HOUSEHOLD WATER USE AND MUNICIPAL WASTE WATER DISCHARGES ALONG THE DANUBE: ACTIONS FOR THE MUNICIPALITIES GIURGIU AND VIDIN

Study report UBM No. 1993/4

Danube Project Group

Paul Absil
Marc ter Brugge
Marleen Dijkman
Adriana Gheorghe
Daniela Kirilova Nedialkova
Catherine Rubbens
Tivadar Szegletes
Jana Zacharová

UBM/EPCEM

Colofon

Dit rapport is opgesteld door een interdisciplinaire werkgroep van het Instituut voor Milieuvraagstukken van de Vrije Universiteit van Amsterdam als onderdeel van de Universitaire Beroepsopleiding Milieukunde en de EPCEM 1992/1993.

Dit rapport is tegen de prijs van *f*35,- verkrijgbaar bij:
het Instituut voor Milieuvraagstukken IVM/VU
De Boelelaan 1115
1081 HV AMSTERDAM
Tel. 020-5483827

De Universitaire Beroepsopleiding Milieukunde is een samenwerkingsverband van het Instituut voor Milieuvraagstukken (VU), het Centrum voor Milieukunde (RUL), de Interfacultaire Vakgroep Milieukunde (UvA) en het Centrum voor Milieustudies (LUW).

This report has been written by the interdisciplinary working group in the Institute for Environmental Studies at the Vrije Universiteit of Amsterdam as part of the European Postgraduate Course in Environmental Management and the UBM 1992/1993.

The report is available at a price of *f*35,- at:
The Institute for Environmental Studies IES/VU
De Boelelaan 1115
1081 HV AMSTERDAM
Tel. 020-5483827

The European Postgraduate Course in Environmental Management is a co-operative venture between the Institute for Environmental Studies (Vrije Universiteit of Amsterdam), Centre of Environmental Science (State University of Leiden), The Interfaculty Department of Environmental Science (University of

Amsterdam) and the Centre for Environmental Studies (Agricultural University of Wageningen).

PREFACE

An interest in the rehabilitation of the Danube crosses international boundaries from East to West. It is for this reason that "The Danube Project Group" was set up: a group of 4 East European and 4 Dutch post-graduate students from various disciplinary backgrounds. This group has undertaken, as part of their post-graduate training in the environmental sciences, a four and a half months study on a particular environmental problem related to the Danube.

The students are taking part in the University Professional Environmental Course (UBM) and the European Postgraduate Course in Environmental Management (EPCEM) which is organised by four universities in the Netherlands.

The group members are:

Paul Absil (Holland)	Foodchemistry and microbiology
Marc ter Brugge (Holland)	Political science
Marleen Dijkman (Holland)	Medical biology
Adriana Gheorghe (Romania)	Economy and law
Daniela Nedialkova (Bulgaria)	Civil engineering in water purification
Catherine Rubbens (Holland)	Economy
Tivadar Szegletes (Hungary)	Biochemistry
Jana Zacharova (Slovakia)	Ecology

The project received assistance in the day-to-day functioning of the project from the following routine supervisors:

Alison Gilbert (Australia)	Ecology (concerning the content of the project)
Frans van der Woerd (Holland)	Economy (concerning the content of the project)
Mieke Tromp Meesters (Holland)	Biology (concerning the procedural aspects)

The information for our study has been derived from different studies and from written and oral comments from various experts in the European Community, the Netherlands, Romania and Bulgaria. These experts represented non-governmental organisations and different governments at several levels. Opinions and ideas in this study, when not stated otherwise, are of the Danube Project Group.
The advice of the Supervisory Committee (oral comments/discussions) and the Advisory Committee (written comments) assisted the group in selecting our topic and in developing the project.

The members of the Supervisory Committee are:

Prof. dr. J. Dogterom	ICWS
Ms. dr. ir. G.M. van Dijk	RIVM
Dr. G.P. Hekstra	VROM/DGM/SVS
Ir. A.B. van Luin	RIZA, Afdeling Informatie & Ontwikkeling
Drs. W. Verhoog	Stichting Reinwater

The members of the Advisory Committee are:

Mr. Florin Stadiu	Secretary of State, MWFEP, Romania
Mr. Atanas Paskalev	Ecoglasnost, Bulgaria
Mr. Ilya G. Natchkov	MoE, Bulgaria

Mr. R. Holland	EC Danube Programme Co-ordination Unit
Mr. P. Glas	Delft Hydraulics
Mr. J.L. Fiseleer	DHV

We would like to thank the goodwill and the help of each person, who has contributed to the successful completion of this report. Special thanks are also due to Robert Groenewold for his production of the organograms, and Ms. Els Hunfeld for her patience with us during our hectic moments at the secretariat.

TABLE OF CONTENTS

SUMMARY

1. Pollution of the Danube

The Danube is the second largest river in Europe (2857 km long) and crosses eight countries before it reaches the Black Sea. The Danube forms several unique and valuable ecosystems and supports 76 million people living along the course. Its water is used for many different purposes like drinking, agriculture (irrigation), industries, energy, transport, fishing and as a natural sewerage. These different and intermingled functions increase the need for a sustainable use of the Danube.

Regarding the present water quality of the Danube river, it is noted that compared with its tributaries the water quality of the Danube is often considerably better. Compared to other large rivers in Europe, the water quality of the Danube can be deemed as quite similar. Contrary to the relatively good water quality of the Danube, the pollutant loads that enter into the Black Sea are very high due to the enormous flow rate of the river. The average annual water flow of the Danube is 170 billion m^3 which is three times higher than the flow of the Rhine. Therefore, the application of the water quality standards, valid for the Rhine river, would result in a 2-3 times increase of the loads of polluting substances into the Black Sea. This is consequently no solution to the pollution problem. In the Danube Delta and the North-Western part of the Black Sea, the loads of pollutants from the Danube and the direct discharge of organic matter from the coastal zone have already caused disturbances in the natural balance of ecosystems and a reduction of the biodiversity. These changes affect not only the nature within the river basin, mainly its last sections, but also human welfare, such as living conditions, fishing, and recreation. At the same time the unfavourable phenomenon of eutrophication can also cause health risks.

Up until now, research about the pollution of the Danube has mainly focused on the main polluters: industries and agriculture. The proportion of household waste water is about 10-12% of the total volume of waste water discharged into the Danube. However, there are four essential reasons why it is relevant to focus on pollution from households. Firstly, municipal sewage discharge significantly contributes to the pollution because of the addition of organic matter, nutrients and locally, pathogens. Secondly, substances like nitrates and phosphates are only partially removed by the natural cleaning capacity of the Danube, many remaining compounds end up in the Black Sea and will cause more severe problems in the future. Thirdly, the problems related to waste water discharge will only increase in the long run due to the development of the cities located along the river. This is because with the advent of Western consumption patterns, the quantity and composition of the sewage will change in a negative manner. Finally, by choosing the household sector a direct involvement of the people can be achieved. Increasing awareness of the environmental problems at the household level could have a spin-off effect that public pressure could increase to solve the environmental problems from the non-household sectors.

2. Goal of the Project

The goal of the project is to contribute to a reduction of the pollution of the Danube by household waste water discharges, and at the same time to decrease the drinking water consumption by households.

One of the reasons Romania and Bulgaria were selected for the project is because they were neglected in research studies and so far have received less international support. Furthermore, these countries have to cope with many problems due to the fact that several negative effects of the Danube water pollution are located downstream. The two municipalities - Giurgiu in Romania and Vidin in Bulgaria - are representative for the average environmental conditions along the Danube. Both towns are relatively small (about 70,000 inhabitants) and have a relatively limited number of industrial activities (which have decreased significantly since 1989).

To reach the goal of the project, two Action Plans were created, based on detailed analyses of the present situation in Romania and Bulgaria.

3. Situation in Romania and Bulgaria

Since 1989, Romania and Bulgaria, like all Eastern European countries, face significant political changes towards a democratic system. The shift towards a market economy is symbolised by a liberalisation of prices, the return of land to the former owners and the starting of the privatisation of state enterprises. This process has led to a reduction of the production and to a switch from heavy industry to light industry, services and trade. All of these changes have both social and environmental implications.
The unemployment rate has risen sharply (in Bulgaria to 15% of the labour force, in Romania to about 5%). Rising unemployment in combination with increasing prices and taxes cause great concern because of their effects on the average family budget. Regarding the situation of specialists, there is a tendency for them to leave the state sector, because of the high salaries in the private sector.
An environmental implication of the transition process is that the interest for the environment is likely to be relegated to a less important priority.

Generally, water is a scarce resource in Romania. From the total water resources used in the country, the Danube provides approximately one third. All towns along the Danube discharge their municipal sewage into the river and only 200 municipalities in Romania have their own sewage treatment plants. Treatment facilities are lacking in big cities such as Bucharest, Brasov or Cluj. Existing facilities are obsolete. For example, the city of Giurgiu possesses a treatment plant with only a mechanical step and has reached its maximum operating capacity.

The quantitative and qualitative aspects of water management are under the responsibility of various organisations in Romania: firstly, the Ministry of Waters, Forestry and Environmental Protection which has a co-ordination role of environmental activities at the national and the local levels. At the local level the MWFEP has Branch Agencies for Environmental Inspection and Survey. Secondly, Apele Romane which is the state company for raw water supply. Thirdly, the Ministry of Health which monitors the quality of water for drinking, bathing and irrigation. Finally, the local governments play at present an increasing role in safeguarding the environment. In Giurgiu the Environmental Commission which is co-ordinated by the City

Council to solve local environmental problems. Non-governmental organizations working in the environmental field have only recently started their activities and their present contribution is still weak.

The water from the Danube is used in Giurgiu only for irrigation and for industrial purposes. According to the Branch Agency, the Danube has a satisfactory quality except for an occasional high concentration of phenols.

In Bulgaria, due to the fact that the groundwater is of a very good quality, it is the main source for drinking water supply. The national average connection to the water supply system covers almost the whole population (98%) whilst it is lower for the sewage system. The water supply and discharge facilities are not satisfactory; there is a very high percentage of water losses along the distribution system. The equipment in the treatment plants (when it exists) is outdated. The main organisational bodies that are active in the field of water management are the Ministry of Environment, the Ministry of Public Health, the National Water Council, the Ministry of Regional Development and their regional branch agencies. The water companies deal with water supply, discharge and treatment. They are state or municipally owned and it is possible that they will be privatised in the future. The water companies have now been given the responsibility to set water tariffs. They are facing at present severe financial difficulties.
In the field of the environment, many legal and economic changes are under preparation or await parliamentary approval. For example, there is the introduction of pollution permits, charges and fines for polluting activities. Environmental awareness and public participation are growing in Bulgaria but could be further increased.

Vidin is supplied with drinking water of high quality coming from the ground. It does not suffer water restrictions. The mixed sewage system is for households and some of the industrial waste water; the waste water is discharged into the Danube without treatment. The Danube water quality in Vidin causes some health problems, especially in the summer, when the river is used for swimming.
The water supply pipes are in a bad condition and losses from the water distribution system are considerable (about 40%). Leakages from the sewer system and from septic tanks of households as well as the water discharged into the Danube have not yet been studied. Prices for drinking water are lower than the current supply costs. Pollution taxes and permit systems have not yet been implemented. The water company, the Inspection (municipal and regional) and the Hygiene Epidemiology Institute are institutions dealing with water management and environmental protection in Vidin. The overall environmental awareness of the people can be considered as relatively low. Some schools in Vidin pay attention to ecological issues. The most active NGO in the region is Ecoglasnost.

4. Some differences in the field of water management

During the research period, some differences in the field of water management became apparent between the two countries at the national and local levels.
In Romania, the situation is different at the national and the local level. At the national level there is a state company for water supply, which sells raw water to all users. At the local

level, there are mixed local enterprises belonging to the municipality. They are responsible for both drinking water supply and waste water treatment.
In Bulgaria, one body is responsible for the drinking water supply and the waste water treatment. Some of these bodies are state companies and others are under the co-ordination of the municipalities. However, there is an overall tendency towards privatisation within the sector.
Non-governmental organisations are developing in both countries. Although their activities and main objectives are not yet very clearly defined, it can be said that there is a strong political interference of some NGO's activities (e.g. Ecoglasnost) in Bulgaria. This is not the case in Romania.
Vidin is relatively more autonomous than Giurgiu.

5. From problems to solutions

An analysis of the problems concerning the pollution of the Danube caused by household waste water proves the interdisciplinary character of the project. Both in Romania and Bulgaria main causes can be found in the technical, organisational, legal and international field. These main causes find their origin in underlying economic, social and organisational problems which are quite similar for both countries. Therefore, it is possible to formulate similar objectives for the future water management policies for both countries.

In order to reach these objectives, active participation at both the national and the local levels is required. The proposed Action Plans focus on the local level because many proposals for the national level already exist and in the last period the power of the municipalities has increased significantly.

6. Action plans for Giurgiu and Vidin

All the actions for both Giurgiu and Vidin mostly depend on the existence of funding possibilities. The availability of national funds plays an important role in the tentative prioritisation. The required investments in the field of water management can, however, be surpassed in importance by other investments that require more attention.

The actions suggested for Giurgiu:
1. Gradually increase the local price for drinking water supply and waste water treatment in order to cover the costs and influence the reduction of the water used in households.
2. Prepare a well-motivated list of project concerning the water management and promote it to the national authorities.
3. Install water meters in each individual house not yet having one and in each new tower block.
4. Extend the sewage network connected to the households. Repair or replace the leaking sewerage network and properly maintain this sewerage network in the future.
5. Repair or replace the leaking water supply distribution system (in the streets) and properly maintain these pipes in the future.
6. Support the privatisation of existing units in the field of repairs and servicing for the household sector.
7. Adopt and enforce local ordinances concerning the water supply and the water use in specific situations.

8. Improve the quality of the control of discharge of pollutants and improve the enforcement of sanctions.
9. Increase the co-operation with other municipalities in Romania in the field of environment and especially in the water management. Create a common fund with other municipalities within the judet for financing big investments in the field of water management (e.g. a common treatment plant to deal with phosphate and nitrate).
10. Co-operate with foreign municipalities in the field of water management.
11. Improve the working conditions for personnel responsible for operations and maintenance of the sewerage network, the water supply system and the waste water treatment plant.
12. Initiate a programme for public information in which the local organizations, NGO's and the mass media are involved.
13. Initiate an optional environmental education programme in schools at all levels.

In Giurgiu, it is advisable that the local authority mainly concentrates its efforts, in the short term, on the elaboration of a realistic inventory of all actions which should be carried out to improve the present state of the water resources. Subsequently, a list of priority projects which should be promoted to the national authorities may be elaborated with the large participation of all the responsible organisations for water management activities at the local level.
At the same time, activities such as public information and public awareness may be initiated using the mass media, local meetings, school lectures, NGO's, etc.. Clearly, without support from the local population, the future actions will become inefficient and difficult to implement.
The local authorities need to increase their support to the privatisation process in the field of services and maintenance of the water devices in households, with the aim to increase the quality of the reparations, and finally to reduce the water use.

All these three actions require small financial resources and prepare the local population for the future implementation of actions in later stages. Only after a good preparation of the local population can more drastic actions such as an increase of the prices for water supply and treatment, the setting up of local taxes and charges for water use/pollution, or big investments (such as the extension of the sewerage network or the construction of a new waste water treatment plant) be considered.

Finally, the development of an extensive co-operation with other municipalities in Romania and abroad may be very useful and could contribute to an active exchange of information, experience and mutual assistance. In this respect new tendencies, practices and methods initiated in the field of the water management, which are environmentally friendly and imply less costly investments, may be considered for the future development of the area.

The actions suggested for Vidin:
1. Introduce a flexible system for drinking water supply favourable for economizing customers; and stimulating the installation of separate water meters in households.
2. Construction of a municipal waste water treatment plant with phosphate and nitrate removal.
3. Extend the sewerage network to include most of the households in the municipality of Vidin.
4. Replace in stages the obsolete water supply network with pipes from reliable materials and set up an appropriate maintenance and repair system for the existing network.

