Chapter 7

WATER MANAGEMENT

7.1 Water resources

Overview

Bosnia and Herzegovina is under the influence of a moderate continental climate in the north and east (the greatest part of the Sava basin) and a maritime climate in the south and west (Adriatic basins). Some parts of the Sava basin, such as Una-Sana canton, have a continental climate with the influence of a maritime regime. The continental climate is characterized by harsh winters and warm summers with the greatest quantity of precipitation during the summer, as opposed to the maritime climate, which is characterized by mild and rainy winters and dry summers. The annual precipitation varies from 800 l/m^2 in the north-east of Bosnia and Herzegovina to 1500 l/m^2 in the south, with an average of 1250 l/m^2.

Bosnia and Herzegovina is therefore rich in water resources compared to the European average of 1000 l/m^2. Damage to the infrastructure during the war combined with insufficient maintenance and an inadequate regulatory framework have, however, brought the water sector into difficulty. The result is that the water resources are exposed to pollution, the quality of drinking water is deteriorating steadily and the flood control infrastructure throughout the country is damaged and deteriorated.

Rivers and lakes

The total outflow from the territory of Bosnia and Herzegovina is 1155 m^3/s, or 57% of total precipitation. Water from the Sava basin, which covers 75.7% of the country, drains to the Black Sea. The main rivers in the Sava basin are the Una-Sana, Vrbas, Bosna, Drina and Sava, with a mean discharge of 722 m^3/s. The first four flow into the river Sava, a tributary of the Danube, which drains into the Black Sea. In the Adriatic Sea catchment area (24.3% of the country), the main rivers are the Neretva, Trebišnjica and Cetina, with a mean discharge of 433 m^3/s. The river Cetina flows entirely through Croatia, but part of its basin is located in Bosnia and Herzegovina.

River lakes and mountain lakes in Bosnia and Herzegovina are important for recreation and tourism, but less so for other water uses. Flooding of karst areas causes periodical lakes in or near the rivers in the Adriatic Sea catchment area, i.e. the Cetina, Neretva and Trebišnjica river basins. The total volume is around 2.5 billion m^3.

There are also 28 artificial reservoirs in Bosnia and Herzegovina with a volume of about 3.6 million m^3, 13 of which are in the Neretva and Trebišnjica river basins and three on the river Drina. The reservoirs are constructed for power generation, but are also important for regulating river flow.

The figures in table 7.1 show that the pressure on water resources varies considerably between the river basins, and that the situation is the most critical in the Bosna river basin, which is home to about 40% of the country's population but has only 14% of its total water run-off.

Groundwater

Bosnia and Herzegovina has relatively abundant groundwater resources, which can be found in three geographically and geologically separate areas. In the north, the groundwater reserves are within alluvial sediments of uneven granulometrical composition along the river Sava and its tributaries. In the centre, groundwater accumulates in the caves and cavities of the limestone massifs and emerges on the surface as lime wells in the Una, Sana, Bosna, Drina, and Neretva river basins. In the south, there are large karst fields within the Adriatic Sea catchment area, and the most abundant groundwater wells are found in the Cetina, Neretva and Trebišnjica river basins.

Table 7.1: Hydrological characteristics of main river basins

River basins	Area (km^2)	Population in 1991	River length (km in Bosnia and Herzegovina)	Average flow (m^3/s)
Total	**51,309**	**4,527,626**	**901**	**1,155**
Black Sea basin	38,899	4,012,266	795	722
Sana (nearby basin)	5,506	635,353	169	63
Una (in Bosnia and Herzegovina)	9,130	620,373	148	240
Vrbas	6,386	514,038	110	132
Bosna	10,457	1,820,080	232	163
Drina (in Bosnia and Herzegovina)	7,420	422,422	136	124
Adriatic Sea	12,410	515,360	106	433
Neretva and Trebisnijca	10,110	436,271	89	402
Cetina (in Bosnia and Herzegovina)	2,300	79,089	18	31

Source: Okvirna vodoprivredna osnova BiH, 1998.

