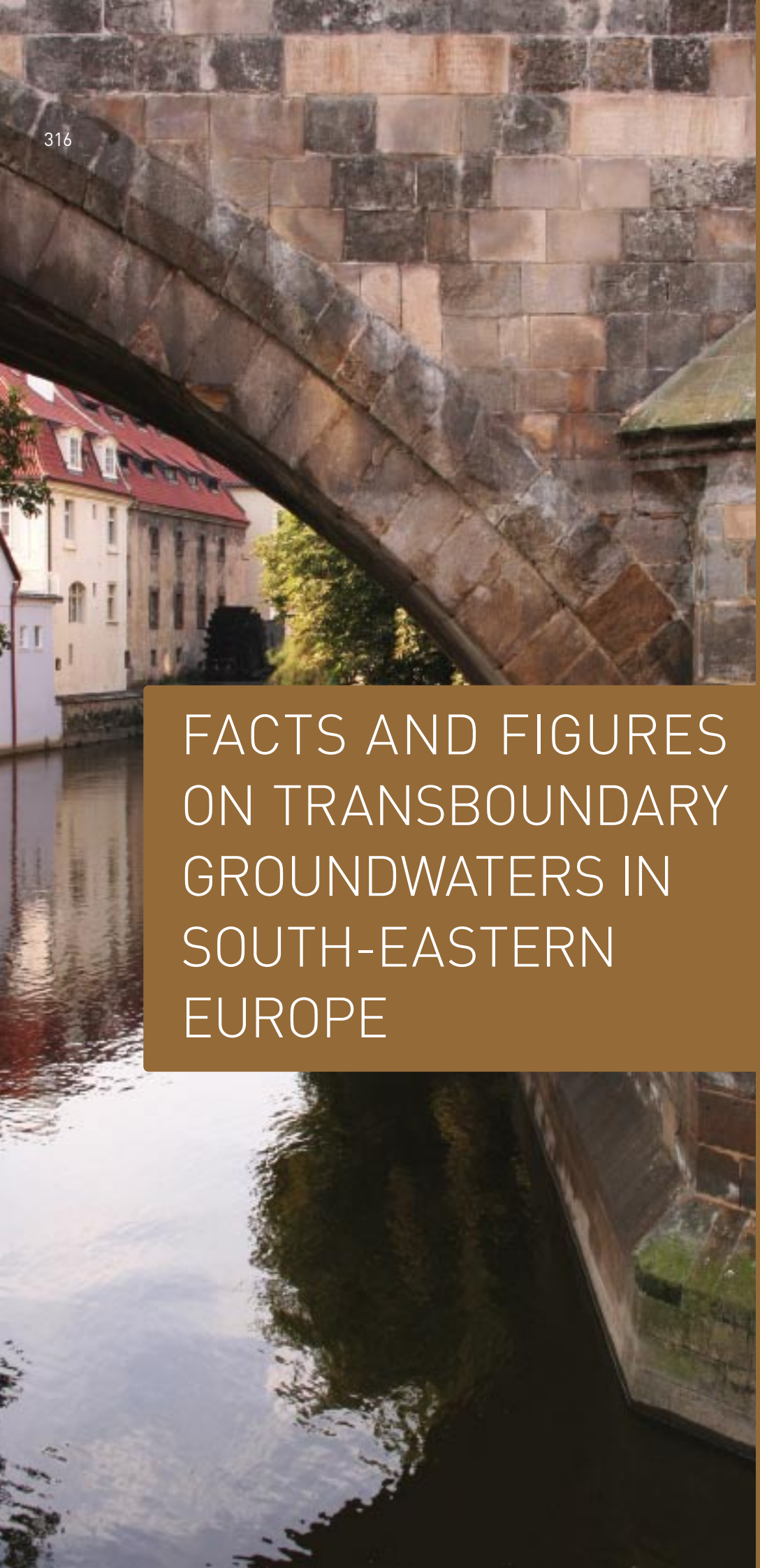

FACTS AND FIGURES ON TRANSBOUNDARY GROUNDWATERS IN SOUTH-EASTERN EUROPE

No. 1 Groundwater: Secovlje-Dragonja/Istra[1]	Shared by: Slovenia and Croatia
Type 5, Predominantly limestones of Cretaceous age, weak to medium links to surface waters Groundwater flows from both Slovenia to Croatia and Slovenia to Croatia. Part of the Istra system, in the valley of the Dragonja River	Mediterranean Sea Basin Border length (km): 21?

	Slovenia	Croatia
Area (km²)	20	99
Water uses and functions	Provides part of regional drinking water supply for the town of Piran	Drinking water supply
Pressure factors	Tourism and transport	Communities
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	Pollution from urbanisation and traffic	Local bacteriological pollution
Transboundary impacts	None	None
Groundwater management measures	Pumping station has been disconnected from water supply system	Existing protection zones
Status and what is most needed	Delineation and enforcement of drinking water protection zones	Agreed delineation of transboundary groundwater systems and development of monitoring programmes
Future trends and prospects		
GWB[2] identification	GWS ID 50811	HR 502
Notes		Transboundary groundwater under consideration but not approved

No. 2 Groundwater: Mirna/Istra[3]	Shared by: Slovenia and Croatia
Type 5, Cretaceous karstic limestones, weak to medium links to surface water systems, groundwater flow from Slovenia to Croatia Part of the Istra system	Mediterranean Sea basin Border length (km): 26?

	Slovenia	Croatia
Area (km²)	...	214
Water uses and functions	Local drinking water supply	Drinking water supply
Pressure factors	Sparsely populated	No data
Problems related to groundwater quantity	-	None
Problems related to groundwater quality	-	-
Transboundary impacts	-	-
Groundwater management measures	-	Existing protection zones
Trends and future prospects	-	
GWB	Not identified	HR 507, HR 516
Status and what is most needed		Agreed delineation of transboundary groundwater systems and development of monitoring programmes
Notes	Not clear which groundwater systems in both countries correspond to each other; delineation of transboundary groundwaters by common research and bilateral expert agreement decision is needed	Transboundary groundwater under consideration, but not approved

[1] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.
[2] EU Water Framework Directive, Regulation 2: Identification of Groundwater Bodies.
[3] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 5 Groundwater: Cerknica/Kupa[4]		Shared by: Slovenia and Croatia
Type 5, Triassic and Cretaceous limestones and dolomites with some alluvium in the river valley, weak to medium links to surface water systems, groundwater flow from Croatia to Slovenia and Slovenia to Croatia		Black Sea basin Border length (km): 32
	Slovenia	Croatia
Area (km^2)	238	137
Water uses and functions	Local drinking water supply, first karst spring of the Ljubljanica River (a karstic river with 7 surface and 6 underground stretches)	Drinking water supply
Pressure factors	None, sparsely populated, forested with some extensive agriculture and pasture	None, very scattered population
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	None, good chemical status	Occasional bacteriological pollution
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	None	Existing protection zones
Trends and prospects		
GWB identification	GWS ID 11823	HR 343 and HR 344
Status and what is most needed	Not at risk. It is unclear which groundwater systems in the two countries correspond to each other; delineation of transboundary groundwaters needs common research and bilateral decision to propose a transboundary groundwater, if appropriate	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	In the basin of the Kolpa/Kupa River, within that of the Sava River	Transboundary aquifer under consideration, but not approved

[4] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 6 Groundwater: Radovica-Metlika/Zumberak[5]		Shared by: Slovenia and Croatia
Type 5, Triassic dolomites, weak to medium links with surface water systems, groundwater flow from Croatia to Slovenia		Black Sea basin
		Border length (km): 12?
	Slovenia	Croatia
Area (km^2)	27	158
Water uses and functions	Drinking water supply to the town of Metlika (captured source Metliski Obrh)	Dominantly drinking water supply
Pressure factors	Agricultural activities	None
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	Excessive pesticide content	None
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	None	Need to establish protection zones
Trends and future prospects		
GWB identification	GWS ID 22931	HR 265
Status and what is most needed	It is unclear which groundwater systems in the two countries correspond to each other; delineation of transboundary groundwater systems needs common research and bilateral expert group decision to propose a transboundary groundwater, if appropriate	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes		Transboundary aquifer under consideration, but not approved

[5] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 7 Groundwater: Bregana-Obrezje/Sava-Samobor[6]		Shared by: Slovenia and Croatia
Type 5, Quaternary alluvial sands and gravels, 5-10 m thick, strong link to surface waters of the Sava River, groundwater flow from Slovenia to Croatia		Black Sea Basin
		Border length (km): 7
	Slovenia	Croatia
Area (km^2)	4	54
Water uses and functions	Local drinking water supply	Dominantly drinking water, and some industry
Pressure factors	Surface water hydro-electric power schemes and associated river regulation on the Sava, transport routes	Agriculture, population, extraction of river gravel and river regulation
Problems related to groundwater quantity	None	Changes in groundwater level detected
Problems related to groundwater quality	None, chemical status good	Hydrocarbons - oils and occasionally nitrogen, iron and manganese
Transboundary impacts	None	From hydropower plants and extraction of gravel
Groundwater management measures	None	Existing protection zones
Trends and future prospects		
GWB identification	GWS ID 12417	HR 188 and HR 187
Status and what is most needed	It is unclear which groundwater systems in the two countries correspond to each other; delineation of transboundary groundwater systems needs common research and bilateral expert group decision to propose a transboundary groundwater, if appropriate	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Very small part in Slovenia Within the Sava River Basin	Transboundary aquifer under consideration, but not approved

[6] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 8 Groundwater: Bizeljsko/Sutla[7]		Shared by: Slovenia and Croatia
Type 5, Triassic dolomites, weak links to surface water systems, groundwater flow from Croatia to Slovenia		Black Sea Basin
		Border length (km): 4?
	Slovenia	Croatia
Area (km^2)	180	12
Water uses and functions	Drinking water	Local drinking water supply
Pressure factors	None	None
Problems related to groundwater quantity	None	Local lowering of groundwater levels detected
Problems related to groundwater quality	None, good chemical status	No data
Transboundary impacts	None	Indications that water supply abstraction for Pod etrtek impacts on groundwater levels
Groundwater management measures	None	Existing protection zones
Future trends and prospects		
GWB identification	GWS ID 12415	HR 073 and HR 078
Status and what is most needed	It is unclear which groundwater systems in the two countries correspond to each other; delineation of transboundary groundwater systems needs common research and bilateral expert group decision to propose a transboundary groundwater, if appropriate	Need for coordination between areas on both sides - agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Area uncertain – possibly only part of the Bizeljsko groundwater system is relevant	Transboundary aquifer under consideration, but not approved

