

Značaj i iskustva u primeni EU Okvirne direktive za vode u R Srbiji sa posebnim osvrtom na podzemne vode

(Application of the Water Framework Directive (WFD) of European Union for sustainable utilization of groundwater resources in Serbia and West Balkan)

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Okrugli sto: Usaglašavanje CG
zakonodavstva o vodama sa EU
WFD, PG 13 Dec 2013, ZStevanovic

EU Water Frame Directive

Why common legislation in Europe?

- Integrative processes
- Common environment but international water
- Stop further degradation of the nature

Questions:

- How to integrate varieties (climate, geology, hydrology)?
- Problem of standardization (MPL)
- Problem to define "status"
- How to monitor and fund

Solution

- Consensus in everything
- Step by step implementation

EU WFD

- Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000
- Agreed by the EU commission 29. June 2000 after over three years of debate and signed in December 2000
- Establishes a **framework for Community action in the field of water policy**.
- May mean extensive changes in regulations and monitoring programme
- The Directive is **legally binding** and is to be reflected in national legislation within three years
- **Common approach** with respect to interpretation, goals, legislative principles and methods

WFD - Main principles

- Legislation based on precautionary principle
- Local participation
- Remedial measures at source
- Polluter pays
- River basin management
- Planning and monitoring



Surface and groundwater bodies

- Surface waters (ecological/chemical status)
 - Rivers
 - Lakes
 - Transitional Waters (*in vicinity of river mouths, partly saline but substantially influenced by freshwater*)
 - Coastal Waters (*within 1 nautical mile of coast baseline*)
 - *Territorial waters for chemical status*
- Ground water (chemical status, quantity)
- *Artificial water body*
- *Heavily modified water body*

Towards "Good status" until 2015

■ Surface waters:

- Characterisation of surface water body types (system A,B)
- Establishing type-specific reference conditions
- Identification of Pressures
- Assessment of Impact
- Classify ecological status (chemical status) (intercalibration)



■ Ground water

- Initial characterisation
- Further characterisation
- Review of the impact of human activity on groundwaters
- Review of the impact of changes in groundwater levels
- Review of the impact of pollution on groundwater quality

Management plan is required !

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■ **Surveillance monitoring:**

- supplement and validate impact assessment procedure
- Basis for efficient and effective design of future monitoring programmes
- Assess long term changes in natural conditions
- Assess long term changes resulting from widespread anthropogenic activity

■ **Operational monitoring**

- Establish the status of waterbodies identified as being at risk of failing to meet their environmental objectives
- Assess changes in status of such bodies resulting from the programmes of measures

■ **Investigative monitoring**

- Where reason for any exceedances is unknown
- Where surveillance monitoring indicates that the objectives are not likely to be achieved and operational monitoring has not already been established
- To ascertain the magnitude and impacts of accidental pollution
- As basis for establishing programme of measures

- 2003 Districts defined, legislative proposals
- 2004 Characterization
Pressures, discharge, economic analyses
- 2006 **Monitoring Assessment**
Management plan proposal
- 2008 Discussion of management plan
- 2009 Management plan in operation
and published
- 2012 First interim report
- 2015 (2020) Environmental (emissions) goal achieved
- 2027 Last deadline for reaching goal where
delays have been granted

EU WFD 2000/60 Application

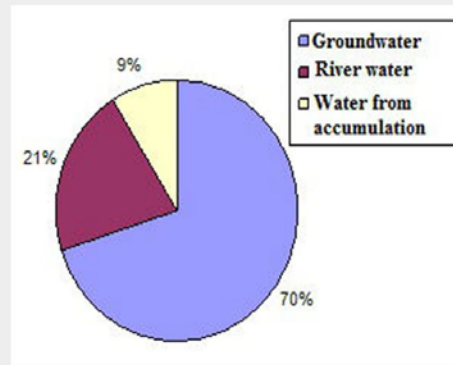
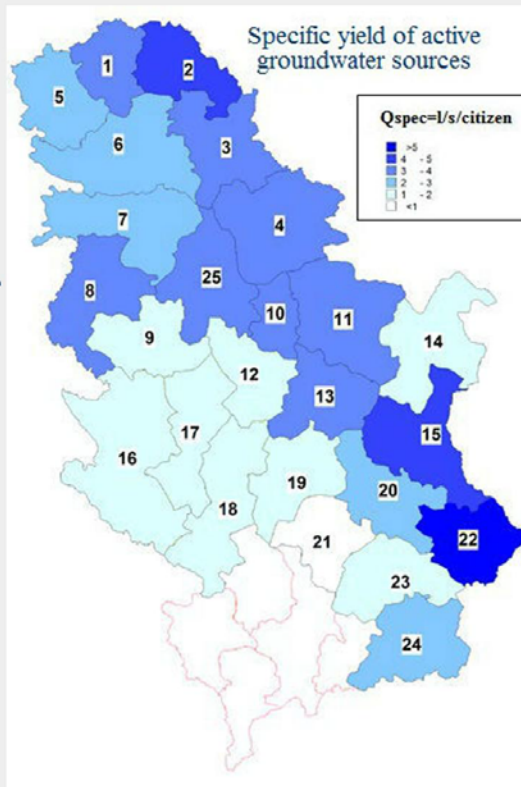
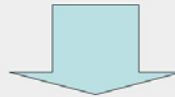
Towards Monitoring of WB and Improvement of Ecological Status

- Characterization of SfWB
- Characterization of GWB

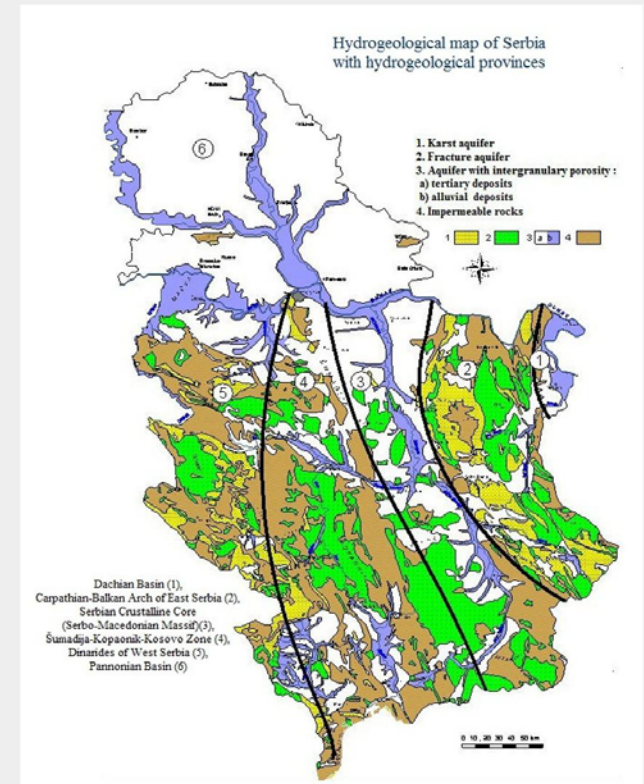


Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic

Groundwater is used in approximately **70%** of all cases for providing drinking water in settlements on the territory of Serbia.



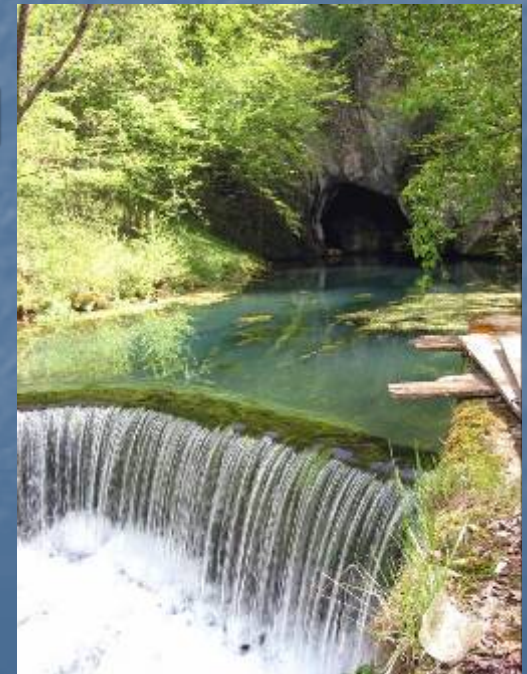
The total yield of active groundwater sources is roughly estimated at 23 m³/s.



They are tapped from: intergranular, artesian aquifers of neogene basins, karst and fracture aquifers.

Application of EU WFD ICPDR 2004 Roof report Serbia & Montenegro

- 67 groundwater bodies or group of gw bodies
- Min area 50 km²
- The largest number in karst (50%)
- Principles of monitoring established
- Involve current users
- Problem in funding



CHARACTERISATION OF GROUNDWATER-STUDY (2005)

Republika Srbija
Ministarstvo poljoprivrede, vodoprivrede i šumarstva
Republička Direkcija za vode

STUDIJA

karakterizacije podzemnih voda na SCG delu Dunavskog sliva
(prema zahtevima ODV-a Član 5 i Aneks II)



INSTITUT ZA VODOPRIVREDU "JAROSLAV ČERNI" A.D.
Zavod za vodosnabdevanje, kanalizaciju i zaštitu voda

Beograd, Februar 2006. godine

STUDIJA

karakterizacije podzemnih voda na SCG delu Dunavskog sliva
(prema zahtevima ODV-a Član 5 i Aneks II)

UČESNICI U IZRADI STUDIJE:

Rukovodilac izrade Studije: Dušan Đurić, dipl.inž.grad.

Konsultanti: Dr.Milan Dimkić, dipl.inž.
Miodrag Milovanović, dipl.inž.

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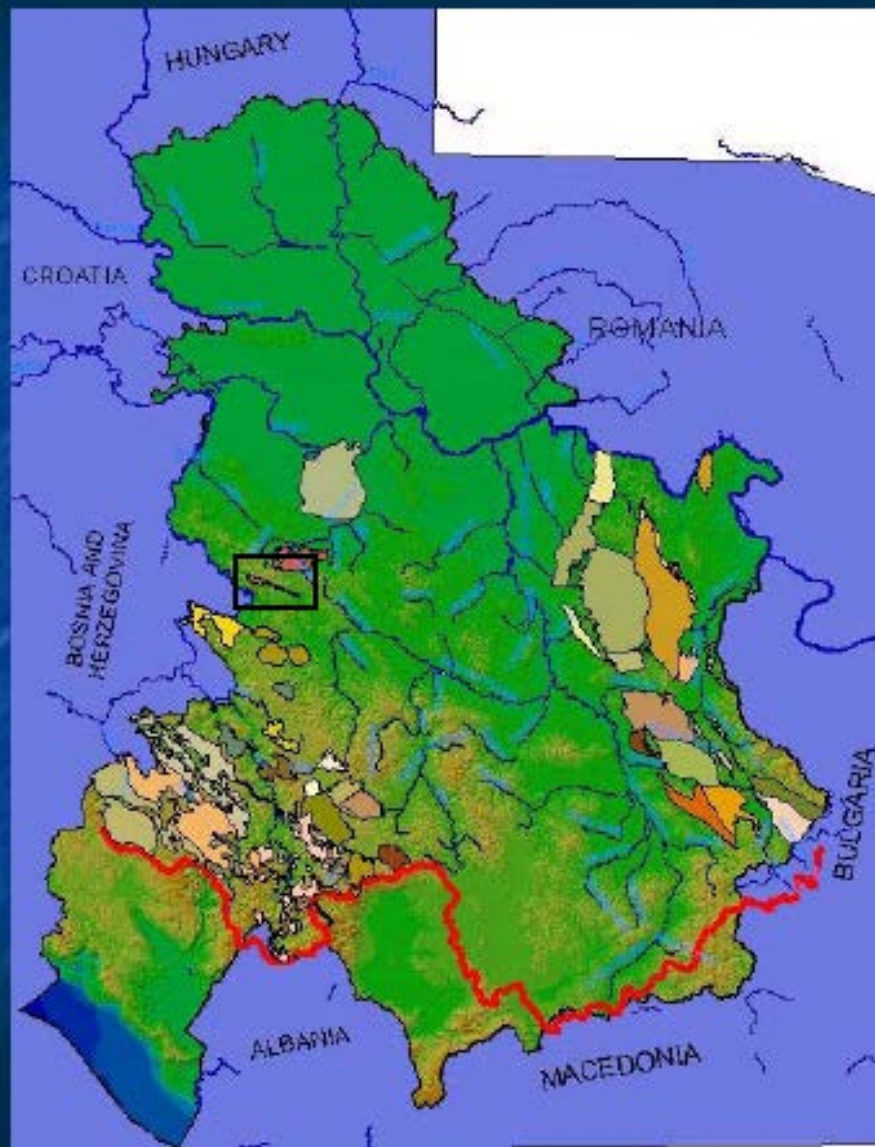
GIS obrada: Milica Milovanović, dipl.inž.grad.
Vladimir Lukić, dipl.inž.geol.