7.2 Water uses and pressures on the resources

The surface water in Bosnia and Herzegovina is, in general, of poor quality and bacteriologically unsafe due to extensive pollution from numerous sources. The main threats to the quality of water are the discharge of municipal or industrial waste water directly into the nearest rivers or springs, the direct disposal of waste in rivers or along riverbanks and run-off from agricultural areas where pesticides and fertilizers are used. The quality of groundwater is in general considered to be good; the data show few examples of groundwater contamination. The lack of reliable data about the quality of surface and groundwater resources is, however, striking, and groundwater contamination might be more widespread.

Drinking-water supply

About half the population has access to public water-supply systems, mainly in urban areas. The rest uses private wells, small village water-supply systems or local systems which are not under national control. Water supply is mainly based on the use of groundwater (89%), 10.2% comes from rivers and 0.8% from natural lakes and artificial reservoirs.

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 full treatment. Old and leaking pipelines and insufficient pressure could also pollute water before it reaches the consumers. Gross specific consumption in urban areas ranges from 200 to 600 litres/capita/day, of which 100 to 200 litres are supplied to households.

The maintenance of the water pipelines has been neglected for years, and they are now in poor condition. Some are 50-60 years old, and when serious leaks occur the pipes are often so fragile as to be beyond repair. On average about 40% is estimated to leak from the pipelines, but in some bigger cities it is much higher (Sarajevo 50%, Tuzla 60-65%).

In some parts of the country, water shortage is a major problem, especially during the dry season. The situation is the most serious in some rural areas, but water shortages also occur in urban areas. Around Tuzla for instance, people have access to water only a few hours a day during the dry season. In the future water shortages should also be expected in Sarajevo and Banja Luka unless the capacity of the water-supply system is enlarged. In both cities, however, concrete plans have been drawn up to meet the future demand for drinking water.

The shortage of water in some areas is not only due to seasonal factors, but also to insufficient capacity in the water-supply systems. Leaks from pipelines are also adding to this problem. A special problem is caused by migration within the country as a result of the war or by the general movement of people from rural to urban areas. This has led to substantial pressure on the water-supply system in many areas. During the war nearly 2.7 million inhabitants (about 60% of the population) were displaced, 1,170,000 of them internally and 1,250,000 became refugees. This accelerated the already pronounced movement of people from rural to urban areas.

Table 7.2: Drinking water treatment method

Treatment method	Number of municipalities	
	Republika Srpska	Federation of Bosnia and Herzegovina
Disinfection only	42	47
Filtration	3	3
Chemical treatment	7	13
Number of municipalities	52	63

Source: National Environmental Action Plan (NEAP). Thematic document No. 02. Integrated Water Resources Managemet. Bosnia and Herzegovina, April 2002 (figures for RS) and e-mail information from Public Enterprise "Vodno Podrucje Slivova Rijeke Save", January 2004 (figures for Fed. BiH).

Note: Total number of municipalities in the Federation of Bosnia and Herzegovina is 84, in Republika Srpska 65.

Agricultural uses

Irrigation systems are not very well developed. In fact, only 2% of the total arable land of about 1,123,000 ha is irrigated compared to the world average of 15%. The lack of water during the vegetation period is the key factor limiting the development of modern agriculture, in particular in the west toward the Adriatic Sea. Even if the percentage of irrigated land is higher in this region, the irrigation systems have been seriously damaged due to poor maintenance and the war. The potential for irrigation of arable land in this region has been estimated at approximately 155,000 ha, while only 4,630 ha are irrigated today.

Hydro energy

Bosnia and Herzegovina's total hydropower potential is estimated at 6,100 MW, mostly located within the Drina, Neretva and Trebišnjica river basins. Less than 40% of this potential is so far used, so about 40% of the country's energy production today comes from hydropower. Analyses show that increased use of hydropower would not only be justified from an economic point of view, but would also have positive environmental repercussions (lower emissions of greenhouse gases and fewer discharges of waste water) compared to increasing the use of thermal (coal) energy. Building artificial reservoirs for hydropower could also be advantageous with regard to flood protection, and could make new irrigation systems possible.