5. Establish co-operation and a clear division of tasks between different institutions dealing with water management and environmental protection.
6. Enhance the role of the Regional Environmental Inspectorate in the preparation of emission and pollution permits for municipal waste water treatment.
7. Create conditions to attract highly educated personnel in the institutions dealing with water management and environmental protection.
8. Acquire sufficient equipment for monitoring discharge and water quality of the Danube.
9. Organise the detection and control of the main causes for water losses in the municipality (illegal connections, leakages in households).
10. Initiate at the municipal level the establishment of an Environmental Centre in Vidin as a border area with Serbia and Romania with the aim to provide information about environmental problems concerning the three countries.
11. Initiate the establishment of a twinning programme with a town in Western Europe to exchange information and provide assistance (sister-cities).
12. Stimulate the study of the pollution of the Danube and water management within the school curricula and in optional subjects.
13. Increase the number of people in environmental NGO's and develop the activities carried out by these organisations.

In Vidin, similarly to Giurgiu, priority should be given to several actions in the short term, and others in the long term according to the central criterion (the "availability of funds").
Extensive research may point out if priority in the long term should be given to important investments like the gradual or immediate construction of a new treatment plant, an extension of the central sewage network, or a replacement of the obsolete water supply network.
It is advisable to undertake these research studies as soon as possible. On their basis, the most important investments can then be selected and carried out in the long term, according to "maximum pollution reduction" and "current and future costs".
Operation and maintenance facilities and costs should be thoroughly taken into consideration in these studies.

In the short term, priority may be given to the enhancement of the co-operation between institutions dealing with water management and research, and to the improvement of the working conditions of the personnel employed in these institutions. The transfer of knowledge from foreign developed countries may play an important role here.
The introduction of modern monitoring equipment to measure the sewage discharge and to determine the water quality of the Danube is a short term action. It is relatively inexpensive and will also contribute to the improvement of working conditions and the accuracy of the data.
The local NGO's can perform a contributory role in the development of a twin-city partnership with a Western European municipality. In addition, NGO's can contribute to institution building in the municipality, and to an enlargement of overall environmental awareness in Vidin.

7. Conclusion

As a general conclusion, it can be mentioned that the Action Plans proposed in this study may be of practical relevance, even if they are only partly carried out. Both the general information about Romania and Bulgaria, and the concrete recommendations in the Action Plans may provide a basis for future pre-investment studies in these countries, and in Giurgiu and Vidin

in particular. Depending on local characteristics, the Action Plans can be used for other municipalities in Romania and Bulgaria and other Eastern European countries.
Mainly, the concern for more public awareness, and the proposals for more efficient fundraising techniques could be transferred to other situations.

CHAPTER I INTRODUCTION

1 INTRODUCTION

The Danube is the second largest river (2857 km) in Europe and crosses eight countries. Inadequate attention to environmental impacts from among others households, industry and agriculture, has resulted in significant problems at local, regional and international levels.

Households in urban areas generate pollution caused by inadequate waste water treatment and solid waste disposal facilities. In the industrial sector, serious problems exist related to the emmisions affecting the air, water and soil. Of special concern are those emissions generated by agro-processing, chemical, pulp and paper, metal-processing, mining and textile industries, and the transport sector. Concerning the agricultural sector, the intensification of agricultural practices and livestock production are major sources of non-point pollution of surface and groundwater.
Contaminants deriving from these different sources (households, industry and agriculture) might result in public health risks due to a low quality of drinking water (Somlyódi and Hock, 1991). Prevention of health risks will demand more intensive and costly water purification.
The contaminants also create ecological problems such as eutrophication or structural and functional changes in sediments and whole ecosystems (Buijs *et al.*, 1991).
Environmental problems also arise from the morphological changes due to the canalisation and damming of the river. These changes have harmful effects on recreation, fishing and the intrinsic value of the Danube (Somlyódi, 1991).

International organisations, national authorities, scientists and non-governmental organisations are now involved in attempts to halt any further environmental deterioration and to assist in making the further use of the Danube sustainable.

This chapter describes the motivation for choosing our research topic, the problem definition, the goal, the criteria for selecting the municipalities, and the four main objectives. Finally a short overview about the working procedure will be presented.

2 PROBLEM MOTIVATION

As chapter II will make clear, there are extensive environmental problems in the Danube river basin. The causes derive from different sources that can be classified in terms of households, industry, agriculture and canalization/damming. This report will be dealing with pollution caused by the household sector along the Danube.

The criteria which were of primary importance in selecting household water use and municipal waste water[1] discharges as the topic of this study were the availability of information and the social relevance. The availability of information lies in the fact that a large number of studies and information are already present. For instance, numerous consultancy companies have elaborated Danube basin pre-investment studies which are supported within the Environmental Management Programme for the Danube River Basin[2] (pers. comm. R. Holland; pers. comm. Dogterom). The project group can utilise this experience and information in gathering data for its own research.
Concerning the criterion of social relevance we have noted that historically the purification of rivers always begins with the cleaning up of organic wastes (pers. comm. Fiseleer) of which household wastes are an important component. At the moment there is a lack of treatment capacity in many countries and these systems are obsolete. The subject of municipal waste water discharges is also socially relevant because of the many institutional changes that are presently taking place. For example, Bulgaria is altering its water tax system and decentralising governmental responsibilities. A comparative study between municipalities would possibly allow adoption of our findings to other cities or regions along the Danube.
Additionally, solutions to environmental problems can come about from direct involvement of the people.
Increasing awareness of the environmental problems at this level could have as a spin-off effect that public pressure could increase to solve the environmental problems originating from the non-household sectors (pers. comm. Hekstra).

Although social relevance and the availability of information formed the main criteria for choosing a study on municipal waste water discharges, other criteria, like interdisciplinarity and an international character, have also been taken into consideration. A study on waste water discharges derived from households requires an interdisciplinary approach; an integration of knowledge from both the social and natural sciences. Political, legal and economic factors needed to be studied in combination with biological, ecological and technological aspects to come up with an integral analysis of the problem and its solution.
Regarding the criterion of an international character, it is noted that the pollution of the Danube river has significant transboundary characteristics. Local action to control and manage waste water discharges is important, particularly in the tributaries. However, the quality and sustainability of environmental conditions in most areas of the Danube basin depends on the effectiveness of practices adopted and implemented upstream by other local and national authorities. The critical interdependence of upstream and downstream neighbours for managing the Danube environment can be observed at all levels of the basin (Task Force of Danube River Basin, 1992).

3 PROBLEM DEFINITION

[1] The domestic or urban or municipal waste water consists of emissions of households, emissions of small companies and industries (that have no own treatment plant and sewage system), emissions of institutes (schools, hospitals, offices) and run-off from paved surfaces.

[2] The Environmental Programme for Danube River Basin is co-ordinated by a Task Force Committee. The funds are provided by the following donors. EC-PHARE, EBRD, UNDP, UNEP, GEF (via World Bank), USAID, and the Netherlands Government The long term objective is to achieve the sustainable use and development of the Danube Basin's natural resources. In support of this, the objective of the Regional Environmental Programme is to establish an operational basis for strategic and integrated management of the environment of the Danube River Basin.

This study will deal with the following problem:

The pollution of the Danube river caused by the waste water discharged from households in municipalities and the excessive water consumption by the households.

The quality of the water in the Danube decreases downstream because of the pollution caused by human activities. The household waste water is a significant contributor of the pollution in the Danube river. Approximately 10-12% (KSH, 1989) of the total volume of waste water derives from this sector, the rest is from industry, agriculture and transport. Household sewage contains organic and inorganic substances and some pathogens. These pollutants may create ecological problems such as anoxia, eutrophication, and changes in species composition. The key role the Danube plays in drinking water supply is also threatened (Somlyódi, 1991). There is a health risk for the population due to the bacteriological contamination and adversely affected groundwater quality.

In Eastern Europe there are not enough waste water treatment facilities, consequently a large amount of sewage flows directly into the Danube river. For instance, in Hungary 78% of the collected sewage (municipal, industrial, agricultural) in the whole country was disposed directly into the Danube in 1989. Presently 55.3% of the discharged waste water is going into the river without any treatment in Hungary (Csiti, 1992). The situation in Slovakia, Romania and the former Yugoslavia, is similarly a cause for concern. There is not one waste water treatment plant for municipal sewage along the Bulgarian bank.

An additional problem arises in industrialised areas, where very often the municipal and industrial wastes are collected in the same sewage system. The industrial toxic wastes can destroy the activated sludge and therefore can greatly reduce the effectiveness of the existing biological treatment phase.

The old plants in Eastern Europe do not treat the phosphorus and nitrogen compounds, which can come from households too. One can deal with the waste water through the reconstruction of the obsolete treatment plants and/or the building of new ones. The installation of the equipment requires large investments, which makes it very difficult under the present economic and financial circumstances.
Another approach is to improve the control of waste water discharges, to improve the operations and maintenance of the sewage systems and the waste water treatment plants, and to develop good management practices. These are cost effective ways to increase treatment effectiveness.

It is generally accepted (pers. comm. Heksta; pers. comm. Dogterom) that the use of drinking water by households is excessive. Until now, there were insufficient incentives and/or constraints to make people interested in saving drinking water. The squandering of drinking water results in large quantities of fairly diluted waste water that has to be treated. This forms a problem because this diluted waste water requires treatment plants with a larger capacity, and in this respect new investments (pers. comm. Fiseleer). The household water use can be decreased via technical, legal, institutional, economic and educational measures.

4 GOAL

On the basis of the problem definition the following goal was formulated:

To contribute to a reduction of the pollution of the Danube by households, and at the same time, to contribute to a decrease of drinking water consumption in households to acceptable levels. This will be achieved by presenting Action Plans for two municipalities.

This report will be dealing with two municipalities along the Danube river and focusses on the pollution of the Danube caused by the household waste water discharges. The discharge of pollutants is closely connected with the treatment of sewage which in turn is dependent on the quantity of water used. Therefore, we will also be examining the use of drinking water by households. The recommendations for the two municipalities will be presented in two separate Action Plans.

5 CHOICE OF THE TWO MUNICIPALITIES

Currently, pre-investment studies, carried out under the co-ordination of the Task Force for the Danube River Basin Programme, are primarily focussed on the tributary basins of the Danube. This report aims not to repeat these efforts, but complement them. Consequently, the two municipalities should meet the following criteria:

A) The municipalities must be situated next to the Danube, but not close to the tributaries, which affect very strongly the Danube water quality. Choosing a municipalities near the tributaries would make it more difficult to use measurements to accurately determine the levels of emissions caused by the specific municipality to be studied.

B) The drinking water supply of the municipalities has to be derived preferably from the river or from the bank-filtered wells[3]

C) There should be no study that has already been undertaken/is being undertaken for the municipality selected. The report should provide a basis for a feasibility study for future investments.

D) The two cases should represent the average case of a not heavily industrialised area where sewage systems from industry and household are separate. This makes it easier to determine the contribution of the households to the Danube pollution. However, it has to be realized, that in most cities the municipal sewage system is mixed.

E) The information regarding the municipalities must be available including the economic, organisational, legal and technical data.

F) The municipality should have a sewage system.

G) The two municipalities should be situated in Romania and Bulgaria, because these countries have been comparatively neglected in studies up until now.

[3] The relation between the waste water discharge from one municipality upstream and the surface water intake for drinking water downstream is very weak. The accumulated sum of upstream pollution sources on the Danube will always be more important than one single local pollution source.

On the basis of the criteria mentioned, the project group made a decision to study Giurgiu in Romania and Vidin in Bulgaria.
Giurgiu is a town along the Danube with a population of about 70,000 inhabitants. A few industries (primarily chemical, textile, machine and food) are located in the town. The drinking water comes from the groundwater stocks. The Danube water is utilised only by industry. Although the municipality possesses a sewage system, 20% of the total waste water derived from the households is not collected in this centralised sewage system. Most of the industrial plants have their own pre-treatment units, but the pre-treated waste water goes into the municipal sewage system. After mechanical treatment the sewage is discharged into the Danube.
Vidin is a not heavily industrialised (chemical works, automobile tires) town, situated on the Bulgarian shore of the Danube with a population of about 71,000 people. The drinking water, coming from groundwater sources, has a very good quality. Therefore, purification is not necessary. Waste water from some industrial plants and from the households is collected in the municipal sewage system. Approximately three-quarters of the households are connected to the sewage system. After a very simple mechanical step (screen) the waste water goes into the Danube downstream from the city.

6 OBJECTIVES OF THE STUDY

To achieve the project group's goal, four objectives were formulated. The first objective aims to provide an overview of the pollution along the Danube, and to point out the contribution of the household sector in the pollution. The second objective is meant to describe and analyse the technical, legal, organisational, educational (including public awareness) and economic aspects regarding water use and municipal waste water discharges in Giurgiu and Vidin. The third objective is to make a connection between the problems and the solutions. This will be done by defining in a systematic way, based on the findings of the previous chapters, the problems that need to be solved to reach the project goal. Following upon this, to list a series of objectives to solve the problems. Also to be found under the third objective is the motivation to restrict the elaboration of these objectives to the municipal level. The fourth objective - to make two municipal Action Plans - will contain possible solutions for the problems and questions defined before, in the short and the long term.

First objective (Chapter II):

To document the environmental problems in the Danube related to the household waste water discharges.

This part serves as a general overview about the pollutants in the Danube focussing on the main contaminants of household sewage. It summarizes the principal environmental problems related to organic matter and nutrient load. Special attention is paid to the endangered and the already damaged ecosystems, the changes in flora and fauna in the Danube Delta and the North-Western part of the Black Sea.
The water quality of the Danube next to the two municipalities is specifically described.

Second objective (Chapters III and IV):

To describe and analyse the present technical, legal, organisational, educational (including public awareness) and economic aspects of the water use and municipal waste water discharges in Giurgiu and Vidin.

Case studies in the two municipalities are necessary to provide data that are necessary to define options for the Action Plans.
The degree of pollution arising from the household waste water discharges and the causes of this pollution need to be known write an Action Plan. Causes of pollution by household waste water lie in the water use and the waste water discharge. These causes can be subdivided into technical, legal, organisational, educational (including public awareness) and economic aspects which in turn reflect the broader context of the society as a whole.

Third objective (Chapter V):
To establish a connection from problems to solutions.

The connection between problems and solutions will be visualised by using a "problem tree".[4] The problem tree will show how the pollution of the Danube by household waste water discharges is caused by a number of causes which may in turn find their origin in other causes. The problem tree should reveal the complicated interrelationships between the causes in a structured manner. From this problem tree a series of objectives for Romania and Bulgaria can be formulated to solve the main problem of the pollution of the Danube by household waste water discharges. Not all of these objectives will be elaborated upon in the Action Plans. A motivation for restricting the Action Plans to meeting objectives at the municipal level will therefore be presented.

Fourth objective (Chapter VI):
To create two Action Plans for Giurgiu and Vidin to reduce the pollution of the Danube by household waste water discharges and to decrease the water use by households to acceptable levels.

The water pollution might be decreased by:
- the improvement of the waste water treatment
- the improvement of the water use by the household sector

The aim of the Action Plan is to propose concrete solutions for those problems described in chapters III and IV (and systematically defined in chapter V): the solution to these problems, with their corresponding objectives, are in the Action Plans restricted to those problems which can be solved at the municipal level. The target group is thus the municipality.

The Action Plans will be composed of a list of actions with the responsible authorities and a time frame. Each action will require a more detailed explanation in which legal, economic and communicative instruments to implement the chosen actions are explained.

The actions and accompanying explanations will primarily draw upon our research in Romania and Bulgaria. Recognizing that the Netherlands do not offer a perfect blueprint, we can still

[4] A problem tree visualises cause-effect relations and tries to simplify the reality. At the top of the tree the main problem (pollution of the Danube by household waste water discharges is indicated). The lower parts of the tree clarify which causes contribute to the main problem.

research the Dutch situation and use it as a reference point to learn from their mistakes and experience to suggest possible applicable solutions in Giurgiu and Vidin. This experience will primarily be used implicitly in our report.
We expect that the approach will represent a useful tool for other municipalities in Eastern Europe, especially along the Danube, so that they have the opportunity to use their enlarged power in an efficient way.

