



## Preparation of water management plan for Adriatic river basin district in Federation of B&H

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**Abstract:** According to Water Act in Federation of B&H, Water Management Strategy in Federation of B&H and EU Water Framework Directive (WFD), it is necessary to prepare and adopt Water Management Plan for Adriatic River Basin District in Federation of B&H (river basins of Neretva with Trebišnjica, Cetina and Krka in Federation of B&H). The aim is achieving of the required good ecological status and/or good ecological potential for all water bodies and prevention of further deterioration as well as protection and improvement of the status of aquatic ecosystems. Main activities during the preparation and adoption of SEA for this Plan are also presented.

**Key words:** EU WFD, Water Act in FB&H, Water management strategy in FB&H, water bodies, good status/potential of water bodies, SEA

## Izrada Plana upravljanja vodnim područjem Jadranskog mora u Federaciji BiH

**Sažetak:** Sukladno Zakonu o vodama u Federaciji BiH, Strategiji upravljanja vodama u Federaciji BiH i EU Okvirnoj direktivi o vodama (ODV) potrebno je izraditi i usvojiti Plan upravljanja vodnim područjima u FBiH. Plan upravljanja vodnim područjem Jadranskog mora u Federaciji BiH obuhvata područje riječnih bazena Neretve s Trebišnjicom, Cetine i Krke. Osnovni cilj izrade Plana upravljanja je postizanje dobrog stanja i/ili potencijala vodnih tijela odnosno sprečavanje pogoršanja stanja vodnih tijela površinskih i podzemnih voda. Također, prikazane su najvažnije aktivnosti na izradi Strateške procjene utjecaja Plana na okoliš (SEA).

**Ključne riječi:** ODV, Zakon o vodama FBiH, Strategija upravljanja vodama u FBiH, dobro stanje/potencijal voda, vodna tijela, SEA



## 1. INTRODUCTION

The Adriatic River Basin District (the area of Neretva with Trebišnjica, Cetina and Krka river basins) covers a part of the land territory of three countries: Croatia, Montenegro and Bosnia and Herzegovina. In the Federation of B&H, it covers a markedly karst area in which significant surface flows are formed, which belong to the river basins of Neretva with Trebišnjica, Krka and Cetina.

The river basin of Neretva with Trebišnjica: It takes up the largest part of the Adriatic river basin district with total length in B&H of 205 km, making the largest river of Bosnia-Herzegovina's karst. The catchment area in FB&H is 5,745 km<sup>2</sup>, while its total area is about 12,750 km<sup>2</sup>. The largest part of the Neretva River flows through the territory of Federation of B&H, in the length of 175 km.

By its input of fresh and high-quality inland water, it is one of the most significant rivers in the Mediterranean.

The river basins of Krka and Cetina: The sources of both rivers are situated in the territory of Croatia and their entire courses are situated within the territory of the Republic of Croatia, but a significant part of their catchment area is in the territory of Bosnia and Herzegovina, or in the Federation of B&H - an area of 2,740 km<sup>2</sup>, of which the catchment area of the Cetina River in FB&H is 2,655 km<sup>2</sup>, and of the Krka River in FB&H only 85 km<sup>2</sup>.

In the territory of Federation of B&H, water management is implemented on the basis of the Water Act in FB&H ("Official Gazette of FB&H", number 70/06), which sets a water management framework pursuant to legal requirements of the EU and the principles set out in the Water Framework Directive (WFD), but also other EU regulations. The Water Management Strategy in the Federation of B&H was adopted in late 2011. It is an important planning document defining the water management policy in FB&H and stressing the need to develop the River Basin Districts Management Plan by 2015. The following were used as basic documents for its preparation: Development of the Characterization Report for parts of the Cetina and Krka river basins in the territory of Federation of B&H and the Draft Neretva and Trebišnjica River Basin Management Plan within the interstate GEF/WB Neretva and Trebišnjica Management Project between the Republic of Croatia and Bosnia and Herzegovina.

