



Water demand management in the Mediterranean, progress and policies

ZARAGOZA, 19-21/03/2007

**Monitoring progress and promotion of water
demand management policies**

National report of Bosnia & Herzegovina

**MEDITERRANEAN STRATEGY FOR
SUSTAINABLE DEVELOPMENT**

**Monitoring progress and promotion of water demand
management policies in Bosnia & Herzegovina**

Sarajevo
January, 2007

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1. Introduction

The long-term objective of Bosnia and Herzegovina is to become a member of the European Union. Therefore a development of the country, including the water sector, will have to be in compliance with relevant EU principles, first of all to Water Framework Directive (WFD).

1.1. Catchment areas in Bosnia and Herzegovina

In the hydro-geographical sense, B&H water streams belong to the Danube and Adriatic Sea catchment areas. Of 51 129 km², which is the total area of B&H, 38 719 km² or 75,7% belongs to the Black Sea, that is, Sava river catchment area, while 12 410 km² or 24,3% belongs to the Adriatic sea catchment area. Mediterranean region of Bosnia and Herzegovina, which presents the Adriatic (Mediterranean) Sea Basin, is composed of Neretva, Trebišnjica and Cetina river basins, and of the narrow coastal zone around Neum Municipality.

Neretva and Trebišnjica river basins have area of 10 100 km² or 81,4% of total Adriatic Sea catchment area, while Cetina river basin in B&H has area of 2 310 km² or 18,6% of total Adriatic Sea catchment area.

Coastal zone includes Klek peninsula, Neum-Klek Bay with natural seaport Neum, coastal Neum-Klek Bay aqua terrain, and coastal aqua terrain of Mali Ston channel. Bosnia and Herzegovina owns 25 km of Adriatic Sea coast, all belonging to site in the Neum Municipality.

According to the data from 1997, obtained from the Federal Institute for Statistics, 351 455 people live in the part of Mediterranean region belonging to the Federation B&H on the territory of 10 794 km², being 33 capita/km².

According to the data from May 1997, 93 000 people live in the part of Mediterranean region belonging to the Republic of Srpska, on the territory of 4 081 km², being 23 capita/km².

Mediterranean region of B&H is densely populated around the karst fields. The biggest municipalities and, at the same time, the urban centers of this region are: the biggest Mostar (101 249 inhabitants in 1998 and expected to rise until 2015 to 180 000), and other municipal centres: Livno, Tomislavgrad, Glamoč, Kupres, Čapljina, Ljubuški, Stolac, Trebinje, Gacko, Nevesinje, Bileća, Prozor, Posušje, Konjic, Jablanica and Neum. Common characteristic of all municipalities is that in their municipal centres or in their immediate surrounding lives the most of the population, over 70% of the total number.

1.2. Administrative and legal set-up

Administratively, Bosnia and Herzegovina comprising two Entities, the Federation of Bosnia and Herzegovina (FB&H) and the Republika Srpska (RS).

State level institutions in B&H relevant for water sector are: Ministry of Foreign Trade and Economic Relations (authorized for fulfilling international obligations within international agreements) and Ministry of Traffic and Communication (competent in navigation sector). All other relevant water management fields (water protection, flood protection) are under competence of Entities structure, i.e. Ministries of Agriculture, Water Management and forestry in FB&H and RS. Both Entities regulate water policy by its own Water Laws, adopted during 2006 which are harmonized with EU legislative and they are in line with guidelines of WFD.

This report will mostly elaborate area of Adriatic Sea catchment area, i.e. Mediterranean region of Bosnia and Herzegovina. If data are not available only for Mediterranean part, the whole B&H territory will be elaborated.

2. Major changes in the water situation in the country

2.1. Resources, their mobilization and unconventional water production

Average renewable natural resources

Average flow in Mediterranean catchment area in B&H is 13,65 km³/year (Neretva and Trebišnjica 12.67 km³/year and Cetina River 0,98 km³/year) which represent average renewable natural resources. In the same time, minimal average monthly flow exceed 95% on flow duration curve in this region is $Q_{mm5} = 64 \text{ m}^3/\text{s}$.

Renewable natural resources per capita

Population in this Mediterranean region in year 1981 was 484 979 inhabitants and in year 1998, number of inhabitants was 429 085. During the war period in this region (1991-1995) number of inhabitants was decreased about 13%, and population growth rate has negative trend. However, expectations are that in the next 10-15 years number of inhabitants will increase. According to data regarding renewable natural resource and number of inhabitants, during 1981 renewable natural resources per capita was 28 145 m³/hab/year, and during 1998, it was 31 811 m³/hab/year.

Non-renewable natural resources

According to available data, there are no non-renewable natural resources. For now, impact on water and water system due to climate change in Mediterranean region of B&H was not recognized.

Mobilization of natural resources

Total water storing capacity in Mediterranean region of B&H is 3 088,5 hm³. This capacity is represent through water accumulations/dams. At this moment none of these accumulations are used for refilling of water tables.

During prewar period (before 1991), there were plans for construction of new accumulations with capacity of 1 000 hm³ which would be mainly used for energy production, but till now they are not constructed.

Production of unconventional water

Production of unconventional water is not common in B&H. Agricultural draining water reuse, wastewater reuse or industrial production of fresh water by desalinization, are generally not applied in B&H.

2.2. Water demand and pressure on resources

Auto-supply (BH)

Auto-supply in industry was not common in B&H. Most of industries in the prewar period were supplied from municipality water networks, while water for irrigation is used from watercourses and from underground by pumping. Only some industries have their own water networks.

Total water demand

Domestic water and industry

According to data from 1985, which were obtained from municipal water utilities at the whole territory of B&H, total abstracted/consumed amount of water for water supply of households and industry, including water losses, was 420 l/person/day. Having in mind that Mediterranean region had 484 979 citizens in that period, it was calculated that abstracted/consumed amount of water was 0,068 km³/year.

Of this amount, the households accounted for 0,022 km³/year (32% 134 l/person/day), commercial and industry for 0,024 km³/year (35% 147 l/person/day), and water losses for 0,022 km³/year (33% 139 l/person/day).

Agriculture

At beginning 1990s, water demand for agriculture was about 0,017 km³/year, but now it is lower because some of the irrigation systems are not in function. Exact data about current demands for agriculture are not available.

Total water demand

According to the above mentioned, total water demand in 1990s was about 0,085 km³/year. Relative share between different sectors was the following:

- Domestic consumption: 0,022 km³/year or 26% of total water demand;
- Commercial (industrial) consumption: 0,024 km³/year or 28% of total water demand;
- Agriculture consumption: 0,017 km³/year or 20% of total water demand;
- Water losses: 0,022 km³/year or 26% of total water demand.

Dominant abstraction in B&H is from the underground water resource and it is 89%, while abstraction from surface waters is 11%.

Exploitation index of renewable natural resources:

$$(0,085/13,65) \times 100 = 0,62$$

13,65 km³/year - Average renewable natural resources

0,085 km³/year - Total water demand

Non-sustainable water production index:

$$100 \times (0 + 0) / 0,085 = 0$$

From above calculation, it is obvious that volume of water withdrawn from aquifers with non-renewable resources (fossil waters) is 0.

