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Environmental Management Framework

Floods Emergency Recovery Project
Bosnia and Herzegovina
Federation of Bosnia and Herzegovina

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ABBREVIATIONS AND ACRONYMS

BAM – the currency code for Convertible Marka
B&H – Bosnia and Herzegovina
BP – Bank Procedure
EA – Environmental Assessment
EIA – Environmental Impact Assessment
EIS – Environmental Impact Study
EMF – Environmental Management Framework
EMP – Environmental Management Plan
ESMF – Environmental and Social Management Framework
EU – European Union
EQS – Environmental Quality Standard
FB&H – Federation of Bosnia and Herzegovina
FERP – Flood Emergency Recovery Project
GDP – Gross Domestic Product
HS – Hydrological station
MZ – Local community (short from "mjesna zajednica")
NGO – Nongovernmental Organization
OCP - Organochlorine pesticides
OP – Operational Policy
PAD – Project Appraisal Document
PAH - polyciclic aromatic hydrocarbone
PID – Project Information Document
PIU – Project Implementation Unit
ROW – Right-of-way
RS – Republika Srpska
UN – United Nations
USD – American Dollar
UXO - Unexploded ordnances
WB – World Bank
WHO – World Health Organization

EXECUTIVE SUMMARY

1. Introduction

The development objective of the World Bank's Floods Emergency Recovery Project (FERP) is to meet critical needs and restore functionality of infrastructure essential for public services and economy recovery in areas affected by the May 2014 floods. This Environmental Management Framework (EMF) document is prepared for a part of the project that will be implemented in municipalities located in the Federation of B&H (FB&H) which are a part of the Bosna River Basin that was under the impact of floods.

2. History of floods in the project area and current flood protection schemes

The floods in January 2010 covered 650 ha area producing damage of 250,000 BAM (170,433 USD). Mainly urban zones were affected that resulted in significant physical damage. The hydrological flow analysis showed that the recorded flow at hydrological station in Zavidovići was of 1/100 occurrence probability.

The floods in May 2014 caused large-scale flooding with subsequent landslides. The most affected areas were Posavina Canton, Tuzla Canton, Zenica-Doboj Canton in the Federation of Bosnia and Herzegovina. Around 60 towns and cities in B&H were severely or slightly affected, occupying an approximately total area of 10,000 km^2 – 13,000 km^2. 25 people had died, about 90,000 people had been evacuated, and about 1 million or one-fourth of the total population had been directly affected. Large number of people is left homeless due to over 3,000 landslides. Water and landslides also moved mines and warning signs to unknown locations. Detailed hydrological analysis of the May floods, as well as damage assessments, is still not completed. The estimates indicate an overall impact of around USD 1.6 billion of physical damage (8% of GDP) and USD 1.2 billion of economic loss (6% of GDP).

The floods in August 2014 caused new flooding that resulted in additional damages and landslides. According to the press release issued by the Water Agency for the Sava River Catchment Area, the most affected areas were the cantons of Tuzla and Zenica-Doboj with highest water level recorded on the Spreča River[1]. The estimates indicate an overall impact of around 119,678,256.48 BAM (81,577,548.98 USD) in the Tuzla Canton only. The preliminary damage assessment for the Zenica-Doboj Canton's August 2014 floods is still not available.

Current flood protection facilities are mainly built in larger settlements along the Bosna River including Visoko, Kakanj, Zenica, Zavidovići, Doboj and Odžak and they do not provide sufficient flood protection. In the Sarajevo area, regulation of the Miljacka River is performed in length of 10 km. The concept of flood protection in the Sarajevo Canton is based on high waters that have occurrence 1/500; however, this goal is not achieved on all regulated water courses. Flood protection along the Spreča River is performed using dikes designed to ensure protection from waters that have occurrence probability of 1/20. The Usora River is the least regulated river. In the Lašva River flooding plain, only few river training projects were implemented and flood protection structures built; however, they do not provide adequate protection.

3. Description of the environment in the project affected area

Location. The Bosna River flows for 275 kilometers through the central part of Bosnia. Its biggest tributaries are the rivers of Željeznica, Miljacka, Fojnica, Lašva, Gostović, Krivaja, Usora, and Spreča. The Bosna River Basin is home to almost a million people living in 43 municipalities including the cities of Sarajevo, Visoko, Kakanj, Zenica, Zavidovići, Žepče, Maglaj, Doboj, Modriča and Bosanski Šamac. The most developed industrial regions in the country are located along this river. Wastewater from local communities and industrial facilities are discharged directly into the river, mainly without any treatment.

Climate and meteorology. Climate of the Bosna River Basin is quite complex and consists of two separate climatic zones: continental mountain or alpine climate in the central part and moderate

[1] Press release by Water Agency for Sava River Catchment Area from 06.08.2014. htpp//www.voda.ba

continental or middle European climate in the north. The average perennial rainfall amounts to 867.33 l/m^2. In 2012, the annual rainfall in the northern part of the basin ranged from 860 to 890 l/m^2. The total rainfall in Doboj was 814 l/m^2 and in Sarajevo 928 l/m^2.

Hydrogeology. The following paleogeographic structural units are found in the Bosna River Basin from south to the north: (i)Dinaric carbonate platform (outer Dinarides) and Bosnian Flysch, (ii) Middle Bosnian Schist Mountains and Paleozoic of the northeastern Bosnia, (iii) Ophiolite zone of Ozren and Konjuh with remaining of carbonate layers and olistoliths (Inner Dinarides), (iv) Sava-Vardar zone (formation of active continental edge) and Neogene basins of B&H (Oligocene, Neogene and Quarter formations).

Hydrology. The specific flow rates of the Bosna River are surface flow 15.59 $l/s/km^2$ and mean flow volume 100 m^3/s. The highest water level of the Bosna River occurs in the period from March to May and in November, whilst the lowest one occurs in August and September. The river freezes only during severe winters. In the lower course, it deposits great amounts of gravel which affects the movement of riverbed. The bottom of the riverbed is predominantly composed of impermeable rocks.

Water quality. Monitoring of physical-chemical, chemical and microbiological status of the Bosna River in 2012 showed that 62% of water samples indicate bad chemical status of waters. Priority substances that were determined not to satisfy the Environmental Quality Standards were mercury, cadmium, lead, nickel, polycyclic aromatic hydrocarbon (PAH) and organochlorine pesticides (OCP). The origin of the pollution, whether it is natural or anthropogenic, is not known.

Soil. The soil classification in the Bosna River Basin is carried out based on standard FAO classification. The following types of soil are found: (i) Acid brown soil 6.38 %, (ii) Hummus silica soil 9.94 %, (iii) Brown soil on limestone and dolomite 20.96 %, and (iv) Limestone-dolomite black soil 25.94 %.

Forests. Remaining of common oak and hornbeam forests can be found at the lowest altitudes. In the hilly zones found in the area from Sarajevo to Zenica and in the part of the Lašva and Usora catchment area, the most common are sessile oak and common hornbeam forest communities that are mixed with common beech and sessile oak forests. At the higher altitudes, common beech forests are found or they are mixed with forests of sessile oak and common hornbeam. Mountain areas are mainly covered with mixed beech and silver fir and spruce forests. At higher altitudes and colder zones, mixed forests of silver fir and spruce are found. At highest subalpine altitudes, subalpine beech and subalpine spruce are found as well as communities of mungo pine.

Flora. This ecosystem of the Bosna River Basin is characterized in the range between medium biodiversity rate due to large urban agglomerations and very rich biodiversity in intact areas. Human activities resulted in the transformation of forest ecosystems into secondary ecosystems of meadow vegetation. The ecosystem of hygrophile forests with black alder is located near rivers and creeks, as well as on smaller surfaces around wells and flooded areas. In the swamp areas that are under the influence of high groundwater level, black alder and willows phytocenosis are present. As a result of anthropogenic activities, fragments of tertiary vegetation can be found that indicate disturbed ecological equilibrium. Vegetation of trodden habitats covers terrains found above groundwater sources and next to the traffic infrastructure, inside protection zones and next to commercial facilities as well as locations that are partially trodden down and with medium content of nitrates. Many centers of endemic species and living communities are found in the Spreča River Valley, as well as centers of relict species – refugia of tertiary flora and fauna.

Fauna. The Bosna River and its tributaries are inhabited by 28 fish species, mainly cyprinid. Fishing is prohibited in the spawning period (e.g. from 1 April to 31 May for common carp, from 1 April to15 June for catfish, from 1 October to 1 March for rainbow trout, etc.). The Bosna River also shows rich biodiversity in macro invertebrate community in all parts of its watercourse. Land fauna is mostly absent in city regions excluding domestic animals like domestic cats and dogs and avian fauna represented mostly by species living together with humans like pigeons, crows, sparrows, etc. In the last few years, the large populations of the duck family can be found around the Bosna River. In parts of the watercourses running through the cities, there are no protected, endangered and sensitive water fauna species because of higher pollution from the city wastewater and industry wastewater.

Protected areas. 9 nature protected areas are found in the Bosna River Basin, out of which 5 are proclaimed as protected while other 4 are "planned" to be protected. Another 27 areas of rich biodiversity are found in the Bosna River Basin and their status is unknown. 29 water springs used for water supply of municipalities in the Bosna River Basin are under protected regime or are to be protected in line with the project documentation prepared.

4. Environmental assessment requirements and procedure

The environmental assessment in FB&H is implemented within the environmental permit issuing procedure. The procedure is integrated into requirements from laws in the following areas: i) nature protection, ii) waste management, iii) water management, and iv) construction. According to the current legislation, the proposed subprojects related to reconstruction of existing local and regional infrastructure are not subject to environmental assessment according to federal and cantonal environmental regulation. However, in case the project involves construction of new or widening of existing infrastructure with increase of current capacities, it might be subject to environmental assessment above the threshold capacities given in appropriate rulebooks. By the analysis of other regulations, it was determined that the infrastructure reconstruction projects need to have water permits and construction permit.

The WB policies that were taken into account for the purposes of development of this document include OP 4.01 on Environmental Assessment as well as policies that might be triggered depending on the project circumstances: OP/BP 4.04 – Natural Habitats, OP 4.07 – Water resources management, OP 4.11 – Physical Cultural Resources, OP 4.36 – Forests. According to the WB OP 4.01, the project is classified as environmental category "B" and the appropriate EA instrument is the ESMF.

Therefore, the necessary steps prior to the commencement of the public procurement of works on the execution of the reconstruction of subprojects not found on the exclusion list in the FB&H, is the following:

- Step 1. Prepare ESMF (per World Bank requirements)
- Step 2. Organize consultation with stakeholders
- Step 3. Obtain Water Approval
- Step 4. Obtain Reconstruction Approval.
- Step 5. Obtain Water Permit.
- Step 6. Obtain Use Permit.

5. FERP Screening Checklist

The ESMF contains the FERP Screening Checklist that is a simple tool for identification of potential environmental impacts related to the reconstruction of existing infrastructure that was damaged due to recent floods. It will also help to simplify decision-making process on whether a detailed EMP needs to be developed for a project or not. The FERP Screening checklist provides a set of associated environmental mitigation measures as well as monitoring measures that will help assess the implementation of the selected mitigation measures. The screening checklist is to be used for all smaller reconstruction subprojects on the reconstruction of roads, railways and buildings where identified issues will not produce significant effects on environment. For all other large reconstruction subprojects, specific EMPs will be developed.

6. Environmental management plan

The sample EMP is prepared based on the identification of possible negative environmental impacts for typical reconstruction works that are to be implemented within the FERP including (i) reconstruction of local road (including bridges, culverts etc.); (ii) reconstruction of local water supply network; (iii) reconstruction of regional public infrastructure (roads, dykes etc.). Considering similar nature of the works to be carried out and common impacts, one sample EMP for infrastructure reconstruction is prepared addressing pre reconstruction, reconstruction and operation phase. The sample EMP includes mitigation measures for reducing possible adverse impacts in all three phases, including the estimation of costs and the responsibility for implementation. The EMP can also serve as guidelines for environmentally sound construction practices. The EMP includes environmental monitoring plan comprising measures for monitoring of emissions from the site during construction, monitoring of implementation of mitigation measures, and monitoring of conditions after the project is put in use.

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1 PROJECT OVERVIEW

An unprecedented rainfall, the worst since the beginning of records 120 years ago, started in early/mid-May 2014 and resulted in massive floods in both entities as well as in the Brčko District in Bosnia and Herzegovina (B&H). Preliminary evidence shows that the largest impact was on infrastructure relating to housing, local services, energy, transport, water and sanitation and agriculture.

The Bank's response to the floods has been prompt, with strong contribution and leadership for the joint damage and needs assessment. A Recovery Needs Assessment (RNA) is prepared by the B&H Government with support from the EU, UN and the World Bank. The RNA will provide a basis to develop effective infrastructure and services rehabilitation measures in the affected areas.

The first element of the Bank's financing response is the Floods Emergency Recovery Project (FERP), an emergency operation focused on the priority sectors of Agriculture and Rural Development, Energy, Transport and Water and Sanitation. The development objective of the FERP is to meet critical needs and restore functionality of infrastructure essential for public services and economy recovery in the floods affected areas. The project has four components as follows:

Component 1: Emergency Disaster Recovery Goods that will finance the purchase of goods urgently needed during the recovery phase.

Component 2: Rehabilitation of Key Public Infrastructure will finance the a) *Subcomponent 2A: Regional Infrastructure Rehabilitation* and b) *Subcomponent 2B: Local Infrastructure Rehabilitation*.

Component 3: Project Implementation Support and Capacity Building will finance the management of the Project and any support needed for the identification and implementation of sub-activities including technical assistance and capacity building.

The FERP is classified as environmental category "B", in accordance with Operational Policy OP 4.01. Since exact subprojects are not determined and will be decided based on demand and consultations with the concerned municipalities and communities, the appropriate instrument of OP 4.01 is an Environmental and Social Management Framework (ESMF).

To this extent, the objective of this assignment is to prepare ESMF targeting three groups of potential investments in Federation Bosnia and Herzegovina (FB&H) recognized as the most pertinent ones: (i) reconstruction of local roads, (ii) reconstruction of local water supply network, and (ii) reconstruction of regional public infrastructures (roads, dykes, etc.). The FERP in the FB&H will be implemented in the regions affected by floods in Sarajevo Canton, Zenica-Doboj (Ze-Do) Canton, Tuzla Canton and Posavina Canton. All regions affected by floods are located in the Bosna River Basin.

The ESMF will establish an approach to meeting reconciled national and WB requirements and presents a unified policy and procedure to be followed while screening the potential investment for its environmental impacts. For that purpose, the ESMF will include:

- a screening Checklist that will serve to (i) screen out activities that correspond to Category A projects, or that may trigger additional safeguards policies, as well as to (ii) make decision on eventual development of EMP for potential investment activities, and
- sample Environmental Management Plan (EMP) for three categories of potential investments focusing on three generic areas: mitigation measures, institutional strengthening and training and monitoring.

2 HISTORY OF FLOODS IN THE PROJECT AREA

2.1 Floods in 2010

The analysis of historical floods in the Bosna River Basin was done in 2012 for the purpose of preliminary flood risk assessment in the Sava River catchment area[2]. The assessment is done based on information collected from concerned municipalities (Table 1). They cover period of the last 15 years where some municipalities sent even older data. Majority of given information is related to the floods in January 2010. Usora, Banovići, Kalesija and Lukavac did not provide data, while Vareš reported that no floods were recorded in the past. The floods in 2010 affected the same municipalities in Bosna River Basin that were under impact of 2014 floods including the largest cities in Sarajevo, Zenica Doboj and Tuzla Cantons, as well as municipalities in Middle Bosnia Canton that are located in the Bosna River flooding plain (see Figure 1 on page 7).

Table 1 Review of history of floods in the Bosna River Basin

Canton	Municipality	Water course	Time of flood occurrence	Flooded areas	Flooded land (ha)	Estimated losses (BAM)
SARAJEVO	Trnovo	Željeznica	21.12–11.01.2010	From bridge Garež to bridge Ilovica	30.00	
	Ilidža	Bosna, Željeznica, Dobrinja	05.–10.01.2010	MZ[3] Otes, MZ Stup, MZ Osijek	65.00	-
	Novi Grad	Miljacka	23.–25.12.2009 06.–10. 01.2010 20.–21.02.2010	Dobroševićka and Reljevska streets from bridge in Bojnik to bridge in the settlement of Rječica	-	-
	Vogošća	Vogošća, Ljubina, Bosna	05.–07.01.2010	Settlements of Semizovac and Svrake	35.00	-
	Ilijaš	Misoča, Bosna	09.–11.01.2010	River banks of Ljubina and Misoča and Rače and Povoče creeks		20.000,00
MIDDLE BOSNIA	Busovača	Lašva, Kozica	09.–10.01.2010	Settlements of Kaonik, Luka, Donja Rovna, Gusti Grab, Kaćuni, Gornje/Donje Polje, Merdani, Solakovići/Donji Solakovići	130.00	
ZENICA-DOBOJ	Breza	Stavnja	09.-10.01.2010	Šaš, Podžupča and Bulbulušići	30.00	
	Visoko	Bosna, Fojnička rijeka	07.–11.01.2010	Seoča, Dobrinje, Radinovići, Okolišće, Gornje and Donje Moštre, Čekrekčije, Ozrakovičko polje, settlement Luke and Prijeko and	110.00	129.549,15

[2] Methodology for preliminary flood risk assessment in the Sava river catchment area for the water courses of I category, Book I and Book II, Hydro-Engineering Institute Sarajevo, June 2010

[3] MZ = mjesna zajednica (*Engl.* Local community)

Canton	Municipality	Water course	Time of flood occurrence	Flooded areas	Flooded land (ha)	Estimated losses (BAM)
				village Zbilje		
	Kakanj	Bosna	06.–12.01.2010	MZ Čatići, MZ Doboj, MZ Povezice, MZ D. Kakanj and MZ Bilješevo	155.00	
	Zenica	Bosna	07.–11.01.2010	Settlements of Lukovo polje, Nemila, Blatuša, Bilmišće, Dolipolje, Ljubetovo-Vranduk, settlements in the Kočeva river basin	40.00	
	Žepče	Bosna	09.–11.01.2010	Residential buildings in Begov Han	-	46.728,00
	Zavidovići	Krivaja	03.–05.07.2005	Settlements of Kovači, Vozuća with Stošnicom, settlement Krivaja, city area and Brezik	55.00	
	Maglaj	Bosna with tributaries-Krivaja, Gostović, Bistričak, Lješnica and Jablanica	03.–05.07.2005	Bradići-Fojnica, Donji Ulišnjak, Liješnica, Maglaj-city, Jelovac, Moševac, Kosova and Bijela ploča	855.00	2.913.254,40
	Doboj Jug	Bosna, Usora	20.-21.06.2001 02.–03.07.2005 03.–04.07.2006 16.–17.01.2010	Matuzići and Mravići Matuzići Matuzići Matuzići	150.00 120.00 120.00 50.00	3.467.000,00 759.500,00 500.000,00 50.000,00
	Doboj Istok	Spreča	18.06.–06.07.2001	Spreča river valley from MZ Brijesnica Mala to exit from MZ Stanić Rijeka		
	Tešanj	Tešanjka, Trebačka river and Usora	23.07.1976 03.07.2006 10.07.2009	MZ Tešanjka Kalošević MZ Karadaglije – Jablanica, MZ Medakovo-Novo Selo-Tešanjka, Mekiš. Braće Pobrić street, Kralja Tvrtka street		
TUZLA CANTON	Živinice	Spreča	30.12.2009–07.01.2010 19.–29.06.2001	Sprečko polje Sprečko polje		
	Tuzla	Jala and Tinja	16.06.–11.07.2005	Western part of the city	100.00	

Canton	Municipality	Water course	Time of flood occurrence	Flooded areas	Flooded land (ha)	Estimated losses (BAM)
	Gračanica	Spreča	31.05.–11.06.2010 18.06.–06.07.2001	Sprečko field from MZ Miričina to MZ Stjepan polje, from MZ Lukavica to Lukavička rijeka, area of MZ D. Orahovica from Moranjičke rijeke, area of MZ D. Lohinja to Lohinjski creek Spreča river valley from MZ Miričina to exit from MZ Stjepan Polje		12.296.629,10 12.296.629,10
	Olovo	Krivaja, Stupčanica, Biošica	09. - 12. 05. 1965 spring 1968 fall 1987	Settlements of Olovo, Križevići, Solun, Čuništa, Careva Ćuprija	20.00	

The floods in January 2010 covered 650 ha area producing damage of 250,000 BAM (170,433 USD). This is significantly less comparing to the floods in 2014, however the common areas were flooded, mainly urban zones, with significant physical damage. Due to insufficient sewage system capacities, the sewage overflow was also recorded worsening epidemiological situation. The highest recorded water flows and water level are given in Table 2.

Table 2 Records of hydrological station in the Bosna River Basin during the floods in 2010[4]

Station	Water course	Period	Highest flow registered Q (m^3/s)	Highest level registered H (cm)	Date and time
Vrelo Bosne	Bosna	21.12.2009.-16.01.2010.	34.11	87.30	10.01.2010 03:00:00
Rimski Most	Bosna	21.12.2009.-16.01.2010.	253.21	203.96	09.01.2010 21:00:00
Ilidža	Željeznica	21.12.2009.-16.01.2010.	115.29	176.85	06.01.2010 22:00:00
Zavidovići-Bosna river	Bosna	28.12.2009.-15.01.2010.	1.795,43	559.20	10.01.2010 07:00:00
Olovo	Krivaja	21.12.2009.-16.01.2010.	138.33	299.00	06.01.2010 04:00:00
Zavidovići-Krivaja river	Krivaja	21.12.2009.-16.01.2010.	271.81	331.80	10.01.2010 03:00:00
Maglaj	Bosna	21.12.2009.-16.01.2010.	1.616,381	602.70	10.01.2010 09:00:00
Karanovac	Spreča	21.12.2009.-15.01.2010.	267.89	407.30	24.12. 2009 06:00:00

The assessment of probability occurrence at the hydrological stations in the Bosna River Basin for the January 2010 floods was done by the Water Agency for the Sava River Catchment Area. The comparison between observed flows and flows of occurrence probability once in 5, 20, 30 and 100 years were done. The analysis showed that the recorded flow at hydrological station in Zavidovići was of 1/100 occurrence probability. The information on extent of damage as given in the Federal Civil Protection Report on 2010 Floods is presented in Table 3.

[4] Methodology for preliminary flood risk assessment in the Sava river catchment area for the water courses of I category, Book I and Book II, Hydro-Engineering Institute Sarajevo, June 2010

Table 3 Flood damage assessment 2010

CANTON	MUNICIPALITY AFFECTED BY FLOODS AND LAND SLIDES	NUMBER OF DEMOLISHED HOUSING FACILITIES	NUMBER OF DAMAGED HOUSING FACILITIES	EVACUATED POPULATION		ENDANGERED POPULATION		FLOODED LAND			FLOODED FACILITIES				FLOODED INFRASTRUCTURE				PRELIMINARY DAMAGE ASSESSMENT (BAM)
															BRIDGES		ROADS		
				NUMBER OF FAMILIES	NUMBER OF PERSONS	NUMBER OF FAMILIES	NUMBER OF PERSONS	TOTAL FLOODED AREA (ha)	AGRICULTURAL LAND (ha)	ACTIVE LANDSLIDES (number)	PRIVATELY OWNED (HOUSEHOLDS)	RESIDENTIAL BUILDINGS	COMMERCIAL BUILDINGS	OTHER FACILITIES	DAMAGED (number)	DESTROYED (number)	DAMAGED (m)	TERMINATION OF TRANSPORT	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
POSAVINA CANTON	Domaljevac Šamac					90	380	3949	3820		128	33	193						2,909,956
	Orašje					50					5								5,074,384
	Odžak																		2,566,507
Total						**140**	**380**	3949.00	**3820**		**133**	**33.00**	**193**						**10,550,847**
TUZLA CANTON	Banovići							4	4	28	5								
	Doboj Istok	5	33	3		20		780	580	73	55		2			1			4,572,286
	Kalesija		9					390	390	152	19		1		2	2		1	2,611,000
	Gračanica		127	112	200	50		550	550	64	510		4			2		4	5,559,328
	Živinice	1	65					830	830	21	350		15			1		7	2,125,664
	Gradačac		72	7		8		180	180	117			2	1		2			3,564,909
	Srebrenik		89	5		50		800	800	200	215		18	144		2			1,696,055
	Čelić	4	25	20						23	102							2	593,386
	Kladanj									7						3			
	Lukavac		76	1	4	5		300	300	14	56		6						3,996,368
	Sapna		1							21									265,080
	Teočak									3	1								
	Tuzla	3	264	17	46	16	46			277					1				10,059,450
Total		**13**	**761**	**165**	**250**	**149**		**3834**	**3634**	**1000**	**1313**		**48**	145		**13**	**0**	**14**	**35,043,526**
ZENICA- DOBOJ CANTON	Breza									2									
	Kakanj							107	65		102		14					2	577,000
	Doboj jug		141	12				115	110	3	106		11						1,170,180
	Maglaj	25	4	1		1		42	35	6	78		12	11				1	3,909,303
	Olovo									6								1	
	Tešanj			8		43		5	5	21	10		3					2	
	Usora		6	30						1	80							1	928,373

CANTON	MUNICIPALITY AFFECTED BY FLOODS AND LAND SLIDES	NUMBER OF DEMOLISHED HOUSING FACILITIES	NUMBER OF DAMAGED HOUSING FACILITIES	EVACUATED POPULATION		ENDANGERED POPULATION		FLOODED LAND			FLOODED FACILITIES				FLOODED INFRASTRUCTURE				PRELIMINARY DAMAGE ASSESSMENT (BAM)
															BRIDGES		ROADS		
				NUMBER OF FAMILIES	NUMBER OF PERSONS	NUMBER OF FAMILIES	NUMBER OF PERSONS	TOTAL FLOODED AREA (ha)	AGRICULTURAL LAND (ha)	ACTIVE LANDSLIDES (number)	PRIVATELY OWNED (HOUSEHOLDS)	RESIDENTIAL BUILDINGS	COMMERCIAL BUILDINGS	OTHER FACILITIES	DAMAGED (number)	DESTROYED (number)	DAMAGED (m)	TERMINATION OF TRANSPORT	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Zavidovići							1	1	2	6			5		1			
	Zenica				1						2								
	Žepče																	1	
Total		**25**	**151**	**51**	**1**	**44**		**270**	**216**	**41**	**384**		**40**	**16**		**1**	**1**	8	**6,584,856**
SARAJEVO CANTON	Ilidža			11	12	7	12	150	90		200						8	96	
	Vogošća					20	48	6	4		45			30			3	72	
	Novi Grad			3	12	8	16				50	1	15					5	
	Hadžići					20	78	45	45		23	2		22	2		1		
	Ilijaš					20	60	1	1		25								
Total				**14**	**24**	**75**	**214**	**202**	**140**		**343**	**3**	**15**	**52**	**2**		**12**	**173**	**0**

2.2 Floods in 2014

Floods in the year 2014 occurred twice by the time of the completion of this report.

