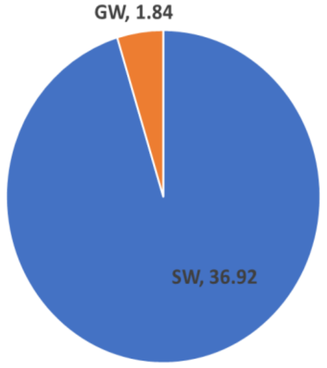


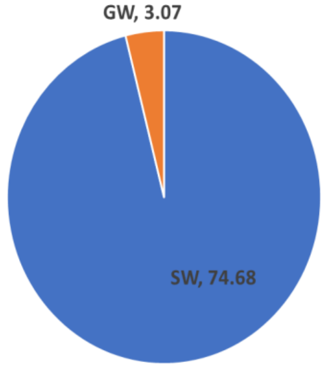
Figure III.3: TRB water source spatial distribution – Irrigation

Chapter 4 – TRB water use and demand: Other agricultural use (livestock farms, fish production, etc.)

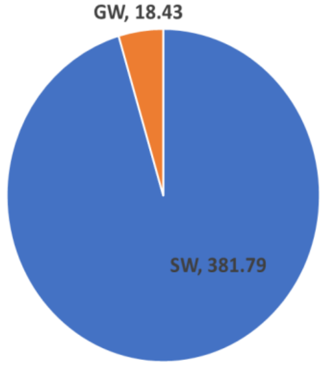
Average total water quantities annually used for livestock farms in last 3 years (2013-2015) (10^6 m^3)



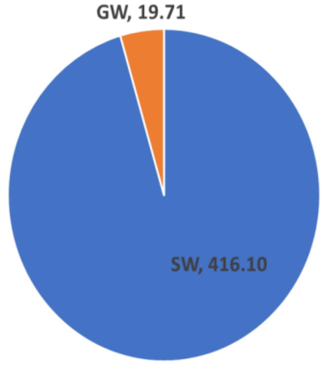
Planned water quantities for livestock farms in 2021 (10^6 m^3)



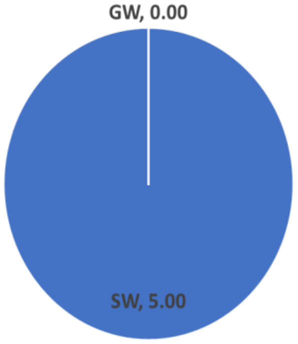
Average water quantities annually used for fish production for last 3 years (2013-2015) (10^6 m^3)



Planned water quantities for fish production in 2021 (10^6 m^3)



Average water quantities annually used for other agricultural uses for last 3 years (2013-2015) (10^6 m^3)



Planned water quantities annually for other agricultural uses in 2021 (10^6 m^3) – list here type of other uses (...)

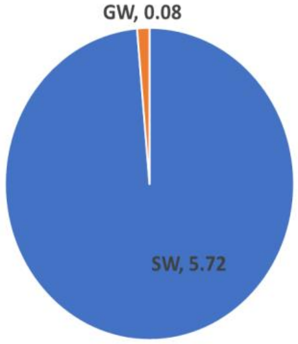


Table IV.1: TRB water use and demand – other agricultural use summary table

JOINTISZA	UA	RO	SK	HU	RS	Summary
Average water quantities annually used for livestock farms for last 3 years (10^6 m^3)	0.9	3.63	1.23	13	20	38.76
Average water quantities annually used for fish production for last 3 years (10^6 m^3)	9.8	153.78	0.89	165	70.75	400.22
Average water quantities annually used for other agricultural uses for last 3 years (10^6 m^3)	-	NA	NA	-	5	5
Planned water quantities for livestock farms in 2021 (10^6 m^3)	0.5	36.02	1.23	15	25	77.75
Planned water quantities for fish production in 2021 (10^6 m^3)	10	169.92	0.89	175	80	435.81
Planned water quantities annually for other agricultural uses in 2021 (10^6 m^3)	0.8	NA	NA	-	5	5.8

Chapter 5 – TRB water use and demand: Public water supply

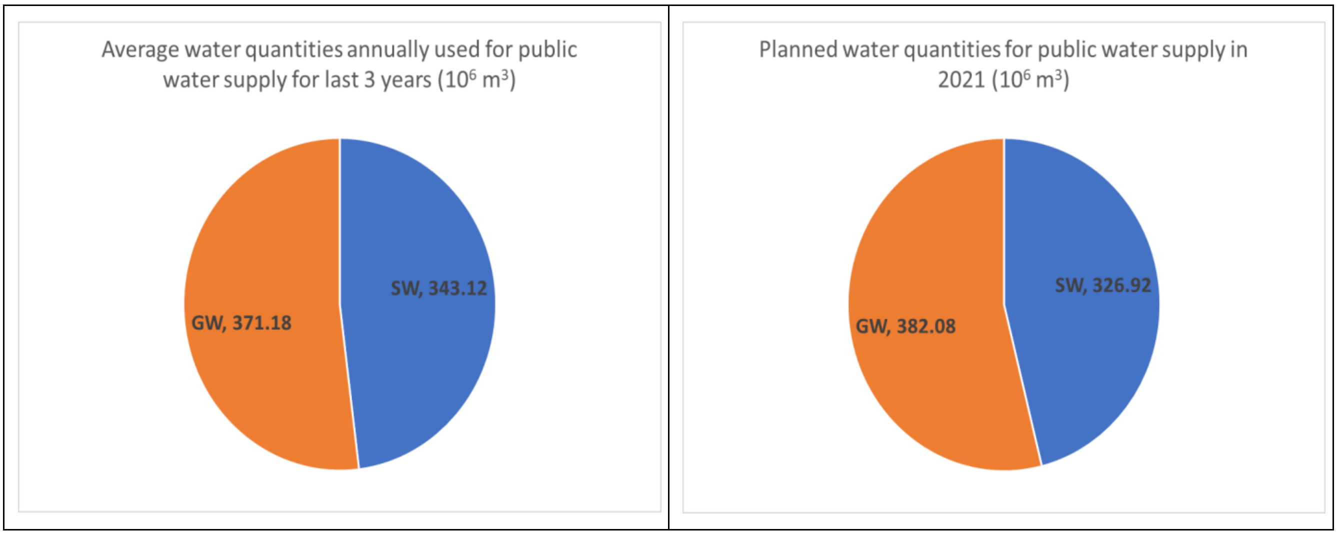


Figure V.1: TRB water source for water use and demand – public water supply

Table V.1: TRB water use and demand – public water supply summary table

JOINTISZA	UA	RO	SK	HU	RS	Summary
Total capacity of public water supply systems (m^3/s)	**0.7**	**93.78**	**5.5**	**9**	**1.7**	**110.68**
Average water quantities annually used for public water supply for last 3 years (10^6 m^3)	**22.1**	**362.91**	**58.97**	**218**	**52.32**	**714.3**
Planned capacity of public water supply systems in 2021 (m^3/s)	**0.5**	**NA**	**5.5**	**9.1**	**1.8**	**16.9**
Planned water quantities for public water supply in 2021 (10^6 m^3)	**17**	**347**	**60**	**225**	**60**	**709**

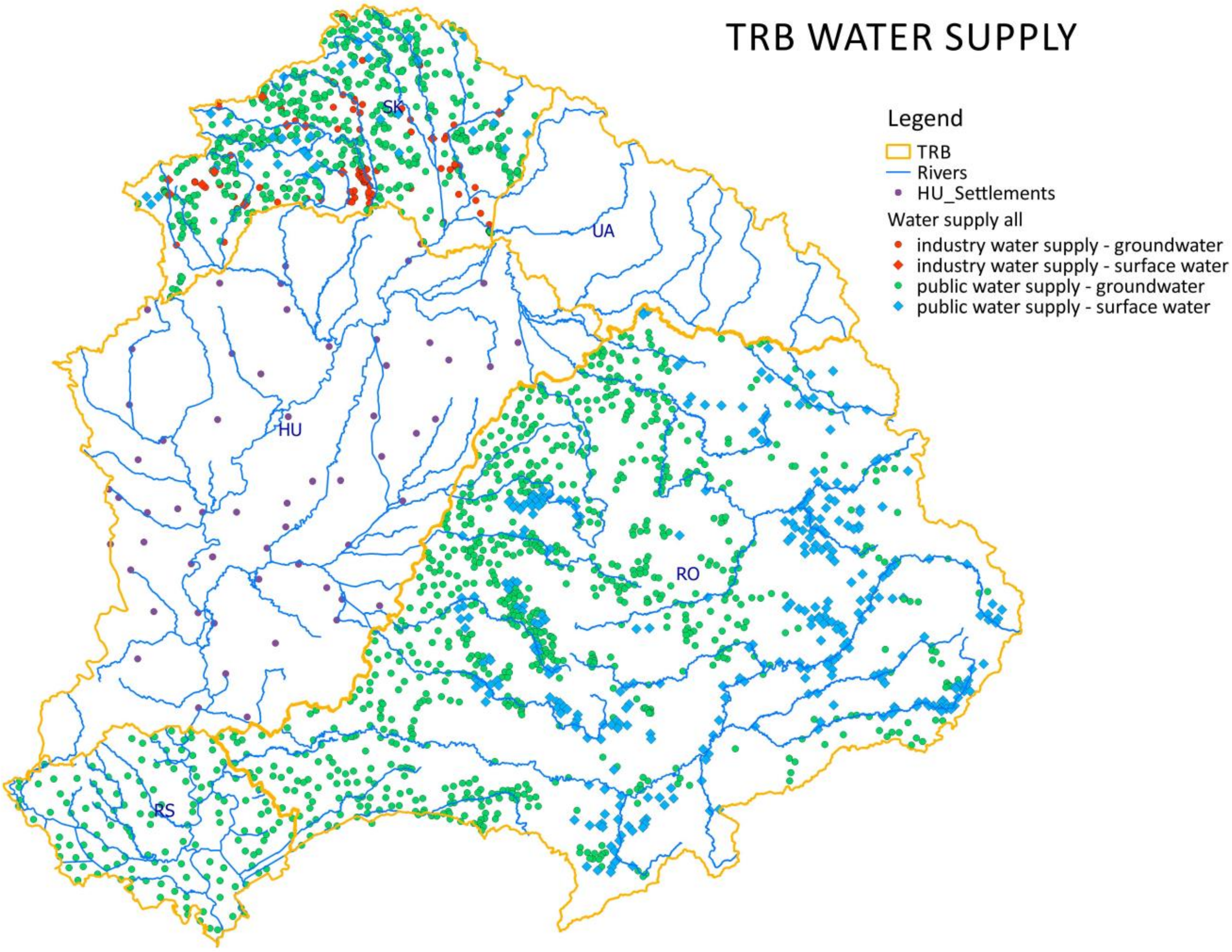


Figure V.2: TRB water source spatial distribution– public water supply

Chapter 6 - TRB water use and demand: Water supply of industry - including thermal power plant cooling

Water supply for industry

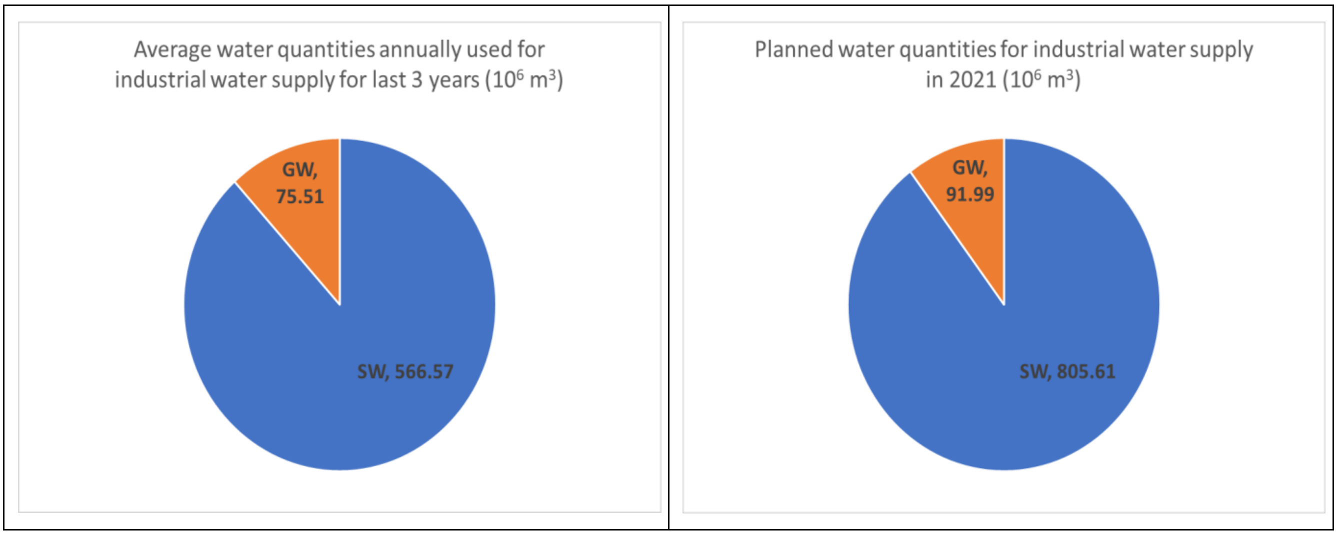


Figure VI.1: TRB water source for water use and demand – industrial water supply

Table V.1: TRB water use and demand – industrial summary table

JOINTISZA	UA	RO	SK	HU	RS	Summary
Total capacity of industrial water supply systems (m^3/s)	0.03	NA	21.3	6.5	2.96	30.79
Average water quantities annually used for industrial water supply for last 3 years (10^6 m^3)	1.1	505.92	39.41	86.3	9.35	642.08
Planned capacity of industrial water supply systems in 2021 (m^3/s)	0.03	NA	21.3	6.5	3.2	31.03
Planned water quantities for industrial water supply in 2021 (10^6 m^3)	1.1	756	40	90	10.5	897.6

Chapter 7 - TRB water use and demand: Hydropower

See Annex 2 and Annex 3

Chapter 8 - TRB water use and demand: Navigation

UKRAINE

Present period

No navigation in Ukrainian part of Tisza, it is planned from Vilok to Zagony.