[7] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 9 Groundwater: Ormoz-Sredisce ob Dravi/Drava-Varazdin[8]		Shared by: Slovenia and Croatia
Type 5, Quaternary sands and gravels, average thickness 5-10 m, strong links to surface water systems groundwater flow from Slovenia to Croatia		Black Sea basin Border length (km): 26?
	Slovenia	Croatia
Area (km²)	27	768
Water uses and functions	Drinking water supply	Drinking water supply
Pressure factors	Agriculture, hydropower schemes, Drava river regulation	Agriculture and population of local communities
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	None, good chemical status	Nitrate concentrations above the drinking water standard in the first shallow aquifer, in the second, deeper aquifer, the water is of good quality
Transboundary impacts	None	None
Groundwater management measures	None	Existing protection zones
Future trends and prospects		
GWB identification	GWS ID 32716	HR 037 and HR 038
Status and what is most needed	-	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Within the Drava basin, tributary of the Danube	Transboundary aquifer under consideration, but not approved

No. 10 Groundwater: Dolinsko-Ravensko/Mura[9]		Shared by: Slovenia and Croatia
Quaternary alluvial sands and gravel, groundwater hydraulically corresponding to surface water systems of the Mura River and in strong connection; groundwater flow from Slovenia to Croatia and from Croatia to Slovenia? Within the Sava River Basin.		Black Sea Basin Border length (km):
	Slovenia	Croatia
Area (km²)	449	-
Water uses and functions	Drinking water supply of town Murska Sobota, local water supply systems	-
Pressure factors	Intensive agriculture; pan European transport corridor	-
Problems related to groundwater quantity	Degradation of the Mura River due to river regulation and hydropower schemes	-
Problems related to groundwater quality	Nitrate, pesticides	-
Transboundary impacts	None	-
Groundwater management measures	None	-
Future trends and prospects		
GWB identification	GWS ID 42813	None
Status and what is needed	At risk Delineation of transboundary groundwater systems needs common research and bilateral expert group decision to propose a transboundary groundwater, if appropriate	-
Notes:	Probably only part of the Dolinsko-Ravensko groundwater system is relevant	According to existing data, no transboundary groundwater is recognised

[8] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.
[9] Based on information provided by the Environment Agency of Slovenia and Croatian Waters.

No. 11 Groundwater: Mura[10]	Shared by: Hungary and Croatia	
Type 3/4, Quaternary alluvial aquifer of sands and silts, with gravels along the river, generally only 5-10 m thick but up to maximum of 30 m in Hungary and 150 m in Croatia, strong links to surface waters of the Mura River, groundwater flow towards the river. Groundwater provides 90% of total water supply in the Croatian part and >80% in Hungary		Black Sea Basin Border length (km): 52
	Hungary	Croatia
Area (km^2)	300	
Water uses and functions	>75% drinking water, <25% each for industry, irrigation and livestock, maintaining baseflow and support of ecosystems	Local water supply
Pressure factors	Agriculture and settlements (fertilisers, pesticides, sewage, traffic), groundwater abstraction	No data
Problems related to groundwater quantity	Local and moderate (at settlements) increased pumping lifts, reduced yields and baseflow, degradation of ecosystems	No data
Problems related to groundwater quality	Local but severe nitrate from agriculture, sewers and septic tanks at up to 200 mg/l, pesticides at up to 0.1 µg/l	No data
Transboundary impacts	None	
Groundwater management measures	Groundwater abstraction management used and effective, transboundary institutions, monitoring, public awareness, protection zones, treatment need improvement, vulnerability mapping, regional flow modelling, good agricultural practices and priorities for waste water treatment, integration with river basin management need to be introduced	-
GWB identification	HU_P.3.1.1	-
Status and what is most needed	Evaluation of the utilisable resource	
Future trends and prospects	Exporting drinking water	-
Notes	(Total groundwater body is 1933 km^2)	Transboundary aquifer under consideration, but not approved

[10] Based on information provided by the Geological Institute of Hungary and Croatian Waters.

No. 12 Groundwater: Drava/Drava West[11]		Shared by: Hungary and Croatia
Type 3/4, Quaternary alluvial aquifer of sands and gravels, of average thickness 10 m and maximum 70 m in Hungary, 300 m in Croatia, medium to strong links to surface waters, groundwater flow from Hungary to Croatia, but mainly towards the border river.		Black Sea Basin Border length (km): 31
	Hungary	Croatia
Area (km^2)	262	97
Water uses and functions	>75% drinking water, <25% each for irrigation, industry and livestock	Local drinking water supply
Pressure factors	Agriculture (fertilisers and pesticides), sewage from settlements, traffic, gravel extraction under water in open pits	Extraction of sand and gravel under water in pits
Problems related to groundwater quantity	Local increases in pumping lifts, reduction of borehole yields and baseflow and degradation of ecosystems	Changes in groundwater levels detected
Problems related to groundwater quality	Widespread but moderate nitrate at up to 200 mg/l from agriculture, sewers and septic tanks, pesticides at up to 0.1 µg/l	No data
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Groundwater abstraction management used and effective, transboundary institutions, monitoring, protection zones need improvement, vulnerability mapping, regional flow modelling, good agricultural practices and priorities for wastewater treatment, integration into river basin management, protection of open pit areas need to introduced	None
Future trends and prospects	Evaluation of the utilisable resource	
GWB identification	HU_P.3.2.2	HR 039
Status and what is most needed	Exporting drinking water	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Within the Drava catchment	Transboundary aquifer under consideration, but not approved

[11] Based on information provided by the Geological Institute of Hungary and Croatian Waters.

No. 13 Groundwater: Baranja/Drava East[12]		Shared by: Hungary and Croatia
Type 4, Pleistocene and Holocene fluvial sands and gravels average thickness of 50 – 100 m and up to 200 m, weak to medium links to surface water systems, groundwater flow from Hungary to Croatia Groundwater provides 90% of total supply in the Croatian part and >80% in the Hungarian part		Black Sea Basin Border length (km): 67
	Hungary	Croatia
Area (km^2)	607	955
Water uses and functions	>75% drinking water, >25% each for irrigation, industry and livestock, maintaining baseflow and spring flow	Drinking water supply
Pressure factors	Agriculture (fertilisers and pesticides), sewers and septic tanks, traffic	None
Problems related to groundwater quantity	Local and moderate increases in pumping lifts, reductions in borehole yields and baseflow	None
Problems related to groundwater quality	Widespread but moderate nitrate at up to 200 mg/l, local and moderate pesticides at up to 0.1 µg/l, widespread but moderate arsenic at up to 50 µg/l	Naturally-occurring iron
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Control of groundwater abstraction by regulation used and effective, transboundary institutions, water use efficiency, monitoring, public awareness, protection zones, effluent treatment and data exchange need improvement, vulnerability mapping, regional flow modelling, better agricultural practices, priorities for wastewater treatment, integration with river basin management and arsenic removal need to be applied	Need to establish protection zones
Future trends and prospects	Evaluation of the utilisable resource, status of groundwater quality	
GWB identification	HU_P.3.3.2	HR 042 and HR 043
Status and what is most needed	Joint monitoring (mainly quantitative) and joint modelling is needed	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	In the Drava catchment, Danube basin	Transboundary aquifer under consideration, but not approved

[12] Based on information provided by the Geological Institute of Hungary and Croatian Waters.

No. 14 Groundwater: South Western Backa/Dunav[13]		Shared by: Serbia and Croatia
Type 3, Eopleistocene alluvial aquifer of mainly medium and coarse grained sands and some gravels, of average thickness 20 m and up to 45 m, partly confined with medium links to surface water systems. Groundwater is about 70% of total water use in the Serbian part.		Black Sea Basin Border length (km):
	Serbia	Croatia
Area (km^2)	2672	-
Water uses and functions	50-75% drinking water, <25% each for irrigation, industry and livestock	-
Pressure factors	Abstraction	-
Problems related to groundwater quantity	Local increase in pumping lifts and reduction in borehole yields	-
Problems related to groundwater quality	Widespread naturally-occurring arsenic at 10-80 µg/l. Local ammonium and pathogens from sanitation	No data, but probably naturally-occurring iron
Transboundary impacts	None for quantity or quality	-
Groundwater management measures	Existing quantity and quality monitoring need to be improved, other management measures needed	-
GWB identification	CS_DU2	
Status and what is most needed	Current status is reported as poor, possible quantitative risk, no qualitative risk	
Notes	Part of the Pannonian Basin, within the Danube basin	According to existing data, no transboundary groundwater is recognised
Future trends and prospects		

[13] Based on information provided by the Directorate for Water and Jaroslav Cerni Institute, Serbia, and Croatian Waters.

No. 15 Groundwater: Srem-West Srem/Sava[14]		Shared by: Serbia and Croatia
Type 3, Sequence of Pontian, Paludine and Eopleistocene sands, gravely sands and gravels of the Danube valley, of average thickness 80-150 m and up to 250-400 m, upper, shallow unconfined part has medium to strong links to surface water system, deeper parts confined or semi-confined by silts and clays, groundwater flow from Serbia to Croatia and also parallel to the river in a S and SW direction within each country. Groundwater provides about 70% of total supply in the Serbian part		Black Sea Basin Border length (km):
	Serbia	Croatia
Area (km^2)	627	
Water uses and functions	50-75% drinking water, <25% each for irrigation, industry and livestock	-
Pressure factors	Groundwater abstraction, agriculture, industry	-
Problems related to groundwater quantity	Local and severe increased pumping lifts and reduction of borehole yields	-
Problems related to groundwater quality	Local, moderate nitrate and pesticides from irrigated agriculture, heavy metals, organics and hydrocarbons from industry, naturally occurring iron and manganese	Naturally-occurring iron
Transboundary impacts	None for quantity or quality	-
Groundwater management measures	Existing quantity and quality monitoring need to be improved, as do abstraction control, protection zones and wastewater treatment, other management measures not yet used but needed	-
Trends and future prospects		
Status and what is most needed	Possible qualitative risk, no quantitative risk	-
Notes		According to existing data, no transboundary groundwater is recognised

[14] Based on information provided by the Directorate of Water, Serbia, University of Belgrade and Croatian Waters.