Heavy rains in May 2014 caused large-scale flooding with subsequent landslides. Those heavy rains are considered the heaviest rainfall in B&H since records began in 1894.

Around 60 towns and cities were severely or slightly affected, occupying an approximately total area of 10.000 km2 - 13.000 km2. The most affected areas in FB&H were Posavina Canton, Tuzla Canton, and Zenica-Doboj Canton. The smaller areas of Sarajevo and Middle Bosnia Cantons along Bosna River Basin were also impacted by floods.

The Government declared a state of emergency on May 14, 2014 in affected municipalities of both entities as well as in the Brčko District in Bosnia and Herzegovina (B&H).

Figure 1 Impact of floods in Southeast Europe[5]

25 people had died, about 90,000 people had been evacuated, and about 1 million or one-fourth of the total population had been directly affected in around 60 of BiH's 142 municipalities. Large number of people is left homeless due to the landslides. At the time of the floods, 12 Collective Centers were opened in the Federation of Bosnia and Herzegovina.

The number of landslides has been over 3000, which have, in addition to all other damages, moved mines and warning signs to unknown locations. Two weeks after the floods, two thirds of the known minefield was affected, but only few mines or unexploded ordnances (UXOs) were found during the retreat of water. Even if, so far, only one mine's explosion was reported in a river, without any more information, the danger of mine and UXO's related accidents remains high[6].

Preliminary evidence shows that the largest impact was on infrastructure relating to housing, local services, energy, transport, water and sanitation and agriculture. Severe damage has been reported to electricity distribution systems and one of the mines supplying the key power generation plant of Tuzla, which supplies over 20 percent of country's demand. In many locations, urban, industrial and rural areas were completely covered with water, cut off and without electricity, transport or communication. The event temporarily deprived an estimated 1 million people (25% of the country´s total population) of

[5] http://poplave.gdi.net
[6] ECHO Joint Mission report – Bosnia and Herzegovina floods, European Commission, Humanitarian Aid and Civil Protection, 6.6.2014

drinkable water. An influx of raw sewage and animal carcasses has increased disease risks. Rough estimates are that around 100,000 homes and other buildings, as well as 230 schools and hospitals, have been damaged or destroyed, in addition to significant damage to other public infrastructure. Landslides and erosion by the sediment-loaded rivers caused substantial damage to houses and public infrastructure at many locations and washed away 20 bridges. Traffic was disrupted along many national roads and railways in the region, and telecommunication lines were disturbed in these areas.

Detailed hydrological analysis of the May floods as well as damage assessments is still not completed and available by the responsible agencies. The estimates indicate an overall impact of around USD 1.6 billion of physical damage (8% of GDP) and USD 1.2 billion of economic loss (6% of GDP) from the floods.

Heavy rains in August 2014 caused new flooding that resulted in additional damages and landslides. According to the press release issued by the Water Agency for Sava River Catchment Area, the most affected areas were the cantons of Tuzla and Zenica-Doboj with highest water level recorded on the Spreča River[7].

Table 4 Recorded water levels on 06.08.2014

Flooded area	Hydrological station	Water course	Current state (cm)	State of alarm (cm)	Trend in last 24 hr
Odžačka Posavina	Slavonski brod	Sava	298	730	(+19)
Middle Posavina	Slavonski Šamac	Sava	210	650	(+81)
Middle Posavina	Grebnice	Sava	454	800	(+72)
Zenica	Raspotočje	Bosna	116	400	(+61)
Maglaj	Maglaj-Poljice	Bosna	464	600	(+335)
Sprečansko polje - Gračanica	Karanovac	Spreča	547	300	(+266)

According to the information from the Civil Protection of the Tuzla Canton[8], in the period from 05.08.2014, 18:00 hr to 06.08.2014, 10:00 hr 127,8 l/m^2 of rainfall was recorded while average rainfall in August is 84 l/m^2. Due to heavy rains, on August 7 the Federal Government proclaimed state of natural and other disaster on the territory of FB&H. The extent of damage is shown in the table below. The estimates indicate an overall impact of around 119,678,256.48 BAM (81,577,548.98 USD).

Table 5 Preliminary flood damage assessment for the Tuzla Canton, May 2014

Preliminary damage assessment for Tuzla Canton				
1	Type of disaster	State of natural disaster in the Tuzla Canton for the period of 5-9.8.2014		
2	Area	Affected municipalities	Banovići, Čelić, Doboj Istok, Gračanica, Gradačac, Kalesija, Kladanj, Lukavac, Sapna, Srebrenik, Teočak, Tuzla, Živinice	
3	Population	Died	0	
		Injured	2	
		Evacuated	2367	
6	Preliminary damage assessment	Housing facilities	Destroyed (number)	3
			Financial assessment (USD)	81796,86
			Damaged (number)	3319
			Financial assessment (USD)	11,743,895.56
		Land Orchards	Area (ha)	7,273.50
			Financial assessment (USD)	16,424,183.22
		Livestock	Died	1,927
			Financial assessment (USD)	34,082.03
			Injured	200
			Financial assessment (USD)	6816.41
		Other damages	Financial assessment (USD)	53,286,774.9
7	TOTAL (USD)			81,577,548.98

[7] Press release by Water Agency for Sava River Catchment Area from 06.08.2014. htpp//www.voda.ba
[8] Information on floods and landslides on the territory of Tuzla Canton in period 05-09.08.2014, no 18/01-44-018289/14 from 11.08.2014

In the Zenica-Doboj Canton, the most difficult situation was in the Zavidovići Municipality. The rain triggered new landslides in several local communities including Željezno polje that was heavy impacted by May's floods.

The preliminary damage assessment for the Zenica-Doboj Canton's August 2014 floods is still not available.

2.3 Current and future flood protection schemes

Current flood protection facilities are mainly built in larger settlements along the Bosna River including Visoko, Kakanj, Zenica, Zavidovići, Doboj and Odžak. Usually the works were done in phases, mainly shorter sections and on one of the river banks due to the lack of financial means, which does not provide sufficient flood protection.

The following rivers belong to the Bosna River Basin: Spreča with Oskova, Gostelja and Turija, Jala and Mramorski creek, Usora and Lašva, as well as water courses in the area of the Sarajevsko field. The information of flood protection structure is taken from Federal Water Management Strategy 2010-2020[9].

The Spreča River's flooding plain upstream from the Modrac reservoir covers the area of 5,000. Flood protection is performed using dikes designed to protect from waters that have occurrence probability of 1/20. The area of Živinice and around the Modrac Lake is endangered by floods from the rivers of Spreča and Oskova, as well as water from the Modrac reservoir. The area downstream from the Modrac reservoir, where high waters are suppressed by the reservoir itself, is not flooded so frequently, although the need for the Jala and Spreča river training is still present.

The Usora River is the least regulated river although it is susceptible to floods due to extensive gravel exploitation that have an impact on the shape of the riverbed and water springs.

Beside the risk that the Lašva River poses to the Travnik Municipality, this river very frequently floods downstream valleys of the municipalities of Dolac, Vitez and Stara Bila, as well as upstream areas of Han Bila on the Bila water course. In this area only few river training works were done and flood protection structures built. They cannot provide adequate protection, especially to those municipalities that rapidly expand such as the Vitez Municipality.

The Sarajevo field is under the influence of high waters from the Bosna River and its tributaries Dobrinja, Željeznica, Miljacka, Zujevina and Tilava. Damages that occur as a result of floods are very significant since it is the densely populated urban area. The Miljacka River regulation is performed in the length of 10 km. The concept of flood protection in the Sarajevo Canton is based on high waters that have occurrence 1/500, however this goal is not achieved on all regulated water courses.

The latest assessment of status of regulation of watercourses of I and II category in the Zenica Doboj Canton is presented in the table below[10]. The same information is not available for the Sarajevo, Tuzla and Posavina Cantons.

Municipalities that prepared project documentation for new flood protection structures in the Zenica Doboj Canton are Maglaj, Žepče, Kakanj, Zenica, Visoko and Olovo. The Report on status of watercourses in the Zenica-Doboj Canton prepared by the Hydro-Engineering Institute in 2014 gives recommendations of measures for protection of riverbank zones in all concerned municipalities in this Canton with the assessment of costs.

[9] Federal Water Management Strategy 2010-2020, Institute for Water Management Sarajevo and Institute for Water Management Mostar, May 2012.
[10] Report on Status of Watercourses in Zenica-Doboj Canton with Recommendations of Measures for Protection of River Bank Zones, Hydro-Egineering Institute, Februar/March 2014.

Table 6 Assessment of situation with water courses regulation in the Zenica Doboj Canton

R.br.	Water course	Length of the water course (km)	Length of regulated riverbed (km)	% of regulated watercourse (%)
1.	Bosna	164.8	8.66	5.25
2.	Krivaja	73.5	0.92	1.25
3.	Trstionica	34.9	0	0
4.	Stavnja	34.1	1.6	4.69
5.	Lješnica	26.6	0	0
6.	Stupčanica	22.3	2.1	9.42
7.	Ribnica	19.3	0	0
8.	Babina rijeka	18.6	1.69	9.08
9.	Usora	18.4	1.7	9.24
10.	Gostović	17.5	0	0
11.	Tešanjka	15.3	1.60	10.46
12.	Kočeva	13.2	1.06	8.03
13.	Bistričak	13.1	0	0
14.	Fojnička rijeka	12.2	0.89	7.29
15.	Biošica	10.2	0.55	5.39
16.	Zgošća	7.5	1.0	13.2
17.	Lašva	1.1	0	0

3 DESCRIPTION OF THE ENVIRONMENT IN PROJECT AFFECTED AREA

3.1 Introduction

The Bosna River Basin covers the largest and most developed area of the Federation part of BiH. Total surface of the Bosna River Basin is 10.809,83 km^2. Around 70 % of the total river basin surface or 7.576,38 km^2 belongs to FB&H.

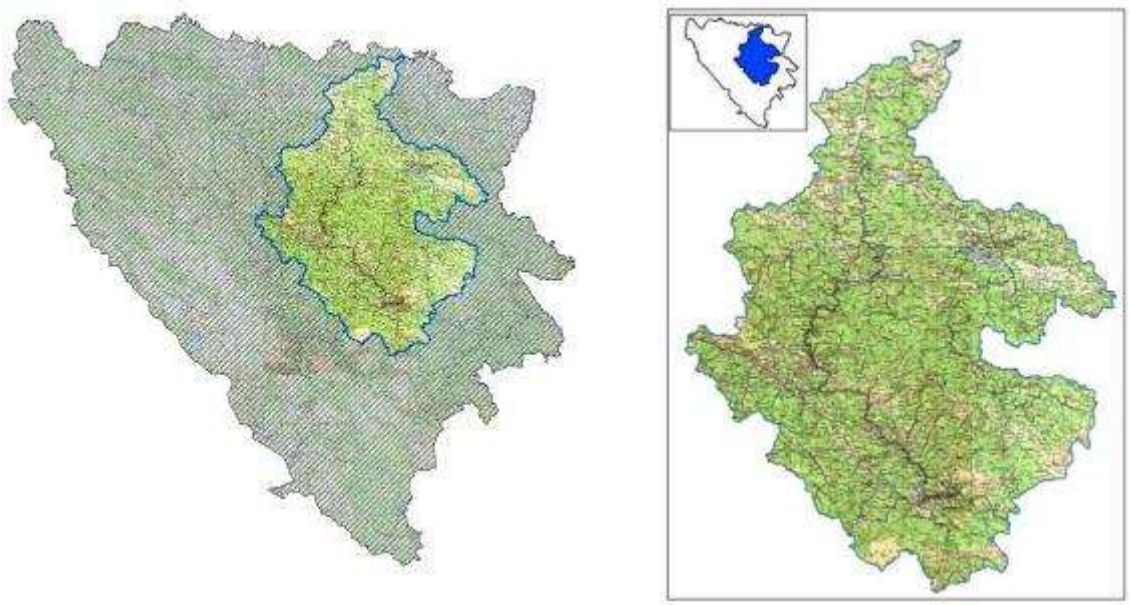

Figure 2 Bosna River Basin

It is the third longest river in Bosnia and Herzegovina and one of the country's major rivers, along with the rivers of Neretva and Vrbas. The Bosna River flows for 275 kilometers through the central part of Bosnia, with very developed hydrography network. Its biggest tributaries are the rivers of Željeznica, Miljacka, Fojnica, Lašva, Gostović, Krivaja, Usora, and Spreča.

The upper flow of the Bosna River flows through Sarajevo field, Visoko field, Zenica field and Kakanj field. The middle flow runs through the canyons cut into steep rocky walls. In the downstream flow, from Doboj to the confluence with the Sava River near Šamac, it flows in an unstable riverbed through the alluvial plain, creating backwaters and river islands.

The Bosna River Basin is the most populated region of BiH. The valley is home to almost a million people living in 43 municipalities including the cities of Sarajevo, Visoko, Kakanj, Zenica, Zavidovići, Žepče, Maglaj, Doboj, Modriča and Bosanski Šamac. The most developed industrial regions in the country are located along this river. Wastewater from local communities and industrial facilities are discharged directly into the river, mainly without any treatment.

3.2 Climate and meteorology

Climate of the Bosna River Basin is quite complex. Two separate climatic zones, with more or less clearly defined boundaries are found:

- In the central part – continental mountain or alpine climate, and
- In the north – moderate continental or middle European climate.

The continental mountain or alpine climate is characterized mainly by cold winters and moderately warm summers, while moderate continental climate is characterized by harsh winters and hot summers, but with a smaller range of winter and summer temperatures.

There are nine meteorological stations along the Bosna River in FB&H: Bjelašnica, Ilidža-Butmir, Sarajevo-Bjelave, Visoko, Zenica, Donji Lug-Zepče, Gradačac, Tuzla, and Kalesija. According to the last available climatological analysis for the year 2012[11], the average annual temperature was higher than the multi-annual average (1961 – 1990) by 1.1°C at Bjelašnica to 2,4 in Gradačac. Extremely low temperature were recorded in February, 6°C below the multi-annual average as recorded in Sarajevo. In the year 2012, exceptional snowfall was observed in Sarajevo with snow height of 107 cm.

The average perennial rainfall for the basin amounts to 867.33 l/m^2. The total volume of rainfall in central areas was slightly above the perennial average, while in the northern areas the volume was below perennial average, but still within the normal values according to the corresponding percentiles. Global precipitation was above perennial averages.

According to the last available annual analysis for the year 2012, annual rainfall in the northern part of the basin range from 860 to 890 l/m^2 with total rainfall in Doboj of 814 l/m^2 and in Sarajevo 928 l/m^2.

3.3 Hydrogeology

Hydrogeological characteristic of the Bosna River Basin are closely related to geological structure of the area and its litostratigraphic characteristics and tectonics.

Lower Triassic in hydrogeological sense represents isolating stones (water impermeable barriers).
Middle Triassic is dominantly carbonate stones (limestone, marlstones and tuffs with volcanic sediments) that make aquifers of crack and cavernous porosity.
Upper Triassic is represented in layers of dolomites and dolomite limestone. Depending on the dominant type, these sediments have hydrogeological function of aquifer with good permeability (limestone), hydrogeological complex of poor to very poor aquifer abilities (clastic, tuffs and dolomites) or can be impermeable rocks (thick layered dolomites).

The following paleogeographic structural units are found in the Bosna River Basin from south to the north:

- Dinaric carbonate platform (outer Dinarides) and Bosnian flysch
- Middle Bosnian Schist Mountains and Paleozoic in the northeast of Bosnia
- Ophiolite zone of Ozren and Konjuh with remaining of carbonate layers and olistoliths (Inner Dinarides)
- Sava-Vardar zone (Formation of active continental edge)
- Neogene basins of B&H (Oligocene, Neogene and Quarter formations).

The zone of Bosnian carbonate flysch, being a northwest border zone of Dinarides carbonate platform, is considered a flysch zone deposited on slopes and in the sole of carbonate platforms. Depending on the sediments origin and time of their formation, two (or four) distinguished series can be observed:

- Impermeable Jurassic- Cretaceous (Nemila and Vranduk series) made of mixed silica-carbonate clastic rocks,
- Cretaceous (Mehurići and Ugar series) of poor cavernous porosity dominated by sediments of carbonate flysch platform.

[11] Climatological analysis for year 2012, Federal Hydrometeorological Institute Sarajevo

The area of Middle Bosnia Schist Mountains includes the mountains of Vranica, Kruščica, Radovan and Bitovnja. Their formation is mainly composed of crystal schist, meta-sandstones and magmatites. Such lithological structure indicates water impermeable and partially permeable terrains, where localized areas of carbonate sedimentation (limestone, dolomites and marble stones of Vranica) with character of karts terrain can be found. Nevertheless, metamorphites (crystal schist, meta-sandstones, quartzites, marble limestone) and magmatites (diabase, gabbro, diorites, syenites, spilites, and quartz keratophyres) are dominant in this zone and they form hydrogeological barrier.

Dinarides Ophiolite zone covers the largest part of Inner Dinarides and is composed of:

- Radiolarite formation (Jurassic – Lower Cretaceous) made of radiolarites and shales, highly impermeable muddy-clayish material.
- Upper Jurassic Ophiolite mélange (diabase chert formation), represent thick package of chaotic layers and tuff-clayish matrix with incorporated fragments ophiolite, chert, clay, crystal schist, marl and limestone. This complex represents hydrogeological isolator.
- Ultramaphite massive is represented by peridotites and intrusive complex covered by gabbros and diabases with basalts. Methamorphosis in deeper sections created amphibolites and of crystal schists. Depending on the level of fracture and tectonic crush, these rocks may be aquifers of cavernous porosity.

Two sediment formations transgressive to ophiolites are found:

- Pogarska clastic formation (conglomerates, sandstones, breccia with rudaceous limestone) found in area of Žepče-Zavidovići, cavernous aquifer with poor impermeability
- Upper Jurassic and Lower Cretaceous limestone at Ophiolite basis, restricted and isolated aquifers of fissure-cavernous porosity.

Middle Triassic limestone masses and Olistolithes of Ophiolite mélange are widely present in the Dinarides Ophilite zone (Kladanj, Stupari, Konjuh, Đurđevik) and represent significant aquifers of fissure-cavernous porosity with typical karst characteristics (significant springs are: Stupari, Studešnica, Krabašnica, Kotornica).

Two Neogene basins are located in the Bosna river basin: the Sarajevo-Zenica and Tuzla. Sarajevo-Zenica basin is made of Neogene isolating sediments that form terrain without aquifers. Quarter indicates presence of gravel and sandstone deposits in Sarajevo field and alluvial components of the Bosna River. These deposits in some places reach depth of 30 m and thus exist as very potent water source used by the Sarajevo city and other settlement in the Bosna River alluvium. This is highly permeable aquifer of intergranular porosity. The Tuzla basin is made of several independent structural units, where the most important is the Kreka coal basin (sediment with aquifer function and isolator). Four different layers of coal are found with water carrying layers of sand at the bottom and water impermeable clays at the top. The Kreka basin is a large underground water body. Gračanica – Klokotnica part of the Neogene basin represents a significant water source for this area. Quarter sediments of intergranular porosity are found in the Sprečko field (Tuzla water source), sometimes reaching 30 m of depth.

3.4 Hydrology

The Bosna River is about 275 km long, its width ranges from 35 to 150 m, and its depth from 1 to 7 m. The average altitude is 640 meters above sea level. The highest water level occurs in the period from March to May and in November, whilst the lowest one occurs in August and September. The river freezes only during severe winters. In the lower course, it deposits great amounts of gravel which affects the movement of riverbed. The bottom of the riverbed is predominantly composed of impermeable rocks.

The Bosna River Basin has highly developed hydrography, with several large and number of smaller tributaries. The river originates from a strong karst spring and is fed by Zujevina, Željeznica and Miljacka in the Sarajevo field. The most important tributaries of the Bosna River are the rivers of Fojnička, Lašva, Krivaja, Usora and Spreča. The Bosna River Basin is hydrologically explored to a large extent.

There is a large number of hydrological stations at which perennial systematic registering of water level and flow measurements have been performed (Figure 5). Specific flow rate are: surface 15.59 l/s/km^2, mean flow volume 100 m^3/s.

