Chapter 5

DEVELOPMENT OF SUSTAINABLE WATER MANAGEMENT

5.1 The new framework for water management

The 1997 Strategy for Integrated Water Management

The 1997 Strategy envisages, among other things, water management by catchment area. It is an adaptation of the French experience and is in line with the EU Framework Directive. Water is considered to be a national heritage held in common and managed as a whole under the authority of the MEW, while sectoral uses (for energy purposes, irrigation, domestic drinking-water, etc.) are supervised by sectoral ministries.

In a river basin management scheme management would be extensively decentralized. Basin Councils and Basin Directorates would have wide-ranging authority to implement the national policy set by the government. Permit taxes and water rights would provide some self-financing capacity at the basin level and within a "National Fund for Water Resources". Implementation has been sought in three stages:

- Collecting information, acquiring knowledge and understanding; evolution of institutional responsibilities; drafting legislation and a strategy for water protection and use
- Enforcing the Water Law (regulatory work, creating basin institutions, drafting basin management plans, etc.)
- Establishing the actual working of basin institutions.

A positive accomplishment of the 1997 Strategy was the 1999 Water Act, but because of insufficient means, most of the other tasks it envisaged are either overdue or incomplete. The major weakness, however, is that the Strategy deals essentially with water objects rather than with water systems as a whole.

The 1999 Water Act

The law entered into force in January 2000. The provisions of the Water Act followed the orientations indicated in the 1997 Strategy, i.e.:

Public ownership of - or responsibility for - water, water sites and related main economic systems:

- Management and protection of water objects overseen by the Ministry of Environment and Waters
- Economic water use policies implemented by specific ministries
- Water management to be organized in terms of river basins.

The Water Act envisages water management at three levels: the Council of Ministers, the Ministry of Environment and Waters (MEW) and the Basin Directorates. In addition, the policies for the various uses of water or water ecosystems is determined by sectoral ministries but is expected to comply with the national water policy. When the Water Act entered into force, the MEW asked four of its 15 regional inspectorates to act as temporary substitutes and make provision for the setting up of Basin Directorates. The management by river basin is weaker in the Water Act, however, than as foreseen in the Strategy, as the Basin Directorates are given little financial and regulatory autonomy, and the Basin Councils are not mandated to take final decisions.

National plan and river basin plans

The National Water Economic Plan will be prepared under the guidance of the MEW. It is intended to be the framework for River Basin Management Plans, and for sectoral usage policies. It should be prepared after consultation with other interested ministries, be subjected to public discussion, and reviewed by the National

Consultative Water Council before approval by the Council of Ministers.

The content of the River Basin Management Plans is more or less complete, except for aquatic ecosystem assessment, protection, restoration and use. It is mainly focused on the quantity and quality of water objects and the economy of their uses.

The MEW leads experimental work to prepare a management plan for a sub-basin of the Yantra river, an affluent of the Danube. It is thought that basin management plans should first be prepared on a sub-basin level, where practical local issues can be negotiated. The experience is expected to help the Ministry to assess the complexity and costs of data collection, hydrosystem studies, public information, dialogue and negotiation, all of which will be necessary for the elaboration of a comprehensive basin management plan.

River basin management plans will probably take five to ten years to become available to all Basin Directorates, academic institutions, private engineering companies and local NGOs as required. The Ministry has not yet drafted a plan of action for writing terms of reference, setting priorities and schedules, neither has the staff needed in the Basin Directorates or external organizations yet been assessed nor the costs evaluated.

Permits and control

The spectrum of activities or works that require permits under the new Water Act is quite comprehensive. It includes notably:

- Water regime modifications
- Linear infrastructures encroaching upon water objects
- Extraction and discharge of surface or ground water
- Extraction of sand and ballast
- Use of water objects for recreation, sports, aquaculture.

Depending on the nature or size of the respective objective or activity, the permit is issued by the Council of Ministers, the MEW or the Basin Directorate. However, in all cases, the Basin Directorate will have a major role to play in analysis, negotiating demands and preparing the decision of the mandated body.

The MEW plans to systematically reissue permits for all existing activities. All applications will include an ecological analysis and proposals for remediation, accidental situation management and self-monitoring. The implementation of this plan will eventually fit into the Environment Impact Assessment Procedure and remediation policy of the MEW.