Tehn.obrada: Rade Marčetić, dipl.grad.inž.
Marina Nestorović-Jovanović, hid.teh.

Eastern Serbian GW bodies – Preliminary classification

No.	NAME	MS_CD: Member state code	Water body (WB)/ Group of WB (GWB)	River Basin	Size: km ²	Aquifer characterisation		Main use: DRW = drinking water AGR = agriculture IRR = irrigation IND = industry SPA = balneology CAL = caloric energy OTH = other	overlying strata: Range in m	Risk: Yes = at risk No = not at risk Insuf = insufficient data/knowledge		Current status:
						Predom: P = porous K = karst F = fissured	Confined: Yes/No			Quality	Quantity	
1	Golubac	CS_DU8	WB	Danube	230	K	No	DRW,IRR	100	No	Yes	Insu
2	Gornjak	CS_DU9	WB	Danube	430	K	No	DRW, IRR	150	No	No	Goc
3	Krš	CS_TM1	WB	Timok	100	K	No	DRW	?	Insuf.	No	Insu
4	Miroč	CS_DU11	WB	Danube	110	K	No	DRW, IRR	?	Insuf.	No	Insu
5	Ravanica	CS_VM6	WB	Velika Morava	115	K	No	DRW,IRR,IND	100	No	No	Goc
6	Rtanj	CS_TM2	WB	Timok	120	K	No	DRW,IRR	100	No	No	Goc
7	Svrljig	CS_NI1	WB	Nišava	438	K	No	DRW	150	No	No	Goc
8	Kucaj	CS_VM7	WB	Velika Morava	1060	K	No	DRW	100	No	No	Goc
9	Tupiznica & V.Cuka	CS_TM30	GWB	Timok	150	K	No	DRW, AGR	NA	No	No	Goc
10	Ozren & Devica	CS_VM80	GWB	V.Morava	560	K	No	DRW, IRR, SPA	10-300	No	No	Fai
11	Kalafat	CS_VM90	GWB	V.Morava	87	K	No	DRW, IRR, SPA	10-200	No	No	Goc
12	Tresibaba	CS_TM4	WB	Timok	95	K	No	DRW, IRR, SPA	NA	No	No	Goc
13	Suva Planina	CS_NI20	GWB	Nisava	298	K	No	DRW, IRR, SPA	10- >400	Yes	Yes	Poc
14	Belava & Vlaska Pl	CS_NI30	GWB	Nisava	304	K	No	DRW, IRR (small),	10-200	No	No	Goc
15	Vidlic	CS_NI40	GWB	Nisava	285	K	No	DRW, IRR (small),	10-300	Yes	Yes	Poc
16	Stara planina	CS_NI5	WB	Nisava	260	K	No	DRW	NA	No	No	Goc
17	Nisava	CS_NI6	WB	Nisava	65	P	Yes,	DRW, IRR, IND,	1-5	Yes	Yes	Poc
18	Timok	CS_TM6	WB	Timok	200	P	Yes,	DRW, IRR, IND,	1-3	Yes	Yes	Poc
19	Dunav	CS_DU12	WB	Danube	140	P	Yes,	DRW, AGR, IRR, IND	3-5	Yes	Yes	Poc
20	Negotin- Kladovo Kljuc	CS_TM70	GWB	Timok	755	P	Yes	DRW, AGR, IRR, IND	30-100	Yes	Yes	Poc
21	Zajecar basin	CS_TM80	GWB	Timok	535	P	Yes	DRW, AGR, IRR, IND	50-150	At risk (small)	At risk (small)	Fai
22	Sokobanja basin	CS_VM10	GWB	V.Morava	164	P	Yes	DRW, IRR, SPA	50-300	No	No	Goc
23	Pirot valley	CS_NI70	GWB	Nisava	189	P	Yes	DRW, IR, IND	30-100	No	No	Goc
24	Timok volcanic area	CS_TM5	WB	Pek, Timok	1065	F	Yes	DRW, SPA, CAL	NA	No	No	Goc

KARTA VODNIH TELA U OKVIRU KARSTNIH AKVIFERA



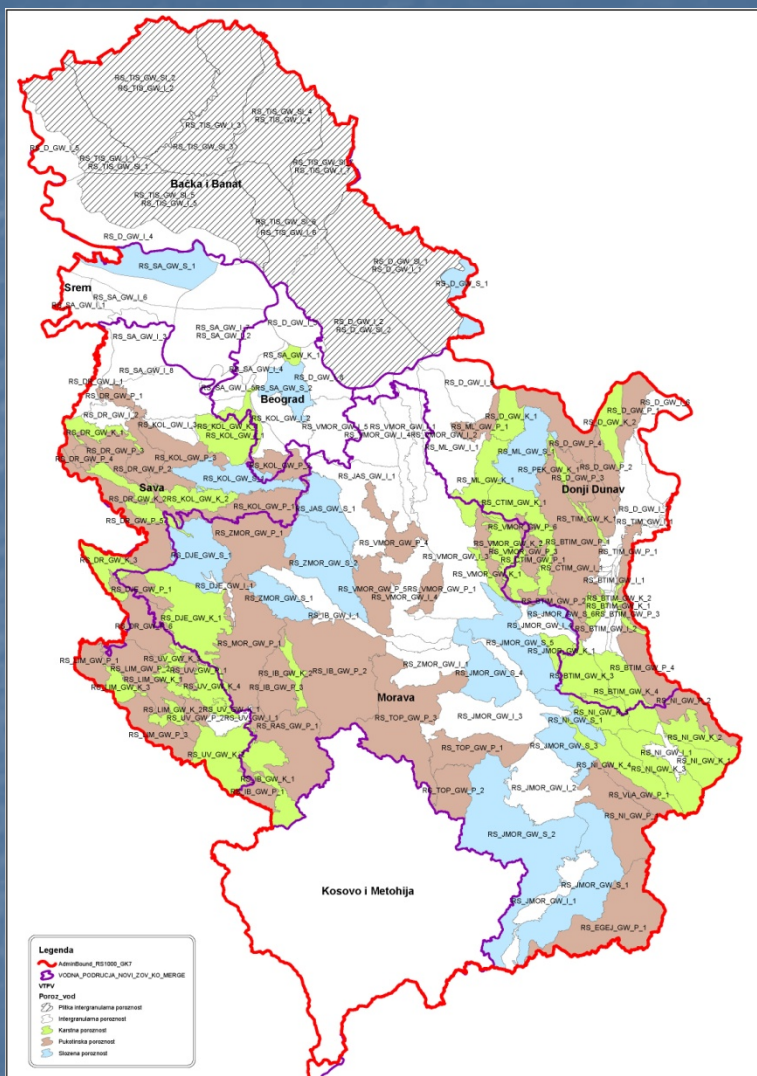
Karta geobazir karst_pukotinski

- CS_DR 20_Povlan
- CS_DR 30_Tura42 vijezda
- CS_DR 40_Piva karst
- CS_DR 50_Tara karst
- CS_DR 60_Cehotina karst
- CS_DU 11_Miroc
- CS_DU 8_Golub_Plan
- CS_DU 8_Gornjaska zona
- CS_IB 1_Raska
- CS_IB 2_Ribarići
- CS_IB 30_Ibar karst
- CS_LI 10_Budje
- CS_LI 2_Jadovnik
- CS_LI 3_Poster
- CS_LI 4_Sjenica
- CS_LI 5_Yopa
- CS_LI 6_Ibar
- CS_LI 7_Zarudine
- CS_LI 80_Lim karst
- CS_NI 1_Sutjaska
- CS_NI 20_Suva
- CS_NI 30_Belava
- CS_NI 40_Midic
- CS_NI 6_Staro Planina
- CS_SA 6_Karst Neprizive
- CS_SA 70_Lelice
- CS_TM 1_Krah
- CS_TM 2_Rbanj
- CS_TM 30_Tupiznica
- CS_TM 4_Trasibaba
- CS_TM 6_Timoc_Erupt_Dblast
- CS_VM 6_Ravanna
- CS_VM 7_Kucej
- CS_VM 80_Otoren & Devica
- CS_VM 90_Kalafat
- CS_ZM 10_Bakibor
- CS_ZM 2_Ljubusnica

JUZNA GRANICA_SUMA

REKE

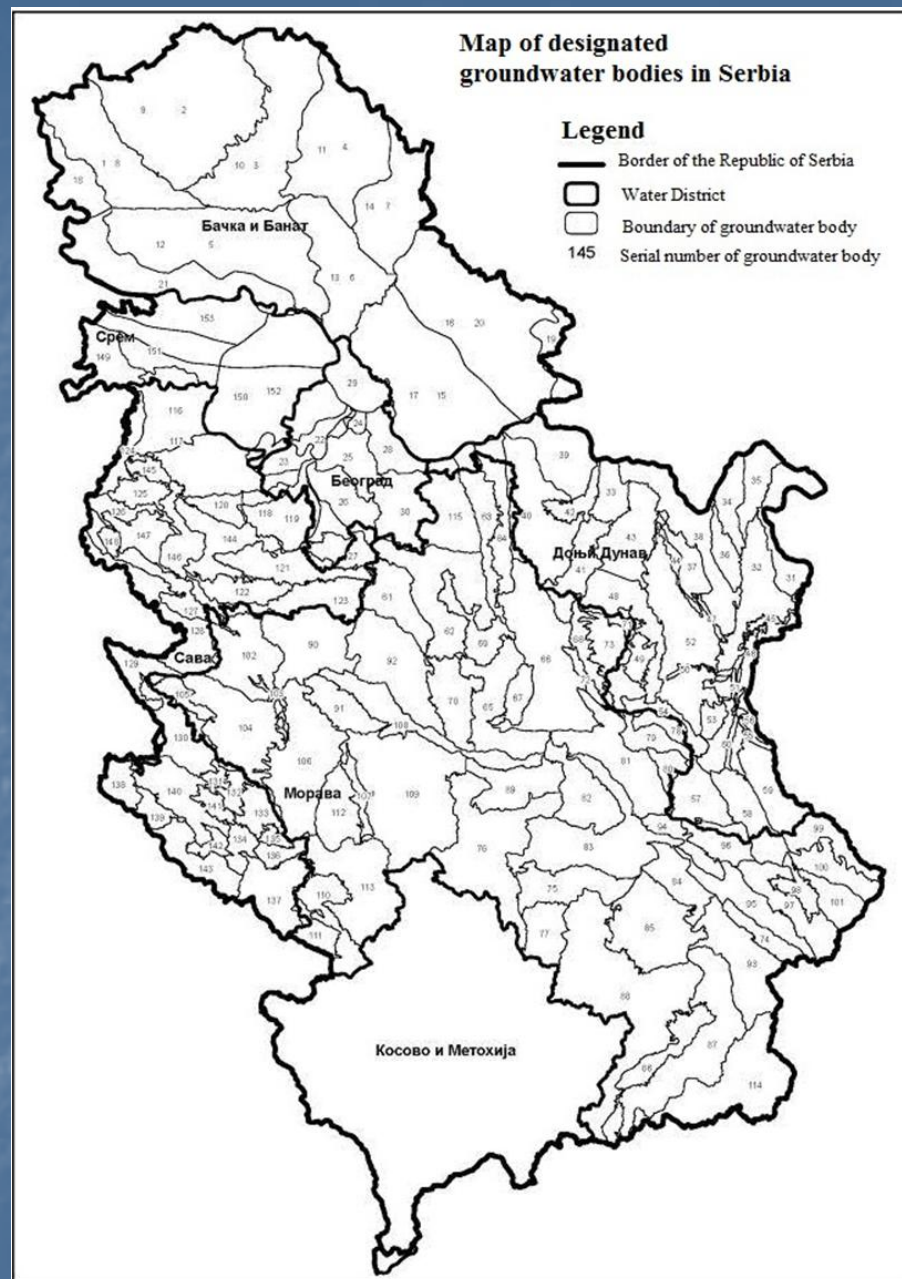
MAP OF GROUNDWATER BODIES IN SERBIA (OG of the RoS 96/10)