7 WORKING METHODS

A working plan was developed to restrict our topic and to plan the research in a structured way. Relevant literature on the Danube river, water pollution and household waste water discharges were studied. To help us restrict our topic and to provide us with background information, we conducted discussions in the Netherlands with experts from various institutions. A study trip to Romania and Bulgaria was organised because not all of the necessary data were available in the Netherlands. In Romania and Bulgaria we interviewed various experts at both the national and municipal level (ministries, NGO's, research institutes, environmental inspection agencies, town halls and water companies).
After our study trip to Eastern Europe we visited water supply and treatment companies in two municipalities in the Netherlands and one in Belgium, in order to learn from the Dutch and Belgian experience (a complete list of all persons interviewed and institutes visited can be found at the end of the report). The Action Plans with the explanations are based on both the verbal and written collected information.

CHAPTER II POLLUTION OF THE DANUBE BY HOUSEHOLD WASTE WATER DISCHARGES

1 INTRODUCTION

Many rivers in Western Europe as well as in Central and Eastern Europe are seriously polluted downstream of major urban areas especially due to the discharge of industrial and household effluents. These discharges are generally combined and do not undergo proper treatment.

Almost all European countries have some problems due to inadequate, unsafe water supply and sewage treatment facilities. In Western Europe in 1980 the population served by waste water treatment plants ranged from 2% in Greece to 100% in Sweden (Preparatory Committee Luzern, 1993).
In so far as municipal waste water treatment plants in the Danubian countries (in Eastern Europe) exist, they tend to be overloaded, and improperly maintained as well as managed. In addition, many large enterprises traditionally discharge liquid wastes requiring special treatment directly into the municipal waste water system.

The large rivers are used for waste water discharge, water supply, fishing, recreation and for navigation. Regarding water supply, in some of the Danubian countries drinking water comes from Danube bank-filtered wells. Then the "chain" of the supply of drinking water drinking water, its use and waste water discharge, is closed and possible pollution directly affects users.
In general, municipal water supply in these countries is sufficient and safe enough not to cause major outbreaks of infectious diseases. Nevertheless, safe drinking water is not always assured especially in rural areas where the central water supply system (which is more controlled) has not been introduced.

In this chapter the pollutants will be listed and analysed focusing on the Danube. As our project aims to study the household sector, the main pollutants coming from households and their environmental effects will be described in detail. The Danube basin also includes tributaries and the Delta. Moreover, the Danube influences the Black Sea. Therefore, special attention will be paid to the Danube Delta and the Black Sea.

2 DESCRIPTION OF THE DANUBE AND THE BLACK SEA

The Danube river flows over a distance of 2857 km and drains an area of 817,000 square kilometres including all of Hungary, Romania and Slovakia, most of Austria and the former Yugoslavia, a third of Bulgaria, significant areas of Germany, small areas of Ukraine, Moldavia and Czechia (Task Force of Danube River Basin Programme, 1992).
The length of the Bulgarian part of the **Danube river**, from the boundary river Timok to Silistra, is 470 km. The length of the controlled Danubian section is 456 km. Surface water is monitored at 11 points in Bulgaria (Ministry of Environment of Bulgaria- MoE, 1993). The Romanian part of the Danube is 1,075 km (including the Delta) (Pers.

comm., Bucharest). The discharges from the tributaries for the following four countries belonging to the lower course of the Danube are: Romanian contribution is 66% (if the total contribution of these four countries is considered totally 100%), former Yugoslavian is 7%, Bulgarian is 22% and Ukrainian is 5%. The average annual water flow of the Danube is 170 billion m^3/year where it enters Romania (ICIM, 1992).

The **Danube Delta**, situated at the end of the Danube River, has an area of 564,000 ha, of which 442,300 ha are in Romania and the remainder in Ukraine (Romanian National Committee for Rio Conference, 1991). The Delta has traditionally acted as an environmental buffer between the Danube river and the Black Sea. It filters out pollutants and maintains the water quality and natural habitats of fish in the Delta and in the environmentally vulnerable shallow waters of the North-Western Black Sea. The Delta is Europe's largest remaining natural wetland, home to several rare bird species, and an important resting point for populations of migrating birds. This area is rich in fish, in extensive reedbeds, forests, grassland and unusual flora and forest vegetation. During higher river flows the Delta has traditionally been flooded, receiving the nutrients that maintain the ecosystem. If the natural resource base of the Delta was sustainably managed it could provide a secure livelihood for the local population, through fishing, reed harvesting, "ecotourism", limited forestry and some agriculture. The Danube Delta was declared a biosphere reserve in 1990, and from that moment onwards, it has become protected by law.

The **Black Sea** is one of the three large semi-enclosed seas in Europe, which are heavily influenced by human activities. The peculiarity of the Black Sea, is among others, its depth (up to 2212 m) and the degree of enclosure. It is connected with the Mediterranean Sea by a narrow and shallow channel (the Bosporous). The shallow biologically productive layer of the Black Sea receives water from a vast drainage basin over five times its own area covering large industrial and agricultural areas in nine countries.

3 WATER POLLUTION IN THE DANUBE RIVER

In water the following groups of polluting chemical substances can be distinguished (Csikós, 1990):

- -heavy metals;
- -some other elements (aluminium, arsenic, fluorine etc.);
- -water soluble salts;
- -halogenated persistent organic compounds (pesticides, polychlorinated biphenyls - PCB, organometallic compounds, oil products);
- -nutrients: nitrogen, phosphorus compounds (nitrate, phosphate) and to a lesser extent potassium; and
- -organic matter.

Identified priorities in the Danube catchment area formulated in an international workshop (Csikós, 1990) are metal pollution (trace metals in ionic form), pollution by water soluble salts and nitrates, phosphates and potassium. The pollution with halogenated persistent compounds (pesticides, PCBs, dioxin), poly-aromatic hydrocarbons, organometallic compounds and phenols are also considered to be of significant importance (Csikós, 1990).

The concentration of pollutants in the main stream of the Danube is in general similar to the improved levels currently found in the Rhine principally because the flow of the Danube (approximately 6,500 m^3/s in the estuary - Buijs *et al*,1992) is about three times greater than the Rhine (approximately 2,200 m^3/s - van der Veen, 1980). There are important exceptions to this rule which include oil; the concentration of which is much higher in the Danube than in the Rhine. Another exception forms the heavy metals which create significant public health and ecological concerns.

The comparison of the current level of chlorinated hydrocarbons in sediments between the Danube and the Rhine is presented in Table 2.1. The sediment concentrations of many contaminants reflect the quality of the overlying water integrated over relatively long periods of time. It can be noticed that, except with lindane compounds, the level of chlorinated hydrocarbons are lower than those ones measured in the river Rhine. For instance, the sedimentary ratio of "new" DDT to its degradation product DDE (DDT is often as much as 30% of the total of DDT and its degradation products) suggests that this pesticide has been used until recently in the Eastern European part of the Danube basin. On the other hand, the quantity used has been insufficient to cause serious contamination of the river. In the case of PCBs the concentrations in the Danube sediments are below the concentrations found in the river Rhine (probably, because the river region is more industrialised in the western countries).

Table 2.1 Concentrations of chlorinated hydrocarbons in sediments in the Danube and the Rhine (Equipe Cousteau, 1992)

Compound	Danube (range) ng/g (dry wt)	Lower Rhine (range) ng/g (dry wt)
Lindane	0.033-6.4	up to 4
DDT	<0.01-24	up to 8
DDE	0.03-16.9	5-17
Dieldrin	<0.002-0.26	up to 2
Endosulfan-I	<0.002-0.35	up to 2
PCB 101*	<0.002-4.1	8-30
PCB 138*	0.021-6.3	14-55

*IUPAC numbers for identifying individual PCB congeners

Note. wt-weight, PCB-polychlorinated biphenyl

The level of petroleum hydrocarbons and PAH compounds, i.e. the concentration of oil and oil residues in Danube are rather high in certain hot spots but are generally lower than those ones in the lower course of the Rhine (Table 2.2). The PAHs are considerably persistent and their carcinogenic properties are have been proven. They are often the products of fossil fuel combustion.

Table 2.2 Concentrations of petroleum hydrocarbons and PAHs in sediments in the Danube and the Rhine (Equipe Cousteau, 1992)

Compounds	Danube (range) µg/g (dry wt)	Lower Rhine (range) µg/g (dry wt)
sigma n-alkanes[1]	1-40	-
UCM[2]	4-530	-
Phenanthrene[3]	0.004-0.58	1-7.5
Fluoranthrene[3]	0.006-1.40	0.1-2.4
Benz(a)anthracene[4]	<0.001-0.73	0.1-1.0
Benzo(a)pyrene[4]	0.002-1.0	up to 1.3

[1]"sigma n-alkanes" refers to the sum of n-alkanes with carbon numbers from 14 to 36. This is a measure of relatively fresh inputs of oil.
[2]"UCM" refers to the chromatographically unresolved complex mixture. This is a measure of degraded forms of petroleum hydrocarbons (principally degraded oil)
[3]These PAH compounds are produced by lower temperature combustion
[4]These PAHs are the result of the high temperature combustion

Note: wt-weight

The levels of certain heavy metals are presented in table 2.3. The Danube sediments span a wide range of concentrations of different heavy metals. The level of mercury in some areas are well above the highest levels found in the lower Rhine. The concentrations of most of the other metals (copper, lead, zinc, chromium and arsenic) also exceed those ones observed for the lower Rhine. This occurs in well defined areas associated with the sources of pollution.

Table 2.3 Concentrations of different heavy metals in sediments in the Danube and the Rhine (Equipe Cousteau, 1992)

Metals	Danube (range) µg/g (dry wt)	Lower Rhine (range) µg/g (dry wt)
Cadmium	0.35-4.70	0.0-5.2
Mercury	0.11-5 55	0.4-1.8
Copper	19-290	65-158
Nickel	17-70	38-68
Lead	23-420	81-238
Zinc	73-2000	377-770
Chromium	35-310	79-123
Arsenic	9-48	16-27

Note: wt-weight

The table 2.4 provides an overview about the sewage contamination of the Danube river through an indicator, called coprostanol. This compound is produced within the digestive tracts of higher developed animals by the microbial reduction of cholesterol and is one of the principal sterols in human and animal faeces. The levels of coprostanol in Danube sediments are highly variable and appear to be related to the proximity to major human settlements. From the comparative Table 2.4 it is obvious that sediments in the Danube are heavily polluted.

Table 2.4 Concentrations of coprostanol as a faecal sterol in sediments in the Danube and other rivers of western Europe (Equipe Cousteau, 1992)

Compound	Danube (range) µg/g (dry wt)	Sewage sludge µg/g (dry wt)	Comparators µg/g (dry wt)
Coprostanol	0.15-56	910-7800	9 (average)[1] 0.1-14[2] 1.0-24[3]

[1]Mersey estuary at Liverpool, UK
[2]Clyde estuary, Scotland, UK
[3]Lower Rhone river, France

Note: wt-weight

Finally, Table 2.5 shows that, despite a relatively low nitrate and nitrite content, the load of the Danube is as high as that of the Rhine. The concentration of total phosphate in the Rhine and the Danube in 1989 was practically the same, but the total phosphate load of the Danube is similar to the load of the Rhine in 1975 when the quality of the Rhine was much worse than that of the Danube now.

Table 2.5 Comparison of nutrient concentration and load of the river Rhine and the Danube (Dogterom, 1992)

River at the estuary	Nitrate + Nitrite		Total phosphate	
	Conc. mg/l	Load tons/year	Conc. mg/l	Load tons/year
Rhine 1975 (Lobith)	3.2	223,080	0.73	49,880
Rhine 1989 (Lobith)	4.6	265,390	0.34	19,480
Danube 1989 (Reni)	1.8	276,920	0.35	55,020

Concluding these data, one can say that the levels of industrial and agricultural organic chemicals appear to be somewhat lower in the case of the Danube than in the case of the Rhine, but that evident problems with heavy metals, some oil derivatives and household sewage exist. Since the Danube on average transports three times as much water as the Rhine, the Danube loads are always three times larger than those of the Rhine, while the concentration is the same. This has a considerable consequences for the Black Sea.
The situation in the tributaries is even more severe because in many cases the concentration of pollutants greatly exceeds acceptable standards (Task Force of Danube River Basin Programme, 1992).

4 HOUSEHOLD WASTE WATER: POLLUTANTS AND EFFECTS

4.1 Pollutants

One of the sources of the Danube pollution are households. For example, in Romanian towns along the Danube, 776,200 inhabitants discharge the domestic waste water without treatment (ICIM, 1992).
Domestic sewage can seriously affect water quality by introducing three main pollutants: organic matter, nutrients and pathogens.

Organic matter is discharged into water courses more than any other pollutant. This organic matter contains a wide range of carbon compounds, the primary source of which is domestic sewage. Another source is industrial effluent coming from tanneries, paper mills and textile factories.
Organic matter is broken down in water by aerobic microbes. The oxygen required for this process is taken from the surrounding water thus diminishing its total oxygen content. The amount of oxygen required for microbial decomposition can be measured as biochemical oxygen demand (BOD). Generally over 75% of organic matter emissions (indicated by BOD) comes from municipal sources in Eastern Europe (Preparatory Committee Luzern, 1993).
There are two other indicators used to estimate the amounts of organic matter present in water. Firstly, chemical oxygen demand (COD) is the amount of oxygen required to oxidize the organic compounds using a powerful chemical oxidant. The reason this parameter is introduced is that not all organic matter can be decomposed by living organisms, but only by strong chemicals. Thus COD also refers to special kinds of organic substances. The other parameter used is the dissolved oxygen content which is required for the respiration of aerobic micro-organisms as well as other life forms. It is expressed as either a percentage of water's oxygen carrying capacity or in mg/l. The dissolved oxygen content also depends on the water temperature and other physical characteristics of the rivers, lakes, ponds. In data evaluation these facts have to be taken into account.

Small doses of **nutrients**, namely nitrogen and phosphorus are essential to the metabolism and growth of all aquatic organisms. But man-made sources of nutrients can upset the natural balance of organisms living in water and cause eutrophication.
Main sources of nutrients are agricultural fertilizers, some industrial activities (mainly food industry, animal farms, slaughterhouses and milk factories) and cities. From urban areas sewage and detergents are discharged as well as general urban run-off from roads and built-up areas.
European rivers have by far the highest average levels of nutrients; in some cases nitrate levels are 45 times the natural background concentrations. The amount of nitrates in drinking water should follow the WHO guideline of 10 mg nitrates per litre (Wheal, 1991).

Municipal wastes include faecal material which can contain **pathogens** such as viruses, bacteria, protozoa and fungi.
These pathogens come primarily from sewage that is discharged directly into water courses. Pathogens can also enter water supplies from stormwater run-off or as a result

of soil percolation from landfills or from agricultural areas where minimally treated waste water is used on crops.
Because water-borne pathogens are difficult to detect in the laboratory, water is tested for "indicators" - easily measured organisms, the presence of which indicates that water is contaminated with faecal matter. The most commonly used indicator of faecal contamination is the presence of bacterial micro-organisms called faecal coliform, so faecal contamination is often expressed as the number of faecal coliform per 100 ml of water. *Escherichia coli* (*E. coli, Esch. coli or Bact. coli*) is one of the most common, non-pathogenic bacterium. However, where *Bacterium coli* can be found, less easily detectable pathogenic bacteria can also grow.
According to the WHO, total coliform in drinking water should not exceed 10 per 100 ml and faecal coliform concentration should be zero (Wheal, 1991).

4.2 General effects and problems

The primary and the most well-known effect is the process of **eutrophication.** It means collapsed natural balance of the aquatic life caused by nutrient overload[1]. One result of these processes is the **nitrate pollution** of surface- and groundwater reservoirs.
Organic matter can cause **oxygen depletion** whilst pathogens can result in **water-borne infections** such as hepatitis A and gastroenteritis.

4.2.1 Oxygen depletion

The decomposition of organic matter mentioned before creates a significant oxygen demand. Thus, large amounts of organic matter cause severe oxygen depletion in water, which is then unable to support both the decomposition and many forms of aquatic life. The species which are more sensitive to the oxygen content disappear. Therefore, great structural changes in the whole aquatic ecosystem can be observed implying again a broken natural equilibrium.

4.2.2 Eutrophication

Eutrophic water is rich in dissolved nutrients (e.g. phosphates and nitrates), often and seasonally deficient in oxygen. The input of excessive nutrients starts a chain of events which follow a typical pattern (Jeffries and Mills, 1990):

[1] Eutrophication is a form of damage that must be gauged relative to the natural balance that should prevail in the area and the size of the basin Nor do eutrophic waters necessarily have high levels of nutrients present all the time The nutrients may be gleaned and utilized by the plants, especially algae, so quickly that amounts at any instant are undetectable. It is a rate at which they are available, the flux of loadings that is important.