No. 16 Groundwater: Posavina I/Sava[15]		Shared by: Bosnia and Herzegovina and Croatia
Type 4, Quaternary alluvial sands, gravels, clays and marls averaging around 100 m thick in Croatia, 5-10 m in Bosnia and Herzegovina, weak to medium links to surface water systems, groundwater flow generally from south to north Groundwater is 100% of total water use in the Bosnian part		Black Sea Basin Border length (km): 85
	Bosnia and Herzegovina	Croatia
Area (km²)	250	396
Water uses and functions	Dominantly drinking water, smaller amounts (<25% each) for industry and livestock	Drinking water supply
Pressure factors	Wastewater, industry and agriculture	Agriculture
Problems related to groundwater quantity	None	None
Problems related to groundwater quality	Naturally occurring iron at 1-4 mg/l in the upper aquifer (15 to 60 m)	Naturally-occurring iron and manganese
Transboundary impacts	None	No data
Groundwater management measures	Sava Commission. Abstraction management, quantity and quality monitoring, protection zones and agricultural measures are used but need improvement, water use efficiency and wastewater treatment are needed or planned	Existing protection zones
Future trends and prospects		
GWB identification	TBGWB 14 - BA_SAVA_3	HR 243 and HR 244
Status and what is most needed		
Notes	In lower aquifer (depth 90 to 115 m), naturally-occurring iron is <0.7 mg/l	Transboundary aquifer under consideration, but not approved

No. 17 Groundwater: Kupa[16]		Shared by: Bosnia and Herzegovina and Croatia
Type 5, Triassic and Cretaceous karstic limestones and dolomites, strong links to surface water systems, groundwater flow from …… to …..		Black Sea Basin Border length (km): 130
	Bosnia and Herzegovina	Croatia
Area (km²)	…	452
Water uses and functions	No data	Dominantly drinking water
Pressure factors	No data	No data
Problems related to groundwater quantity	No data	No data
Problems related to groundwater quality	No data	No data
Transboundary impacts	N/A	N/A
Groundwater management measures	_	Need to establish protection zones
Future trends and prospects		
GWB identification		HR 361
Status and what is most needed	_	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Possible transboundary aquifer should be considered	Transboundary aquifer under consideration, but not approved

[15] Based on information provided by the Directorate of Waters and Institute of Geological Research, Republic Srpska, Bosnia and Herzegovina and Croatian Waters.
[16] Based on information provided by Croatian Waters.

No. 18 Groundwater: Pleševica/Una[17]	Shared by: Bosnia and Herzegovina and Croatia	
Type 5, Thick Palaeolithic, Mesozoic and Cenozoic limestones and dolomites, average thickness 200 m and maximum 500 m, in hydraulic contact with overlying alluvial sediments, strong links with surface waters, flow from Croatia to Bosnia and Herzegovina towards the Una River.		Black Sea Basin Border length (km): 130
	Bosnia and Herzegovina	Croatia
Area (km^2)	108	1592
Water uses and functions	>75% to support ecosystems and fishing, 25-50% of abstraction is for drinking water supply	Dominantly drinking water supply
Pressure factors	Solid waste disposal	Communities
Problems related to groundwater quantity	Polluted water locally drawn into the aquifer	None
Problems related to groundwater quality	Local but severe nitrogen, heavy metalsand pathogens	-
Transboundary impacts	Yes, for quality only	Sinkholes in Bosnia and Herzegovina with transboundary effects in Croatia
Groundwater management measures	Many used but need improving, others needed or currently planned	Protection zones exist at Klokot, Privilica, Toplica, Ostrovica and need to be established Koreni_ki Izvor, Stipinovac and Mlinac
Future trends and prospects		-
GWB identification	BA_UNA_2	HR 359 and HR 360
Status and what is most needed		Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes	Una River is a tributary of the Sava within the Danube basin	Transboundary aquifer under consideration, but not approved.

[17] Based on information provided by the Public Enterprise for the Sava Catchment Area, Bosnia and Herzegovina, and Croatian Waters.

No. 19 Groundwater: Krka[18]		Shared by: Bosnia and Herzegovina and Croatia
Type 5, Cretaceous karstic limestone, strong links to surface water system, groundwater flow from Bosnia and Herzegovina to Croatia		Mediterranean Sea Basin
		Border length (km): 42
	Bosnia and Herzegovina	Croatia
Area (km²)	85	414
Water uses and functions	>95% to support ecosystems, <5% of abstraction is for drinking water supply	Drinking water supply
Pressure factors	Solid waste disposal	Population in communities and industry
Problems related to groundwater quantity	Reduced springflow and ecosystem degradation	None
Problems related to groundwater quality	Polluted water locally drawn into the aquifer	-
Transboundary impacts	No data (possibly for quality only)	Sinkholes in Bosnia and Herzegovina with transboundary effects in Croatia
Groundwater management measures	Quantity and quality monitoring need to be improved, as do abstraction control, protection zones and wastewater treatment	Need to establish protection zones
Future trends and prospects		
GWB identification		HR 546, HR 547 and HR 548
Status and what is most needed	Not at risk	Agreed delineation of transboundary groundwaters, and monitoring
Notes		Transboundary aquifer under consideration, but not approved

[18] Based on information provided by the Public Enterprise for the Sava Catchment Area, Bosnia and Herzegovina, and Croatian Waters.

No. 20 Groundwater: Cetina[19]		Shared by: Bosnia and Herzegovina and Croatia
Type 5, Palaeolithic, Mesozoic and Cenozoic karstic limestones of average thickness 500 m and maximum 1000 m, in hydraulic connection with recent sediments, groundwater flow from Bosnia and Herzegovina to Croatia towards the Cetina River, strong links to surface water system		Mediterranean Sea Basin Border length (km): 70
	Bosnia and Herzegovina	Croatia
Area (km^2)	2650	587
Water uses and functions	Up to 50% for hydroelectric power, smaller amounts for drinking water, irrigation, industry, mining and livestock, also support of ecosystems and maintaining baseflow and springs	Drinking water supply
Pressure factors	Solid waste disposal, wastewater, agriculture, industry	None
Problems related to groundwater quantity	Widespread but moderate degradation of ecosystems, and polluted water drawn into the aquifer	None
Problems related to groundwater quality	Local and moderate nitrogen, pesticides, heavy metals, pathogens, organics, hydrocarbons	-
Transboundary impacts	None for quantity or quality	Sinkholes in Bosnia and Herzegovina with transboundary effects in Croatia
Groundwater management measures	Quantity and quality monitoring need to be improved, as do abstraction control and protection zones	Existing protection zones used, but needed at Vukovi_a Vrelo
Future trends and prospects		
GWB identification		HR 558
Status and what is most needed	Need to improve protection of upper catchment, vulnerability mapping planned, and improved wastewater treatment needed	Agreed delineation of transboundary groundwaters, and development of monitoring programmes
Notes:		Transboundary aquifer under consideration, but not approved. Includes the Glamo_ko-Kupreško and other Poljes with very large springs Intensive agriculture in the coastal delta region

[19] Based on information provided by the Public Enterprise for the Adriatic Sea Catchment Area of Bosnia and Herzegovina and Croatian Waters.

No. 21 Groundwater: Neretva Right[20]		Shared by: Bosnia and Herzegovina and Croatia
Type 5, Cretaceous and Neogene layered and massive limestones and dolomites, marls, clays, sandstones, breccias and conglomerates average thickness 250-600 m and up to 600-1000 m, strong link to surface waters, groundwater flow from Bosnia and Herzegovina to Croatia		Mediterranean Sea basin Border length (km): ...
	Bosnia and Herzegovina	Croatia
Area (km^2)	>1600	862
Water uses and functions	Dominantly drinking water supply and hydroelectric power, some irrigation	Drinking water supply
Pressure factors	Agriculture, sanitation, waste disposal and industry	None
Problems related to groundwater quantity	Widespread but moderate drawing of polluted water into the aquifer, reduced springflow and ecosystem degradation	None
Problems related to groundwater quality	Nitrogen, pathogens and organic compounds, widely but moderate	Occasionally local and moderate pathogens – microbiological pollution
Transboundary impacts	Possibly for quality	Improved connection with sink points in Bosnia and Herzegovina and wells and springs in Croatia
Groundwater management measures	Groundwater quantity monitoring used but needs improvement, as do protection zones and wastewater treatment	Existing protection zones for the Opa_ac and Prud spring systems
Future trends and prospects		Increased road construction and urbanisation in the Neretva delta, which needs protection of its wetlands, lakes and wildlife
GWB identification		HR 565, 566, 567, 569, 598, 573, 574
Status and what is most needed	Need to improve protection of upper catchment, vulnerability mapping planned	Agreed delineation of transboundary groundwaters and development of monitoring programmes are needed
Notes		Transboundary aquifer under consideration, but not approved

[20] Based on information provided by the Public Enterprise for the Adriatic Sea Catchment Area of Bosnia and Herzegovina and Croatian Waters.

No. 22 Groundwater: Trebisnjica/Neretva Left [21]		Shared by: Bosnia and Herzegovina and Croatia
Type 5, Triassic, Jurassic, Cretaceous layered and massive limestones, with local Eocyne flysch of marls, clays with coals, sandstones, breccias and conglomerates, total average thickness 1000 m and maximum 2500 to 3000 m, groundwater flow from Bosnia and Herzegovina to Croatia, medium to strong links to surface water systems. Groundwater is 100% of total water use in Bosnia and Herzegovina,		Mediterranean Sea Basin Border length (km): 124
	Bosnia and Herzegovina	Croatia
Area (km^2)	>2000	242
Water uses and functions	50-75% for hydroelectric power, <25% for drinking water supply and irrigation, also to support ecosystems	Dominantly drinking water supply – Slano and the Ombla spring
Major pressure factors	Agriculture, sanitation, waste disposal	None
Problems related to groundwater quantity	Widespread but moderate drawing of polluted water into the aquifer, reduced springflow and ecosystem degradation	None
Problems related to groundwater quality	Nitrogen and pathogens and heavy metals from thermal power generation, widely but moderately, some local, moderate pesticides from agriculture	Natural saline intrusion and occasionally microbiologic pollution
Transboundary impacts	Decline of groundwater levels and increased groundwater pollution	Improved connection with sink points in Bosnia and Herzegovina and wells and springs in Croatia
Groundwater management measures	Transboundary agreements and data exchange used, but need improvement, monitoring is needed	Need to establish protection zones
Trends and future prospects		Increased development pressures on the Neretva delta
GWB identification		HR 576, 576a, 577, 578, 580, 581, 585, 586
Status and what is most needed	Need to improve protection of upper catchment, vulnerability mapping planned, and improved wastewater treatment needed. Evaluation of the utilisable resource	Agreed delineation of transboundary groundwaters and development of monitoring programmes are needed
Notes		Transboundary aquifer under consideration, but not approved Supplies Dubrovnik

[21] Based on information provided by the Public Enterprise for the Adriatic Sea Catchment Area of Bosnia and Herzegovina, the Directorate of Water and Institute of Geological Research, Republic Srpska, Bosnia and Herzegovina, and Croatian Waters.