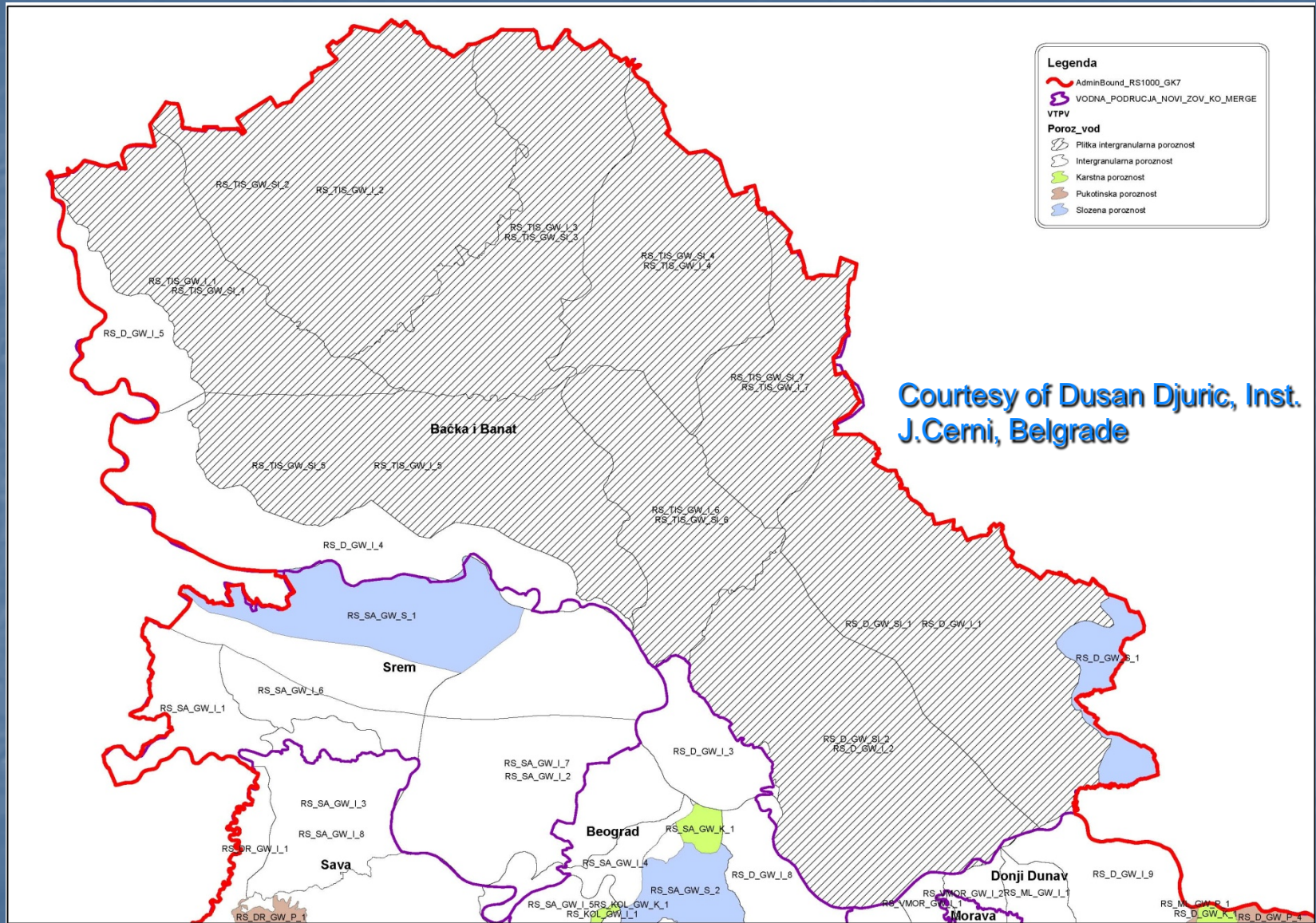
- 153 GWBs in 6 RB districts
- whole territory covered with GWBs (principle of area-wide protection)
- Size range min. 35 km² max. 2640 km²
- shallow and deep GWBs overlapping in some parts

Okrugli sto: Usaglašavanje CG zakonodavstva
o vodama sa EU WFD, PG 13 Dec 2013,
Zstevanovic

Courtesy of Dusan Djuric, Inst. J.Cerni, Belgrade



MAP OF GROUNDWATER BODIES IN VOJVODINA



GROUNDWATER BODIES IN VOJVODINA

R.Br.	NAME	Vod_podruc	EUCD_GWB	AREAKM2
1	OVK SZ Backa	Backa i Banat	RS_TIS_GW_I_1	1232,43
2	OVK Telecka	Backa i Banat	RS_TIS_GW_I_2	2643,55
3	OVK Gornja Tisa	Backa i Banat	RS_TIS_GW_I_3	1772,02
4	OVK Severni Banat	Backa i Banat	RS_TIS_GW_I_4	1545,78
5	OVK Srednja Backa	Backa i Banat	RS_TIS_GW_I_5	2068,06
6	OVK Donja Tisa	Backa i Banat	RS_TIS_GW_I_6	1099,78
7	OVK Srednji Banat	Backa i Banat	RS_TIS_GW_I_7	1013,72
8	SZ Backa prva izdan	Backa i Banat	RS_TIS_GW_SI_1	1232,43
9	Telecka prva izdan	Backa i Banat	RS_TIS_GW_SI_2	2643,55
10	Gornja Tisa prva izdan	Backa i Banat	RS_TIS_GW_SI_3	1772,02
11	Severni Banat prva izdan	Backa i Banat	RS_TIS_GW_SI_4	1545,78
12	Srednja Backa prva izdan	Backa i Banat	RS_TIS_GW_SI_5	2068,06
13	Donja Tisa prva izdan	Backa i Banat	RS_TIS_GW_SI_6	1099,78
14	Srednji Bant prva izdan	Backa i Banat	RS_TIS_GW_SI_7	1013,72

Courtesy of Dusan Djuric, Inst.
J.Cerni, Belgrade

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GROUNDWATER BODIES IN VOJVODINA

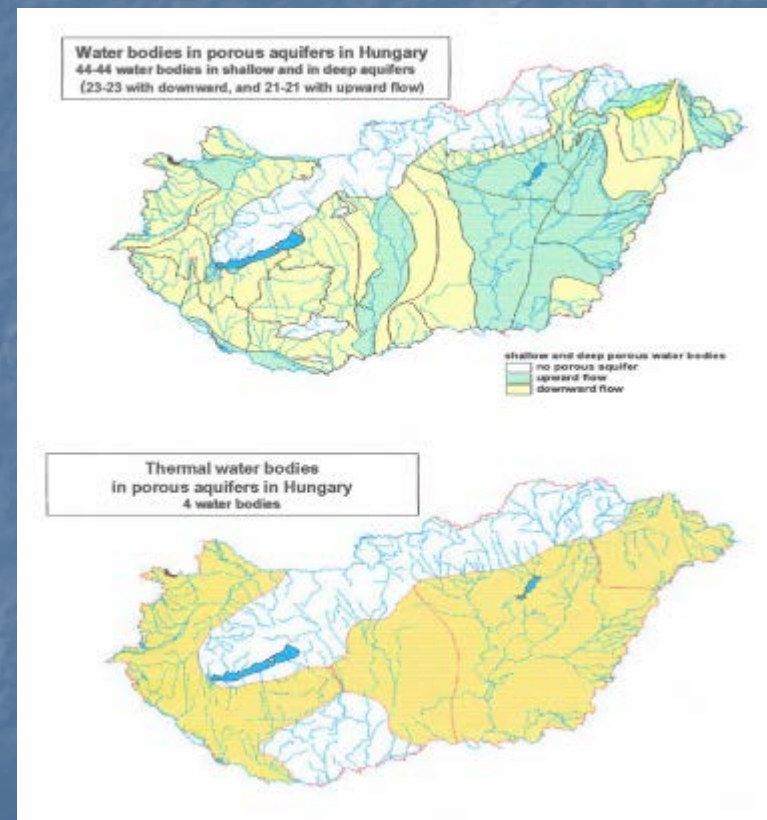
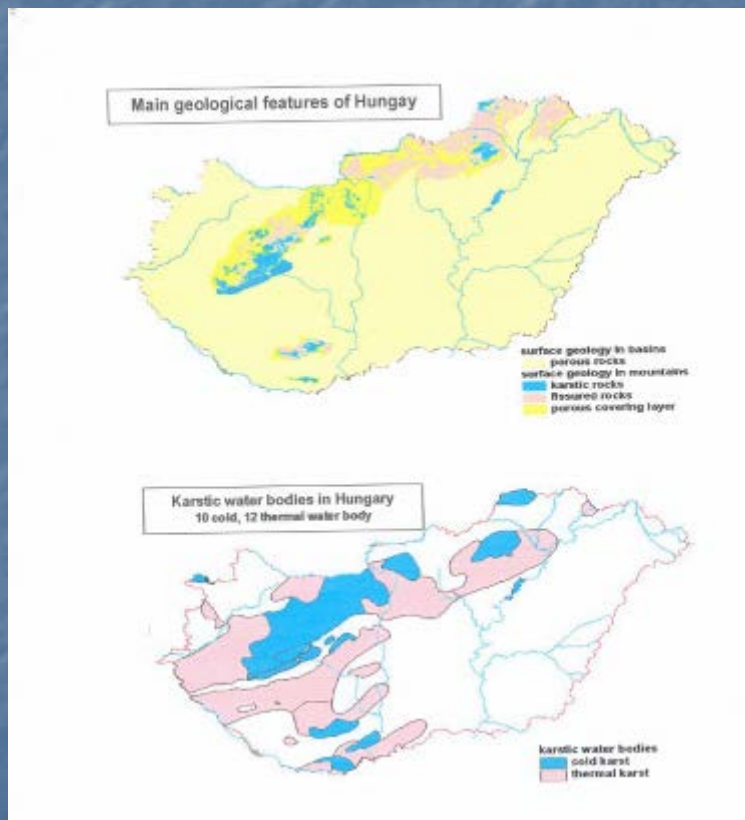
R.Br.	NAME	Vod_podruc	EUCD_GWB	AREAKM2
15	Jugozapadni Banat prva izdan	Backa i Banat	RS_D_GW_SI_2	2228,19
16	OVK Jugoistocni Banat	Backa i Banat	RS_D_GW_I_1	2298,93
17	OVK Jugozapadni Banat	Backa i Banat	RS_D_GW_I_2	2228,19
18	Jugozapadna Backa	Backa i Banat	RS_D_GW_I_5	440,74
19	Vrsacke planine	Backa i Banat	RS_D_GW_S_1	257,63
20	Jugoistocni Banat prva izdan	Backa i Banat	RS_D_GW_SI_1	2298,93
21	Juzna Backa	Backa i Banat	RS_D_GW_I_4	1167,14
22	OVK Zapadni Srem	Srem	RS_SA_GW_I_1	450,05
23	OVK Istocni Srem	Srem	RS_SA_GW_I_2	1593,65
24	PL Zapadni Srem	Srem	RS_SA_GW_I_6	1172,92
25	PL Istocni Srem	Srem	RS_SA_GW_I_7	2248,99
26	Fruska gora	Srem	RS_SA_GW_S_1	735,56