Emissions of organic water pollutants

According to available data from 2004, emissions of organic water pollutants from industry in Mediterranean region of B&H are 27 828 kg BOD5/day, and share between catchments was:

- Neretva – 19 239 kg BOD5/day
- Trebišnjica – 6 300 kg BOD5/day
- Cetina – 2 257 kg BOD5/day
- Coastal area – 32 kg BOD5/day.

2.3. Degradations and threats affecting water resources, facilities, ecosystems and populations

Water general quality index

This indicator is for B&H presented by using enforced “Decree on Water streams Categorization from 1967 in B&H”. This Decree shall remain in force until new Decree in accordance with the new law is enacted.

According to Decree the classification of water streams is as following:

Flowing waters are classified with regard to their potential utilization into four classes. 1st class: waters which in their natural state of flowing disinfection can be used as drinking-water, in food-

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processing industry, as well as in breeding high class fish species (Salmonidae); 2nd class: waters which in their natural state can be used for bathing, water sports, breeding other species of fish (Ciprinidae), or following normal treatment (coagulation, filtration and disinfection), can be used as drinking-water or in food-processing industry; 3rd class: waters which in their natural state can be used in irrigation, or following normal treatment in industry, except food-processing industry; 4th class: waters which may be used for any other purpose only following an adequate treatment.

The 1st and the 2nd quality class are defined as drinking water.

Ist category of water streams include water streams and the sea waters which have to have conditions of I class,

IInd category of water streams include water streams which have to have conditions of II class,

IIIrd category of water streams include water streams which have to have conditions of III class,

IV category of water streams include water streams which have to have conditions of IV class

Physical, chemical, biological and radioactive parameters of waters have to be in accordance with following criteria:

	Parameters	Class 1st	Class 2nd	Class 3rd	Class 4th
1	Dissolved Oxygen mg O ₂ /l	8	6	4	3
2	Oxygen saturation % Supersaturation %	90-105 -	75-90 105-115	50-75 115-125	30-50 125-130
3	Max BOD (20o, 5d) mg O ₂ /l	2	4	7	20
4	Max COD (K ₂ Cr ₂ O ₇) mg O ₂ /l	10	12	20	40
5	Saprobic degrees by Liebman (not applicable for ground waters)	Oligosaprobic	Mesosaprobic beta-alfa	Mesosaprobic alfa-beta	From Alfa mesosaprobic to polysaprobic
6	Max suspended solids mg/l	10	30	80	100
7	Max dry residual of filtrated water mg/l -surface water -ground water -in carst -out carst	350 - 350 800	1000 - 1000 1000	1500 - 1500 1500	1500 - - -
8	Acidity pH	6,8-8,5	5,8-8,5	6,0-9,0	6,0-9,0
9	Visible waste substances	without	without	without	Without
10	Notable collar	without	without	hardly notable	-
11	Notable odor	without	without	hardly notable	-
12	Fecal coliformes n/ l -for bathing	1000 -	100000 20000	200000 -	Up 200000 -
13	Toxic substance, temperature changes and other	Not to exceed prescribed limits in any class			

Maps below shows water streams classification according to Decree on water categorization as well as water streams classification according to monitoring in the period 1985 – 1989.

Annual production of ashes and clinker varies in scope between 350 000-400 000 t/year
 Negative environmental influence of Thermolectric Plant Gacko and mine is manifested trough following:

- system of smoke gas
- system for transport and disposal of ash and clinker
- coal supply
- identification and currents of waste water
- mine

Basic characteristics of waste water according to its quality and place of origin are given in table below.

Characteristics of waste waters:

Waste water place of origin	Discharge		Present quality of effluents		Standard		Proposed treatment
	m3/day	m3/hrs	pollutant	concentration	pollutant	concentration	
Oiled waste water		40	grease and oil	100 mg/l	grease and oil	0.05 mg/l	oil separator
Waste water from the regeneration process	394	27.7	pH value		pH value	6.5-...?	neutralization
Waste water from the decarbonization process	878	37	suspended substances pH 9.5-10.5	742 mg/l	suspended substances pH 9.5-10.5	30 mg/l	depositing
Waste water from the process of cooling the clinker		85	temperature suspended substances pH value	40-60 0C 12	temperature suspended substances pH value		cooling
Waste water from the process of mudding the cooling tower out		130	sodium chlorides of suspended substances		sodium chlorides of suspended substances		no treatment
Sanitary waste water	138		suspended substances BOD5	28 kg/day	suspended substances BOD5	30 mg/l 20 mg/l	Sanitary waste water treatment plant

According to previously mentioned waste water can be divided as follows:

- oiled waste water
- regeneration waste water
- decarbonization waste water
- waste water from cooling the clinker
- waste water from cleaning the boiler plant
- waste water from the mudding the cooling tower out
- sanitary waste water
- atmospheric waste water

Wetland areas

Neretva river's delta is a unique Mediterranean marsh region and important ecosystem in the south Adriatic Sea coast. Neretva's Blatije, (main channel and few smaller, including the Neretva's Blatije polje fields) covers the area of 19 000 ha, 7 000 ha belonging to the Bosnia and Herzegovina, and 12 000 ha to the Republic of Croatia. Hutovo Blato location, having the area of approximately 3 700 ha of marsh, represents the most valuable resource of Blatije. In 1964, Hutovo Blato is included in the list of Barcelona Convention Program for Mediterranean Areas Under the Special Protection (MAR). International Council for Birds Protection (ICBP) in 1998 included Hutovo Blato on the list of internationally important bird habitats. The significance of Hutovo Blato is also recognized through the signatures of international contracts by ex- Yugoslavia on birds and their habitat protection. In September 2001. Hutovo Blato was included on the List of Wetlands (wet habitats) of Directorate of Ramsar Convention in Paris.

The water regime which is for the last fifty years, according to the available indicators, changed significantly in the negative way, is very important for the life of complete plant and animal world in this wetland. The main reason of destroying and reducing of this area is extortion of wetland in favor of fertile agricultural land, during the period from 1946 to 1968, when left and right defensive dike was built, with two pumping stations, "Ovanj" and "Višici" (4 + 6 = 10 m³/s water capacity). These actions introduced the melioration at cca 1 500 ha. Other great action, performed from 1968 to 1979, was building of a pumping hydro-plant and creation of the compensational reservoir, at the area of cca 1 100 ha (volume of 44 x 10⁶ m³, where daily oscillations in the water depth goes up to 2 m).

Measurements of the water inflow and outflow in the ecosystem, during extreme water levels, shows that before the building of mentioned melioration systems and hydro-power plant, flow regime of river Krupa into Neretva River was a natural, and after the building of all these objects, water regime was completely changed.

There are also noticed the high oscillations between high and low waters, so during the summer water stays in few small lakes and in river Krupa, what has a significant negative consequences on animal and plant world. For the purpose of regular water discharge from Deran mad, regulation plant was installed. The problem is also the entrance of the salt into Hutovo blato.

Performing of water's transfer also affected Hutovo blato. The first phase of water's transfer was finished before 20 years and included: transfer from Bilećko lake, over the Trebinje, up to the hydropower plant "Plat" in Dubrovnik, and water transfer through the canals over Popovo polje, up to the reversible hydro-power plant Svitava. Water transfer influenced all sources in Svitavsko mad and sources at the left side of Neretva River. Slightly smaller impact occurred at the sources Deransko mad and sources of River Bregava. Changes occurred in the underground of karst also.