Figure 3 Hydrological stations in the Bosna River Basin (1/3)

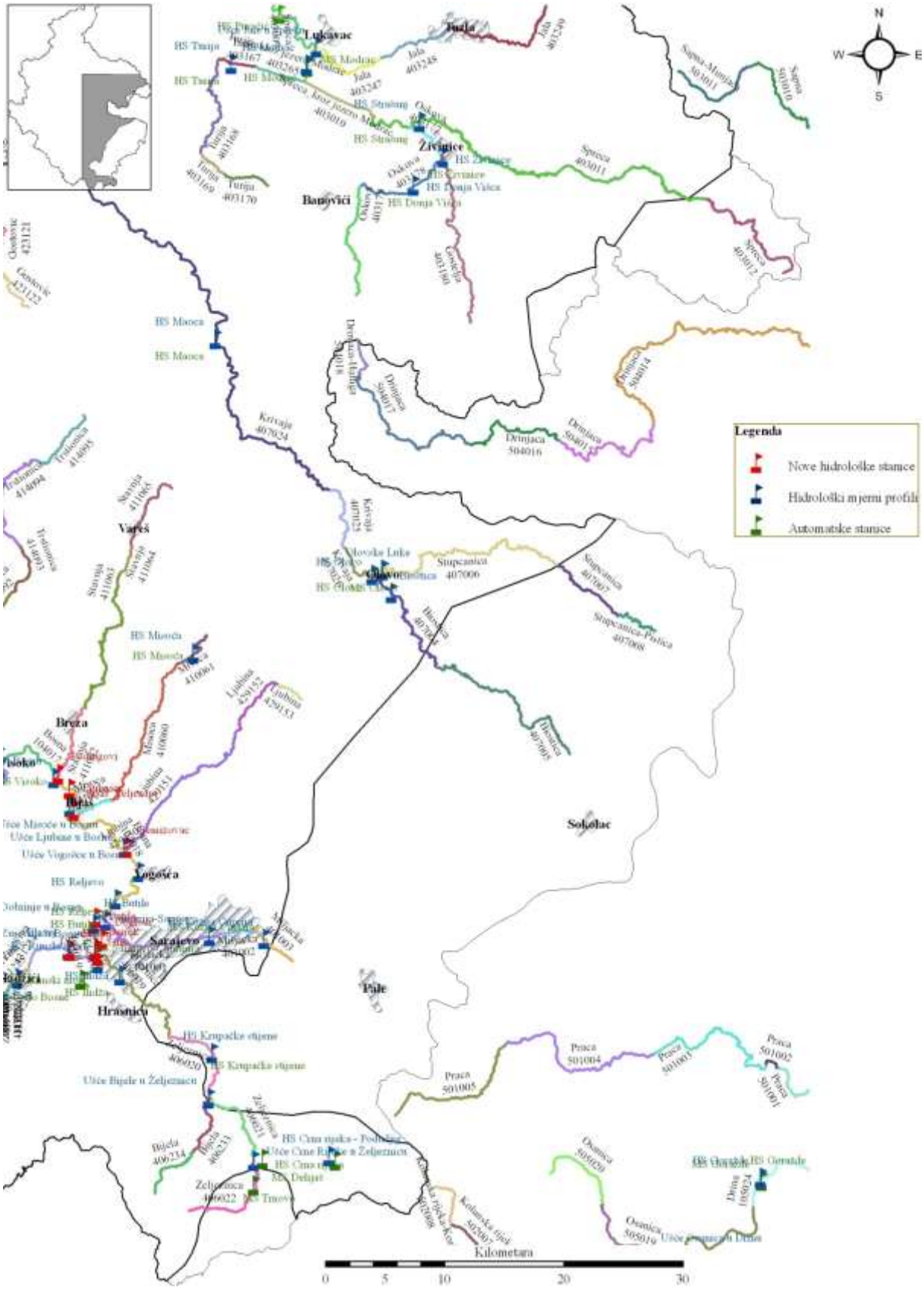

Figure 4 Hydrological stations in the Bosna River Basin (2/3)

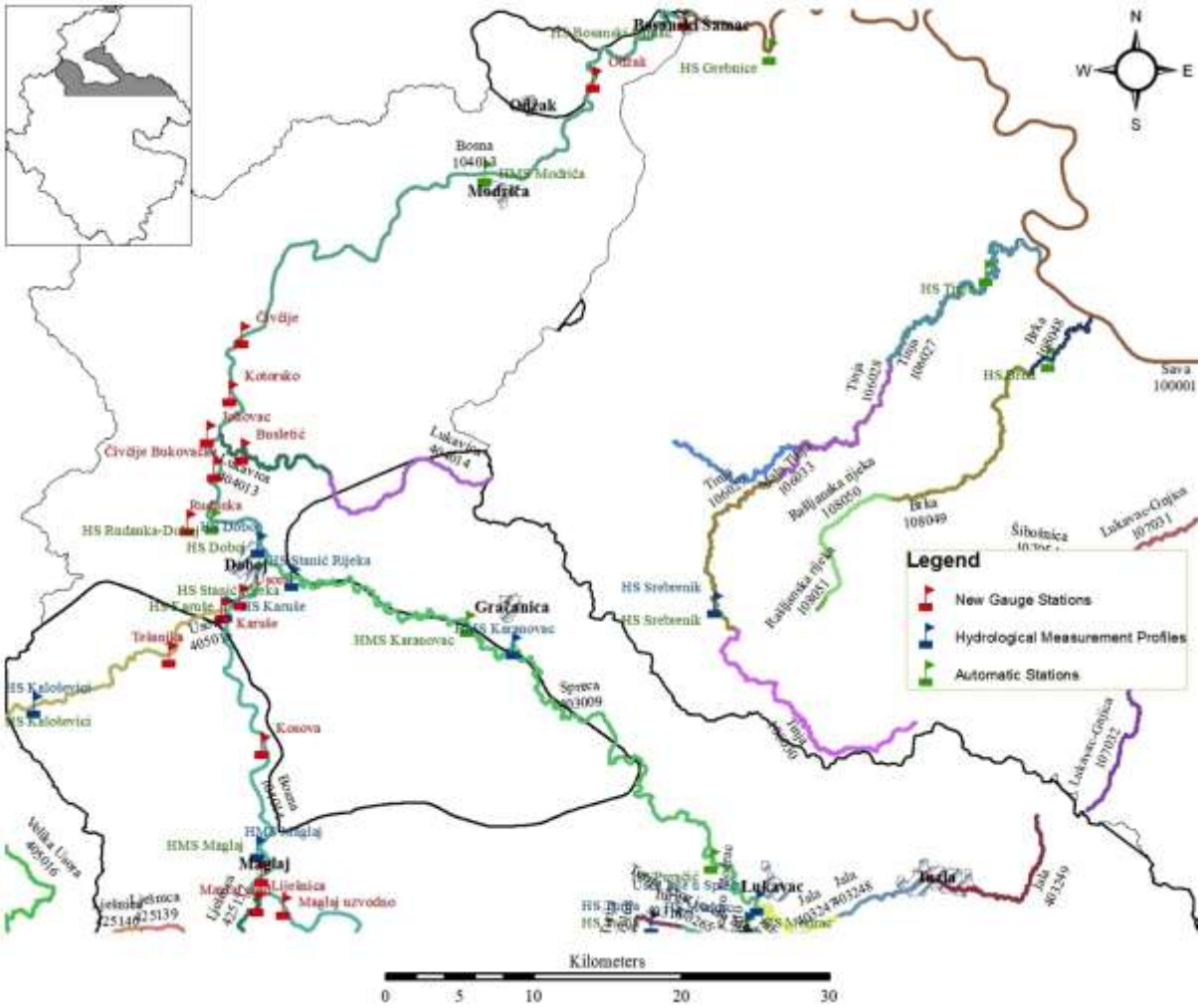

Figure 5 Hydrological stations in the Bosna River Basin (3/3)

Generally, the flow regime of the Bosna River is stochastic, except for significant deterministic effects on several tributaries that disrupt the natural flow regime. This primarily refers to the Sarajevo Field area, since water is being abstracted from Vrelo Bosne for purposes of water supply of the City of Sarajevo, thus impoverishing the waters of the Željeznica River (which, flowing through Ilidža, in the summer months displays rather low flow rates). Also, there is the impact of the HPP Bogatići located on the Željeznica River, which disrupts the natural flow regime of the aforementioned river. Deterministic impact is most evident on the right tributary of river Bosna–Spreča: reservoir Modrac which impacts the flow regime of the Spreča River downstream of the dam, making it completely artificial.

Hydrological characteristics of the main water courses in the Bosna River Basin that have flooding characteristics are given in Table 7. The flow registered during 2010 flood was 12-18 times higher than average.

Table 7 Hydrological characteristics of the main water courses in the Bosna River Basin in comparison with registered flow during the floods in 2010

Station	Water course	Area of the basin (km^2)	Qavg.yr. (m3/s)	$Q_{1/10}$	$Q_{1/50}$	$Q_{1/100}$	Maximum registered flow in 2010 (m^3/s)	Occurrence probability of the flow registered in 2010
Plandište	Bosna	-	6.28	24	29.5	34	253.21	-
Ilidža	Željeznica	-	8.93			290	115.30	-
Zavidovići	Bosna	4996	97.4	1100	1502	1770	1.795,43	1/100
Olovo	Krivaja	737	12.0	494	742	824	138.33	1/5
Zavidovići	Krivaja	1410	24.6	703	1046	1176	271.81	1/5
Maglaj	Bosna	6765	125	1610	2200	2420	1.616,381	1/20
Karanovac	Spreča	1804	24.1	352	450	485	267.89	1/5

Characteristic flow values at all hydrologic stations of the Bosna River Basin in the FB&H, as well as intra-annual variations of average monthly flows for the river Bosna in the FB&H are given in Annex 1.[12]

3.5 Water quality

During the year 2012, Water Agency for the Sava River Catchment Areas performed monitoring of physical-chemical, chemical and microbiological status of the Bosna River at 33 selected locations. Chemical status was monitored in line with the recommendations from the Water Framework Directive 2000/60/EC and supporting Directive 2008/105/EC that define list of the priority substances and environmental quality standards (EQS) for surface water bodies. Priority substances were analyzed in the water samples with the frequency from four to six times during the year.

Results of the monitoring[13] are presented in Table 8. 62% of the water samples indicate bad chemical status of waters in the Bosna River Basin. Priority substances determined not to satisfy the EQS were mercury, cadmium, lead, nickel, polycyclic aromatic hydrocarbon (PAH) and organochlorine pesticides (OCP). The origin of the pollution, whether it is natural or anthropogenic, is not known.

Table 8 Result for the quality water monitoring for the Bosna River Basin in 2012

No.	Monitoring place	Required quality class	Observed quality class	Chemical status	Positive micobiol. status	Negative microbiol. status
1.	Bosna – spring	I	I	Bad	+	
2.	Zujevina – downstream from Hadžići	II	III	Bad		+
3.	Zujevina –confluence	II	III	Good		+
4.	Bijela rijeka	II	II	Bad	+	
5.	Željeznica – Ilovice	II	II	Bad		+
6.	Željeznica – upstream from Kijev	II	II	Good	+	
7.	Željeznica – confluence	II	II	Bad		+
8.	Miljacka – Kozija ćuprija	II	III	Bad		+

[12] Zavod za vodoprivredu Sarajevo, Zavod za vodoprivredu Mostar, The Water Agency of Sava River Catchment Area, The Adriatic Sea River Basin District,Water Management Strategy of The Federation of Bosnia and Herzegovina, March, 2012

[13] Sanela Džino, Ajla Rizvanbegović – Rizvanović, Almedina Žero, Anesa PitA-Bahto, Alena Merdan, Danijela Sedić, Emir Mujić, Miodrag Tešević, Results of the monitoring in 2012., Journal „ Voda i mi“, no. 83, October, 2013

No.	Monitoring place	Required quality class	Observed quality class	Chemical status	Positive micobiol. status	Negative microbiol. status
9.	Miljacka - confluence	III	V	Good		+
10.	Ljubina – downs. from Srednje	II	III	Good		+
11.	Ljubina – confluence	II	III	Bad		+
12.	Misoča – confluence	II	III	Good		+
13.	Stavnja –donst. from Vareš	III	III	Good	+	
14.	Stavnja – confluence	III	III	Good	+	
15.	Lepenica - Han Ploča	II	II	Bad		+
16.	Lepenica – confluence in Fojnica.	II	III	Bad		+
17.	Bila – confluence with Lašva	II	III	Good		+
18.	Grlovnica – confluence e	II	III	Good		+
19.	Kozica – confluence with Lašva	II	III	Bad		+
20.	Stupčanica – confluence	II	III	Good		+
21.	Bioštica – confluence	II	II	Bad	+	
22.	Krivaja – near Olovo	II	II	Good	+	
23.	Bosna – downstream from Maglaj	III	IV	Good	+	
24.	Usora – confluence	II	II	Good		+
25.	Gostelja – confluence	II	III	Bad		+
26.	Oskova – upstream from Gostelja	II	V	Bad		+
27.	Oskova – confluence to Spreča	II	V	Bad		+
28.	Spreča – upstream from Modrac	II	V	Bad		+
29.	Turija –upstream from Bukovice	II	II	Good		+
30.	Turija – confluence to Modrac lake	II	II	Good		+
31.	Jala – upstream from Simin Han	II	V	Bad		+
32.	Jala - confluence	III	V	Bad		+
33.	Spreča – confluence	III	V	Bad	+	

Results of the surface water quality monitoring for the rivers in FB&H for the year of 2013 are still under preparation.

3.6 Soil

The soli classification in the Bosna River Basin is done based on standard FAO classification. The following types of soil are found:

- Acid brown soil (DYSTRIC CAMBISOL) – Ferralic Cambisol 6.38%,
- Hummus silica soil (RANKER) – Umbric Leptosols 9.94 %,
- Brow soil on limestone and dolomite (CALCOCAMBISOL) – Humic Cambisols 20.96% and
- Limestone-dolomite black soil (CALCOMELANOSOL) – Mollic Leptosols 25.94 %.

Their spatial distribution is given in Table 9 and Figure 6 to Figure 8.

Table 9 Type of soils in the Bosna River Basin

FAO classification	Surface area	
	km²	%
Calcaric Cambisols	178.38	2.33
Calcaric Fluvisols	106.45	1.39
Calcic Vertisols	200.56	2.62
Dystric Cambisol	346.81	4.54
Dystric Leptosols	28.77	0.38
Eutric Cambisols	309.16	4.04
Eutric Fluvisols	109.97	1.44
Eutric Gleysols	70.18	0.92
Eutric Vertisols	77.26	1.01
Ferralic Cambisol	487.79	6.38
Ferralic Luvisols	18.41	0.24
Gleyic Cambisols	133.23	1.74
Haplic Luvisols	205.65	2.69
Humic Cambisols	1603.00	20.96
Mollic Leptosols	1668.69	21.82
Rendzic Leptosols	425.46	5.56
Stagnic Luvisols	245.91	3.22
Umbric Leptosols	759.91	9.94
Vertic Cambisols	375.57	4.91
Vertic Luvisols	294.98	3.86

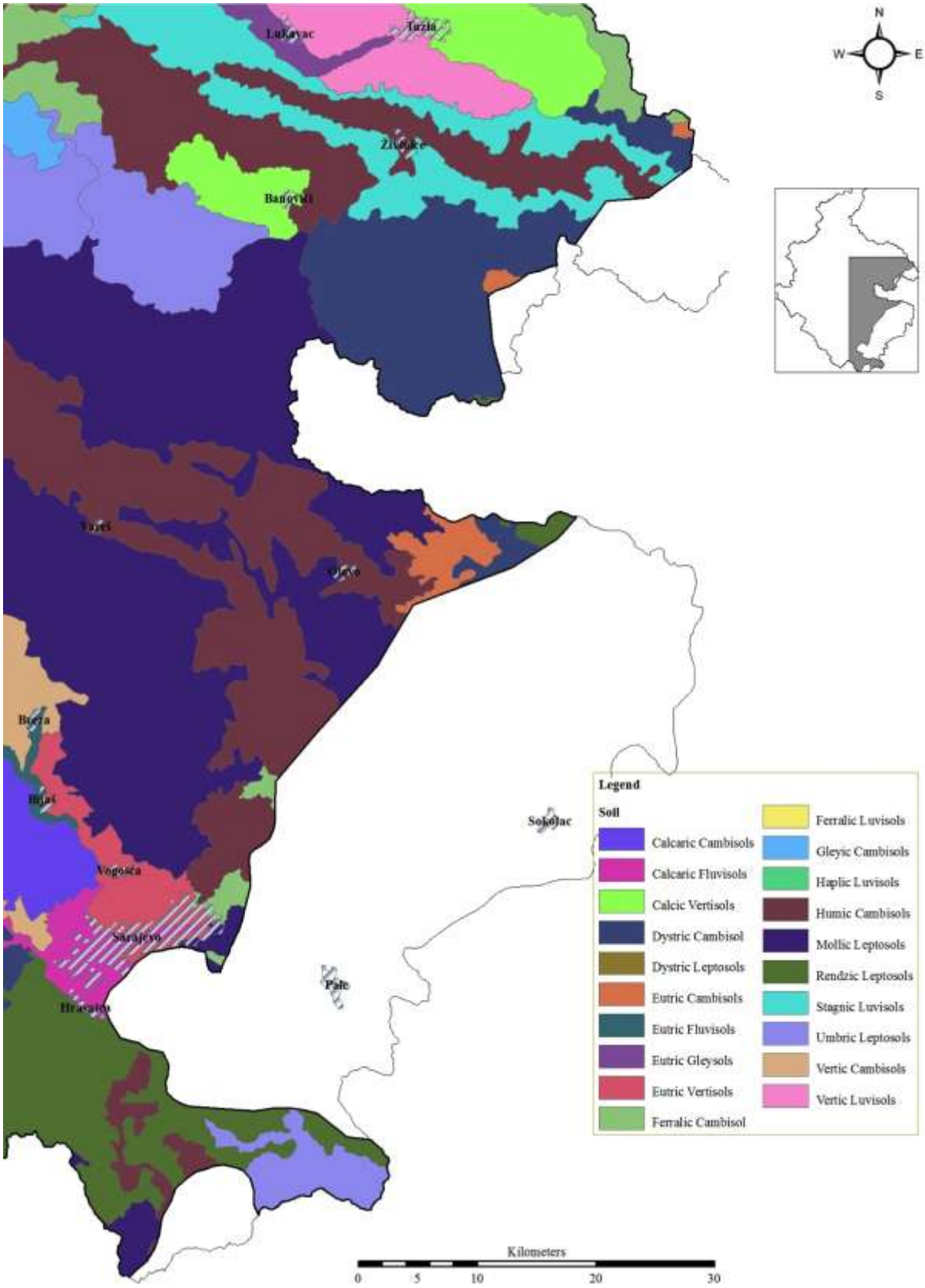

Figure 6 Types of soils in the Bosna River Basin (1/3)

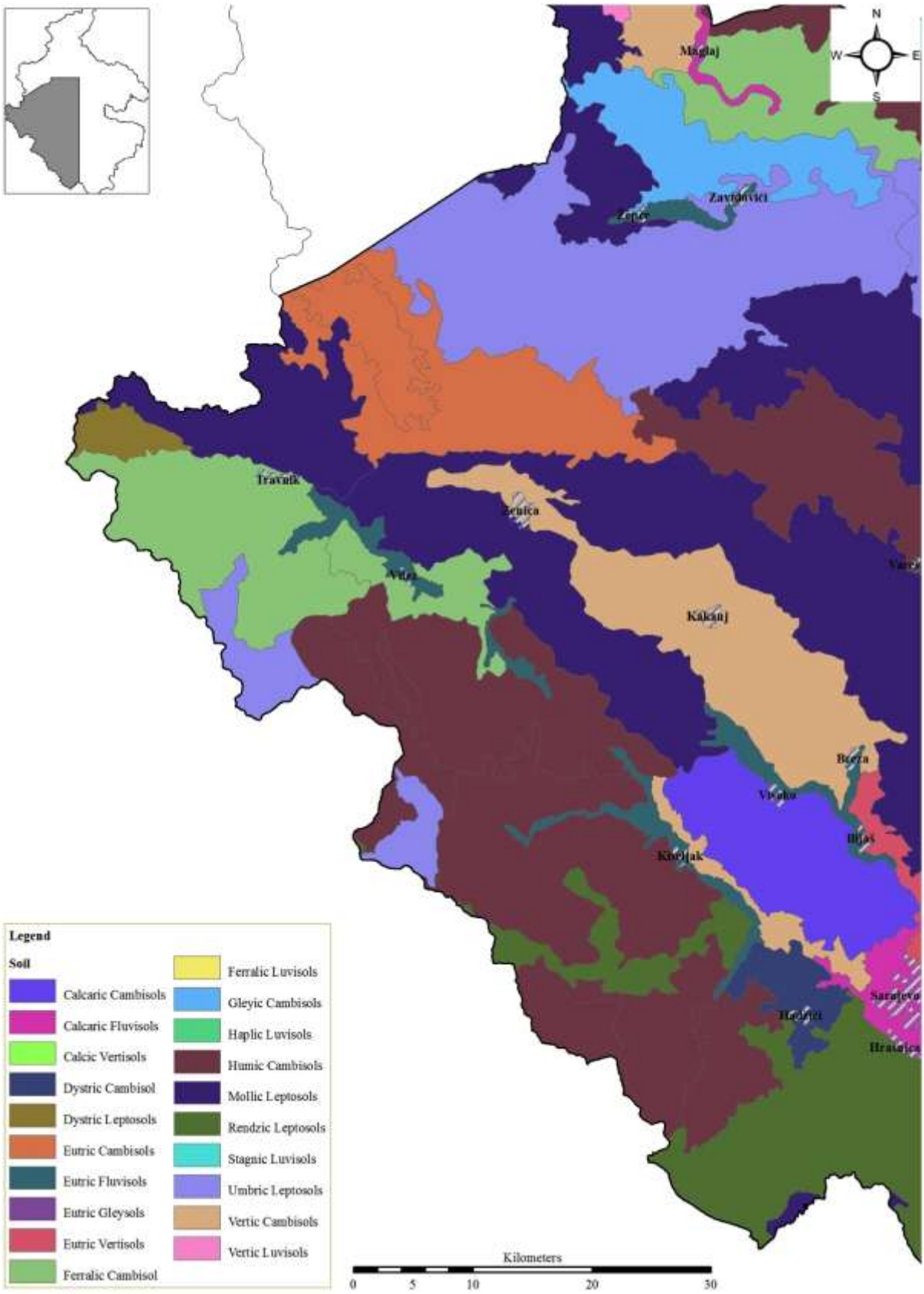

Figure 7 Types of soils in the Bosna River Basin (2/3)

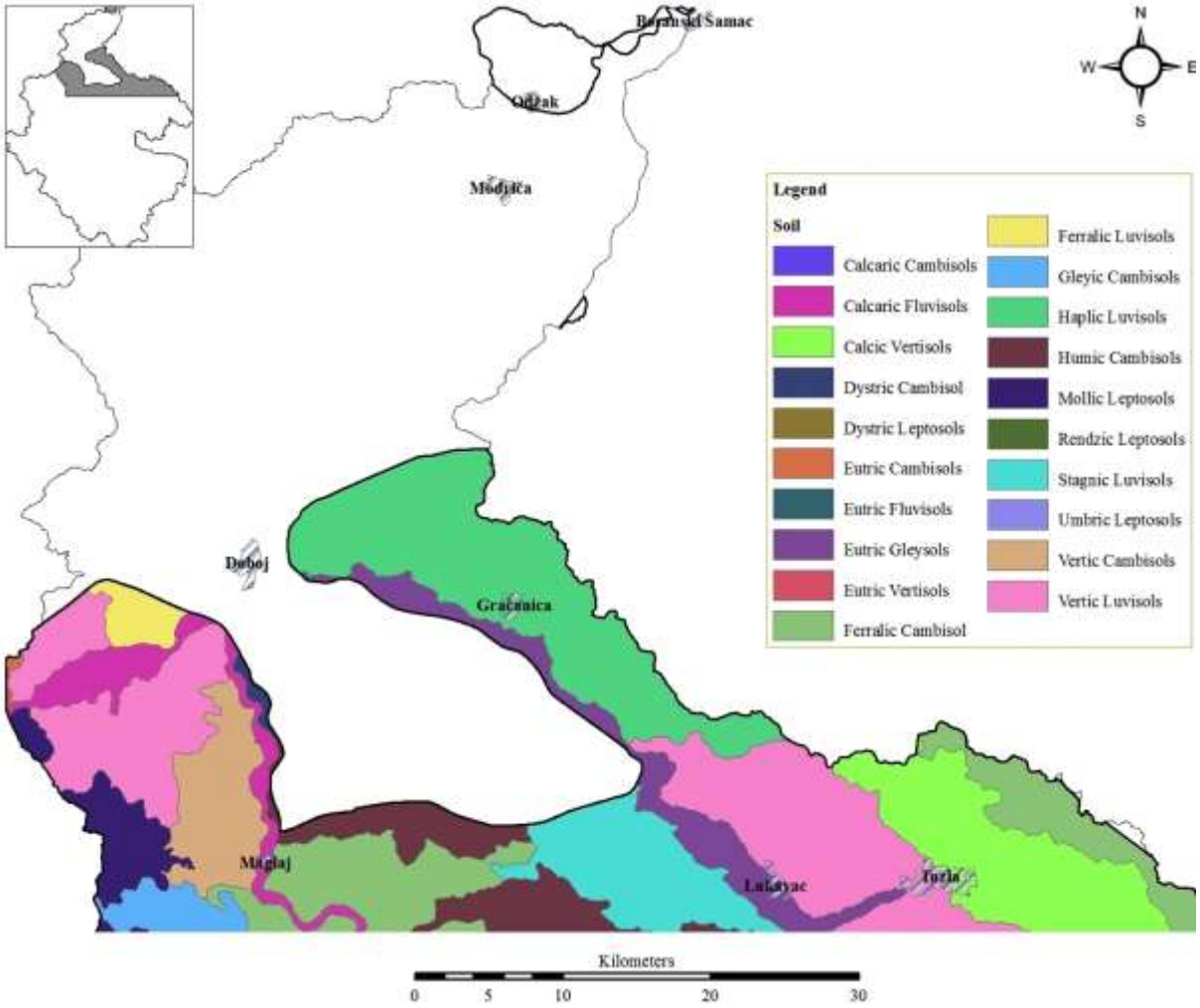

Figure 8 Types of soil in the Bosna River Basin (3/3)

3.7 Forests

The Bosna River basin is geographically the largest river basin in B&H with altitudes ranging from 80 to 2,200 m a.s.l. Phytogeographically, it includes plants common to the Middle Bosnia zone[14].

Remaining of common oak and hornbeam forests can be found at the lowest altitudes.

In the hilly zones found in the area from Sarajevo to Zenica and in the part of the Lašva and Usora catchment area, the most common are sessile oak and common hornbeam forest communities that are mixed with common beech and sessile oak forests.

At the higher altitudes, common beech forests are found or they are mixed with the forests of sessile oak and common hornbeam.

Mountain areas are mainly covered with mixed beech and silver fir and spruce forests. Common beech forests are also found and their character depends on the type of soil. Magmates and wide ophiolite zone dominate in the area of Nemila, Zavidovići and Maglaj, supporting specific forest vegetation such as thermophile woods of black pine, forests of black and white pine, sessile oak forest, mixed beech and silver fir forests and mixed beech and spruce forests. At higher altitudes and colder zones, mixed forests

[14] Information for this chapter are taken from Federal Water Management Strategy 2010-2020, Water Management Institute Sarajevo and Water Management Institute Mostar, May 2012

of silver fir and spruce are found. At highest, subalpine altitudes, subalpine beech and subalpine spruce are found as well as communities of mungo pine.

The Middle Bosnia zone where the Bosna River Basin is located is very susceptible to erosion processes. In that sense, all types of forest ecosystems have very important role, especially forests at lower altitudes and in hilly areas. Mixed forest in mountain zones protect groundwater aquifers from pollution retaining most of the physical and chemical pollutants through in their root system, as well as prevent deep erosion.

3.8 Flora

3.8.1 Bosna River Valley

Ecosystem of hygrophile forest of common oak and common hornbeam (*Carpino betuli-Quercetum roboris*) is developed in the area of the Sarajevo field, mainly on terrain above the flood plains but under the impact of groundwater. Geological seed is made of gravel and sand sediments while soils are brown valley glaysoils. The most important flora species are common oak (*Quercus robur*), common hazel (*Corylus avellana*), common hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), common spindle (*Evonymus europaea*), common mezereon (*Daphne mezereum*), wood anemon (*Anemone nemorosa*), woodland sedge (*Carex silvatica*), fig buttercup (*Ficaria verna*), etc. This ecosystem is characterized by medium biodiversity rate due to large urban agglomerations. Human activities resulted in the transformation of common oak and hornbeam ecosystem to secondary ecosystems of meadow vegetation, order *Deschampsietalia*.