Courtesy of Dusan Djuric, Inst.
J.Cerni, Belgrade

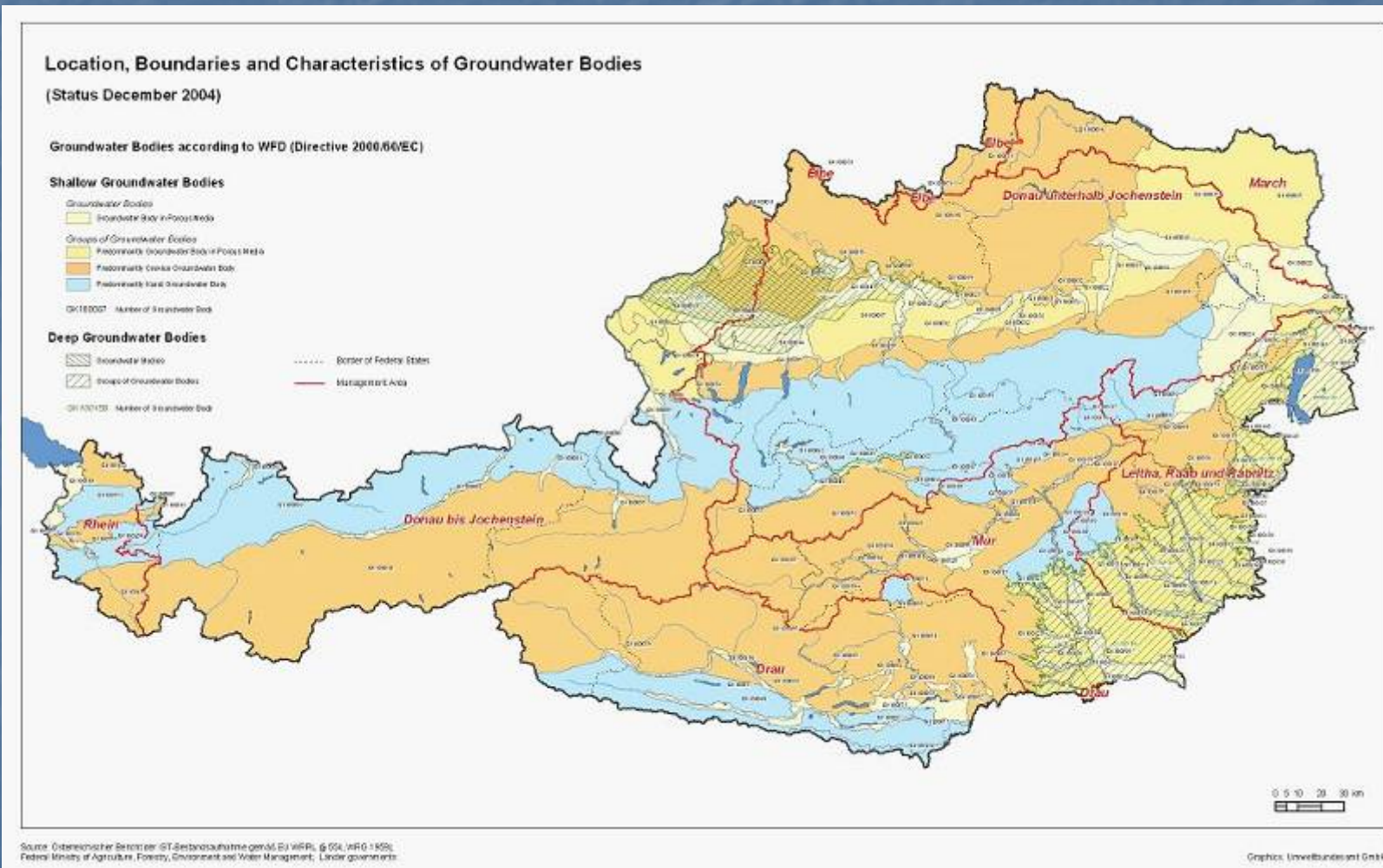
Okrugli sto: Usaglašavanje CG zakonodavstva
o vodama sa EU WFD, PG 13 Dec 2013,
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Hungary – First delineation of GW bodies

- 44 GWB in porous aquifers + 4 thermal GWB;
- In karst 10 cold and 12 thermal GWB



Groundwater bodies in Austria



Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU
WFD, PG 13 Dec 2013, ZStevanovic

Number of GW-bodies AUSTRIA

	Aquifer Type	Shallow GW (100 % of AT)	Deep GW (12 % of AT)	sum
GW- bodies	Porous media	64		
	Karstic media		1	
Groups	Predominantly porous media	18	7	
	Predominantly fractured media	29		
	Predominantly karstic media	15	1	
	sum	126	9	135

Okrugli sto: Usaglašavanje CG
zakonodavstva o vodama sa EU

WFD, PG 13 Dec 2013,
ZStevanovic

Size: GW-bodies (6 – 1,200 km²), Groups (8 - 11,000 km²)

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND THE COUNCIL

EU Groundwater Directive –
Summary of final compromise text

European Commission, DG Environment

NOTE: this summary provides a general overview of the reached compromise and does not correspond to a word-by-word transcription of the still-to-be-adopted directive

on the protection of groundwater against pollution “DAUGHTER DIRECTIVE”

Article

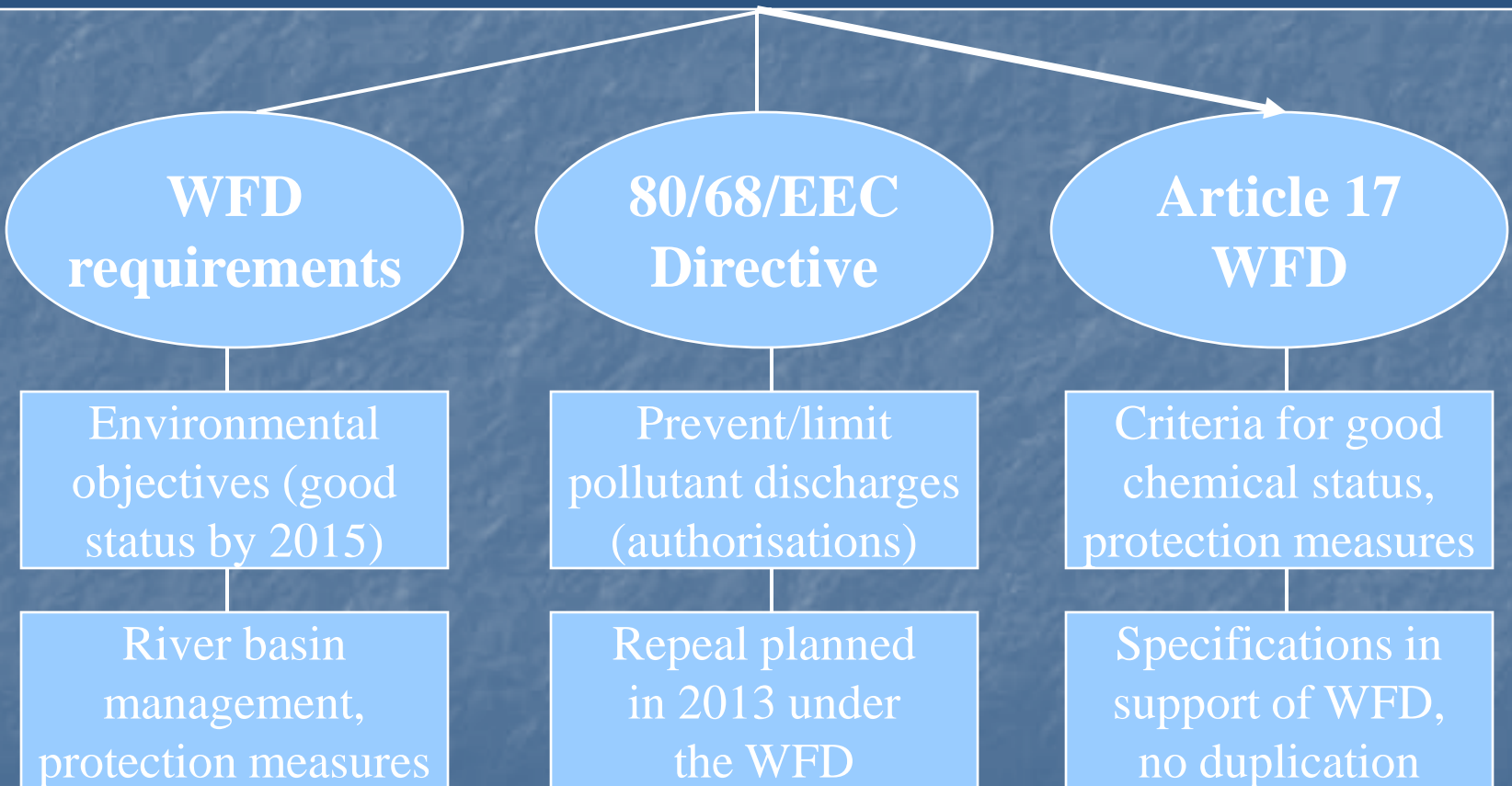
- 1.1. Groundwater is an important natural resource. It acts as a reservoir from which good quality water can be abstracted for drinking and for use in industry and agriculture. It is also valuable in maintaining wetlands and river flows, acting as a buffer through dry periods. Groundwater moves slowly through the ground and so the impact of human activities may last for a relatively long time...
- 3.2. The WFD requires the achievement of good groundwater status and to that end provides for the monitoring of groundwater bodies as well as measures to protect and restore groundwater. While the WFD provides a general framework for groundwater protection, Article 17 of the Directive provides for the adoption of specific criteria for the assessment of good chemical status and the identification of significant and sustained upward trends and for the definition of starting points for trend reversals.

5.1 The proposal for a Groundwater Daughter Directive sets out criteria for assessing the chemical status of groundwater, as required by Article 17.2a of the WFD. **It was not considered appropriate to list new quality standards that would be applied uniformly to all groundwater bodies throughout Europe, because of the natural variability of groundwater chemical composition and the present lack of monitoring data and knowledge...**

Groundwater is a resource under increasing pressure from human activities. But for many people it is “out of sight, out of mind”. While the need to protect drinking water is well understood because of its environmental value, Member States do not all agree on how to manage groundwater protection. While most Member States support the concept of good groundwater protection, the majority considers assessing chemical status on the basis of compliance with a long list of pan-European quality standards is not the right way to achieve this protection. However, there are some Member States that would like to see EU standards established as soon as possible.

Groundwater legislative framework

GROUNDWATER PROTECTION AGAINST POLLUTION



General statements (recitals) – Links with Drinking Water supply

- Groundwater= **natural resource to be protected against pollution and deterioration (in particular for dependent ecosystems and for the use in water supply)**
- Groundwater= **most sensitive freshwater body and main source of public drinking water supply in many regions**
- Protection of water used for DW abstraction according to **Articles 7(2) and (3) of the WFD (avoiding deterioration in order to reduce level of purification treatment)**
- Reminder about 6th EAP objective **that water quality levels should not lead to risks to human health and the environment**
- Protection of environment and human health **implies that detrimental concentrations of harmful pollutants in GW be avoided, prevented or reduced**

- **"Hazardous substances"** means substances or groups of substances that are toxic, persistent and liable to bio-accumulate; and other substances or groups of substances which give rise to an equivalent level of concern.