The second phase of water's transfer, from the upper horizons, started just before the war. It significantly impact Hutovo blato, especially Deransko blato, sources of rivers Bregava and Bunica, with slightly smaller impact on sources of river Bune and river Neretve from settlement Buna to the delta in the sea.

At the edge of Hutovo blato, on the land is being raised pepper, cucumbers and other vegetables, which require a huge amounts of synthetic fertilizers and water, which comes from surface or underground to the Blato, and pollutes complete ecosystem. Particular danger represents landfills either from industry or households.

Untreated industrial waters from river basins of Neretva, Bregava and Trebišnjica can reach Deransko and Svitavsko med through the water streams and ground waters. Special problem is the eutrophication of wet-land what should be explored and analyzed.

2.4. Access to drinking water and to sanitation and collection and treatment of waste water

Proportion of the population having a durable access to an improved water source (total, urban, rural)

According to data from Water Management Plan of Bosnia and Herzegovina from 1994, proportion of the population having a durable access to an improved water source (total, urban, rural), in 1991 was following:

Neretva and Trebišnjica river basin:	Urban	99 %
	<u>Rural</u>	<u>42 %</u>
	Total	64%

Cetina river basin:	Urban	96 %
	<u>Rural</u>	<u>34 %</u>
	Total	51%

According to the same Plan, situation in 2020 should be:

Neretva and Trebišnjica river basin:	Urban	100 %
	<u>Rural</u>	<u>80 %</u>
	Total	84%

Cetina river basin:	Urban	100 %
	<u>Rural</u>	<u>60 %</u>
	Total	71%

Proportion of the population having an access to an improved sanitation system (total, urban, rural)

Proportion of the population having an access to an improved sanitation system in B&H for the years 1981 and 1991 are as following:

1981:	Urban	70 %
	<u>Rural</u>	<u>6 %</u>
	Total	30 %

1991:	Urban	80 %
	<u>Rural</u>	<u>11 %</u>
	Total	38 %

According to available data, construction of new sewerage systems in B&H territory during last 15 years occurred only in some cases, and data from 1991 could be relevant for the time being.

Mediterranean region of B&H

In Neretva river Basin, small settlements, and some bigger as well, do not have a build sewerage system. Settlements which are not connected to the public sewerage system use septic tanks. It is very usual that Utility Companies perform an emptying of those septic tanks which content are being taken into the sewerage systems of the bigger settlements.

In Cetina river basin, cities like Livno, Tomislavgrad, Kupres and some smaller settlements are not entirely covered with the sewerage systems and do not have WWTPs. Therefore, wastewaters are mostly being taken into septic tanks, and as they are almost regularly permeable, wastewaters are being discharged directly into underground.

In Trebišnjica basin all municipal centers, except Berkovići, at least partially have constructed sewage systems. In parts of municipal centers without sewage system there are septic tanks but most of them do not fulfill sanitary and technical requirements for those objects.

For entire coastal area, the unique infrastructure sewerage system, which covers the areas of Komarna, Duboka, Klek, Neum and Ston, has been designed and partly constructed. System is dimensioned at 35 000 equivalent of population (ES), and mostly the bigger objects are connected (hotels, buildings, companies and some private objects) on the sewerage system, what means that there are only 40 connections (around 17 l/sec of waste water). This represents about 70% of total waste waters of the area of Neum Municipality, and other 30% which are not connected on the sewerage system use septic tanks.

Share of collected and treated wastewater by the public sewerage system

Percent of treated wastewater by the public sewerage systems in the Mediterranean region of B&H is up to 10% of collected waste waters.

In Neretva river basin most of the settlements do not have a constructed sewerage with the installations for wastewater treatment. Up to date, that problem has being partly solved by municipalities of Ljubuški and Grude. In booth municipalities were constructed 1. phase for wastewater treatment, mechanically and biological type, with an active mud (WWTP Ljubuški = 5.000 ES and WWTP Grude = 2.500 ES). Also, project documentation was elaborated for WWTP in the cities of Čitluk and Široki Brijeg. Their WWTPs were destroyed during the war and should be reconstructed. For the cities Mostar and Konjic investment - technical documentation has been prepared at the level of preliminary projects, which include, besides designs of WWTP, designs of missing sewerage and collector systems.

In Cetina river basin construction of sewerage systems is in stage of planning, but the implementation was still not yet commencing. Project documentation is prepared for the reconstruction of WWTP in Bosansko Grahovo (WWTP was destroyed during the war).

In Trebišnjica basin, Trebinje town is the only one with the waste water treatment plant. Effects of waste water treatment are very high and are in accordance with designed values. Waste waters from other systems are being discharged directly in to the open streams (Gacko, Kalinovik) and reservoir (Bileća) and abyss (Nevesinje, Ljubinje). Mentioned solutions have negative impact on spring water quality on lower horizons and reservoir.

Wastewaters from B&H coastal area are being transported by main collector, up to the central treatment plant which is based near small city Ston in Croatia. This treatment plant has only first phase of treatment (mechanical), and after this treatment, effluent is being disposed into the deep sea of Mljet canal (length of discharge is 950 m).

Share of industrial wastewater treated on site

In Mediterranean region in B&H are present industries whose wastewaters are significantly loaded with organic compounds, suspended particles and nutrients. According to estimated BOD5 values, the biggest polluters in Neretva river basin are textile industry, industry of milk and milk products, industry of non-alcohol beverages, breweries, wine industry and slaughter houses; in Cetina river basin textile industry, and in Trebisnjica river basin textile industry and wine industry.

The most often case is that these industries don't own pre-treatment nor treatment of wastewaters, with the exception of "Uniline" brewery in Grude, which uses city plant for treatment of its wastewaters, and meat industry "LIJANOVIĆI" from Široki Brijeg who uses its own plant for treatment. Capacity of the first WWTP is 5 000 PE and of second one is 35 000 PE.

3. Water demand management policies in different sectors

Bosnia and Herzegovina has at its disposal significant water resources, which could be one of the most important factors of general economic development for the majority of areas in the forthcoming period. The fresh water basins are a key natural resource in Bosnia and Herzegovina. The quality of surface water varies from region to region. Water supply in the territory of Bosnia and Herzegovina is mainly based on the use of ground water sources (89% of the overall sources of water supply), while 10.2% of the water comes from the rivers and 0.8% from the natural lakes and artificial reservoirs.

3.1. Data and indicators

Water in agriculture

The total surface area of the agricultural land in Bosnia and Herzegovina is about 2,5 million hectares, i.e. about 50% of the state territory or 0,7 ha/per capita. About 68% of the total agricultural land in Bosnia and Herzegovina (1,7 million ha) is arable land and 32% are meadows (0,8 million ha). Fertile lowlands compose 16% of the total agricultural land in Bosnia and Herzegovina, 62% are less fertile hilly-and-mountainous areas, while Mediterranean area accounts for 22%. In prewar period, under irrigation was 14 310 ha, which represent less than 1% of arable land in Bosnia and Herzegovina.

During 1990s, under irrigation in Mediterranean region in B&H was around 6 830 ha (6 330 ha under big systems and about 500 ha under individual users). Irrigation under big systems was by sprinkling, while individual users were apply gravitating type of irrigation. Water demand for irrigated agriculture in that time was 0,01715 km³/year, or 0,00000343 km³/year by irrigated hectare. Main type of crops concerned are vineyards, early vegetables (tomato, papers, onions, etc.), orchards, alfalfa, tobacco etc..