Protection from floods

A total area of 250,000 ha is threatened by flooding. This is 4% of the total territory or about 60% of the lowlands. Urban areas that are particularly vulnerable are Tuzla, Banja Luka, Celinac, Prnjavor, Derventa, Modrica, Janja, Zvornik and settlements along the river Sava. Before the war, substantial investments were made to protect agricultural land and urban areas from flooding, mainly along the rivers Sava and Neretva and their tributaries. In 1992 there were about 420 km of dikes, 220 km of boundary channels, 80 km of flood regulation channels and 30 pumping stations with a capacity of 120 m^3/s, and about 80,000 ha of land was protected.

Since the outbreak of the war investment in new flood protection facilities has stopped, and the resources for maintaining existing facilities have been negligible. Some of the installations were also used for military purposes and damaged so badly during the war that they no longer function properly. For instance, the structure of some dikes has been damaged as a result of bunkers being built inside the dikes. In addition mines have been laid around some flood protection installations.

Floods cause enormous damage to crops, private property and infrastructure, lead to the erosion of arable land and increase the likelihood of landslides, in particular along the Sava, but also in other parts of Bosnia and Herzegovina. For instance, the flooding in the Tuzla region in June 2001 was estimated to have caused damage worth approximately € 30 million. In other regions, where there are no flood protection systems at all, the consequences of exceptional high water might be even worse.

To prevent, control and mitigate floods, structural flood protection measures are not sufficient. As set out, for example, in the 2000 UNECE Guidelines on sustainable flood prevention and the recent EU best practice document on the same issue, a combination of structural and non-structural flood protection measures, including the conservation or

rehabilitation of natural wetlands and retention areas, is needed.

The past ten years have passed without very high streams in Bosnia and Herzegovina. Situations with exceptionally high water levels must, however, be expected in the future. Unless adequate measures are taken urgently, enormous material damage caused by floods must be expected.

Municipal waste water

In the former Socialist Republic of Bosnia and Herzegovina, the construction and maintenance of sewerage systems and treatment facilities for municipal waste water got limited attention and few resources. The result was that not all towns and cities had sewer systems, and even in the cities where they did exist they often served only part of the population. Today about 30% of the population has access to sewerage systems. In urban areas the connection rate for households is 56%, but in villages and rural areas a maximum of 10% of the households are connected. Due to the lack of resources the sewerage systems are on the whole poorly maintained. In many cases they have not even been completed, often only partially designed and constructed. In some locations the capacity is insufficient for receiving storm waters, and the systems overflow during the rainy season, affecting around 65% of the municipal centres.

At the outbreak of the civil war 1992-95, only seven municipal waste-water treatment plants were built and in operation. Except for one plant, the treatment included biological treatment. The treatment plants were located in Sarajevo, Trebinje, Trnovo, Ljubuski, Grude, Celinac and Gradacac. These plants treated waste water from about 484,000 inhabitants of a total population of about 4.4 million. The treatment plant in Sarajevo was considerably bigger than all the others and received waste water from about 454,000 inhabitants (94% of people with access to waste-water treatment plant before the war) compared to 30,000 inhabitants for all the other plants combined. During the war, five of the seven plants were closed due to war damage, stripping of equipment and installations, lack of maintenance or shortage of electricity. After the war all the plants were put into operation again, except the plants in Sarajevo and Trnovo, and a new treatment plant has been built in Srebrenik. The plants in operation today are, however, all very small, and more than 95% of the municipal waste water is discharged directly into water bodies without any kind of treatment.

Industry, manufacturing and mining

Heavy industry was predominant before the war and the main polluter of watercourses. Combined with weak implementation of environmental measures and the use of obsolete, polluting technologies, industry's impact on water quality was devastating. In 1991 the industrial waste-water load was equivalent to a population of 6.8 million people. By comparison the municipal waste-water load was equivalent to a population of 2.7 million. The huge discharges of waste water polluted almost all rivers, especially the rivers Bosna and Vrbas. Most of the industrial waste water was, like municipal waste water, discharged to the nearest watercourse with little or no treatment. For instance, there were 122 plants for the treatment of industrial waste water before the war, but only 40% of them worked properly.

As many industrial plants have shut down and many others have reduced their capacity, the discharge of pollutants to air and water from industry has been substantially reduced and is today approximately 30-35% of its pre-war level. The big reduction in discharges of industrial waste water has led to a significant improvement in water quality. However, the industrial waste-water load is disproportionately high because there are few treatment facilities for industrial waste water in operation, and the negative pressure on water resources is still very high. When industry recovers from the setback caused by the war, river pollution will rapidly get worse unless waste-water treatment facilities are put in place.