No. 23 Groundwater: Bileko Lake[22]	Shared by: Bosnia and Herzegovina and Montenegro
Type 5, Triassic, Jurassic and Cretaceous limestones and dolomites up to 3000 m thick, weakly linked to surface waters, groundwater flow from Montenegro to Bosnia and Herzegovina. Groundwater provides 100% of total water usage in Bosnia and Herzegovina	Mediterranean Sea Basin Border length (km): 90

	Bosnia and Herzegovina	Montenegro
Area (km²)	>1000	...
Water uses and functions	>75% for hydroelectric power, small amounts for drinking water and irrigation	No information
Pressure factors	None	-
Problems related to groundwater quantity	Local, moderate degradation of ecosystems	-
Problems related to groundwater quality	None mentioned	-
Transboundary impacts	None for quantity or quality	-
Groundwater management measures	Existing groundwater quality monitoring needs improvement, other measures need to be applied	-
Trends and future prospects		
Notes		
Status and what is most needed		

No. 24 Groundwater: Dinaric Littoral (west coast)[23]	Shared by: Montenegro and Croatia
Type 2, Jurassic and Cretaceous karstic limestones, average thickness 500 m and maximum greater than 1000 m, weakly connected to surface water systems. Groundwater provides 100% of total water use in the Montenegran part	Mediterranean Sea basin Border length (km):

	Montenegro	Croatia
Area (km²)	200	-
Water uses and functions	25-50% each for drinking water supply and industry, <25% each for irrigation and livestock	-
Pressure factors	Abstraction of groundwater	-
Problems related to groundwater quantity	Widespread and severe saline intrusion at the coast	-
Problems related to groundwater quality	High salinity from the above	-
Transboundary impacts	None for quantity or quality	-
Groundwater management measures	Existing control of abstraction, efficiency of water use, groundwater monitoring, public awareness, protection zones and agricultural practices need to be improved, other measures need to be introduced	-
Future trends and prospects		-
Status and what is most needed		-
Notes		According to existing data, no transboundary groundwater is recognised

[22] Based on information provided by the Directorate of Water and Institute of Geological Research, Republic Srpska, Bosnia and Herzegovina,- and Croatian Waters.
[23] Based on information provided by the National Committee of the International Association of Hydrogeologists of Serbia and Montenegro and Croatian Waters.

No. 25 Groundwater: Shkodra/Skadar Lake, Dinaric east coast[24]		Shared by: Albania and Montenegro
Type 2, Jurassic, Cretaceous and lesser Palaeogene massive and stratified limestones and dolomites, average thickness of 150 to 500 m and maximum 300 - 1000 m, alluvial fans along the lake up to 80-100 m thick, strong links to surface water systems, groundwater flow in both directions Groundwater is 100% of total water use in Montenegro, 80-90% in Albania		Mediterranean drainage basin Border length (km): 35 (excluding the lake border)
	Montenegro	Albania
Area (km^2)	200	About 450
Water uses and functions	25-50% for drinking water supply, <25% each for irrigation, industry and livestock	50-75% for irrigation, <25% for drinking water supply, industry and livestock, also maintaining baseflow and support for ecosystems
Pressure factors	Groundwater abstraction	Industry, waste disposal, sanitation and sewer leakage
Problems related to groundwater quantity	Widespread and severe sea water intrusion at the coast	Widespread but moderate degradation of ecosystems around Shkodra Lake
Problems related to groundwater quality	Widespread and severe increased salinity	Local and moderate pathogens from waste disposal, sanitation and sewer leakage, local and moderate heavy metals from industry
Transboundary impacts	None for quality or quantity	Shkodra Lake is moderately polluted mainly by industrial wastewater and less by sewage effluents
Groundwater management measures	Abstraction management, efficient water use, monitoring, protection zones and good agricultural practices used but need improving, wastewater treatment needed	Detailed hydrogeological and groundwater vulnerability mapping, monitoring of groundwater quantity and quality (particularly the large karst springs and those used for public water supply), public awareness campaigns, delineation of protection zones and wastewater treatment are all needed. Investigation of the relationships between karst groundwater and groundwater of the alluvial deposits with Shkodra Lake
Future prospects and trends		The realization of large planned engineering projects in this area could deeply influence surface and groundwaters.
Status and what is most needed		No significant risk at the moment, but the area around the Shkodra Lake is developing rapidly. Long term measures to protect surface and groundwater are needed
Notes	National park and Ramsar site. See also lakes assessment	To increase collaboration, to build transboundary institutions and to create joint programmes for protecting karst and alluvial groundwater, as well as protecting Shkodra Lake and the surrounding wetlands. Improvement of village water supply is needed (and irrigation too)

[24] Based on information provided by the National Committee of the International Association of Hydrogeologists of Serbia and Montenegro and by ITA Consult, Albania.

No. 26 Groundwater: Beli Drim/Drini Bardhe[25]		Shared by: Serbia and Albania
Type 3, Lower and Upper Cretaceous karstic and dolomitised limestone, Miocene to Quaternary multilayer sequence 100 to 200 m thick, medium to strong links to surface waters, groundwater flow from Serbia to Albania Groundwater is 30 % of total water use in the Serbian part and 60-70% in the Albanian		Mediterranean Sea Basin Border length (km): 30
	Serbia	Albania
Area (km^2)	1000	170
Water uses and functions	25-50% for irrigation, <25% for drinking water and industry, and maintain baseflow	75% for irrigation, <25% each for drinking water and livestock, and maintain baseflow
Pressure factors	Abstraction of groundwater	Waste disposal, sanitation, sewer leakage
Problems related to groundwater quantity	None	No problems
Problems related to groundwater quality	Nitrogen, pesticides and pathogens	Local and moderate pathogens
Transboundary impacts	None for quantity or quality	None for quantity or quality
Groundwater management measures	Numerous management measures mentioned as needed	Monitoring of groundwater quantity and quality (particularly the big karst springs and those used for public water supply), public awareness campaigns, delineation of protection zones and wastewater treatment are needed, together with detailed hydrogeological and vulnerability mapping
Future trends and prospects		Better evaluation of the quantity and quality of groundwater
Status and what is most needed	No status assessment	Not at risk, the population is small and at the moment the industry is not developed
Notes	Water level decline of 0.3 m/yr reported, but do not affect neighbouring Drini Bardhe as they are not in direct hydraulic connection	

[25] Based on information provided by the Directorate of Water and the Jaroslav Cerni Institute, Serbia, and National Committee of the International Association of Hydrogeologists of Serbia and Montenegro, and ITA Consult, Albania.

No. 27 Groundwater: Metohija[26]	Shared by: Serbia and Montenegro
Type 4, Tertiary (Miocene) alluvial sediments, average thickness 100 m and maximum 200 m, weak links to surface water systems. In Montenegro, Type 1, Triassic karstic limestones with thickness 300 to 800 m, weak links to surface water systems. Groundwater is 20% of total water use	Basin……. Border length (km):

	Serbia	Montenegro
Area (km^2)	1000	300-400
Water uses and functions	25-50% for irrigation, <25% each for drinking water, industry and livestock, maintaining baseflow and spring flow	>25% for drinking water, <25% each for irrigation, mining and industry
Pressure factors	Agriculture and local small industries	None
Problems related to groundwater quantity	None mentioned	None reported
Problems related to groundwater quality	Pesticides and industrial organic compounds	None reported
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Several mentioned as needed	Several mentioned as needed
Future trends and prospects		
Status and what is most needed	No status assessment	
Notes		

No. 28 Groundwater: Pester[27]	Shared by: Serbia and Montenegro
Type 2, Middle Triassic karstic limestones, mean thickness 350 m and up to 1000 m thick, weak links to surface water systems, dominant groundwater flow is towards the south west. Groundwater provides 80% of total water use	Mediterranean Sea Basin Border length (km):

	Serbia	Montenegro
Area (km^2)	407	>150
Water uses and functions	>75% for drinking water, <25% each for industry and livestock, support of ecosystems and maintaining baseflow	<25% for drinking water, livestock and mining
Pressure factors	Domestic wastewater	Domestic wastewater
Problems related to groundwater quantity	None reported	None reported
Problems related to groundwater quality	None reported	None reported
Transboundary impacts	None	None
Groundwater management measures	None reported as being in use, a whole range of measures mentioned as needing to be applied, including monitoring of quantity and quality	Monitoring of groundwater quantity and quality need to be applied and exchange of data, as well as vulnerability mapping for land use planning
GWB identification	CS_LI3	
Status and what is most needed	No systematic monitoring data for status assessment; good status according to limited data	
Trends and future prospects		
Notes		

[26] Based on information provided by the Directorate of Water, and the Jaroslav Cerni Institute, Serbia, and the National Committee of the International Association of Hydrogeologists of Serbia and Montenegro.
[27] Based on information provided by the Directorate of Water, Serbia and the National Committee of the International Association of Hydrogeologists of Serbia, and Montenegro.

No. 29 Groundwater: Lim [28]		Shared by: Serbia and Montenegro
Type 1, Triassic-Cretaceous karstic limestone with overlying Quaternary alluvium of average thickness 200 m and maximum 400 m, medium connection to surface water, groundwater flow relatively equally shared in both. Groundwater is 40% of total water use in the Serbian part		Black Sea Basin Border length (km):
	Serbia	Montenegro
Area (km^2)	600-800	...
Water uses and functions	25-50% for drinking water, <25% each for irrigation, mining and thermal spas, and hydroelectric power at Potpec	<25% for irrigation
Pressure factors	Waste disposal, mining and industry	Waste disposal, agriculture and industry
Problems related to groundwater quantity	None mentioned	None reported
Problems related to groundwater quality	Local but severe nitrogen, heavy metals, pathogens, industrial organics and hydrocarbons from waste disposal, mining and industry	Pollutants from industry
Transboundary impacts	None for quantity, yes for quality due to pollution from Lim River in the upper catchment	
Groundwater management measures	Abstraction management and protection zones used but need to be improved, other measures needed	Abstraction management, protection zones and vulnerability mapping for land use planning need to be applied, together with monitoring of groundwater quantity and quality
Future trends and prospects		
Status and what is most needed	According to limited data, the current status is most probably good, but systematic monitoring of the quantitative and chemical status should be established	
Notes		

[28] Based on information provided by the Directorate of Water, Serbia and the Department of Hydrogeology, University of Belgrade.

No. 30 Groundwater: Tara Massif [29]		Shared by: Serbia and Bosnia and Herzegovina
Type 3, Triassic and Jurassic karstified limestones of 250-300 m average thickness and maximum 600 m, strong links to surface water systems, groundwater flow from Serbia to Bosnia and Herzegovina. Groundwater is 10% of total water use		Black Sea Basin Border length (km): 117?
	Serbia	Bosnia and Herzegovina
Area (km^2)	211	>100
Water uses and functions	Drinking water and fish breeding	Drinking water, mostly small amounts for supplying villages
Pressure factors	Sanitation and septic tank leakage	Wastewater, mining activity
Problems related to groundwater quantity	Local and severe degradation of ecosystems, local but moderate drawing of polluted water into the aquifer	Local moderate drawing of polluted water into the aquifer
Problems related to groundwater quality	Pathogens	Bacteriological contamination
Transboundary impacts	None for quantity or quality	None for quantity or quality
Groundwater management measures	Groundwater abstraction management and quantity monitoring need improvement, other management measures need to be introduced or are currently planned	Protection zones needed for some significant but as yet unused karst springs
Future trends and prospects		
Status and what is most needed	According to limited data, the current status is most probably good	
Notes	Negligible conditions for nomination as a transboundary groundwater	Negligible conditions for nomination as a transboundary groundwater

[29] Based on information provided by the Directorate of Water, Serbia, the Department of Hydrogeology, University of Belgrade, the Directorate of Water and Institute of Geological Research, Republic Srpska, Bosnia and Herzegovina, and the Public Enterprise for the Black Sea Basin.