The ecosystem of hygrophile forests with black alder (*Alnetum glutinosae*) is located near the rivers and creeks, as well as on smaller surfaces around wells and flooded areas. In the swamp areas that are under the influence of high groundwater level, black alder and willows phytocenosis are present.

The forest of black alder with Alpine grass (*Carici brizoides-Alnetum glutinosae*) is found around the Bosna River spring. Geological seed of native *Alnetum* is made of gravel and sand with clay deposits and hydrogenated black soil. The most important species in this ecosystem are black alder (*Alnus glutinosa*), gray willow (*Salix cinerea*), bay willow (*Salix pentandra*), alpine grass (*Carex brizoides*), guelder rose (*Viburnum opulus),* etc. This ecosystem is characterized by middle biodiversity rate. Ecosystem dynamics is continuous in period between April and beginning of October. Black alder ecosystem is mainly converted to secondary hygrophile meadows, order *Molinietalia*.

The ecosystem of willow forest (*Salicetum albe – fragilis*) is located longitudinal along the Bosna River. Willow forests show signs of transversal spreading as a result of anthropogenic influence decrease. Geological seed is made of alluvial gravel of different granulometic content while swamp soil is gleyed. The most important species are white willow (*Salix alba*), silver poplar (Populus alba), black alder (*Alnus glutinosa*), purple willow (*Salix purpurea*), and other hygrophile species.

As a result of anthropogenic activities, fragments of tertiary vegetation can be found. Presence of tertiary vegetation on terrains above groundwater is indicator of disturbed ecological equilibrium. Tertiary vegetation class *Bidentetea tripartiti* is developed on the hygrophile forest terrains, flooded depressions, along infiltration channels and creeks. The most important species are marigold (*Bidens tripartitus*), creeping buttercup (*Ranunculus repens*), reeping bentgrass (*Agrostis stolonifera*), road-leaved Ragwort (*Senecio fluviatilis*), horse mint (*Mentha longifolia*), etc.

The class *Artemisietea* includes vegetation of dry landfills and in this area is developed on smaller surfaces. The main edificatory species are burdock (*Lappa maior*), common wormwood (*Artemisia vulgaris*), ribwort plantain (*Plantago lanceolata*), common vetch (*Vicia sativa*), etc.

Tertiary vegetation of stubble and plough land is covered by vegetation of *Stellarietea mediae* class and covers larger terrain from valley to hilly zones. Those are larger areas with extensive agricultural

production. The most important species are corn poppy (*Papaver rhoeas*), common vetch (*Vicia angustifolia*), corn buttercup (*Ranunculus arvensis*), sickle spurge (*Euphorbia falcate*), etc.

Vegetation of trodden habitats of class *Plantaginetea maioris* covers terrains found above groundwater sources and next to the traffic infrastructure, inside protection zones and next to commercial facilities as well as locations that are partially trodden down and with medium content of nitrates. The most important species are common knotgrass (*Polygonum aviculare*), common dandelion (*Taraxacum officinale*), quack grass (*Agropyron repens*), white clover *(Trifolium repens*), red clover *(Trifolium pratense*), daisy (*Bellis perennis*), Pineapple Weed (*Matricaria discoides),* annual meadow grass (*Poa annua*), etc.

Vegetation of class *Chenopodietea* covers vegetation of weeds and landfills rich in organic and inorganic material. This vegetation is lush and flourishing, difficult to pass through. The main edificatory species are danewort (*Sambucus ebulus*), black horehound (*Ballota nigra*), coltsfoot (*Tussilago farfara*), etc.

3.8.2 Spreča River Valley

This region is very heterogenic from the aspect of biodiversity. Many centers of endemic species and living communities are found in this region, as well as centers of relict species – refugia of tertiary flora and fauna that survived till today in specific paleoclimatic conditions. Such rich biodiversity still has great value. Unfortunately, only approximate estimates of species numbers and level of their vulnerability are available. Preliminary assessments indicate large number of endangered species as well as whole communities.

Biodiversity is clearly differentiated to standard levels: diversity of genes, diversity of species, biocenological diversity (diversity of plan communities) and ecological diversity (diversity of biocenosis or living communities and ecosystems, i.e. geobiocenosis or biogeocenosis).

Beside general diversity of species, the representatives of number of bio-geographical elements are also present including Dinarides, Carpates, Ponts as well as presence of number of endemic species found in parts of the Tinja and Spreča river basins.

Depending on geological-pedological and eco-climatic conditions, several types of ecosystems are found:

- Ecosystem of knee holly and white hornbeam shrub land (*Rusco-Carpinetum orientalis*) that is developed in lower areal cover of this biome with several communities
- Ecosystem of downy oak and hop hornbeam (*Ostryo-Quercetum pubescentis*) at higher altitudes
- Ecosystem of hop hornbeam and autumn moor grass (*Seslerio autumnalis-Ostryetum carpinifoliae*)

Main producers in this biome are kseroterm type of plants such as: downy oak (*Quercus pubescens*), oriental hornbeam (*Carpinus orientalis*), evergreen Eurasian shrub (*Ruscus aculeatus*), hop hornbeam (*Ostrya carpinifolia*), manna ash (*Fraxinus ornus*), maple (*Acer monspessulanum*), mahaleb cherry (*Prunus mahaleb*), smoke tree (*Cotinus coggigria*), dogwood (*Cornus mas*), rock buckthorn (*Rhamnus rupestris*), silver lime (*Tilia tomentosa*), early green hellebore (*Helleborus multifidus*), burning bush (*Dictamnus albus*), bloody cranesbill (*Geranium sanguineum*), *Aristolochia pallida*, wavy cyclamen (*Cyclamen repandum*), mercurialis (*Mercurialis ovata*), purple gromwell (*Lithospermum purpureo-coeruleaum*), honey balm (*Melittis melisophyllum*), etc..

This biome can be also observed together with ecosystems of xerothermic forests and bushes of manna ash and oriental hornbeam of Illyric zone (Orno-Carpinetum orientalis), relict forests of tillia and maple (*Aceri-Tilietum mixtum*) found in canyons of Drinjača, Gostilja and Tinja rivers, relict communities of knee holly and hop hornbeam, relict forests of oriental and common hornbeam (*Carpinetum betuli- orientalis*), hop hornbeam and sessile oak (*Ostryo-Quercetum daleschampii*) also found in canyons of Drinjača, Gostilja and Tinja rivers, relict communities of hop hornbeam and knee holly of continental zone (*Rusco-Carpinetum orientalis continentale*), and thermophile woods of sessile oak and hop hornbeam (*Ostryo-Quercetum petraeae*) on mild slopes and developed soils in canyons of Drinjača, Gostilja and Tinja rivers. These woods indicate terminal phase of biome development. Many of these ecosystems have refugial-relict character and bio-geographical significance.

The stripe of Pre-Pannonian forests of bushes and shrubs is degraded to continental karts that differentiate to several ecosystems of lower organization levels when going from lower to higher altitudes.

Along the rivers, on mainly alluvial plains of Pliocene and Holocene age, biomes of English oak and narrow leaved ash are developed, with main characteristics of mild continental climate partially modified to river plains. The structure of this biome makes several ecological and by appearance differentiated ecosystems whose existence is conditioned by different groundwater levels. Main indicators of these ecosystems are: English oak (*Quercus robur*), narrow leafed ash (*Fraxinus angustifolia*), black alder (*Alnus glutinosa*), silver poplar (*Populus alba*), black poplar (Populus nigra), white willow (*Salix alba*), crack willow (*Salix fragilis*), hackberry (*Prunus padus*), guelder rose (*Viburnum opulus*), alder buckthorn (*Frangula alnus*), common hop (*Humulus lupulus*), dewberry (*Rubus caesius*), bittersweet (*Solanum dulcamara*), silver lime Tilia tomentosa (in Pre-Pannonian zones), summer snowflake (*Leucojum aestivum*), water forget-me-not (*Myosotis palustris*), grasses herb two pence (*Lysimachia nummularia*), *Lysimachia vulgaris*, marsh woundwort (*Stachys palustris*), milk parsley (Peucedanum palustre), gypsywort (*Lycopus europaeus*), comfrey (*Symphytum officinale*), wild liquorice (*Glycyrrhiza echinata*), elongated sedge (*Carex elongate*), alpine grass (*Carex brizoides*), and many others.

Important geographical role among the flora species in this biome have invasive species that are imported to this area from different parts of the world including North and South America, Asia and other parts of Europe. The most important indicators are presence of common beggarticks (*Bidens frondosus*), water agrimony (*B. tripartitus*), wild cucumber (*Echinocystis lobata*), common ragweed (*Ambrosia artemisifolia*), guascas (*Galinsoga parviflora*), calamus (*Acorus calamus*), pondweed (*Elodea Canadensis*) and others.

Depending on the hydro-thermic regime this biome is differentiated to several clearly distinctive ecosystem groups.
Going from the most important habitats, ecosystems of black alder, willows and white poplar forests and complex systems of English oak are found. English oak forest are differentiated to ecosystems of hygrophile forests of oak and dyer's broom (*Genisto elatae-Quercetum roboris*) and ecosystems of hygromesophile forest of oak and common hornbeam (*Carpino betuli – Quercetum roboris*), on dryer soils and sloped terrains.

Along the watercourses on alluvial soils, ecosystems of hygrophile forests and shrubs of willows and poplar are found including:

- Ecosystem of white willow (*Salicetum albae*),
- Ecosystem of white and crack willow (*Salicetum albae-fragilis*),
- Ecosystem of willows and poplars (*Salici – Populetum*),
- Ecosystem of white and black poplars (Populetum nigro-albae)
- Ecosystem of almond willow (*Salicetum triandrae*) forests, and
- Shrubs with purple osier (*Salicetum purpureae*).

Alder forests are mainly found in wet habitats within this biome, along the riverbanks and going deep into continental zones. The following communities are the most common:

- Forests of black alder and alder buckthorn (*Frangulo alni- Alnetum glutinosae*)
- Forests of continental black alder (*Alnetum glutinosae montanum*)
- Forests of black alder and elongated sedge (*Carici elongatae-Alnetum glutinosae*)

Shrubs of grey willow (*Salix cinereae*) also belong to this biome. Additionally, numerous ecosystems of hygrophile meadows of *Molinion coeruleae* and *Deschampsion caespitosae* are developed.

On permanently wet soils swamp ecosystems are periodically developed with common reed (*Phragmition australis*), sedge (*Magnocaricion and Spaganio-Glycerion*), water ecosystems with lotuses *Nymphaeion*, *Potamion eurosibiricum*, ecosystems of floating flowers Lemnion, and ecosystems of coastal water *Nanocyperion flavescentis*.

On a hilly terrain, entering continental zones, especially along the rivers where pseudogley and acid brown soils of Paleogene and Neogene age dominate, biom of sessile oak is developed at optimum

altitude of 600 m above sea level and up to 800 m where habitats are warmer. The main edificatory types found are: sessile oak (Quercus petraea), common hornbeam (Carpinus betulus), wild cherry (Prunus avium), field maple (*Acer campestre*), tatar maple (*Acer tataricum*), wild pear (*Pyrus pyraster*), field elm (*Ulmus campestre*), bladdernut (*Staphyllea pinnata*), spindle (*Evonymus europaeus*), wild privet (Ligustrum vulgare), wood anemone (*Anemone nemorosa*), lungwort (*Pulmonaria officinalis*) and others.

Within this biome zone, moist *Arrenatherion elatioris* meadows are developed, as well as numerous ecosystems of tertiary vegetation as a result of anthropogenic impact.

3.8.3 Usora River Valley

This area is represented by narrow strip hygrophile forest vegetation which develops on the wet swampy soils with high level of groundwater. Alder associations of *Alnetalia* order are developed near watercourses on swampy and hydrogenated soils, mainly on the flat terrains. These associations are mixed with associations of silver poplar (*Populetalia albae*). Associations of alder are represented by *Alnion glutinosae*, that is association of *Alnetum glutinosae* with woody species such as black alder (*Alnus glutinosa*), elm (*Ulmus effusa*), alder buckthorn (*Frangula alnus*), common dogwood (*Thelycrania sanguinea*), uelder rose (*Viburnum opulus*) and common hop (*Humulus lupulus*). Of herbaceous plants, the most types are *Lycopus europaeus*, *Solanum dulcamara*, *Scrophularia nodosa*, *Ficaria verna*, *Petasites hybridus*, *Rumex sanguineus*, *Ranunculus repens*, *Lysimachia vulgaris* and others.

Hygrophile forests of silver poplar (Populetalia albae) are developed on alluvial deposits and swamp soils. Based on floristic content, these stand of trees belong to association *Salicetum albae fragilis Tx.*, that is commonly found along rivers and creeks of the Dinaride area and wider. Fragments of this association are developed in the narrow coastal zone. Edificatory role have white willow (*Salix alba*) and crack willow (*Salix fragilis*) while other trees and shrubs are represented with white elm (*Ulmus laevis*), black poplar (*Populus nigra*), field maple (*Acer campestris*), common spindle (*Evonymus europae*), dewberry (*Rubus caesisus*), common hawthorn (*Crataegus monogyna*), wild privet (Ligustrum vulgare), ivy (*Hedera helix*), common hop (Humulus lupulus), common dogwood (*Thelycrania sanguinea*), alder buckthorn (*Frangula alnus*), guelder rose (*Viburnum opulus*) and some others. Herbaceous plants are represented by *Glechoma hederacea*, *Lysimachia nummularia*, *Lycopus europaeus*, *Stachys palustris*, *Roripa sylvestris*, *Angelica sylvestris*, *Potentilal reptans*, *Geranium robertianum*, *Brachypodium sylvaticum* and others.

3.9 Fauna

Fauna of the Bosna River and its major tributaries (Lašva, Spreča and Usora) shows high fauna difference from its spring to the lower parts of its watercourse. River fauna is slightly different in parts of the river watercourses running through the cities because of higher pollution from the city wastewater and industry wastewater and is not inhabited by protected, endangered and sensitive water fauna species Land fauna is mostly absent in city regions excluding domestic animals like domestic cats (*Fellis catus* Linnaeus, 1758) and dogs (*Canis lupus familiaris*), and avian fauna represented mostly by species such as like pigeons (*Columba livia* Gmelin, 1789), crows (*Corvus corone* Linnaeus, 1758), sparrows (*Passer domesticus* (Linnaeus, 1758)), Jay (*Garrulus glandarius* (Linnaeus, 1758)), magpie (*Pica pica* (Linnaeus, 1758)), Jackdaw (*Corvus monedula* (Linnaeus, 1758)). In the Bosna River, in last few years the large populations of the duck family (Anatidae) can be found with the most abundant species Mallard duck (*Anas platyrhynchos* Linnaeus, 1758).

The Bosna River also shows rich biodiversity in macro invertebrate community in all parts of its watercourse. Characteristics of the macro invertebrate community in part of the river in the urban areas demonstrate less qualitative and more quantitative abundance of the species. The most abundant species that can be found it these parts of the watercourse are: *Dicrotendipes nervosus*, *Eukiefferiella similis*, *Hydropsyche incognita*, *Paratrichocladius rufiventris*, *Atherix ibis*, and *Holandriana holandrii*. The most abundant families in these parts of the watercourse are Simulidae, Tubificidae and Lumbricidae.

Bosna River and its tributaries are inhabited by 28 fish species, mainly cyprinid. Some of the species are: European brook lamprey (*Lampetra planeri* (Bloch, 1784)), carp (*Cyprinus carpio* Linnaeus, 1758), gudgeon (*Gobio gobio* Linnaeus,1758), tench (*Tinca tinca* (Linnaeus, 1758)), vimba (Vimba vimba

(Linnaeus, 1758)) carp bream (*Abramis brama* (Linnaeus, 1758)), schneider (*Alburnoides bipunctatus* (Bloch, 1784)), common rudd (*Scardinius erythrophthalmus* (Linnaeus, 1758)), common roach (*Rutilus rutilus* (Linnaeus,1758)), European chub (*Leuciscus cephalus* (Linnaeus,1758)), common nase (*Chondrostoma nasus* (Linnaeus,1758)), spined loach (*Cobitis taenia* (Linnaeus,1758)), European perch (*Perca fluviatilis* Linnaeus,1758), zander (*Stizostedion lucioperca* (Linnaeus,1758)), and northern pike (*Esox lucius* Linnaeus,1758). Fishing is prohibited in the spawning period of certain fish species. For example, the spawning period for common carp is between 1 April to 31 May, catfish during the period from 1 April – 15 June, rainbow trout from 1 October to 1 March etc.

3.10 Protected areas

3.10.1 Nature protected areas

Nine protected areas are found in the Bosna River Basin, of that five are proclaimed as protected while other four are "planned" to be protected. Table 10 gives overview of protected areas with respect to water courses in the Bosna River Basin. These locations are shown on Figure 9 and Figure 10.

Besides the above mentioned protected areas, several other areas of unknown status exist in the Bosna River Basin. They are listed in Table 11.

The identified areas are mainly located on higher altitudes and are not susceptible to negative impact of floods. Only natural values of Monument of Nature Vrelo Bosne and Protected Landscape Miljacka Canyon can be influenced by floods since they are located in the river valley.

Table 10 Protected areas in the Bosna River Basin

Name	IUCN category	Status	Area (km²)	Water course (Hydrological station ID)	Comment about the location of water course with respect to protected area	Surface of protected area inside the river basin	
						(km2)	(%)
Protected landscape Bijambare	V	Protected	3.70	Krivaja – downstream from Olovo (407026)	-	3.70	4.26
National Park Bjelašnica-Igman	II	Planned	562.87	Convulsion of Željeznica with Bosna (406019)	-	64.68	44.22
				Zujevina – convulsion (431223)	-	2.26	4.69
				Zujevina (431224)	Upstream section flows through protected areas	5,23	41.53
				Zujevina (431226)	-	20.66	74.82
				Zujevina (431225)	Downstream section flows through protected areas	18.52	49.27
				Zujevina (431227)	-	56.85	78.35
				Bijela (406234)	Completely inside protected area	44.12	99.81
				Željeznica (406021)	Upstream section flows through protected areas	18.58	75.52
				Željeznica (406020)	-	2.38	9.03
				Bijela (406233)	Upstream section flows through protected areas	71.25	99.92
				Lepenica 409202)	-	57.64	30.44
				Bosna (104019)	-	12.02	12.57

Name	IUCN category	Status	Area (km²)	Water course (Hydrological station ID)	Comment about the location of water course with respect to protected area	Surface of protected area inside the river basin	
						(km2)	(%)
				Željeznica (406022)	Upstream section flows through protected areas	104.51	63.10
Protected Landscape Miljacka Canyon	V	Protected	1.48	Miljacka (401003)	Downstream section flows through protected areas	0.95	0.31
				Miljacka (401002)	Upstream section flows through protected areas	0.53	1.12
Monument of Nature Prokoško Lake	III	Protected	22.26	Dragača (409037)	-	15.42	14.69
Monument of Nature Skakavac	III	Protected	14.34	Bosna (104018)	-	13.20	8.50
				Miljacka (401001)	-	0.99	1.57
				Ljubina (429151)	-	0.15	0.16
Protected Landscape Vlašić	V	Planned	123.,20	Lašva (408030)	-	11.83	6.77
				Lašva(408029)	-	2.63	5.61
				Bila (408070)	Downstream section flows through protected areas	20.31	34.82
				Bila (408069)	Upstream section flows through protected areas	53.53	88.22
				Bila (408068)	-	0.51	0.59
National Park Vranica	II	Planned	282.18	Željeznica (409038)	Protected area border next to the left bank	45.63	46.56
				Dragača (409037)	Upstream section flows through protected areas	62.12	59.17
				Kozica (408074)	-	0.01	0.07
Monument of Nature Vrelo Bosne	III	Protected	5.54	Željeznica (406019)	-	0.01	0.01
				Bosna (104019)	Upstream section flows through protected areas	5.31	5.55
				Zujevina (431223)	-	0.22	0.46
Protected Landscape Trebević	V	Protected	401	Miljacka (401002)	Left bank of Miljacka river	N/A	N/A
National Park Zvijezda	II	Planned	493.73	Gostovića (423122)	-	23.84	14.21
				Stupčanica (407006)	-	5.92	4.68
				Krivaja (407026)	-	15.65	17.99
				Krivaja (407025)	-	57.44	66.76
				Krivaja (407024)	-	251.15	49.89
				Misoča (410061)	-	6.83	10.24
				Stavnja (411063)	-	0.01	0.01
				Stavnja (411065)	-	15.44	32.91
				Trstionica (414092)	-	0.85	0.89
				Trstionica (414094)	-	1.82	4.09
				Trstionica (414095)	-	0.34	2.44
				Gostelja (403180)	-	0.001	0.001
				Oskova (403179)	-	19.54	15.60

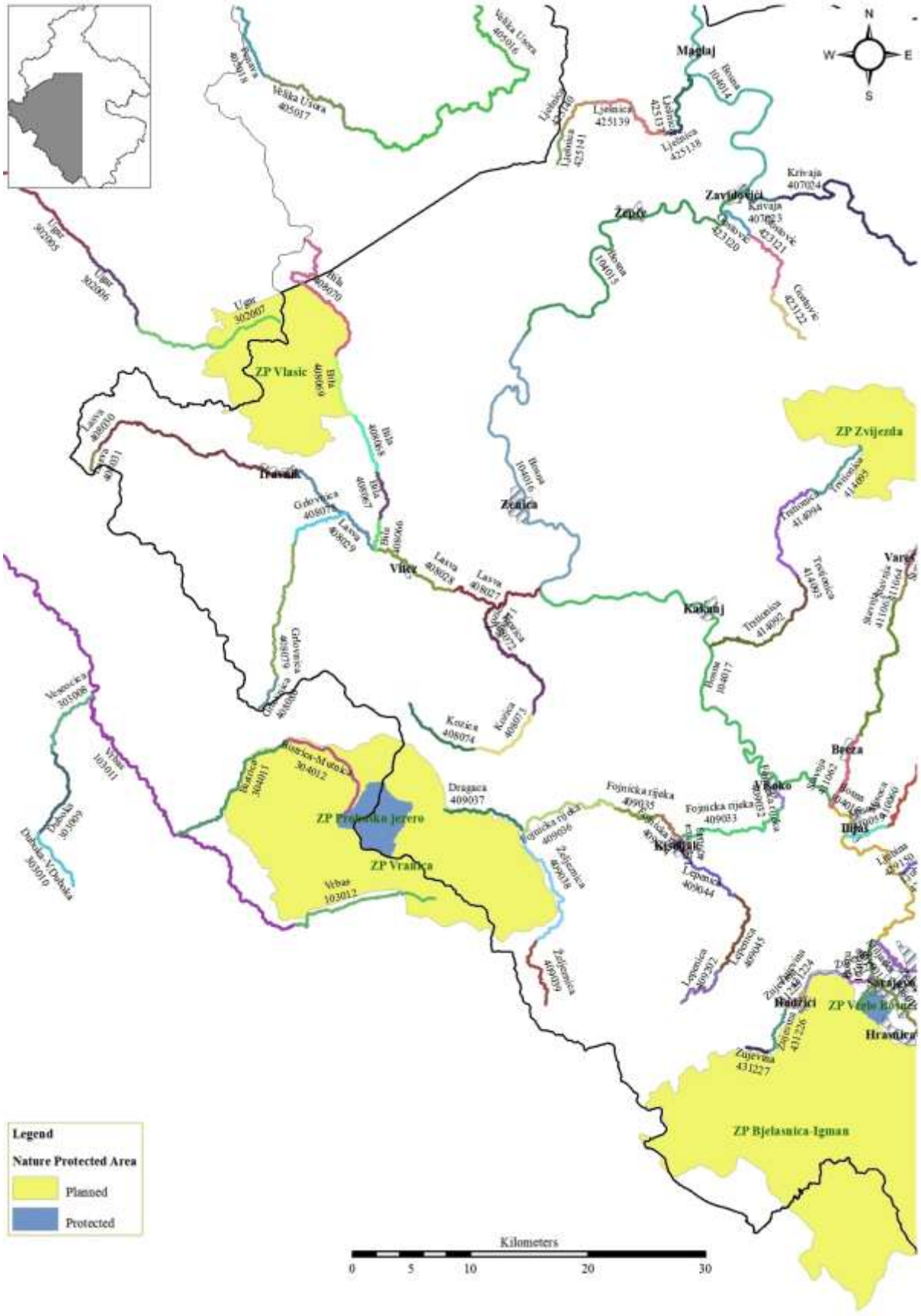

Figure 9 Nature protected areas in the Bosna River Basin (1/2)