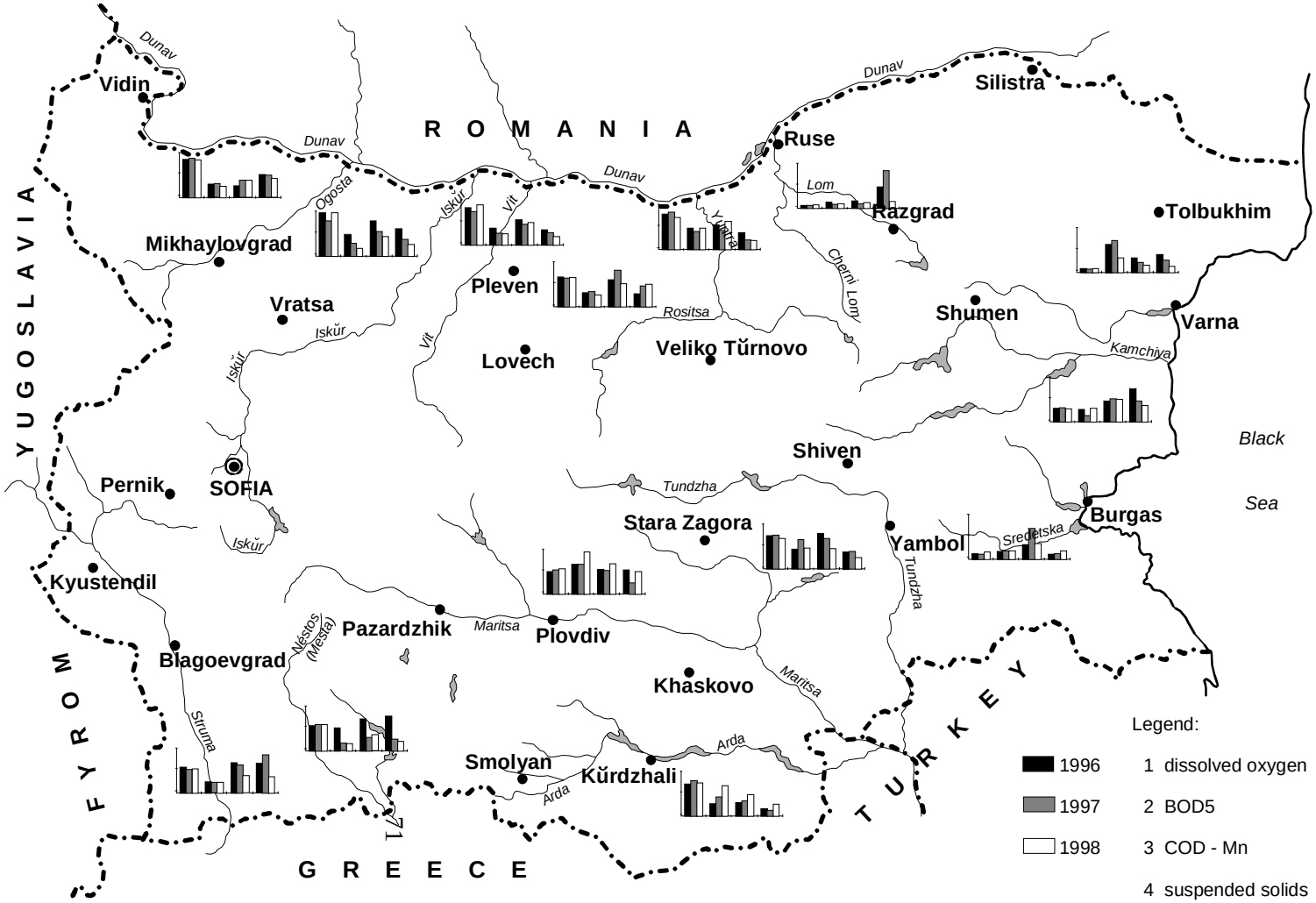
It is obvious that such an authorization scheme will be difficult to implement before some strength and capability is built into the Basin Directorate, and before the Basin Management Plans are drafted and approved. On a river section, where the global effect of all impacts on the whole aquatic ecosystem has to be assessed, individual analysis of impacts is generally irrelevant. Furthermore, the global coherence of individual remediation plans has to be checked against actual quality and quality objectives, to be set by the Basin Management Plan. Before the new authorization and control scheme can function smoothly and effectively, considerable planning and regulatory work is needed. Consequently, the MEW seeks a progressive implementation, starting with provisional permits of three years' duration, which can be revised once Basin Management Plans are available. Permits may require a scheduled reduction of impacts, associated with an investment plan.