1. Algae blooms. Species able to exploit the conditions break out and can cause, amongst others, oxygen depletion, especially at night. The blue-green algae become increasingly dominant as eutrophication proceeds.
2. Alterations in macrophyte communities. Nutrient sensitive species are lost. Losses of species can also be due to anoxia caused by the enormous oxygen consumption of algae. The overall effect will be a decline in diversity.
3. Sedimentation of "nutrient rich" dead algae, development of benthic algae. Nutrient input may happen together with increased solid effluent that increases sedimentation.
4. The animal life changes again with a loss of diversity. Losses will be due to anoxia, changes in water chemistry and alterations in algae and macrophyte populations. Fish species are progressively affected with the loss of sensitive game fish. Only a few, if any, coarse fish will remain.
5. The entire look of the water changes. Noxious odours develop.
6. Health problems can arise from bacteria and toxins produced by the blue-green algae. Excessive nitrate levels in drinking water are also a health risk, especially for babies. Both adults and infants are vulnerable to carcinogens called nitrosamines, which are formed from nitrate and amine compounds.

Concluding, the changes due to eutrophication processes have some effects on the river ecosystem itself (Danube), on floodplain waters, on the coastal water (due to the discharges from the river) and can influence the sources of drinking water supply.

4.2.3 Nitrate pollution

The high nitrate content of drinking water is a very serious problem in Eastern Europe. The nitrate pollution affects to a large extent the rural population, and the high nitrite content also has some ecological impacts.

The pollutants (like nitrogen and its derivative compounds) are transported by the groundwater into the rivers and back from the rivers into the groundwater. Thus, if the river is polluted, sooner or later the pollutants will occur in the ambient groundwater stocks. One source of the nitrate is the careless and unsatisfactory disposal of household sewage (e.g. septic tank run-off close to wells, streams, etc). Of course, it has to be realized that the main pollutants causing nitrate pollution derive from the intensive agriculture. The role of households can not be however neglected. In many rural areas (also in Romania and Bulgaria) heavily contaminated shallow drinking water wells are used and the population is therefore more at risk than in Western Europe. The high nitrate content in drinking water results in health problems because some nitrogen compounds bind to haemoglobin and can cause suffocation in babies (methaemoglobinaemia[2]).

[2] Methaemoglobinaemia ('blue baby syndrome') is a blood disorder; symptomes are bluish skin, faintness and shortness of breath. Severe anemia occurs because the blood loses the capacity to carry oxygen.

5 STANDARDS FOR WATER QUALITY

5.1 Standards

The concentration of nutrients and organic matter determines significantly the quality of the water. Their indicators are part of the water quality standards.

Table 2.6 Classification of the surface water quality in Romania and Bulgaria (referring to some parameters) (STAS 4706-88, Romania; MoE, 1992)

Category		Nutrients				Organic matter			
		NO_3^-	NH_4^+	P	PO_4^{3-}	DO	BOD_5	COD_I	COD_{II}
		mg/l							
I	RO	<10	<1	<0.1	-	>6	<5	<10	<10
	BG	<5	<0.1	-	<0.2	>6	<5	<10	<25
II	RO	<30	<3	<0.1	-	>5	<7	<25	<15
	BG	<10	<2.0	-	<1.0	>4	<15	<30	<70
III	RO	N.N.	<10	<0.1	-	>4	<12	<30	<25
	BG	<20	<5.0	-	<2.0	>2	<25	<40	<100

Note: NO_3^--nitrates, NH_4^+-ammonium ions, P-phosphorus, PO_4^{3-}-phosphates, DO-dissolved oxygen, BOD_5-biological oxygen demand for 5 days, COD_I-chemical oxygen demand measured by permanganate, COD_{II}-chemical oxygen demand measured by dichromate, N.N.-Not normated, RO-Romania, BG-Bulgaria, I cat.-drinking water, II cat.-agricultural purposes (fishery, irrigation), swimming water, some industrial use, III cat.-mainly for industry (The blank cell means no data is available)

Table 2.7 Classification of the surface water quality according to EC-directives (referring only to some parameters) and the implementation of these directives in the Dutch water law (Trouwborst, 1986)

Category		Nutrients			Organic matter			Pathogen
		NO_3^-	NH_4^+	PO_4^{3-}	DO	BOD_5	COD_I	T.C.
		mg/l		mg/l P	% (mg/l) O_2	mg/l O_2		/100ml
1	EC	25	-	0.4	N.N.	<3	<2(5)	50
	NL	<10	<1.2	<0.2	>5	<7	<30	-
2	EC	N.N.	N.N.	N.N.	80-120%	N.N.	N.N.	500
	NL	N.N.	N.N.	N.N.	>5	N.N.	N.N.	-
3	EC	<0.01*	<0.04	0.2	>7-9	<3	N.N.	N.N.
	NL	<0.1*	<0.8	0.2	>7	<6	N.N.	N.N
4	EC	<0.03*	<0.2	0.4	>5-8	<6	N.N.	N.N.
	NL	<0.3*	<0.8	0.2	>6	<10	N.N	N.N
5	EC	N.N.	N.N.	N.N	>80%	N.N.	N.N.	<300**
	NL	N.N.	N.N.	N.N.	>7	N.N	N.N.	-

*Nitrite concentration, **Faecal coliform

Note: NO_3^--nitrates, NH_4^+-ammonium ions, PO_4^{3-}-phosphates, DO-dissolved oxygen, BOD_5-biological oxygen demand for 5 days, COD_I-chemical oxygen demand measured by permanganate, T.C.-total coliform number, N.N.-Not normated, EC-European Community directives, NL-Holland norms. (The blank cell means no data is available.)
Categories: 1-drinking water, 2-swimming water, 3-water for Salmonidae (salmonoid fish), 4-water for Cyprinidae (carp-like fish), 5-water for shells (it includes also other invertebrate animals)

As is obvious from Table 2.6 there are some differences between standards used in Romania and Bulgaria. In the next five years both countries will accept the EC directives. After this step the measured data about the water quality will be more comparable. The EC regulation uses a different approach in the division of surface water quality. As Table 2.7 shows two categories are human oriented (categories 1 and 2), whilst the last three ones (categories 3, 4, and 5) refer to ecological conditions.

Table 2.8 shows the new ecological objectives in the Netherlands concerning the surface water quality compared to the norms of water companies, EC guidelines, the Dutch water law and the Danube countries regulation. Compared to the values of the former regulation as is given in Tables 2.6 and 2.7, it becomes clear, that ecological requirements are sometimes stricter than, for example, the norms for use of the surface water for drinking water.

Table 2.8 Comparison of standards, guidelines for surface water quality of different organisations: Danube and Rhine (MILBOWA, 1992)

River	Country, organisation (surface water quality)		NO_3^- mg N/l	NH_4^+ mg N/l	Total P mg P/l	DO mg/l (%)	T coli* N/ml
Danube	Romania Cat I.		<10	<1	<0.1	>6	-
	Bulgaria Cat I.		<5	<0.1	-	>6	-
Rhine	RIWA, NL Water Company drinking purpose	A	5.6	0.2	0.1	>80%	20
		B	5.6	0.8	0.3	>60%	-
	Water decision (Dutch law for drinking purpose	T	5.6	0.2	0.2	>6	0.2
		B	11.3	3	-	>4	200
	EC guideline for drinking purpose 75/440	T	>5.6	0.04	0.17	>70%	-
		B	>11.3	1.6	0.31	>30%	-
	MILBOWA Ecological standards	T	-	-	-	-	-
		B	-	0.02	0.15	>5	20
	IRC (Ecol. st.)	T	-	0.2	0.15	-	-

*Thermotolerant coli

Note: NO_3^--nitrate, NH_4^+-ammonium ion, Total P-total phosphorus, DO-dissolved oxygen, B-border value: if it is passed, action has to be taken; this value is on the basis of health risk tests, A and T-target value: on the basis of ecological/ecotoxicological tests or of theoretical estimation, IRC-International Rhine Committee, MILBOWA-Milieukwaliteitsdoelstellingen (The blank cell means no data is available.)

5.2 The attainment of standards

The water quality of the **Danube river** in Romania and Bulgaria is generally good when compared to the standards. However, in certain areas and at certain times the quality of the water drastically decreases mainly due to pollution from the tributaries. It has to be stressed, that a **great amount of pollutants comes from upstream**. Romania and Bulgaria only worsen the already existing pollution.
According to official opinion from Bulgaria, the water quality for the Bulgarian stretch of the Danube is classified as category III (MoE, 1993). (Surface water categories are described in Table 2.6.)
The interpretation of the water quality in Romania is different (Pers. comm., Bucharest). According to the data, the Danube enters Romania in poor condition with a water quality of category III. Then, due to its natural self purification capacity, it improves to category I at Turnu Severin but near the Danube Delta it deteriorates to category II.
According to the Environmental Agency in Giurgiu the Danube water quality meets the requirements of category I concerning the indicators of oxygenisation and mineralisation. From the parameters of mineralisation only the concentration of total phosphorus (0.22 mg/l) is higher than the standard value (0.1 mg/l). Regarding the indicators for toxicity, the Danube water is in category II-a, and the concentration of phenol is over the limit of category I-a (Giurgiu BA, 1993).

Since the construction of the Iron Gates Projects I and II[3] the turbidity of the river water has been reduced and has reached 40% downstream of the Svishtov monitoring point. As a result, a sediment deficit has been created and the processes of erosion and abrasion activated (MoE, 1993).

At present, the **Danube Delta** water quality is relatively acceptable. It accomplishes the standards established for ensuring the aquatic environment life in the main stems. The exceptions are critical periods when the river flow is low, the water temperature is high and during the cold winter periods with a lasting ice bridge. The moderate worsening of the water quality in the Danube arms has caused a **series of negative biological phenomena within the deltaic lakes**. This is due to their eutrophic, hypereutrophic stages which will be discussed in the next chapter.
The Danube Delta water quality is the result of certain complex processes occurring in the entire river basin. But the main factors influencing it are mostly observed on the lower course, particularly for the deltaic lakes and within the Danube Delta (Romanian National Committee for Rio Conference, 1991).

In 1990 the water supply was studied in 2,474 **Romanian** rural locations. According to its results the **nitrate concentration in the drinking water** in 7.1% of locations was above 200 mg/l, in 10.1% between 100 and 200 mg/l, and in a further 19.1% between 45-100 mg/l. In 14 districts more than half of the water supplies exceeded the standard of 10 mg/l. In these districts annually up to 13% of the newborns were reported to develop methaemoglobinaemia. In 1991 there were 181 cases of methaemoglobinaemia including 35 which were associated with diarrhoea[4]. In total, 9 deaths occurred which represent 5% of the 181 reported cases (Preparatory Committee Luzern, 1993).
In Bulgaria approximately 35% of the population is affected by the nitrate pollution of drinking water (MoE, 1993). Two regions face a critical situation: Loudogorie and Dobroudzha. The main cause is excessive use of nitric fertilizers which have infiltrated into the soil and endangered the groundwater.

6 POLLUTANTS FROM HOUSEHOLD WASTE WATER ALONG THE DANUBE IN ROMANIA AND BULGARIA

6.1 Danube

The pollution with **organic substances** at the Danube River can be divided into two groups according to its origin: (1) substances formed in the river itself; (2) influxes by tributaries and direct waste water discharges. The COD (measured as permanganate oxidation) is decreasing downstream along the Romanian and Bulgarian section as self-purification occurs. The values vary between 3.68-4.4 mg O_2/l. However, after Ruse (Bulgarian town opposite Giurgiu) and Vidin the values are locally higher (5.84-7.28 mg

[3] The Iron Gates Projects were finished in the 1970s. The water is dammed to ensure the proper water fall to generate electricity. These two complexes were built at the common border of the former Yugoslavia and Romania.

[4] Diarrhoea means the excessive evacuation of too fluid faeces.

O_2/l) (Buijs *et al*, 1992) because sewage enters the river. This municipal sewage has an influence about 5 km downstream and up to 150-200 m in width. Afterwards, because of the dilution and self-purification, the substances coming from the households are hardly detectable. The COD values in Giurgiu (monitoring point on the left bank) (5.15-8.961 mg/l, 1990-1992, Table 2.9) prove that organic matter content is higher, than they are in the former sections, but the data still fall under category I (Giurgiu BA, 1993). There is a decreasing tendency in organic matter content in Giurgiu from 1990 until 1992, because the industrial activities have slightly diminished. The contribution of the city to the organic matter pollution of the Danube is almost negligible; no significant differences above and below Giurgiu along the Danube (Table 2.9) can be detected. The explanation lies in dilution and the big water flow of the Danube.
The amount of dissolved oxygen (DO) slightly increases along the river in Romania and Bulgaria and changes within limits from 6.1 mg/l to 8.4 mg/l (Tables 2.6 and 2.7 show the water categories concerning the DO content). Taking into account the water discharge of the Danube (6500-8000 m^3/s), the quantity of dissolved oxygen might generally be accepted as normal. However, from Ruse towards Silistra (downstream) there is a reduction of the dissolved oxygen content. In Vidin and in Giurgiu the dissolved oxygen values are high, 8.7 (1992 January) and 5.3-11.5 mg/l (monthly values 1990-1992) respectively. These data refer to water quality I (Buijs *et al*, 1992; Giurgiu BA, 1993).

Table 2.9 The water quality of the Danube river referring to some indicators upstream and downstream of Giurgiu (Giurgiu BA, 1993)

		Nutrients			Organic matter		
		NO_3^-	NH_4^+	P	DO	BOD_5	COD_I
		mg/l					
Year	Cat. I.	<10	<1	<0.1	>6	<5	<10
1990	Upstream	4.16	0.58	0.175	8.80	3.32	8.96
	Downstream	4.95	0.46	0.172	8.92	2.95	8.405
1991	Upstream	5.67	0.67	0.247	8.57*	2.18	5.605
	Downstream	5.38	0.63	0.248	8.54	2.41	6.19
1992	Upstream	6.65	0.49	0.216	9.11	2.31	5.37
	Downstream	7.05	0.49	0.222	9.03	2.24	5.15

*The value in 1991 July was 5.3 mg/l

Note: NO_3^--nitrates, NH_4^+-ammonium ions, P-phosphorus, DO-dissolved oxygen, BOD_5-biological oxygen demand for 5 days, COD_I-chemical oxygen demand measured by permanganate, Cat. I.-for drinking water (according to Romanian standards), Upstream-close to the left bank of the Danube upstream Giurgiu, Downstream-close to the left bank of the Danube downstream Giurgiu (All of the data show the mean value /average of 12 months measurements/ of the given year)

The analysis concerning the Danube water in Romania (monthly loading during the last 30 years) confirms an important increase of the biogen substances - **nitrates and phosphates** - into the river water. In the Danube river the average annual values for the chemical indicators show that after 1970, increases have been recorded for the ammonium ions (1989: 0.23-0.44 mg/l), nitrates (1989: 1.64-1.95 mg/l) and phosphates (1989: 0.16-0.29 mg/l) (Romanian National Committee for Rio Conference, 1991). In 1989 they were about 3-6 times greater than during the previous periods. In Giurgiu

these values were the following in 1992: ammonium ions 0.31-0.96 mg/l (upstream close to the left bank) and 0.023-1.01 (downstream close to the left bank), nitrates 4.2-11.25 mg/l (upstream close to the left bank) and 3.2-11.25 mg/l (downstream close to the left bank), phosphorus 0.14-0.49 mg/l (upstream) and 0.15-0.53 (downstream) (Giurgiu BA, 1993). In Vidin the ammonium ion content was 3.23 mg/l (1992 January); the concentration of nitrate was 0.3-0.74 mg/l and the concentration of phosphates 0.00-0.09 mg/l (Buijs *et al*, 1992). As above data reveal the water quality parameters differ to a large extent even at the same place and period. Therefore, a uniform monitoring system (using the same methods, the same equipment) along the Danube is should be introduced. The data from Giurgiu show a small increase in nitrate content between 1990 and 1992, but again any significant contribution of the city to the pollution could not be detected (Table 2.9).

To gain some idea about the contribution of households to the pollution, some data and estimations are presented in this paragraph. The percentages on the load with inorganic and organic pollutants are shown in Table 2.10. It can be observed that households are significant contributors compared to other sectors, especially concerning the organic pollutants.