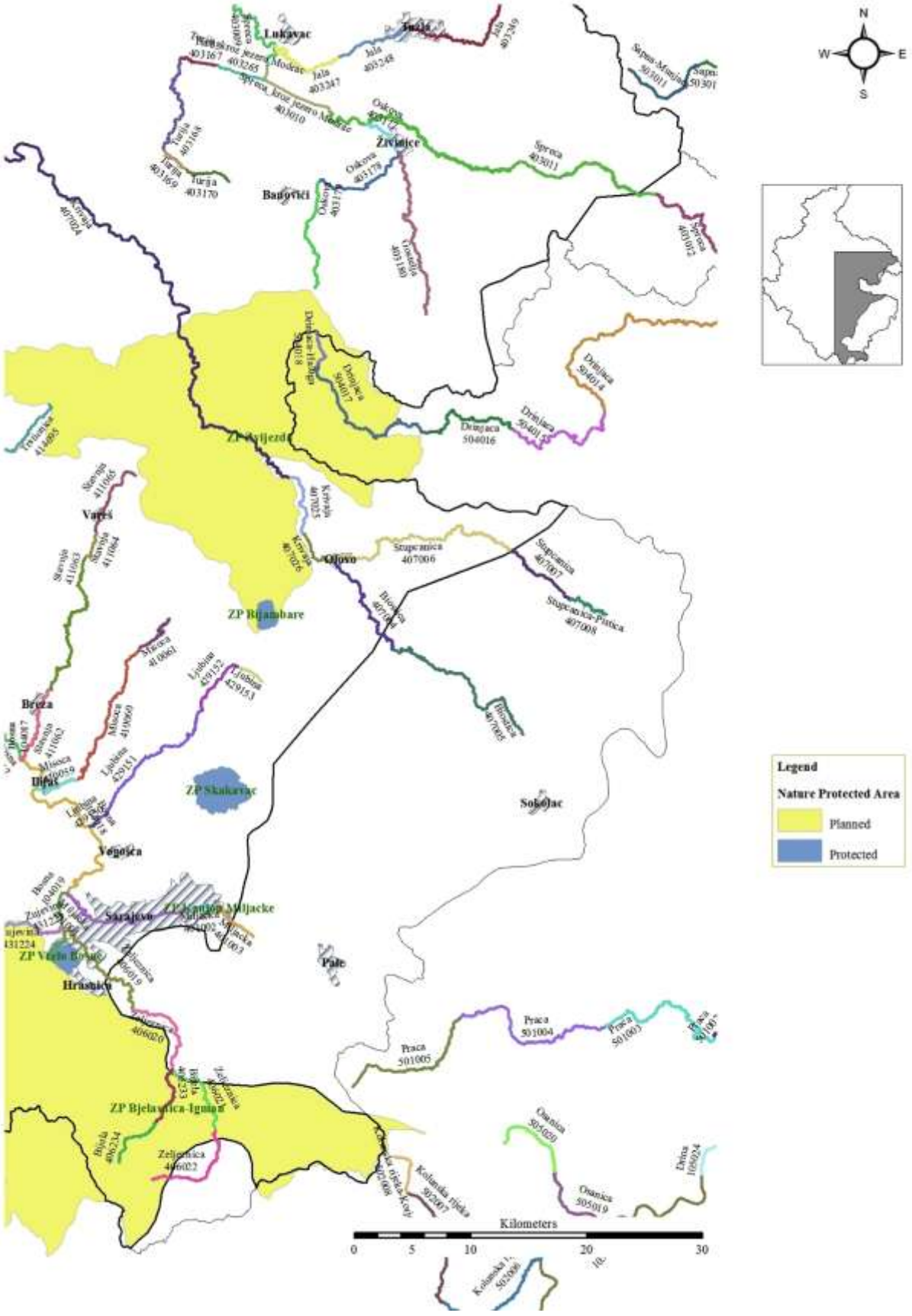

Figure 10 Nature protected areas in the Bosna River Basin (2/2)

Table 11 Protected areas of unknown status in the Bosna River Basin

Name	Total surface area (ha)	Surface area inside the Bosna River Basin (ha)	IUCN Category	Water course (Hydrological station ID)
Regional Park of Nature "Park Treskavica"	-	-	I - IV	Željeznica (406022)
Nature Reserve "Part of Željeznica water course (Turovi - Treskavica)"	6	6	I - II	Željeznica (406022)
Recreational and other areas "Recreational area Jahorina"	-	-	II - IV	Željeznica (406022)
Recreational and other areas "Recreational area Bjelašnica and Igman"	-	-	II - IV	Bijela rijeka (406233)
Recreational and other " Bosna River " (from spring to Krivoglavci)	-	-	I - III	Bosna (104019)
Recreational and other areas "Miljacka river Canyon, from Pale to Kozja ćuprija"	-	-	I - III	Miljacka (401003)
Nature Reserve "Vodopad Skakavac"	4	4	I	Bosna (104018)
Regional Park of Nature "Planina Vranica"	-	-	I - III	Dragača (409037)
Recreational and other areas "Misoča River valley, from spring to confluence with Bosna River "	-	-	I - III	Misoča (410060)
Nature Reserve "Sastojina Tise"	10	10	I - II	Bosna (104018)
Recreational and other areas "Fojnička River valley, from Fojnica to Kiseljak"	-	-	I - III	Fojnička River 409036
Recreational and other areas "Parts of Ozren Mountain"	-	-	II - III	Ljubina (429151)
Nature Reserve "Waterfall on Kozica River" (next to Read rocks-Crvene Stijene)	5	5	I	Kozica (408073)
Nature Reserve "Forest area Tisovac"	50	50	III - IV	Lašva (408028)
Nature Reserve "Waterfalls on Jaglenica River"	1	1	I	Grlovnica (408079)
Nature Reserve "Forest area Kruščica"	50	50	III - IV	Lašva (408028)
Nature Reserve " Čuda Canyon"	14	14	I - II	Krivaja (407025)
Nature Reserve "Peatland Djilda, Zvijezda Mountain"	10	10	I	Misoča (410061)
Nature Reserve "Peatland Zvijezda Mountain"	10	10	II	Stavnja (411065)
Nature Reserve "Waterfall Očevlje"	1	1	I	Krivaja (407025)
Nature Reserve "Rainforest Zuča-Ribnica"	30	30	I	Bosna (104017)
Recreational and other areas "Krivaja river valley, from Olovo to Zavidovići"	-	-	II - IV	Krivaja (407024)
Recreational and other areas " Vlašić Mountain"	-	-	II - IV	Bila (408069)
Recreational and other areas "Parts of Konjuh Mountain"	-	-	III - IV	Krivaja (407024)
Nature Reserve "Forest land Bistričak"	30	30	III - IV	Bosna (104015)
Recreational and other areas "Artificial reservoir Modrac near Tuzla"	-	-	III - IV	Spreča through Modrac (403010)

3.10.2 Water spring protection zones

This chapter gives the review of water springs used for domestic water supply for which the protection related documents are prepared (e.g. reports on protection zones, decisions on protection and alike).

Table 12 Springs used for domestic water supply

Spring name	Location (municipality)	Used for water supply of	Minimum yield of 1/20 probability occurrence Q_5 (l/s)	River Basin
Sarajevsko polje	Sarajevo	Sarajevo	2,800	Bosna Σ Q = 5,945 l/s
Planinska vrela	Sarajevo	Sarajevo	310	
Grupa vrela	Hadžići	Hadžići	50	
Studešnica	Banovići	Banovići	30	
Krabašnica	Banovići	Banovići	30	
Mahmutovića rijeka	Breza	Breza	18	
Tocili	Fojnica	-	70	
Požarna	Fojnica	Fojnica	30	
Bježanija	Fojnica	Fojnica	23	
Grupa vrela	Kiseljak	Kiseljak	35	
Grupa vrela	Kreševo	Kreševo	27	
Zeleni vir	Olovo	Olovo	120	
Orlja	Olovo	Olovo	40	
Grupa vrela	Novi Travnik	Novi Travnik	35	
Plava voda	Travnik	Travnik	700	
Bašbunar	Travnik	Travnik	60	
Očevlja	Vareš	Vareš	70	
Stijene	Vareš	-	70	
Vrutak	Visoko	Visoko	100	
Kruščica	Vitez	Zenica-Vitez	300	
Babina rijeka	Zenica	Zenica	120	
Klopče	Zenica	Zenica	10	
Kremenik	Vitez	Vitez	120	
Izron	Zavidovići	Zavidovići	160	
Ravna rijeka	Žepče	Žepče	17	
Toplice	Živinice	Tuzla	200	
Sprečko polje	Živinice	Živinice	150	
Stupari	Kladanj	Tuzla	250	

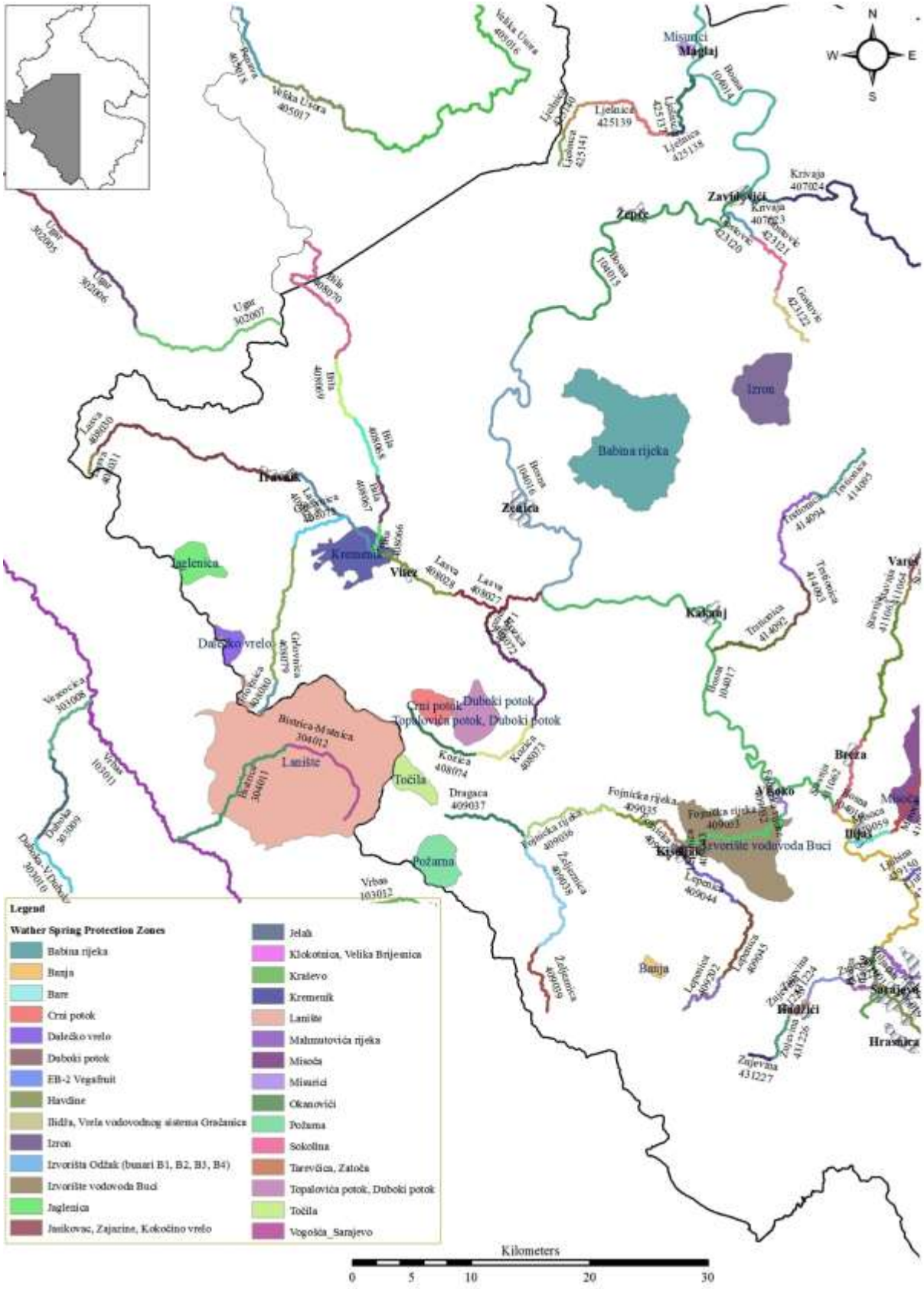

Figure 11 Water spring protection zones (1/3)

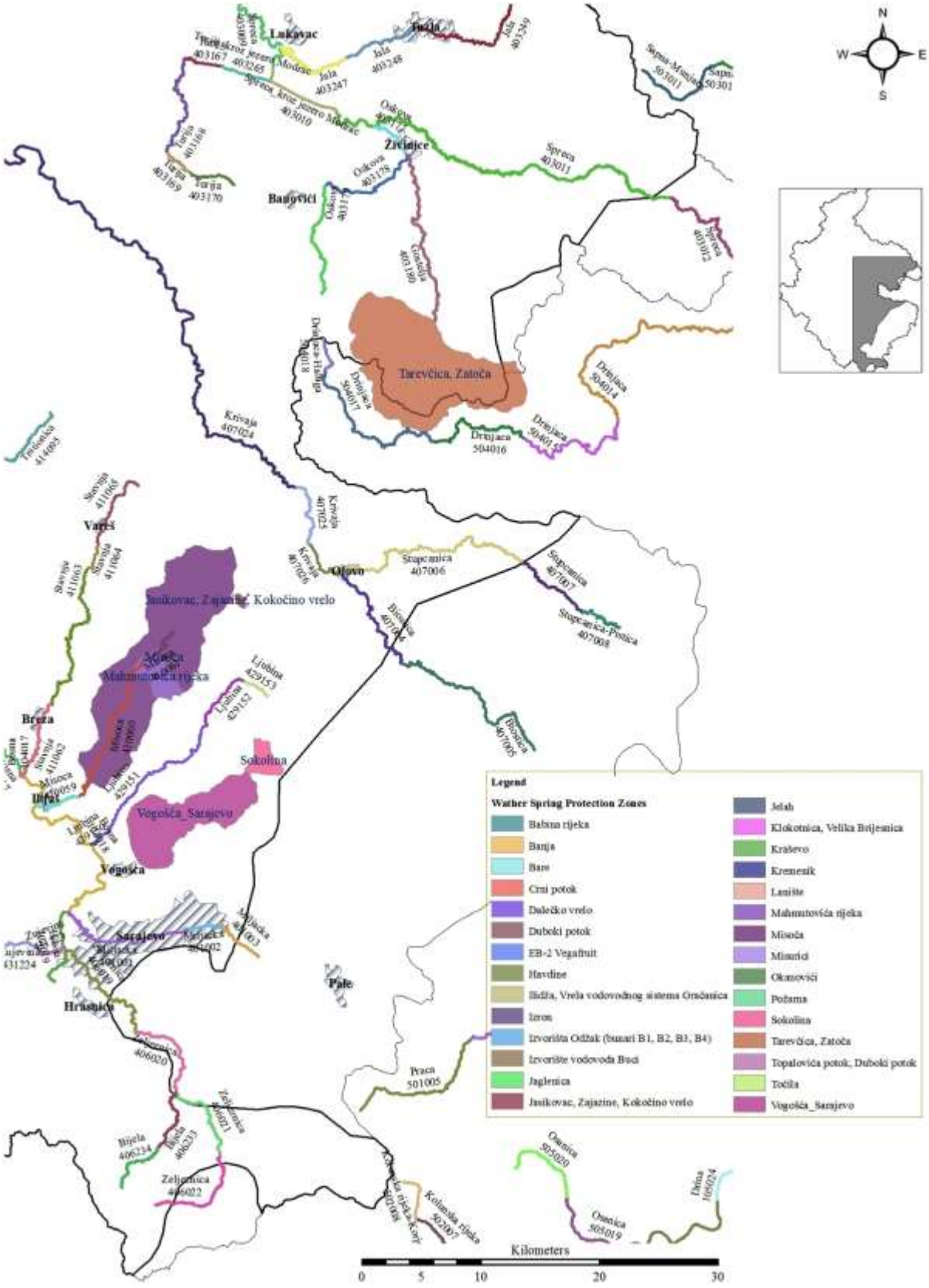

Figure 12 Water spring protection zones (2/3)

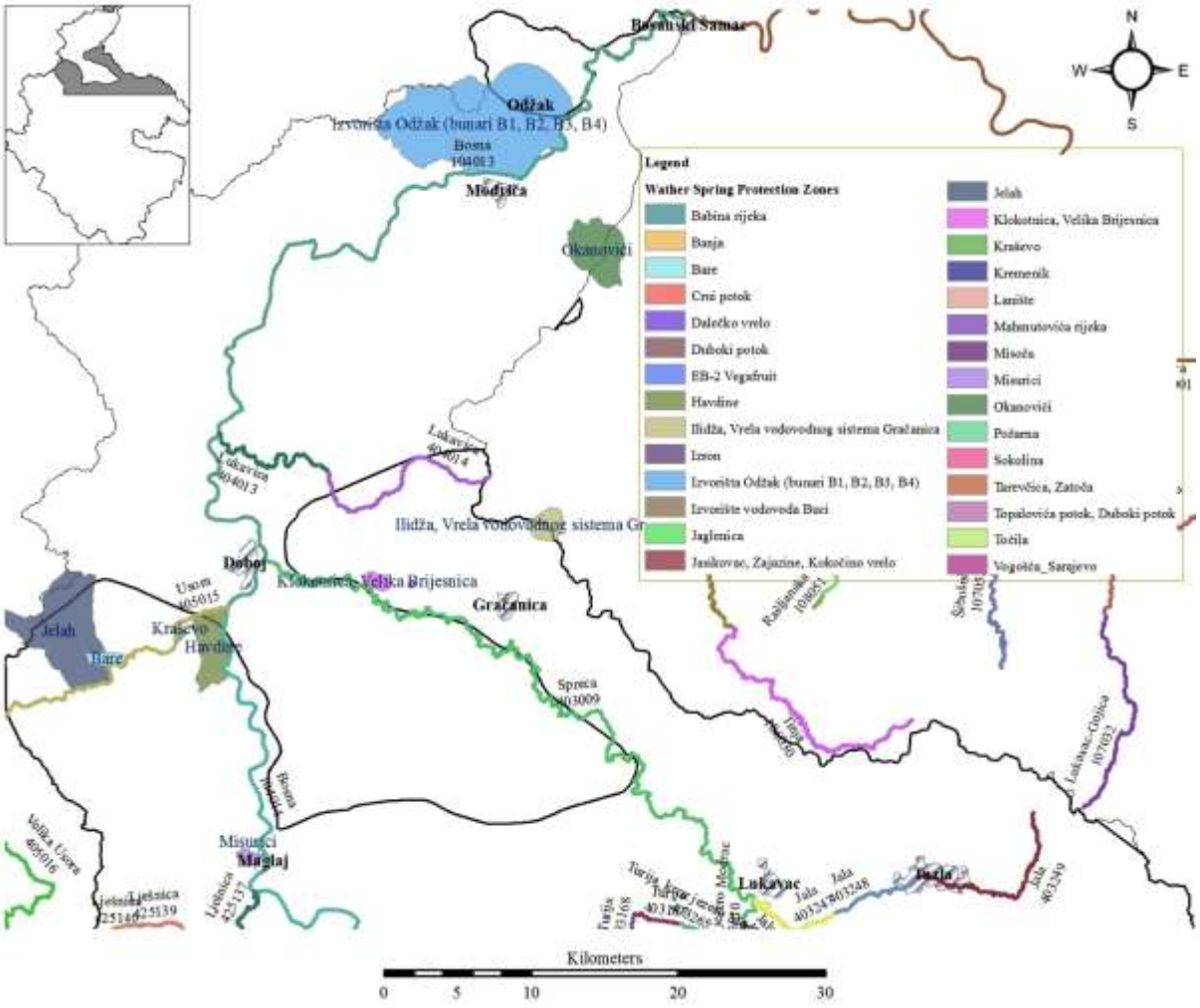

Figure 13 Water spring protection zones (3/3)

4 OVERVIEW OF ENVIRONMENTAL REQUIREMENTS IN FB&H

4.1 Environmental assessment procedure

The competences for environmental assessment in FB&H are split between Federal and Cantonal Ministries responsible for environment.

The environmental assessment in FB&H is implemented within the environmental permit issuing procedure. The procedure for the issuance of environmental permits in the Federation is prescribed by:

- Law on Environmental Protection ("Official Gazette of FB&H" 33/03),
- Law on Amendments to Law on Environmental Protection ("Official Gazette of FB&H" 38/09),
- Regulations of plants and facilities requiring environmental impact assessment and plants and facilities allowed to be constructed and commission only if provided with the environmental permit ("Official Gazette of FB&H" 19/04) (hereinafter referred to as the Federal Regulations),

The Federal Regulations define:

- plants and facilities requiring a mandatory environmental impact assessment,
- plants and facilities for which the environmental impact assessment is carried out based on the assessment of the Federal Ministries, and
- plants and facilities that do not require environmental impact assessments, and for which the Federal Ministry issues the environmental permit.

For plants and facilities requiring environmental impact assessment, assessment procedure begins with the submission of the Environmental Impact Study (hereinafter referred to as the Study) to the Federal Ministry of Environment and Tourism (hereinafter referred to as the Ministry). Throughout the assessment procedure, the Ministry provides public with the access to the Study via website of the Ministry, informs and invites public to discuss the Study (ensuring participation of the public and the stakeholders), and appoints an expert committee to review the Study. After the public hearing and assessment of the expert committee, the Ministry issues a Decision approving or rejecting the Study. In case of the approval, the Ministry issues a Decision approving the environmental permit. In case of refusal, the procedure is terminated.

For plants and facilities for which the environmental impact assessment is carried out based on the assessment of the Federal Ministry, the assessment procedure begins by preparation and submission of the Request for Environmental Permit (hereinafter referred to as the Request) to the competent Ministry and the Ministry submits the Request along with the attachments to the competent authorities and stakeholders for the purpose of receiving opinions and suggestions (ensuring participation of the public and the stakeholders). While reviewing the Request for the environmental permit, the Ministry takes into account the following criteria:

- Project characteristics (size, accumulation of other structures, use of natural resources, production of waste, pollution and interferences, the risk of accidents, etc.)
- Project location and environmental sensitivity of geographical areas likely to be affected by the project (existing land use, availability, quality and regenerative capacity of natural resources, absorption capacity of the natural environment: wetlands, coastal zones, protected areas, etc.)
- Characteristics of potential impacts (extent of impact, impact of the trans boundary nature, size and complexity of the impact, impact probability, duration, frequency and reversibility).

If it is determined that the location of the project is in the zone under a specific protection regime, either under the Water Law (water protection zone) or Law on Environment Protection, then the estimate is required to verify compliance of the activities with the protection regimes and potential impacts.

If, based on the Request and the enclosed evidence, it is determined that the Environmental Impact Study (EIS) is not necessary, the Ministry shall issue the Environmental Permit. Otherwise, the Ministry issues the Decision on the necessity of carrying out the Environmental Impact Assessment. The development of the Study includes the obligation to conduct a public discussion, and the evaluation of the Study is carried out by the expert commission appointed by the Minister.

For plants and facilities not requiring the Environmental Impact Assessment, for which the Federal Ministry issues the environmental permit, the procedure for the environmental permit begins with the submission of the Environmental Permit Request to the Ministry, which issues the environmental permit within 120 days from the date of application.

For projects, plants and facilities allowed to be constructed and commissioned only if provided with the environmental permit and which, based on the size and capacity belong to the cantonal level (and municipal level in Middle Bosnia Canton) pursuant to the cantonal regulations, it is necessary to prepare the Environmental Permit Request. The Request shall be submitted to the competent cantonal Ministry of Environmental Protection (or responsible municipal department for physical planning in Middle Bosnia Canton), which has an obligation to publish the Request on the website of the Ministry, and deliver the copies of the Request to the stakeholders for comments and suggestions to ensure public participation.

The comparative overview of the content of documents relevant to the environmental assessment is given in Table 13.

A graphic presentation of the above described EIA procedure in FB&H is presented in the Figure 14.

Table 13 Comparative Overview of the Contents of Documents Relevant to the EA

Environmental Permit Request Content	EIS Content
▪ Excerpt from a planning document of the respective area marked with the legend of the use of a wider surface area and the site land uses Description of: ▪ plants, facilities and activities (plan, technical description of work, etc.) ▪ basic and auxiliary materials, other substances and energy used or produced by plants and facilities, ▪ sources of emissions from plants and facilities, ▪ condition of the location of plants and facilities, ▪ the nature and amount of projected emissions from plants and facilities into environment (air, water, soil) ▪ Identification of significant environmental impacts, ▪ Proposed measures, technology and other techniques for preventing or, if not possible, reducing emissions from the plant, ▪ Measures to prevent the production and for recovery of useful materials from wastes produced by the plant, ▪ Other measures to comply with the basic obligations of operators, especially measures after the closure of the plant	▪ Description of physical characteristics of the overall project and conditions of land use, during construction and operation of the plant and facilities planned by the project, ▪ Description of the basic characteristics of the production process, nature and quantity of materials used, ▪ Assessment, by type and quantity, expected waste and emissions (pollution of water, air and land, noise, vibration, light, heat, radiation, etc.) that are the result of planned production process. ▪ Description of the environment, which might be affected by the project: o Population data, o Data on flora, fauna, water, air, land, o Climatic characteristics of the area, o The existing tangible property, including cultural, historical and archaeological heritage, o Description of the landscape, o Specific elements identified in the previous EIA. ▪ Description of potentially significant impacts of the project on environment, population, flora, fauna, water, air, soil, climatic factors, on material goods, including cultural, historical and archaeological heritage, landscape, ▪ Interrelation of the above mentioned factors, ▪ Specific impacts of the project on the environment identified in the previous EIA, ▪ Description of the methods proposed by the applicant for the EIA. ▪ Description of mitigation measures for adverse effects includes measures to prevent, reduce or mitigate any adverse impact on environment: ▪ Overview of basic alternatives, ▪ Non-technical summary, Indication of difficulties.