No. 31 Groundwater: Macva-Semberija[30]	Shared by: Serbia and Bosnia and Herzegovina
Type 3/4, Lower Pleistocene alluvial sands, sandy gravels with clayey lenses, of 35-60 m average thickness and maximum 75-100 m, overlying multiple aquifer sequence, including karstified Triassic limestones, total thickness of sequence could be 300 m average and 1000 m maximum, strong links to surface water systems, dominant flow from southwest to northeast towards the Drina River and to the Sava, but see note below. Groundwater is 40-60% of total water use in the Serbian part, and 100% in the Bosnian part	Black Sea basin Border length (km): 87?

	Serbia	Bosnia and Herzegovina
Area (km^2)	967	250
Water uses and functions	50-75% drinking water, <25% each for irrigation, industry and livestock, and support of ecosystems	Drinking water, irrigation, industry and livestock
Pressure factors	Agriculture and sanitation, some industry	Agriculture and sanitation
Problems related to groundwater quantity	Local and moderate increase in pumping lifts, no declines in groundwater levels	Local and moderate increase in pumping lifts, no significant declines in groundwater levels
Problems related to groundwater quality	Local and moderate nitrogen and pesticides from agriculture, local and moderate heavy metals and organics from industry, natural Fe and Mn in alluvium	Local and moderate nitrogen and pesticides from agriculture
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Abstraction control, monitoring of groundwater, protection zones and wastewater treatment need improvement, other management measures need to be introduced or are currently planned	Sava Commission, groundwater abstraction regulation and quantity monitoring, protection zones, and good agricultural practices used and effective, water use efficiency, public awareness, wastewater treatment need to be applied
GWB identification	CS_DR 1	TBGWB 28 – BA_DR_5
Future trends and prospects		
Status and what is most needed	Possibly at chemical risk, not at quantitative risk	
Notes	Drina River forms the boundary, within the Sava river basin. Information refers to the alluvial aquifer	Component of inflow from Drina River to groundwater is suggested Information refers to the alluvial aquifer

[30] Based on information provided by the Directorate of Water, Serbia, the Department of Hydrogeology, University of Belgrade, and the Directorate of Waters and Institute of Geological Research, Republic Srpska, Bosnia and Herzegovina.

No. 32 Groundwater: Northeast Backa/Danube-Tisza Interfluve[31]	Shared by: Serbia and Hungary
Type 5, Part of North Pannonian basin, Miocene and Eopleistocene alluvial sediments, partly confined, predominantly sands with clayey lenses of average thickness 50-100 m and maximum 125-150 m in Serbia, average 250 m and maximum 700 m in Hungary, medium to strong links to surface waters, groundwater flow from Hungary to Serbia. Groundwater is 80% of total use and provides 100% of drinking water supply in Vojvodina, Serbia, >80% of total supply in the Hungarian part	Black Sea Basin Border length (km): 169

	Serbia	Hungary
Area (km^2)	4020	9545
Water uses and functions	>75% drinking water, <25% each for irrigation, industry and livestock	>75% drinking water, <25% each for irrigation, industry and livestock, support of ecosystems
Pressure factors	Abstraction of groundwater	Abstraction, agriculture, sewers and septic tanks
Problems related to groundwater quantity	Local and severe increased pumping lifts and reduction in borehole yields, local and moderate land subsidence	Local and moderate increased pumping lifts, reduced borehole yields and baseflow, and degradation of ecosystems
Problems related to groundwater quality	Widespread and severe naturally occurring arsenic at 10-50 µg/l, widespread but moderate nitrogen and pathogens from sanitation, organic compounds, natural iron	Widespread and severe naturally occurring arsenic at 10-200 µg/l, widespread but moderate nitrate at up to 200 mg/l, pesticides at up to 0.1 µg/l
Transboundary impacts	Insufficient information to know, or possibly for quantity	None
Groundwater management measures	Abstraction management used, water efficiency, existing monitoring, protection zones, agricultural practices need to be improved, other measures need to be introduced	Groundwater abstraction regulation used and effective, water use efficiency, monitoring, public awareness, protection zones and wastewater treatment and exchange of data need improvement, vulnerability mapping, regional flow modelling, good agricultural practices and priorities for wastewater treatment, integration with river basin management, arsenic treatment or import of arsenic free water are needed
GWB identification	CS_DU1	HU_P.1.15.1, HU_P.15.2, HU_P.1.16.1, HU_P.2.11.1, HU_P.2.11.2
Future trends and prospects	Possibility for use of groundwater from Danube alluvium as substitution for groundwater from deeper aquifers	Evaluation of the utilisable resource
Status and what is most needed	Current status is reported as poor, possible quantitative risk, no quality risk. Need for improved groundwater monitoring. Bilateral cooperation concerning groundwater is in an inception phase	Joint monitoring (mainly quantitative) and joint modelling is needed
Notes	Groundwater abstraction in both countries exceeds recharge, local declines in groundwater level of 0.5 m/yr, and 0.1 my/r more widely	Importation of arsenic-free drinking water is reported as planned

[31] Based on information provided by the Directorate of Water and the Jaroslav Cerni Institute, Serbia and the IAH National Committee of Serbia, and Montenegro, and the Geological Institute of Hungary.

No. 33 Aquifer: North and South Banat [32]	Shared by: Serbia and Romania
Type 4 or 5, Thick (up to 2000 m) alluvial aquifer of sands and gravels of Tertiary to Pleistocene age in a deep tectonic depression, forming a confined aquifer sequence with weak links to surface water systems, groundwater flow from Romania to Serbia, with Quaternary lacustrine and alluvial sediments above. Groundwater is up to 90% of total water use in the Serbian part, with all drinking water supply from groundwater	Black Sea Basin Border length (km): 225

	Romania	Serbia
Area (km^2)	11408	4231 (N) + 4325 (S)
Water uses and functions	50% drinking water, 30% for industry and 20% for irrigation	>75% drinking water, >10% each for irrigation, industry, livestock and spa, also support of ecosystems
Pressure factors	None mentioned	Sanitation, irrigated agriculture, waste disposal, industry, oilfields
Problems related to groundwater quantity	Local and moderate increases in pumping lifts	Local, severe increase in pumping lifts and decrease of borehole yields, and declining groundwater levels of 0.5 m/yr locally (Kikinda). Some degradation of ecosystems
Problems related to groundwater quality	None mentioned	Local, moderate, nitrogen, pesticides & pathogens, more widespread heavy metals, and organic pollutants. Widespread high natural arsenic concentrations (10-80 µg/l), Fe and Mn
Transboundary impacts	Reported as none for quantity and quality	Yes, declining groundwater levels and quality
Groundwater management measures	None reported as already in use, a wide range of measures are currently planned	Monitoring of quantity and quality needs improvement, a wide range of other measures need to be introduced or are planned
GWB identification	RO_BA18	CS_TS1 (N) and CS_DU3 (S)
Status and what is most needed	Good status, Not at risk for quality or quantity	Current status is reported as poor for North Banat and good for South Banat Not at risk for quality and possibly at risk for quantity (North part)
Future trends and prospects		
Notes	Part of Pannonian Basin. Very important aquifer, provides 100% of drinking water supplies in Vojvodina	Separate groundwater bodies in Serbia as North is in Tisza catchment and South in Danube. Very important aquifer – provides 100% of drinking water supplies in Vojvodina

[32] Based on information provided by the Directorate of Water, the Jaroslav Cerni Institute and the Department of Hydrogeology, University of Belgrade, Serbia, and the National Institute of Hydrology and Water Management of Romania.

No. 34 Aquifer: Stara Planina/Salasha Montana[33]		Shared by: Serbia and Bulgaria
Type 2, Triassic and Cretaceous karstic limestones with some overlying Quaternary alluvium, average thickness 100 – 200 m and maximum 400 m, medium links to surface water systems, groundwater flow from north east to south west, from Bulgaria to Serbia Groundwater is about 50% of total water use		Black Sea Basin Border length (km):
	Serbia	Bulgaria
Area (km^2)	785	87? + 203? + 28?
Water uses and functions	25-50% drinking water, <25% each for irrigation, industry, thermal spa and livestock, also supports ecosystems	-
Pressure factors	Waste disposal and industry, agriculture	-
Problems related to groundwater quantity	Local and moderate reduction in baseflow and degradation of ecosystems, with polluted water drawn into aquifer	-
Problems related to groundwater quality	Local and moderate nitrogen and pathogens from waste disposal and farming, more severe heavy metals from industry and organic pollutants from waste disposal	-
Transboundary impacts	Not for quantity or quality	-
Groundwater management measures	Abstraction management, protection zones and treatment of industrial effluents need improvement, other measures need to be introduced or are currently planned	-
GWB identification	? + CS_NI4	BG063, BG082 and BG131
Trends and future prospects		
Status and what is most needed	According to limited data the current status is most probably good, there is need for quantity and quality monitoring	-
Notes	Includes the Vidlic/Nishava and Tran	The Salasha Montana and Nishava karst basins are part of the West Balkan Nature Park which may become an agreed transboundary park

[33] Based on information provided by the Directorate of Water, Serbia, and the Department of Hydrogeology, University of Belgrade.

No. 35 Groundwater: Korab/Bistra - Stogovo[34]		Shared by: Albania and The former Yugoslav Republic of Macedonia
Type 1 Mesozoic and Paleozoic schists and flysch sediments, containing Triassic evaporites (anhydrite and gypsum) and Triassic and Jurassic karstic limestones. Minor alluvial sediments with free (unconfined) groundwater, mean aquifer thickness from 500 to 700 m, maximum more than 2000 m, weak links to surface waters, groundwater flow occurs in both directions, but more from The former Yugoslav Republic of Macedonia to Albania Groundwater provides >90% of total supply in Albania and The former Yugoslav Republic of Macedonia		Mediterranean Sea basin Border length (km): 25
	Albania	The former Yugoslav Republic of Macedonia
Area (km^2)	About 140	...
Water uses and functions	25-50% for thermal spa, < 25% each for drinking, irrigation and livestock	Drinking water, irrigation, mining
Pressure factors	Waste disposal, sanitation and sewer leakage	Groundwater abstraction, agriculture
Problems related to groundwater quantity	Local and moderate degradation of ecosystems and drawing of polluted water into the aquifer	Local reduction of discharge from springs
Problems related to groundwater quality	Local and moderate pathogens from waste disposal, sanitation and sewer leakage	None for quality
Transboundary impacts	None for quality and quantity	Only for quantity
Groundwater management measures	Detailed hydrogeological mapping and vulnerability mapping, public awareness campaigns, delineation of protection zones and wastewater treatment are all needed. To increase the collaboration, to build up transboundary institutions and to create a joint programme for quantity and quality monitoring of the sulphur thermo-mineral springs issuing in both countries.	Quantity and quality monitoring need to be improved, protection zones and all water activities, transboundary agreements and data exchange used, but need improvement
Status and what is most needed	Not at risk at the moment. Intensification of use of sulphur thermo-mineral groundwater by deep boreholes	
Future trends and prospects	delineation of the protection zones of the sulphur thermo-mineral springs and to improve the capture structures.	
Notes	Comparative study of the thermo-mineral springs of Albania and The former Yugoslav Republic of Macedonia is needed. There are large fresh water karst springs issuing at high elevations	

[34] Based on information provided by ITA Consult, Albania, and the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia.