Table 2.10 The percentage of different activities on the load with inorganic and organic pollutants discharged into surface waters in Romania (Report for Dublin Conference, 1992)

Type of the activity	Contribution to the discharge into water (%)	
	Inorganic pollutants	Organic pollutants
Agriculture	1.7	29.4
Chemical	45.0	18.3
Others	2.7	1.5
Energy	16.6	-
Communal households	**25.4**	**39.3**
Foodstuff industry	1.4	11.5
Mining	7.3	-

As no precise data were available, some rough calculations were made to estimate the contribution of households in Giurgiu and Vidin to the pollution of the Danube.

In Giurgiu, the discharges of organic matter is approximately 380-550 tons/year, phosphorus is 9 tons/year and nitrate is 27 tons/year from the waste water treatment plant. The data are based on the values measured in the effluent of the two decantors (the last step of the waste water treatment in Giurgiu). From the collected sewage, 39% derives from the households, 60% from the industrial activities and 1% from other

sources, like public institutions (Giurgiu BA, 1993)[5].
In Vidin, it can be concluded that the municipal sewerage discharges approximately 260 tons phosphorus/year and 60 tons nitrogen/year into the Danube, which expresses roughly 0.44% of the total P load and 0.02% of total N load of the Danube into the Black Sea respectively. The ratio of households is 77% relative to the total volume of the centrally collected waste water in Vidin[6].

6.2 Danube Delta

The concentration of different types of pollutants in the Danube Delta water has not been systematically studied. The existing data show a gradual increase of contaminants during the last decades, especially in the amount of organic matter (COD_I), the concentration of nitrates and phosphates (Table 2.11).

Table 2.11 The concentration of organic matter and nutrients in the Danube Delta water (ICIM, 1992)

Period	DO	NO_3^-	PO_4^{3-}
	mg/l (min/max)		
1958-1959	17.9/-	0.97/5.35	traces/0.55
1988-1989	16.8/24.4	6.11/10.19	0.28/1.44

Note: DO-dissolved oxygen, NO_3^--nitrates, PO_4^{3-}-phosphates

The increase of the pollutants is, on the one hand, due to human activities, but on the other hand, it is also due to the water retention in the reservoirs upstream and to the drought (ICIM, 1992).

---

5 The calculations to estimate the contribution of the households in Giurgiu municipality to the Danube pollution are the following:
The volume of the collected sewage is about 650 l/s, which is equal with 37,440 m³/day, if 16 hours/day were used (night hours were not taken into consideration) The concentrations of some parameters in the effluent coming from decantor 1 and 2 are (Giurgiu BA, 1993)
organic matter 27.93-40.67 mg/l; phosphorus 0 59-0.62 mg/l, nitrate 2.2-1.84 mg/l
From these values it is possible to make some rough estimations concerning pollutant loads into the Danube using the daily amount of collected sewage According to these calculations the waste water treatment plant in Giurgiu discharges about 383-555 tons organic matter, 9 tons P and 27 tons NO_3^- per year.

6 The calculations to determine the contribution of households in Vidin to the discharges are the following.
Vidin has 71,000 inhabitants. Because there are some small industries, a factor (1.3) was used to determine the amount of inhabitant equivalent waste water. The fact, that only 72% of the population is served by common sewerage was also taken into account. Therefore 71,000*1.3*0.72 = 66,456 i.e. wastewater is collected into the common sewage system, which is discharged into the Danube. The content of the i e. in the term of phosphorus is 11 g/day/i.e. and the nitrogen is 2.5 g/day/i.e. (Pers comm., Sofia). From these data the results are 260 tons P/year and 60 tons N/year. Because the Danube introduces approximately 60,000 tons P/year and 340,000 tons N/year into the Black Sea (Pers. comm., Bucharest), the ratio compared to it also was calculated (0.44% of P and 0.02% of N). The ratio of wastewater coming from households is approximately 77% from the result of 1/1 3, where the value 1 expresses the share of households, and value 1.3 refers the sewage deriving from households plus industrial activities.

6.3 Black Sea

The north-western area of the Black Sea has a great quantity of **organic matters** (BOD_5: 5.1-14.8 mg/l) deriving from the Danube and from the discharged sewage of domestic and industrial waste water treatment plants. The concentration of dissolved oxygen is low (sometimes under the Romanian minimum admissible limit - 6.0 mg/l) especially if it is compared with the high values of former sections (Romanian National Committee for Rio Conference, 1991).

Concerning the **nutrients** in the Black Sea there is evidence that the assimilative capacity of much of the Black Sea's coastal waters has been considerably surpassed, resulting in eutrophication. In the period from 1970 to 1990 total nitrogen and phosphorus loads from the Danube increased 2.5 and 3.8 fold respectively (Dogterom, 1993). The 1989 loads of these nutrients from the Danube itself were similar to those from all rivers draining to the North Sea. The Danube currently introduces 60,000 tons of total phosphorus/year and some 340,000 tons of total inorganic nitrogen/year (Pers. comm., Bucharest).

7 EFFECTS AND PROBLEMS ALONG THE DANUBE

Since pollutants (either bound or in solution) are part of the whole system they affect the characteristics of the river and its environment. Therefore a local pollution source can have local, regional, fluvial and even continental influences.
The local effects of pollution from organic material (oxygen depletion) can be compensated by the "self-purification" capacity of rivers. This is the case if the flow is reasonably rapid and dilution is large as for the Danube. Thus, rivers exist carrying large loads of suspended solids, organic matter and to some extent phosphorus, without causing local problems[7]. However phosphorus and nitrogen loads can influence the functions in the Danube Delta and the Black Sea.

7.1 The Danube

The pollutants, as it was mentioned, may cause significant ecological damage, present a risk to public health and reduce the availability of useable water. The Danube provides water for domestic, industrial and live stock uses, as well as irrigation of agriculture areas. The Danube is also used as a means of transportation. The substantial loads of nutrients and non-degradable contaminants discharged from the Danube into the Black Sea have caused a serious level of environmental

[7] A large portion of nitrogen compounds is converted sooner or later to nitrate which is persistent and not easily removed. 'Self-purification' is therefore less effective in assuring the quality of drinking water resources - a problem which is compounded by the inability of existing water treatment plants to cope with nitrate contamination. There may also be local problems with phosphorus which can cause high algae biomass if light conditions are favourable and the flow is slow. Again, existing water treatment facilities cannot cope with this problems.

deterioration. The final result is very high treatment costs for municipal and industrial water supplies.

The nutrients contributions have modified the existing physicochemical and biological balance as it was described in II.4.2.2. The consequences have been reflected in an abundant phytoplankton growth. During the last years, the density of phytoplankton was 100 times greater compared to the values obtained before 1970 (Romanian National Committee for Rio Conference, 1991).

As phytoplanktonic excessive growth acts on the dissolved oxygen, an unbalanced relationship between oxygen consumption and re-aeration can appear at certain times and places. There is a passive oxygen balance in the areas where re-aeration speeds are lower due to the low flowing speed (the area of the Iron Gates I and II reservoirs, the lower Danube course, the Danube Delta). In these areas, the oxygen shortage can reach, at summer and autumn low flows, values of 25-40%.
The high rate of the oxygen shortage caused by nitrification is indicated by the phytoplankton excessive growth being the most active during the last 15 years. The occurrence of the high oxygen shortages, with high frequency, during the last 10-15 years, has influenced the living conditions of aquatic organisms.
In this respect the taxonomic determinants are very significant as they indicate the scarcity or the disappearance of certain species of organisms sensitive to the dissolved oxygen concentration and their replacement by other less sensitive species (Romanian National Committee for Rio Conference, 1991).
The hypoxic conditions created even only periodically, have unfavourable effects on water quality, by the increase of the toxic potential of certain specific pollutants.

7.2 The Danube Delta

Natural values of the Delta have declined over the last 40 years due to excessive agricultural exploitation in the past and the increased pollution loading from the Danube, especially phosphorus and nitrogen. This resulted in the eutrophication of 668 lakes located in the Delta and the accumulation of toxic compounds and heavy metals in the soils and fauna. The eutrophication is followed by reed regression, macrophyte losses and increased sedimentation. Finally the losses of habitats, the losses of species (invertebrate and vertebrate decline), and their replacement by degraded, unstable systems can be detected. There have been reductions in the numbers and variety of plant and animal species recorded over the past 40 years. For example, the spoonbill and great white egret have considerably diminished in numbers (Romanian National Committee for Rio Conference, 1991).
In the anoxic sediments a bacterium *Clostridium botulinum* flourishes and builds up toxins during the blooming period. These algal toxins affect birds and mammals (even humans who swallow water whilst swimming), and cause a typical paralysis, called botulism (Jeffries and Mills, 1990).

An indication of the damage to the Delta's ecosystem is fish-catch, which has declined from 14,000 tons in 1967 to under 4,000 tons in 1991 (Pers. comm., Bucharest). There have been correspondingly dramatic declines in the fish catch in the north-western Black Sea. The human population of the Delta has also declined steadily to the current figure of 12,000 inhabitants because of a decrease in the sources of livelihood (Pers. comm., Bucharest).

7.3 The Black Sea

The relative vulnerability of the Black Sea derives from its degree of isolation from the world oceans and the magnitude of land-based sources of pollution.
The consequences of the high nutrient load has been to destabilize the Black Sea ecosystem. In coastal waters, vast blooms of phytoplankton have been registered. Although eutrophication effectively fertilizes the sea, it leads to a simplification of the trophic chain, often eliminating species of economic value to man. In the case of the Black Sea, valuable "top predator" fishes were rapidly lost and of 26 commercially fished species in the 1960's, only five remain in appreciable quantities today (Dogterom, 1993).
The migration of some prey fishes (e.g. mackerel) and the decrease in the number of some other species (sturgeon, flat fish, grey mullet, dolphins) were observed. For instance, the sturgeon quantities fished in the Romanian marine waters represent less than 10% of the quantities from 20-25 years ago. The reduction in the number of the traditional prey fishes has resulted in a great increase of small species, like anchovy, sprat, mackerel. They have however become the main target of excessive fishing. Therefore, the number of them has slightly reduced. For example, the quantity of anchovy fished has decreased 100 times in the last 4-5 years (ICIM, 1992).

The process of eutrophication introduces huge quantities of organic material to the sea bottom, adding to the increased load introduced by domestic and agricultural effluent. In shallow areas, its decomposition has led to a great oxygen depletion. In the north-western shelf, for example, anoxic areas increased from 3,000 km^2 in 1970 to some 15,000 km^2 in 1990.
As a consequence, the large 11,000 km^2 field of the commercially harvested red algae *Phyllophora* has now been reduced to a mere 500 km^2, 5% of its original size. Losses of organisms amounted to 100-200 tons/km^2 along the Romanian and Ukrainian coasts (Dogterom, 1993). These losses included commercially viable fish stocks, some native mollusk species and shellfish beds (oyster, mussels) and represent a major decrease in biodiversity. Furthermore, the loss of filter-feeding organisms has seriously decreased the capacity of the coastal areas for self-purification from chemical and microbiological contaminants.

A further issue having immediate economic and social consequences is that of microbial pollution from inadequately treated sewage. This has led to several limited outbreaks of cholera in recent years as well as an increased incidence of gastrointestinal diseases. The short-term consequence of poor bathing water quality has been the temporary closure of some beaches in Romania and Bulgaria.

8 CONCLUSION

The water quality in the Danube is better than the quality of its tributaries, and generally meets the norms of category I and II according to the Romanian and Bulgarian standards. The Danube Delta and the North-Western part of the Black Sea are, however, already considered to be polluted, mainly due to the discharges coming from the Danube and the direct discharges of biogen matters from the coastal zone (Report for Dublin Conference, 1992). These have resulted in disturbances of the natural balance of ecosystems and in the reduction of biodiversity. The changes mentioned affect the human welfare, like conditions for living, fishing and recreation. At the same time the unfavourable phenomena of eutrophication can also cause health risks.
Opposed to the relatively good water quality of the Danube, the pollutant loads from the Danube into the Black Sea are very high due to the enormous flow rate of the river. If the same standards and norms were applied for the discharge of pollutants and for the water quality like along the Rhine, it would result in about 2-3 times bigger loads of polluting substances, than in the Rhine. Therefore, the quality objectives for the Rhine cannot be copied for the Danube.

The portion of household waste water discharged into the Danube is lower than the portion of industry. From the total pollution the households contribute mainly by the addition of organic matter, nutrients and locally pathogens. This situation is primarily caused by missing or insufficient treatment capacities.
The contribution of Giurgiu and Vidin to the Danube pollution is low probably due to the relatively small size of the two municipalities, to the relatively few industrial activities, and due to the already polluted water of the Danube. However, the pollution deriving from the settlements can have a local effect, and contributes, even if only in a small way, to the total pollutant load discharged into the Black Sea.

The water quality in Vidin can cause some health problems, especially in summer, when the water is used for swimming. This can be due to the lack of municipal waste water treatment. In Giurgiu the water quality is satisfactory according to the Branch Agency for the Environment. The people in Giurgiu do not use the water for recreation or drinking purposes. It is interesting, that in Ruse (opposite side) the local pollution caused by the waste water discharges is considered as one of the main problems. The explanation can be that Ruse is two and half times bigger than Giurgiu, very industrialized, and the monitoring methods are probably different.

CHAPTER III R O M A N I A

Chapter III and IV deal respectively with Romania and Bulgaria and they are divided into three parts. The first part, which comprises a general introduction, deals with the present Romanian and Bulgarian situation. The second part focusses on the environment and it provides a description of the management of water (resources) in both countries. Finally, the third part contains the information of the case studies in Giurgiu and Vidin.

PART 1 GENERAL PRESENTATION

This part will present the significant changes which took place after 1989, in the political, economic and social context. The most important phenomena on these three levels will be explained and the environmental concerns and actions which started in this period will be described.

1.1 Political changes

The period after the Revolution from 1989 is characterised by fundamental changes in the whole political context, at the national as well as the county (judet) and municipal level. In this respect, a new Constitution was adopted in November 1991, and new political bodies were elected on a democratic basis. The Parliament, which has a bicameral structure is at present the supreme legislative forum. It consists of representatives from various political parties.

The Government represents the executive power and is formed by (specialized) ministers. The programme for the future development of the country, is elaborated under governmental co-ordination and submitted to the Parliament for comments and approval.

The judicial power in Romania is exercised by the judicial courts at city, judet and national level. They are independent and function on the basis of the Constitution and specific laws.

The process of democratisation continued in 1992 with the election of new local authorities, called Local Councils, for each of the 41 judets of Romania. In this respect, a new law concerning the structure, the role and the activities of these councils was enacted in March 1992. According to this new regulation, the Local Council has the possibility to organise specialised commissions in various fields, including the environment, town development and land redistribution. At the same time, the head of the local government (The Prefect), and the head of the local administration (The Mayor) are responsible for strategic and tactical development through, respectively, the issuing of certificates for the future town development and the issuing of permits for construction. Although the local authorities are facing a lot of financial problems now, it is expected that the role and the position of these authorities will increase substantially in the next four to five years.

At the end of 1992, after the local elections had been organised, general elections for all national bodies and for the presidency were organised on the basis of the new Constitution. The election procedure will take place on a regular basis, every four years.

1.2 Economic changes

Another characteristic of the transition is the severe reduction of the industrial production, especially in heavy sectors: e.g. metallurgy, ferrous and non-ferrous extraction, chemistry, construction of machines, production of raw materials. The withdrawal of most subsidies, the demand for hard currency for all imports (especially for fuels and raw materials), combined with the pressure coming from the trade unions to keep inefficient units operating, has resulted in the following:

- a severe reduction in production levels;
- a systematic decline of many industrial complexes;
- endemic cash flow problems in businesses; and
- a drastic decline in the quality of life.

In this respect it should be mentioned that the state subsidies were withdrawn in steps, starting from August 1990 until May 1993, to support the economy and to readjust its structure according to the principles of the free market economy.

The construction sector practically stopped its activities, due to the lack of funds and the inflation rate, which affected to a large extent the price of raw materials.

The agricultural sector faced a total restructuring, on the basis of the new "Land Fund Law[1]", which was adopted in February 1991. Land is now being distributed to the former owners. The size of farm lots has significantly decreased which has caused a return to farming with traditional methods. The advantages of large economies of scale under the old system have also disappeared. In general, one can speak of a decrease in the agricultural harvest.