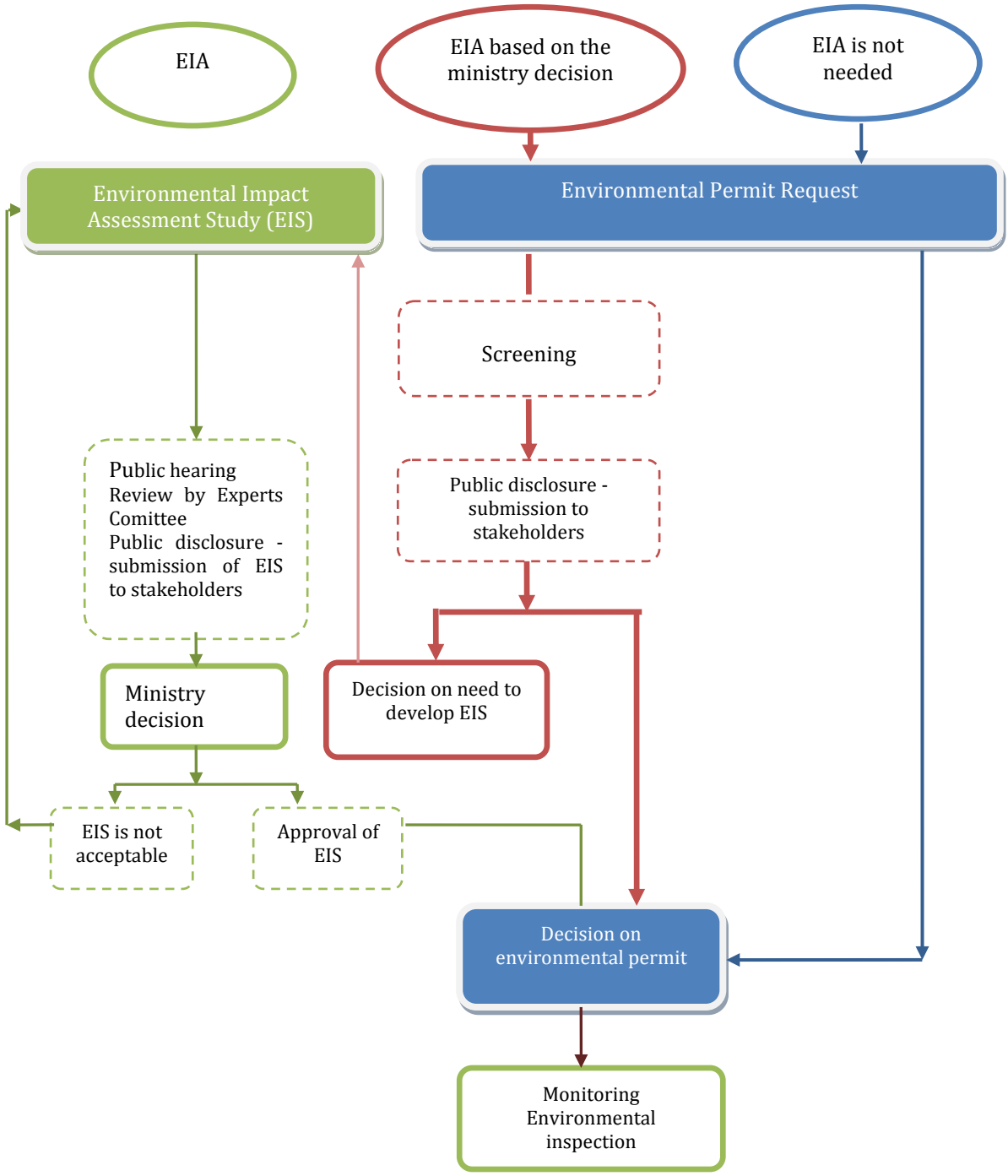

Figure 14 EIA procedure in FB&H

4.2 Other regulation that have impact on the environmental assessment

4.2.1 Water management regulation

Pursuant to the Water Law ("Official Gazette of the FB&H" 70/06), the environmental permit is issued on the basis of the previously obtained Preliminary Water Approval.

Preliminary Water Approval is one of the water acts, which decides on the entitlement of the rights to water to an applicant, as well as the manner of exercising these rights (Article 11).

Water Law prescribes that project such as water intake and discharge of wastewater in all sectors, activities including construction of flood defense structures, river training as well as all other activities that can influence the water quality and quantity, impact aquatic systems, and influence stability of river beds, it is necessary to obtain water acts, namely:

- Preliminary Water Approval, prescribing the conditions under which the competent Ministry agrees to the use of water, and issued in the phase of issuing location permits in terms of regulations on civil constructions and environmental permits in terms of environmental regulations;
- Water Approval, determining that the documentation, enclosed to the water permit request, is pursuant to the preliminary water permit, water regulations and planning documents, and issued prior to the issuance of construction approval in terms of civil construction regulations,
- Water Permit, confirming the fulfillment of the conditions set in the Water Approval, and issue prior to the issuance of use permits in terms of civil construction regulations. Water Permit determines purpose, way and conditions for water use, working regime of facilities and plants, ways and conditions for wastewater discharge, ways and conditions for solid and liquid waste, and other conditions. Water Permit also determines responsibility of users related to wastewater quantity measurement, measurement frequency, quality control and recording of taken and used water, as well as responsibilities related to calculation and payment of water fees.

Water acts in FB&H are issued in accordance with the Regulations of the Water Acts Content, Form, Terms, Issuing Procedure and Storing ("Official Gazette of FB&H" 06/08, 57/09 and 72/09).

Water acts are not necessary for (i) construction of water supply system that delivers water to residential and other type of objects that use water solely for drinking and sanitary purposes in quantities up to 1 l/sec, (ii) construction of sewage system and other facilities for collection and transport of wastewater from residential and touristic facilities, and (iii) cable telecommunication (above and underground), low-voltage electrical and low-pressure gas network if it does not have influence of water assets and is not constructed in water good.

The Water Law also prescribes that the competent Ministry for environment should integrate water protection recommendations and measures from the Preliminary Water Approval into the Environmental Permit for those projects that are subject to environmental assessment. The issuing request together with the Study for Preliminary Water Approval, pursuant to the legislation shall be submitted by the authority competent to issue the Environmental Permit. It should be noted that the practice is different from the above prescribed practice and that the investor itself is required to start the procedure of the Preliminary Water Approval issuance.

For plants and facilities, which prior to obtaining the Environmental Permit must undergo the EIA procedure, the authority responsible for the issuing of Water Acts is to be involved in the EIA procedure, at the request of the authority conducting the EIA procedure.

Sava River District Water Agency and the Cantonal Ministries of Agriculture, Water and Forestry of respective Canton are competent for the issuance of water acts. In the specific case of FERP in FB&H, division of competencies is given in table below.

Table 14 Division of responsibilities for issuing of water acts relevant to FERP

Water Agency for Sava River Catchment Area	Cantonal Ministries responsible for water
▪ Water intake of more than 10 l/s ▪ Discharge of wastewater in surface or ground waters ▪ Construction of flood defense facilities in water courses of I category as well as construction of flood defense facilities in water courses of II category, if these activities influence water courses of I category ▪ Construction of railways, highways and magisterial roads ▪ Construction of bridges and other facilities above or in surface waters of I category ▪ Training or any intervention in surface waters of I category	▪ Water intake of less than 10 l/s ▪ Construction of flood defense facilities in water courses of II category, if these activities does not influence water courses of I category ▪ Construction of regional and local roads including forest roads ▪ Construction of bridges and other facilities above or in surface waters of II category ▪ Training or any intervention in surface waters of II category

According to the article 114 of the Water Law, reconstruction projects are subject to issuing of Water Approval and Water Permit only.

4.2.2 Waste management regulation

Pursuant to the Law on Waste ("Official Gazette of FB&H" 33/03, Article 19) Waste Management Plan is to be enclosed to the Environmental Permit Request. The plan should include:

- documentation on waste produced by enterprises (origin, type of waste in accordance with the list of wastes, composition, quantity),
- measures to be taken for prevention of waste production, especially concerning the hazardous waste,
- separation of waste, especially separation of hazardous and other types of waste from the waste to be reused,
- disposal of waste to the landfill,
- treatment and/or disposal methods.

Law on Waste Management, from the aspect of this project, sets general requirements concerning the construction and demolition waste management.

Regulation of Waste Categories with Lists ("Official Gazette of FB&H" 09/05) establishes a list of wastes by operations they are produced from. Construction and demolition waste is specified as one of the subcategories in this List under classification 17 00 00.

4.2.3 Civil construction regulations

Civil construction in Bosnia and Herzegovina is regulated by the following legal acts:

1. Law on Physical Planning and Land Use on the Level of the Federation of Bosnia and Herzegovina ("Official Gazette of FB&H" 2/06, 72/07, 32/08, 4/10, 13/10 and 45/10)
2. Cantonal Laws on Physical Planning and Civil Construction in FB&H.

Pursuant to the Federal and Cantonal regulation on physical planning and civil construction, for reconstruction projects, it is necessary to obtain the construction approval and the use permit.

According to the Article 7 of Decision on construction site organization, obligatory documentation on the construction site and participants in construction ("Official Gazette of FB&H", 48/09, 75/09, 93/12), the Contractor shall prepare **Construction Waste Management Plan** as a part of obligatory documentation on a construction site.

5 OVERVIEW OF WORLD BANK ENVIRONMENTAL REQUIREMENTS

5.1 OP/BP 4.01 Environmental Assessment

World Bank introduced the Environmental Assessment Policy through Operational Directions (OD) 4.01 in 1989. This policy has been expanded to the Operational Policy (OP) 4.01 and Bank Procedure (BP) 4.01 in 1999 with the latest revision in April 2013. OP/BP 4.01 is applied to any investment loan financed or implemented by the Bank in case there is a possibility that the referred project results in adverse environmental impacts. This operational policy has also been envisaged as an instrument to improve the implementation of the project itself and to enhance the project quality and sustainability.

The World Bank environmental assessment evaluates potential environmental impacts and risks related to the project, examines project alternatives, identifies ways of improving the selection of project alternatives, siting, planning, designing of interventions on site (for the planned project), and implementation by prevention, minimization, mitigation, or compensation of adverse environmental impacts. The Bank favors preventive measures over mitigation or consequential compensatory measures, whenever feasible. Environmental assessment takes into account all components of the natural environment (air, water, and land), human health and safety, social aspects (population resettlement, indigenous population and physical cultural resources), as well as transboundary and global environmental aspects involving climate changes, use of substances harmful to the ozone layer, contamination of international water courses, and adverse impacts on the biodiversity.

Environmental assessment considers natural and social aspects in an integrated way. It also takes into account differences among projects and conditions of each individual country, the findings of a country environmental studies, national environmental action plans; the country's overall policy framework, national legislation, and institutional capabilities related to the environment and social aspects, as well as, pertaining to the specified project activities, obligations of the country under relevant international environmental treaties and agreements.

As stated in the paragraph 8 of the Operational Policy (OP) 4.01 - Environmental Assessment, the Bank undertakes screening of each of the proposed projects to determine the appropriate extent and type of the environmental assessment. The Bank classifies the proposed project into one of four categories (A, B, C, F), depending on the type, site, sensitivity and scale of the project, as well as nature and magnitude of its potential environmental impacts. Depending on the project, WB applies different instruments to satisfy the WB requirements for the environmental assessment (Table 15).

Table 15 EA Categories and Instruments Pursuant to the Operational Policy 4.01

Project category	Type of impact	Environmental Assessment Instrument
A	The project is likely to have significant adverse environmental impact that is sensitive, diverse or unprecedented.	Environmental Impacts Assessment Regional or Sectoral Environmental Assessment Strategic Environmental and Social Assessment
B	The project's potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats - are less adverse than those of Category A projects	Environmental Audit Hazard and Risk Assessment Environmental Management Plan Environmental and Social Management Framework
C	The project is likely to have minimal or no adverse environmental impacts	
F	The project involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts	

When the borrower has inadequate legal or technical capacity to carry out key EA-related activities (such as review of EA, environmental monitoring, inspections, or management of mitigation measures) for a proposed project, the project includes components to strengthen that capacity.

For all Category A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and thereby takes their views into account.

5.2 Activities that may trigger additional safeguard policies

The Flood Emergency Recovery Project foresees investments in three types of activities: (i) reconstruction of local roads (ii) reconstruction of local water supply network, and (ii) reconstruction of regional public infrastructures (roads, dykes, etc.).

Considering that the activities involve reconstruction only, it is envisaged that the project will not go beyond the original design and will not involve any extension of current capacities.

Nevertheless, the following safeguard policies should be considered when screening the project for its potential environmental impacts:

- OP 4.04 – Natural Habitats in case that a project is implemented in naturally protected areas and/or might involve the significant conversion or degradation of critical natural habitats;
- OP 4.07 - Water Resources Management in case that a project (i) intend to increase use of groundwater resources for drinking water purposes and thus potentially lead to their overexploitation, or (ii) intent to change water regime, or (iii) might lead to any other type of water resources misuse;
- OP 4.11 – Physical Cultural Resources, in case that a project (a) involves any significant excavations, demolition, movement of earth, flooding, or other environmental changes; and (b) is located in, or in the vicinity of, a physical cultural resources site.
- OP 4.36 – Forests, in case that a project is implemented in or nearby forests thus posing threat to health and quality of forests.

6 ENVIRONMENTAL SCREENING PROCESS

6.1 Project related environmental assessment needs

The analysis of the necessity for environmental assessment of local/regional infrastructure reconstruction subprojects was based on the positive regulations from the concerned field at Federal and Cantonal level[15]. Table 16 gives overview of requirements for proposed subprojects as well as for projects similar in nature that should be considered in screening process.

Table 16 Environmental Assessment Requirements in FB&H

Project Description	FB&H EIA Required	FB&H Assessment of need for EIA or envtl permit	Sarajevo Canton Envtl permit	Zenica - Doboj Canton Envtl permit	Tuzla Canton Envtl permit	Posavina Canton Envtl permit
PROPOSED PROJECTS						
Reconstruction of local roads	No	No	No	No	No	No
Reconstruction of local water supply network	No	No	No	No	No	No
Reconstruction of regional public infrastructures (roads, dykes, etc.)	No	No	No	No	No	No
SIMILAR PROJECTS						
Construction of transmission lines	• 110 kV if part or the transmission system • > 220 kV	No	No	No	No	No
Abstraction of ground water[16]	>3 million m^3/y	1 - 3 million m^3/y	0.2 - 3 million m^3/y	0.2 - 1 million m^3/y	No	No
Widening of existing regional and local road (or street in settlements and cities in Canton Sarajevo) with two or less lines to four or more lines, where the new road or widened part of the road would be	>10 km of continuous by length	No	< 10 km of continuous by length	< 10 km continuous by length	< 10 km continuous by length	< 10 km continuous by length
Construction of channels and flood defense structures on internal water courses	No	No	No	No	No	Yes
Projects that might have impact on nature protected areas	Yes	No	No	No	No	No
Existing EIA facilities that are subject to increase of capacity for more than 25% related to use of space or resources	Yes	No	No	No	No	No

[15] Regulation of plants and facilities allowed to be constructed and commissioned only if provided with the environmental permit (Official Gazette of Canton Sarajevo, 08/11).
Regulations on activities, plants and facilities allowed to be constructed only if provided with the environmental permit (Official Gazette of Zenica Doboj Canton, 12/05);
Regulations on issuing the environmental permit for plants and facilities and other planned activities that may have significant impact on the environment (Official Gazette of Tuzla Canton, 03/05, 09/07);
Regulations on issuing the environmental permit for plants and facilities and other planned activities that may have significant impact on the environment (Official Gazette of Posavina Canton, 06/10);
[16] To be considered in relation to possible use for water supply

It should also be noted that, according to the Article 60 of Law on Nature Protection ("Official Gazette FBiH" 66/13) any project that can have impact on nature protected areas will be subject to environmental assessment on the federal level in relation to the protection goals of the area. According to the article 56 of the Law on Environmental protection, any change in the existing EIA facility that will cause increase in capacity for more than 25% related to the use of space or resources also triggers EIA procedure on the federal level.

It can be concluded that the proposed subprojects related to reconstruction of existing local and regional infrastructure are not subject to environmental assessment according to federal and cantonal environmental regulation. However, in case the project involves construction of new or widening of existing infrastructure with increase of current capacities, it might be subject to environmental assessment if it is above the threshold capacities given in table above. While assessing the requirements, the project exclusion list prepared by the WB for Flood Emergency Reconstruction project should be consulted (Table 17).

Table 17 Subproject activities not eligible for financing

Subproject activities NOT eligible for financing
GENERAL CHARACTERISTICS
Corresponds to World Bank Category A project. Has a significant and irreversible environmental impact and requires a mandatory environmental license based on a full EIA report as per the entity bylaws on *"plants and processes that require an environmental permit*" (under the Laws on Environmental Protection in RS and FBIH)
Involves significant conversion or degradation of critical natural habitats. These may include, but not be limited to any protected areas, protected landscapes or nature parks including the Bardača special reserve area. No works, other than removal of debris and repair of pre-existing infrastructure is allowed.
Will involve works and potential damages on any of the listed or potential cultural heritage sites and buildings that are proclaimed as such by the State Level Commission for the Preservation of Monuments and the responsible Entity Institutes for Monument Protection.
Require pesticides that fall in WHO classes IA, IB or II
Require displacement/resettlement of affected population.
Repair of privately owned production facilities/ houses.
Supports commercial logging or plantations in forested areas. Any "salvage logging" operations (which might be undertaken as a result of damage to forests)
Drinking Water Supply: New or expansion of piped water scheme to serve 500 or more households.
Sanitation: New or significant expansion of sewerage or wastewater treatment plant. Rehabilitation of existing wastewater treatment plant.
Solid Waste: New or significant expansion of sanitary and engineered disposal sites. No expansion of open municipal dump-sites.
Roads and Infrastructure: New roads. Widening of primary roads Construction of new temporary or permanent infrastructure to bypass devastated areas which have a segment length greater than 500 m and cumulative length of 2,000 m within a corridor of 10 km or less
Agriculture/Irrigation: Procurement of seeds or planting material for crops meant for consumption, without prior soil sampling to ensure no contamination and/or heavy metal presence in soil Procurement of seeds and seedlings allowed only with guidance of the relevant agriculture/plant institutes in country New irrigation scheme or expansion of a scheme requiring increased water intake. New tube-well for irrigation.
River Basin Management: Repair of dykes or dams that are higher than 5 m or store water volumes larger than 1,000,000 m^3 construction of new, or substantial expansion of existing flood protection works, including the

Subproject activities NOT eligible for financing
GENERAL CHARACTERISTICS
conversion of floodplains or riverine forests.
Power: New power generating capacity of more than 5 MW Rehabilitation of hydro-electric power station with dam, or entailing alteration of the water flow regime.
Oil and Gas: New distribution
Income Generating Activities: Activities involving use of unsustainably harvested timber or fuel-wood. Activities involving the use of hazardous substances such as pesticides/herbicides, explosives, products deemed illegal by national laws, PCBs, radioactive materials unbound asbestos fibers.

Pursuant to the requirements of the Water Law in FB&H, for all proposed reconstruction projects it is necessary to obtain Water Approval and Water Permit. These acts are issued in a two stage process implemented in parallel with the civil construction permitting (issuing of construction approval and use permit). Water acts regulate aspects of protection of facilities against water, , conditions for protection of water against pollution generated by permitted facility and conditions for water use at the location of the project.

According to the Project Appraisal Documents for the Floods Emergency Recovery Project, the project is classified as environmental category "B", in accordance with Operational Policy OP 4.01. Since exact subprojects are not determined and will be decided based on demand and consultations with the concerned municipalities and communities, the appropriate instrument of OP 4.01 is the ESMF. The ESMF will identify the policy triggers for the Project, the screening criteria of subprojects, the environmental and social impacts for the likely subprojects and the measures to mitigate the identified risks. The ESMF will directly enable screening out of activities that correspond to Category A projects, or that may trigger additional safeguards policies. The projects that are not eligible for financing are given in Table 17.

Project environmental requirements are summarized in Table 18. The subprojects in FB&H shall need to satisfy environmental assessment requirements of the World Bank as well as the two-step water permitting requirements laid down in the federal water management regulations.

Table 18 Project Environmental Requirements

Project type	Category Pursuant to WB	WB EA Instrument	Instruments Pursuant to the FB&H Regulations
Reconstruction of local roads	B	Checklist EMP or full EMP depending on the scope of the project	Water Approval Water Permit
Reconstruction of local water supply network	B	Checklist EMP or full EMP depending on the scope of the project	Water Approval Water Permit
Reconstruction of regional public infrastructures (roads, dykes, etc.)	B	Checklist EMP or full EMP depending on the scope of the project	Water Approval Water Permit

6.2 Reconciled environmental assessment process

The steps to be followed concerning environmental assessment process are the following:

Step 1. Prepare ESMF for the whole project with the following content:

- Abbreviations and Acronyms
- Executive Summary

- Introduction
- Description of the environment in project affected areas (physical environment, biological environment);
- Overview of Environmental Requirements in FB&H;
- Overview of World Bank Environmental Requirements (including a section on activities that may trigger additional safeguard policies);
- Environmental Screening Process (reconciled process between WB and FB&H requirements);
- Environmental management plan;
- Environmental impact mitigation plan;
- Environmental monitoring plan.

ESMF should also include separate social assessment report.

Step 2. Organize consultation with stakeholders. The document should be publicly disclosed on the web site of the borrower and public hearing organized if deemed necessary. Invitation to public hearing shall be published in daily newspaper at least five days before public hearing. Suggestions and comments should be recorded in the form of the Minutes and integrated into the Final Document.

Step 3. Fill in Checklist EMP or do full EMP. For most pertinent activities (reconstruction of local roads, reconstruction of local water supply network and reconstruction of regional public infrastructure) fill in Checklist EMP provided within ESMF or do the full EMP depending on the scope of the project.

Step 4. Obtain Water Approval. Engage expert institution registered for project design and licensed by the federal ministry responsible for water management to prepare investment-technical documents (detailed reconstruction design). The documentation should be prepared in accordance with requirements set in the Law on Physical Planning and Land Use. The documentation should be attached to the Request for Water Approval and submitted to the Water Agency of Sava River Catchment Area or Cantonal Ministry responsible for waters in line with the division of responsibilities presented in Table 14.

Step 5. Obtain Construction Approval. Submit the Request for Construction Approval to responsible municipal authority. Investment and technical documentation and Water Approval should be attached to the Request**.**

Step 6. Obtain Water Permit. Prepare Project Final Design and submit it together with the Request for Water Permit.

Step 7. Obtain Use Permit. Submit the Request for Use Permit to the responsible municipal authority. Final Design and Water Permit should be submitted together with the Request.

7 FERP SCREENING CHECKLIST

7.1 Introduction

The main purpose of the FERP Screening Checklist is to provide a simple tool for the identification of potential environmental impacts related to the reconstruction of existing infrastructure that was damaged due to the recent floods. It will also help to simplify decision-making process on whether a project is suitable for financing and whether a detailed EMP needs to be developed for a project or not.

The term reconstruction is understood to cover rebuilding of infrastructure after being damaged or destroyed to a previous state without change in its original purpose or increase of capacities.

The FERP screening checklist provides a set of associated environmental mitigation measures as well as monitoring measures that will help assess the implementation of the selected mitigation measures.

The screening checklist is to be used for all smaller reconstruction subprojects on reconstruction or roads, railways and buildings where identified issues will not case significant effects on environment. For all other large reconstruction subprojects, specific EMPs will be developed.

The design and concept of the FERP Screening Checklist allow for it to be used either by specialists or non-specialists dealing with infrastructure reconstruction. The checklist-type format has been developed to provide "example good practices" and designed to be user friendly and compatible with the World Bank safeguard requirements.

7.2 Description of the FERP Screening Checklist

The checklist-type format attempts to cover typical core mitigation approaches to civil and other reconstruction works with small, localized impacts on environment and human health. It is accepted that this format provides the key elements of an Environmental Management Plan (EMP) or Environmental Management Framework (EMF) to meet World Bank Environmental Assessment requirements under OP 4.01. The intention of this checklist is for it to be applied as guidelines for the rehabilitation works contractors and constitute an integral part of bidding documents and contracts for contractors carrying out said works under Bank-financed infrastructure rehabilitation subprojects.

It consists of two major sections:

1. Administrative and institutional data: includes a descriptive part that characterizes the project, including administrative and institutional data and short description of project's technical content and location of works execution. This section could be up to two pages long. Attachments for additional information can be supplemented when needed.
2. Project exclusion criteria: includes a set of five questions that should help the evaluator to understand whether the project is suitable for financing under this financing scheme.
3. Environmental screening: includes a set of questions about possible environmental impact of a project where identified environmental issues can be checked in a simple Yes/No format. If any given issue is triggered by checking "yes", the corresponding mitigation and monitoring measures are to be implemented.
4. Summary of features of project and of its location indicating the need for specific EMP development: includes a descriptive part that summarizes important conclusions about the identified environmental impacts, conclusion about possibility to mitigate impacts with available measures and indicating the need to develop a more specific EMP for a specific subproject.
5. Recording of decision: includes several options related to the final decision on a specific subproject.