Romania

Present period

The main discharge on Bega Channel (approximately 4-5 m^3/s) covers the water demand of all water uses including the navigation.

By the 2021

NA

Hungary

Present period

There is no information available on minimum discharges as condition of navigability in Hungary. Along impounded river reaches of the Tisza the minimum flow of 40 m^3/s might make navigation possible, while on not impounded reaches waterway parameters vary greatly depending on actual, local riverbed and depth/discharge conditions.

The following river sections of Tisza and its tributaries are fulfilling international navigability conditions:

- *Tisza in Hungary* is navigable from the Serbian border up till Csongrád (160-254 river km, impounded by the Novi Bečej dam) as a Class IV waterway.
  From Csongrád to Kisköre (254-403 rkm, not impounded) only Class II navigability conditions are fulfilled. From Kisköre to Tuzsér (403-612 rkm, impounded by the Kisköre and Tiszalök dams) it is Class III again, and finally from Tuzsér to Vásárosnamény (612-685 rkm, not impounded) the Tisza is a Class I waterway.
- *Bodrog* is navigable up till Sárospatak (0-39 rkm) as Class III.
- *Hármas-Körös* is navigable between the mouth and Mezőtúr (0-91 rkm) and its upper section, Kettős-Körös from Mezőtúr until Békés (0-23 rkm), both as Class II. Sebes-Körös is also Class II from the mouth till Körösladány (0-10 rkm).

By the 2021

No development is planned.

Serbia

- Tisza river, upstream of Novi Bečej dam (with ship lock), belongs to the 4th class of navigable waterways and downstream to the 6th class (over 2,500 tons);
- The Tisza navigation regime is not based on certain flows, but at the water levels upstream and downstream of the Novi Bečej dam.

- The Upper Water level varies from 74.50 to 75.50 above Adriatic see in normal water regime mode during the year, while during ice and ice flood defense the level is lowered down to 73.50 m.
- Navigation for to vessels of up to 1,500 tons is possible to the whole of the Tisa River through Serbia, but downstream is possible for vessels of higher tonnage.
- During Flood defence upstream and downstream levels depends on flood criteria, related with status and measures downstream and upstream from Novi Bečej dam, but maximum upstream level cannot be higher than 76.00 above Adriatic see (in that case, downstream level can be higher than 75,50);
- The whole Danube Tisza-Danube hydro system channel network is based on water levels, so water catchment and discharge depends on required water levels on specific share of channel network;
- Each of the channel network shares and channels has unique restriction and roles regarding to vessel dimensions (width, depth, weight, etc).; and
- More of the other channel network shares belong to the 4th class of internal waterways (two way navigation for vessels 1,000-1,500 tons vessels). Other channels has sufficient width, but insufficient navigation depth, so they belongs to the 3rd of 2nd navigation class (one way or two way 500-1,000 tons).

By the 2021

There are no planed changes in comparison to present use.

Chapter 9 - TRB water use and demand: Hydrological requirement for good water status

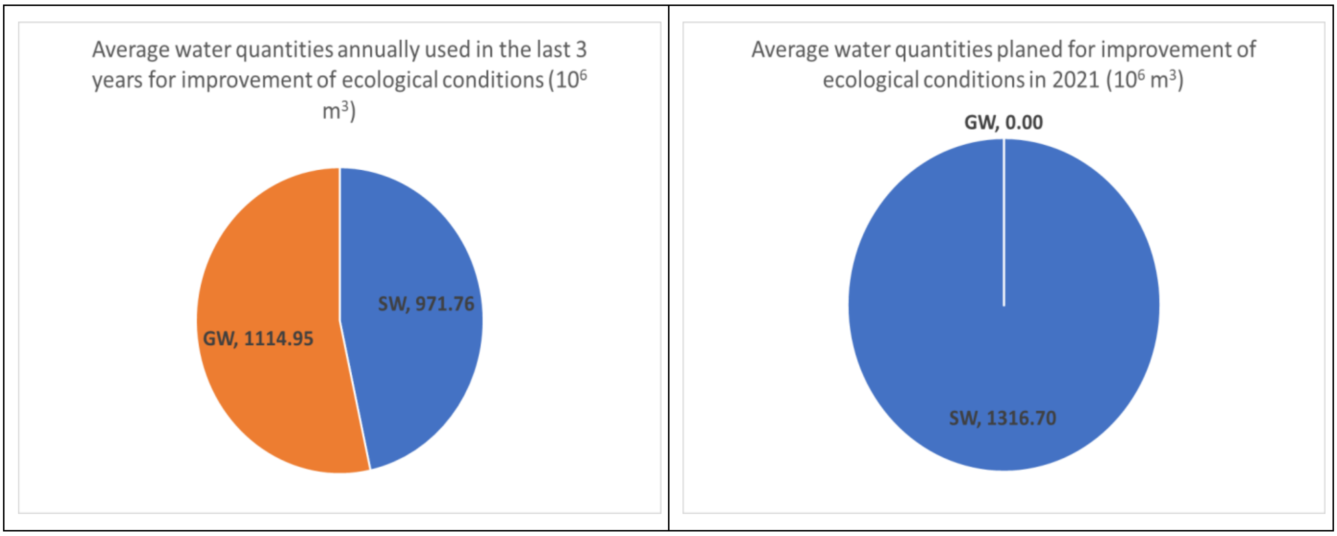
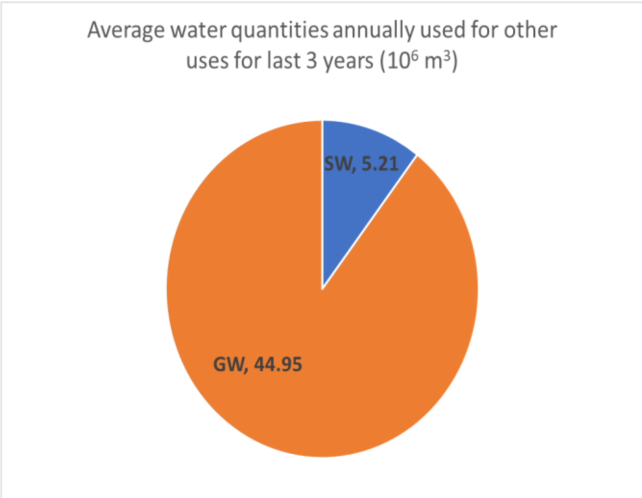


Figure IX.1: TRB water source for water use and demand – hydrological requirement for good water status

Table IX.1: TRB water use and demand – hydrological requirement for good water status summary table

JOINTISZA	UA	RO	SK	HU	RS	Summary
Average water quantities annually used in the last 3 years for improvement of ecological conditions (10^6 m^3)	*	498.26	1321.03	15.3	252.12	2086.71
Average water quantities planed for improvement of ecological conditions in 2021 (10^6 m^3)		998.7	NA	18	300	1316.7

Chapter 10 - TRB water use and demand: Other uses and improvement of ecological conditions



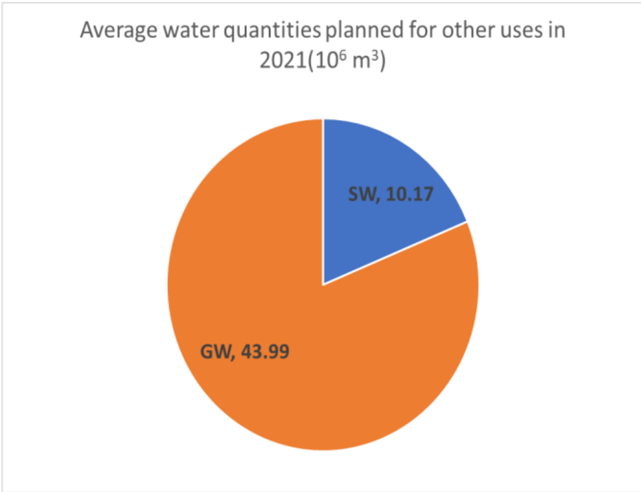


Figure X.1: TRB water source for water use and demand – hydrological requirement for other uses

Table X.1: TRB water use and demand – other uses summary table

JOINTISZA	UA	RO	SK	HU	RS	Summary
Average water quantities annually used for improvement of ecological conditions for last 3 years (10^6 m^3)	1.4	NA	0.16	48.6	0	50.16
Average water quantities annually used for improvement of ecological conditions in 2021 (10^6 m^3)	2	NA	0.16	47	5	54.16

Chapter 11 - TRB water use and demand: Preservation of hydraulic regimes and ecological conditions in canal network

Table XI.1: TRB water use – preservation of hydraulic regimes and ecological conditions in canal network

MONTH	COUNTRY/ Location/*other*				
	UA	HU		RS	
	Channel Verke	Keleti-főcsatorna, intake from Tisza	Nagykunsági-főcsatorna, intake from Tisza at Abádszalók	PS Bezdan	Slu. Bezdan
	-	*48.022963 21.321919*	*47.475547 20.561640*	*45.3074934 18.3124176*	*45.306111 18.3087486*
	$10^6 m^3$				
I	0	21.4	0	0	0
II	0	21.4	0	0	0
III	0	21.4	8	0	0
IV	0	12.9	12.3	4	4
V	3.8	12.9	12.3	4	6.3
VI	3.8	12.9	12.3	8	23.5
VII	3.8	12.9	12.3	12	39.8
VIII	3.8	12.9	12.3	8	43.8
IX	3.8	12.9	12.3	8	43.8
X	3.8	24.1	12.3	4	27.1
XI	-	24.1	2.7	0	15.8
XII	-	24.1	2.7	0	0
TOTAL	22.8*	213.7	99.6	48	204.1

* Only 1,5 m^3 / sec is provided from Borzhava to Verke
(more is not possible because of the channel overgrowing).

Table XI.2: TRB water demand (2021) – preservation of hydraulic regimes and ecological conditions in canal network

MONTH	COUNTRY/ Location/*other*				
	UA	HU		RS	
	Channel Verke	Keleti-főcsatorna, intake from Tisza	Nagykunsági-főcsatorna, intake from Tisza at Abádszalók	PS Bezdan	Slu. Bezdan
	-	*48.022963 21.321919*	*47.475547 20.561640*	*45.3074934 18.3124176*	*45.306111 18.3087486*
	$10^6 m^3$				
I	0	21.4	0	0	0
II	0	21.4	0	0	0
III	0	21.4	8	0	0
IV	0	12.9	12.3	4	4
V	7.6	12.9	12.3	4	6.3
VI	7.6	12.9	12.3	16	28
VII	7.6	12.9	12.3	20	45
VIII	7.6	12.9	12.3	20	45
IX	7.6	12.9	12.3	16	45
X	7.6	24.1	12.3	4	27.1
XI	-	24.1	2.7	0	15.6
XII	-	24.1	2.7	0	0
TOTAL	45.6 *	213.7	99.6	84	216

* Channel Verke will be partly cleaned and water supply from Borzhava will increase up to 3 m / sec. The water supply should be conducted only during May-November (in other months it is prohibited because of fish spawning in Borzhava).

Chapter 12 – Other Projects & Studies Relevant for Water Quantity Issues (Country Specific)

As presented during the JOINTISZA project meetings, following projects and studies are relevant for water quantity issues:

- ICPDR Tisza EG studies and projects;
- EU JRC water- food- energy – environment nexus;
  (how to get data from them? ICPDR? LP?);
- ICPDR strategy on adaptation to climate change (2012, 2018);
- *CARPATCLIM* - Climate of the Carpathian Region, the regional project financed by the Joint Research Center of the European Commission – JRC;
- *CCWaterS* – Climate *Change and Impacts on Wat*er Supply, the transboundary project funded by European Regional Development Fund (ERDF) and IPA;
- *WATCAP* - Water and Climate Adaptation Plan for the Sava River Basin funded by World Bank;
- *CC-WARE* - Integrated transnational strategy for water protection and mitigating water resources vulnerability, the transboundary project funded by European Regional Development Fund (ERDF) and IPA;
- *ClimWatAdapt* - Climate Adaptation–modeling water scenarios and sectoral impacts, funded by the European Commission - DG Environment;
- *SEERISK* -Joint Disaster Management Risk Assessment and Preparedness in the Danube macro-region;
- *OrientGate* A network for the integration of climate knowledge into policy and planning;
- *PROMITHEAS-4K* - knowledge transfer and research needs for preparing mitigation/adaptation policy portfolios;
- South East European Forum on Climate Change Adaptation - SEE Forum on CCA *(CCAFORUM);*
- Weather extremes and climate change in Serbia financed by the Ministry of Education, Science and Technological Development;
- Studying climate change and its influence on the environment: impacts, adaptation and mitigation (CLENIAM - III43007), funded by the Ministry of Education and Science of the Republic of Serbia;
- Impact of a changing climate, land use, and water usage on water resources in the Danube river basin (2018), Bisselink et al., JRC technical reports, EC JRC
- Other (TBD during project implementation).

Romania country specific projects

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

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

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

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

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

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

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

The methodology used was applied to 8 river basins in Romania: Crişul Repede, Crişul Negru, Crişul Alb, Mureş, Jiu, Olt, Ialomiţa and Siret, the surface of which represents 53.0 % of the Romanian territory. Four river basins (Crişul Repede, Crişul Negru, Crişul Alb and Mureş) are located with the RO part of the TRB.