Mining and ore processing are an important sector in Bosnia and Herzegovina. The most important mineral deposits are those of coal, lead, zinc, iron and bauxite. For instance, more than 100 coal deposits are registered. The significant reduction in industrial operating capacity has led to a similar reduction in activity within the mining and ore sector. The production rate for mining and ore processing has declined to about 33% of its pre-war level. Coal and other ore and stone production have been reduced to 40% and 23%, respectively.

When rocks containing sulphuric minerals are exposed to water and air, the ongoing oxidation and acidification will accelerate, and trace metals leach out to the environment. The environmental impact of mining activities on water resources arises at almost all stages of the production phase, and does not end with the completion of mining activity. On the contrary, the environmental impact can last for

centuries after the closure of the mine through seepage from waste rock piles, tailing dams and seepage water from abandoned pits and quarries. Acid mine water containing heavy metals represents a serious threat to the environment and to human health in Bosnia and Herzegovina. The problem with mine water pollution is, however, not recognized or regulated, and today there is no treatment of seepage water at all.

Waste disposal

Uncontrolled dumping of waste (fly-tipping) directly into or close to watercourses is a widespread problem and a major threat to water quality, especially in the Bosna, Drina and Una river basins. Hazardous waste from mining and industry is usually dumped at landfills close to the plants or at nearby municipal landfills of poor standards, often directly on the ground without any kind of underground sealing or collection and treatment of seepage water. Coal power plants, the wood and paper industry, the chemical industry and mineral oil processing, the textile and leather processing industry and the metal finishing industry are, in addition to the mining sector, the largest producers of hazardous waste in Bosnia and Herzegovina. The result is that significant environmental problems have been identified in several locations, for instance in Samac, Sava river alluvium (where the spring sources for the drinking-water supply are located), Bijeljina, Modrica, Gorazde and Visegrad.

Fly-tipping of household waste is very visible along the rivers, with plastic and other waste floating on the surface of the water or hanging in bushes and trees along the riverbanks. This is, however, mainly an esthetic problem. A more serious effect on the environment is probably that the waste is a significant source of river pollution with hazardous chemicals. Household waste is also adding to the overall pollution with organic matter, but its contribution is assumed to be rather small compared to other sources.

Forestry and soil erosion

Forestry is an important sector in Bosnia and Herzegovina with about 50% of the total land area, or 2.5 million ha, covered by forests. The intensive use of forest resources combined with outdated technology is, however, causing much organic pollution of many rivers. Another serious consequence of deforestation is increased soil erosion. Deforested and eroded areas were further damaged because they lost their ability to retain precipitation, which caused sudden run-off and increased the risk of flooding. This risk will also increase as a result of deposits in reservoirs and riverbeds in plain areas, which reduce their capacity to receive and transport water. Increased soil erosion will also have a negative influence on the quality of water by increasing its turbidity.

7.3 Policies, strategies and legislative framework

The policy framework

The National Environmental Action Plan (NEAP) of March 2003, drawn up by the entities in cooperation with the World Bank, has a brief chapter on integrated water resources management that sets goals and measures for the water sector. Its main goals are to provide sufficient quantities of high-quality water for water supply and other needs; to protect water resources and preserve surface and groundwater quality; and to protect from flooding.

The Mid-term Development Strategy (2004-2007), adopted by the Council of Ministers on 5 February 2004, notes that the sustainable development of water management requires more attention being paid to: the protection against water-related hazards, the planned use of water resources, and water conservation and protection. The emphasis is on integrated river-basin water management. The Mid-term Development Strategy also identifies nine development priorities for water:

- Repairing flood-control facilities along the rivers Sava and Neretva;
- Regulating the river beds and torrential watercourses in the most vulnerable areas;
- Ensuring an adequate supply of clean water to inhabited areas;
- Improving the quality of water supplied to the rural population;
- Creating the right conditions for the restoration of navigation on the river Sava in cooperation with Croatia, Slovenia, and Serbia and Montenegro;
- Repairing and renovating sewerage systems and rehabilitating water treatment plants for urban waste water, as well as building new ones;
- Introducing measures to protect existing and potential sources of drinking water;

- Ensuring a sufficient volume of water to irrigate cultivated land for intensive farming; and
- Increasing the level of exploitation of hydroenergy by building multipurpose water management facilities not only for power generation but also for the development of tourism and recreation, flood control, irrigation and fish farming, among other activities.