## 2. THE MAIN OBJECTIVE

The objectives of water protection and management are defined by the FB&H Water Act and the FB&H Water Management Strategy (adopted by the House of Representatives and House of Peoples of the Parliament of FB&H in 2010 and 2011, respectively, with a plan of validity until 2022). The general water management objectives are: (i) achieving a good condition or good environmental potential of surface waters and groundwaters, or water and water-related ecosystems; (ii) reducing the damage caused by various harmful effects of water, i.e. protection against harmful effects of water; (iii) providing the necessary quantities of water, of appropriate quality, for various purposes, including sustainable water use, taking into account the long-term protection of available sources and their quality.

## 3. CONTENTS OF THE WATER MANAGEMENT PLAN

The River Basin District Management Plan is the basic document for management of the river basin district whose general content is defined by Appendix VII of the EU WFD and Article 25 of the FB&H Water Act.



In accordance with the mandatory content, the Management Plan contains:

1. General description of characteristics of the river basin district, specifically:
  - a) For surface waters:  
Maps of positions and boundaries of water bodies; Maps of ecoregions and types of surface waters in the river basin district; and Mark of reference conditions for surface water types
  - b) For groundwaters:  
Maps of positions and boundaries of groundwater bodies; Summary of all significant pressures and anthropogenic impacts on the condition of surface waters and groundwaters, including: assessment of pollution from point sources; assessment of pollution from diffuse sources, including overview of land uses, assessment of pressures on the quantitative state of waters, including water abstraction, and analysis of other anthropogenic impacts on water status
2. Identification and maps of protected areas
3. Monitoring network map and presentation of results of the monitoring program that monitors the condition of:  
surface waters (ecological and chemical); groundwaters (chemical and quantitative) and protected areas
4. Water management objectives, in particular:  
for achievement of good status and ecological potential of water bodies, with regard to water regulation and protection from harmful effects of waters and for sustainable use of waters and deadlines for achieving these goals
5. Overview of economic analyses of water use
6. Description of a program of measures including methods to reach these goals, specifically:  
summary of water protection measures; report on practical steps and measures taken in order to apply the principle of cost recovery for water use; overview of measures taken in order to establish monitoring of all sources that are used or planned to be used for public water supply with capacity of more than 100 m<sup>3</sup>/day; summary of water capture and storage control, including an overview of registers and reference to cases in which exemptions were made; summary of inspections conducted for point sources affecting the state of waters; specifying the cases in which direct discharge into groundwater was allowed; overview of measures taken to prevent water pollution related to priority substances; overview of measures taken to prevent/reduce impacts of accidental pollutions; overview of measures taken for water bodies for which achievement of the set objectives is questionable; detailed description of additional measures in order to achieve the set goals; detailed description of measures for prevention of sea pollution; assessment of the means necessary for implementation of the measures as well as determination of the provision of these funds
7. Overview of all detailed water management programs and plans relating to the river basins of Neretva with Trebišnjica, Cetina and Krka, subbasins, sectoral plans, problems or types of waters, along with an overview of their contents
8. Report with description of activities and results of public participation in the plan development process
9. List of institutions and method of obtaining documents based on which the plan is made
10. Overview of international obligations taken over by B&H relating to water management and method of their implementation.

#### 4. CHARACTERIZATION REPORT

The characterization report (developed in accordance with the "Decision on characterization of surface waters and groundwaters, reference conditions and parameters for assessing the status and monitoring of waters", Official Gazette of FB&H, no. 1/14)) includes parts from 1 to 6 of contents of the Plan.



Based on the data of systematic monitoring of surface waters in the Adriatic river basin district, conducted for basic physical-chemical indicators, chemical indicators and biological elements (periphyton/phytoplankton, benthic macro invertebrates), field visit of all watercourses for assessment of hydromorphological state as an integral part of ecological status assessment, based on a detailed analysis of pressures (anthropogenic pollution sources) and impacts, evaluation of the overall condition of surface waters, or potentials for heavily modified and artificial water bodies, is given for each water body with the associated catchment area.