Discharge series, with a 6 hours' time step, resulting from the two long-term simulations, were analyzed comparatively in order to identifying the changes in the maximum monthly, maximum multiannual and maximum with different probabilities of exceeding, as well as the distribution of annual maximum discharges over the year. Another research study mentioned in the Action Plan of National Climate Change Strategy and performed with the National Institute of Hydrology and Water Management is "Identification for national main potential of water scarcity areas in the current regime and the perspective of climate change". Some details are presented in Romanian Country report on measures: Chapter 5 – Drought and water scarcity measures (by 2021) - Maps with water scarce areas identified for the Tisza Basin.

Serbia country specific projects

In addition to projects and studies in Republic of Serbia the following list includes legal and other frameworks relevant for Climate Change and Water Quantity issues:

- The Water Management Strategy of the territory of the Republic of Serbia (Official Gazette of the Republic of Serbia no. 3/2017);
- The Second National Communication of the Republic of Serbia under the UNFCCC (Submitted on the ICPDR Danubius, December 2016);
- South East European Climate Change Framework Action Plan for Adaptation- SEE/CCFAP-A (2008);
- Jaroslav Černi Institute for the Development of Water Resources (JCI), 2010-2012, Climate Change Impacts on River Hydrology in Serbia – National Study in Serbian (financially supported by Water Directorate – Ministry of agriculture, forestry and water management of Serbia);
- Jaroslav Černi Institute for the Development of Water Resources (JCI), 2012-2016, Climate Change Impacts on Water Resources in Serbia – National Study in Serbian (project is financed by the Ministry of education, science and technological development);
- Weather extremes and climate change in Serbia financed by the Ministry of Education, Science and Technological Development;
- Studying climate change and its influence on the environment: impacts, adaptation and mitigation (CLENIAM - III43007), funded by the Ministry of Education and Science of the Republic of Serbia.

Chapter 13 - Results and Conclusions

The purpose of reservoirs within the TRB is over 50% for multipurpose reservoirs. Based on map TRB reservoirs spatial distribution with respect to volume, there are two reservoirs with volume 250 -500 Mm^3 one in Slovakia and one in Hungary. Reservoirs with volume range between 10 and 250 Mm^3 exists in Romania, Slovakia and Hungary. Reservoirs with volume equal to or smaller then 10 Mm^3 exists in all Tisza Countries.

With respect to water use and demand within the TRB and relevance of the interlinkage between water quantity and quality increase in water demand in comparison to present use is evident.

In summary, according to data reported by Tisza countries total water quantity for present uses (irrigation, other agricultural use, public water supply, industrial water supply, other uses) is 1,409.84 Mm3, regardless the source of water is significantly smaller than planned water demand by the end of the next planning period 2,585.67 Mm^3, e.g., approximately 54 %. The most significant water demand increase within the TRB is planned for irrigation – 67 %, and according to provided data with respect to water source the majority of water intake increase is planed from surface water.

For other agricultural use, water intake increase is planned both for surface and groundwater sources. Although the quantity of water for public water supply is higher at the present than future demand, there is planned increase of intake form groundwater. Based on data and information reported by Tisza countries, it is obvious that planned increase in water demand refer both to surface and ground water sources, from 566.57 to 805.61 Mm^3 and from 75.51 to 91.99 Mm^3, respectively. Since for some water uses elaborated with TRB water quantity issues data are not reported by all countries, these water uses are not included in water quantity summary comparison between present water use and planned water demand.

Instead of conclusion, all proposed measures that are relevant for water quantity and quality integration should be carefully and comprehensively elaborated at the TRB, and any issue or constrain that have or might have adverse impacts on the Integrated River Basin Management Planning within the TRB and with respect to transboundary level should be carefully re evaluated and win - win upstream – downstream approach should be applied.

Abbreviations

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

References

Tisza Analyses Report (2007)
The First Integrated Tisza River Basin Management Plan
EU Water Framework Directive
The ICPDR CC adaptation strategy
ICPDR DanubeGIS
Data and information reported by Tisza countries:

Ukraine:
JOINTISZA Template (Report) for water quantity data collection –country report,
Slovakia:
JOINTISZA Template (Report) for water quantity data collection –country report
Romania
JOINTISZA Template (Report) for water quantity data collection –country report
Hungary
JOINTISZA Template (Report) for water quantity data collection –country report
Serbia
JOINTISZA Template (Report) for water quantity data collection –country report

Annex 1 TRB annual discharge data

Table 1: TRB Mean Annual discharges (m³/s)

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
1986	33.0	190	117.47	100.493	203	468	768
1987	30.0	156	97.09	87.447	168	376	584
1988	39.7	193	128.78	111.266	193	491	732
1989	37.3	202	120.66	121.509	203	517	732
1990	23.2	144	82.84	79.116	139	336	465
1991	21.8	138	89.47	76.423	145	368	572
1992	32.8	206	96.73	103.756	181	424	690
1993	25.4	180	114.03	82.440	183	364	537
1994	33.4	194	105.06	96.801	176	461	662
1995	42.6	284	155.02	112.799	263	557	800
1996	26.8	155	121.89	82.140	158	450	770
1997	30.4	193	155.49	96.122	191	517	884
1998	65.3	329	197.61	155.622	298	808	1130
1999	46.0	241	162.95	135.499	255	704	1170
2000	41.7	196	143.85	136.784	187	563	929
2001	43.8	246	141.80	124.865	263	649	949
2002	36.4	216	131.59	96.637	237	517	777
2003	23.4	118	79.39	71.128	127	348	575
2004	36.7	208	132.30	121.142	219	511	866
2005	39.1	183	166.39	140.189	182	615	1100
2006	38.4	231	191.47	135.089	232	739	1230
2007	31.4	220	138.53	101.852	215	491	752
2008	36.6	248	140.35	116.417	258	542	827
2009	32.3	164	111.48	100.830	172	428	646
2010	60.9	262	212.89	204.159	272	950	1430
2011	27.3	142	94.42	90.151	142	455	732
2012	22.7	136	67.30	78.132	135	296	442
2013	32.4	172	104.39	113.024	176	513	736
2014	18.4	108	69.96	68.249	112	298	496

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
2015	16.9	139	91.09	63.122	141	315	530

Table 2: TRB Minimum Annual discharges (m^3/s)

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
1986	3.92	36.2	170	15.020	30	61.4	164
1987	4.90	37.9	190	18.480	43	75.8	130
1988	5.45	32.2	170	30.680	30	105.0	183
1989	7.04	58.2	210	34.270	41	110.0	253
1990	5.23	32.4	96	33.280	33	75.7	95.0
1991	5.15	40.3	200	31.890	43	122.0	237
1992	3.16	31.6	180	28.040	27	59.5	132
1993	5.49	56.8	190	30.130	53.2	89.0	90.0
1994	5.31	32.5	168	27.480	10.1	69.6	90.0
1995	6.24	35.0	180	31.790	42.3	113.0	251
1996	7.70	42.3	210	32.640	50	115.0	188
1997	8.56	74.2	170	37.860	81.9	161.0	306
1998	11.8	62.3	80	44.630	77.8	226.0	360
1999	7.98	60.0	200	31.500	60.4	145.0	326
2000	6.50	26.3	180	31.280	26.7	94.7	242
2001	7.90	69.2	110	39.720	41.8	198.0	272
2002	4.96	44.8	100	26.030	44.5	105.0	220
2003	3.78	22.2	140	21.770	22.3	66.2	128
2004	7.00	40.5	130	34.585	41.3	101.0	213
2005	5.67	42.8	185	38.795	44	163.0	373
2006	6.22	40.2	200	30.031	47.3	148.0	312
2007	3.72	46.5	193	26.234	44	79.7	193
2008	7.58	48.0	208	32.049	44	151.0	265
2009	5.48	29.0	197	22.859	31.6	67.5	180
2010	10.4	75.0	385	45.070	81	308.0	541

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
2011	4.14	25.0	248	21.688	29.4	81.9	151
2012	4.40	26.0	233	20.453	22.3	72.9	120
2013	3.85	33.5	263	21.969	33.3	64.9	135
2014	5.70	42.7	196	28.392	45.7	94.7	222
2015	2.96	23.4	340	13.331	27.5	63.7	137

Table 3: TRB Maximum Annual discharges (m^3/s)

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
1986	311	2050	1020	605.600	2500	1380	1830
1987	330	1240	612	613.800	1180	1500	3730
1988	246	1270	855	563.900	1130	1550	2120
1989	325	1980	863	752.900	1720	1580	1620
1990	77.8	883	279	230.100	884	825	1800
1991	76.4	1280	1033	251.900	1080	1370	1430
1992	455	2110	537	586.100	1160	1450	2420
1993	242	2730	910	394.700	2520	1490	1970
1994	114	1450	533	394.000	1820	1500	1800
1995	257	2390	1320	436.900	2120	1450	3400
1996	112	876	682	239.400	847	1480	3310
1997	158	1250	685	347.300	1090	1210	3200
1998	472	3150	1177	629.000	3260	2060	1190
1999	386	1410	1290	798.800	1510	2350	2200
2000	341	2240	1426	879.900	2050	2590	1670
2001	540	3580	1497	569.600	3700	1990	1570
2002	193	1490	890	347.600	1390	1430	1930
2003	112	709	756	269.900	691	1010	2410
2004	213	1380	882	535.612	1270	1460	1480
2005	270	1270	1041	647.950	1320	1680	1770
2006	382	1900	974	826.221	1980	2440	1940

Year	UA		RO	SK	HU		RS
	Chop	Vilok	Satu Mare	Streda nad Bodrogom	Tiszabecs	Szolnok	Senta
2007	211	1590	886	483.813	1550	1430	2280
2008	144	2070	630	402.179	1890	1410	2360
2009	232	1620	609	422.700	1490	1260	1530
2010	412	2100	945	676.929	2060	2380	2200
2011	175	854	424	338.750	828	1690	2360
2012	119	806	342	307.783	810	991	2070
2013	186	1240	897	511.567	1250	1990	2580
2014	69.2	464	281	265.554	415	751	1370
2015	66.5	1710	523	269.413	1610	1120	1800

Annex 2 TRB water use in last 3 years

Water use for irrigation

Table III.1: TRB water use – irrigation summary

<table>
<tr><th colspan="2" rowspan="2">INDICATOR</th><th colspan="5">Tisza Countries</th><th rowspan="2">Summary</th></tr>
<tr><th>UA</th><th>RO</th><th>SK</th><th>HU</th><th>RS</th></tr>
<tr><td colspan="2">Areas under irrigation systems (ha)</td><td>875.00*</td><td>3,928.00</td><td>40,565.00</td><td>192,165.0</td><td>60,843.00</td><td>298,376.0</td></tr>
<tr><td colspan="2">Average areas annually irrigated in last 3 years (ha)</td><td>600.00</td><td>1353.33</td><td>66.33</td><td>94,006.00</td><td>40,000.00</td><td>136,025.6 6</td></tr>
<tr><td colspan="2">Average water quantity annually used for irrigation in last 3 years per hectare (m^3 per ha)</td><td>350.00</td><td>6,110.83</td><td>1,326.68</td><td>2,046.00</td><td>1,200.00</td><td>11,033.51</td></tr>
<tr><td colspan="2">Average total water quantities annually used for irrigation in last 3 years (10^6 m^3)</td><td>0.10**</td><td>8.41</td><td>0.09</td><td>192.00</td><td>73.02</td><td>273.62</td></tr>
<tr><td colspan="2">Estimation of consumptive use (%)</td><td>100</td><td>40</td><td>100</td><td>95</td><td>80-85</td><td></td></tr>
<tr><td colspan="2">Sources of irrigation water (%)</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
<tr><td rowspan="3">Surface Water</td><td>Rivers</td><td>56</td><td rowspan="2">91.61</td><td>56</td><td>24</td><td>35</td><td></td></tr>
<tr><td>Reservoirs</td><td>0</td><td>0</td><td>1</td><td>15</td><td></td></tr>
<tr><td>Canals</td><td>NA</td><td></td><td>NA</td><td>72</td><td>40</td><td></td></tr>
<tr><td rowspan="3">Ground Water</td><td>Springs</td><td></td><td rowspan="2">8.39</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Alluvial aquifers</td><td>0</td><td>0</td><td>1</td><td>0</td><td></td></tr>
<tr><td>Deeper aquifers</td><td>44</td><td></td><td>44</td><td>2</td><td>10</td><td></td></tr>
</table>

*875 ha is the total area of irrigated systems, although that the irrigation system itself does not work at the whole this area.

**data are incomplete, because some farmers do not submit the data on water use

SK: We cannot determine differ between rivers and canals. They are same for us and they are marked as rivers. The reporting obligation for the withdrawal of surface water and groundwater is subject to Act no. 364/2004 Coll. (The Water Act and the amendment to the Act of the Slovak National Council no. 372/1990 Coll. On Offenses as amended (Water Act)).

RO: Water abstracted for irrigation purpose is subject of a contract between National Administration of Romanian Waters, which administrates the water resource and National Land Improvement Agency (NLIA) irrigation channels. The volume effectively used for irrigation is controlled by National Land Improvement Agency (NLIA).