A memorandum of understanding between the Council of Ministers of Bosnia and Herzegovina, the Government of the Federation of Bosnia and Herzegovina, the Government of Republika Srpska and the Commission of the European Communities was signed in September 2004. In it, the Parties agree to reorganize the water sector and to use the EU Water Framework Directive for the purpose of establishing a new water policy.

The legislative framework

Pursuant to the Dayton Peace Agreement, water management is the responsibility of the two entities. There is no responsibility at the State level, although this is likely to change in the near future. In the draft memorandum of understanding with the European Communities, referred to above, the Parties agree to develop a new water law and sub-laws, as well as new organizational and institutional frameworks, based on the principles and goals of the EU Water Directive. Until now, however, two separate legal systems have been developed.

Republika Srpska's Law on Water Protection was adopted in 2002 (Official Gazette RS 53/2002). It establishes river basins (Danube and Adriatic Sea), river sub-basins (Una-Sana, Sava, Drina, Bosna, Vrbas and Trebišnjica) and parts of river sub-basins as the territorial basis for water protection, planning and implementation. The Law calls for the development of a minimum ten-year water protection strategy and protection plans for Republika Srpska, to be an integral part of the National Environmental Action Plan unless an inter-entity agreement states differently. The Law further stipulates that "water protection consent" is required before other permits (e.g. environmental, construction) will be issued, and it establishes an inspection system.

The Law on Water Protection of the Federation of Bosnia and Herzegovina (Official Gazette F BiH 33/2003) was adopted in 2003 and is almost identical. It, too, establishes a regime based on river basin district bodies (Danube and Adriatic Sea) and sub-basins (Una, Sana, Sava, Vrbas, Bosna, Drina, Trebišnjica, Neretva and Cetina). It calls for the adoption of a ten-year water protection strategy for the Federation, which may be part of the National Environmental Protection Programme, and it establishes consent and inspection systems.

Both Laws intend to ensure that water protection in Bosnia and Herzegovina is in line with EU policy, directives, regulations and standards.

The Federation's cantons also have water laws. In addition, the Federation's Ministry of Agriculture, Water Management and Forestry is finalizing a new water act to address water management.

In 1998 both entities also adopted Laws on Water, which address both water management and water protection, but they do not generally meet EU requirements.

International cooperation

The lack of State institutions to handle water issues have made foreign relations difficult. The result is that Bosnia and Herzegovina has not signed any major multilateral environment and water protection treaties since 1992. It is an observer only to important conventions like the Convention on the Protection and Use of Transboundary Watercourses and International Lakes and the Convention on Cooperation for the Protection and Sustainable Use of the Danube River. As it is not a Signatory to these treaties, Bosnia and Herzegovina cannot obtain financial and technical assistance to implement and monitor international procedures or standards.

The Government has, however, undertaken procedures for the ratification of the Convention on Cooperation for the Protection and Sustainable Use of the Danube River, and is expected to become a Party in the near future. Bosnia and Herzegovina became a Party to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) by succession in 1998 (Official Gazette SFRJ IA 12/77; Official Gazette BiH 26/98) and to its four protocols, but has not accepted the 1995 Amendments. To increase cooperation on transboundary waters Bosnia and Herzegovina has also ratified the Framework Agreement on the Sava River Basin, which it signed on 3 December 2002 along with Croatia, Serbia and Montenegro, and Slovenia. The Agreement, which covers all surface water and groundwater of the Sava catchment, aims

at establishing an international regime of navigation and sustainable water management. It foresees the drafting of specific protocols to further regulate cooperation on such issues as protection against floods; control of excessive groundwater use; erosion; ice hazards; drought and water shortages and accidental water pollution; protection and improvement of water quality and quantity; and protection of aquatic ecosystems. Bosnia and Herzegovina has also established bilateral cooperation on water with Croatia.