Financial incentives

The Water Act defines principles for economic stimulation of rational use, protection and restoration of water and water objects. Water prices are set at levels covering the full cost of services, the polluter-pays principle is to be implemented, and payments are a function of the quantity used or the pollution loads generated. As an incentive to water savings, water supply companies and associations cannot charge users the cost of water losses exceeding 25 per cent of the water abstracted.

The law is quite clear about administrative fees, fines for violating the law, and remedies for damage to water objects. The amount of fees to be paid will be established by the Basin Directorates, and collected by the National Environmental Protection Fund. The tariff for fees are either determined by the law, or fixed by the Council of Ministers. It is not entirely clear, how the polluter-pays principle is implemented in terms of the fees for water use. To induce rational use of water

Figure 5.1: Quality of Surface Waters in Bulgaria, 1996-1998



bodies, fees should include the external costs of user activities, and this would call for further legislative and regulatory development.

The National Environmental Protection Fund may allocate subsidies or loans to water users for water protection investment. Basin Directorates have no direct control over financial incentive schemes that might be applied, this being a major limitation to basin management.

5.2 Hydrosystem monitoring

Hydrological monitoring

Hydrological monitoring is managed and operated by the National Institute of Meteorology and Hydrology, a branch of the Academy of Science. Its programmes and budget are initially prepared by a scientific advisory council, before being approved by the president of the Academy. The programme is not easily suited to other users' needs for hydrological information (administrations responsible for the environment, hydro-electricity, flood protection, irrigation, etc.).

The Institute operates 209 stations on rivers (132 with limnigraphs) and 461 for ground water monitoring (328 wells and 133 springs). The technical quality of river gauging, level measurement, and discharge evaluation is excellent, but the equipment is rather old (20 years or more) and inefficient. All data for the year are available in April of the following year. Four automatic real-time telemetric stations, integrated into the international Metrokos Project and financed by the World Bank, are operated by the Institute. The staffing and the number of gauging stations is half of what it was in 1989. This has led to a serious lack of information about the country.

Data management, data analysis and publication are rather scant. Paper publications are delayed, computerized data and standard hydrological analysis are not publicly available, and are sold by the Institute in an effort to acquire financial resources. General statistical indicators for the stations are not available. Correction for hydro-electricity operations and large abstractions are not performed on a routine basis.

Physico-chemical monitoring

The Executive Environmental Agency is in charge of chemical monitoring of the surface and underground water resources. This monitoring is not fully co-ordinated with the hydrological monitoring. The Executive Agency has its own discharge measurement teams for the quality monitoring stations.

For surface waters, a new network of 254 stations that comply with the Eurowater standard has been in operation since July 1997. Since 1 January 2000, 111 of the stations have been integrated into the Euronetwork of the EU, managed by the WRC in England. No linkage scheme was designed using data from the previous network that had provided data since 1976. However, the quality of sampling and analysis is satisfactory, although relatively inefficient due to insufficient equipment and management.

Data management, analysis and publishing need extensive improvement to transform the raw data into information suitable for water quality assessment, policy planning and control, for the emerging Basin Directorates.

There is no organized monitoring of organic or metallic toxic substances in sediments or biological accumulators (aquatic plants or fish). The trophic status of rivers and lakes is not monitored.

Simple groundwater quality parameters are monitored at about 250 stations. For financial reasons, most of them are located at drinking water abstraction points, a practice that does not permit satisfactory monitoring of the general quality of groundwater.

Hydro-biological monitoring

Hydro-biological monitoring has been carried out since 1992, using a standard bioindex method. It is a rather detailed monitoring, performed in river basins every six years or so. A useful complement to the physico-chemical monitoring could be obtained, if yearly evaluations would be carried out for a significant proportion of the stations, appropriately distributed over the whole river network.

Ecosystem monitoring

Aquatic ecosystems are not monitored on an organized basis with standard protocols. The most important national Ramsar Convention wetland is monitored by academic institutes and NGOs, generally in connection with the MEW and some kind of technical and financial agreement.

Analytical laboratories

The Executive Environmental Agency manages a main laboratory in its Sofia facility, and regional laboratories in the Regional Environmental Inspectorates. The production of data from physico-chemical monitoring is of satisfactory quality, but the lack of automated laboratory instruments is a limitation on the efficiency of the operation. The laboratories do not appear to be ready to confront a large increase in quantity or a change in the type of analysis - a capacity that will be needed in the future. The evolution of the situation in the direction of few independent laboratories, capable of handling large volumes of data, and working with increased efficiency and effectiveness, under a certification scheme managed by the Executive Environmental Agency, and charging real costs to any user, is a likely perspective.