No. 36 Aquifer: Jablanica/Golobordo[35]	**Shared by: Albania and The former Yugoslav Republic of Macedonia**
Type 2, Triassic and Jurassic karstic limestones of average thickness 700 m and maximum 1500 m, weak links to surface waters, groundwater flow occurs in both directions Groundwater is 70-80% of total water use in Albania	Mediterranean Sea Basin Border length (km): 50

	Albania	The former Yugoslav Republic of Macedonia
Area (km^2)	250	...
Water uses and functions	25-50% for irrigation, <25% each for drinking water and industry, also for maintaining baseflow and springs	Drinking water supply, thermal water and industry, also hydroelectric power
Pressure factors	Modest pressures from waste disposal, sanitation and sewer leakage	Sanitation and sewer leakage
Problems related to groundwater quantity	Local and moderate polluted water drawn into aquifer	Local reduction of groundwater yields from wells and discharges from springs
Problems related to groundwater quality	Local and moderate pathogens from waste disposal, sanitation and sewer leakage	None mentioned
Transboundary impacts	None for quantity or quality	None for quantity and quality
Groundwater management measures	No management measures in place, many need to be introduced, detailed hydrogeological and vulnerability mapping, groundwater monitoring, public awareness, delineation of protection zones, wastewater treatment and exchange of data are all needed	Monitoring of quantity and quality, protection zones, hydrogeological mapping, good agricultural practices, exchange of data between countries, other measures, need to be applied or are planned
Trends and future prospects	The use of a large karst spring for the production of electricity by hydroelectric power is planned	
Status and what is most needed	Not at risk at the moment, the population is small and the industry is not developed	
Notes	Surface karst phenomena are very well developed on Klenja plateau	

[35] Based on information provided by ITA Consult, Albania, and the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia.

No. 37 Groundwater: Mourgana Mountain/Mali Gjere[36]	Shared by: Greece and Albania
Type 1 or 2, karstic aquifer developed in Triassic, Jurassic and Cretaceous limestones in large anticlines with flysch in synclines. Average thickness about 100 m and maximum about 150 m. Thickness of alluvium of the Drinos River 20-80 m. Strong links to surface water systems. Little groundwater flow across the border. The Drinos River flowing from Greece to Albania recharges the alluvial aquifer which contributes to the Bistritsa (Blue Eye) Spring (average discharge 18.5 m^3/s) in Albania. The Lista Spring (average 1.5 m^3/s) issues in Greece. Groundwater provides about 70% of total water use	Mediterranean Sea Basin Border length (km): 20

	Greece	Albania
Area (km^2)	90	440
Water uses and functions	50-75% for irrigation, 25-50% for drinking water supply, <25% for livestock, also support of ecosystems and maintaining baseflow and springs	Provides 100% of drinking water supply and spa use, and >75% for irrigation, industry and livestock
Pressure factors	Low population in mountain area, minimal pressures due to agriculture	Minor from waste disposal and sewer leakage
Problems related to groundwater quantity	Local and moderate from increased pumping lifts	Some local and moderate drawing of polluted water into the aquifer. No declines in groundwater level
Problems related to groundwater quality	None	Widespread but moderate salinisation – the alluvial groundwater has high sulphate (300 -750 mg/l), which contributes to increased average sulphate (135 mg/l) in Blue Eye Spring
Transboundary impacts	Neither for quantity or quality	None
Groundwater management measures	Existing monitoring needs to be improved, a range of other management measures are needed or planned, according to the requirements of the Water Framework Directive	No measures employed, those needed include detailed hydrogeological and groundwater vulnerability mapping, public awareness, delineation of protection zones and wastewater treatment. Also to increase collaboration, to build up transboundary institutions and to create a joint basin wide programme for quantity and quality monitoring
Trends and future prospects	Implementation of the WFD is in progress	Increased use of groundwater in alluvial deposits and export of karst water to Italy
Status and what is most needed	Groundwater management in the framework of IWRM is needed	Small risk at the moment, but with increasing tendency because the area is rapidly developing, both industrial and agricultural
Notes		According to a preliminary proposal, about 4.5 m^3/s of water from Blue Eye spring will be exported to Puglia - Italy through an undersea water supply pipeline.

[36] Based on information provided by the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece, and ITA Consult, Albania.

No. 38 Groundwater: Nemechka/Vjosa-Pogoni[37]	Shared by: Albania and Greece
Type 1, Succession of large anticlines containing karstic limestones of mainly Jurassic and Cretaceous age and synclines with formations of Palaeocene and Eocene flysch; average thickness about 2500 m, maximum more than 4000 m (Albania), 100 to 150 m (Greece), the complicated geological structures and hydrogeological conditions which bring these formations together produce large karst springs, groundwater discharges towards both countries, weak links to surface waters. Groundwater provides about 70% of total water use in the Greek part and up to 90% in the Albania part	Mediterranean Sea Basin Border length (km): 37

	Greece	Albania
Area (km^2)	370	550
Water uses and functions	25-50% irrigation, <25% each for drinking water supply and livestock, maintaining baseflow and springs and supporting ecosystems	25-50% irrigation, <25% each for drinking water, livestock and industry, maintaining baseflow and springs and supporting ecosystems
Pressure factors	Minimal due to very small population, mainly from agriculture	Minor waste disposal and sewer leakage
Problems related to groundwater quantity	Local and moderate increases of pumping lifts	Local and moderate degradation of ecosystems
Problems related to groundwater quality	Sulphate concentrations of 300-800 mg/l in many of the springs	Local and moderate pathogens from waste disposal and sewer leakage
Transboundary impacts	None for quantity or quality	None for quantity or quality
Groundwater management measures	Existing awareness raising and monitoring need improvement, other measures need to be applied or are planned according to WFD requirements	None already used, but a range of measures need to be applied, detailed hydrogeological and vulnerability mapping, groundwater monitoring, public awareness, delineation of protection zones and wastewater treatment
Trends and future prospects	Implementation of the WFD in progress	
Status and what is most needed	Groundwater management in the framework of IWRM is needed	No risk at the moment, the population is small and industry is not developed
Notes	Large spring discharges of Kalama, Gormou and Drinou	Large karst groundwater quantities (average about 8 m^3/s) discharge in the Vjosa River gorge in Albanian territory. There are also other large karst springs, the Glina sulphate spring is a well known bottled karst spring

[37] Based on information provided by the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece, and ITA Consult, Albania.

No. 39 Aquifer: Prespes and Ohrid Lakes [38] [39]		Shared by: Albania, The former Yugoslav Republic of Macedonia and Greece	
Type 5, Mainly Triassic and Jurassic and up to Middle Eocoene massive limestones and lesser dolomites, mean thickness 200 m in the Greek part and 400 m in the Albanian, and up to a maximum of 330 m (Greece) and 550 m (Albania), including Galicica mountain between the lakes, medium to strong links to surface water systems, groundwater flow dominantly from the basin of Small Prespa Lake to that of Big Prespa Lake and from there to the Ohrid lake basin. Groundwater movement is interconnected between all three countries. Groundwater provides greater than 80% of total water use in the Albanian part and less than 25% in the Greek part			Mediterranean Sea Basin Border length (km): 40 (GR/AL), 20 (GR/MK)
	Albania	The Former Yugoslav Republic of Macedonia	Greece
Area (km^2)	350	...	110
Water uses and functions	25-50% for irrigation and <25% each for drinking water, livestock and industry, also support for baseflow and ecosystems	Drinking water, industry and ecosystems	<25% for water supply and also support of ecosystems and maintaining baseflow and springs
Pressure factors	Minor sanitation and sewer leakage and sewage effluent from Pogradec	Minor sanitation	Tourism but not a major pressure yet
Problems related to groundwater quantity	Widespread but moderate degradation of ecosystems, and polluted water drawn into aquifer	Local and moderate reduction of groundwater level, yields of wells and discharges of springs	Local and moderate degradation of ecosystems
Problems related to groundwater quality	Local and moderate nitrogen and pathogens from sanitation and sewer leakage in both groundwater and lakes, but the trend is increasing. Local pesticides from agriculture	None mentioned	None significant
Transboundary impacts	A slight increase in the phosphorus in Lake Ohrid	None mentioned	None
Groundwater management measures	No management measures in place, many need to be introduced: transboundary institutions, water use efficiency, monitoring of groundwater and lakes, protection zones, vulnerability mapping, priorities for wastewater treatment, integration with Prespa and Ohrid lakes basin management	Monitoring of groundwater, must be improved with agreements, data exchange, hydrogeological databases, planned together	Monitoring of groundwater status is used, other management measures are planned or need to be improved according to the requirements of the WFD
Trends and future prospects	Increasing groundwater use by the growing population and intensive development of tourism. Increasing collaboration of all three countries to protect groundwater and surface water resources in a basin-wide way		Increasing groundwater use by the development of tourism. Increasing collaboration of all three countries to protect groundwater and surface water resources in a basin-wide way
Status and what is most needed	Small risk at the moment. Increasing risk of contamination of karst water and of the lakes in the future by the increasing population and tourism		Not at risk
Notes	Ohrid lake is intensively recharged from Prespa Lake through the Mali Thate-Galicica karst massive. Large karst springs with average discharge about 10 m^3/s issue near the Albanian- The former Yugoslav Republic of Macedonia border at the edge of Lake Ohrid	Lake Ohrid has been a World Natural Heritage Site since 1980	Groundwater management in the framework of IWRM is very important in relation, inter alia, to the protection of the ecosytems supported by Prespa Lake which is a Natura 2000 site

[38] Based on information provided by ITA Consult, Albania, the Institute of Geology and Mineral Exploration and Central Water Agency, Greece, and the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia.
[39] See also lakes assessment in Part II, Section II, Chapter 6.