The institutional framework

With the adoption of the entities' new Laws on Water Protection, some questions have arisen regarding institutional responsibility.

The Federation's 1998 Law on Waters assigned responsibility for water management primarily to its Ministry of Agriculture, Water Management and Forestry, two public water management corporations, the cantonal ministries of agriculture, water management and forestry, and municipal authorities responsible for water management. However, the Federation's 2003 Law on Water Protection assigned primary authority to its Ministry of Physical Planning and Environment, with considerable devolution of responsibility for water protection to river Authorities.

The situation is similar in Republika Srpska. The 1998 Law designated the Ministry of Agriculture, Forestry and Water Management and the Directorate for Waters as the institutions responsible for water management. The municipalities were responsible for water supply and sewerage systems, while public utilities were the responsibility of the Ministry of Physical Planning, Civil Engineering and Ecology. The 2002 Law on Water Protection assigned responsibility for "certain issues of water protection" to the Ministry "responsible for environmental protection".

According to the 1998 Laws, the entities' Ministries of Agriculture, Forestry and Water Management are responsible for drawing up strategies, policies and regulations for the management and protection of water resources, issuing agreements and permits, setting standards and securing the enforcement of laws and regulations through licensing and inspections. Republika Srpska's Ministry of Physical Planning, Civil Engineering and Ecology and the Federation's Ministry of Physical Planning and Environment are responsible for water issues in relation to environmental protection, including setting standards, and monitoring and control. The entities' Ministries of Health are responsible for safeguarding the quality of drinking water.

The new Laws on Water Protection imply that the "Environment Ministries" would develop water protection strategies and by-laws. In addition, in the Federation, a river basin district steering committee would be established for each river basin district with one representative from each of the following: the Ministry of Physical Planning and Environment, each participating canton, the agricultural sector, the respective public company, the main water utility of the river basin district and an appropriate non-governmental organization. The river basin district body is to be responsible for inspections.

In Republika Srpska, a "special organization for water management and protection in the river basin" would be set up. All other issues that are important for the organization of the river basin are to be specified in a special law. A steering committee would also be set up, with one representative each from: the Ministry of Physical Planning, Civil Engineering and Ecology, each town or municipality in the river basin, the agricultural sector, the respective public company responsible for water management, the main water utility of the river basin and an NGO.

The new Laws on Water Protection do not make reference to the 1998 Laws, and it is not clear how the institutional responsibilities identified in the new Laws will affect or be affected by those contained in the 1998 Laws. Further specification is needed to implement the new Laws fully.

In the Federation of Bosnia and Herzegovina some competences for licensing and the allocation of water are delegated to the cantons. For instance, the cantons are responsible for providing drinking water to municipalities that do not have adequate resources themselves by ensuring the construction of water-supply systems to the border of these municipalities. The municipalities themselves are responsible for further distribution to the consumers. The cantons are also responsible for ensuring the construction of installations and equipment needed for waste-water treatment to protect drinking water resources.

Under the Federation's Ministry of Agriculture, Water Management and Forestry two public enterprises have been established, one for the

watershed of the Sava and one for Adriatic Sea watershed. The enterprises are responsible, for instance, for the management of rivers and the nearby zones and for the protection of water and water sources to ensure that enough good-quality water is available for the water supply. They also monitor water quality and collect fees for water abstraction and discharges. In Republika Srpska the Public Water Management Enterprise has similar responsibilities for the whole entity. It reports to the Ministry of Agriculture, Forestry and Water Management. These public enterprises do not have direct links with the entities' Environment Ministries. This, together with the responsibilities of these public enterprises and the new river Authorities, is another arrangement that requires clarification under the new Laws on Water Protection.

The municipalities in both entities are responsible for building and operating the water-supply and sewerage systems and the treatment facilities for waste water. In Republika Srpska they are also responsible for urban flood protection. This is not the case in the Federation.

Almost all the main rivers in Bosnia and Herzegovina cross the entities' borders, and there is a considerable need for cooperation and coordination of actions and instruments between the two entities. The Inter-entity Commission for Water was therefore established in 1998 with four members from each entity. The Commission is responsible for the cooperation between the relevant ministries in both entities for all water management issues, including harmonization of regulations and water quality. So far it has been a useful body for sharing information and initiating action of mutual interest. However, if the entities' interests are contradictory, it is difficult for the Commission to make the necessary decisions, and in such cases there is little or no progress.