A total of 216 water bodies of surface waters have been identified in the Adriatic Sea river basin district in the Federation of B&H, specifically 211 on running waters, four (4) on stagnant waters and one (1) water body on coastal sea. Of 211 water bodies on running waters, 209 are natural, and two are artificial water bodies. Of the four water bodies on stagnant waters, three are natural and one is artificial, while the one water body on coastal waters is natural. These surface water bodies were evaluated as follows: for running waters very good 5 (3%), good 117 (56%), moderate 30 (14%), poor 55 (26%) and very poor 2 (1%); for stagnant waters: 2 in good condition and 1 in moderate condition; there are no transitional waters, and coastal waters: 1 in good condition.

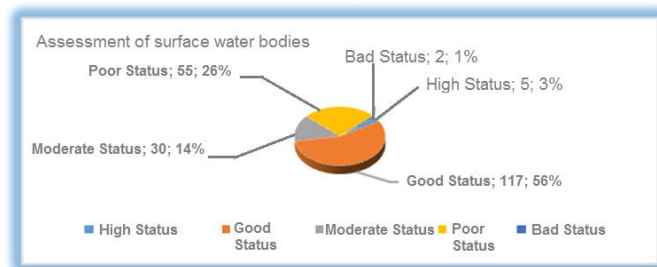


Figure 1. Assessment of surface water bodies in the Adriatic Sea river basin district in FB&H

Out of a total of 216 surface water bodies established in the Adriatic Sea river basin district in the Federation of B&H, 155 (72%) water bodies are in the category of natural water bodies, 58 water bodies (27%) are in the category of heavily modified water bodies, specifically 57 on running waters and 1 water body on stagnant waters, while 3 water bodies are in the category of artificial water bodies (1%), specifically 2 on running waters and 1 water body on stagnant waters.

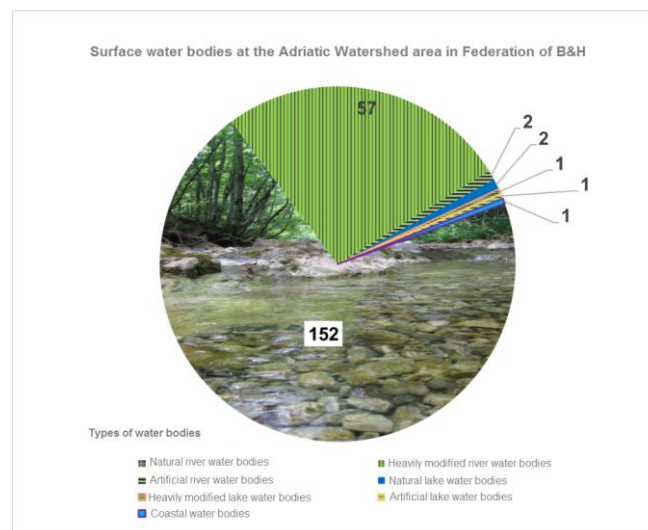


Figure 2. Number of surface water bodies in the Adriatic Sea river basin district in FB&H



Out of these heavily modified and artificial water bodies of running waters, 41 (72%) have good potential and 16 (28%) have moderate potential, while of stagnant waters 1 has moderate potential.

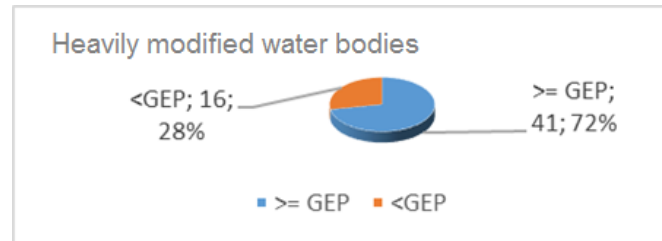


Figure 3. Assessment of significantly modified surface water bodies in the Adriatic Sea river basin district in the Federation of B&H