Other agricultural water use

Table IV.1: TRB water use – other agricultural use summary

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Average water quantities annually used for livestock farms for last 3 years (10^6 m^3)		0.9*	3.63	1.23	13	20	38.76
Estimation of consumptive use (%)		3	70	23	10	20	126
Average water quantities annually used for fish production for last 3 years (10^6 m^3)		9.8**	153.78	0.89	165	70.75	400.22
Estimation of consumptive use (%)		29	NA	-	46	60	135
Average water quantities annually used for other agricultural uses for last 3 years (10^6 m^3) – list here type of other uses (...)		-	NA	NA	-	5	5
Estimation of consumptive use (%)		1	NA	NA	-	15	
Sources of water (%)		100	100	100	100	100	100
Surface Water	Rivers	15	96.5	42.3	13	60	
	Reservoirs	70		0	1		
	Canals	5		NA	79	40	
Ground Water	Springs	0	3.5	14.7	0		
	Alluvial aquifers	10		43.0	0		
	Deeper aquifers	0		0	7		

* - with each year, the number of water used for animal husbandry got reduced.

**** - fish production is done by the enterprise “Zakarpattya fishery enterprise” in water reservoirs of system “Chorny Mochar”, which are used for many purposes: accumulation of flood waters, fish breeding, irrigation and recreation. The high percentage (29%) of use of surface waters for fish breeding can be explained by this multipurpose use of the water reservoirs.

SK: We cannot determine differ between rivers and canals. They are same for us and they are marked as rivers. Percentage are calculated from fish production with livestock farm together.

Public water supply

Table V.1: TRB water use – public water supply summary

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Total capacity of public water supply systems (m^3/s)		0.7	93.78	5.5	9	1.7	110.68
Average water quantities annually used for public water supply for last 3 years (10^6 m^3)		22.1*	362.91	58.97	218	52.32	714.3
Estimation of consumptive use (%)		48*	NA	14	15	15	
Sources of water (%)		100	100	100	100	100	
Surface Water	Rivers	14.6	77.64	14.6	5	0	
	Reservoirs	31.5		31.5	4	0	
	Canals	NA		NA	2	0	
Ground Water	Springs	31.9		31.9	4	0	
	Alluvial aquifers	21.6		21.6	4	24.5	
	Deeper aquifers	0.4	22.36	0.4	81	75.5	

*** - for municipal water supply utilities in Tisza basin it is typical to have significant loses during transporting (up to 50%). It is caused by outdated water supply systems, which require urgent capital investments. The water losses are put on consumers, who pay more for the water supply services.

** According to UA legislation, possible loses in the public water supply are up to 28%. But because of the outdated system of pipes, this figure at present is higher than allowed by the legislation.*

Water supply for industry

Table VI.1: TRB water use – water supply for industry

INDICATOR	Tisza Countries					Summary
	UA	RO	SK	HU	RS	
Total capacity of industrial water supply systems (m^3/s)	0.03	NA	21.3	6.5	2.96	30.79

Average water quantities annually used for industrial water supply for last 3 years (10^6 m^3)		1.1	505.92	39.41	86.3	9.35	642.08
Estimation of consumptive use (%)		3	NA	7	10	5-10	
Sources of water (%)		100	100	100	100	100	100
Surface Water	Rivers	50	94.7	82.1	51	25.0	
	Reservoirs	0		4.9	4	1.0	
	Canals	0		0	1	20.0	
Ground Water	Springs	0	5.3	0.3	0	0.0	
	Alluvial aquifers	50		12.7	4	13.2	
	Deeper aquifers	0		0	40	40.8	

SK: Data from groundwater for water supply of industry included food industry, other industry, making metal, manufacture of electrically optic devices, chemical industry, mining and construction.
RO: water quantities used for industrial water supply do not include volumes for hydropower.

Thermal power plant cooling

Table VI.3: TRB water use – thermal power plant cooling

INDICATOR		Tisza Countries			Summary
		RO	SK	HU	
Average water quantities annually used for thermal power plant cooling for last 3 years (10^6 m^3)		276.07	2.26	37.3	315.63
Estimation of consumptive use (%)		*	5	20	
Sources of water (%)		100	100	100	
Surface Water	Rivers	99.57	100	92	
	Reservoirs			0	
	Canals			8	
Ground Water	Springs	0.43		0	
	Alluvial aquifers			0	
	Deeper aquifers			0	

****In the case of C.T.E. (Thermoelectric Power Plants), the cooling water is provided by a closed circuit of recirculated water. The average water recirculation rate is about 94%***

UA: There is no thermal water cooling in the Ukrainian part of Tisza. Only in 2014, in Rakhiv city, a first biological thermal power plant was constructed (aimed at burning of the wooden residues) for hot water supply for the city. The water in-take is from Tisza not more than 0.063 thousands m3 per day or 11.5 thousands m3 per year.
SK: Groundwater is not used for thermal power plant cooling.

HU: Significant reduction of cooling water use has taken place, due to technological changes at power plants.
RS: There is no thermal power plants in Serbia

Hydropower water use

Table VII.1: TRB water use and water demand (2012) – hydropower

Name	River	Installed capacity (MW)	Installed discharge (m^3/s)	Average yearly production in last 3 years (GWh/year)	Remarks
UKRAINE					
Tereblya-Rikska HPP	Tereblya-Rika	27	6	0.12	Commenced in 50s f XX century needs upgrade. Each 5 years, assessment of the dam, tunnel and turbines are done.
ROMANIA					
Gura Apelor	Raul Mare	335	7.44		
Poiana Marului	Bistra Marului	140	2.17		
Dragan	Dragan	158	2.33		
Tarnita	Somesul Cald	45	3.75		
Fantanele	Somesul Cald	220	3.94		
Colibita	Bistrita Ardealului	21			
Oasa	Sebes	150	2.35		
Runcu	Mara	2x14			
Tau	Sebas	150	3.12		
Herculane	Cerna	32	2.00		
Cugir	Cugirul Mare	150			
Gozna	Barzava	22.4			
Obrejii de Capalna	Sebes	42	3.22		

Tileagd	Crisul Repede	18	5.45		
Somesul Cald	Somesul Cald	12	3.55		
Ostrovul Mic	Raul Mare	15.9	4.02		
Paclisa	Raul Mare	15.9	3.96		
Hateg	Raul Mare	15.9	4.19		
Lugasu	Crisul Repede	18	5.44		
SLOVAKIA					
Palcmanská Maša	Hnilec	21.6	9	49.6	
Ružin I.	Hornád	60	135	136	
Veľká Domaša	Ondava	12.8	50	12	
HUNGARY					
Tiszalök HPP	Tisza	12.9	300	61.3	
Kisköre HPP	Tisza	28.0	560	119	
TRB SUMMARY		**1, 696.4**	**1,116.93**	**377.9**	

Water use – hydrological requirements for good water status

Table IX.1: TRB water use – hydrological requirement for good water status

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Average water quantities annually used in the last 3 years for good ecological status (10^6 m^3)		*	498.26	1321.03	15.3	252.12	2086.71
Estimation of consumptive use (%)		*	100	NA	30	20	
Sources of water (%)		100	100	100	100	100	100
Surface Water	Rivers		100	15.6	7	100	
	Reservoirs			NA	0	0	
	Canals			0	93	0	
Ground Water	Springs			NA	0	0	
	Alluvial aquifers			34.9	0	0	
	Deeper aquifers			49.5	0	0	

UK: No information as it is not defined in Ukraine.

SK: In this case we do not know differ springs from deeper aquifer- the number 49.5 stands for deeper aquifers + springs based on Slovakian country report

RO: Currently, the hydrological requirement for good water status is salubrious discharge which represents the mean daily flow from the duration curve of the daily mean flows, in natural flow regime, corresponding to 95% probability of occurrence.
The *Instructions on the calculation of salubrious and servitude flows on watercourses*, developed by the National Institute of Hydrology and Water Management and approved by the National Administration Romanian Water (2013) has been used for computing the salubrious discharge in Satu Mare Gouging Station on the Someş River.

Water use other uses

Table X.1: TRB water use – other uses

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Average water quantities annually used for other uses in last 3 years (10^6 m^3)		1.4*		0.16	48.6	0	50.16
Estimation of consumptive use (%)		4	NA	NA	4	0	
Sources of water (%)		100	100	100	100	100	
Surface Water	Rivers	20	100	45.9	3		
	Reservoirs	0	NA	0	0		
	Canals	0	NA	0	7		
Ground Water	Springs	0	NA	12.8	1		
	Alluvial aquifers	20	NA	41.3	6		
	Deeper aquifers	60	NA	0	82		

* data for water use by health resorts in Zakarpattya (tourism and recreation).
HU: Consumptive use refers to the overall losses of all sources of water, thus does not reflect losses to specific groundwater resources. Only cca. 20 % of deep (thermal) groundwater extractions are artificially recharged into the aquifers, the rest is discharged into surface waters.
RS: other uses are included in the table IX.1.

Annex 3 TRB Planned water quantities in 2021

Water demand - irrigation

Table III.2: TRB water demand (2021) – irrigation summary

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Planned areas for irrigation in 2021 (ha)		1,200.0	2,723	15,086.0	120,000.0	100,000.0	239,009.0
Water quantity planned for irrigation per hectare in 2021 (m^3 per ha)		300.0	2,000	400	1,950.0	1,600.0	6,250.0
Total water quantities planned for irrigation in 2021 (10^6 m^3)		0.3	5.5	6.0	234.0	160.0	405.8
Estimation of consumptive use (%)		100.0	100.0	100.0	95.0	80-85	
Planed Sources of irrigation water (%)		100	100	100	100	100	
Surface Water	Rivers	56	91.61	100	25	25	
	Reservoirs	0			3	15	
	Canals	NA		0	70	55	
Ground Water	Springs		8.39	0			
	Alluvial aquifers	0		0	1	0	
	Deeper aquifers	44		0	1	5	

Water demand – other agricultural use

Table IV.2: TRB water demand (2021) – other agricultural use summary

INDICATOR	Tisza Countries					Summary
	UA	RO	SK	HU	RS	
Planned water quantities for livestock farms in 2021 (10^6 m^3)	0.5	36.02	1.23	15	25	77.75

Estimation of consumptive use (%)		2	NA	23	15	20	
Planned water quantities for fish production in 2021 (10^6 m^3)		10	169.92	0.89	175	80	435.81
Estimation of consumptive use (%)		30	NA	NA	46	60	
Planned water quantities annually for other agricultural uses in 2021 (10^6 m^3) – list here type of other uses (...)		0.8	NA	NA	-	5	5.8
Estimation of consumptive use (%)		2	NA	NA	-	15	
Sources of water (%)		100	100	100	100	100	100
Surface Water	Rivers	15	96.5	42.3	13	45	
	Reservoirs	70		0	1	10	
	Canals	5		NA	79	45	
Ground Water	Springs	0	3.5	14.7	0		
	Alluvial aquifers	10		43.0	0		
	Deeper aquifers	0		0	7		

UA: We consider that gardening and growing vegetables will increase together with increase of water in-take from channels.

Water demand – public water supply

Table V.2: TRB water demand (2021) – public water supply summary

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Planned capacity of public water supply systems in 2021 (m^3/s)		0.5	NA	5.5	9.1	1.8	16.9
Planned water quantities for public water supply in 2021 (10^6 m^3)		17	347	60	225	60	709
Estimation of consumptive use (%)		60	NA	12	16	15	
Sources of water (%)		100	100	100	100	100	100
Surface	Rivers	30	77.64	14.6	5	0	

Water	Reservoirs	0		31.5	4	0	
	Canals	0	NA	NA	2	0	
Ground Water	Springs	0	NA	31.9	4	0	
	Alluvial aquifers	20	NA	21.6	4	24.5	
	Deeper aquifers	50	22.36	0.4	81	75.5	

UA: We consider that water use by municipal water supply utilities will reduce due to modernization of the water supply systems and reduction of water losses as well as rational use of water resources. The increase of the cost of water will stimulate this process.

Water demand – water supply for industry

Table VI.2: TRB water demand (2021) – water supply for industry

INDICATOR		**Tisza Countries**					**Summary**
		UA	**RO**	**SK**	**HU**	**RS**	
Planned capacity of industrial water supply systems in 2021 (m^3/s)		0.03	NA	21.3	6.5	3.2	31.03
Planned water quantities for industrial water supply in 2021 (10^6 m^3)		1.1	756	40	90	10.5	897.6
Estimation of consumptive use (%)		3	NA	7	10	5-10	
Sources of water (%)		100	100	100	100	100	
Surface Water	Rivers	50	94.7	82.1	51	25.0	
	Reservoirs	0		4.9	3	1.0	
	Canals	0	0	0	1	20.0	
Ground Water	Springs	0	5.3	0.3	0	0.0	
	Alluvial aquifers	50		12.7	4	13.2	
	Deeper aquifers	0		0	41	40.8	

Water demand – thermal power plant cooling

Table VI.4: TRB water demand (2021) – thermal power plant cooling

INDICATOR	**Tisza Countries**			**Summary**
	RO	**SK**	**HU**	
Average water quantities planned for thermal power plant cooling in 2021 (10^6 m^3)	413	2.86	40	
Estimation of consumptive use (%)	NA	5	22	
Sources of water (%)	100	100	100	

Surface Water	Rivers	99.57	100	93	
	Reservoirs			0	
	Canals			7	
Ground Water	Springs	0.43		0	
	Alluvial aquifers			0	
	Deeper aquifers			0	

Water demand - hydropower

Table VII.2: TRB water demand (2012) – hydropower

Name	River	Planned installed capacity (MW)	Planned installed discharge (m3/s)	Planned average yearly production (GHh/year)	Remarks
UKRAINE					
Tereblya-Rikska HPP	Tereblya-Rika	27	6	0.10	
ROMANIA					
Hydroelectric power station Răstolița	Răstolița	29.1	2 x 8.5	95	Investment projects for harvesting the hydropower potential
Hydroelectric power station Mărișelu	Someșul Cald	220.5	3 x 20	390	Investment projects for rehabilitation, upgrading or modernization of existing hydroelectric power station
Hydroelectric power station Retezat	Râul Mare	335	2 x 70	420	Investment projects for rehabilitation, upgrading or modernization of existing hydroelectric power station
HUNGARY					
Tiszalök HPP	Tisza	12.9	300	55	Planned production as average of years 2011-2016
Kisköre HPP	Tisza	28.0	560	110	Planned production as average of years 2011-2016
TRB SUMMARY		**652.5**	**1236**	**1,070.1**	

Water demand – hydrological requirements for good water status

Table IX.2: TRB water demand (2021) – hydrological requirement for good water status

INDICATOR	Tisza Countries					Summary
	UA	RO	SK	HU	RS	
Average water quantities planed for improvement of ecological conditions in 2021 (10^6 m^3)		998.7	NA	18	300	1316.7

Estimation of consumptive use (%)				NA	33	30	
Sources of water (%)				NA	100	100	
Surface Water	Rivers		100	NA	6	100	
	Reservoirs		0	NA	0	0	
	Canals		0	NA	94	0	
Ground Water	Springs		0	NA	0	0	
	Alluvial aquifers		0	NA	0	0	
	Deeper aquifers		0	NA	0	0	

RO: In the future, in Romania the hydrological requirement for good water status is planned to be the ecological flow. The calculation method was established in the study "*Methodology for determining the Environmental Flow / Ecological Flow based on the recommendations of the European Guidance developed at the European Commission level*" (2015), within the National Institute of Hydrology and Water Management.
The methodology is taking into account the recommendation of the European Guidance Document no. 31 "*Ecological flows in the implementation of the Water Framework Directive*" for achieving the Water Framework Directive objectives (non-deterioration, achieving good ecological status for natural water body and compliance with standards and objectives of protected areas etc.).
The ecological flow was computed in the Satu Mare Gouging Station on the Somes River having a monthly variation and aiming at maintenance and restoration of the natural features and functions of the river necessary to maintain long-term development of the aquatic ecosystem. The preliminary methodology for computing the ecological flow is going to be approved by a normative act.