Currently in Mediterranean region of B&H the irrigated land is less than 5 000 ha, and data about water used for irrigation is not available.

Agricultural GDP in Bosnia and Herzegovina in 1991 was 1 145 000 USD and it was 10% of total GDP. According to data from 1998, agricultural GDP in Bosnia and Herzegovina was 351 000 USD.

Domestic water

Total domestic water demand in Mediterranean region of B&H is 0,022 km³/year, and per capita it is about 51 m³/year. Efficiency index of drinking water use varies from 50 – 70% and it depends from region. Price of domestic water also varies, and is in range from 0,2 – 0,7 USD/m³. Exact data about cost recovery is not available, but it is obvious that costs for production, transport, distribution, exploitation and maintenance of equipment can not be covered by existing tariffs and collection rate from the users. Data about existing water efficiency plans in rural towns and territory does not exist, but from experience it can be assumed that this process is not started yet in Bosnia and Herzegovina.

Water for industry

Industrial water demand is 0,024 km³/year, without water demand for thermo power plant Gacko, which has water demand about 0,003 km³/year. So in total, industrial water demand (including

energy) is 0,027 km³/year. Here it is important to mention existing hydro power plant in basin. Currently, there are 11 HPP (5 in Neretva river basin, 5 in Trebišnjica river basin and 1 in Cetina river basin), and sum of average flows on these 11 HPP is 33,77 km³/year.

3.2. Retrospective analysis

Water for agriculture

According to the studies that elaborated and analyzed natural factors (lack of moisture, terrain gradient, soil quality, height above sea level etc.) and possibilities of abstracting necessary amounts of water during dry periods, it has been concluded that 72 010 ha of land area can be irrigated in Mediterranean region of B&H.

Important limiting factor for intensive development of agricultural production in the Mediterranean Region of B&H is a shortage of water in the vegetation period. The precipitation distribution is unfavourable. During the vegetation period (summer), precipitation levels are very low, and drought periods are very long. In the period from May to August, the precipitation level amounts to 25% of the total annual precipitation. In eastern Herzegovina, karstic fields have very unfavourable water regime. In natural conditions, in the period autumn-winter they are the karstic fields, however, during larger part of the spring they are flooded by water and represent karstic lakes. On the other hand, in the vegetation period, they are practically completely dry.

For example, in the Neretva River Basin, according the studies, it is possible to irrigate approximately 50 000 ha. This irrigation would on average require 6 m³/s, or 2% of the average annual discharge. However, if compare this amount with the discharge during the summer season (August), when this percentage for the Neretva River amounts to approximately 4,5 m³/s, the Neretva River would completely run dry, and approximately 30% of water necessary for irrigation would again be missing. This indicates the necessity for planned management of water resources, as well as the necessity to construct infrastructures essential to achieve that.

Additional problem regarding agriculture represent a lot of small landowners with estates of 0,9 to 2 ha with many scattered parcels of less than 500 m².

Currently, main type of irrigation is by surface-gravity flow, with some small scale pumping stations recently introduced by groups of farmers. Present water-use practices are following:

- Farmers open intake holes, for their land, at will. The position, size, shape, etc., of those holes are without any control.
- Tendency that farmers closest to the water-source waste a lot of water, leaving those farther away without supplies.
- A measurement of water intake is not taking place. There are neither gauging stations nor instruments for flow measurements.

Until the 1991, water fees were collected (based on municipal decision from 1988) at rate of up to 3,5 USD per "dunum" (1000 m² = 0.1x ha). Additional charges were made for drainage and flood protection.

In the post war period (since 1995) irrigation service charges are not in use due to destroyed irrigation system during the war. In the last ten years the water for irrigation has been illegally used by farmers without any charges.

Currently in Mediterranean region of B&H the irrigated arable land is less than 5 000 ha, i.e. less than 7% of arable land that can be irrigated (72 010 ha).

Immediately after the war, the share of investments in agriculture amounted to 10,2% of the total investments in B&H, however, this share was reduced to 4,1% during the last several years.

Investments in the field of agriculture are negligible and are largely related to small cooperatives and private companies.

All the above mentioned is a consequence of the wrong strategy for agricultural sector development in last years. Unfavourable loans, lack of support by government, disorganised farmers etc. also contributed to this situation. Countries in our neighbourhood (Greece, Albania, Italy, Bulgaria, Romania) have 10-30 times (in percents) larger areas of irrigated arable land.

Small Scale Commercial Agricultural Development Project

Within the World Bank Project «Small Scale Commercial Agricultural Development Project» were analyzed possibilities and options for self-sustainability and transparent collection and management of irrigation system. Two pilot sites were selected, Ljubuški filed region in FBH and Trebinje filed region in RS. Means and methodologies used within those tow pilot sites could be applied to similar agricultural areas in future. Project analyzed present state within the pilots, from the point of management, institutional, legal, technical and financial aspect that was relevant for irrigation system. It was estimated that present level of agricultural land use in pilots was 10-30% in Ljubuški and 30-50% in Trebinje. Water intake is from natural streams, and range of abstracted quantities is unknown. Present practice regarding institutional arrangements, management, maintenance, collection rate and financing in both regions is partly implemented according to existing laws as in FBiH as in RS. Practically, those systems are mainly used and managed by individual farmers, mostly without any supervision. During the war and after, within municipalities Ljubuški and Trebinje, there were no collection of water charges from users so system stayed without any income needed for maintenance or capital investments. Based on analysis of the current condition, this study gave recommendations related to institutional and financial arrangements, which would gradually provide self-sustainable functioning of this activity:

Institutional structure

Establishment of Water User Association for irrigation (WUA). These associations represent an adequate organizational form of expressing and achieving interests, but also taking over the responsibility of users of irrigation system and/or land reclamation system. Thus, and adequate and efficient management would be assured, as well as maintenance, financing and implementation of other activities necessary for self-sustainable functioning of irrigation system.

Financial analysis

Theoretical basis and methodology for setting the water prices has been suggested, as well as phase introduction of water prices based on suggested methodology. In the first phase (2-3 years) would be maintained the way of determining the price of water as it was before the war, i.e. fixed charge should be paid by the size of surface under irrigation system (regardless if it is currently irrigated or not) + variable part which would be paid by the quantity of delivered water. This variable part would be estimated/measured on the main water intakes, and the quantity of delivered water charged proportional to irrigated land surface.

In the next phase, after the fulfilment of necessary conditions during the first phase, method of setting the water price would be applied, based on real costs generated by users, taking into account quantities of consumed water, electricity and type of crop on the land.

Domestic water (B&H)

Due to war in Bosnia and Herzegovina, the water infrastructure of the country was severely damaged. Although it is estimated that the water supply sector has been rehabilitated up to 90% of the pre-war level, as a whole it is still far below the international, particularly European, standards. The springs and source fields are not sufficiently protected, and the quality of potable water is questionable, in certain cases utterly unacceptable. The potential pollution is still hanging as a threat to human health, due to aged and damaged pipelines, uncontrolled chlorination and insufficient pressure. The extracted water is of varying quality, some is drinkable without any kind of treatment but in other cases the quality is totally unacceptable, especially during the dry season. Water treatment is in many cases insufficient, often just chlorination even when the water needs additional treatment.