No. 40 Groundwater: Pelagonia - Florina/Bitolsko[40]		Shared by: Greece and The former Yugoslav Republic of Macedonia
Type 5, Quaternary and Neogene unconfined shallow alluvial sands and gravels with some clay and silt and cobbles, with confined Pliocene gravel and sand aquifer, total thickness average 60 m and up to 100-300 m overlying Palaeozoic and Mesozoic schists, medium links to surface waters, groundwater flow from Greece to The former Yugoslav Republic of Macedonia. Groundwater is more than 50% of total use		Mediterranean Sea Basin Border length (km): 45?
	Greece	The former Yugoslav Republic of Macedonia
Area (km^2)	180	...
Water uses and functions	25-50% for irrigation, <25% each for drinking water supply, industry and livestock, also support of ecosystems	Drinking water supply, support of ecosystems and agriculture and maintaining baseflow and springs
Pressure factors	Agriculture	Groundwater abstraction
Problems related to groundwater quantity	Local and moderate reduction of borehole yields and drawing of polluted water into the aquifer	Widespread and severe increase of pumping lifts, degradation of ecosystems and drawing of polluted water into aquifer, widespread but moderate reduction of borehole yields, local but severe reduction in baseflow and spring flow
Problems related to groundwater quality	Nitrate, heavy metals	Salinization, nitrogen, pesticides, heavy metals, pathogens, industrial organic compounds and hydrocarbons
Transboundary impacts	None	None for quantity or quality
Groundwater management measures	Existing ,monitoring, vulnerability mapping for land use planning and wastewater treatment need to be improved, a range of other measures are mentioned as needed or currently planned according to WFD requirements	Increasing efficiency of groundwater use, monitoring of quantity and quality, public awareness, protection zones, vulnerability mapping, good agricultural practices, exchange of data between countries and treatment of industrial effluents need to be improved, other measures need to be applied or are planned
Trends and future prospects	Implementation of the WFD is in progress	
Status and what is most needed	Groundwater management in the framework of IWRM is neeeded	
Notes		

[40] Based on information provided by the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece, and the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia.

No. 41 Groundwater: Gevgelija/Vardar[41]		Shared by: The former Yugoslav Republic of Macedonia and Greece
Type 3 or 5, Quaternary alluvial sediments, sands with gravel, partly clayey and silty with cobbles of bedrock - diabases, biotite gneisses and schists. Average thickness of 10-30 m and maximum 60-100 m. Very shallow water table. Medium to strong link with surface water systems, groundwater flow from The former Yugoslav Republic of Macedonia to Greece and from W to E in the Greek part.		Mediterranean Sea Basin Border length (km):
	The former Yugoslav Republic of Macedonia	Greece
Area (km^2)	...	8
Water uses and functions	Maintaining baseflow and springs and support of ecosystems	>75% of abstraction is for irrigation, <25% each for drinking water supply and livestock, also support of ecosystems
Pressure factors	Abstraction of groundwater, agriculture	Agriculture
Problems related to groundwater quantity	Extensive and severe increases in pumping lifts, reduction in borehole yields, degradation of ecosystems and drawing in of polluted water, local and severe reduction of baseflow and springflow	None
Problems related to groundwater quality	Salinization of natural origins and Nitrogen, pesticides, heavy metals, pathogens, industrial organics and hydrocarbons	None
Transboundary impacts	Observed both decline of groundwater levels and increased groundwater pollution	None for quantity or quality
Groundwater management measures	Existing efficiency of groundwater use, monitoring of quantity and quality, public awareness, protection zones, vulnerability mapping, agricultural practice, data exchange and treatment need improvement, other measures need to be applied or are planned	Existing abstraction controls and monitoring need to be improved, other measures are needed or currently planned according to the requirements of the WFD
Status and what is needed		Not at risk Groundwater management in the framework of IWRM
Trends and future prospects		Implementation of the WFD is in progress
Notes		Within the Vardar River catchment

[41] Based on information provided by the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia, and the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece.

No. 42 Groundwater: Dojran Lake[42, 43]		Shared by: Greece and The former Yugoslav Republic of Macedonia
Type 3, Quaternary and Upper Eocene alluvial aquifer, lake deposits and terraces of silts, clays, sands and gravels, average thickness 150 m and up to 250 m, overlying metamorphic rocks, sedimentary sequences and carbonate formations - Precambrian, older Paleozoic and Green Metamorphic Complex. Unconfined, with strong links with surface water systems, groundwater flow is from north to south in the Nikolic area of The former Yugoslav Republic of Macedonia, north east to south west on the Greek side and generally towards the lake. The catchment of the Lake covers a total of 270 -280 km^2 Groundwater is 90% of total water use in the Greek part		Mediterranean Sea basin Border length (km)
	Greece	The former Yugoslav Republic of Macedonia
Area (km^2)	120	92
Water uses and functions	>75% for irrigation, <25% for drinking water supply and livestock, maintaining baseflow and springs and support of ecosystems	Irrigation and water supply
Pressure factors	Groundwater abstraction for irrigation	Groundwater abstraction
Problems related to groundwater quantity	Local and moderate reduction in baseflow and degradation of ecosystems, the lake volume and area has declined drastically	Declining groundwater levels, reduction of water from the lake, degradation of associated ecosystems
Problems related to groundwater quality	Low concentrations of heavy metals, but see comments on pollution in the lakes assessment	None
Transboundary impacts	Not for quantity or quality	For quantity only
Groundwater management measures	Existing data exchange, good agricultural practices and public awareness need to be improved, other management measures are needed or currently planned according to the requirements of the WFD	Existing efficiency of groundwater and lake water use, monitoring of quantity and quality of the lake, level of the lake, wells on both sides, public awareness, protection zones, vulnerability mapping, data exchange and treatment need improvement or are planned measures.
Status and what is needed	Groundwater management in the framework of IWRM is very important for protection of the available resources	
Trends and future prospects	Implementation of the WFD is in progress	
Notes	Groundwater abstraction exceeds mean annual recharge, decrease in precipitation and reduction of surface water inflows have also contributed to the decline in lake levels and area	Serious decline in lake level and area, losing 75% of volume between 1988 and 2002, groundwater abstraction to help recover lake levels has been tried

[42] Based on information provided by the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia, and the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece.
[43] See also lakes assessment in Part 2, Section II, Chapter 6.

No. 43 Aquifer: Sandansky - Petrich[44]	**Shared by: Bulgaria, Greece and The former Yugoslav Republic of Macedonia**
Type 5, Pliocence and Quaternary alluvial sands, gravels, clays and sandy clays of the Sandansky (up to 1000 m thick) and Petrich (up to 400 m) valleys, with aquifer with free level of groundwater from 10 to 100 m, thermal water is characterized from 100 to 300 m in Paleozoic rocky masses with schists and Paleozoic limestones with karst aquifers with different quantity of groundwater, flow occurs in both directions but more from The former Yugoslav Republic of Macedonia to Bulgaria and Greece	Mediterranean Sea Basin Border length (km): BG/GR - 18, BG/MK - 5

	Bulgaria	Greece	The former Yugoslav Republic of Macedonia
Area (km^2)	768	…	…
Water uses and functions	Drinking water, irrigation and industry		Drinking water, irrigation and industry, thermal springs, agriculture
Pressure factors			
Problems related to groundwater quantity			None mentioned
Problems related to groundwater quality			
Transboundary impacts			
Groundwater management measures			Protection zones need to be improved, monitoring systems, exchange of data and other measures need to be introduced
Status and what is needed			
Trends and future prospects			
Notes	Alluvium of Struma River and tributaries		

[44] Based on information from the Ministry of Environment and Physical Planning, The former Yugoslav Republic of Macedonia and the 2004 INWEB report.

No. 44 Groundwater: Orvilos-Agistros/Gotze Delchev [45]		Shared by: Greece and Bulgaria
Type 1 Karstic marble aquifer formed in the Proterozoic crystalline schist of the Rhodopi with thick marbles overlying gneiss, some Pleistocene alluvial sediments at the edges. Dominant groundwater flow from east to west (in Greece)		Mediterranean Sea Basin Border length (km): 22
	Greece	Bulgaria
Area (km^2)	96	202
Water uses and functions	<25% for each of irrigation, drinking water supply, industry, mining, thermal spa, livestock, fish production, hydropower, also maintaining baseflow and support of ecosystems	
Pressure factors	Minimal pressures from groundwater abstraction	
Problems related to groundwater quantity	None	
Problems related to groundwater quality	None	
Transboundary impacts	None	
Groundwater management measures	Monitoring of groundwater status is already used, a range of other management measures are planned or need to be improved according to WFD requirements	
GWB identification		
Status and what is needed	Not at risk Further collaboration between the two countries to protect groundwater and surface water resources in a basin-wide way	
Trends and future prospects		
Notes		Within the Mesta and Struma river catchments. Large springs (eg Petrovo)

[45] Based on information provided by the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece.

No. 45 Groundwater: Orestiada/Svilengrad-Stambolo Edirne[46]	Shared by: Greece, Bulgaria and Turkey
Type 3, Pliocene and Pleistocene lake and river alluvial sands, clayey sands, gravels, sandy clays and clays of mean thickness 120 m and maximum 170 m, overlying the metamorphic rocks of the Rhodopi Massif. Dominant groundwater flow is from Greece towards Turkey and Bulgaria. Strong links with surface water systems, with recharge from and discharge towards the rivers Ardas and Evros. Groundwater is 25% of total use	Mediterranean Sea Basin Border length (km):

	Greece	Bulgaria
Area (km^2)	450	665
Water uses and functions	>75% for irrigation and <25% for drinking water supply, also support of ecosystems	Drinking water supply, irrigation and industry
Pressure factors	Agriculture	
Problems related to groundwater quantity	Moderate problems due to abstraction for irrigation	
Problems related to groundwater quality	Recharge of the groundwater from the irrigation network of the Kiprinos Dam on the Ardas River increases the danger of pollution from nitrogen and pesticides from agriculture	
Transboundary impacts	Observed decline in groundwater levels and pollution	
Groundwater management measures	Existing groundwater abstraction regulation, monitoring of groundwater quantity and quality and effluent reuse and treatment need to be improved, a range of other measures need to be applied or are planned according to WFD requirements	
Status and what is needed		
Trends and future prospects	Collaboration of the three countries to protect groundwater and surface water resources in a basin-wide way	
Notes	Alluvial sediments of Maritza River Although groundwater abstraction is reported to greatly exceed recharge, the problems mentioned were not severe	

[46] Based on information provided by the Institute of Geology and Mineral Exploration and the Central Water Agency, Greece.