In the complex process of transition many legal documents were adopted to encourage and accelerate this process. An example is the Law of Privatization which creates the legal framework for free competition in all economic sectors. Unfortunately, because of the lack of national funds, low purchasing power and lack of experience, this process is developing slowly. Privatisation is at present mainly oriented towards the commercial and the tourism sectors. Still under discussion is the most appropriate modality for the privatisation of the big industrial complexes. The lack of national private capital (in order to buy and modernise the existing units) and the reduced interest of foreign investors are main constraints which need to be considered in choosing the appropriate modality for the privatisation process.

1.3 Social implications

All the changes which took place in Romania at a political and economic level have had a direct impact on (social) life. It is expected that this process of change will continue in the future. The standard of living has decreased and the number of people living under the threshold of poverty has increased to almost half of the population (de Volkskrant, April 16th 1993). This is due to, among others, the permanent decline of the national currency in comparison with the U.S. dollar, the quick

---

[1]In this law the privatisation of the agricultural land is described. It also states the restitution of agricultural land to its former owners.

rise in the inflation rate, the reduction of state subsidies and the low efficiency of the exports. Regarding the exchange rate it can be noted that it has altered from 180lei/1 US dollar in 1990 to 600 lei/1 US dollar in 1993.

At present the expenses for food represent more than 60% of the total monthly income of a household. Between 1991 and 1992 the expenses for energy, gas, central heating, water supply, etc. doubled. It is expected that in May 1993 (when all the state subsidies will be reduced to zero) this proportion will increase even more. For pensioners and families with low incomes or with many children the situation is even worse. The monthly expenses for food represent more than 75% of the total income (Comisa Nationala Pentru Statistica, 1992).

The social security system, which just started to function, is confronted with a lack of experience and organisational difficulties. It is at present impossible to face all these problems, especially if we take the expected increase in the unemployment rate into account (at present approximately 5% in 1992).
The Romanian Government is preparing an austerity programme. In this programme social aspects will be considered more attentively. It should be mentioned that the present unemployment rate is below the levels reached in other ex-communist countries. It is expected that the number of people affected by this phenomenon will increase considerably in the near future.

The internal migration of people is another social aspect which Romania is confronted with. In the past, excessive industrial development of certain areas caused many people to migrate from one part of the country to another. The present severe reductions in industrial activity cause many people to return to their former houses which creates major social upheavels. This is specifically the case for Bucharest and other municipalities in the south such as Giurgiu, Calarasi etc..

1.4 General description of the state of the environment in Romania

Romania is an Eastern European country, covering a surface of approximately 237.500 km^2 and with circa 22 million inhabitants. For more than 45 years, the country developed

its economy in a very intensive but inefficient way. Large energy intensive industries were created although the national resources could not cover the demand.

As a result of this unsustainable development the quality of environment as well as the health of the population decreased. SO_2 emissions systematically exceed the OECD standards. In some areas, the emissions of lead and other heavy metals are extremely high, which particularly affects the growth of children.
Water pollution is very high. Almost 30% of the total length of the rivers is polluted, much of the pollution sources coming from industry and from big zootechnical complexes. Underground water is polluted in many areas due to industry, oil extraction or fertilizers (especially nitrates). Natural resources, including the large tracts of forests, have been severely affected by pollution. Numerous species (both flora and fauna) have either disappeared or are threatened (pers. comm. Bucharest).

The changes which took place in Romania after 1989 have created possibilities to integrate environmental concerns in the future development strategy of the country as one of its main components.

PART 2 WATER MANAGEMENT

Part 2 will present various aspects concerning water management. After a description of the present state of the water resources, and the characteristics of water supply and discharge, the institutions involved in the field of water management (at the national, judet and municipal level) will be presented. Special attention will be given to the the existing and planned legal framework, relevant for water management. Economic instruments and social instruments, which are both in the process of being implemented, in the field of environment in general, and the field of water management in particular, will be described. Apart from that an overview will be given of the international projects in which Romania is participating.

2.1 Present state of the water resources

The fresh water resources of Romania consist of transboundary rivers, inland waters (inner rivers and lakes) and groundwater. Table 3.1 gives an overview of the potential of the different fresh water sources, the amount of fresh water which (with the present technology) could be made usable and the amount of fresh water presently used.

Table 3.1 Water resources in Romania in 1991 (Report for Dublin Conference, 1991)

Source	What can be used (billion m^3/year): Theoretically	Technically	Developed
Inland waters	40	25	5 (13)**
Danube river	85*	30	10
Groundwater	9	6	3
Total	134	61	36

* Half of the water stock when entering the country. As a source it is 170 billion m^3.
** 5 billion m^3/year are inland water resources under a natural regime. 13 billion m^3/year are being harnessed.
The potential water resources is the amount of water theoretically available. With the presently available technology it should be possible to use the water sources mentioned in column 2. The presently used sources are listed in column 3 (developed sources).

Storage reservoirs (11 billion m^3) have been built to ensure water supply of the inland waters. These are unequally distributed over Romania leaving some areas with a water shortage. The most important water source (the Danube river) can be used only to a lesser extent due to its position at the southern limit of the territory (Report for Dublin Conference, 1991) and because of its function as a transport route.
With 1,700 m^3/inhabitant/year Romania is among the European countries described as having limited water resources (Report for Dublin Conference, 1991; Romanian National Committee, 1991). The average for European countries which do not have limited water resources is 2600 m^3/inhabitant/year (Report for Dublin conference, 1991; pers. comm. Bucharest).

The overall quality of fresh water in Romania is deteriorating as will be revealed in the following description of river, lake and groundwater quality.
Rivers show a progressive decrease in the water quality between 1986 and 1989.[2] Table 2.3 shows that in this period the share of river sections with water quality I (highest quality, see also chapter II) diminished, whereas the share of river sections of water of the lowest quality (qualitatively depreciated water) increased. Part of the decrease in water quality can be explained by the droughts which have occurred during the past ten years. These droughts resulted in a decrease in the dilution capacity of the rivers and therefore in increased pollutant concentrations. Water quality protection measures are, however, taken on the basis of the worst hydrological conditions. Therefore, the decrease in quality reflects shortcomings in technology and organisation concerning waste water treatment.
The water quality of lakes (natural and artificial) is good on the whole (quality I, according to Romanian standards). Ground water quality is, however, a reason for concern. Ammonia, nitrites, organic substances and pathogenic germs are the main pollutants. This kind of pollution affects (with different intensities) all the catchments in the "phreatic aquifers[3]" and is thus a long term (potential) health risk to consumers of the water.
Linear impurifications in ground water have been detected in river valleys with polluted rivers. Areal or zonal pollution of groundwater is caused by, among others, industrial waste and leakage of waste water from the sewage system (mainly in urban areas). In rural inner areas more than 70% of the household wells have nitrite concentrations over 100mg/l (maximum admissible concentration - MAC 45mg/l, standard U.S. 10mg/l) and many sources contain other pollutant concentrations above the admissible level. This is mainly caused by the lack of rural sewage systems and the use of latrines in such a way that they become a source of pollution for water in household wells.

2.2 Water supply and discharge

---

[2] Data on the period from 1989 until now were not available.

[3]water within a layer of permeable rock, sand or gravel under the water table

The centrally supplied water in Romania is at present used for domestic, public and industrial use. In 1989 circa 56% of the total population had a connection to the centralised drinking water supply system.

In 1989, 3.39 billion m^3 of raw water was taken from surface- and ground-water sources for drinking purposes (Romanian National Report for Rio, 1991). Table 3.2 shows the different uses of the drinking water. Of the 3.39 billion m^3 drinking water supplied, circa 2.18 billion m^3 was collected as domestic waste water.

Table 3.2: Different uses (in percentages) of the total drinking water supply through the centralised system.

Domestic use	43%	Public use (streets, fire services)	19%
Industrial use	38%	Others, circa	1%

It was calculated that the water use in urban centres is about 200 l/inhabitant/day. However, this water reaches the people only partly mainly because of losses varying in total between 20% and 40% of the total water supplied. 10% to 20% is lost in the supply system and another 10% to 20% is lost in the pipe system in the dwellings (Romanian National Report for Rio, 1991). The percentage lost in the pipes of the dwelling was said to take into account the amount of water people "flush through" in summer to get colder water. The quantity of water supplied per day is reduced with 20% in certain areas during dry periods.

Investments in water supply systems have practically stopped because of a lack of funds and because of the fact that state subsidies are very small. Therefore, it is difficult (if not impossible at present) to have a proper water supply system for the whole population. Apart from that, the big water losses caused by leakages in the supply system can not be diminished (Report for Dublin Conference, 1991).

It was concluded in 1989 that water was used excessively in households. No data could, however, be found on how excessive use was estimated and how much water was used. Insufficient measuring equipment (meters) in dwellings was

mentioned as one of the reasons for an excessive use of water. Only 70% of the estimated number of required meters is in place and most of them function inadequately (Romanian National Committee for Rio Conference, 1991).

Concerning the discharge of water it can be said that much discharged waste water is insufficiently treated or not treated at all. The total amount of waste water produced by households and industry was 10 billion m^3 in 1989 (Report for Dublin Conference, 1991). 50% is only thermally polluted and does not require treatment according to Romanian standards. The other 50 % requires treatment. Of this 50%, 10% is adequately treated (according to Romanian standards), 60% is insufficiently treated and 30% is discharged without treatment (Romanian National Committee for Rio Conference, 1991). This is mainly caused by the following:

- the non-allocation of funds and equipment for the realisation of the necessary treatment stations;
- some treatment plants can not purify the waste water properly, because the waste water does not have the appropriate composition. This occurs when assumptions about the quality of the waste water are incorrect and the treatment plant is built to purify water of a different composition;
- no repair of deficiencies in the treatment procedure;
- inadequate training of personnel; and
- the intensive development of industry with low performance technologies.

Various activities contribute differently to the pollution of fresh water. Table 2.10 shows the contribution of different activities to respectively the load of inorganic polllutants and the load of organic pollutants discharged in water in 1989 (Romanian National Committee for Rio Conference, 1991).

It was concluded that the decrease in the share of natural water resources of water quality I resulted from the impact of the waste water.

2.3 Organisational aspects of water management

In Romania many authorities and organisations deal with different aspects of the management of the water(resources). Since water is considered a national

resource the state carries most of the responsibilities. The Ministry of Waters, Forestry and Environmental Protection (MWFEP) and Branch Agencies (BA's) are responsible for the strategic/planning side of the water management at respectively the national and judet level. The Environmental Research and Engineering Institute (ICIM) supports the decision making processes of the MWFEP scientifically.
The state company Apele Romane (AR) together with their representatives at the local level, the River Basin Agencies (RBA's), are responsible for the distribution and supply of raw water and protection against overuse of water. Apele Romane is economically independent.
Local drinking water supply is organised by the local enterprises. These enterprises are co-ordinated by the municipality, but they are economically independent. With regard to drinking water quality the Institute of Hygiene and Preventive Health (IHPH) has some responsibilities. §2.3.1 will give an overview of the organisations involved in water management. §2.3.2 will describe the actual water management (organisation of supply, discharge and monitoring).

2.3.1 Overview of organisations involved

The Ministry of Waters, Forestry and Environmental Protection

After the elections in 1992 the Ministry of Environment was reorganised and became the Ministry of Waters, Forestry and Environmental Protection (MWFEP). The MWFEP represents the central authority in charge of the co-ordination of all environmental activities in Romania[4].

The Minister of WFEP has the task to inform his Government about all relevant activities, which are under his/her co-ordination and to submit proposals to the Government. These proposals encompass all the draft laws in the field of the environment and the (newly developed) environmental strategy. The Government integrates the environmental strategy into the national strategy. At present the national strategy is in the Parliament for approval. This report will take the draft environmental strategy into

[4] The present structure and functions of the ministry are set up according to the Gov. Dec. 792/1992.

account. (see annex C for a more detailed description of the MWFEP).

Branch agencies
In 1990, each judet (and also Bucharest) received their own BA. BA's are local state agencies subordinated to the MWFEP. They are financed with money from state funds. Each BA is managed by a Council of Administration. The daily leadership of the BA is realised by a Committee of Direction (Romanian National Committee for Rio Conference, 1991).

BA's are responsible for the implementation of the environmental policy through activities such as data collection, monitoring, inspections, issuing permits and authorizations, and legal actions. These tasks are performed by different units within a BA, which correspond to responsible authorities at the national level.[5]

1. The Integrated Monitoring unit, which monitors surface water and discharged waste water. They report the monitoring data to the directorate of Monitoring on a daily basis and they cooperate with the central laboratory from ICIM (see below).
2. The Laboratory, which performs laboratory tests of surface-, ground- and waste water.
3. The Inspection unit which controls whether economic units comply with environmental standards and regulations (concerning waste water) mentioned in permits and certificates. They enforce the standards. They report to the State inspection.
4. The unit for Permits and Authorizations, which issues permits and authorizations for (only small) economic activities within the territory of the county. They issue environmental permits for the discharge of waste water (see § 2.4.2). This unit is connected to the Directorate for Environmental Impact Assessment, Permits and Authorisation.
5. The Administration unit, which is responsible for the total administration of the BA. (EC-PHARE, 1992).

[5] It should be noted that apart from responsibilities related to water management, the BA's have other responsibilities. Only the responsibilities related to water management are mentioned here.

The different units reported their plans for the coming year to the corresponding directorates, which had to approve them (EC-PHARE, 1992). Every trimester the BA's had to report to inspectorates of the MWFEP about the achievement record of these plans. In practise this was not done because the MWFEP never used the reports. Therefore, the agencies could not be compared neither by the ministry nor by the people from the BA's themselves, which hindered improvement of the work done by the BA's. This situation remains the same today.

Environmental Research and Engineering Institute (ICIM)
This institute was established in 1989 after a fusion of the Hydrological Research Institute and the Water Management Research Institute. The ICIM has twelve departments with a total of 850 employees. The institute (in Bucharest) harmonizes the work done in the laboratories of the BA's. This is a compulsory part of their work based on research contracts with the MWFEP. Apart from the work done for the Ministry, the ICIM can also accept work from private companies. Before this kind of work can be accepted, approval by the MWFEP is necessary.

The emphasis of the ICIM at the moment is in the fields of environmental research and engineering. The departments relevant for our study are:
- water quality monitoring and management;
- aquatic ecology;
- water and environmental economy;
- drinking water and industrial water treatment technology;
- waste water treatment;
- laboratory of urban engineering and ecology; and
- hydrotechnic construction.

ICIM is financed primarily through the State budget. For private contracts they are renumerated by the private company.

State company APELE ROMANE
Apele Romane, which is an autonomous state company, is in charge of the actual management of Romanian water resources. This company is a corporate/juridicial entity with economic and administrative power to implement the "national water management strategy". They are affiliated

to the MWFEP and they respond directly to the Secretary of State for Water. Interventions from the MWFEP only occur in special situations (EC-PHARE, 1992). AR is divided into six divisions and a special division for co-operation, international relations, frontier waters and juridical matters.

Each main catchment area or hydrographical basin in the country has an RBA. Each RBA is subdivided into 4-8 units, each unit representing an important hydrological structure or installation (e.g. dam). Romania has circa 80 units, each judet has at least one such unit. There is one RBA for the river Danube without the tributaries.

AR and thus the RBA's deal with:

1. management of water resources;
   - protection against exhaustion or overuse through the monitoring of the quantity of water resources and the subsequent calculation of the amount of water the Romanians can use in the coming year, also control of the amount of water used;
   - prevention of water degradation through monitoring of the quality of discharged water;
2. supply of raw water and control of the quality of the water supplied;
3. civil engineering works (treatment plants, equipment for water supply);
4. flood control; and
5. accidental pollution clean up (EC-PHARE, 1992).

The total operation costs of AR were circa 4 billion lei in 1991. The operation and maintenance costs are covered from the sale of raw water and from revenues from penalties and fines. Large investments (dams etc.) must be covered by funding from the Government.

Local enterprises
At municipal level local enterprises are responsible for:
- drinking water supply (accompanied by control of water quality) within their territorial district; and
- waste water treatment.