Deviation from natural condition:

- **"Emission limit values"** means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during any one or more periods of time. Emission limit values may also be laid down for certain groups, families or categories of substances...

- **Groundwater quality standards** for assessing GW chemical status:

- Nitrates: **50 mg/l**
- Active substances in pesticides, including their relevant metabolites, degradation and reaction products: **0.1 µg/l for individual substances, and 0.5 µg/l for total sum of detected and quantified individual pesticides**

- **MPL** for As, Hg, Cd, Pb ... to national regulation

Zakonska regulativa u oblasti voda u Srbiji

- **ZAKON O VODAMA** (SL GLASNIK 30-10 OD 5.5.2010) PROMOVIŠE *INTEGRALNO UPRAVLJANJE VODAMA* KAO „SKUP MERA I AKTIVNOSTI USMERENIH NA ODRŽAVANJE I UNAPREĐENJE VODNOG REŽIMA, OBEZBEĐIVANJE POTREBNIH KOLIČINA VODA ZAHTEVANOG KVALITETA ZA RAZLIČITE NAMENE, ZAŠTITU VODA OD ZAGAĐIVANJA I ZAŠTITU OD ŠTETNOG DEJSTVA VODA.“ U TOM SMISLU UPRAVLJANJE VODAMA JE U NADLEŽNOSTI REPUBLIKE SRBIJE KOJE SE OSTVARUJE PREKO MINISTARSTVA I ORGANA LOKALNE SAMOUPRAVE I JAVNIH VODOPRIVREDNIH PREDUZEĆA (ČL. 24).

Upravljanje vodama po ovom zakonu se „zasniva na:

- 1) *načelu održivog razvoja* -
- 2) *načelu celovitosti* - procesi u prirodi, čija je značajna komponenta voda, kao i povezanost i međuzavisnost akvatičnih i priobalnih ekosistema, moraju se poštovati;
- 3) *načelu jedinstva vodnog sistema* - upravljanje vodama u okviru jedinstvenog vodnog prostora mora se odvijati u skladu sa razvojem Republike Srbije, u cilju postizanja maksimalnih ekonomskih i socijalnih efekata na pravičan način i uz uvažavanje međunarodnih sporazuma;
- 4) *načelu obezbeđivanja zaštite od štetnog dejstva voda* -;
- 5) *načelu „korisnik plaća“*;
- 6) *načelu „zagađivač plaća“*;
- 7) *načelu učešća javnosti*;
- 8) *načelu uvažavanja najboljih dostupnih tehnika*

Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic

Planska dokumenta za upravljanje vodama (čl. 29) su:

- 1) Strategija upravljanja vodama na teritoriji Republike Srbije;
 - 2) plan upravljanja vodama;
 - 3) godišnji program upravljanja vodama;
 - 4) planovi kojima se uređuje zaštita od štetnog dejstva voda, i to: plan upravljanja rizicima od poplava, opšti i operativni plan za odbranu od poplava, kao i planovi kojima se uređuje zaštita voda (plan zaštite voda od zagađivanja i program monitoringa).
-
- Sadržina *Strategije upravljanja vodama* na teritoriji Republike Srbije (čl 30.) je planski dokument kojim se utvrđuju dugoročni pravci upravljanja vodama. Ona „sadrži:
 - 1) ocenu postojećeg stanja upravljanja vodama;
 - 2) ciljeve i smernice za upravljanje vodama;
 - 3) mere za ostvarivanje utvrđenih ciljeva upravljanja vodama;
 - 4) projekciju razvoja upravljanja vodama”.

- **PROPISI O GEOLOŠKIM ISTRAŽIVANJIMA SRBIJE**
- **I PODZEMNE VODE**

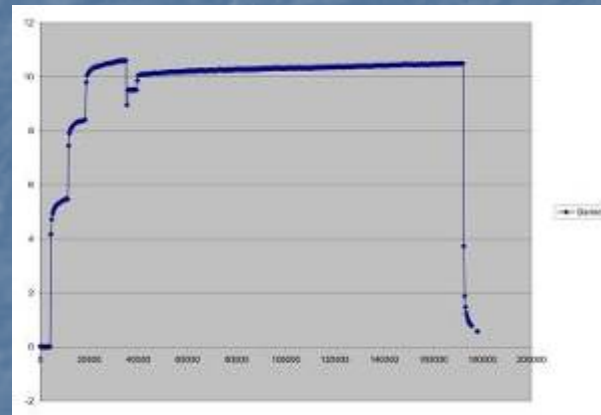
- Podzemne vode su u ovom trenutku u nadležnosti više ministarstva, ali se korišćenje i zaštita ovih resursa ipak odvija na relativno zadovoljavajući način. U postojećoj organizaciji državne uprave u Srbiji, nadležnosti nad resursima podzemnih voda su, u zavisnosti od njihovog kvantitativnog i/ili kvalitativnog statusa, odnosno pretpostavljene namene, "rasute" u nekoliko institucija, od kojih su najvažnije: Ministarstvo životne sredine i prostornog planiranja, Ministarstvo poljoprivrede, šumarstva i vodoprivrede sa Direkcijom za vode Srbije i Ministarstvo rudarstva i energetike. Pored toga za kvalitet podzemnih voda kada su u pitanju vode za piće direktno je odgovorno Ministarstvo zdravlja.
- Problem nadležnosti nije prisutan samo u Srbiji.
- **Podzemne vode deo su jedinstvenog vodnog ciklusa i bilansa** (povezane sa atmosferskim i površinskim vodama), kako ih smatraju vodoprivredni stručnjaci, **ali su istovremeno i mineralna sirovina od posebnog značaja** kako su tretirane od strane stručnjaka geologije. Može se smatrati da ni jedno od ova dva polazišta nije pogrešno i da se ona ne isključuju (Stevanović, 2009), što se često čini u svakodnevnoj praksi

Propisi za podzemne vode

- Postojeća legislativa iz oblasti podzemnih voda sastoji se više zakona i pravilnika, koji se bave kako korišćenjem tako i zaštitom podzemnih vodnih resursa. Neka od pravnih dokumenta su delom i anahrona i već dugo čekaju inoviranje:
- **Zakon o rudarstvu i geološkim istraživanjima** (2011)
- **Pravilnik o klasifikaciji i kategorizaciji rezervi podzemnih voda i vođenju evidencije o njima** (Sl. List SFRJ, br.34, 1979)
- Zakon o utvrđivanju i razvrstavanju rezervi mineralnih sirovina i prikazivanju podataka geoloških istraživanja (Sl.list SRJ br.12, 1998)
- Pravilnik o higijenskoj ispravnosti vode za piće (Sl.list SRJ br.42, 1998)
- Zakon o zaštiti životne sredine (Službeni glasnik RS, br.135, 2004)
- Zakon o strateškoj proceni uticaja na životnu sredinu (Službeni glasnik RS, br. 135, 2004)
- Zakon o integrisanom sprečavanju i kontroli zagađivanja životne sredine (Službeni glasnik RS, br. 135, 2004)
- **Pravilnik o načinu određivanja i održavanja zona sanitarne zaštite izvorišta vodosnabdevanja** (Službeni Glasnik RS br. 92, 2008)



Monitoring is crucial for GW sustainable use and management



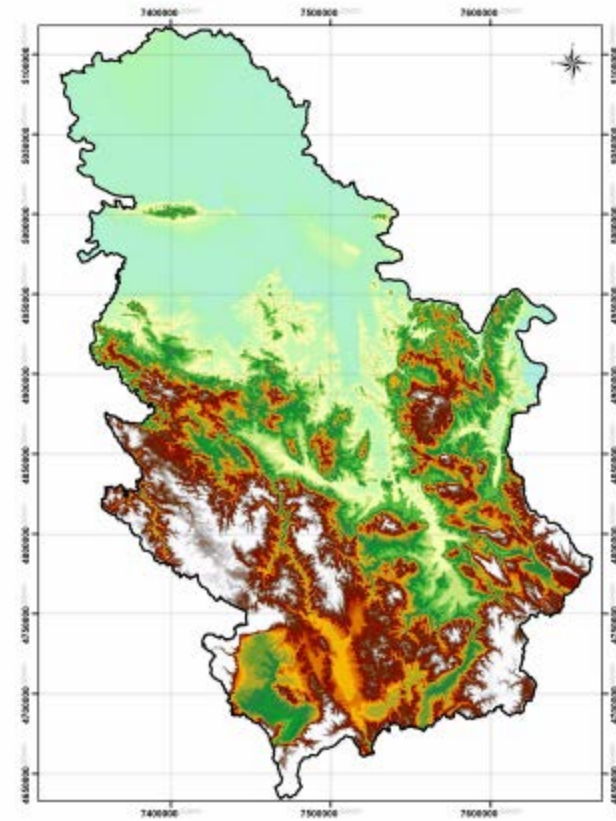
U	V	W	X	Y	Z	AA
DobidBroj	Datum	Vreme	Apsolutna Vreme	Konverzija		
0	30-Jan-00	10:44:01	0.28	0	0	
1	30-Jan-00	10:50:01	15.39	360	0	
2	30-Jan-00	10:56:01	15.4	720	0	
3	30-Jan-00	11:02:01	15.4	1080	0	
4	30-Jan-00	11:08:01	15.41	1440	0	
5	30-Jan-00	11:14:01	15.41	1800	0	
6	30-Jan-00	11:20:01	15.41	2160	0	
7	30-Jan-00	11:26:01	15.41	2520	0	
8	30-Jan-00	11:32:01	15.41	2880	0	
9	30-Jan-00	11:38:01	15.41	3240	0	
10	30-Jan-00	11:44:01	15.41	3600	0.01	
11	30-Jan-00	11:50:01	15.4	3960	0.01	
12	30-Jan-00	11:56:01	15.4	4320	0	
13	30-Jan-00	12:02:01	11.24	4680	4.17	
14	30-Jan-00	12:08:01	10.68	5040	4.75	
15	30-Jan-00	12:14:01	10.46	5400	4.93	
16	30-Jan-00	12:20:01	10.37	5760	5.04	
17	30-Jan-00	12:26:01	10.29	6120	5.12	
18	30-Jan-00	12:32:01	10.23	6480	5.18	
19	30-Jan-00	12:38:01	10.17	6840	5.24	
20	30-Jan-00	12:44:01	10.15	7200	5.26	
Kontinuirano merenje n. duzini od jednog meseca sa izlascem 7381 zapisa						
7363	1-Mar-00	3:02:01	0.02	2649860	15.39	
7364	1-Mar-00	3:08:01	0.02	2650020	15.39	
7365	1-Mar-00	3:14:01	0.02	2650180	15.39	
7366	1-Mar-00	3:20:01	0.02	2650340	15.39	
7367	1-Mar-00	3:26:01	0.02	2651430	15.39	
7368	1-Mar-00	3:32:01	0.02	2651760	15.39	
7369	1-Mar-00	3:38:01	0.02	2652120	15.39	
7370	1-Mar-00	3:44:01	0.02	2652480	15.39	
7371	1-Mar-00	3:50:01	0.02	2652840	15.39	
7372	1-Mar-00	3:56:01	0.02	2653200	15.39	
7373	1-Mar-00	4:02:01	0.01	2653660	15.4	
7374	1-Mar-00	4:08:01	0.01	2654020	15.4	
7375	1-Mar-00	4:14:01	0.01	2654380	15.4	
7376	1-Mar-00	4:20:01	0.01	2654740	15.4	
7377	1-Mar-00	4:26:01	0.01	2655100	15.4	
7378	1-Mar-00	4:32:01	0.01	2655460	15.4	
7379	1-Mar-00	4:38:01	0.01	2655820	15.4	
7380	1-Mar-00	4:44:01	0.01	2656180	15.4	
7381	1-Mar-00	4:50:01	0.01	2656540	15.4	

Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic

Database – tool for GW management

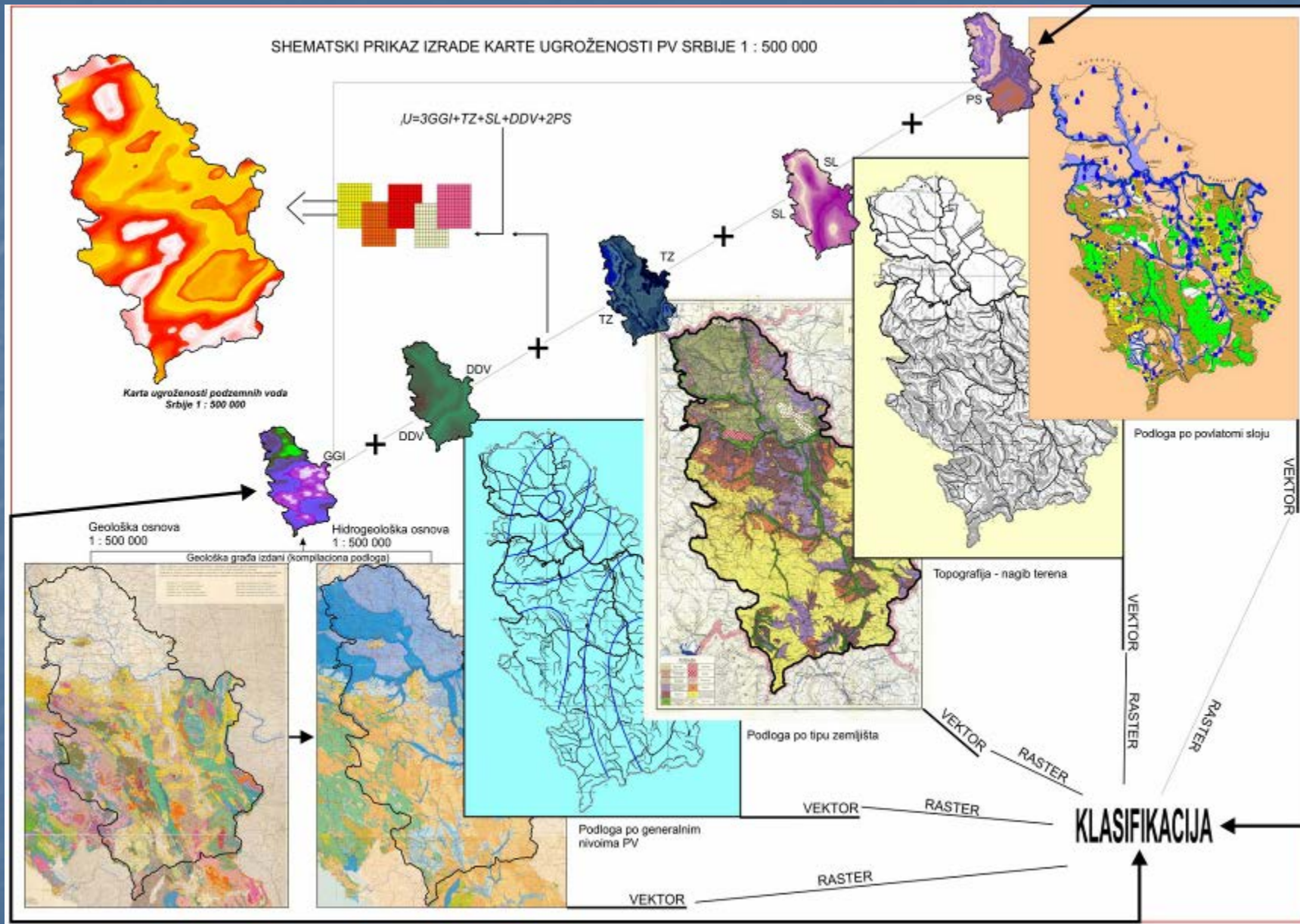
The screenshot shows the ArcCatalog interface with the following components:

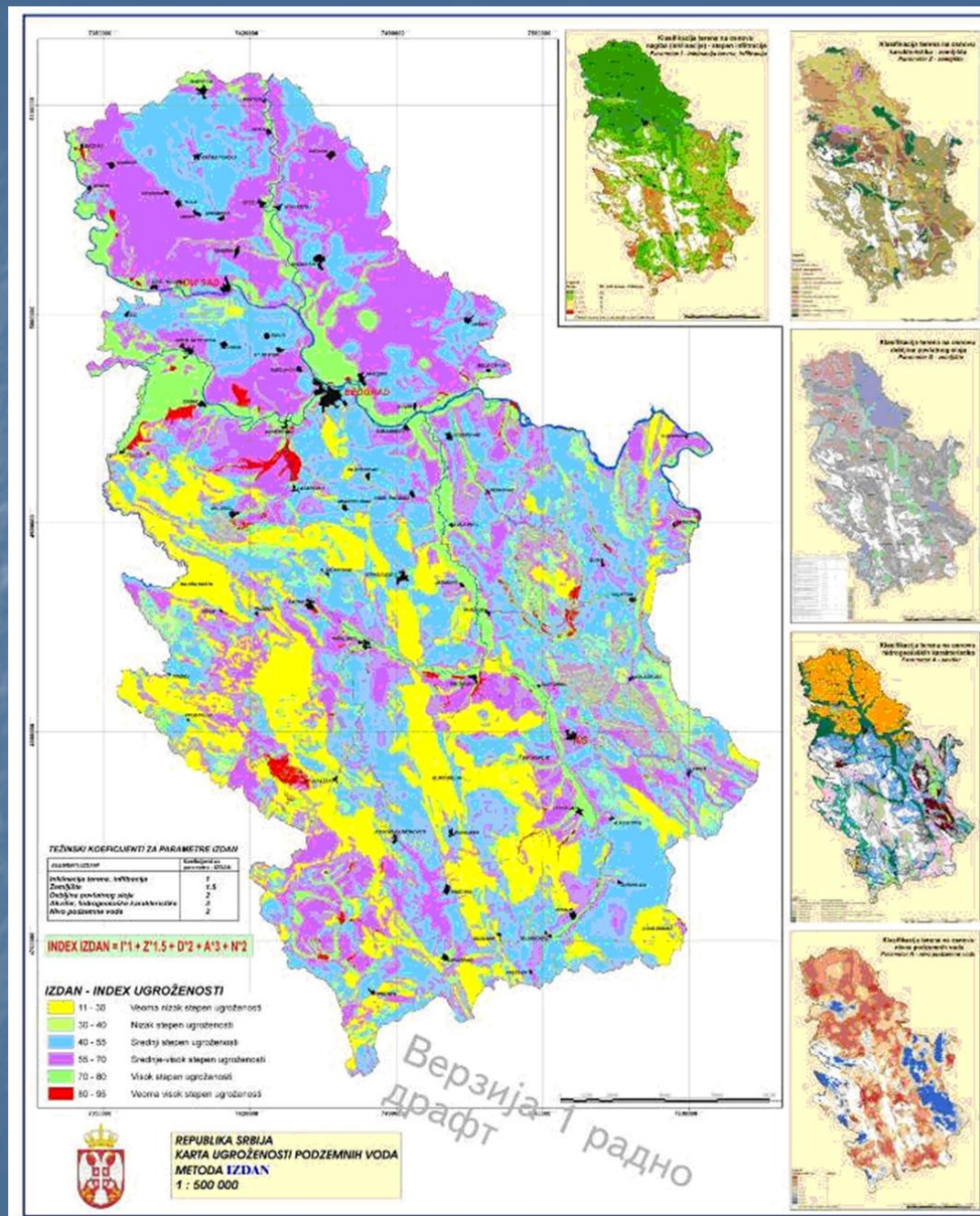
- File Tree:** A hierarchical view of a folder named 'GISMODEL'. Underneath, there is a sub-folder 'KartaUgro500Srbija' containing several sub-folders: 'Geologija', 'Geomorfologija', 'Hidrogeologija', and 'Topografija'. Each of these folders contains various feature classes, such as 'ElementiSklopa', 'GeološkaStruktura', 'GeološkeJedinice', 'LitologijaImačlanove', 'LitološkiČlanJeklasifikovan', 'Vrtače', 'HGJedinicaImaGeoJedinicu', 'HidroGeoLinije', 'HidrogeološkaJedinica', 'HidroGeoTacke', 'IndustrijskeZone', 'Izohipse', 'NaseljenaMesta', 'Litologija', 'LitološkoStablo', and 'OpisStenaGeološkeJedinice'.
- Feature Class Properties Dialog (Top):** This dialog box is open for a feature class. It shows a table of fields with the following columns: 'Field Name' and 'Data Type'. The fields listed are: OBJECTID (Object ID), SHAPE (Geometry), GeoID (Long Integer), GeološkaJedinica (Long Integer), RangJedinice (Text), Mjesta (Long Integer), MjestaNaziv (Long Integer), TipičnaJedinica (Text), JedinicaNaziv (Text), Šifra (Text), ŠifraJedinice (Text), and SHAPE_Length (Double).
- Feature Class Properties Dialog (Bottom):** This dialog box is also open for a feature class. It shows a table of fields with the following columns: 'Field Name' and 'Data Type'. The fields listed are: OBJECTID (Object ID), SHAPE (Geometry), HGJedinica (Long Integer), GeoID (Long Integer), Jedinice (Long Integer), Class (Text), Duzina (Long Integer), ID (Long Integer), TipičnaJedinica (Text), GeološkaJedinica (Long Integer), SHAPE_Length (Double), and SHAPE_Area (Double).



Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG
13 Dec 2013, ZStevanovic

SHEMATSKI PRIKAZ IZRADE KARTE UGROŽENOSTI PV SRBIJE 1 : 500 000





Recommendations for GW monitoring

- The WFD does not specify the minimum duration or frequency of surveillance monitoring. Operational monitoring, however, must be conducted at least once a year, during the interval between surveillance monitoring cycles.
- WFD the following core set of determinants must be monitored on all GW bodies: dissolved oxygen, pH-value, electrical conductivity, nitrate, ammonium,
- As for the transboundary groundwater bodies, beside the core set of parameters they shall also be monitored for those parameters which are relevant for the protection of all of the uses supported by the groundwater flow.
- ICPDR recommends that temperature and a set of major (trace) ions should also be monitored.