Figure 4. A view of the overall assessment of ecological status on natural surface water bodies and ecological potential on heavily modified ones in the Adriatic Sea river basin district in FB&H

In the approach to identification of groundwater bodies for the area of the Adriatic basin in FBiH, two types of groundwater bodies were taken into consideration: productive and non-productive. In this, productive groundwater bodies are water entities with sources of considerable capacity, and unproductive groundwater bodies are entities of low capacity (secondary aquifers of low capacity and entities of negligible capacity, such as entities characteristic of the coastal area, deep unused aquifers, areas without significant source zones, areas of large karst fields). Forty productive and seven unproductive groundwater bodies were identified. Twenty-three productive and two unproductive groundwater bodies have inter-entity or cross-border status.

The overall assessment of condition of the grouped groundwater entities is determined by their quantitative and chemical status, depending on which of these two assessments is worse. Only one groundwater body is in poor condition due to its quantitative state.





## 5. PROGRAM OF MEASURES

The program of measures for fulfillment of the objectives set by the Water Management Strategy of FB&H includes basic, additional and supplementary measures for achieving good status of waters. The proposed schedule for achieving the EU WFD environmental objectives is given in the following table.

Condition of waters in 2015.	Environmental objectives
Water bodies in good and very good condition in 2015.	Setting environmental objectives and measures within the Program of Measures by which the existing condition of water bodies will be maintained through all planning cycles by 2039 and further.
Water bodies that are: - at risk of failing to achieve environmental objectives in 2015. - in moderately good condition in 2015.	Setting environmental objectives in the first planning cycle by 2021 that will: - provide assessment of the condition according to WFD - achieve good condition by 2021.
Water bodies that are: - at risk of failing to achieve environmental objectives in 2015. - in poor state in 2015.	Setting environmental objectives that will: - provide assessment of the condition in accordance with WFD by 2021 or - achieve moderate condition by 2021 or good condition by 2027.
Water bodies that are: - at risk of failing to achieve environmental objectives in 2015. - in very poor condition in 2015.	Setting environmental objectives that will: - provide assessment of the condition in accordance with WFD by 2021 or - achieve moderate condition by 2021, moderate or good condition by 2027 and certainly good condition by 2039.

Table 1. The schedule for implementation of environmental objectives for six-year planning cycles (2016-2039)

The basic measures under the Water Act of the Federation of B&H, Article 26, are:

- Measures relating to protection of waters, defined by water legislations of the Federation of B&H, namely: (i) measures that ensure adequate water quality for drinking water supply, (ii) measures defined by environmental protection and nature protection regulations pertaining to water and water-dependent ecosystems;
- Measures relating to water regulation and protection against harmful effects of waters: (i) preservation and equalization of water quantities, (ii) protection against harmful effects of waters, (iii) determining the scope of construction of water facilities;
- Measures relating to the use of water that: (i) pertain to license issuing procedures, (ii) relate to recovery of costs for use and protection of waters and (iii) relate to achieving sustainable water use.

Supplementary measures are not specifically prescribed by the WFD but are determined according to the specific situation in the basin. In creating and realizing supplementary measures, states are given freedom, but within which they will ensure achievement of the set goals. Supplementary measures can be adopted for additional protection or improvement of the condition of waters.

Additional measures relate to protected areas according to the FB&H Water Act (protection of aquatic species and habitats, drinking water, bathing water) for which additional goals and their monitoring are set.