Water demand – other uses

Table X.2: TRB water demand (2021) – other uses

INDICATOR		Tisza Countries					Summary
		UA	RO	SK	HU	RS	
Average water quantities planned for improvement in 2021 (10^6 m^3)		2	NA	0.16	47	5	54.16
Estimation of consumptive use (%)		5	NA	NA	5	10.0	
Sources of water (%)		100	100	100	100	100	
Surface Water	Rivers	20	100	45.9	3	33	
	Reservoirs	0	NA	NA	0	33	
	Canals	0	NA	NA	7	33	
Ground Water	Springs	0	NA	12.8	1	0.0	
	Alluvial aquifers	20	NA	41.3	5	0.0	
	Deeper aquifers	60	NA	NA	84	0.0	

Annex 4 – TRB reservoirs

Table 1: Outline of TRB reservoirs with volume ≤10 Mm³ per Country

LOCATION			RESERVOIR				
Country	**River**	**River**	**Name**	**A km2**	**V Mm3**	**RA ha**	**Purpose**
UA	Tisza / Tereblya -Rika	Tereblya	Tereblya-Rikske (Vilshanske)	438	0.203	160,0	Hydropower (Tereblya-Rikska HPP)
UA	Tisza / Latorica / Chornyy Mochar	Roman potik	Gorbok	50,4	3.9	246,5	Complex (water accumulation, fish breeding, irrigation, recreation)
UA	Tisza / Latorica / Chorniy Mochar	Babichka	Zaluzh	36,6	2.9	170,0	Complex (water accumulation, fish breeding, irrigation)
UA	Tisza / Latorica / Chorniy Mochar	Mochylo	Mochila	23,0	1.9	156,0	Complex (water accumulation, fish breeding, irrigation)
UA	Tisza / Latorica / Chorniy Mochar	Fornosh	Fornosh	24,0	3.3	285,0	Complex (water accumulation, fish breeding, irrigation)
UA	Tisza / Latorica / Stara	Poluy	Bobovyschanke	13,2	1.6	31,1	Complex (water accumulation, fish breeding, irrigation)
UA	Tisza / Borzhava	Sal'va	Sal'va	23,0	1.4	10,1	Complex (water accumulation, fish breeding, irrigation, recreation)
UA	Tisza	Boronyava	Boronyavo	13,6	1.1	6,5	Complex (water accumulation, fish breeding, irrigation)
UA	Tisza / Latorica	Stara	Andriivske	83,6	1.4	6,2	Complex (water accumulation, irrigation, recreation)

RO	Banat	Valea Sisco	Satchinez	23	0.3	152	flood protection
RO	Banat	Valea Mociur	Topolovăt	24	0.3	117	flood protection; pisciculture; irrigation
RO	Banat	Gherteamuş	Ianova	68	0.68	160	flood protection; pisciculture
RO	Banat	Slatina	Izvorin	102	6.6	276	flood protection
RO	Banat	Magheruş	Murani	108	1.47	192	flood protection; pisciculture
RO	Banat	Chizdia	Cosarii II	35	2	NA	flood protection
RO	Banat	Repaş	Repaş	38	1.6	NA	flood protection
RO	Crişuri	Valea Izvoarele	Carasău	10	1.8	28	flood protection
RO	Crişuri	Valea Făncica	Creştur	67	0.58	118	flood protection
RO	Crişuri	Valea Bistra	Ciutelec	139	4.2	146	flood protection
RO	Crişuri	Barcău	Suplacu de Barcău	420	6.2	159.76	water supply; flood protection
RO	Crişuri	Peţa	1 Mai	8	1.212	NA	flood protection
RO	Crişuri	Adona	Adona	17	2.024	NA	flood protection
RO	Crişuri	Corhana	Bicaciu	52	3.59	NA	flood protection
RO	Crişuri	Carpeştii Mici	Carpeştii Mici	77	2.6	NA	flood protection
RO	Crişuri	Cheţ	Egher	24	1.56	NA	flood protection
RO	Crişuri	Hidişel	Felix	30	2.48	NA	flood protection
RO	Crişuri	Rât	Galoşpetreu I	96	3.84	NA	flood protection
RO	Crişuri	Gepiu	Gepiu II	58	1.59	NA	flood protection
RO	Crişuri	Hodişel	Hodişel	29	1.879	NA	flood protection
RO	Crişuri	Holod	Luncasprie	70	0.4	6	water supply
RO	Crişuri	Sânnicolau	Sânnicolau de Munte	40	2.3	NA	flood protection
RO	Crişuri	Valea Nouă	Șipot	9	1.04	NA	flood protection
RO	Crişuri	Cosmo	Uileacul de Munte	41	2.75	NA	flood protection
RO	Mureş	Mărtineşti	Rediu	17	0.2	51	flood protection; pisciculture
RO	Mureş	Ighiş	Ighiş	23	5	102	water supply; recreation

RO	Mureş	Mureş	Mintia	24	1.8	90	water supply
RO	Mureş	Mojna	Nemşa	55	7.9	79	flood protection; pisciculture
RO	Mureş	Fâneaţa Vacilor	Fâneaţa Vacilor	66	0.5	143	flood protection; pisciculture
RO	Mureş	Valea Racilor	Tureni	71	0.27	154	flood protection; pisciculture
RO	Mureş	Cugirul Mare	Cugir	174	1	15	hydropower
RO	Mureş	Arieş	Mihoeşti	414	6.3	71	water supply; hydropower
RO	Mureş	Râul Mare	Ostrovul Mic	421	9.2	89	hydropower; water supply
RO	Mureş	Râul Mare	Păclişa	447	9.1	99	hydropower; water supply
RO	Mureş	Sebeş	Obrejii de Căpâlna	619	3.5	25	hydropower
RO	Mureş	Strei	Subcetate	1,553	6.07	80	hydropower
RO	Mureş	Cladova	Cladova	33	0.8	NA	flood protection
RO	Mureş	Drauţ	Drauţ	20	1.16	NA	flood protection
RO	Mureş	Şiştarovăţ	Şiştarovăţ	22	2.1	NA	flood protection
RO	Mureş	Valea Caldă Mare	Tăul Ceanului	34	4.45	NA	flood protection
RO	Mureş	Niraj	Valea	242	6	NA	flood protection
RO	Someş-Tisa	Mineu	Salaţig	38	0.66	70	flood protection; water supply; pisciculture
RO	Someş-Tisa	Someşul Mic	Floreşti II	115	0.9	38	hydropower
RO	Someş-Tisa	Someşul Rece I	Someşul Rece	276	0.73	6	hydropower
RO	Someş-Tisa	Someşul Cald	Someşul Cald	520	7.5	78	water supply; hydropower
RO	Someş-Tisa	Someşul Mic	Gilău	947	2.4	68	water supply; hydropower; pisciculture
RO	Someş-Tisa	Valea Vinului	Crucişor III	4	1.13	NA	flood protection
RO	Someş-Tisa	Rodina	Valea Vinului	26	1.7	NA	flood protection
SK	Bodva	Ida	Bukovec I.	55.4	2.19	29	Water supply, in case of emergency and

							failure of the main source. Increases the minimum discharge, water supply to fishponds, fish breeding and recreation.
HU	Zagyva	Kövicses-patak	Hasznosi tározó	36	2.06	22.66	drinking water supply
HU	Zagyva	Gyöngyös-patak	Viszneki tározó	418	4.5	555	flood retention
HU	Zagyva	Bene-patak	Ludasi tározó	113	5	162	flood retention
HU	Sajó	Bán-patak	Lázbérci tározó	217.5	5.88	78	drinking water supply
HU	Bódva	Rakaca-patak	Rakacai tározó	233	5.773	193.8	drinking water supply, flood retention
HU	Sajó	Gilip-patak	Monoki tározó	46.6	1.02	37.72	irrigation, angling
HU	Tisza	Csincse-övcsatorna	Geleji tározó	137	3.052	162.34	flood retention, irrigation, fish farming
HU	Tisza	Hór-patak	Hórvölgyi tározó	131.4	8.8	160	flood & excess water retention, irrigation, angling
HU	Tisza	Laskó-patak	Laskóvölgyi tározó	90.5	4.18	121	flood retention, irrigation, recreation
HU	Tisza	Ostoros-patak	Ostorosi tározó	17	1.15	21.5	flood retention, irrigation, recreation
HU	Zagyva	Gyöngyös-patak	Csór-réti tározó	8.31	1.08	12.8	drinking water supply
HU	Zagyva	Berek-patak, Domoszlói-patak	Domoszlói tározó	27.1	1.01	53	irrigation
HU	Zagyva	Tarján-patak	Gyöngyös-Nagyrédei tározó	70.3	1.2	42	flood retention, irrigation, angling
HU	Zagyva	Nyiget patak, Bene-patak	Markazi tározó	11	7.3	157	industrial water supply, irrigation, angling
HU	Körösök	Hármas-Körös	Peresi holtág	231.1	2.5	174	excess water retention, irrigation

HU	Körösök	Hármas-Körös	Szarvas-Békésszentandrási holtág	926.8	2.5	199	excess water retention, irrigation, recreation
HU	Körösök	Keleti-főcsatorna	K-V-1 tározó	-	4.75	313	fish-farming, irrigation
HU	Tisza	Keleti-főcsatorna	K-XI tározó	-	1.7	154.9	nature conservation, fish-farming, irrigation
HU	Tisza	Keleti-főcsatorna	L-1 tározó	24	1.7	60	irrigation, fish-farming, recreation
HU	Tisza	Nagykunsági főcsatorna	X. tározó	-	2.04	146.2	excess water retention, fish-farming
HU	Tisza	Nagykunsági főcsatorna	Kecskeri tározó	-	1.8	155	excess water retention, irrigation, fish-farming
HU	Zagyva	Zagyva-patak	Mizserfai tározó	38	1.1	12	angling
HU	Zagyva	Bujáki-Patak	Palotási tározó	51.5	1.77	63.6	flood retention, angling
HU	Zagyva	Sinkár-patak	Püspökhatvani tározó	63.8	2	67	irrigation, flood retention, angling
RS	Tisza	Krivaja	Zobnatica	423 (RS)	4.83	230	irrigation
RS	Tisza	Krivaja	Panonija	12	0.47	17	irrigation
RS	Tisza	Krivaja	St. Moravica	95	1.35	70	irrigation
RS	Tisza	Krivaja	Skenderovo	26	0.4	31	irrigation
RS	Tisza	Čik	Svetićevo	496	3.97	240	irrigation
RS	Tisza	Knl 300	Čonoplja	72	0.65	41	irrigation
RS	Tisza	Tisa-Palić	Velebit	10	2.07	103	irrigation
RS	Tisza	Budžak	Budžak	120	0.71	63	irrigation
RS	- Tisza	-	Tisa (brana - dam)	6.544 (RS)	9	650	Water regime
					23.45		
RS	- Tisza	-	Tisa (brana - dam)	6.544 (RS)	50	650	Water regime
RS	- Tisza	-	Tisa (brana - dam)	6.544 (RS)	50	650	Water regime