7.3 Directions for use and application of results

Section 1 Administrative and Institutional Data of the FERP Screening Checklist requires knowledge about basic general information on sub-projects. Where asked, the boxes should be checked and values filled in. Additional information can be attached to the document.

Section 2 Project Exclusion Criteria requires knowledge about basic technical information on sub-project. This section should be completed in three steps:

Step 1 – Questions 8 and 9 require the evaluator to check whether the sub-project is listed on the exclusion lists (Annex A and Annex B). The appropriate Yes/No boxes adjacent to each question should be marked. If "Yes", these projects are not considered eligible for financing. The evaluator should move to *Section 4 and Section 5* and record that the project is not "Not approved".

Step 2 – Question 10 and 11 require the evaluator to check whether the action will involve large reconstruction activities that will significantly change the state of environment compared to the state before reconstruction. The appropriate Yes/No boxes adjacent to each question should be marked. If marked "Yes", the appropriate action should be checked including change in design, development of site specific EMP or project exclusion. The evaluator should move to *Section 4* and *Section 5* and record appropriate decision in line with the selected action (e.g. "Increased use on natural resources" will call for an action to "Develop a site specific EMP" that will trigger the decision "Approved with requirement to produce specific EMP for the subproject").

Step 3 – Question 13 requires a brief assessment of the reconstruction requirements which, if not fulfilled, may lead to project exclusion. The appropriate Yes/No boxes adjacent to each question should be marked. If marked "No", the appropriate action should be checked.

If answers to questions 8-11 are "No" and answers to questions under 13 are "Yes" this means that the project is suitable for financing and that evaluator should move to *Section 3 "Environmental Screening".*

Section 3 Environmental Screening should be completed in four steps:

Step 1 – user should identify present or potential impacts of the project on environment among those listed in the column *Possible Environmental Impacts*. The appropriate Yes/No boxes adjacent to each impact identified should be checked.

Step 2 – for each impact identified, appropriate mitigation measures are listed in the column *Mitigation Measures*. One environmental impact can trigger one or several of the mitigation measures stated in the table. An attempt is to be made to implement all mitigation measures proposed. Following completion of monitoring activities, those measures that are actually implemented should be circled.

Step 3 – the monitoring parameters appropriate to mitigation measures among are listed in the column *Monitoring parameters*. The proposed monitoring parameters will be checked accordingly, as suitable. Decision on which of the monitoring parameters is optimal to monitor is based on the possibility of occurrence of the impact and its severity, cost of monitoring, etc. Following completion of monitoring activities, those parameters that are actually monitored should be circled.

Step 4 –the Bodies (Proponent, Design Engineer, Contractor, etc.) listed in the column *Responsible body* are identified as responsible for implementing mitigation measure and/or conduct the monitoring. They should be notified of their obligations.

Section 5 Decision requires checking of appropriate box related to the decision made.

7.4 Environmental checklist questionnaire

ENVIRONMENTAL CHECKLIST QUESTIONNAIRE (to be filled in for every subproject separately)				
Section 1. Administrative and institutional data				
1.	Sub-project name	*(Name of rehabilitation sub-project)*		
2.	Sub-Project location	*(Municipality / City, Canton, Entity)*		
3.	Proximity to nearest settlement (houses)			
4.	Proximity to nearest river/lake			
5.	Institutional Arrangements (names and contacts)	*WB (Task team leader)*	*Project Management (PIU)*	*Local Counterpart or Recipient*
6.	Implementation arrangements (names and contacts)	*Safeguard Supervision*	*PIU Supervision*	*Contractor*
7.	Project description *(Describe main project features and location of work execution)*			

Section 2. Project exclusion criteria			
	Issue	Yes/No	Comment
8.	Is the project found of the FERP exclusion list (see the Attachment A)	Yes [ ] No [ ]	[ ] If yes, the project is not eligible for financing. Identify another project.
9.	Is the project found on the list of projects that must undergo environmental assessment based on national legislation (see Attachment B)	Yes [ ] No [ ]	[ ] If yes, the project is not eligible for financing. Identify another project.
10.	Will the project involve actions which will cause new physical changes in the locality (topography, land use, waterbodies, etc.) compared to the state before reconstruction?	Yes [ ] No [ ]	[ ] Go back to original design and avoid any physical changes in the locality [ ] Develop a site specific EMP [ ] Exclude the project and identify another site
11.	Will the project result in increased use of natural resources such as land, water, materials or energy compared to the state before reconstruction?	Yes [ ] No [ ]	[ ] Go back to original design and avoid increase in natural resources use [ ] Develop a site specific EMP [ ] Exclude the project and identify another site
12.	Is the project satisfying general reconstruction requirements?	All legally required permits for reconstruction from local authorities are acquired. Yes [ ] No [ ] Water acts from responsible authorities are obtained. Yes [ ] No [ ] Reconstruction materials are purchased from licensed sources/companies only? Yes [ ] No [ ]	[ ] Temporary stop the project until required permits and water acts are obtained [ ] Ensure that Contractor is contractually obliged to purchase material from licensed companies [ ] It is not possible to fulfill all general reconstruction requirements. Identify another site.

Section 3. Environmental screening					
	Possible environmental impacts	Yes/No?	Mitigation measures (circle those implemented upon completion of monitoring)	Monitoring parameters	Responsible Body
13.	Are there any areas on or around the location which are important or sensitive for reasons of their ecology, e.g. wetlands, watercourses or other water bodies, mountains, forests or woodland, which could be affected by the project?	[ ] Yes [ ] No	(a) All recognized areas in the immediate vicinity of the activity will not be damaged or exploited (b) Staff will be strictly prohibited from foraging, logging or other damaging activities. (c) A survey and an inventory shall be made of large trees in the vicinity of the construction activity, large trees shall be marked and cordoned off with fencing, their root system protected, and any damage to the trees avoided (d) Adjacent wetlands and streams shall be protected from construction site run-off with appropriate erosion and sediment control feature to include by not limited to hay bales and silt fences (e) There will be no unlicensed borrow pits, quarries or waste dumps in adjacent areas.	(a) Visual inspection on site (b) Construction diary (c) Public complaints	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU
14.	Are there any areas on or around the location which are used by protected important or sensitive species of fauna or flora, e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?	[ ] Yes [ ] No	(a) All recognized areas will be completely avoided (b) Staff will be strictly prohibited from hunting, foraging or other damaging activities.	(a) Visual inspection on site (b) Construction diary (c) Public complaints	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU
15.	Will the project lead to risk of contamination of land or water from releases of pollutants onto the ground or in surface/ground waters during construction and operation?	[ ] Yes [ ] No	(a) Set up sediment traps along rivers and/or gabions along banks to filter out eroded sediments (b) Provide slope protection through bank compaction, rip-rapping on critical sections, or vegetative stabilization (c) Designate a Spoils Storage Area, with topsoil set aside for later use and allow maximum re-use of spoils (d) Use material for restoration of degraded areas (e) Provide oil & grease traps in stilling ponds	(a) Complaints received (b) Visually for presence of turbidity in surface water (c) Analyze surface water quality in case of complaints (for pH, turbidity, conductivity and suspended	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU

Section 3. Environmental screening					
	Possible environmental impacts	Yes/No?	Mitigation measures (circle those implemented upon completion of monitoring)	Monitoring parameters	Responsible Body
			(f) Provide ring canals around fuelling tanks/motor pool/ maintenance areas (g) Collect used oils in containers and hand over to authorized agency for handling (h) Construction vehicles and machinery will be washed only in designated areas where runoff will not pollute natural surface water bodies. (i) The approach to handling sanitary wastes and wastewater from building sites (installation or reconstruction) must be approved by the local authorities (j) Before being discharged into receiving waters, effluents from individual wastewater systems must be treated in order to meet the minimal quality criteria set out by national guidelines on effluent quality and wastewater treatment	solids and total mineral oils) (d) If groundwater is used for drinking water supply, analyze tap water for drinking water quality parameters as prescribed in national legislation (e) Appropriate approvals by the local authorities	
16.	Will the project involve actions such as construction/demolition activities, use of machinery and/or transport vehicles, etc. that might release pollutants to air during construction or operation (e.g. exhaust fumes, dust, fire smoke, odors)?	[ ] Yes [ ] No	(a) Regular equipment maintenance (b) Contractor to present proof of compliance with emission standards as part of the annual vehicle registration process (c) Wet areas of dust sources to minimize discomfort to nearby residents (d) Control of vehicle speed to lessen suspension of road dust (e) Keep the surrounding environment (sidewalks, roads) free of debris to minimize dust (f) During interior demolition debris-chutes shall be used above the first floor (g) No open fire at the site (h) Ensure no pollutants are released originating from building heating system (i) Increase energy performance of buildings	(a) Presence of black smoke from construction vehicles (b) Attestation documentation (c) Visual inspection of dust presence (d) Public complaints received	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU
17.	Will the project cause excess noise generation during construction?	[ ] Yes [ ] No	(a) Schedule equipment movement during non-peak	(a) Public complaints	(a) Contractor for execution

Section 3. Environmental screening					
	Possible environmental impacts	Yes/No?	Mitigation measures (circle those implemented upon completion of monitoring)	Monitoring parameters	Responsible Body
			hours of daytime vehicular traffic (b) Avoid night-time construction activities and abide by local laws on construction hours (c) Provide housing for gensets, if near residences (d) Provide silencers/mufflers for heavy equipment	received (b) Measure a noise level in case of complaints	of civil works (b) Supervising engineer on behalf of PIU
18.	Will the project produce solid waste during construction and/or demolition and operation?	[ ] Yes [ ] No	(a) Whenever feasible the contractor will reuse and recycle appropriate and viable materials (except asbestos) (b) Waste collection and disposal pathways and sites will be identified for all major waste types expected from demolition and construction activities. (c) Mineral construction and demolition wastes will be separated from general refuse, organic, liquid and chemical wastes by on-site sorting and stored in appropriate containers. (d) Construction waste will be collected and disposed properly by licensed collectors (e) No open burning of wastes on or off site (f) The disposal site and approach to handling solid wastes from building sites must be approved by the local authorities	(a) Visual inspection of separate waste management piles (b) Written receipts of all separate waste streams handled by the designated authorities (c) Visual inspection of burn marks on site (d) Construction diary (e) Appropriate approvals by the local authorities	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU
19.	Will the project involve use of substances or materials which could be harmful to human health or the environment or raise concern about actual or perceived risks to human health?	[ ] Yes [ ] No	(a) Use renewable construction materials (e.g. use of ECO cement, wood fiber insulation boards, wooden floors and windows, etc.) if economically feasible. (b) Use low VOC paints and varnishes. (c) Do not use asbestos containing materials in construction.	(a) Construction diary (b) Visual inspection on site	(a) Contractor for execution of civil works (b) Supervising engineer on behalf of PIU
20.	Will there be any risk of accidents during construction which could affect human health?	[ ] Yes [ ] No	(a) Notify the local construction and environment inspectorates of upcoming activities. (b) Notify the public of the works through appropriate notification in the media and/or at publicly	(a) Keep written proof of notifications, local permits, and/or media announceme	(a) Site supervisor (b) PIU (c) Contractor for execution of civil works

Section 3. Environmental screening					
	Possible environmental impacts	Yes/No?	Mitigation measures (circle those implemented upon completion of monitoring)	Monitoring parameters	Responsible Body
			accessible sites (including the site of the works). (c) Formally agree with the Contractor that all work will be carried out in a safe and disciplined manner designed to minimize impacts on neighboring residents and environment. (d) Formally agree with the Contractor that workers health and safety requirements will comply with international good practice (always hardhats, as needed masks and safety glasses, harnesses and safety boots). (e) Appropriate signposting of the sites will inform workers of key rules and regulations to follow and emergency contact numbers. (f) Provide on-site medical services and supplies for any emergency, through institutional and administrative arrangements with the local health unit. (g) Provide portable water & sanitary facilities for construction workers.	nt clippings (b) Supervisor to ensure use of PPE (c) Supervisor to visually inspect adequate signage	
21.	Are there any (transport) routes on or around the location which are used by public which could be negatively affected by the project?	[ ] Yes [ ] No	(a) Schedule vehicle movement during lean daytime traffic hours or at night. (b) Provide traffic aides/flagmen, traffic signs to help ensure the free and safe flow of traffic. (c) Maintain & Repair temporary alternative route of vehicles & pedestrians.	(a) Presence of traffic signs (b) Public complaints received (c) Occurrence of traffic jams	(a) Contractor for execution of civil works
22.	Are there any facilities on or around the location which are used by public which could be negatively affected by the project (e.g. difficult public access)?	[ ] Yes [ ] No	(a) Designate an alternate route for pedestrian and/or vehicles in coordination with the Municipal Authorities or provide safe passageway through the construction site.	(a) Public complaints received	(a) Contractor for execution of civil works
23.	Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facility,	[ ] Yes [ ] No	(a) Address the issue of expropriation/ economic loss using appropriate resettlement instruments in accordance with the O.P. 4.12 Involuntarily Resettlement and national legislation.	(a) Public complaints received	(a) PIU

Section 3. Environmental screening					
	Possible environmental impacts	Yes/No?	Mitigation measures (circle those implemented upon completion of monitoring)	Monitoring parameters	Responsible Body
	agriculture, forestry, tourism, mining or quarrying which could be negatively affected by the project?				

Section 4. Summary of project features indicating the reasons for specific decision

Section 5. Decision:
The following subprojects is: [ ] Not approved. [ ] Approved with requirement to produce specific EMP for this subproject. [ ] Approved with requirement to implement mitigation measures from this Screening Checklist.

Name of the evaluator:

Date:

Place:

Signature:

ATTACHMENT A

Subproject activities not eligible for financing according to the WB criteria

SUBPROJECT ACTIVITIES NOT ELIGIBLE FOR FINANCING
General characteristics
Corresponds to World Bank Category A project. Has a significant and irreversible environmental impact and requires a mandatory environmental license based on a full EIA report as per the entity bylaws on *"plants and processes that require an environmental permit*" (under the Laws on Environmental Protection in RS and FBIH)
Involves significant conversion or degradation of critical natural habitats. These may include, but not be limited to any protected areas, protected landscapes or nature parks including the Bardača special reserve area. No works, other than removal of debris and repair of pre-existing infrastructure is allowed.
Will involve works and potential damages on any of the listed or potential cultural heritage sites and buildings that are proclaimed as such by the State Level Commission for the Preservation of Monuments and the responsible Entity Institutes for Monument Protection.
Require pesticides that fall in WHO classes IA, IB or II
Require displacement/resettlement of affected population.
Repair of privately owned production facilities/ houses.
Supports commercial logging or plantations in forested areas. Any "salvage logging" operations (which might be undertaken as a result of damage to forests)
Drinking Water Supply: New or expansion of piped water scheme to serve 500 or more households.
Sanitation: New or significant expansion of sewerage or wastewater treatment plant. Rehabilitation of existing wastewater treatment plant.
Solid Waste: New or significant expansion of sanitary and engineered disposal sites. No expansion of open municipal dump-sites.
Roads and Infrastructure: New roads. Widening of primary roads Construction of new temporary or permanent infrastructure to bypass devastated areas which have a segment length greater than 500 m and cumulative length of 2,000 m within a corridor of 10 km or less
Agriculture/Irrigation: Procurement of seeds or planting material for crops meant for consumption, without prior soil sampling to ensure no contamination and/or heavy metal presence in soil Procurement of seeds and seedlings allowed only with guidance of the relevant agriculture/plant institutes in country New irrigation scheme or expansion of a scheme requiring increased water intake. New tube-well for irrigation.
River Basin Management: Repair of dykes or dams that are higher than 5 m or store water volumes larger than 1,000,000 m^3 construction of new, or substantial expansion of existing flood protection works, including the conversion of floodplains or riverine forests.
Power: New power generating capacity of more than 5 MW Rehabilitation of hydro-electric power station with dam, or entailing alteration of the water flow regime.
Oil and Gas: New distribution
Income Generating Activities: Activities involving use of unsustainably harvested timber or fuel-wood. Activities involving the use of hazardous substances such as pesticides/herbicides, explosives, products deemed illegal by national laws, PCBs, radioactive materials unbound asbestos fibers.

ATTACHMENT B

Subprojects requiring environmental assessment according to the national legislation

Project Description	FB&H EIA Required	FB&H Assessment of EIA need or envtl permit	Sarajevo Canton Envtl permit	Ze -Do Canton Envtl permit	Tuzla Canton Envtl permit	Posavina Canton Envtl permit
Construction of transmission lines	• 110 kV if part or the transmission system • > 220 kV	No	No	No	No	No
Abstraction of ground water (to be considered in relation to possible use for water supply)	>3 million m^3/y	1 - 3 million m^3/y	0.2 - 3 million m^3/y	0.2 - 1 million m^3/y	No	No
Widening of existing regional and local road (or street in settlements and cities in Canton Sarajevo) with two or less lines to four or more lines, where the new road or widened part of the road would be	>10 km of continuous by length	No	< 10 km of continuous by length	< 10 km continuous by length	< 10 km continuous by length	< 10 km continuous by length
Construction of channels and flood defense structures on internal water courses	No	No	No	No	No	Yes
Projects that might have impact on nature protected areas	Yes	No	No	No	No	No
Existing EIA facilities that are subject to increase of capacity for more than 25% related to use of space or resources	Yes	No	No	No	No	No

8 ENVIRONMENTAL MANAGEMENT PLAN

The sample Environmental Management Plan (EMP) has been prepared based on previous identification of possible negative environmental impacts for typical reconstruction works that are to be implemented within the FERP including (i) reconstruction of local road (including bridges, culverts etc.); (ii) reconstruction of local water supply network; (iii) reconstruction of regional public infrastructure (roads, dykes etc.).

Considering the similar nature of works to be carried out, the impacts are identified to be common to all three types of project. Thus, one sample EMP for infrastructure reconstruction is prepared addressing pre reconstruction, reconstruction and operation phase. The sample EMP includes mitigation measures for reduction of possible adverse impacts in all three phases, including the estimation of costs and the responsibility for implementation. The EMP can also serve as guidelines for environmentally sound construction practices.

Mitigation measures are classified as:

- **Mitigation measures prior to the construction works** include provision of other relevant permits and agreements in relation to the contracting of works as well as environmentally sound contracting of works and organization of reconstruction site to minimize environmental impacts.
- **Mitigation measures during the construction phase** mostly refer to the implementation of good construction practices to avoid adverse impacts on the soil stability, water and land quality, level of noise and flora and fauna as well as disturbance to local communities. Their implementation is under the responsibility of the Contractor for execution of works and shall be included in the works contract together with the Environmental Monitoring Plan. The costs of these measures shall be included in the construction costs, although they mostly include good management measures and usually require no substantial funds. The Client and the appointed Site Supervisor will supervise the implementation of mitigation measures and the Monitoring Plan.
- **Mitigation measures during the operation phase** refer to avoidance of adverse impacts on environment through timely and appropriate maintenance of reconstructed infrastructure.

The EMP includes environmental monitoring plan that included measures for monitoring of emissions from the site during construction, monitoring of implementation of mitigation measures, and monitoring of conditions after the project is put in use. Monitoring requirements can be grouped in three categories:

- **Monitoring of state of environment in the construction zone and emissions from the construction site** is related to baseline monitoring of state of location where project will be executed and monitoring of noise, dust emissions, and water pollution at construction sites located nearby watercourse. This monitoring will be subcontracted to laboratories that are authorized for monitoring and supervised by Supervising Engineer appointed by the Contractor.
- **Monitoring of implementation of mitigation measures** includes supervision of implementation of good working practices. In order to ensure that the whole life cycle of the project satisfies environmental, health and safety criteria, the Contractor shall ensure appropriate licenses and agreements as well as during the procedure for selection of suppliers, request from all potential candidates valid environmental and operation permits. The contractor shall also organize the reconstruction site to minimize environmental impacts. The Supervising Engineer will be responsible for monitoring of implementation of mitigation measures.
- **Monitoring of environmental condition after the project is put in use** includes mainly inspection of regular infrastructure maintenance. This monitoring will be the responsibility of the Municipality through the municipal inspection.

Table 19 Environmental Mitigation Plan

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
Pre-(re)construction	Permits and agreements	• Obtain all legally required agreements for construction in the vicinity of ground installations. • Obtain all legally required permits (reconstruction and use permits) from local authorities. • Obtain water acts from responsible authorities.	1000	-	PIU	PIU	Agreements for construction are to be obtained by relevant governmental authorities and companies (water and sewerage utility companies, BH Telecom, cable TV companies and road directorates). Water permit is to be obtained by the Cantonal Ministry responsible for water management. Reconstruction permits are to be obtained from local authorities.
Pre-(re)construction	Contracting of works	Ensure that the contract contains environmental requirements as follows: • Contractors shall be obliged to follow good construction practices during all activities, and to reduce to the minimum the damage caused to environment, as well as disturbance of settlements and local communications. • Implementation of environmental protection and mitigation measures as well as monitoring will be implemented in parallel with construction activities. They will start at the time when workers, equipment and/or material are moved to the construction site, and they will end with the termination of construction works, when all workers, equipment and/or material leave the construction site, and when environment in restored to previous condition.	-	-	PIU	PIU	To be specified in bid documents and the Contract.

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
		• The contractor shall appoint Environment, Health and Safety Coordinator who will be responsible to ensure compliance with the laws and objectives of the environmental protection, occupational safety and fire protection. The EHS Coordinator shall ensure regular contact with the representatives of local inhabitants (local community council) with purpose of information exchange or in order to find solutions to possible disputes (originating from violation of ownership rights, damage caused during construction works, etc.). • Contractor shall ensure order, discipline and professional responsibility of all employees on the construction sites. • Work and residence must be restricted exclusively to the zone of construction works and damage to private property, land and crops must be avoided.					
Pre-(re)construction	Organization of reconstruction site to minimize environmental impacts	• Develop a project of construction site organization with the appropriate solutions of drainage and treatment of sanitary wastewater as well as storm water from the construction site zone. • Receive used water from the construction site by appropriate systems sewage, collect in waterproof tanks and threat in the prescribed manner (whether on-site, or at the remote location), and prior to discharge into the recipient or the city sewage system. • Establish temporary disposal sites for construction materials, area for rinsing of concrete pumps and mixers, and area for washing of vehicle tires with adequate cleaning agent. • Establish temporary disposal sites for	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in bid documents and the Contract. Construction Waste Management Plan is to be prepared in line with the Article 7 of Decision on construction site organization, obligatory documentation on the construction site and participants in construction ("Official Gazette of FB&H" 48/09, 75/09, 93/12).

Phase	Issue	ENVIRONMENTAL MITIGATION PLAN Mitigating measure	Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
		excavation material (topsoil). • Establish temporary disposal sites for demolition and construction waste, if not immediately removed by third parties. • Prepare Construction Waste Management Plan manage all wastes accordingly. • The approach to handling solid wastes from building sites must be approved by the local authorities.					
(Re)construction	Material supply	• Ensure that reconstruction materials are purchased from licensed sources/companies only	Included in the reconstruction cost	Included in the reconstruction cost	PIU	Contractor	To be specified in the Contract. If possible, use local materials. If feasible, use renewable materials in construction.
(Re)construction	Material transport	• Aiming at prevention of dust emissions, the contractor shall transport asphalt, gravel, stone, earth and other material in trucks covered with tarpaulin. • Transport of stone and gravel shall be carried out in moist condition. • The speed of transport vehicles shall not exceed 30 km/h. • The contractor shall avoid unnecessary driving of vehicles. If possible use of alternative routes to minimize transport through urban zones. • The contractor shall submit the plan in which the paths for transport of material have been listed, and he also needs to give statements about proposed method of dust control in places where transport through settlements may not be avoided.	Included in the reconstruction cost	Included in the reconstruction cost	PIU	Contractor	To be specified in the Contract.
(Re)construction	Traffic safety management	• Contractor shall implement adequate traffic control measures, in accordance with the law, during contract period, and such measures must first be approved by the Supervision Engineer.	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract. For regional road reconstruction projects the contractor needs to appoint permanent staff

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
		• Traffic safety management measures shall include temporary illumination and adequate signalization during trenching and rehabilitation works. • The contractor shall not leave trenches unattended and shall fence and signalize all open trenches to prevent accidents. • Designate an alternate route for pedestrian and/or vehicles in coordination with the Municipal Authorities or provide safe passageway through the construction site.					that would be engaged on traffic safety issues, and would be responsible for implementation of traffic safety measures and implementation of traffic measures as prescribed by the national laws, which would include: (i) inspection of the condition and position of the equipment for traffic control in use; (ii) design review – part related to traffic control equipment necessary to provide safe and efficient traffic flow; (iii) correction of all traffic deficiencies where that is applicable; (iv) inspection of work areas, handling of equipment and storage, handling of material and storage related to traffic safety.
(Re)construction	Soil damage	• Reconstruction should start (if possible) at the time of the year when the advantages of dry soil conditions can be utilized. • Adequate machines shall be used and/or protection plates that would prevent compaction during soil removal (if any). Adequate procedures for separate removal, handling, storage and replacement of humus and subsoil shall be used. • Designate a Spoils Storage Area, with topsoil set aside for later use and allow maximum re-use of spoils. They shall be reduced to maximum 2 m of height, in	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract.