The maintenance of the existing water pipelines has been neglected for years, and they are now in poor condition. Water losses are in some utilities up to 70% of produced water. During the last couple of years, with aid of international grants and loans, and with resources of water utility companies themselves, the losses have started to be reduced, but the situation is still difficult, especially in smaller municipal centers.

Before the war water metering was carried out in all municipalities for almost all of the customers. During the war many meters were stolen or they became out of order because of intermittent flows and lack of maintenance. Consumer's metering is quickly improving in the last years in many utilities, although there are still some municipalities where old water meters are not replaced or not maintained and calibrated, and therefore, water bills are based on a lamp-sum.

Water tariffs rates and structure vary a lot from region to region in B&H and they are generally still inadequate to cover related expenses. Low payment collection rate is still problem for many water utilities, although it is improving in last years.

All observed problems are basically due to improper institutional and management weaknesses in water utilities.

Water for industry

Most of industries in the prewar period were supplied from municipality water networks, while just few of them have own water networks.

Before the war, industry was a significant consumer (it used almost one third of the total amount of water), all water management plans and programmes, especially the ones related to the water use, did not pay enough attention to the issue of industrial consumption. The industry as a user was mainly analysed from the aspect of water pollution.

It is assumed that industrial production in Bosnia and Herzegovina is to a large extent smaller than at the beginning of 1990s (about 35% of the pre-war capacities). Due to this fact, the water consumption in the industrial sector has largely been reduced which also contributes to reduction in terms of pollution.

3.3. Prospective analysis

Water for agriculture

As it can be concluded from the previous chapter, arable land which is currently under irrigation makes less than 7% of land that could be irrigated in Mediterranean region of B&H. However, according to the Medium-Term Development Strategy for the agricultural sector in FB&H from 2006, and future development plans, a priority should be given to increase in fertility by application of agricultural engineering and land-improvement measures on land currently used for

agricultural production. The proposed measures should be part of a comprehensive programme for regulation of agricultural land issues at the level of B&H. In addition, this strategy has envisaged reconstruction and upgrading of the existing irrigation systems that largely belonged to the state sector, in order to make them capable of state production. Since B&H is in a certain way at the beginning of irrigation system development, there is a great possibility that it is being implemented in accordance with the basic principles of IWRM and WDM. In order to use this opportunity it is necessary to prepare State Law on Agribusiness and Rural Development. Such a law is needed to clarify the allocation of competencies in the agricultural sector and to improve coordination and efficiency. It will also help in complying with the requirements of EU and WTO.

Domestic water

The collected data indicates that losses and wastages within water supply systems are extremely large. In the previous period, a great effort has been put into attempts to improve the situation. It is certain that with application of certain measures (legal, technical and financial), the state in the future can be largely improved. According to studies on water supply in B&H, the following measures should be undertaken:

- Water Utility Companies must have adequate level of autonomy in relation to the municipalities they serve. The largest number of Water Utility Companies are currently owned by municipalities;
- The collection rate for water bills must be significantly increased
- Metering of consumption of all consumers, calibration and maintenance of water meters must become a regular practice;
- Water losses and unaccounted-for-water must be reduced to below 20%
- Improvement of accounting, budgeting and reporting of financial flows in Water Utility Companies
- Structuring of tariffs for consumed and sewage water
- Establishment of an organisation for support and protection of Water Utility Companies' interests
- Development of the readiness of citizens to pay the reasonable price for the water supply service
- Increase in the private sector participation in some functions of the Water Utility Companies
- Improvement in the internal organisation of Water Utility Companies, management information system, and relationship with the clients-consumers;
- Improvement in human resources
- Government should improve the existing situation of questionable potable water quality by approving subsidy schemes (grants, soft loans, reduced tax rates) as a form of financial assistance to producers of potable water.

Establishment and Institutional Strengthening of Water Works Association in B&H – BHWWA, EC LIFE Third Countries, 2002 – 2004

This institutional project was implemented in period 2002 – 2004, and main objective of project was to improve sustainability of the use of water resources through sector partnership by strengthening water works association (BHWWA).

The established Water Works Association in B&H - BHWWA has become a strong supporting organization to the whole water sector in B&H. Organization gathers more than 70 water utilities from B&H, and is recognized in B&H and wider as relevant partner in improvement of water management. It has directed its efforts primarily to the water works operations, providing them:

- Technical help in overcoming of major operating problems, like enormous UFW and shortage of technical and management knowledge in water works management, through organization of seminars, web site, operating manuals and continuous communication between Association members.
- Legal assistance, strengthening and representing this society in front of governments, helping the water sector to improve legal environment in B&H.
- Introduction of EU Water Framework Directive and other water related international acts, by which the awareness of the need to harmonize current B&H water legislation with international, especially EU water and environment legislation.
- Representing of B&H water sector in international organizations and in international cooperation.

Water for industry

Since the industrial production has been reinitiated, it will result in increasing of the water consumption. For that reason it is necessary to introduce timely measures that will be in accordance with IWRM and WDM for this field. According to this, it is necessary to involve public/private partnership in sector, apply targeted subsidies/tax benefits for water-saving systems, establish depollution funds, provide awareness raising campaigns and training of managers, etc.

One of the possible measures that should be taken is introduction of cleaner production, i.e. application of BEP (best environmental practices) in industry facilities. On one hand, these measures can contribute to significant BOD5 reduction, and on the other hand, bring economic profit, i.e. savings of raw material, water and energy-generating products in these industries. Cleaner production in B&H industries is introduced into national policy and strategy as a tool for accomplishing environmentally sustainable industrial development. Its application in industrial facilities in B&H is based, by adoption of set of environmental laws in B&H (FB&H and RS, in 2003), on EU directive for integral pollution prevention and control (IPPC).

Cleaner Production

Application of cleaner production is not a usual practice in B&H industries. First activities in this field were made during 2002, through implementation of project “Capacity building of cleaner production in B&H” – EC LIFE Third Countries Program. Project was implemented by non-governmental organization “Center for Environmentally Sustainable Development” with technical assistance of MAP regional Center for cleaner production from Barcelona, Spain and Croatian Center for cleaner production from Zagreb. Project was implemented in 9 industrial facilities in B&H where cleaner production measures were applied. It is calculated that implementing CP in industries, water savings and reduction of wastewaters varies between 24 to 81%. with average of 60%.

4. Towards integrated policies for water resource and demand management

4.1. Environmental objectives in the water policies

According to administrative organization, both in FB&H and in RS water sector is under responsibilities of Ministry of Agriculture, Water Management and forestry, and environment sector is in FB&H under responsibilities of Ministry of environment and tourism and in RS under Ministry of Urbanism, Civil Engineering and Ecology. As it can be seen, water and environment sector are not integrated under same ministries, but they are harmonized.

In post war period (1998), both FB&H and RS adopt water laws which has serious gaps and deficiencies including a poorly developed policy on the use and protection of water resources; insufficient provisions on permits, interaction standards and water use.

In order to improve environmental legislation in B&H, the EU PHARE program has financed the preparation of a new set of environment laws, one of which is a **Law on Water Protection**, and which are adopted 2003, both in FB&H and in RS.

The **Law on Water Protection** governs the protection of waters, watersides and water lands: water protection planning and programming, organization, supervision, financing and penalties for each legal and natural person. Protection of waters, watersides and water lands shall comprise the preservation and adjustment of water quantities, the maintenance of waters, watersides and water lands, and the adoption of decisions on the use and loading of waters.