Table 2: Outline of TRB reservoirs with volume 10 Mm^3 – 500 Mm^3 per Country

LOCATION			RESERVOIR				
* TC	River Basin	River	Name	** CUoR (km^2)	*** RV (Mm^3)	**** SA (ha)	Purpose
RO	Mureş	Râul Mare	Haţeg	475	11.6	124	hydropower
RO	Mureş	Sebeş	Petreşti	695	13	38	water supply; hydropower
RO	Mureş	Târnava Mica	Bălăuşeri	955	24	33	flood protection
RO	Mureş	Târnava Mare	Vânători	1755	25.5	583	flood protection
RO	Someş-Tisa	Firiza	Strâmtori	212	15.8	113	water supply; hydropower; flood protection
RO	Someş-Tisa	Crasna	Vârşolţ	345	16.1	652	flood protection; water supply; pisciculture
RO	Someş-Tisa	Tur	Călineşti Oaş	375	29	382	irrigation; flood protection; pisciculture; recreation
HU	Tisza	Keleti-főcsatorna	K-V-3 tározó	-	10.96	510	fish-farming, irrigation
RO	Mureş	Râul Mare	Haţeg	475	11.6	124	hydropower
RO	Mureş	Sebeş	Petreşti	695	13	38	water supply; hydropower
SK	Bodrog	Cirocha	Starina	131	59.9	311	Water supply, reduction flood peaks.
SK	Hornád	Hornád	Ružín I. and II.	1929	62.7	455	Increase the minimum discharge and irrigation, hydropower.
RO	Crişuri	Crişul Repede	Lugaşu	1736	63.5	640	hydropower; water supply
RO	Crişuri	Crişul Repede	Tileagd	1846	52.9	605	water supply; irrigation; hydropower
RO	Someş-Tisa	Bistriţa Ardealului	Colibiţa	113	69.3	314	water supply; hydropower
RO	Someş-Tisa	Someşul Cald	Tarniţa	491	70.3	220	hydropower
SK	Bodrog	Ondava	Veľká Domaša	823	185	1510	Water supply for industry and irrigation, reduction of flood peaks, increasing of low discharges, power production, recreation and water sports.
RO	Mureş	Sebeş	Oaşa	187	136	401	hydropower; flood protection; recreation
RO	Mureş	Râul Mare	Gura Apelor	235	200	411	hydropower
RO	Mureş	Strei	Bretea	1620	110	40	hydropower
SK	Bodrog	Laborec	Vihorlat	1560.3	334	3290	Water for the thermal power plant Vojany, for irrigation, for increasing of minimum discharges, recreation and

LOCATION			RESERVOIR				
* TC	River Basin	River	Name	** CUoR (km^2)	*** RV (Mm^3)	**** SA (ha)	Purpose
							water sports.
RO	Someş-Tisa	Someşul Cald	Fântânele	325	**225**	826	hydropower; flood protection
HU	Tisza	Tisza	Tisza-tó	65670	**253**	12700	recreation, irrigation, flood protection, electricity production

Tisza Country
*****Catchment Area Upstream of the Reservoir***
******Reservoir Volume***
******* Surface Area***

Annex 5 – TRB interannual discharge data table

UA	River name	Tisza	Catchment area [km^2]	33000	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Chop	River km	695	Minimum flow [m^3/s]	8.0	10.7	26.0	17.5	11.6	7.6	6.0	3.8	4.2	5.1	5.1	5.4	3.0
	Station ID UA:	?	LON	48°24’56”N	Mean flow [m^3/s]	38.4	43.4	70.0	63.2	34.2	24.4	19.5	17.4	14.3	18.8	31.5	35.9	34.2
			LAT	22°11’04”E	Maximum flow [m^3/s]	95.6	123	173	163	114	107	99.3	87.2	35.6	98.5	142	159	540.0
UA	River name	Tisza	Catchment area [km^2]	9140	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Vilok	River km	808	Minimum flow [m^3/s]	54.1	36.5	111.0	118.0	101.0	47.7	63.5	37.6	26.3	33.1	30.6	45.0	22.2
	Station ID UA:	?	LON	48°05’48”N	Mean flow [m^3/s]	159.6	162.4	308.2	390.3	254.5	181.5	147.8	100.9	114.9	125.7	184.2	188.2	193.1
			LAT	22°50’14”E	Maximum flow [m^3/s]	463	402	806	810	501	412	543	194	283	461	693	597	3580.0
RO	River name	Someş	Catchment area [km^2]	15385	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Satu Mare	River km	376	Minimum flow [m^3/s]	18.5	22.3	30.1	42.3	36.3	25	22.3	17.1	16.1	17.1	19.2	9.05	9.1
	Station ID RO:	?	LON EPSG: 104258, ETRF 1989	22.875923	Mean flow [m^3/s]	123.77	140.8	238.19	234.57	139.75	124.51	93.29	68.52	66.5	68.21	94.18	114.54	125.6
			LAT EPSG: 104258, ETRF 1989	47.78735	Maximum flow [m^3/s]	932	890	1497	1426	1033	1177	885	702	335	770	734	1320	1497.0
SK	River name	Bukovec I.	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
	Station ID SK:		LON		Mean flow [m^3/s]	0.2	0.3	0.5	0.8	0.6	0.5	0.3	0.2	0.2	0.2	0.2	0.3	0.4
			LAT		Maximum flow [m^3/s]	2.3	1.6	4.7	4.1	5.4	6.6	3.6	1.2	1.8	1.7	2.2	2.2	6.6
SK	River name	Bukovec II.	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	0.035	0.03	0.055	0.09	0.074	0.043	0.039	0.031	0.03	0.038	0.05	0.044	0.03
	Station ID SK:		LON		Mean flow [m^3/s]	0.245	0.266	0.539	0.837	0.62	0.463	0.272	0.201	0.154	0.182	0.239	0.261	0.356
			LAT		Maximum flow [m^3/s]	2.282	1.649	4.718	4.139	5.442	6.617	3.645	1.229	1.835	1.701	2.196	2.245	6.617
SK	River name	Palcmanská Maša	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	0.144	0.121	0.136	0.348	0.258	0.159	0.152	0.216	0.225	0.2	0.2	0.174	0.121
	Station ID SK:		LON		Mean flow [m^3/s]	0.53	0.46	0.863	1.72	1.589	1.368	1.156	0.984	0.719	0.737	0.904	0.641	0.974
			LAT		Maximum flow [m^3/s]	9.043	5.51	6.149	11.38	15.796	18.978	14.8	11.65	14.67	4.915	9.517	6.734	18.978
SK	River name	Ružín I. and II.	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	1.887	1.803	2.594	3.916	3.556	3.686	2.675	1.979	2.412	2.611	1.928	1.96	1.675
	Station ID SK:		LON		Mean flow [m^3/s]	7.862	7.888	15.844	22.698	19.572	18.834	16.476	13.273	9.957	8.964	10.391	9.1	13.424
			LAT		Maximum flow [m^3/s]	89.067	56.53	124.074	155.56	242.21	425.384	284.781	113.512	157.12	67.812	102.1	83.785	425.384
SK	River name	Starina	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	0.078	0.08	0.107	0.1	0.075	0.016	0.023	0.014	0.01	0.02	0.05	0.063	0.01
	Station ID SK:		LON		Mean flow [m^3/s]	0.548	0.574	1.155	0.952	0.497	0.349	0.356	0.209	0.241	0.302	0.499	0.494	0.514
			LAT		Maximum flow [m^3/s]	6.161	4.325	8.838	5.78	8.579	5.871	8.013	3.858	3.84	5.232	8.684	5.861	8.838
SK	River name	Veľká Domaša	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	1.329	1.206	2.026	1.744	1.042	0.625	0.341	0.261	0.32	0.444	0.593	0.627	0.261
	Station ID SK:		LON		Mean flow [m^3/s]	8.003	8.13	11.976	7.183	6.721	6.181	4.563	2.246	2.372	2.488	3.412	5.527	5.726
			LAT		Maximum flow [m^3/s]	78.343	63.706	60.16	48.208	167.18	190.388	96.875	23.761	48.075	38.062	40.686	59.403	190.388
SK	River name	Vihorlat (Zemplínska Šírava)	Catchment area [km^2]		Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name		River km		Minimum flow [m^3/s]	0	0	0	0	0	0	0	0	0	0	0	0	0
	Station ID SK:		LON		Mean flow [m^3/s]	7.799	11.269	20.317	13.985	7.731	4.426	5.342	2.476	2.568	3.389	6.631	7.221	7.746

			LAT		Maximum flow [m³/s]	212.7	352	318.2	234.6	328.921	150.609	235.333	70.512	59.41	64.86	228.3	114.265	352
SK	River name	Tisza	Catchment area [km²]	11474,25	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Bodrog - Streda nad Bodrogom	River km	52	Minimum flow [m³/s]	18.48	21.47	30.98	42.961	26.773	25.99	22.28	15.267	13.331	14.258	19.62	15.02	13.331
	Station ID SK:	?	LON	-228207,906	Mean flow [m³/s]	111.01032	123.26261	207.04861	203.80758	121.16306	92.742355	71.316581	66.115387	54.088806	60.967677	89.059387	101.27681	108.48827
			LAT	-1277292,375	Maximum flow [m³/s]	605.6	483.813	798.8	879.9	752.9	676.929	402.179	350.392	233	438.9	629	671.608	879.9
HU	River name	Tisza	Catchment area [km²]	9707	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Tiszabecs	River km	744.3	Minimum flow [m³/s]	29.3	25.2	52.0	90.5	62.5	40.7	25.9	10.1	15.4	19.1	26.3	20.8	10.1
	Station ID HU:	001514	LON	22.830044	Mean flow [m³/s]	176.7	169.9	309.4	396.6	251.7	179.7	146.2	101.7	113.9	119.9	174.5	190.9	194.2
			LAT	48.103617	Maximum flow [m³/s]	1690	1470	3700	2500	1090	1480	1890	595	900	2260	3260	2520	3700
HU	River name	Tisza	Catchment area [km²]	29057	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Vásárosnamény	River km	684.5	Minimum flow [m³/s]	70.0	80.3	98.0	146.0	119.0	82.2	72.2	33.6	29.7	45.7	45.0	44.3	29.7
	Station ID HU:	001516	LON	22.340747	Mean flow [m³/s]	365.1	365.1	580.9	663.9	415.3	324.1	257.1	181.9	187.1	197.2	299.4	341.1	347.9
			LAT	48.127017	Maximum flow [m³/s]	1720	1880	3780	3090	1960	2100	2340	1410	1400	2290	3440	3540	3780
HU	River name	Tisza	Catchment area [km²]	32782	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Záhony	River km	627.8	Minimum flow [m³/s]	69.1	90.0	142.0	168.0	123.0	88.3	93.8	60.3	51.8	57.7	56.0	56.0	51.8
	Station ID HU:	001518	LON	22.173282	Mean flow [m³/s]	415.6	415.6	639.7	733.1	459.0	353.1	276.4	202.0	202.3	216.8	328.4	365.4	383.4
			LAT	48.412302	Maximum flow [m³/s]	1830	2070	3680	2860	1940	2080	2420	1710	942	1990	3820	2900	3820
HU	River name	Tisza	Catchment area [km²]	62730	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Tiszapalkonya	River km	484.7	Minimum flow [m³/s]	76.4	95.9	177.0	280.0	228.0	102.0	63.3	56.9	50.7	46.0	30.3	33.6	30.3
	Station ID HU:	001722	LON	21.058932	Mean flow [m³/s]	452.5	462.3	678.8	860.7	452.0	402.2	262.8	210.8	180.9	173.9	198.0	295.4	366.8
			LAT	47.893641	Maximum flow [m³/s]	1610	1310	1710	1970	942	1070	655	846	873	780	1260	914	1720
HU	River name	Tisza	Catchment area [km²]	65670	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Kisköre alsó	River km	403.1	Minimum flow [m³/s]	26.8	59.5	61.2	101.0	25.0	44.5	1.0	26.7	13.6	0.0	17.9	43.2	0.0
	Station ID HU:	002042	LON	20.517824	Mean flow [m³/s]	503.8	532.2	828.4	954.8	640.4	458.7	323.6	265.1	263.6	307.9	467.8	429.3	474.1
			LAT	47.492404	Maximum flow [m³/s]	1820	1520	2620	2560	1940	1920	1780	1580	1280	1550	2380	1630	2620
HU	River name	Tisza	Catchment area [km²]	73113	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Szolnok	River km	334.6	Minimum flow [m³/s]	75.8	148.0	123.0	193.0	113.0	72.2	68.3	61.6	58.7	65.9	78.0	58.6	58.6
	Station ID HU:	002046	LON	20.189929	Mean flow [m³/s]	531.4	542.3	810.8	970.4	649.9	488.2	332.0	274.0	255.6	291.6	446.3	445.2	502.4
			LAT	47.169883	Maximum flow [m³/s]	1690	1430	2360	2600	2030	2400	1560	1410	1130	1330	2060	1960	2600
HU	River name	Tisza	Catchment area [km²]	138408	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Szeged	River km	173.6	Minimum flow [m³/s]	142.0	196.0	235.0	341.0	193.0	87.3	57.8	83.2	58.9	87.3	133.0	101.0	57.8
	Station ID HU:	002275	LON	20.153601	Mean flow [m³/s]	836.0	853.1	1219.9	1516.9	1139.9	826.6	579.1	480.6	447.6	477.4	652.3	694.5	809.5
			LAT	46.250429	Maximum flow [m³/s]	2570	2120	2970	3790	3380	2730	2620	1800	1760	1720	2530	2660	3790
HU	River	Túr	Catchment area [km²]	944	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Garbolc	River km	27.7	Minimum flow [m³/s]	0.42	0.46	0.72	0.55	0.68	0.51	0.14	0.1	0.14	0.17	0.15	0.19	0.1
	Station ID:	2275	LON	22.878755	Mean flow [m³/s]	15.45	16.37	21.23	16.28	7.16	7.03	5.27	3.69	4.05	4.64	9.33	11.94	10.17
			LAT	47.957553	Maximum flow [m³/s]	151	124	199	145	116	112	103	161	46.2	112	110	170	199
HU	River	Szamos	Catchment area [km²]	15283	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Csenger	River km	49.4	Minimum flow [m³/s]	18.4	20.8	26.3	36.7	27.2	24.8	22.5	16.5	12.8	18	19.3	16.8	12.8
	Station ID:	1523	LON	22.69328	Mean flow [m³/s]	127.9	143	221.4	218.3	127.7	110.9	82.8	60.6	59	62	86.2	108.3	117.1
			LAT	47.841263	Maximum flow [m³/s]	1000	1380	1370	1810	1490	1080	858	722	397	719	726	1240	1810
HU	River	Kraszna	Catchment area [km²]	1974	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year