Monitoring of water resources: uses and pressures

The most important water abstracts are available in terms of yearly volumes. The data are collected on forms, which are sent both to the statistical agency and the Executive Environmental Agency. There are no specific data covering the dry season, when minimum runoff in rivers may be insufficient. Detailed data on the modification of water regimes by dams and reservoirs are kept by their operators, but no central collection of such data takes place. This could well be difficult, owing to the absence of a common monitoring protocol.

Urban and industrial discharges are monitored through forms filled in annually by the regional water companies and the 1,070 industrial facilities, reporting on the volumes treated (mechanically and biologically) and discharged. Similar but different forms have to be filled in for the national statistical agency and for the Executive Environmental Agency. For control purposes, occasional sampling and analysis of discharged water is carried out. No information is available about industries discharging into urban sewage networks.

Due to the lack of detailed monitoring of the treatment processes, self-monitoring of the discharging activity, and sufficient control analysis, it is not possible to estimate yearly or seasonal pollution loads discharged into rivers. It is hoped that in a not too distant future, the Water Act will provide for better monitoring of discharged pollution loads under the authority of the Basin Directorates.

Little is known about effluent management by important cattle breeding farms, and whether slurry and manure are used as fertilizer or discharged. No data is available for nitrate or pesticide discharges into groundwaters from large intensive or irrigated cropping.

5.3 Drinking-water and waste-water treatment

General organization

The Water Act of 1999 does not provide unequivocal guidance concerning the ownership of facilities, nor determine the legal responsibility for providing drinking water and sewerage. At the national level, the Ministry of Regional Development and Public Works has the global responsibility for drinking-water supply. The Ministry of Health is in charge of quality control of drinking water. Until 1999, most facilities were owned and operated by publicly owned companies at the district level. There were 22 such companies. Since 1999, 49 per cent of the ownership of those water and sewerage companies has been transferred to municipalities. The Sofia water and sewerage company was a municipal property and partially privatized in 1999.

Treatment facilities

It is generally acknowledged that most drinking-water and sewerage facilities in Bulgaria are in poor condition, due to faulty design and building, and lack of maintenance and ineffective operation as a consequence of the decline of the economic situation in the past decade. Average leakage in the drinking-water distribution network is more than 50 per cent. External pollution of distributed water is frequent. Most of the network is built from asbestos-cement pipes and needs replacement.

Policy

The current fundamental objective in medium- and long-term planning for investment, maintenance operations and water prices, is to attain financial equilibrium without permanent public subsidies. The investments are planned to meet EU standards. Delegation of the management of facilities is pursued as a means to facilitate financing and technology transfer, as well as providing for better operations and water price collection.

The Sofia facilities, apart from the waste-water treatment plants, have been under concession since

1999. Tenders for concessions for the municipality of Varna, and for Dobrich and Shumen, two other municipalities nearby, are expected by the end of the year 2000. In the years to come, the Ministry of Regional Development expects privatization to increase considerably.

Water price development scenario

The average price paid by domestic users for drinking water is 0.55 leva per cubic metre (in a range of 0.30-1.20 leva), and the price for sewerage 0.15 leva (range of 0.10 - 0.20 leva). This price level represents a two- to fourfold increase since 1989, in a move to substitute user payments for subsidies. Due to declining income and the deficient system of collection of payments due, a significant number of individual users do not pay, but no global data were available at the time of the EPR Review Mission. Industries which are traditionally used to very low water prices are heavy users of drinking water, and under the present degraded economic conditions, many of them cannot pay their higher priced bills.

Even taking into account the low level of wages and potential improvement in efficient water use, still higher relative water prices will be required in the future to meet EU standards for drinking water and waste-water treatment. An average price of 2 leva per m^3 would be a minimum. This is clearly unacceptable within the next ten years for social and economic reasons. It is clear that an effective growth of revenues from drinking-water sales will take years to materialize, and will be linked to economic recovery. It is therefore necessary, when planning long-term investment, to recognize that improvements of this type of income will be slow and, in the meantime, to organize some form of public funding.

Planning for the renewal of facilities

Water companies do not develop a comprehensive long-term investment plan. Detailed knowledge or estimates of discharged pollution loads is not yet available, choices about the separation of sewerage for rainwater and waste water have not been made, the scheduling of repairs or reconstruction of sewerage networks has not been established, choices about storm water management before discharge are not clear, control over industrial discharges into urban sewerage networks is not effective, actual waste water levels are unknown and schedules of treatment (BOD and later nutrient) cannot be implemented, the disposal of treatment sludge requires integrated, interdependent pre-engineering studies, and financial evaluations and global scheduling are not yet available.