Phase	Issue	ENVIRONMENTAL MITIGATION PLAN Mitigating measure	Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
		order to prevent compaction caused by weight of the soil, and storage time is to be reduced to minimum. • Use topsoil material for restoration of degraded areas. • Ensure protection of areas sensitive to erosion with stabilization agents (temporary banks, fences, ditches) and replanting after termination of construction works.					
(Re)construction	Emissions to air	• The Contractor shall specify and follow the control measures for dust generated through handling of equipment and/or during rehabilitation works • Contractor shall ensure that all construction equipment has been licensed and approved in accordance with local regulations, and if possible, certified in compliance with the EU standards. • The contractor shall use modern machines and vehicles that fulfill environmental standards in terms of exhaust emission (complete combustion). He also shall use filters for reduction of emissions of soot particles, and fuel with favorable chemical structure (low sulphur content) and efficient/safe decantation. • The contractor shall present proof of compliance with emission standards as part of the annual vehicle registration process • Regular equipment maintenance • Compact spoils storage piles • Wet areas of dust sources to minimize discomfort to nearby residents • Control of vehicle speed to lessen suspension of road dust • Keep the surrounding environment	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract.

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
		(sidewalks, roads) free of debris to minimize dust • No open fire at the site					
(Re)construction	Noise generation	• The contractor shall use modern machines and vehicles that have enclosed sources of noise (engines, exhaust system). This mainly implies supply of new machines or measures for installation of additional sound insulation (housing for gensets) if near residences, as well as its constant maintenance. • Provide silencers/mufflers for heavy equipment • Schedule equipment movement during non-peak hours of daytime vehicular traffic. • Avoid night-time construction activities and abide by local laws on construction hours	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract. It is recommended that machines should only operate in the period from 07-20 h in all sections of the route whose distance from nearest residential houses is less than 60 m.
(Re)construction	Water (and soil) pollution	• The contractor shall use biodegradable lubricants and gear oils. • Set up sediment traps along rivers and/or gabions along banks to filter out eroded sediments • Provide slope protection through bank compaction, rip-rapping on critical sections, or vegetative stabilization • Provide oil & grease traps in stilling ponds • Provide ring canals around fuelling tanks/motor pool/ maintenance areas • Collect used oils in containers and hand over to authorized agency for handling • Construction vehicles and machinery will be washed only in designated areas where runoff will not pollute natural surface water bodies. • The approach to handling sanitary wastes and wastewater from building sites	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract.

Phase	Issue	ENVIRONMENTAL MITIGATION PLAN Mitigating measure	Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
		(installation or reconstruction) must be approved by the local authorities • Before being discharged into receiving waters, effluents from individual wastewater systems must be treated in order to meet the minimal quality criteria set out by national guidelines on effluent quality and wastewater treatment • In case of water supply system reconstruction, chlorine solution for disinfection of pipeline system shall not be discharged to surface waters without prior storage to chlorine tank and dissolution to maximum of 0.5 mg/l of residual chlorine.					
(Re)construction	Waste management	• Whenever feasible the contractor will reuse and recycle appropriate and viable materials (except asbestos) • Waste collection and disposal pathways and sites will be identified for all major waste types expected from demolition and construction activities. • Mineral construction and demolition wastes will be separated from general refuse, organic, liquid and chemical wastes by on-site sorting and stored in appropriate containers. • Asbestos containing waste shall be stored and transported in such a way to prevent emission of asbestos fibers/dust. The waste shall be wrapped in polyethylene folio of 0,.4 mm minimum thickens. Workers handling asbestos waste shall wear protective equipment. • Construction waste will be collected and disposed properly by licensed collectors.					Include these measures in the Construction Waste Management Plan. To be specified in the Contract.
(Re)construction	Impact on flora and fauna (areas important or	• All recognized areas in the immediate vicinity of the activity will not be damaged or exploited, while areas used by protected important or sensitive species of	Included in the reconstruction cost	Included in the reconstruction cost	Contractor	Contractor	To be specified in the Contract.

Phase	Issue	Mitigating measure	ENVIRONMENTAL MITIGATION PLAN Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
	sensitive for reasons of their ecology)	fauna or flora will be completely avoided • Staff will be strictly prohibited from foraging, logging or other damaging activities. • A survey and an inventory shall be made of large trees in the vicinity of the construction activity, large trees shall be marked and cordoned off with fencing, their root system protected, and any damage to the trees avoided • Contractor shall ensure that machines and vehicles parking places and worker's residence containers are not located inside the forest areas, that they do not impact watercourses and do not affect endangered flora and fauna. • Adjacent wetlands and streams shall be protected from construction site run-off with appropriate erosion and sediment control feature to include by not limited to hay bales and silt fences • There will be no unlicensed borrow pits, quarries or waste dumps in adjacent areas. • Maintenance, filling and cleaning of machines shall be carried out off the site and outside of the area with surface water. • In case of works on river banks or in river bed, avoid works in the spawning season and when the minimum flows. Preferably carry out construction works in the period September-February. • In case of flood defense facilities reconstruction, save the riparian vegetation (rhizomes, root stock, whole grove), properly store and integrate in new embankment structures. • In case of river training, redesign channel lining to use constructive typologies which make use of natural materials (wood,					

Phase	Issue	ENVIRONMENTAL MITIGATION PLAN Mitigating measure	Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
		stones or gabions) and reduces the environmental impact, ensuring both a partial revegetation and the continuity of interactions between the fluvial habitat and those surrounding it. • Reinstate land and surrounding areas after completion of works.					
(Re)construction	Chance finds of objects of cultural historical heritage, graves or UXO	• Artifacts or other possible "chance finds" encountered in excavation or construction shall be noted and registered, responsible officials contacted, and works activities delayed or modified to account for such finds.	-	-	Contractor	Contractor	To be specified in the Contract.
Operation	Maintenance of local and regional roads subject to reconstruction (protection of soil and water) *Note: also applicable to regional railway reconstruction*	• Protection of areas sensitive to erosion with stabilization agents and plants that prevent erosion. • Development of a Plan of Activities for regular and extraordinary maintenance of the drainage system including measures such as: a) leaning, and, as necessary, deepening of road and drainage ditches to the prescribed profile and longitudinal gradient should be carried out in such a way to enable unobstructed drainage from the area of road land. Cleaning of channels, catchdrains etc. is carried out continuously, in order to ensure unobstructed drainage. b) revention of inflow of water to the carriageway from the side of the road (from access roads, front yards etc.), and prevention of creation of rills on the carriageways and shoulders should be carried out immediately, and 30 days upon finding about them at the latest.	-	35.000/year	Municipality	Road Management Service	To be specified in the Contract.

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
		c) aintenance of free profile of the culvert should be carried out continuously, by removal of sediment, vegetation, branches and the like. d) epair of undermined foundations or the bed of the culvert should be carried out immediately. e) epair and rehabilitation of the lining of ditch bottom and area in front of the culvert inlet and outlet, is carried out during regular maintenance. f) iltration and drainage pipes need to be controlled at least twice a year (in spring and autumn), during melting of snow and immediately after heavy rains. g) ld filtration and drainage pipes need to be replaced during regular maintenance. h) estroyed or missing covers of manholes or catch drain gratings on the road need to be replaced immediately or the opening should be secured in some other way. • Prepare Operative Winter Maintenance Plan (use of salt and other defrosting agent) including: a) efining of adequate locations and manner of storage of chemicals used during maintenance of the road and surrounding environment (salt, fertilizers, pesticides, etc.), which need					

Phase	Issue	Mitigating measure	ENVIRONMENTAL MITIGATION PLAN Cost (USD) Install	Operate	Institutional responsibility Install	Operate	Comments
		to be placed outside of sensitive zones. b) se of agents needs to be reduced to the minimum, by adequate prediction of carriageway condition. • Prepare Accidents Emergency Plan which will contain at least the following: a) f a vehicle carrying dangerous freight in a dust-like or grain-like state has been damaged, stop the traffic and a request from a specialized service to remove the freight and repair the carriageway. The dispersed, dust-like or grain-like material must be removed from the carriageway exclusively in a mechanical manner (by returning into a new adequate packaging, cleaning, vacuum cleaning etc.), without rinsing with water. b) f a vehicle carrying liquid dangerous substances has been damaged, immediately stop the traffic and inform competent service and engage specialized emergency response teams. The spilled substance is removed from the carriageway with special sorbents. If the liquid gets outside of the profile and pollutes the soil, the rehabilitation is performed by its removal. All substances collected in this manner are treated in accordance with special regeneration procedures or disposed of at sites intended for disposal of such substances.					
Operation	Maintenance of local water supply	• Reduction of losses in water supply network in all concerned municipalities through regular leak detection and	Depending on availability of leak detection	25.000/year	Municipality	Water Utility	

ENVIRONMENTAL MITIGATION PLAN							
Phase	Issue	Mitigating measure	Cost (USD)		Institutional responsibility		Comments
			Install	Operate	Install	Operate	
	network subject to reconstruction (protection of water resources and human health)	maintenance activities to prevent excess use of natural resources • Regularly check quality of water at source and in the system in accordance with national regulations including regular control of residual chlorine content in drinking water. • Ensure health and safety protection measures at work for workers handling chlorine used for water disinfection.	equipment and water quality testing equipment the price can go up to 70,000 USD				

Table 20 Environmental Monitoring Plan

Phase	Issue	What parameters is to be monitored?	Where is the parameter to be monitored?	How is the parameter monitored/type of monitoring equipment?	When is the parameter to be monitored – frequency of measurement or continuous?	Cost		Responsibility	
						Install	Operate	Install	Operate
Baseline	Closure of lifecycle	Record of reconstruction related permits and approvals including water acts	At the premises of project owner	Inspection of documentation	Prior to contracting of works	-	-	PIU	PIU
Baseline	State of location where project will be executed	Current state of location from the aspect of physical appearance (presence of erosion, wild dumps, state of vegetation, quality of water courses based on available data)	At the project location	Visual inspection	Prior to organization of construction site	-	-	Contractor	Contractor
Baseline	Organization of reconstruction site to minimize environmental impacts	Availability of construction site obligatory documents including Construction Waste Management Plan and implementation of adequate organization measures as specified in the EMP	At the construction site	Visual inspection	During organization of construction site	Included in construction costs	-	Contractor	Contractor
(Re)construction	Supply of material	Possession of valid approvals and permits for operation	For all suppliers of materials used during construction	Inspection of documentation provided by supplier in the selection procedure	During supplier selection procedure	-	Included in construction costs	PIU	Contractor

Phase	Issue	What parameters is to be monitored?	Where is the parameter to be monitored?	How is the parameter monitored/type of monitoring equipment?	When is the parameter to be monitored – frequency of measurement or continuous?	Cost		Responsibility	
						Install	Operate	Install	Operate
(Re)construction	Elevated levels of noise that cause disturbance for nearby residents	Noise level	Near the nearby house in affected settlements.	In line with the requirement of Law on Protection from Noise ("Official Gazette of FBiH", 110/12)	Monitoring is to be performed if complains received by the local residents. Dynamic of monitoring is to be adjusted to the dynamics of construction - conduct monitoring at the time when the work is performed in specific section.	-	100€/ sample	Contractor	Authorized laboratory/ company
(Re)construction	Pollution from transport and earthworks dust	Control of vehicle coverage during the transport, control of the application of prevention measures to reduce dust-splash	Along the construction zone, especially in residential areas and near agricultural land	Visual monitoring	Daily	-	Included in the reconstruction costs	PIU	Supervising Engineer

Phase	Issue	What parameters is to be monitored?	Where is the parameter to be monitored?	How is the parameter monitored/type of monitoring equipment?	When is the parameter to be monitored – frequency of measurement or continuous?	Cost		Responsibility	
						Install	Operate	Install	Operate
(Re)construction	Pollution of water and soil with oils and fats, increase of suspended solids in a watercourse, etc. due to inadequate storage of materials, disposal of waste, construction near or inside the river bed, and the like	Turbidity, total and volatile suspended solids, mineral oils	Upstream and downstream of sections where the works are performed at watercourses of interest as well as any other site.	Standard physical and chemical methods used by authorized laboratories	Monitoring is to be performed if complains received by the local residents or in case of accidental situations. Dynamic of monitoring is to be adjusted to the dynamics of construction - conduct monitoring at the time when the work is performed in specific section. Monitoring is to be performed soon after the beginning of construction in specific section and after a complaint has been submitted	-	250USD/ sample	Contractor	Authorized laboratory/ company
(Re)construction	Compliance with good working practices from the Contract including supervision of emissions monitoring	Compliance with the planned scope of tested parameters, sampling sites, sampling methods and frequency.	At the construction site	Visual inspection	Daily or unannounced inspection during construction works	-	Included in the reconstruction costs	PIU	Supervising Engineer

Phase	Issue	What parameters is to be monitored?	Where is the parameter to be monitored?	How is the parameter monitored/type of monitoring equipment?	When is the parameter to be monitored – frequency of measurement or continuous?	Cost		Responsibility	
						Install	Operate	Install	Operate
(Re)construction	Waste management	Waste type and quantity and waste management methods (separate collection, transport, temporary storage and disposal of waste and other aspects defined by the Waste Management Plan)	Inside and around construction site, especially in residential zones, water courses, on agricultural land and in forest areas	Visual and by quantity measurement	Daily	-	Included in the reconstruction costs	PIU	Supervising Engineer
(Re)construction	Traffic safety and management	Availability of signpost and signalization	At the construction site	Visual inspection	Daily	Included in construction costs	Included in construction costs	Contractor	Supervising Engineer
(Re)construction	Impact on underground infrastructure	Execution of works in accordance with the Agreement obtained from responsible utilities/companies	At the section crossing underground installations	Visual inspection and comparison with the Agreement	Daily monitoring at the time when the work is performed at specific crossing. Monitoring is to start soon after the beginning of construction in specific section and finish when the section is completed.	Included in construction costs	Included in construction costs	Contractor	Supervising Engineer
(Re)construction	Staff safety during construction	Use of protection equipment, on-site work organization in accordance with regulations on safety at work	At all sections where works are performed	Visual inspection	Unannounced inspections during construction works	Included in construction costs	Included in construction costs	Contractor	Supervising Engineer

Phase	Issue	What parameters is to be monitored?	Where is the parameter to be monitored?	How is the parameter monitored/type of monitoring equipment?	When is the parameter to be monitored – frequency of measurement or continuous?	Cost		Responsibility	
						Install	Operate	Install	Operate
(Re)construction	Public safety	Signalization, fencing of trenches and construction areas	At all sections where works are performed	Visual inspection	Unannounced inspections during construction works	Included in construction costs	Included in construction costs	Contractor	Supervising Engineer
(Re)construction	ROW reinstatement	Reinstatement of land and surrounding areas after completion of works	At all sections where works are performed	Visual inspection	Unannounced inspections during reinstatement works	Included in construction costs	Included in construction costs	Contractor	Supervising Engineer
Operation	Regular maintenance of the facilities	Availability of maintenance documents and record of performed maintenance activities	In the premises of service provider	Visual inspection	Unannounced inspections	-	-	Municipality	Inspection

ANNEX 1 HYDROLOGICAL CHARACTERISTICS OF WATER COURSES IN THE BOSNA RIVER BASIN

Table 21 Typical flow values at hydrologic stations in the Bosna River Basin

Hydrological station	Water course	$Q_{avg.yr.}$ (m^3/s)	$A_{vg}Q_{min}$ (m^3/s)	maxQ l/T (m^3/s)		
				1/20	1/50	1/100
Plandište	Bosna	6.28	2.40	26.3	30.8	34.7
Podteljig	Crna Rijeka	2.15	0.361	44.3	53	60.3
Bogatići	Bijela	2.56	0.618	62.8	76	86.9
Krupačke Stijene	Željeznica	8.93	1.52	151	183	206
Hadžići	Zujevina	1.43	-	56	74	96
Blažuj	Zujevina	2.80	-	102	133	168
Sarajevo	Miljacka	5.71	1.00	152	189	227
Reljevo	Bosna	29.7	7.39	421	495	547
Fojnica 2	Fojnička r.	3.18	0.647	-	-	-
Homoljska Ćuprija	Lepenica	5.40	0.840	-	-	-
Podstijenje	Fojnička r.	16.1	3.95	-	-	-
Visoko	Fojnička r.	17.2	4.62	255	310	361
Dobrinje	Bosna	57.5	14.6	-	-	-
Travnik	Lašva	2.80	0.591	-	-	-
Mošćani	Bila	2.00	0.411	-	-	-
Merdani	Lašva	17.2	4.94	336	390	466
Zenica	Bosna	79.8	20.6	1,078	1,277	1,427
Stipovići	Gostović	6.54	0.590	153	175	192
Zavidovići	Bosna	97.4	22.7	1,370	1,545	1,723
Bioštica	Bioštica	7.30	1.89	-	-	-
Olovske Luke	Stupčanica	5.50	0.490	-	-	-
Olovo	Krivaja	12.0	2.38	482	665	824
Zavidovići	Krivaja	24.6	3.85	835	1.010	1.176
Maglaj	Bosna	125	26.9	1,870	2,190	2,442
Kaloševići	Usora	14.6	2.25	461	553	620
Osmaci	Spreča	1.19	0.040	-	-	-
Krivača	Spreča	4.29	0.224	-	-	-
Strašanj	Spreča	4.50	0.305	-	-	-
Donja Višća	Oskova	2.92	0.204	91.9	112	129
Živinice	Gostelja	3.74	0.264	136	160	182
Turija	Turija	2.89	0.499	122	140	152
Modrac	Spreča	16.3	2.50	360	455	534
Dobošnica	Spreča	19.6	-	-	-	-
Miričina	Spreča	21.6	-	-	-	-
Kakmuž	Spreča	22.7	-	-	-	-
Karanovac	Spreča	24.1	-	-	-	-

Table 22 Characteristic average flows for watercourses in the Bosna River Basin

Watercourse	Station ID	Area of river basin (km²)	Upstream/ Downstream	Hydrological station (HS)	Q_{avg}
Bosna	104014	321.62	upstream	HS Maglaj	124.75
	104015	366.44	upstream	HS Raspotočje	97.32
	104016	326.53	upstream	HS Raspotočje	85.69
	104017	501.13	downstream	HS Raspotočje	61.55
	104018	155.24	upstream	HS Reljevo	44.29
	104019	95.67	downstream	HS Reljevo	22.64
Miljacka	401001	63.11	upstream	HS Ćumurija	6.79
	401002	46.86	downstream	HS Ćumurija	5.7
	401003	302.00	downstream	HS Ćumurija	4.93
Spreča	403009	521.39	upstream	HS Karanovac	26.0
Spreča through Modrac lake	403010	44.32	downstream	HS Modrac	16.0
Spreča	403011	422.52	upstream	HS Strašanj	8.85
Turija	403167	41.09	upstream	HS Turija	5.53
	403168	169.81	downstream	HS Turija	3.0
	403169	13.33	downstream	HS Turija	0.89
	403170	27.12	downstream	HS Turija	0.59
Oskova	403177	8.18	upstream	HS Donja Višća	7.25
	403178	31.39	upstream	HS Donja Višća	3.03
	403179	125.25	downstream	HS Donja Višća	2.42
Gostelja	403180	190.61	downstream	HS Živinice	3.74
Jala	403247	46.72	downstream	Confluence of Jala and Spreča	1.51
	403248	54.82	downstream	Confluence of Jala and Spreča	1.12
	403249	130.37	downstream	Confluence of Jala and Spreča	0.79
Turija_kroz jezero Modrac	403265	27.88	upstream	HS Turija	6.14
Lukavica	404014	93.78	downstream	Confluence of Lukavica and Bosna	1.41
Usora	405015	226.46	downstream	HS Karuše	16.0
Željeznica	406019	146.27	upstream	HS Krupačke stijene	10.5
	406021	24.60	downstream	HS Krupačke stijene	5.16
	406022	165.63	downstream	HS Krupačke stijene	3.05
Bijela	406233	71.30	downstream	HS Bogatići	2.62
	406234	44.20	downstream	HS Bogatići	1.05
Bioštica	407004	212.63	upstream	HS Bioštica	7.3
Stupčanica	407006	126.33	upstream	HS Olovske luke	4.55
	407007	53.47	downstream	HS Olovske luke	2.26
Krivaja	407023	5.95	downstream	HS Zavidovići	24.64
	407024	503.42	upstream	HS Olovo	22.0
	407025	86.05	upstream	HS Olovo	14.56
	407026	87.03	upstream	HS Olovo	13.28
Lašva	408027	43.50	upstream	HS Merdani	17.37
	408028	141.96	downstream	HS Merdani	13.62
	408029	46.84	downstream	HS Merdani	6.97
	408030	174.80	downstream	HS Merdani	3.25

Watercourse	Station ID	Area of river basin (km^2)	Upstream/ Downstream	Hydrological station (HS)	Q_{avg}
	408031	4.66	downstream	HS Merdani	0.08
Bila	408066	6.45	downstream	Confluence of Bila and Lašva	3.21
	408067	12.99	downstream	Confluence of Bila and Lašva	3.12
	408068	86.58	downstream	Confluence of Bila and Lašva	2.93
	408069	60.67	downstream	Confluence of Bila and Lašva	1.69
	408070	58.33	downstream	Confluence of Bila and Lašva	0.83
Kozica	408071	2.34	downstream	Confluence of Kozica and Lašva	2.32
	408072	117.89	downstream	Confluence of Kozica and Lašva	2.29
	408073	24.85	downstream	Confluence of Kozica and Lašva	0.6
	408074	17.67	downstream	Confluence of Kozica and Lašva	0.25
Grlovnica	408078	79.39	downstream	Confluence of Grlovnica and Lašva	2.26
	408079	72.45	downstream	Confluence of Grlovnica and Lašva	2.16
	408080	6.74	downstream	Confluence of Grlovnica and Lašva	0.1
Fojnička rijeka	409032	6.84	upstream	HS Visoko	18.2
	409033	67.74	downstream	HS Visoko	18
	409034	74.76	downstream	HS Visoko	8.65
	409035	16.57	downstream	HS Visoko	6.9
	409036	43.59	downstream	HS Visoko	6.5
Dragaca	409037	104.99	downstream	Confluence of Dragača and Fojnička rijeka	2.5
Željeznica	409038	98.01	downstream	Confluence of Željeznica and Fojnička rijeka	1.84
	409039	24.54	downstream	Confluence of Željeznica and Fojnička rijeka	0.37
Lepenica	409043	80.21	downstream	Confluence of Lepenica and Fojnička rijeka	5.5
	409044	25.68	downstream	Confluence of Lepenica and Fojnička rijeka	4.14
	409045	29.29	downstream	Confluence of Lepenica and Fojnička rijeka	3.7
	409202	189.35	downstream	Confluence of Lepenica and Fojnička rijeka	3.21
Misoča	410059	6.94	downstream	Confluence of Misoča and Bosna	1.62
	410060	50.85	downstream	Confluence of Misoča and Bosna	1.53
	410061	66.68	downstream	Confluence of Misoča and Bosna	0.87
Stavnja	411062	28.89	downstream	Confluence of Stavnja and Bosna	2.5
	411063	89.55	downstream	Confluence of Stavnja and Bosna	2.1
	411064	8.03	downstream	Confluence of Stavnja and Bosna	0.8
	411065	46.92	downstream	Confluence of Stavnja and Bosna	0.68
Trstionica	414092	94.82	downstream	Confluence of Trstionica and Bosna	2.3
	414093	7.93	downstream	Confluence of Trstionica and Bosna	0.95
	414094	44.41	downstream	Confluence of Trstionica and Bosna	0.83
	414095	13.99	downstream	Confluence of Trstionica and Bosna	0.2
Gostović	423120	5.85	upstream	HS Stipovići	6.68
	423121	84.94	downstream	HS Stipovići	6.53
	423122	167.80	downstream	HS Stipovići	4.34
Lješnica	425137	26.88	downstream	Confluence of Lješnica and Bosna	1.85
	425138	32.30	downstream	Confluence of Lješnica and Bosna	1.45
	425139	49.92	downstream	Confluence of Lješnica and Bosna	0.96
	425140	8.55	downstream	Confluence of Lješnica and Bosna	0.21

Watercourse	Station ID	Area of river basin (km^2)	Upstream/ Downstream	Hydrological station (HS)	Q_{avg}
	425141	5.35	downstream	Confluence of Lješnica and Bosna	0.08
Ljubina	429150	0.54	downstream	Confluence of Ljubina and Bosna	3.23
	429151	94.86	downstream	Confluence of Ljubina and Bosna	3.21
	429152	25.13	downstream	Confluence of Ljubina and Bosna	0.83
	429153	8.05	downstream	Confluence of Ljubina and Bosna	0.2
Zujevina	431223	48.13	upstream	HS Blažuj	3.2
	431224	12.59	downstream	HS Blažuj	3.11
	431225	37.60	downstream	HS Blažuj	2.85
	431226	27.61	downstream	HS Blažuj	2.1
	431227	72.56	downstream	HS Blažuj	1.5