These activities are co-ordinated by the county (judet) councils at a local level. The councils are responsible for the organisational and infrastructural aspects of public services, which includes the provision of water supply and waste water treatment.

Institute of Hygiene and Preventive Health
The IHPH is co-ordinated by the Ministry of Health. The IHPH plays an important role in the determination of the quality of water for: drinking, bathing and irrigation. The institute has to ensure the water quality is not threatening people's health. Due to a lack of equipment, the collection of data takes place only twice a year, in more than 250 important towns in Romania (EC-PHARE, 1992).

2.3.2 Working procedures and cooperation between organisations

Organisational structure of water supply
The RBA's are responsible for the supply of raw water. Users are connected to the central supply system of the RBA (e.g. local units of a municipality, private users). It depends on the user and the source, what the price of raw water is (see annex D).
In some areas of Romania the costs for the RBA to supply water are higher than in other areas. However, the prices set by the RBA are the same for the whole country. They are calculated in such a way that, with the revenue of the sold water, the water-costs for the whole country can be covered and a social profit is obtained. 5% of the revenue must be handed to the so called Water Fund (see § 2.4.2 economic instruments).

On the basis of the annual water balance the RBA's calculate how much water will be supplied to the users. The raw water is supplied on the basis of a contract in which norms (for the amount of water which can be used) are mentioned. The RBA's control each user twice a month. Both the quantity of the water used and the quality of the water discharged (see discharge for more details) are controlled. These controls are compulsory. Utilizers who use above the norm have to pay penalties (5%-50% of the water-price extra).

The local enterprises in municipalities are users who, in their turn, sell water to households and other users. The local enterprise thus buys raw water and sells drinking water. Each local enterprise, which supplies drinking water, has the right to set its own price for the drinking water. The price for drinking water includes the price of raw water, purification costs, distribution- and

maintenance costs and waste water treatment costs. Again the price differs per user.

Households have to pay for the water, on a monthly basis. The amount of water used determines the bill. Most of the time, this is calculated from the total amount of water used in the municipality. Meters are available in single houses and in the flat blocks (but not in each apartment) to measure the amount of water used. If "private" users use more than 70,000m^3/year (pers. comm. Giurgiu) they are obliged to get their own connection to the central supply system of the RBA.

Organisation of waste water discharge
The user (e.g. local enterprise in a municipality) who collects the waste water is responsible for the quality of the discharged water. Discharge costs are included in the price of drinking water. In the future, local enterprises can use several economic instruments (mentioned in Gov. Dec. 1001/90) as a means to gather money, from the users of their discharge system, to cover discharge costs. A local enterprise is allowed to use 50% of the revenue for local development in the field of environment (thus for a reduction of pollution). The other 50% is collected by the Water Fund (see § 2.4.2 economic instruments).

Every utilizer who discharges waste water has to get a permit for discharge. Standards for water, set by the Institute of Standardisation, are the basis for the limits used in the permits. At present the issuing of the permit for discharge is for free. In the future this will change (Draft Environmental Law). The price of the permit will depend on the sector who discharges and on the amount of pollutants discharged (pers. comm. Bucharest).

RBA's control, twice a month, whether discharges correspond with the limits established in the permit. If the amount of pollutants discharged surpasses the limits, the users have to pay a penalty for each unit of pollution surpassing the norms.

Industries or other (private) users which have their own discharge system need a separate permit. Users, who discharge in the municipal discharge system are obliged to pre-treat the waste water before discharging (pers. comm. Giurgiu and Bucharest). They do not require their own

permit. In those cases only the municipality (thus the local enterprise) who discharges needs the discharge permit.

Organisation of the monitoring

The monitoring of the water quality is done by many different bodies:

Surface water	BA (ICIM as a reference laboratory)
Discharged waste water	BA and RBA
Intake raw water	RBA
Bathing water	Ministry of Health
Irrigation water	,,
Drinking water	,, and local enterprises

This list points out that the present monitoring system is very sector oriented. The present monitoring system covers the total hydrological cycle (surface water, rain, groundwater) and both water-quality and -quantity (EC-PHARE, 1993).

The National Network for Water Quality Management is presently operated by the BA's through their monitoring units. The actual network consists of 5 sub-systems:

1. surface water - focusses upon the main rivers. 270 sampling points. Collection and analysis monthly (slow flux) 50 sampling points. Collection and analysis daily (fast flux);
2. Lakes and reservoirs;
3. Coastal areas;
4. Ground water - 270 hydrological stations. Each contains 2-5 drilled wells for observation. It covers the main ground water structures of the hydrographic basin. The wells are sampled 4 times a year; and
5. Waste water - 3000 sources. Criteria: impact of the pollution upon the water quality. Survey through sampling campaigns of RBA's (Romanian National Committee for Rio Conference, 1991).

In the future the network will probably be assimilated and operated by River Basin Agencies (AR). This will be done to remove the existing overlap between the use of existing laboratory facilities for quality control of surface water and drinking water (EC-PHARE, 1993). In the future AR and the French International Institute for Waters will co-operate (EC-PHARE, 1993; EC-PHARE, 1992).

The present units provide a good basis for developing the future system for water resource management. The units will, however, need upgrading in the future and links between causes of pollution (waste water, leach etc.,) and the quality of the water need to be established (EC-PHARE, 1993).
Data on transport of pollution to the Black Sea are needed. At present only information on water pollution is collected; comparable information on pollution in sediments and pollution in biota is required.

2.4 Policy instruments

2.4.1 Legal instruments

National legislation
The legal framework has involved review, redrafting and readjustment since 1989. To begin with it should be mentioned that the old legislation, which is still partially in force, was a good one. It covered various fields and it set up severe norms and limits, especially if we consider the quality of the environment. The main problem in the past was not connected to the quality of the laws and regulations itself but to their implementation and enforcement. The control of these processes was very weak and in many cases the responsibility was divided among so many authorities that the real effectiveness was practically non existent.

Starting from these realities it became clear that it was impossible to neglect the whole legal framework (which existed in the past) whilst building a complete new one. Therefore, the two different processes take place in parallel: the reviewing of the old legislation and the elaboration of the new one.

In this respect the first document which was adopted in the environmental field, after 1989, was the **Gov. Dec. no. 783/1990** (now 792/1992) concerning the establishment of the MWFEP. This document establishes MWFEP as the central state authority which organises, co-ordinates and controls all the activities in the field of environmental protection, and promotes concrete measures for the management of Romania's natural resources.

The following laws are still in force: **the Environment Law (9/1973)** and **the Waters Law (8/1974)**. Both these laws were completely revised according to present realities and international standards. The draft laws are expected to be adopted by the Parliament before mid-1993.
The draft of the new Environmental Law, which is already in the Parliament for discussion and adoption, is a general law covering all environmental factors. In the near future specific regulations will be elaborated on the basis of this general law.
The new Water Law, which is still under preparation, will cover all the aspects concerning the exploitation, conservation, management and protection of waters, to maintain the ecological equilibrium. At the same time the new Water Law will define the economic instruments in the field of water management. It will also regulate the participation of users (with a high water consumption) in activities such as planning and water management in the hydrographical basins.

Parallel to the setting up of AP, the **Gov. Dec. 1001/1991** was adopted which contains the economic instruments used in the field of water management. For the first time the whole system of economic instruments in the field was clearly established.

It is also important to mention **Decree 414/1979**, which sets the admissible limit values for the main pollutants existing in waste water before it is discharged. This document, which has as a main guiding principle "the principle of dilution", created and still creates big problems concerning the maintenance of the quality of the receivers[6].
Another important document is the **Ministerial Order (MO) 170/1990** which establishes that all the economic activities (existing or new ones) require an authorisation issued by the environmental authorities. The list of the activities requiring an authorisation is a very large one, including manufacturing, agriculture, transport, mining, forestry, tourism etc..[7] The authorisation is issued on the basis of a set of standards which should be respected

[6]In this context a receiver is a river which receives the discharged waste water.

[7] It is presented in the annex to the MO 437/1991.

by the economic agents. For new investment projects, an environmental permit must now be obtained as a compulsory first step. This environmental permit represents the precondition for obtaining an environmental authorisation when the economic agent starts operating. The permit will become the most important regulatory instrument for all the activities which will be developed in the future. The authorisation will only confirm that the legal requirements are met for these activities. National and local environmental authorities are in charge with the issuing of these documents, according to the importance of the project (national or local). The new draft of Environmental Law specify that for issuing these documents the environmental authorities have the legal right to collect taxes.

During the next period it is expected that the following existing regulations, norms and standards will be reviewed:

- **Gov. Dec. 1342/1984** concerning the quality conditions which should be reached for the drinking water;
- **Normative** concerning the discharge of the waste water into the sewage systems (C-90/1983); and
- **Standard** concerning the categories and the technical conditions for quality (4706/1988).

Parallel with the process of redrafting the existing regulations, new normative acts should be adopted. Among the priorities it is important to mention the elaboration of the Law for Public Works. This document will include all regulations in the field; the specific ways in which local budgets, "physical" or legal persons can participate in financing and planning of public works, etc.. This new law will create the legal frame for the participation of local authorities in activities concerning public works (MWFEP/2, 1993; EC-PHARE, 1992).

International co-operation

International co-operation, through the ratification of many international documents in the field of environment, and especially in the field of water management, has a long tradition in Romania. This process was initially orientated towards co-operation with the neighbouring countries.

Taking into consideration that the Danube represents for Romania a natural border in the southern part of the country, that the Danube Delta is located on the Romanian

territory and that the Black Sea needs to be protected against pollution by all countries in the area, several international documents have already been adopted or are under preparation. Among them, the most important are:

- **Convention concerning the navigation along the Danube (Belgrade 1948).** This document contains norms regarding the obligation of the riparian countries to ensure free navigation and to maintain the sailing channel. Although the convention is enforced by the Ministry of Transportation, for problems concerning the quality of water or hydrometeorology, the MWFEP participates effectively in the implementation process.
- **Bucharest Declaration (1985).** This declaration concerns the water management of the Danube, especially protection against pollution. Although it contains only recommendations, this document represented for a long period the basis for the co-operation among the riparian countries. In this respect, systematic observations and common measurements were carried out. An efficient system for exchanging data on a regular basis was set up and a suitable co-operation against floods was implemented. Due to the very acceptable results achieved until now, the Romanian Government proposed to transform this document into an international convention concerning the water management of the Danube. Unfortunately, due to political changes which took place in the former USSR, the war in Yugoslavia, etc., the negotiations have been postponed.
- **Convention on protection and use of the transboundary rivers and international lakes (Helsinki,1992).** This convention was signed by the Romanian Government, but has not yet been ratified.
- **Convention on the protection of the Black Sea against pollution (Bucharest 1992).** This convention was ratified by Romanian Parliament Law 98/1992.
- **Convention between Romanian and Bulgarian Governments concerning the co-operation in the field of environmental protection (Sofia 1992).** This convention was ratified by Romanian Parliament Law 97/1992 and creates the legal framework for co-operation in various environmental fields between the two countries.

Two draft conventions concerning the Danube river are at present under negotiations:

- Convention on the ecological basin of the Danube river (Hungarian proposal).

- Convention on Danube river waters management (Austrian proposal) strongly supported by the Romanian Government which also proposes the setting up of a permanent Secretariat of the Convention in Romania. It is expected that the negotiations, which started in 1991, will continue for a long period due to the political situation in this area, different economic interests and approaches between the countries involved (MWFEP/2, 1993).

On the basis of bilateral agreements in the field of water management, many joint co-operation commissions were set up, especially with the other riparian countries. On the basis of the Bucharest Declaration, Romania is in charge of the co-ordination of all the activities concerning the survey of water quality along the Danube. Periodically sessions are organised by these commissions in order to exchange information, to elaborate the annual balance in the water management field, and to set up or to improve the measures already taken against floods, etc..

In 1991 a meeting was held in Sofia to draw up the main points for the implementation of the Danube River Basin Programme. The aim of this very large programme is to assist the riparian countries in their efforts to reduce the pollution of the river and to financially support their efforts in the field. This programme is coordinated by a Task Force which includes representatives from the European Community (EC), the World Bank, the European Bank for Reconstruction and Development (EBRD), USAID and other donors. At present several pre-investment studies for different tributaries (Olt, Arges, Crisuri, Tisa) are under preparation. At the same time, national inventories are under preparation to determine the main sources of the pollution and to set up priorities for future investments.

Under EC-PHARE co-ordination, a Programme for setting up a monitoring system for all environmental factors has now been started. Due to the fact that the creation of a good system for data collection and survey is a long and very costly process it is expected the programme will be developed in the coming years.

A programme financed by the Global Environmental Facility, which is a special assistance fund, jointly administered by the United Nations Development Programme (UNDP), the

United Nations Environmental Programme (UNEP) and the World Bank, was started to improve the management, data collection and the monitoring activities in the Black Sea area. The project also has the purpose to ensure the comparability of information as well as the co-ordination of the protection measures taken by the countries involved.

A programme for the conservation of bio-diversity in the Danube Delta is co-ordinated by the World Bank. The Danube Delta was declared a biosphere reserve and was included on the list of World Heritage Monuments. Therefore, special attention will be paid to the management of the area, the development of ecological tourism, and the improvement of the quality of life for the local population. The EBRD also has a significant Danube Delta programme.

For the near future other co-operation programmes are under preparation, such as:

- Programme for decisions support in the field of water management, in co-operation with USAID;
- Programme for setting up an automatic control system for water pollution for Bucharest, parallel with a system of warning in flood cases, in co-operation with France and Italy; and
- Programme for setting up a telecommunication system in the field of water management, in co-operation with Italy, etc..

(MWFEP/2, 1993; MWFEP/3, 1993).

2.4.2 Economic instruments

The setting up of a new environmental framework after 1990 has resulted in the improvement of existing economic instruments and the introduction of new ones. In this paragraph economic instruments such as prices, tariffs and penalties will be described. Afterwards the existing Water Fund and the proposed Environmental Fund will be described.

Prices, tariffs and penalties in the field of water management

To stimulate the users to reduce the water consumption and to improve the water quality a system of economic

instruments in the field of water management was set up (Gov. Dec. 1001/1990).
The present system has been in force since January 1991, and will be developed in the new Water Law which is under preparation.

Gov. Dec. 1001/1990 stipulates that the price of the raw water is similar for the whole country, but differentiated according to the source (inner rivers, Danube, ground water) and to the users (industry, irrigation, fishery, population, etc.).
The price for water used by industry, transport, zootechnical complexes is higher compared to the price of raw water for the production of drinking water to stimulate the reduction of the water use in the former. On the basis of this unique set of prices each distribution unit which supplies drinking or industrial water and/or treats the waste water coming through the central sewage system, has the legal right to set up a differentiated level of prices and tariffs, according to the specific costs of distribution, pumping, maintenance, treatment etc..

All the violations of the legal regime of water withdrawal, or waste water discharge are liable to penalties, on the basis of the law and enforced by the water authority.
For the drinking water supply and sewage networks managed by local enterprise (co-ordinated by the municipalities), the penalties are set up by the head of the Municipal Services Unit and the sums are deposited into a separate Water Fund.

Water Fund
The Water Fund is a special money deposit, established by law and used to improve the existing water management system, to finance new investments in the field and to cover losses in the dry periods, etc.. Its main sources are: 5% from the prices and tariffs collected by the water authorities and from all the penalties stipulated in the Gov. Dec. 1001/1990. The utilisation of this fund is centralised for the whole country and coordinated by the MWFEP.
Another economic instrument used in the water management field is the allocation given to different water users from the Water Fund, users who show a real interest in

reducing the pollution, reducing the quantity of water used, increasing the efficiency etc. To encourage the local development in the field of water management, the law states that the local water supply units have the right to use for their own development 25% of the penalties collected.
This system started to be implemented in 1991 and has already proved its efficiency in the sense that the quality of the water discharged into the sewage system slightly increased. Concerning the quantity of water used the level is still high. (pers. comm. Bucharest). It is expected that the new Water Law which is under preparation will develop the existing system and set up high levels of prices and penalties in order to reduce the water use and the water pollution (EC-PHARE, 1992; Gov. Dec. 1001/1990).