The objective of the Water Protection Act is to ensure the sustainable use of waters in order to preserve and improve their quality, to ensure the preservation of natural processes and the natural balance of waters, aquatic and semi-aquatic ecosystems and the landscape properties of waters, and – in cooperation with the bodies responsible for water management – to preserve and adjust water quantities for various types of use in order to realize their economic, social and ecological functions.

Subject to the observation of the fundamental principles of environmental and water protection, the protection of waters, watersides and water lands shall be based on:

- Integrity of river basins, taking into account the dynamics of waters and natural processes, and the coherence and interdependency of aquatic and semi-aquatic ecosystems in accordance with the river basin approach;
- Sustainable use of waters based on ensuring the functionality of natural processes and maintaining the natural balance of aquatic and semi-aquatic ecosystems, and on the long-term protection and rational use of available water resources;
- Prevention of the excessive load on waters and promotion of sustainable use or utilization of waters and waterside and water land;
- Economic evaluation of waters and exercise of the principle of compensation of costs for water use and water pollution;
- Public participation;
- Observation of the best available techniques and new scientific findings on ecology,
- Precautionary principle, i.e. where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason to postpone measures aimed at preventing environmental degradation.

The reforms of Water Sector in B&H are the part of EU assistance to the transition of B&H from centrally planned economy to market oriented economy. Within project Water Sector Institutional

Strengthening - Phase II Implementation - River Basin Management Programme, this was realized in period 2003-2005, spatial attention was on preparation of water sector legislation. Project takes into consideration future requirements for B&H toward European Community according to Water Framework Directive. As one of project results, new **Water Law** was prepared and adopted by governments of FB&H and RS during 2006.

By adoption of this law, previous legislation (Water Law from 1998), as well as Law on Water Protection (from 2003) will be out of force. Here it is important to stress that new legislation incorporate all important decrees from Law on Water Protection. Also it is important to stress that this law is in line with other directives which deal with water and environmental protection (Urban Waste Water Treatment Directive, Drinking Water Directive, Discharges of Dangerous Substances Directive, Nitrates Directive, etc.)

4.2. Water demand management (WDM) in the water policies

As it is mentioned in previous chapter new Water Law was adopted in both FB&H and RS during 2006. Entering into force of this new Water Law is the first concrete result of Water Sector Reform Implementation in B&H. This act practically initiated the implementation of the EU Water Framework Directive (WFD). The ultimate objective of the above mentioned reforms, as well as the overall objective of the Water Sector Institutional Strengthening, is to contribute to the achievement of transparent, cost-efficient and sustainable water resources management in Bosnia and Herzegovina, based on the natural catchments areas.

In addition to the complete regulation of the water sector in B&H, the Law also ensured harmonized management and protection of water resources. The Law envisaged development of over 50 bylaws, which will further explain and elaborate its provisions.

Basic objectives of the new Law are the following:

- To carry out transposition of WFD into the legislation of the water sector in B&H;
- To implement the institutional reform of the water sector, which includes legal and financial autonomy of relevant institutions, in form of the Agencies for Water;
- To provide legislation that enables integrated water management including water use, protection of water and protection from harmful effects of water.

Sections in the Law are the following:

- General provisions
- Surface water categorization, water assets and water structures
- Water management
- Water use
- Protection of waters
- Regulation of watercourses and other waters and protection from harmful effects of waters
- Water information system
- Water acts
- Limitations of rights vested to land owners and users
- Organisation of water management
- Water management financing
- Inspectional supervision
- Penalty provisions
- Transitional and final provisions.

By this law, responsible institution (Ministry for Water Management) is obligatory to prepare Water Management Strategy which will define the policy of water management. Strategy shall especially contain:

- status assessment of the water management,
- aims and directions of water protection, protection from harmful effects of waters and sustainable use of waters,
- priorities in achieving of water management objectives,
- assessment of the necessary resources for implementation of the programme and deadlines for the achievement of the objectives and
- necessary activities for implementation of obligations from international agreements related to water management.

For the implementation of the Strategy, the water management plans for River Basin District of Sava River and Adriatic Sea shall be enacted. Water management plan must include the following elements:

- General description of the characteristics of river basin district
- Summary overview of all significant pressures and impacts of human activities on status of surface and groundwater
- Identification and production of map of protected areas
- Map of monitoring network, as well as presentation of the results of monitoring program with which the status has been followed
- Determining the objectives of water management,
- Overview of economic analysis of water use
- Overview of program of measures, including also ways of achieving the objectives of water management
- Overview of all detailed programs and plans for water management that refer to certain river basins, that is sub-basins, sectors, problems or water types, together with the summaries of their contents;
- Report that includes description of activities and results of public participation in the procedure of plan making;
- The list of institutions and the way of obtaining the documents, on basis of which the plan had been made,
- Summary of obligations, taken over from international treaties that refer to management of waters, and the manner of their execution

In addition to these laws, it is important to mention the development of national and regional strategies and plans, which also elaborate the issues of water management. The following are the most important strategies developed in the previous period.

National Environmental Action Plan (NEAP)

National Environmental Action Plan (NEAP) for Bosnia and Herzegovina was completed in 2003 with assistance of the World Bank. The goal of the NEAP was identification of short and long-term priority actions and measures providing the basis for preparation of a long-term environmental protection strategy in accordance with the economic, social and political situation in Bosnia and Herzegovina. A key element of the NEAP is the comprehensive analysis of the state of the environment.

Based on the analysis of the current situation in all fields of environmental protection it was determined that the area of water resources and wastewater represents the first priority of the NEAP. Pollution prevention and prevention of irrational and uncontrolled use of water represents a necessary measure for protection of water which is one of the most important resources of B&H. In

addressing these problems NEAP proposes: establishment of the catchment areas management, realization of long-term water supply projects, construction and reconstruction of the wastewater treatment plants and sewerage systems, rehabilitation of flood protection systems to the required safety level, and use of water for irrigation and production of electricity.

Poverty Reduction Strategy Paper (Mid-term Development Strategy)

The preparation of the B&H Medium-Term Development Strategy (PRSP) started in April 2002 and lasted approximately eighteen months. Definition of proposals of priorities and of the strategy itself was the task of 20 working groups, composed of the representatives of the Council of Ministers and of the entity governments, as well as of the lower levels of government (Brčko District, cantons, municipalities). The working groups covered the following sectors: macroeconomic and fiscal framework, business environment, privatization, financial sector, labor market, the combat against corruption, foreign trade regime, public administration reform, statistics, education, social protection, health care, agriculture, forestry, ***water management, environment***, infrastructure, energy, information technologies, mine action and industry.

According to PRSP ***Water management*** will be organized on the level of river basins. A regulatory mechanism will be established for monitoring the work of municipal councils on setting tariffs and for ensuring the preservation of the quality of water and protection of the environment. The autonomy and management capacity of water utilities will be reinforced, and the degree of cost-recovery of utility services will increase to reflect real costs, with the tendency to prepare these segments for privatization. Investment in expansion of water supply and sewage systems will increase, as well as in regulation of watercourses and protection from harmful effects of waters. More efficient utilization of water for irrigation and power generation, exploitation of mineral and thermal waters will respectively receive increased attention.