German experience – Qualitative monitoring / Sampling frequency

Scenarios	Frequencies					
	Monthly	Quarterly	Half yearly	Yearly	2 Years	5 Years
Shallow groundwater (depth to table ≤ 3 m), unconfined porous aquifer	(x)	X	X	(x)		
Deep groundwater (depth to table ≥ 10 m), unconfined porous aquifer				(x)	X	X
Shallow ground-water (depth to table ≤ 3 m), unconfined fractured aquifer	(x)	X	X	(x)		
Deep groundwater (depth to table ≥ 10 m), unconfined fractured aquifer		(x)	X	X		
Karst aquifer (without more or less impermeable cover)	X	X	X			
Karst aquifer (with more or less impermeable cover)	(x)	X	X	(x)		
Confined groundwater (with more or less impermeable cover with thickness < 2 m)				X	X	(x)
Confined groundwater (with more or less impermeable cover with thickness > 2 m)				(x)	X	X
High rate of recharge		(x)	X	X		
Trend assessment			X	X		
Season-dependent human activities		(x)	X	(x)		

General recommendations for the development of groundwater monitoring – Sava Commission experience

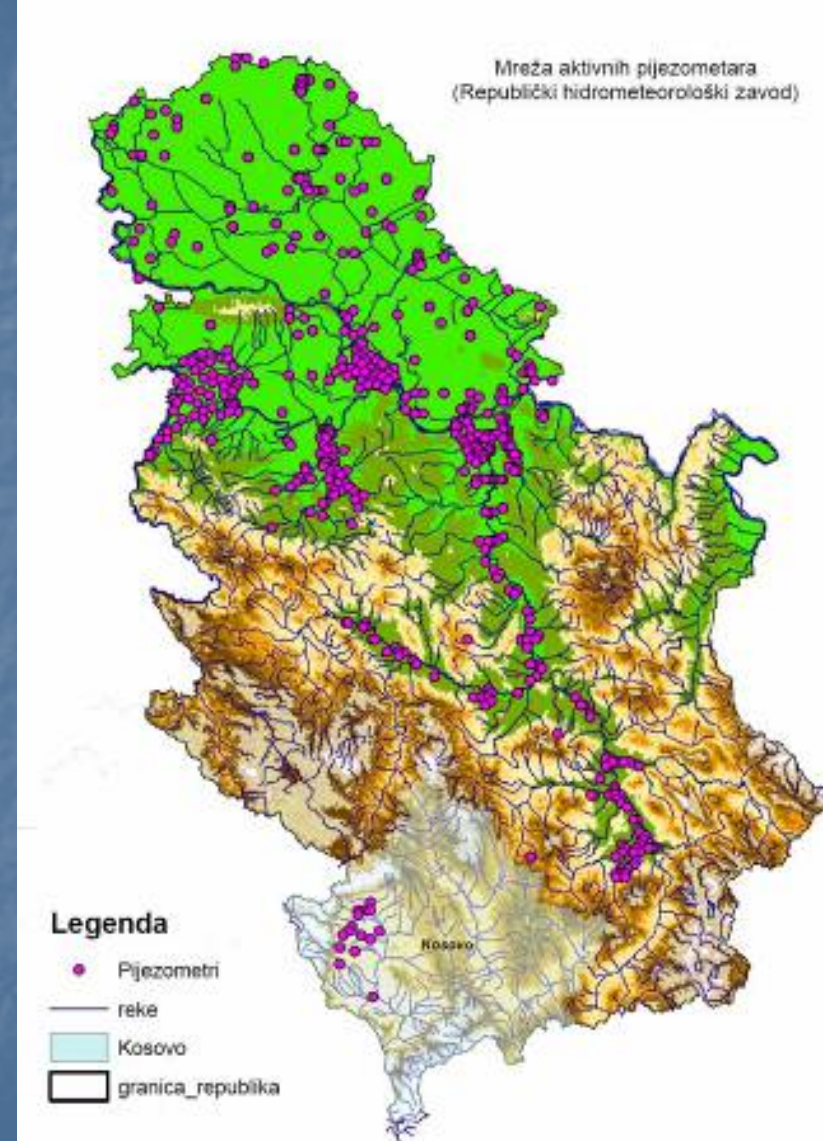
- Establishment of legal background for groundwater monitoring (where it does not exist), with clearly defined objective, scope, types of monitoring, monitoring parameters, monitoring frequency, applied standards, responsible institutions
- Systematic integration of water supply companies (and other water users) into the national wide groundwater monitoring system by a legal solution; groundwater monitoring must also be the task of water users such as public and industrial water suppliers, using groundwater for drinking and process water purposes.
- The network should have a balanced spatial density which considers the conceptual understanding of the natural characteristics and of the pollution risks of the groundwater body, to help focusing monitoring activities in areas where significant pressures combined with higher vulnerability exist. This approach requires preparation of land use maps and vulnerability maps.
- List of monitoring parameters should be adjusted to the WFD requirements, (core parameters: oxygen content, pH value, conductivity, nitrate, ammonium + parameters which put GW body at risk of failing to achieve good chemical status. Transboundary water bodies shall also be monitored for those parameters which are relevant for the protection of all of the uses supported by the ground-water flow.
- The number of monitoring stations and sampling frequency should be proportional to the complexity of status assessment of the groundwater body and presence of pollution trends

GW monitoring network in Serbia

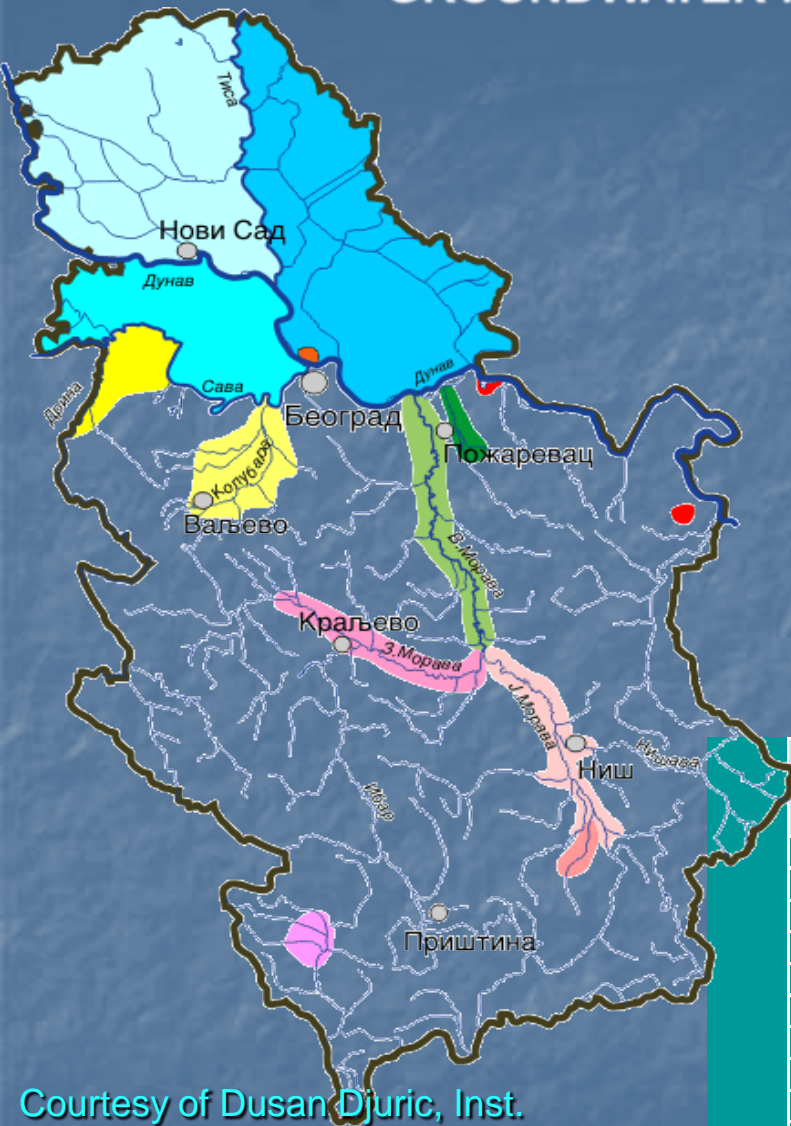
Monitoring of groundwater resources is undertaken at several levels: national level, city level, and water supply source level, as well as in a portion of riparian lands of the Danube, Sava, and Tisa rivers which are within the backwater zone of the Iron Gate Dam. The current Water Law requires the Hydrometeorological Survey of Serbia to **monitor groundwater regime only in alluvial sediments and shallow aquifers.**



Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic



GROUNDWATER MONITORING IN SERBIA (HMSS)



- Territory of Serbia is divided into 13 monitoring districts that generally correspond to major river catchments and major hydrogeologic collectors.
- The network is comprised of approx. 500 monitoring stations-piezometers, classified into 3 groups: Major stations (GWL and T), First order stations (GWL) and Second order stations (GWL).
- Water quality assessment program is performed on approx. 70 selected piezometers, mostly on GW from alluvial deposits
- 50 quality parameters are tested once a year (pH, conductivity, CO₂, HCO₃, NH₃, NO₂, NO₃, Ca, Mg, THC, Na, K, Cl, SO₄, P, N, H₂S, As, Phenol, pesticides, Triazine, PAHs, mineral oils, PCBs...)

District	Major stations 30 meas/month	First order stations 6 meas/month	Second order stations 3 meas/month
Južna Morava	4	16	23
Veternica	0	0	7
Podunavlje	4	0	0
Zapadna Morava	3	10	11
Kolubara	0	21	11
Mačva	4	17	38
Bačka	0	34	17
Banat	0	27	62
Srem	0	9	14
Velika Morava	3	78	75
Mlava	0	0	5
Podunavlje	0	0	4
Pančevački rit	0	0	4
Metohija	0	0	9
UKUPNO	18	195	297

Courtesy of Dusan Djuric, Inst. J.Cerni, Belgrade

Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic

NEED FOR IMPROVEMENT OF GW MONITORING IN SERBIA

- Assumption of the introduction of the **principle of an area-wide groundwater protection** into the Serbian water legislation
- Development of a **GIS-based groundwater vulnerability map**
- Implementation of a **GIS-based land cover or land use map**.
- Systematic integration of **water supply companies** into the national wide groundwater monitoring system by a legal solution
- Systematic integration of other **special networks**, that serve for identification of impacts on groundwater (e. g. groundwater damages by landfills or waste, ash and slag depots and other contaminated sites) and diffuse impacts (e. g. agriculture, industrial zones or settlements).

Courtesy of Dusan Djuric, Inst.
J.Cerni, Belgrade

ZAKON O VODAMA

Обавезе имаоца права коришћења вода који се бави снабдевањем водом, према члану 74 ЗоВ-а , без обзира да ли се ради о јавном предузећу или другом правном лицу, има обавезу да:

- 1) постави уређаје и обезбеди стално и систематско регистровање количина воде и испитивање квалитета воде на водозахвату;*
- 2) предузима мере за обезбеђење здравствене исправности воде за пиће и одржавање хигијене у објекту;*
- 3) предузима мере за обезбеђење техничке исправности уређаја.*

Правно лице, односно предузетник које користи воду у процесу рада или производње дужно је да обезбеди стално и систематско регистровање количина воде.

Лице из ст. 1. и 2. овог члана дужно је да податке о мерењима количине и квалитета воде на водозахвату доставља Министарству и јавном водопривредном предузећу, најмање једанпут годишње.

Јавно водопривредно предузеће податке из става 3. овог члана уноси у водни информационални систем.