Number of KTM measure	Description of the measure	Measure category according to FB&H WA	Basic or supplementary measure	Effect of the measure	Cost of the measure during the period of the plan on the river basin district (KM)
0	Increasing the degree of connection of the population to public water supply systems	Water use	Basic	Increasing % of water supply to households, reducing water supply losses	64,000,000
1	Construction or upgrading of wastewater treatment plants	Water protection	basic	Reduction of org. matter and nutrients from	133,500,000



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				settlements	
2	Reduction of pollution by nutrients from agriculture	Water protection	basic	Reduction of nutrients from agriculture	135,000
3	Reduction of pollution by pesticides from agriculture	Water protection	basic	Reduction of hazardous substances from agriculture	250,000
4	Rehabilitation of contaminated sites (remediation of contaminated soils, river sediments, groundwater)	Water protection	supplementary	Reduction of hazardous substances that can reach groundwater	180,000
5	Improving longitudinal continuity of watercourses (e.g. establishing fish passes, demolishing old barriers/dams)	Water use Water protection Protection from waters	supplementary	Reducing the negative hydromorphological effect on the status and/or ecological potential of surface waters	250,000
6	Improving hydromorphological conditions of water bodies other than longitudinal continuity of watercourses (e.g. restoring natural river flow, improving conditions in coastal areas, removing embankments, reconnecting rivers with floodplains, etc.).	Water use Water protection Protection from waters	supplementary	Reducing the negative hydromorphological effect on the status and/or ecological potential of surface waters	200,000
7	Improvements in flow regime and/or establishment of an environmentally acceptable flow	Water use Water protection Protection from waters	supplementary	Reducing the negative effect on the status and/or ecological potential of surface waters	250,000
8	Technical measures for improving the efficient use of water for irrigation, industry, energetics and households	Water use	basic	Rational use of waters	2,000,000
9	The policy of water price setting measures to implement recovery of costs of water services for households	Water use	basic	Rational use of waters	380,000
10	The policy of water price setting measures to implement recovery of costs of water services for industry	Water use	basic	Rational use of waters	100,000
11	The policy of water price setting measures to implement recovery of costs of water services for agriculture	Water use	basic	Rational use of waters	200,000
12	Advisory services in agriculture	Water protection Water use	supplementary	Reduction of nutrients and hazardous substances from agriculture	200,000
13	Drinking water protection measures (e.g. establishing protection zones etc.)	Water protection Water use	basic	Protection of drinking water	6,000,000
14	Research, improvement of knowledge base, in order to eliminate unknowns by reducing imprecision of input data	Water protection Water use	supplementary	Maintaining good status of surface waters and groundwaters	3,500,000
15	Measures to gradually reduce emissions, discharges and prevent priority and hazardous substances from entering the environment.	Water protection	basic	Reduction of pollutants from industry	150,000
16	Upgrading and improvement of industrial wastewater treatment plants (including farms)	Water protection	basic	Decreasing input of nutrients from cattle breeding	*
17	Measures to reduce sediments from soil erosion and surface runoff	Water protection Protection from waters	supplementary	Reduction of water pollution	600,000
18	Measures to prevent or control harmful effects of invasive alien species that transmit diseases	Water protection	supplementary	Preservation of biodiversity of surface waters	100,000
19	Measures to prevent or control harmful effects in tourism including fishing	Water protection	supplementary	Preservation of biodiversity of surface waters	
20	Measures to prevent or control	Water protection	supplementary	Preservation of	

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	harmful effects of fishing and other exploitation / removal of animals and plants			biodiversity of surface waters	
21	Measures to prevent or control the input of pollution from urban areas, transport and infrastructure	Water protection	supplementary	Reduction of pollution from infrastructure	
22	Measures to prevent or control the input of pollution from forestry	Water protection	supplementary	Reduction of pollution from forestry	100,000
23	Establishment of natural retentions	Water protection Protection from waters	supplementary	Preservation of biodiversity of surface waters	
24	Measures of adaptation to climate changes	Water protection Protection from waters	supplementary		1,000,000
25	Measures to suppress acidification	Water protection	supplementary	Reducing acidification of surface waters	
<b>Total costs of the measures for the duration of the plan in the river basin district (KM)</b>					<b>213,095,000</b>

Table 2. The list of Key Types of Measures (KTMs) containing basic and supplementary measures

During the Plan, the highest necessary investments are in drainage and wastewater treatment and water supply in the Adriatic Sea river basin district in the period 2016-2021, requiring an investment amount of  $133,500,000 + 63,978,556 = 196,478,556$  KM, where strategic goals in coverage of public water supply from the current 60% would reach 80%, while the coverage of drainage and treatment would reach nearly 50%.