Regional Economic Development Strategy for Herzegovina Economic Region

The EU RED project financed under the CARDS 2002 project facilitated the drafting of strategy documents in five identified regions of Bosnia and Herzegovina. One of these five regions is Herzegovina, which cover Mediterranean basin in B&H. Regarding strategy which was created for this region, development of the agriculture and industry is one of the priorities. In strategy it is stressed that this development should be in line with EU standards, and that preservation of water resource, and environment should be achieved.

National Action Plan (NAP) for Mediterranean region in B&H for prevention of pollution from land based activities

"National Action Plan for Mediterranean region in Bosnia and Herzegovina for prevention of pollution from land based activities" (NAP) is elaborated through GEF/SAP MED project, which lasts from 1st January 2001 until 30th September 2005, with coordination of Mediterranean Action Plan (MAP) Athens, Greece, and with financial support of Global Environment Facility (GEF), Mediterranean Fund METAP, French Environmental Fund, and ICS-UNIDO.

According to "Protocol for the protection of the Mediterranean Sea against pollution from land-based sources and Activities" (LBS protocol) of Barcelona convention, on XI meeting of Contractual parties of Barcelona convention, held in Tunis, in 1997, Strategic action plan (SAP) has been adopted, which gave guidelines to signatory countries for elaboration of National Action Plans.

B&H National Action Plan deals with a south part of Bosnia and Herzegovina, i.e. Adriatic sea catchment area (river basins Neretva, Trebišnjica and Cetina) and a narrow coastal area of Neum.

Document's objective is to give guidelines for achieving sustainable development of Mediterranean region, by defining proposal of actions for pollution prevention, control and reduction, caused by land based activities.

A following methodology was applied during document elaboration:

- Diagnostic Analysis (NDA) defines problems and analyzes their causes, consequences and significance;
- Baseline Budget of specific pollutants (BB) of water and air expressed in kg/year for all three river basins and narrow coastal area of Neum, defines a referent level of pollution which allows further following of reduction rate;
- Based on NDA results and evaluated BB, Issue/Impact matrix for river basins and Neum coastal area have been created, which helped in choosing priority problems for NAP preparation;
- Based on ranked problems a Plan has been suggested with a list of priority problems and necessary activities for reduction of specific pollutants emission.
- Sector plans with proposed measures for pollution reduction and estimated degree of pollution reduction have been elaborated in accordance with existing state diagnosed through NDA and BB, relevant provisions of the law, existing relevant studies and projects, and objectives and activities of SAP;
- NAP had been elaborated based on NDA and BB and sector plans. Draft of NAP gave an overview of existing and proposal of new economic instruments, with purpose to ensure sustainability of proposed activities and projects;
- Ranking of proposed projects / activities has been conducted, according to investment oriented criteria, with a purpose of defining a final list of priorities for 2010. Among others, main proposed projects / activities include industrial wastewaters (BOD5), metal industry, thermo power plant and mine Gacko, mineral fertilizers and pesticides, physical alteration and destruction of habitat, Wetland and salt marsh alteration, Marine waters and costal watershed alterations, etc.

5. Water demand management in the cooperation and development aid policies

After the war was stopped, international community together with local authorities in B&H initiated Reconstruction and Development Program for Water Sector in B&H. As it can be seen from previous chapters, most of laws, strategies, as well as institutional strengthening in water sector in B&H was implemented with help of international institutions, mainly EU and USAID funds and aid policies. While EU was focused mainly on institutional strengthening on national level (which is elaborated in previous chapter), USAID was concentrate on local level and strengthening of water utilities. In addition to mentioned institutions, important was support from World Bank, EBRD, and direct help from different countries (Sweden, Norway, Italy, Japan, Austria, Germany, Spain, etc.).

Regarding Mediterranean region in B&H, most important project was "National Action Plan for Mediterranean region in Bosnia and Herzegovina for prevention of pollution from land based activities" (NAP) which was elaborated through GEF/SAP MED project, with coordination of Mediterranean Action Plan (MAP) Athens, Greece, and with financial support of Global Environment Facility (GEF), Mediterranean Fund METAP, French Environmental Fund, and ICS-UNIDO.

Some of successful projects, which take into account of water demand management, and which are implemented in last years within cooperation and development aid policies are given below.

Program "Assistance to Water Utilities in B&H"

This program is one of a series of USAID-funded programs for water utility strengthening that began in 1999, when USAID Sarajevo commissioned a study to assess the needs for the reform of the water sector. The objective of that particular assessment was to examine the water problems at the local level in order to strengthen the capability of these water utilities to provide satisfactory water and wastewater services to their customers in a business-like manner, i.e., to become efficient and financially self-sustaining.

The first phase of this program included a detailed field diagnosis of conditions in selected ten water utilities considered as representative, and the recommendations arising from that study in a form of designing of basic models, tools and procedures which address areas of weakness in the water and wastewater utilities of Bosnia and Herzegovina. Weaknesses were recognized in three aspects of their functioning:

- Legislative
- Technical
- Financial

Second phase of program started in March 2002, under the project "Assistance to Water Utilities in B&H - Pilot Water Utilities Doboje, Orašje, Konjic, Tuzla".

Overall objective of this project was to strengthen the institutional and financial sustainability and operational efficiency of selected water utilities, to make them self-sustainable public companies and to qualify them for commercial credits from the World Bank and/or other lenders.

Project covered legal, technical and financial components and in accordance to that, the different activities and tools were implemented in order to improve water utility's management and operation.

Nevertheless, achieved results in the areas of increasing water utilities' revenues, development of effective metering programs, full understanding and further reducing unaccounted-for-water losses, development of networks mapping and GIS, development of effective accounting and budgeting systems, establishment of more realistic tariff rates completely confirmed that the overall project objective was met, so as increased capacities within the water utilities are full guarantee for long-term results sustainability. Even more, selection of additional water utilities during the second project year and implementation of limited number of activities proved replication potential to other water utilities in B&H.

Training programs supported by USAID

Accounting/ budgeting/reporting program for water utilities

During period March – July 2001, B&H water utilities have been invited to participate in accounting/budgeting/reporting program. The whole program was done in several phases which were including workshops, visiting of utilities and follow on events.

All water utilities at first participated in the four-day Workshops. First two days were devoted to improvement of accounting procedures in the water utilities, third day to budgeting/operating procedures and water tariff structure, and fourth day to wastewater tariff structure and to Internet technologies and distance learning module. Water utility representatives were introduced with models and tools for improvements of their accounting and bookkeeping, developing budget and operating procedures, establishment of proper tariff structure.

Unaccounted for water reduction and water demand management training

The objective of the training was to provide skills and knowledge to participants for development of Water Demand Management and Unaccounted for Water (UFW) Reduction Programs for their own utilities. This was accomplished by providing technical know-how transfer to participants, as well as explaining the role of government and/or local authorities in demand and reduction management.

Target for B&H water utilities was to reach a UFW level of 30%, which is believed to be reasonable and achievable for the incoming period. Water demand management program would reduce or eliminate the need for expensive investment in new water sources.

The training program included topics like water demand management concept, water audit procedure, organization in water utilities relevant to UFW reduction, efficient metering and methods for testing big water meters in place, leak detection methods, mapping or setting proper tariffs.

Examples from other cities in B&H were presented to the participants, as well. Each training was consisted of in-class work and field visit to the water utility from the training hosting municipality and its network.