Many of these issues of coordination and responsibility are addressed in the draft memorandum of understanding with the European Communities. In the existing draft, it is agreed that the Council of Ministers would establish an environment agency at the State level, which would, inter alia, "bear responsibilities in the water sector for fulfilling the following main obligations:

- Address all international issues dealing with water;
- All matters of common interest that the entities want to bring at State level;
- Harmonize data collection/dissemination (IS Standardization/training);
- Assessment of technical performance of river authorities and water boards;
- National public awareness campaign; and
- Coordination of the planning and management of all international and inter-entity flood control projects."

As a part of the memorandum of understanding, the Parties also "pledge" that they will establish river authorities in the entities which will enjoy legal and financial autonomy. The river authorities will, among other things, plan all water and water-related environmental projects within their jurisdiction; collect and process data and maintain the water database; license water abstraction, discharge and water regime changes; and control and monitor floods and flood defence.

Bosnia and Herzegovina has already established water agencies for the river basin Bosna and the river basin Vrbas as pilot projects. The intention is to have water authorities for all river sub-basins, including, as defined in the Laws on Waters, the Una-Sana, Sava, Vrbas, Bosna, Drina, Trebišnjica, Neretva and Cetina.

Monitoring

From 1965 to the outbreak of the war, data for both water quality and quantity were collected from 58 monitoring stations all over the country. During the war, all monitoring stations were destroyed, and there were no data available for the period 1992-97. Since the end of the war the monitoring network has been gradually re-established, partly with financial contributions from donors. Still, the number of monitoring stations seems to be far too low, and few automatically measure both water levels and water-quality parameters. At the other monitoring sites, water quality is measured only occasionally, when funding is available.

To meet the need for reliable data and information on water quality, the information needs for decision-making and water management should be analysed thoroughly before a decision is made to increase significantly the number of monitoring stations, the number of analysed parameters and the frequency of sampling. In any case, the laboratories will have to be upgraded because most of them lack proper equipment for analysing water quality.

Water pricing

The price of water supply and waste-water discharges is far too low to cover the full costs, and the sector is either subsidized by the entities, cantons or municipalities, or it suffers from insufficient maintenance that will jeopardize the water-supply and waste-water systems in the long run. Due to the economic crisis and the poor service, there is, however, stiff resistance against increasing the tariffs. Illegal connections and inadequate systems for collecting the tariffs are also adding to this problem. (See chapter 2, on economic instruments and privatization)

Table 2.2 in chapter 2 shows differences between average water and waste-water tariffs for households in the two entities and some European countries.

7.4 Conclusions and recommendations

Bosnia and Herzegovina is endowed with abundant water resources though they are unevenly distributed and most precipitation comes when it is least needed. However, there should be no doubt that water resources provide an important economic potential for the future.

The quality of water resources is endangered by pollution from various sources, e.g. organic pollution and hazardous substances from municipal and industrial waste water, uncontrolled landfills and tips, industry and mining, pesticides and fertilizers, deforestation and soil erosion. The quality of surface water is considerably influenced by all this pollution, while the quality of groundwater with some exceptions is still quite good. There is, however, an urgent need to take action to prevent the large-scale contamination of groundwater.

To enable prosperous exploitation of the water resources, a number of shortcomings in the water sector have to be overcome. They include a weak and non-transparent administration, an incomplete or confusing legal framework and an unclear division of responsibilities between different authorities.

Recommendation 7.1:

(a) The Government of the State of Bosnia and Herzegovina, in cooperation with the Government of the Federation of Bosnia and Herzegovina and the Government of Republika Srpska, should develop and adopt a new State water law based on the EU Directive that would, inter alia, establish autonomous river authorities.

(b) The Government of the Federation of Bosnia and Herzegovina and the Government of Republika Srpska should adopt the new Water law, which will include institutional responsibilities for both water protection and water management.