In 1999, in response to EU requirements, MEW prepared a national programme for priority construction of urban waste-water treatment plants for populated areas with over 10,000 Eq. inhabitants. The programme has been approved by the Council of Ministers.

There are plans for developing the use of domestic waste-water treatment sludge as fertilizer as an alternative to landfill dumping. The implementation of such a plan, if dangerous hazards to soils in terms of pollution by toxic elements are to be avoided, would presuppose the existence of substantial, complex controls of industrial discharges in most important cities. Landfilling of sludge, accompanied by control and proper management or treatment of lixiviated waters, might thus have to be favoured in most cases for quite a few years.

Delegated management and restructuring of water companies

The existence of large water companies at the district level is a real advantage, for both technical and economic reasons. In this respect, the Bulgarian situation is similar to that of the United Kingdom. It is easier to optimize the use of production factors at the regional level, as well as to negotiate and control sub-contracts. Unfortunately, institutional factors seem to favour the disaggregation of water companies into smaller entities at the municipal level, as follows:

- The Water Act does not prescribe the setting up of institutional associations of municipalities at the district level to take responsibility for drinking-water supply and sewerage. Therefore, there is no single legal authority entitled to negotiate and control a global concession on behalf of all the interested municipalities and the government.
- Bulgarian law has no provision for public subsidies to private companies. Since national and international financing is expected for waste-water treatment plants, this part of a company's water facilities will frequently be separated for later privatization. This was the case in the 1999 concession of the Sofia facilities.
- Representatives of municipalities may not yet have sufficient understanding of the issues

related to the delegation of public services or facilities. This makes it difficult for them to agree on a common policy. Local interests, and private operators of drinking water and sewerage companies, have a natural tendency to try to retain the most profitable parts of water facilities.

Protection of drinking-water resources

Most drinking water is abstracted from groundwater, and a lesser part (as for Sofia) from multi-purpose artificial reservoirs. Villages, especially in mountainous areas, draw drinking water from a large number of small springs, but this does not account for a large part of the population. Quality monitoring managed by the National Centre for Hygiene, Medical Ecology and Nutrition shows a 20 per cent rate of non-conformity to the national standards (which are in line with EU standards). But most of the non-conformity is not viewed as serious by the Ministry of Health.

Along with the bad condition of distribution networks, the bad quality of water objects and the insufficient treatment of raw water are the major causes of non-conformity. Therefore, the protection of resources from industrial, agricultural or domestic pollution is an important problem, requiring future resolution. Alluvial ground waters are polluted through soil pollution from industry or agriculture, and the protection at the point of abstraction is too local to be effective in large feeding areas. Eutrophication of reservoirs is frequently a source of difficulty in customary treatment processes.

A significant proportion of drinking water from alluvial reservoirs is close to the 50 mg/l standard for nitrates. This is not a public health priority for the Ministry of Health, but it could become a future issue for the agricultural policy in large irrigated plains, along with the presence of agrochemicals not yet monitored.

5.4 Hydroelectric and irrigation dams and reservoirs

The total reservoir volume is 5,000 million cubic metres. This volume is 15 to 30 per cent of the natural runoff of Bulgarian rivers. Three million cubic metres belong to the dams and cascades of the national electric company, which operates 43 dams, 6,171 km of derivations and 500 abstraction sites. A new big dam is under construction on the Arda river, in cooperation with Turkey, and there is an important project to complete the derivations and abstractions scheme for the hydroelectric complex in the southern mountains.

This hydraulic infrastructure has a considerable impact on the water regime and, subsequently, on various aspects of the aquatic ecosystem in the reservoir lakes and downstream. It affects the temperature and quality of water flowing from the reservoirs, can cause insufficient runoff in derived segments or upstream rivers, modification of seasonal variability, a huge daily variation of runoff, and subject biodiversity to stress. The potential impact of the discharge of sludge accumulated behind the dams when they require emptying for control or maintenance, has not yet been provided for. The hope that no emptying will ever be necessary seems optimistic.

A process of privatization and concessions should be considered in the next few years for hydroelectricity facilities and, in the longer term, for irrigation reservoirs and main supply networks. An extended and detailed Environmental Impact Assessment of hydraulic equipment and operations would then be necessary, at least to guide the planning of new investments and the terms of future concession or privatization contracts. Such assessment will certainly show the environmental and economic interest of some remediation work to be incorporated in the contracts and scheduled within the next 20 or 30 years.