No. 46 Aquifer: Topolovgrad Massif [47]		Shared by: Bulgaria and Turkey
Type 2, Proterozoic and Paleozoic gneisses and schists, Triassic and Jurassic karstic limestones, dolomites, marbles, schists, sandstones, in a narrow synclinal structure with complicated, faulted bloc structure, medium links with surface water systems: Dominant groundwater flow direction: from W-SW to E-NE towards Turkey Proportion groundwater of total use is not known		Mediterranean Sea Basin Border length (km):
	Bulgaria	Turkey
Area (km^2)	249	
Water uses and functions	25 – 50% Drinking water supply, < 25% each for irrigation and livestock, maintaining baseflow and springs and support of ecosystems	
Pressure factors		
Problems related to groundwater quantity	None mentioned	
Problems related to groundwater quality	Nitrate in NE part	
Transboundary impacts	None for quantity or quality	
Groundwater management measures	Existing groundwater abstraction by regulation needs to be improved, several other measures mentioned as needing to be applied or currently planned, including monitoring of quality and quantity and exchange of data between countries	
GWB identification		
Status and what is needed		
Trends and future prospects		
Notes	Tundzha River in the catchment of the Meric River	

[47] Based on information provided by the Basin Directorate for the Black Sea Region, Bulgaria.

No. 47 Groundwater: Pleistocene Mure/Maros alluvial fan[48]	Shared by: Romania and Hungary
Type 4, Pleistocene and Holocene alluvial sediments, predominantly pebbles, sands and silts, weak to medium links with surface water systems, mean thickness 200 m and maximum 500 m, groundwater flow from SE (Romania) to NW (Hungary). In Romania the shallow (15-30 m) upper part is considered to be a separate aquifer (ROMU 20) than the deeper, confined part of the sequence (ROMU22). Groundwater is 80% of total use use in Hungary.	Black Sea Basin Border length (km):

	Romania	Hungary
Area (km²)	2200	4319
Water uses and functions	75% for drinking water supply, 15% for industry and 10% for irrigation (shallow), and 45%, 35% and 20% respectively for the confined aquifer	>75% drinking water, <25% each for irrigation, industry and livestock, support of agriculture and ecosystems
Pressure factors	Groundwater abstraction	Groundwater abstraction, agriculture, septic tanks
Problems related to groundwater quantity	Local and moderate increased pumping lifts and local small drawdowns only around four important catchments	Local and moderate increase in pumping lifts, reduction in yields and reduced baseflow, local but severe degradation of ecosystems
Problems related to groundwater quality	None mentioned	Widespread but moderate nitrate at up to 200 mg/l, local and moderate pesticides at up to 0.1 µg/l, widespread and severe arsenic at up to 300 µg/l
Transboundary impacts	None for quantity or quality	No
Groundwater management measures	Vulnerability mapping for land use planning needs to be applied , range of other measures currently planned	Groundwater abstraction by regulation is already used and effective, transboundary agreements, improved efficiency, monitoring, public awareness, protection zones and wastewater treatment and arsenic removal need improvement, vulnerability mapping, good agricultural practices and priorities for wastewater treatment, integration with river basin management need to be applied
GWB identification	RO_MU20 and RO_MU22	HU_P.2.13.1 and HU_P.2.13.2
Status and what is needed	Good status. Not at risk for quantity or quality	Possibly at risk for quantity and quality Evaluation of the utilisable resources, quality status, joint monitoring (mainly quantitative) and joint modelling is needed, including for estimation of the amount of transboundary groundwater flow
Notes		
Trends and future prospects		Water importation because of arsenic may be required

[48] Based on information provided by the National Institute of Hydrology and Water Management, Romania, and the Geological Institute of Hungary, supplemented by the Danube Basin Analysis (WFD Roof Report 2004).

No. 48 Aquifer: Pleistocene Some/Szamos alluvial fan[49]	Shared by: Romania and Hungary
Type 4, Holocene-Lower Pleistocene alluvial sediments of sands, clayey sands, gravels and even boulders, weak to medium links with surface water systems. In Romania, the shallow (15 -30 m) Holocene unconfined upper part (ROSO01) and the confined Lower Pleistocene (ROSO13), varying from 40 m thick in the west to 130 m are considered separate groundwater bodies. Mean thickness 180 m and maximum 470 m in the Hungarian part. Dominant groundwater flow from East (Romania). to West (Hungary). More than 80% of total water use is from groundwater in the Hungarian part.	Black Sea Basin Border length (km): 64

	Romania	Hungary
Area (km^2)	1,380	976
Water uses and functions	Upper, 40% industry, 30% each irrigation and drinking water; lower, 75% for drinking water supply and 25% for industry, minor agricultural use	>75% drinking water supply, less than 10% each for irrigation, industry and livestock, maintaining baseflow and support of ecosystems
Pressure factors	Agriculture and industry	Agriculture, sewers and septic tanks
Problems related to groundwater quantity	Local and moderate increased pumping lifts and small drawdowns only around two major wellfields near Satu-Mare	Local and moderate increases in pumping lifts, reduction in borehole yield, reduced spring flow and degradation of ecosystems
Problems related to groundwater quality	None mentioned	Widespread but moderate nitrate, up to 200 mg/l, local and moderate pesticides up to 0.1 µg/l and widespread but moderate arsenic at up to 50 µg/l
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Vulnerability mapping for land use planning needs to be applied, and a range of other measures are currently planned	Groundwater abstraction control by regulation effective, control by financial mechanisms, water use efficiency, monitoring, public awareness, protection zones, wastewater treatment, data exchange and arsenic removal all need improvement, vulnerability mapping and improved agricultural practices, integration into river basin management are needed
GWB identification	RO_SO01 and RO_SO13	HU_P.2.1.2
Status and what is needed	Good status. Not at risk for quantity or quality	Not at risk Evaluation of the utilisable resources, quality status
Notes	Considered as two separate groundwater bodies in RO, one in HU	More information is needed about groundwater inflow from Ukraine
Trends and future prospects		Joint monitoring (mainly quantitative) is needed and the existing joint modelling should be updated

[49] Based on information provided by the National Institute of Hydrology and Water Management, Romania, and the Geological Institute of Hungary, supplemented by the Danube Basin Analysis (WFD Roof Report 2004).

No. 49 Aquifer: Middle Sarmantian Pontian[50]	Shared by: Romania and Moldova
Type 4, Middle Sarmatian – Pontian sediments from the Central Moldovian Plateau, predominantly sands, sandstones and limestones, confined conditions provided by overlying clays up to 50 m thick, with weak links with surface water systems, dominant groundwater flow direction: from East (Romania) to West (Moldova)	Black Sea Basin Border length (km):

	Romania	Moldova
Area (km^2)	11,964	9,662
Water uses and functions	50% dinking water supply, 25% industry and 15% irrigation, minor spa	
Pessure factors	None mentioned	
Problems related to groundwater quantity	None mentioned	
Problems related to groundwater quality	Local, moderate to severe salinity	
Transboundary impacts	None for quantity or quality	
Groundwater management measures	Transboundary institutions already used and effective for this groundwater, other management measures need to be applied or are currently planned	
GWB identification	RO_PR05	
Status and what is needed	Good status	
Trends and future prospects		
Notes	Within the Prut and Siret river basins	

[50] Based on information provided by the National Institute of Hydrology and Water Management, Romania.

No. 50 Aquifer: Neogene-Sarmatian[51]	Shared by: Bulgaria and Romania
Type 1 or Type 4 Neogene – Sarmatian oolitic and organogenic limestones in Romania, limestones, marls and sands in Bulgaria, with some sands and clays, average thickness 80 m (Bulgaria) and 75 m (Romania) and up to 250 m or 150 m respectively, weak to medium links with surface water systems, largely unconfined groundwater, dominant groundwater flow from W-SW (Bulgaria) to E-NE (Romania) Groundwater is approximately 30% of total water use in the Bulgarian part	Black Sea Basin Border length (km): 90

	Bulgaria	Romania
Area (km^2)	4,450	2,178
Water uses and functions	25 – 50% for drinking water, < 25% each for irrigation, industry and live-stock, also maintaining baseflow and springs, support of ecosystems and agriculture	50% drinking water supply, 30% irrigation and 20% for industry
Pressure factors	Agriculture, solid waste disposal	Agriculture, some industry
Problems related to groundwater quantity	Local and moderate reduction of borehole yields	None mentioned
Problems related to groundwater quality	Local and moderate concentrations (10 – 100 mg/l) of nitrogen from agriculture	None reported
Transboundary impacts	None for quantity or quality	No
Groundwater management measures	Control of abstraction used and effective, transboundary agreements, monitoring, protection zones, vulnerability mapping, effluent treatment used but need improvement, other measures needed or currently planned	None reported as already in use, a range of measures are currently planned
GWB Identification	BG_BSGW01	RO_DL04
Status and what is needed	Possibly at risk for quality, not for quantity Improved monitoring needed	Good status, not at risk for quantity or for quality Improved monitoring needed
Notes		
Trends and future prospects		

[51] Based on information provided by the Black Sea and Danube Basin Directorates of Bulgaria and the National Institute of Hydrology and Water Management, Romania, supplemented by the Danube Basin Analysis (WFD Roof Report 2004).

No. 51 Groundwater: Upper Jurassic – Lower Cretaceous[52]		Shared by: Bulgaria and Romania
Type 4, Upper Jurassic –Lower Cretaceous karstic limestones, dolomites and dolomitic limestones, mean thickness 500 m and maximum 1000 m in Bulgaria mean 350 m and maximum 800 m in Romania, weak links with surface water systems, largely confined by overlying marls and clays, groundwater flow from NW (Bulgaria) to SE (Romania) Groundwater is about 40% of total water use in the Bulgarian part		Black Sea Basin Border length (km): 290
	Bulgaria	Romania
Area (km²)	15,476	11,427
Water uses and functions	25-50% for drinking water supply, <25% for irrigation	70 % for drinking water supply, 15% each for irrigation and industry
Pressure factors	Agriculture	None
Problems related to groundwater quantity	Local but severe increased pumping lifts	Local and moderate increased pumping lifts
Problems related to groundwater quality	Local and moderate concentrations (30 – 60 mg/l) of nitrogen species from agriculture	None mentioned
Transboundary impacts	None for quantity or quality	None
Groundwater management measures	Groundwater abstraction regulation already used and effective, transboundary institutions, monitoring of groundwater quantity and quality, protection zones, vulnerability mapping, good agricultural practices and wastewater and effluent treatment used but need improvement, exchange of data is needed	No management measures reported as being in use, a range of measures is currently planned
GWB identification	BG_DGW02	RO_DL06
Status and what is needed	Not at risk for quantity or quality based on available data Improved monitoring is needed	Good status, not at risk for quantity or quality according to available data Improved monitoring is needed
Trends and future prospects		
Notes	Connected to Srebarna Lake	Connected to Sintghiol Lake

[52] Based on information provided by the Black Sea and Danube Basin Directorates of Bulgaria and the National Institute of Hydrology and Water Management, Romania, supplemented by the Danube Basin Analysis (WFD Roof Report 2004).