	Station	Ágerdőmajor	River km	44.9	Minimum flow [m³/s]	0.65	0.76	0.58	0.65	0.54	0.53	0.45	0.31	0.29	0.42	0.31	0.45	0.29
	Station ID:	1530	LON	22.421256	Mean flow [m³/s]	8.74	9.21	12.6	9.48	5.56	7.77	4.6	3.34	2.98	2.63	3.69	5.88	6.36
			LAT	47.763203	Maximum flow [m³/s]	90.1	141	143	148	95	160	128	44.5	60.2	57.5	50.8	69.5	160
HU	River	Bodrog	Catchment area [km²]	12886	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Felsőberecki	River km	47.74	Minimum flow [m³/s]	5.4	15.3	27.4	32.8	24.3	11.2	7.1	13.1	9.5	7.6	15.1	15	5.4
	Station ID:	1724	LON	21.693279	Mean flow [m³/s]	116.7	130.5	208.9	210.5	122.2	92.9	70.1	66.3	54.1	62	91.2	100.8	110.4
			LAT	48.356821	Maximum flow [m³/s]	647	690	961	926	816	706	469	366	226	418	691	695	961
HU	River	Hernád	Catchment area [km²]	944	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Hidasnémeti	River km	27.7	Minimum flow [m³/s]	0.42	0.46	0.72	0.55	0.68	0.51	0.14	0.1	0.14	0.17	0.15	0.19	0.1
	Station ID:	2275	LON	22.878755	Mean flow [m³/s]	15.45	16.37	21.23	16.28	7.16	7.03	5.27	3.69	4.05	4.64	9.33	11.94	10.17
			LAT	47.957553	Maximum flow [m³/s]	151	124	199	145	116	112	103	161	46.2	112	110	170	199
HU	River	Bódva	Catchment area [km²]	15283	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Hídvégardó	River km	49.4	Minimum flow [m³/s]	18.4	20.8	26.3	36.7	27.2	24.8	22.5	16.5	12.8	18	19.3	16.8	12.8
	Station ID:	1523	LON	22.69328	Mean flow [m³/s]	127.9	143	221.4	218.3	127.7	110.9	82.8	60.6	59	62	86.2	108.3	117.1
			LAT	47.841263	Maximum flow [m³/s]	1000	1380	1370	1810	1490	1080	858	722	397	719	726	1240	1810
HU	River	Sajó	Catchment area [km²]	1974	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station	Sajópüspöki	River km	44.9	Minimum flow [m³/s]	0.65	0.76	0.58	0.65	0.54	0.53	0.45	0.31	0.29	0.42	0.31	0.45	0.29
	Station ID:	1530	LON	22.421256	Mean flow [m³/s]	8.74	9.21	12.6	9.48	5.56	7.77	4.6	3.34	2.98	2.63	3.69	5.88	6.36
			LAT	47.763203	Maximum flow [m³/s]	90.1	141	143	148	95	160	128	44.5	60.2	57.5	50.8	69.5	160
RS	River name	Tisza	Catchment area [km²]	141715	Period: 1986-2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Station name	Senta	River km	123.5	Minimum flow [m³/s]	350.1	278.2	525.2	452.2	436.3	258.8	237.4	127.4	132.8	162.4	229.0	244.1	127.4
	Station ID RS:	44020	LON	20.0954	Mean flow [m³/s]	808.2	810.8	1149.3	1442.5	1106.6	798.7	573.6	481.1	442.3	473.9	623.0	702.6	784.4
			LAT	45.9317	Maximum flow [m³/s]	2180.0	1592.5	2466.1	3134.0	2477.1	2541.7	1803.9	1159.2	939.1	1231.2	1864.3	1889.0	3134.0

Annex 6

Discharge data - mean monthly (interannual) values from gauging station Bodrog - Streda nad Bodrogom

	1	2	3	4	5	6	7	8	9	10	11	12
1985	72.093	77.984	319.983	259.703	306.639	168.31	133.667	99.805	83.971	55.436	123.953	160.865
1986	277.679	123.715	201.671	244.12	74.801	67.085	57.125	45.181	39.183	33.316	24.029	19.371
1987	22.636	80.034	103.046	314.878	113.705	113.951	38.977	43.655	41.351	38.807	63.409	80.125
1988	105.219	249.967	241.574	234.06	77.695	81.003	52.254	48.476	92.693	51.719	36.831	72.632
1989	48.233	94.891	290.184	158.657	384.221	128.625	57.921	54.837	55.571	42.113	43.844	93.234
1990	61.959	91.328	90.235	85.939	76.358	67.49	94.524	38.028	53.291	59.177	100.837	131.118
1991	132.834	67.105	119.612	92.639	99.095	69.484	42.337	49.274	40.324	71.036	85.042	46.803
1992	56.925	64.969	182.226	211.007	61.226	74.057	43.001	36.619	41.214	99.801	264.58	112.614
1993	68.153	42.585	173.099	202.419	54.781	45.611	50.69	40.476	59.337	40.078	51.686	157.448
1994	125.632	106.81	180.987	241.243	93.211	91.65	39.845	41.888	41.818	57.968	68.29	75.038
1995	108.416	227.986	214.6	183.903	150.275	83.614	69.538	42.912	61.421	44.568	85.523	90.792
1996	93.596	45.07	76.666	121.435	114.75	52.119	47.012	63.093	91.95	85.747	91.116	101.634
1997	51.855	93.757	166.317	112.662	149.613	92.256	124.196	80.588	48.986	60.018	68.79	102.21
1998	149.131	107.426	108.878	260.742	108.628	84.437	192.648	162.301	73.356	231.771	303.477	83.214
1999	146.139	65.547	508.401	312.823	117.726	70.291	72.305	60.177	42.815	43.844	58.054	119.22
2000	55.96	186.981	349.145	573.69	100.305	50.9	63.684	56.639	47.569	41.407	53.087	71.022
2001	120.402	142.105	356.055	131.671	54.902	82.174	139.789	120.91	93.167	59.069	145.004	53.266
2002	83.488	282.836	206.077	76.85	55.308	63.634	47.901	46.9	46.8	95.994	113.617	55.502
2003	75.323	54.075	167.021	166.81	67.562	42.711	32.875	28.632	27.886	65.089	72.612	52.117
2004	62.44	106.509	291.629	190.565	113.604	54.736	63.936	137.025	71.139	84.292	128.319	147.287
2005	112.854	95.992	222.932	289.153	399.462	139.46	61.246	107.309	65.354	56.822	45.48	81.236

2006	136.271	84.576	234.315	480.977	118.967	228.497	60.032	68.971	63.307	37.139	73.297	39.69
2007	194.974	320.557	188.434	58.576	43.831	37.527	33.296	26.954	61.952	43.71	81.168	146.984
2008	95.477	99.858	214.775	208.744	94.574	47.513	148.469	164.381	48.516	54.857	47.298	167.815
2009	135.717	163.288	174.706	143.75	36.865	71.043	57.664	39.234	28.315	78.246	140.834	145.723
2010	212.991	133.996	230.154	192.422	310.249	418.746	128.636	102.032	108.393	67.089	137.189	402.516
2011	261.221	102.97	143.839	89.171	44.577	33.485	104.19	97.574	36.799	29.989	25.439	108.132
2012	74.152	37.416	189.812	160.951	69.196	125.941	45.093	28.782	24.428	33.088	68.079	80.172
2013	129.825	196.892	270.771	360.677	82.815	109.984	35.547	25.239	27.267	26.47	63.395	39.053
2014	62.183	125.538	94.088	60.057	114.376	36.683	47.729	73.769	41.992	75.825	41.609	47.694
2015	107.542	148.378	107.275	97.741	66.738	41.996	24.687	17.916	16.588	25.513	54.953	55.054
average	111.0103	123.2626	207.0486	203.8076	121.1631	92.74235	71.31658	66.11539	54.08881	60.96768	89.05939	101.2768

Discharge data - minimum monthly values from gauging station Bodrog - Streda nad Bodrogom

	1	2	3	4	5	6	7	8	9	10	11	12
1985	30.23	34.17	46.4	110.8	179.3	79.97	51.43	53.87	49	46.66	48	75.59
1986	81.4	71.75	73.17	126.2	50.81	44.98	39	38.17	34.83	30.24	19.62	15.02
1987	18.48	21.47	30.98	75.56	51.7	75.04	28.75	32.45	29.6	31.45	27.79	39.75
1988	46.74	88.34	99.78	101.4	52.52	49	44	30.68	38.35	38.5	32.4	35.23
1989	41.01	40.5	145.2	86.02	66.35	68.15	40.53	41.11	43.54	34.98	34.27	35.67
1990	38.47	55.84	60	50.77	42.3	42.93	39.96	34.21	33.28	37.62	58.37	76.21
1991	58.68	49.35	84.97	55.04	60.32	43.53	39.02	34.26	31.89	37.85	45.92	41.6
1992	43.4	42.72	65.13	74.12	42.1	37.49	37.74	28.25	28.04	30.19	122	75
1993	48.58	39.35	34.16	96.66	45.09	37.65	30.13	35.23	42.41	35.64	37.1	31.6
1994	72.24	69.43	123.6	111.4	51.78	52.9	27.48	34.96	31.6	36.94	40.01	33.46
1995	51	113.9	94.29	130.5	74.85	60.23	40.05	38.47	43.87	31.79	38.83	37.89
1996	53.88	34.75	32.64	76.31	73.63	42.15	37.6	39.42	34.89	42.29	58	64.22
1997	45.48	41.11	69.71	84.5	101	54.38	49.24	43.94	40.8	41.93	37.86	57.89
1998	61.49	44.63	56.54	67.28	52.74	48.56	73.07	68.21	50.46	102.4	105.3	64.23
1999	61.09	57.81	87.72	216.4	53.84	49.6	46.77	43.28	31.5	36.28	35.46	66.07
2000	47.56	64.28	125.9	300.4	67.07	43.9	39.84	39.19	40	36.27	44.11	31.28
2001	51.08	57.89	70	70.5	39.72	41.07	57.15	51.09	48.9	47.46	47.17	41.58
2002	47	237.2	93.38	62.58	47.59	43.3	33.67	26.03	33.39	47.35	62.33	38.7
2003	52.13	40.99	50.8	104.7	45.97	37.38	28.4	26.83	21.77	26.71	44.48	39.78
2004	42.399	42	92.834	73.198	67.194	43.761	34.585	55.106	48.811	39.44	52.24	79.582
2005	47	47	82.375	188.575	178.342	55	44.171	42.44	52.806	40.517	38.795	50.589
2006	51.188	45.093	114.692	205.642	74.622	69.53	44.055	48.083	32.073	33.393	30.031	31.459
2007	30.8	192.863	93.521	44.223	31.773	28.421	27.428	26.234	26.915	30.67	31.348	50.59
2008	44.737	64.771	77.925	110.688	54.807	35.654	36.938	50.688	33.208	34.134	32.049	68.278

2009	54.365	78.308	78.125	55.548	26.773	44.474	29.79	22.997	22.859	25.551	51.397	35.438
2010	67.07	65.04	103.771	134.55	91.813	200.396	62.09	45.07	64.613	47.298	45.15	272.196
2011	162.808	76.041	60.667	51.833	34.832	25.99	33.533	39.929	26.776	24.734	21.688	24
2012	39.169	29.937	72.462	106.642	37.089	37.363	33.882	23.592	20.658	20.453	36.525	38.813
2013	39.121	99.071	154.246	181.529	47.018	51.194	23.094	22.219	21.969	23.875	26.875	29.265
2014	38.135	35.703	41.335	42.961	38.014	28.392	30.944	32.995	29.595	29.429	33.697	28.834
2015	33.884	76.539	59.5	54.374	36.91	29.373	22.28	15.267	13.331	14.258	19.833	39.143
Minimum	18.48	21.47	30.98	42.961	26.773	25.99	22.28	15.267	13.331	14.258	19.62	15.02

Discharge data - maximum monthly values from gauging station Bodrog - Streda nad Bodrogom