5.5 Irrigation and drainage

In the years 1950 to 1989, Bulgaria set up huge agro-engineering drainage and irrigation works. They were built and managed by the national irrigation company, whose staff now comprises 2,600 (at the head office in Sofia and 22 regional branches). This company has an excellent technical capacity with regard to agro-hydraulic issues, and exports its know-how to a number of other countries.

The maximum extension of irrigation was reached in 1989, with 800,000 ha. This surface corresponds to 20 per cent of arable cropland in Bulgaria, and most of the flat alluvial plains. Drainage and irrigation are associated with 80 million cubic metres of water reserves in 200 dams, and the necessary network of mains and collectors, mostly gravitational. The national irrigation company manages 3,000 km of dikes for flood protection. Drainage water is pumped from the collectors into the rivers. Irrigation water is pumped from the

reservoirs and, mostly, from rivers (eventually re-fed from the large multi-purpose reservoirs managed by the hydro-electricity company). The main crops grown are corn, rice, vegetables, and fruit.

The yearly water use for irrigation ranges from 1,000 to 5,000 cubic metres per hectare, according to climate and crop. The total irrigation needs for a 1/5 frequency dry year could reach 2,500 million cubic metres, i.e. most of the natural runoff during the irrigation season. The impacts of irrigation and drainage on river ecosystems and on alluvial groundwater quality are not being comprehensively assessed.

Since 1989, this infrastructure, which cannot be adequately maintained, is degenerating rapidly. Farmers are reluctant to pay for irrigation water (rates are 0.05 leva for gravity adduction and 0.30 leva for pressure water), and the needs are decreasing along with demand for and production of agricultural goods. The income of the irrigation company is far from being sufficient to finance the necessary maintenance and repair work. The land redistribution programme disrupted the farmers' organization necessary for the management of the irrigation and drainage facilities. The irrigated surface therefore shrank by 28 per cent to 580,000 ha. The national irrigation company expects and is planning for a long-term technical-economic equilibrium at 400,000 ha of irrigated land.

Plans are being prepared for major repairs and restructuring of the network at this reduced scale. The technical and financial feasibility of a two-step programme (for implementation in 2000-2025 and 2025-2050, respectively) is being examined together with the World Bank, whose financing is expected. Complementary schemes are being prepared to organize farmers into local irrigation associations, responsible for end-of-line hydraulic networks and crop selection. The main infrastructures could be privatized by river basin management in a few years. The objective is to revive agricultural production, increase farmers' income, and bring the Bulgarian agro-hydraulic heritage to economic efficiency. The protection or remediation of aquatic ecosystems is not yet a major concern. Consequently, this area offers opportunities for the development of further project objectives.

5.6 Water pollution from waste management

Lixiviated or accidental pollution from waste deposits or tailing ponds are a major hazard to surface and groundwater in Bulgaria, as well as to aquatic ecosystems. A precise assessment and monitoring of this hazard for effects of radioactive tailings of the closed uranium industry is being undertaken, and a remediation plan is being developed. Similar action is lacking for groundwater and river pollution from other industrial and mining waste deposits. Heavy metal pollution in river sediments appears to be rather widespread, but is neither appropriately surveyed nor monitored. Waste sites are not considered to be pollution discharges to rivers and groundwaters but in fact should be regulated as such.

New mining concessions (for gold ore in particular) are potentially hazardous to rivers and require regulation for careful (and costly) waste management.

5.7 Aquatic ecosystems

Systematic surveys of river and riverside ecosystems are in general lacking, or scant. In mountains, river ecosystems downstream of mining waste dumps and hydro-electric works are probably seriously affected. The standard arrangement for rivers flowing through plains (dykes and drainage of riparian space) destroyed their natural ecology leading to poor biodiversity.

Valuable knowledge of major wetlands (notably in the Danube and the Black Sea areas) was derived from their ornithological interest and the Ramsar Convention. Their biodiversity is extremely rich (in terms of birds, fish, mammals, insects, plants, etc.). Large areas along the Danube river were destroyed, however, by agro-engineering works. A partial revivification of such areas has been left for the future.

Most of the Bulgarian wetlands of major interest have been impacted by industrial pollution, civil engineering works modifying the water regime, or destroying habitats. A plan for remedial action was drafted for the MEW, but its enforcement depends on strong political will and finances which are not yet clearly identified and available.