The water infrastructure was severely damaged during the war, and even before the war the water-supply systems suffered from a lack of investment and maintenance. So although it is estimated that 90% of the water-supply sector has been rehabilitated to its pre-war level, it still does not reach international standards. The quality of drinking water is on the whole mediocre, and for the nearly 50% of the population who do not have access to public water-supply systems the water quality is probably even more questionable.

Recommendation 7.2:

(a) The Government of the State of Bosnia and Herzegovina, in cooperation with the Government of the Federation of Bosnia and Herzegovina and the Government of Republika Srpska, should develop a new water policy pursuant to the memorandum of understanding with the European Communities and taking into account the Millennium Development Goal to halve by 2015 the proportion of people without access to safe drinking water.

(b) The Federation's Ministry of Physical Planning and Environment and Republika Srpska's Ministry of Physical Planning, Civil Engineering and Ecology, in cooperation with their Ministries of Agriculture, Forestry and Water Management, should start now to:

(i) Ensure that drinking water is safe by properly treating abstracted water;

(ii) Develop water protection strategies consistent with the new State policy and the Millennium Development Goals;

(iii) Establish standards and norms for water quality which are consistent with international ones; and

(iv) Reduce the leaks from the distribution systems by repairing and replacing old and damaged pipelines. The number of households with access to public water-supply systems should be substantially increased.

(c) As soon as they are established, the river authorities should develop plans for river basin management.

Discharges of untreated municipal waste water have a major impact on the quality of surface water in most of Bosnia and Herzegovina, and they are also potential threats to the quality of groundwater, which are the main source of drinking water. However, the most serious impact is on public health and the environment.

Recommendation 7.3:
The entities' Ministries of Agriculture, Forestry and Water Management in cooperation with the entities' Ministries of environment and with the help of the public enterprises for water management, should assist and require the municipalities to reduce the negative impact of waste-water discharges by:

(a) Reducing the leaks from public sewerage systems and by building new sewerage systems to substantially increase the number of household connections;
(b) Building municipal waste-water treatment plants of environmentally high standards and with sufficient treatment capacity in all the big cities; and
(c) Ensuring that sewage sludge from municipal treatment plants and septic tanks is sufficiently treated for use as fertilizer in agriculture or disposal in sanitary landfills.

Waste water from industrial plants containing organic and hazardous substances are, with very few exceptions, discharged into the nearest watercourse with little or no treatment. This is also true for seepage water containing hazardous substances from mining and ore-processing. The negative impact on water quality is considerable, and there is no doubt that these discharges could represent a threat to public health and the environment. Moreover, this situation must be expected to get much worse when industry recovers from the devastating effects of the war, unless proper action is taken.

Recommendation 7.4:
The Federation's Ministry of Physical Planning and Environment and Republika Srpska's Ministry of Physical Planning, Civil Engineering and Ecology, in cooperation with the other ministries involved, should take appropriate action to reduce the negative environmental impact of waste-water discharges from industry and seepage water from mining and manufacturing by:

(a) Ensuring that water treatment plants are reconstructed and brought on stream again;
(b) Drawing up a survey of the most polluting mining, manufacturing and other industries; and
(c) Instructing mining, manufacturing and other industries to take immediate and appropriate action to stop or reduce the discharges where drinking-water resources are seriously threatened.

Flood protection installations have been poorly maintained, and dikes, channels and pumping stations were damaged or destroyed during the war. Some large areas that are exposed to flooding do not have flood protection installations at all. Since the end of the war Bosnia and Herzegovina has not experienced extremely high water levels, even if a flood in the Tuzla region caused large-scale damage in 2001. However, extremely high water levels must be expected in the future. If there is no proper flood protection in place, they could cause many casualties and much material damage.

Recommendation 7.5:
The proposed environment agency, with the Federation's Ministry of Agriculture, Water Management and Forestry and Republika Srpska's Ministry of Agriculture, Forestry and Water Management, should work in close cooperation with the new river authorities on an urgent basis to reduce the impacts of floods. Steps to be taken include:

(a) Improving and repairing, in cooperation with the regional and local authorities, existing flood protection systems and building new ones in exposed areas that do not have them, and taking non-structural measures for flood protection, in particular the conservation or rehabilitation of natural wetlands and retention areas; and
(b) Drawing up a comprehensive national flood disaster strategy, which includes preparedness, mitigation, recovery and reconstruction.