	1	2	3	4	5	6	7	8	9	10	11	12
1985	240.6	208.7	601.1	531.2	450.7	259.6	311.8	225.2	154.1	73.9	209.5	396.2
1986	605.6	416.5	340.9	340.6	170.2	110.5	107.3	57.12	49.09	41.43	29.59	22.75
1987	34.48	188.2	482	613.8	277.3	176.7	61.54	72.33	90.73	59.32	140.1	172.1
1988	232	353	563.9	450	114.9	116.7	74.93	88.81	233	98.18	41.84	120.1
1989	71.62	476.1	625.3	246.5	752.9	281	103.4	96.87	81.43	54.96	70.66	206.7
1990	159.5	156.8	143.5	165.3	192	154.4	223.4	46.68	99.89	172.4	159.7	230.1
1991	251.9	101.1	168.7	178.1	142.7	107.5	47.24	81.71	59.82	112.1	134.9	51.4
1992	83.01	126.8	366.8	364	105.8	218.5	49.07	42.52	93.58	274.1	586.1	148.1
1993	124.6	50.44	394.7	365.2	84.02	54.82	113.1	49.43	94.85	53.01	98.18	318.7
1994	175	163	267.9	394	182.6	186	51.75	47.97	69.46	203	160.9	173.4
1995	264.5	403.5	436.9	359.6	379.2	151.4	151.7	55.44	162.9	75.86	203	258.3
1996	239.4	55.68	133.5	184.7	158.9	101.1	61.4	126.2	164.8	172.3	141.5	160.4
1997	63	313.5	347.3	148.7	205.7	126	325.4	217	63.44	107.2	151.5	190
1998	228.9	233.7	188.7	504.9	251.8	128.9	310.8	278.4	176.5	438.9	629	99.23
1999	259.4	79	798.8	463.6	292.9	111.4	133.1	100.3	53.81	54.71	135.8	201.3
2000	83.21	268.8	491.9	879.9	265	67.87	146.5	136.7	64.77	45.77	80.83	268.5
2001	273.5	266.4	569.6	357.6	82.62	207.5	355.3	327.3	150.5	90.89	296.3	89.91
2002	253.6	347.6	318.2	98.1	66.97	100.4	66.4	83.08	76.21	158.3	176.9	97.95
2003	111.5	68.33	262.7	269.9	118.1	52.57	38.79	34.18	39.84	113.9	148.3	87.25
2004	94.215	178.017	535.612	367.225	189.25	71.475	292.896	310.833	116.463	152.917	222.967	239.725
2005	167.012	243.95	400.558	462.833	647.95	263.05	124.808	202.137	130.813	124.646	54.521	255.683
2006	301.583	201.163	768.583	826.221	193.471	439.675	127.075	113.821	139.671	41.095	132.05	54.097
2007	437.813	483.813	291.988	89.146	68.48	77.358	61.146	33.046	144.138	66.044	162.279	246.25
2008	225.613	184.933	298.321	311.633	181.113	79.098	402.179	350.392	77.437	140.338	110.179	296.383

2009	355.417	269.721	233.217	223.454	53.37	112.903	98.843	78.714	46.835	159.479	232.683	422.7
2010	399.65	403.633	437.538	272.838	549.183	676.929	242.604	239.358	160.975	108.125	246.517	671.608
2011	338.75	144.633	274.025	125.046	58.105	42.85	163.117	192.154	52.454	41.795	28.78	235.154
2012	133.558	81.025	307.783	223.442	107.542	256.208	74.708	59.621	40.418	76.889	155.85	123.438
2013	261.146	270.825	342.708	511.567	160.479	204.387	69.393	30.431	44.618	43.538	175.571	75.991
2014	150.246	197.679	142.996	88.469	265.554	59.91	81.685	138.283	68.563	217.529	57.623	107.188
2015	243.308	269.413	199.758	152.479	173.442	119	31.789	22.308	25.378	61.63	160.971	98.469
Maximum	605.6	483.813	798.8	879.9	752.9	676.929	402.179	350.392	233	438.9	629	671.608

Discharge data on mean yearly values, minimum and maximum, mean monthly (interannual) values- Chop UA			
Year	yearly		
	average	max	min
1986	33.0	311.0	3.9
1987	30.0	330.0	4.9
1988	39.7	246.0	5.5
1989	37.3	325.0	7.0
1990	23.2	77.8	5.2
1991	21.8	76.4	5.2
1992	32.8	455.0	3.2
1993	25.4	242.0	5.5
1994	33.4	114.0	5.3
1995	42.6	257.0	6.2
1996	26.8	112.0	7.7
1997	30.4	158.0	8.6
1998	65.3	472.0	11.8
1999	46.0	386.0	8.0
2000	41.7	341.0	6.5
2001	43.8	540.0	7.9
2002	36.4	193.0	5.0
2003	23.4	112.0	3.8
2004	36.7	213.0	7.0
2005	39.1	270.0	5.7
2006	38.4	382.0	6.2
2007	31.4	211.0	3.7
2008	36.6	144.0	7.6
2009	32.3	232.0	5.5
2010	60.9	412.0	10.4
2011	27.3	175.0	4.1
2012	22.7	119.0	4.4
2013	32.4	186.0	3.9
2014	18.4	69.2	5.7
2015	16.9	66.5	3.0
avg	34.2	240.9	5.9
max	65.3	540.0	11.8
min	16.9	66.5	3.0

Mean monthly (interannual) values Chop UA												
	1	2	3	4	5	6	7	8	9	10	11	12
1986	95.6	44.3	66.6	80.1	24.7	21.6	19.0	12.6	8.9	9.6	7.6	5.4
1987	8.0	41.8	44.9	111.0	32.0	36.0	10.0	10.3	10.2	9.1	23.6	23.7
1988	34.3	76.2	91.5	89.8	31.4	31.2	18.1	14.5	33.5	17.9	8.1	29.4
1989	15.3	41.0	77.3	47.8	114.0	38.0	16.5	19.1	18.1	11.3	13.7	35.1
1990	19.6	39.2	35.0	26.1	19.1	13.5	20.2	6.8	14.6	13.6	35.2	35.2
1991	38.9	14.1	36.0	29.3	27.5	25.3	8.9	9.9	8.6	25.1	29.6	8.9
1992	12.6	22.6	50.3	58.4	13.3	12.1	8.0	4.4	7.8	39.8	121.0	43.8
1993	20.8	10.7	52.5	59.2	16.6	11.4	14.2	8.5	19.4	9.1	13.2	69.5
1994	53.3	46.2	67.4	77.5	32.9	24.0	8.2	7.2	11.2	18.1	27.7	27.6
1995	45.0	90.0	84.4	69.7	62.9	29.0	19.9	8.2	15.2	12.4	31.5	42.4
1996	42.0	11.4	27.0	40.9	33.9	11.3	12.6	21.4	27.6	24.8	29.8	38.6
1997	12.8	33.4	52.5	34.6	51.5	36.6	30.3	20.8	12.7	19.5	22.2	38.2
1998	54.6	27.4	42.7	90.2	34.0	35.2	99.3	87.2	35.6	98.5	142.0	37.1
1999	60.4	24.2	173.0	97.4	39.4	17.4	20.9	18.4	10.4	12.8	23.5	54.2
2000	21.2	82.0	118.0	163.0	22.3	10.5	14.8	12.4	11.3	7.5	9.9	27.0
2001	39.4	57.0	168.0	40.1	13.6	18.9	43.5	32.1	29.0	16.1	54.1	13.4
2002	28.8	123.0	88.0	25.6	16.7	19.5	10.1	9.5	10.9	36.0	50.4	18.2
2003	32.8	14.1	62.1	58.2	21.2	7.6	6.2	4.4	5.5	23.1	28.3	17.5
2004	27.6	41.1	98.1	47.7	37.7	15.4	13.1	23.2	16.0	27.8	44.2	48.0
2005	35.5	25.3	76.5	96.9	114.0	31.5	13.4	20.6	13.3	9.8	8.1	24.8
2006	41.2	26.5	88.2	138.0	28.9	46.2	11.0	18.6	17.3	8.7	22.8	12.9
2007	76.1	98.5	62.6	17.5	13.8	9.4	7.4	5.5	15.4	10.9	23.8	35.5
2008	22.3	27.3	79.1	72.8	27.0	14.7	43.7	48.2	13.8	14.8	14.4	61.1
2009	49.9	51.9	50.4	40.3	11.6	24.0	21.7	9.8	6.0	24.1	42.4	54.9
2010	71.3	50.1	60.9	54.7	87.5	107.0	28.9	22.3	25.9	17.9	45.7	159.0
2011	81.2	30.3	43.2	26.1	12.9	8.2	27.7	30.5	7.7	6.6	5.1	48.0
2012	28.0	14.6	65.5	45.3	22.8	33.4	10.8	5.6	5.4	7.7	19.3	25.9
2013	35.2	67.2	84.2	109.0	20.4	22.1	8.0	4.7	5.7	5.1	18.2	9.3
2014	19.2	42.6	27.5	18.0	21.5	9.3	11.3	21.4	9.0	19.2	9.6	12.6
2015	28.0	27.0	26.0	31.4	19.4	11.5	6.0	3.8	4.2	6.8	19.6	19.7
avr	38.4	43.4	70.0	63.2	34.2	24.4	19.5	17.4	14.3	18.8	31.5	35.9
min	8.0	10.7	26.0	17.5	11.6	7.6	6.0	3.8	4.2	5.1	5.1	5.4
max	95.6	123.0	173.0	163.0	114.0	107.0	99.3	87.2	35.6	98.5	142.0	159.0
ova polja su sračunata kao u sheet-u Vilok												

Discharge data on mean yearly values, minimum and maximum, mean monthly (interannual) values- Vilok (UA)			
Year	Yearly		
	average	max	min
1986	190.0	2050.0	36.2
1987	156.0	1240.0	37.9
1988	193.0	1270.0	32.2
1989	202.0	1980.0	58.2
1990	144.0	883.0	32.4
1991	138.0	1280.0	40.3
1992	206.0	2110.0	31.6
1993	180.0	2730.0	56.8
1994	194.0	1450.0	32.5
1995	284.0	2390.0	35.0
1996	155.0	876.0	42.3
1997	193.0	1250.0	74.2
1998	329.0	3150.0	62.3
1999	241.0	1410.0	60.0
2000	196.0	2240.0	26.3
2001	246.0	3580.0	69.2
2002	216.0	1490.0	44.8
2003	118.0	709.0	22.2
2004	208.0	1380.0	40.5
2005	183.0	1270.0	42.8
2006	231.0	1900.0	40.2
2007	220.0	1590.0	46.5
2008	248.0	2070.0	48.0
2009	164.0	1620.0	29.0
2010	262.0	2100.0	75.0
2011	142.0	854.0	25.0
2012	136.0	806.0	26.0
2013	172.0	1240.0	33.5
2014	108.0	464.0	42.7
2015	139.0	1710.0	23.4
Average	193.1	1636.4	42.2

Mean monthly (interannual) values Vilok (UA)												
	1	2	3	4	5	6	7	8	9	10	11	12
1986	281.0	114.0	347.0	697.0	197.0	135.0	138.0	124.0	86.5	63.5	55.4	45.0
1987	72.0	203.0	165.0	415.0	212.0	226.0	73.5	111.0	74.5	62.3	136.0	127.0
1988	178.0	218.0	332.0	492.0	268.0	214.0	136.0	86.1	172.0	69.7	38.7	116.0
1989	62.2	187.0	286.0	368.0	362.0	159.0	117.0	167.0	149.0	76.1	125.0	365.0
1990	118.0	151.0	229.0	192.0	153.0	157.0	103.0	44.5	86.3	86.1	256.0	156.0
1991	151.0	93.1	126.0	145.0	275.0	163.0	83.2	97.7	69.5	221.0	169.0	61.4
1992	54.1	78.9	226.0	457.0	186.0	92.1	65.9	41.2	98.5	351.0	624.0	199.0
1993	121.0	74.8	190.0	313.0	173.0	108.0	145.0	81.7	283.0	78.9	118.0	479.0
1994	176.0	176.0	410.0	440.0	349.0	219.0	68.9	41.6	60.0	131.0	109.0	146.0
1995	277.0	356.0	431.0	473.0	501.0	236.0	150.0	63.8	112.0	82.3	313.0	407.0
1996	176.0	56.8	111.0	242.0	230.0	76.6	75.0	72.1	276.0	162.0	150.0	230.0
1997	131.0	177.0	178.0	198.0	458.0	304.0	174.0	109.0	132.0	163.0	121.0	168.0
1998	179.0	133.0	219.0	588.0	259.0	400.0	543.0	147.0	194.0	461.0	693.0	128.0
1999	186.0	128.0	532.0	642.0	428.0	234.0	123.0	115.0	94.0	88.7	130.0	197.0
2000	60.1	171.0	467.0	810.0	180.0	83.5	157.0	73.2	59.9	33.1	47.6	207.0
2001	176.0	244.0	806.0	236.0	139.0	255.0	279.0	127.0	246.0	106.0	252.0	86.9
2002	165.0	402.0	474.0	258.0	214.0	131.0	79.8	96.6	118.0	278.0	288.0	91.2
2003	135.0	75.0	151.0	243.0	176.0	47.7	79.0	48.4	26.3	151.0	204.0	80.9
2004	101.0	183.0	436.0	402.0	248.0	113.0	87.9	144.0	115.0	157.0	234.0	277.0
2005	130.0	95.8	307.0	558.0	358.0	146.0	117.0	188.0	88.7	64.6	48.5	92.5
2006	100.0	89.4	393.0	705.0	336.0	412.0	122.0	165.0	139.0	60.9	167.0	84.3
2007	463.0	400.0	363.0	183.0	251.0	132.0	163.0	69.9	183.0	92.8	162.0	172.0
2008	107.0	133.0	495.0	488.0	331.0	179.0	436.0	194.0	100.0	131.0	104.0	280.0
2009	166.0	157.0	199.0	351.0	101.0	198.0	117.0	56.5	37.0	143.0	205.0	240.0
2010	266.0	182.0	218.0	241.0	366.0	289.0	306.0	165.0	165.0	122.0	223.0	597.0
2011	256.0	111.0	194.0	219.0	137.0	82.4	194.0	165.0	53.7	40.1	30.6	219.0
2012	107.0	36.5	236.0	396.0	190.0	271.0	72.4	45.4	36.4	46.9	108.0	83.7
2013	100.0	171.0	398.0	582.0	193.0	208.0	68.1	42.7	78.0	55.4	119.0	54.7
2014	132.0	168.0	146.0	118.0	101.0	60.9	95.9	106.0	69.8	140.0	63.0	98.4
2015	162.0	106.0	180.0	258.0	262.0	113.0	63.5	37.6	43.1	51.5	232.0	158.0
avg	159.6	162.4	308.2	390.3	254.5	181.5	147.8	100.9	114.9	125.7	184.2	188.2
min	54.1	36.5	111.0	118.0	101.0	47.7	63.5	37.6	26.3	33.1	30.6	45.0
max	463.0	402.0	806.0	810.0	501.0	412.0	543.0	194.0	283.0	461.0	693.0	597.0

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