Courtesy of Dusan Djuric, Inst.
J.Cerni, Belgrade

GW monitoring in Adriatic/Ionian region

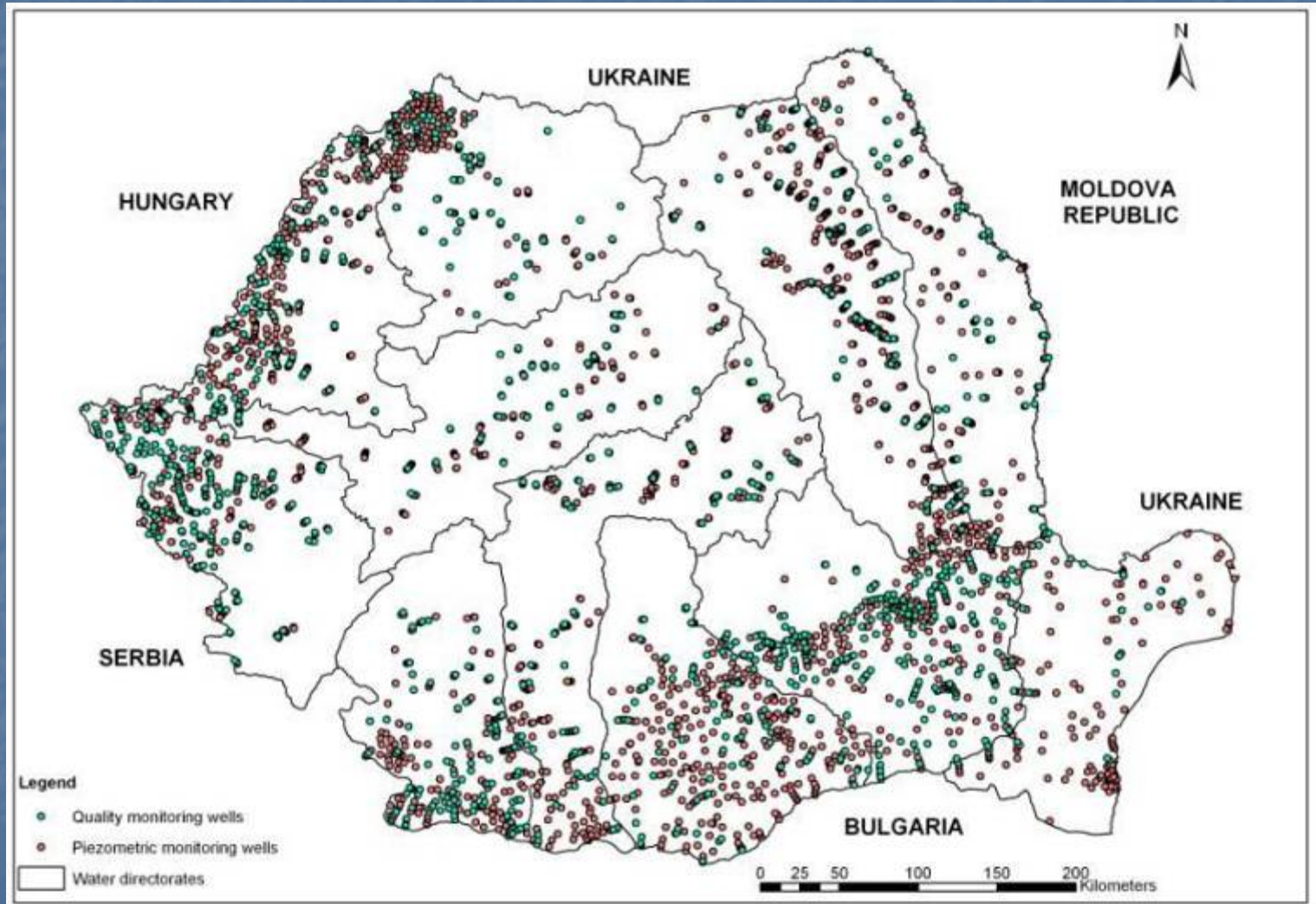
- **Croatia:** Characterization of GW bodies completed; Monitoring is taking place in accordance with EU WFD (Hrvatske Vode responsible). Data from local waterworks widely used.
- **B&H:** Characterization of GW bodies is on-going; no defined methodology for GW status/risk assessment. Data from local waterworks used.
- **Albania:** Preliminary characterization of GW bodies performed within CEMSA project. Currently, characterization undertaken by Albanian geological Survey (scale 1:200 000).
- **Montenegro:** Characterization of GW bodies firstly made in 2005 (ICPDR), a new one is taking place; Not yet established methodology for GW status/risk assessment.

Slovenia experience

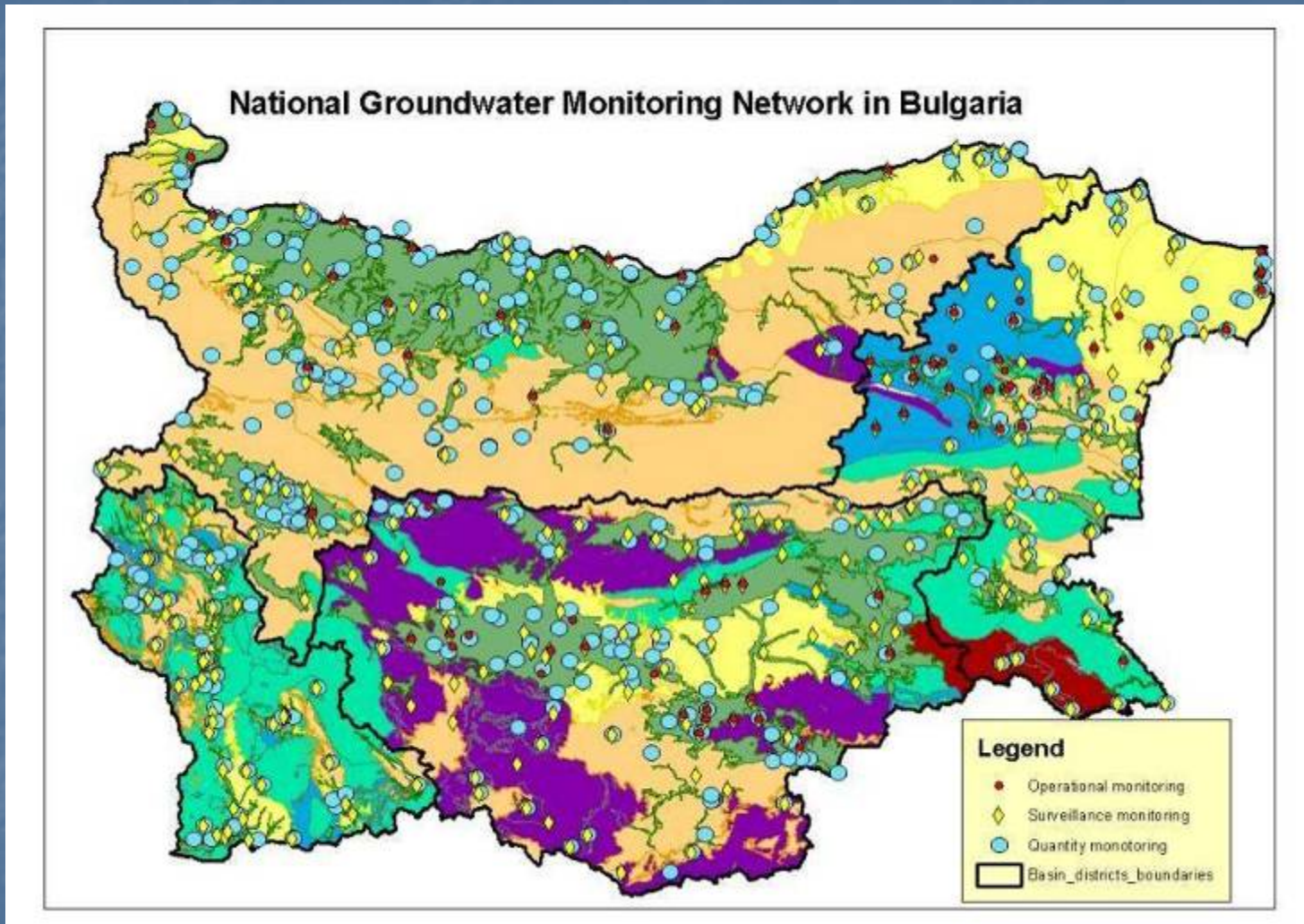
- Monitoring of the quality of groundwater in Slovenia is done since 1987. It is consistent with the requirements of the Water Framework Directive and the Slovenian legal regulations. The national monitoring of **groundwater quality** includes 123 sampling points in 15 water bodies of groundwater. The network is denser in aquifers with intergranular porosity and alluvial aquifers, where the groundwater is intensively used and pollution exist. At each point sampling is done 2-3 times per year. The analysis is done for 130 to 165 chemical and physical parameters.
- (*source: Sava River Basin MP, Bck.pap.2, Sava Commission, 2011*)

GROUNDWATER MONITORING IN ROMANIA

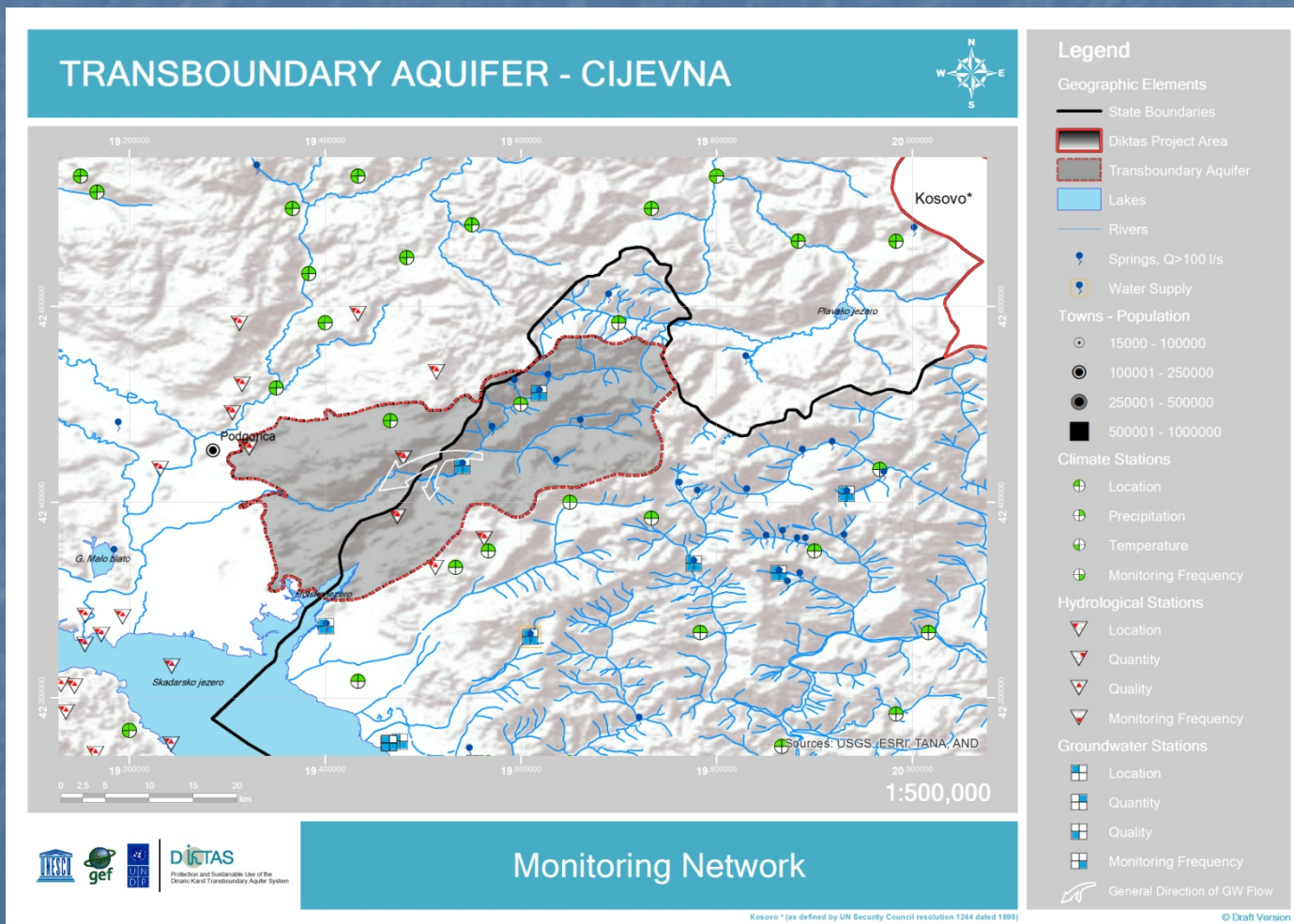
The National Hydrogeological Network



Bulgaria



DIKTAS project – Monitoring network in selected TB aquifers





Experts EU are working on adaptation and several guidances for WFD implementation in water practice. Working Group C is dealing with groundwater

Okrugli sto: Usaglašavanje CG zakonodavstva o vodama sa EU WFD, PG 13 Dec 2013, ZStevanovic



Thank you for your attention