5.8 Conclusions and recommendations

Despite the fact that there has been no sign of improvement in river water quality since the mid-nineties, a very positive development is the growing consciousness and understanding of the unsatisfactory situation and the building of a suitable institutional framework to overcome the difficulties. The EU accession goal gives a strong impulse to Bulgarian water policy. But in some respect this policy appears imperfectly grounded in reality and needs. A clear strategy with the financial and human capability to implement it has still to be set.

The 1999 Water Act of Bulgaria is an excellent framework for the development of sustainable water management. Its implementation will be long, difficult and expensive, more than is usually expected in the country, and the actual building of this solid foundation for sustainable water management should be the highest priority. Building up the monitoring network and the basin institutions call for detailed action plans, funded and controlled by the Water Directorate of the MEW, and should be implemented by the future River Basin Directorates.

Recommendation 5.1:
Based on the Water Act of 1999, detailed action plans should be drafted and implemented for the installation of a related monitoring network and the creation of the necessary basin institutions. The implementation of such plans should be designated a priority for international funding. The monitoring system should become part of a modern system of data collection, analysis and dissemination to all user groups.

Substantial time, effort and financing are required to improve the monitoring, as well as the knowledge and understanding of water ecosystems. The MEW should rapidly draft short- and long-term plans of action and allocate a substantial share of available public finances to their implementation. It is suggested that the implementation of such plans should also become a priority for international financing.

The national water monitoring system should be extended. Particularly required are more frequent bio-index measurements, monitoring of toxic elements in sediments and biological integrators, and measurement of the geomorphology and ecology of water systems. The constitution of a few independent laboratories for analysis of monitoring samples should be planned and facilitated. Such labs should be allowed to work for any public or private organization. Large sized laboratories, the prescription of common sampling and analysis protocols, and a certification procedure could induce efficiency and quality.

The data production function of the National Institute of Meteorology and Hydrology should be integrated into the national water monitoring system and achieve some independence from the Academy of Science. The main users of such data (academia; administrations dealing with the environment, agriculture, energy, and regional development; NGOs and others) should be associated with the development of the objectives for the network.

The Executive Environmental Agency should develop more standard data analysis and presentations using raw data from monitoring. This is necessary to nourish the decision, planning and control processes effectively. A number of such quality assessment tools are available in the EU, defining quality classes for the main uses of water, its sites, and the way to compute the actual quality class from the raw data.

The practical implementation of most monitoring, data management and analysis, quality assessment, public data and information dissemination should be done by the Basin Directorates, under the authority of and following protocols issued by the Executive Environmental Agency. The Agency should be in charge of national aggregation, synthesis, and information. It is a general recommendation that more value can be expected from monitored data nationwide when they are publicly and easily available at low cost. Such diffusion has now been facilitated by Internet technologies.

River surveys are urgently needed in Bulgaria for relevant river basin planning, enabling the identification of issues as well as their analysis. They should be managed by the Basin Directorates under the authority and guidelines of the MEW. Sufficient funding should be allocated as soon as possible. As in the case of monitoring, the surveys should become a priority for domestic and international financing. The carrying out of the surveys, following an appropriate process of tendering, can provide an opportunity to strengthen the ability to conduct such studies among Basin Directorates, NGOs, academic institutions and private engineering companies. It is also

recommended that over the next five to ten years mixed Bulgarian/EU member-country teams be favoured as a vector for technological transfer.

More attention should be given to the physical and hydrobiological aspects of water systems, which are currently only considered as a natural infrastructure and major producer of quantitatively regulated water of good quality. Training, communication, testing for river basin management plans, and the permit process in both the Basin Councils and Basin Directorates will progressively build efficient processes.

Recommendation 5.2:
The future River Basin Directorates should, as a matter of priority, undertake river basin surveys and identify and analyse issues for corresponding basin planning. Furthermore, in their work, they should give special attention to the physical and hydrobiological aspects of water systems. The task necessitates the presence of adequate expertise in the future Councils and Directorates.

The perspective for privatization of hydro-power generation, and the need for extensive restructuring, repair and maintenance of the irrigation system should provide a real opportunity for a better integration of those major impacts on the hydrosystem. Extensive Environmental Impact Assessment of the facilities and their operations are needed. They should, among other effects, cover the ecological consequences of modified runoff regimes and water quality, and the pollution of ground and surface water by intensive irrigated agriculture. Long-term schedules for remedial action should be included in the privatization deals and in the restructuring of irrigation facilities.