USAID Linking Agricultural Markets to Producers Project (LAMP)

Since 2003, government of the United States of America is giving a significant assistance to the farmers of Bosnia and Herzegovina through the USAID Linking Agricultural Markets to Producers Project (LAMP). The goal of Project (LAMP) is to increase the rate of economic growth in Bosnia-Herzegovina through expanded, environmentally sustainable production and sales of value-added agricultural products. Technical, legal and financial support is provided through this project for purpose of achieving improvement in the field of agriculture.

EU support

EU provided much of its assistance relating to the water management in Bosnia and Herzegovina in the past period. The main focus of the EU was the institutional strengthening of the water sector in B&H. The main aspects addressed in the scope of these projects were legal, financial, institutional and water quality aspect, as well as human capacity building. At the very beginning of realisation of these projects (1998 EU Phare in FB&H and Finnish government in RS) the focus was to determine the existing state of the water sector (institutional, legal, technical and financial aspect) and to give recommendations for future activities to be implemented. In addition, identification and implementation of emergency and urgent works in sector was carried out right at the start. Afterwards, a large number of projects focusing on concrete problems and giving proposals for their solutions has been implemented. The highlight of this process was the several times mentioned new Water Law. This law was developed within the Water Sector Institutional Strengthening - Phase II Implementation - River Basin Management Programme and it represents the result of several years long efforts of local and foreign experts to harmonise the legislation of B&H in the field of water management with the legislation of EU.

The following are just some of the projects implemented with the assistance of EU and governments of the EU member states in B&H.

- "Water Sector Institution Strengthening Federation of Bosnia and Herzegovina" – EU Phare Program 1998/1999
- "Water Sector Institution Strengthening Republic of Srpska" –Finish Government 1998/1999
- "Water Sector Institutional Strengthening in FB&H – Human Resources Development Aspect", Spanish Government 1999

- "Water Sector Institutional Strengthening in FB&H- Water Quality Aspect", Italian Government 1999
- "Institutional Strengthening of Mediterranean Action Plan (MAP) Office for Bosnia and Herzegovina" – EU LIFE Third Countries Programme 1998/2000
- "Strengthening of Diffuse Source Pollution Control in FB&H" - EU LIFE Third Countries Programme 2001
- "Sustainable Development and Sustainable Use of Nature Resources in Bosnia and Herzegovina" - European Commission Fifth Framework Programme 2001/2002
- "Capacity building of cleaner production in B&H" – EC LIFE Third Countries Program 2002
- Water Sector Institutional Strengthening - Phase II Implementation - River Basin Management Programme, EC project, 2003-2005
- "Environmental Regulation of Mine Waters (ERMITE)" – European Commission Fifth Framework Programme 2002
- "Establishment and institutional strengthening of Bosnia and Herzegovina Water Works Association (BHWVA)" - EU LIFE Third Countries Program 2002
- "Cost-effective technologies for wastewater treatment and waste biodegradation in agro-industries with reclamation of resource - AGROIWATECH" - European Commission Fifth Framework Programme 2003

6. Overview and conclusion

As it is already stressed, Bosnia and Herzegovina has at its disposal significant water resources, which could be one of the most important factors of general economic development for the majority of areas in the forthcoming period. The fresh water basins are a key natural resource in Bosnia and Herzegovina. However, lack of rational usage and care for good water quality has led to discrepancy between water availability and water demands.

From this report it can be seen that water management was not one of the priority issues for B&H. The general opinion of the people in Bosnia and Herzegovina indicates that water is a resource present in large amounts in this region, and that saving of this resource is not necessary. This can also be confirmed by water consumption in different sectors (households, industry and agriculture) in the past period. All these sectors had large water losses that were not rehabilitated in most of the cases, but additional amounts of water were provided from new water sources.

In the after-war period, the legal and institutional framework of the water sector was based on the socialist administrative culture characterised by a high level of centralisation, non-transparent financing, with the stress on planning, and limited public participation in the water sector management processes. The same period was also characterised by lack of coordinated and harmonised action of relevant institutions that would aim for overcoming of the consequences of war and meeting of the increasing needs for water, which resulted in the disorganised system in the field of water management. In addition, the differences in water management entity structures have to a large degree limited the adequate water management. For that reason, it was necessary to define the new platform for integrated water management and use. As the result of these activities, the new Water Law has been prepared and adopted, which is based on the basic guidelines of EU legislation, and above all in accordance with WFD. Each of the entities adopted its law, but the laws are largely harmonised. This law has foreseen the water management at the level of river basins, and development of the water management plans. In order to ensure the implementation strategy, the development of the river basin management plans has also been foreseen. These plans should be the basis for the future management of the needs of different users (households, industry, agriculture). For that reason it is necessary for all of them to be involved in development of these

plans and to realise their rights through them. For that purpose, it is necessary to implement continuous education of all stakeholders in this region.

In addition, it is necessary to pay closer attention to protection of water resources in the following period. Almost all wastewater in the Mediterranean basin is directly discharged into environment, without any previous treatment. For that reason it is necessary to build sewerage networks and wastewater treatment plants in all municipal areas where they do not exist, but also to repair the existing ones that are in most cases out of function.

As it can be seen from the strategies elaborated in the previous sections, the possibilities for development of agricultural production in the Mediterranean region of B&H are significant. Considering that Bosnia and Herzegovina is importing large amounts of food and at the same time has the possibilities for development of agricultural production that have not been utilised, it can be expected that the situation will change in the near future. If the agricultural production is further developed, it can then be expected that larger land areas will be irrigated in order to achieve better yield as well as better managed water needs. Industrial consumption is also negligible in relation to the pre-war situation, mainly due to the fact that some industries are no longer operating. However, similarly to agriculture, it can be expected that industrial production will be reinitiated, which will increase the water needs.

Generally, economic development of Bosnia and Herzegovina will in future exert a lot of pressure on water resources. On the one hand this will be reflected in the increased water needs (production processes and irrigation) and on the other in the increased pollution loads. In order to reduce this pressure to the lowest possible extent, it will be necessary to apply different measures (technical, financial, institutional) and new legislation in the sector.

In order to implement all the above-mentioned measures, large financial resources will be necessary in a short period of time. It would be an illusion to expect that the state itself and individuals can provide these resources. Therefore, the assistance of international institutions will be necessary for provision of these resources.

All of this represents a large temptation for the citizens of Bosnia and Herzegovina in the near future, but we can hope that the need to preserve these valuable resources will be recognised, and that water will be utilised in the best possible way.

7.2. List of the main reference

- National Action Plan (NAP) for Mediterranean region in B&H for prevention of pollution from land based activities, Hydro Engineering Institute Sarajevo
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- Law on Water Protection (Official Gazette of the F B&H, No. 33/03; Official Gazette of RS, No. 53/02)
- Water Management, Tarik Kupusovic, Sarajevo 2001

7.3. Note taking into account the difficulties encountered to gather together the information needed to draw up the report

During preparation of this document biggest problem was occurred in data collection process. It is very difficult to find official data about water resources in Mediterranean region of Bosnia and Herzegovina. Usually, information exist for entire territory of B&H (Danube and Adriatic river basins), and not exactly for Mediterranean. It is also important to stress lack of monitoring and data collection after the war in this area. Hopefully in next few years, situation will be improved and it will be possible to collect more data and on base of that make better analyzes.