From the affordability analysis it follows that the average monthly bill for water services to be paid by a household with average income is about 2.1% of the net income of the same household in 2016. In the baseline scenario for 2021, due to increased investments in water utility infrastructure and increasing demand for water, the monthly water service bill to be paid by a household with average income reaches 4% of net household income.

	INVESTMENTS IN DRAINAGE AND WWTP 2017-2021	ANNUAL COSTS OF MAINTENANCE IN DRAINAGE AND WWTP 2017-2022	INVESTMENTS IN WATER SUPPLY 2017-2021	ANNUAL COSTS OF MAINTENANCE IN WATER SUPPLY 2017-2022
ČITLUK	4,000,000	175,000	4,940,159	98,803
ČAPLJINA	15,000,000	681,695	6,279,588	125,592
GRUDE			3,114,457	62,289
JABLANICA			1,540,379	30,808
KONJIC	10,000,000	521,120	3,316,893	66,338
LJUBUŠKI	2,000,000	120,000	3,665,238	73,305
MOSTAR	45,000,000	3,155,822	22,167,118	443,342
POSUŠJE	9,000,000	289,140	2,629,647	52,593
PROZOR - RAMA	6,500,000	185,788	674,718	13,494
STOLAC			1,282,979	25,660
ŠIROKI BRIJEG	8,000,000	302,310	1,571,527	31,431
KUPRES	5,000,000	185,000	1,342,503	26,850
LIVNO	10,000,000	415,650	5,043,874	100,877
TOMISLAVGRAD	8,000,000	243,883	4,354,640	87,093
GLAMOČ			681,108	13,622
B. GRAHOVO			448,245	8,965
NEUM	1,000,000	60,000	925,483	18,510
Small plants	10,000,000			
<b>TOTAL:</b>	<b>133,500,000</b>		<b>63,978,556</b>	

Table 3. Total costs of new investments in water supply and drainage in the Adriatic Sea river basin district during the period of the Plan





## 6. IMPLEMENTATION OF THE PUBLIC DEBATE AND SEA

After development of the Draft Adriatic River Basin District Management Plan in the Federation of B&H, a public debate was conducted from June to the end of December 2015, within which workshops were organized in all counties in the respective river basin district. The interested public submitted their comments, remarks and suggestions to the Agency's address in writing, and then the requested corrections were carried out. All documents were published on the website of the Adriatic Sea River Basin District Agency ([www.jadran.ba](http://www.jadran.ba)).

The need to develop the Strategic Environmental Assessment by the bodies responsible for development of water management plans is defined pursuant to the FB&H Environmental Protection Act ("Official Gazette of FB&H", number: 33/03 and 39/09) and is carried out on the basis of results established by the strategic study that defines, describes and evaluates the expected significant environmental impacts that may be caused by implementation of the plan related to environmental protection, taking into account the objectives and scope of the ASRBDMP. The public debate was conducted from the beginning of July to 5 September 2016, and the SEA related to the Adriatic Sea River Basin District Management Plan was adopted by the FB&H Government Decision of 15 June 2017.

The document Adriatic Sea River Basin District Management Plan is expected to be adopted soon.

## 7. CONCLUSION

According to the Water Act, Water Management Strategy in the Federation of B&H and EU Water Framework Directive (WFD), the first Water Management Plan in the Adriatic Sea river basin district in FB&H has been prepared.

The plan implemented the characterization of waters and defined the condition/potential of all water bodies in the Adriatic Sea river basin district in the Federation of B&H.

It established goals and defined measures to achieve good condition and/or potential of water bodies or to prevent deterioration of the condition of surface water and groundwater bodies.

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