The renaturation of some important drained wetlands along the Danube river is a priority of the national plan for restoring and protecting wetlands. Further, irrigation restructuring is an opportunity to study and organize a real protection of groundwater resources by inducing permanent vegetation, low yield high quality agricultural practices on large areas, feeding the groundwater abstraction stations. It is also an opportunity to create "green corridors" some 50 to 100 metres wide along rivers in irrigated plains and to restore some natural functions of surface and underground aquatic ecosystems.

Recommendation 5.3:
The generation of hydro-electricity, as well as irrigation schemes, should be better integrated into hydrosystem management efforts. The tool of Environmental Impact Assessment should be used extensively in this regard. Long-term remediation programmes should be part of privatization contracts, particularly for irrigation schemes. Needs derived from the declared objectives of wetland restoration and of general nature management should be taken into account.

The integrity of regional water companies is a powerful advantage, which should be strengthened through comprehensive long-term integrated planning of action and investment. In all respects, regional water companies have opportunities for economic and technical economies of scale and efficient cooperation between neighbouring municipalities. It is therefore recommended that disaggregation of regional water companies be avoided. This would call for some regulatory and legislative adjustments:

- The association of municipalities and the State within legal authorities for the purpose of organizing drinking-water supply and waste-water sewerage and treatment should be introduced into the legal system. Corresponding institutional bodies should have the right to delegate and control these functions after their possible privatization or concession.
- Subsidization of private companies in charge of delegated management of a regional water company should become a legal possibility.

The Ministry of Regional Development and Public Works and the MEW should develop guidelines for the urban water management delegation process and respective contracts, by agreeing on accounting rules, economic and quality auditing, price evolution, negotiation rules, investments programmes, required public financing, and other relevant conditions. Some transfer of experience could be obtained from EU countries, particularly the United Kingdom, where an elaborate control scheme is operated for regional companies.

Recommendation 5.4:
Modifications should be made in regulatory and legislative rules in order to maintain the operation of regional water companies. The Ministries of Regional Development and Public Works and of Environment and Waters could enhance the delegation of urban water management to regional companies through the joint development of appropriate guidelines. The necessary control scheme could be based on relevant practices in European Union member countries.

Sound integrated long-term plans are necessary to underlie and circumscribe proper investment or delegation. Complete and precise pre-engineering studies for all water companies, undertaken by independent engineering firms, could help to fill this gap. It could be a priority for international funding. Financing, tender and supervision of such studies should be managed by the regional water companies, under close control by the municipalities, the MRDPW and the MEW. The studies would contain:

- An assessment and analysis of the actual state of facilities
- A schedule for reaching goals for adequate drinking water supply, for quality of water discharges, for availability and protection of water objects, for storm water and for sludge management
- A long-term global investment plan (including broad technical specifications, costs, revenues, and funding of facilities)

Recommendation 5.5:
Pre-engineering studies by independent engineering firms should be undertaken for all water companies, under the joint control of the Ministry of Regional Development and Public Works, the Ministry of Environment and Waters, and the Municipalities concerned, possibly financed from international sources.

More focus on all components of aquatic ecosystems (river beds and embankments, wetlands and riversides) is needed. The institutional framework in Bulgaria focuses on water quantity, quality and economic uses, but does not clearly support an integrated apprehension of water systems in the broad sense (quantity and quality of water *as well as* the aquatic ecosystems and the physical milieu where water runs). In this sense, the water systems are, among other benefits, the most effective infrastructure for water quality and quantity and should be known, protected and managed as such.

The privatization policy and various planning processes can be a real opportunity for better sustainable management of water systems, but this is not fully recognized and accounted for.

The consistency of water plans with the national or regional user plans calls for explicit guidelines, including assessment and arbitration procedures. Such general hydrosystem protection guidelines for water usage plans should be prepared under the responsibility of the ministries responsible for regional development, agriculture, and energy. They should be drafted in agreement with the MEW and the Ministry of Health and then be approved by the Council of Ministers. They should stipulate the inclusion of explicit measures for hydrosystem protection in the national and local plans by the aforementioned ministries, when using or impacting water and aquatic ecosystems. The measures should be subject to approval by the MEW.

Recommendation 5.6:
The necessary guidelines ensuring consistency between water plans and water use requirements at national and regional level should be developed in cooperation between the ministries concerned and should include explicit measures for aquatic ecosystem protection.

Recommendation 5.7:
The reduction of excessive water use, as well as of losses of water in distribution, should remain priorities for water management. A policy regarding the long-term development of water prices should become an instrument for the achievement of these goals.