Environmental Fund
A new economic instrument which will be regulated through a specific law is the Environmental Fund. The role of this new instrument is to support the ecological reconstruction of affected areas, to reduce the pollution from the sources, to provide financial assistance to the environmental authorities in order to improve and modernise their activity, and to develop a coherent system for public information and education in the field of environment.
The main sources of this new fund, proposed to be created and administrated under the direct co-ordination of the MWFEP will be the following:
- taxes for issuing environmental permits and authorizations;
- the total amount of money representing fines from the regime set up by this law;
- penalties for water, air and soil pollution, due to discharges over the maximum admissible limits; and
- donations, external financial assistance, incomes from different events organized by the environmental authorities, etc..

Due to the importance of this new proposed fund, and taking into consideration the necessity to provide detailed guidelines for each source and destination of the fund, it was decided that the Environmental Fund should be regulated through a separate normative act (MWFEP/1, 1993; EC-PHARE, 1992).

2.4.3 Social instruments

Environmental Awareness

The environmental awareness of the Romanian people in general may be recognised as low. Even where more environmental awareness does exist, it does not necessarily lead to more concern or involvement. This is understandable considering the weak state of the economy in the period of transition. Economic priorities dominate at the moment and will continue to do so in the foreseeable future.

The environmental awareness of a population is linked strongly to the facilities for environmental education and information. Regarding environmental education, it is noted that the Ministry of Education has made it obligatory in the school curriculum to discuss for 10 minutes per lecture the environmental impact of subjects discussed in biology class. Some NGO's assist schools in this task of environmental education.

At the university level, attention is also given to environmental education. For example, in the state universities the traditional faculties (biology, law, economics, etc.) have special sections dealing with environmental aspects. Private universities were created parallel to the state universities starting in 1990. One of these private universities is the Ecological University in Bucharest which began activity in 1990.

Concerning environmental information, the MWFEP at the present time does not conduct any systematic programmes in this field. Publications on the environment are, however, published by the MWFEP and articles appear in national newspapers. Environmental information is also provided by NGO's when they use the media to support their projects. A few NGO's have regular columns in newspapers and slots on radio programmes.

Public Participation

Public participation in environmental issues can take various forms in Romania. In the Draft Environmental Law it is stated that each citizen has the right to a clean environment. If this right is violated the citizen has the right to appeal in front of a tribunal and to request payment for damages caused.

Another means of public participation is the possibility for public involvement in environmental impact assessment hearings. Although no hearings have as yet been held the plan is that during these hearings the public can make

their concerns felt before the decision is made whether, and in what form, a permit will be provided for a polluting activity. After the permit is granted the public would have the right to take the polluting body to court if it exceeds the limits mentioned in the permit.

For the new investments the Environmental Impact Assessment is compulsory in order to apply for a permit or authorization. For all the activities which will have an impact on the state of the environment, the environmental authorities will require an impact study. According to the new Env. Law the investors will finance these studies. The study will be carried out by specialized institutes , authorised by the environmental authorities. For investments which have a national importance the cost of the impact study will be supported from the state budget.
All of the procedures mentioned above are operating at present, and the new regulations only improve the existing system.
A set of difficulties are, however, met in the implementation process, which can be described as follows:
- the quality of the impact studies is rather low, and this procedure remains practically formal;
- a lot of existing activities which require an authorisation can not meet the prescribed standards, and continue their activity semi-illegally. At present, the environmental authorities are co-operating with these units to set up a realistic schedule for meeting these standards;
- the economic development was more important in the past than the environmental protection and a lot of very polluting agents continue to operate, although according to the norms they should be closed down; and
- the low level of fines and penalties for non-compliance cause several economic agents to prefer to pay instead of improving their performances in accordance with the exigences stated in the authorisation (EC-PHARE, 1992).

In Romania public participation in environmental matters can also take the form of involvement in environmentally friendly activities such as recycling. There has been a strong tradition of recycling in Romania with the collection by state agencies of paper, glass, metal and textile. Unfortunately, this tradition is crumbling with the privatisation process. For example, supermarkets that have become privatised are now no longer interested in the

collection of empty bottles. They refuse to accept them because it is inconvenient and unprofitable.

By both officials within the MWFEP and NGO's, a very important, if not the most important, means of public participation is membership of NGO's. Membership can be either passive or active. During the communist regime before December 1989, NGO's were illegal but after the revolution numerous NGO's sprang up. Their origins stem largely from the scientific and teaching communities. At the moment there are about 50 active NGO's in Romania involved at local, national and international levels. The estimated total membership is 450,000 (EC-PHARE, 1992). Their activities centre on environmental education, action projects and data collection.

To improve the state of the local environment NGO's give special attention to data collection despite the limited resources (measuring devices, etc.) they possess. The attention on data collection rests on the belief of most NGO's that environmental problems can be objectively determined. The general feeling held by NGO's at the moment is that if the objective figures and facts are presented the responsible parties (both governmental and industrial) will see the light and change their actions and policies (EC-PHARE, 1992).

It is doubtful whether in future this firm belief in the power of scientific objectivity will remain as strong. The problem is that it ignores existing power structures and competing interest groups in society. The main contradiction of course exists between the environmentalists and the proponents of 'wealth creation'.

The organisational strength of the NGO's is limited. The organisations are almost all based on the work of volunteers and funds are in short supply. Another difficulty is that the co-operation among the NGO's is quite limited. Their knowledge of communication techniques is also very restricted (EC-PHARE, 1992).

Regarding the green parties in Romania, it can be noted that after the elections in November 1992 the green parties in the Parliament lost their positions. This drastic reduction of the role of the green parties in

Romanian politics occurred because of their narrow political purposes.

PART 3 CASE STUDY: GIURGIU

3.1 Location, History and Economic Development

Giurgiu, with a surface area of 44.25 square km, is located on the northern bank of the Danube in south-central Romania. Giurgiu is the capital of the judet (county) Giurgiu which comprises in total twenty settlements. The town of Giurgiu was first documented in 1403 with mention of the fortress of Mircea cel Batrin (1386-1418). More important development of the town occurred after the war of independence in 1877. By 1910 Giurgiu had 16,016 inhabitants. It's population increased steadily especially after 1960 when there was a brisk economic development. The shipyard and port in Giurgiu contributed to this development. Industrial output in Giurgiu includes power, chemical, textile, machine building and food industries (Joint Environmental Commission Ruse-Giurgiu, 1991). Farms for extensive pig raising also exist near Giurgiu.

The industrial development which continued in the 1970's and 1980's attracted many workers from other part of the country especially the north to Giurgiu. Nowadays many of these workers have to return to their native places because of the rise in unemployment levels after the Revolution due to the transition process and the severe reduction of the industrial activities which Romania is facing. The level of unemployment in Giurgiu at the present time therefore does not differ greatly from figures elsewhere in Romania. As a result of the economic recession the population of Giurgiu has dropped to 70,000. No demographic increase in the population is expected. More likely there will be a further decrease, at least in the short-term, as the migration of unemployed workers from the north back to their birthplaces continues (pers. comm. Giurgiu).

In the future, it is expected that no new industrial objectives will be set having a detrimental effect on the environment.

As it is located on a fertile plain, Giurgiu has a favourable agricultural development. Despite the economic difficulties it remains a fact that Giurgiu is a relatively prosperous area of Romania certainly compared to the less developed north. The relative wealth of Giurgiu also finds its explanation in its location only 60

km south of the capital city Bucharest and its position on the transportation route across the border to Bulgaria and onwards to Turkey. The relative prosperity of the town translates itself in a higher educational level of the citizens of Giurgiu.
Originally housing in Giurgiu was restricted to single family houses with a small garden and perhaps a private well. With the strong industrial development after 1960 the housing pattern changed and many tower blocks under state ownership were built for the growing population. Today 70% of the population lives in these tower blocks. Recently it has been made possible to purchase these flats for private ownership (pers. comm. Giurgiu).

To understand the environmental situation in Giurgiu it is necessary to bear in mind Giurgiu's proximity to the heavily industrialised and populated (200,000 inhabitants) Bulgarian city of Ruse on the other side of the Danube. The emissions of Ruse have an effect on the environment in Giurgiu and vice versa. For instance the industrial and municipal treated waste water of Ruse is discharged into the Danube possibly influencing the quality of the waters downstream also on the Romanian bank.

3.2 Water supply

Giurgiu does not have problems with water supply and does not expect to have so in the future. There are three sources of water supply in Giurgiu. First, there is water from the Danube which is only used by industries and irrigation for agriculture. Second, there are private wells used by households in single family houses having a depth of between 20-60m. Third, there is the centralised water supply system which pumps up groundwater from different layers up to a depth of about 600 metres. This water is of very good quality and does not need to be extensively purified requiring only chlorination (pers. comm. Giurgiu). It is claimed that Giurgiu is one of the few municipalities in Romania with such a good quality water source. Of this centralised water supply the capacity is 0.4 cubic metres per second (pers. comm. Bucharest).

90% of the households in Giurgiu are attached to the centralised water supply implying that the remaining 10%

are still using private wells (pers. comm. Giurgiu). The length of the distribution network for the centralised water supply is 63% of the total length of the streets (pers. comm. Bucharest).

As is the case in the rest of Romania the RBA of AR sells the raw water to local users on the basis of a contract. In Giurgiu there are six to seven big users which have contracts. Major industrial plants can collect water with their own installations on the basis of the signed contract with AR. Other industrial units without their own installations, and industries requiring important quantities of drinking water need to purchase their water through the special unit (ELTIS). This local enterprise for the drinking water supply, which is co-ordinate by the City Hall, has its own contract with the local office of AR. It not only provides industries with drinking water but also households connected to the centralised water supply system. In both the contracts for industries and for ELTIS, agreements are formulated to monthly review the amount of water required. ELTIS has an installation capacity of 1.1 m3 per second (pers. comm. Giurgiu).

3.3. Water use and measurement

Concerning the use of drinking water, the norm is 8.5 m3/month per household. Last year the actual use was an average of 19 m3/month. The consumption is higher in the winter because the pumping system is working continuously to prevent the freezing of pipes. This leads to great losses. During the summer, consumption is also higher because Giurgiu is a semi-agricultural city and drinking water is used for animals and agricultural gardens (pers. comm. Giurgiu).

Single family houses and tower blocks have meters to measure the use of water. A problem is that in the tower blocks not each individual household has a meter. Instead there is one meter for one block administration with one main distribution line. Such a line with a block administration could for example include fifteen families. As a result of this system it is technically (and legally) impossible to shut households off for not paying their water bills if there are still some people on the line who are paying their bills. But a new regulation about water

supply for Giurgiu is being prepared by ELTIS (pers. comm. Giurgiu).

3.4 Waste water discharge

Only five of the twenty settlements (including the municipality of Giurgiu) in the Judet of Giurgiu have sewage systems (pers. comm. Bucharest).

Although 90% of the single family houses in the town of Giurgiu are connected to the centralised water supply system, only 30% of these houses are attached to the central sewage system. The remaining 70% of the single family houses utilise septic tanks. All of the tower blocks are connected to the sewage system which are laid out on 49% of the length of the streets. Therefore in total about 80% of the household waste water in the town of Giurgiu is collected centrally (pers. comm. Giurgiu).
All the industries connected to the centralised sewerage system have their own pre-treatment systems which contain chemical operations in order to neutralise the toxins, correct the ph, separate the grease substances and retain the big residues. The treated waste water then goes into the central pipelines for further treatment at the local waste water treatment plant. Unfortunately, the quality of the treated waste water is not optimal because the pre-treatment plants are not all operating well. In addition to the necessity to improve operations and maintenance, there are plans to modernise and extend the capacities of the existing pre-treatment plants (pers. comm. Giurgiu).

The present central waste water treatment plant consequently collects waste water from both households and industries; the percentage of the total waste water coming from the households forming about 39%. The waste water treatment plant is located downstream from the city near to the border area and the treated water is discharged into the Danube. This waste water treatment plant has only one step-a mechanical (sedimentation) step. There is no biological treatment of the waste water. The levels of the mechanical treatment are 45% (6 800 kg of suspended particles/day) and 5% (COD - 8000 kg/day) (pers. comm. Giurgiu).
In 1989 the central waste water treatment plant had reached its maximum capacity. The capacity of the

treatment plant is 415 l/sec, which is below the present requirements due to the increasing number of industries using drinking water and the size of the local population. An extension of the existing waste water treatment plant is at present impossible due to its location near to the custom area. Therefore a plan exists to build a new treatment plant with an increased capacity of 1000 l/s. It would have two steps; mechanical and biological (pers. comm. Giurgiu). With the new treatment plant 90% of the total waste water would be treated. The construction demands five years and at the moment only internal financial sources (taxes) are counted on to finance the plant (pers. comm. Giurgiu). If possibilities for external funds exist the municipality would consider using them. No funds from the national government are expected because this project is not one of the main priorities of the national government. Giurgiu is a small municipality, there are other priorities, and the funds are limited.

Taking into consideration the fact that Giurgiu is a small municipality experiencing a severe reduction in industrial activity (and a corresponding 60-70% decrease in pollution) it can be stated that the contribution of the town to the pollution of the Danube in this part of the river is at the moment practically negligible. The effects on the Danube Delta and Black Sea must however be considered (see chapter II). Moreover, in the long term, when economic development starts again, it is expected that the contribution of Giurgiu to the total pollution of the Danube will increase if no new waste water treatment plant is built. The present reduction in pollution is thus an artificial one and it is expected that pollution will increase in the future if no environmental measures are taken now.

As is the case in the rest of Romania, permits are required for the discharge of waste water. These permits with agreed limits for pollution discharges are issued by the BA. Penalties need to be paid if the limits are exceeded. The allowed quantity of waste water discharged is also mentioned in the permit.

3.5 Price of water supply and discharge

The cost of drinking water in Giurgiu for households depends on the source. People with their own private wells pay nothing. Houses and flats connected to the centralised water supply system do need to pay for the drinking water supplied. In the tower blocks there are meters for the local administrative units (see § 3.3). The price per household for drinking water in the tower blocks is determined by dividing the number of households attached to the line and the total water use measured by the meter. In the single family houses connected to the centralised water supply the water bill is determined by multiplying the mean use by the standard price per unit of water. In other words there are no individual water meters in the single family houses. The price of drinking water is constantly increasing because of both the inflation rate and government policy (Gov. Dec. 1001/90). For example, the price has increased almost fifty-fold from 0.3 lei/m3 in November 1992 to 14 lei/m3 in February 1993 (pers. comm. Giurgiu). On top of the price of raw water which ELTIS purchases from AR, the local enterprise for water supply (ELTIS) charges for the pumping, purification, distribution and maintenance costs of the drinking water supply and treatment of the waste water.

The discharge of waste water into the Danube is a relatively expensive process because the level of the plain is below the Danube. The waste water therefore needs to be pumped over the banks of the Danube which increases the costs.

The water bill for the households has both a supply and a discharge component which are clearly specified on the bill itself. The costs for discharge are quite low compared to the costs for supply.

3.6 Responsible institutions

Branch Agency

In Giurgiu the BA is responsible for both qualitative aspects of the water management of the Arges mini-river basin. They are consulted by the MWFEP for all planned regulations in the field of environment. The branch agency has 65 employees (25 hydrotechnical engineers, 9 chemists, biologists, agronomists, a mathematician, etc.). In addition to water management they are responsible for the

measurement of other environmental factors (air pollution, radioactivity, etc.) (pers. comm. Giurgiu).

They control the water quality of the Danube river using measuring points for daily and monthly measurements. Each month three samples downstream, three samples upstream and three samples in Giurgiu harbour are taken whereby 33 indicators are analyzed. Daily two samples are analyzed: rapid flux - 22 indicators; and 5 litres of water for evaporation analysis (pers. comm. Giurgiu).

The treatment system is controlled each week or more often if necessary.

Joint Environmental Commission (Giurgiu-Ruse)
As a result of Giurgiu's proximity to Ruse (the city across the river in Bulgaria) and the pollution problems experienced on both sides of the river, a joint environmental subcommission co-ordinate for Giurgiu by the city hall was installed. This commission is a component of a joint Romanian-Bulgarian commission set up for the whole common border along the Danube. The commission prepares regular monthly meetings for the talks with the authorities in Ruse. Because the air pollution problems were very severe in this area the main activity of the commission was mostly oriented towards this field of cooperation. The commission has 23 members from 7 political parties dealing with air, soil and water pollution, urbanisation, planning, nature protection, etc.. (pers. comm. Giurgiu). This commission is a confirmation of the bilateral co-operation between Romania and Bulgaria (see also international agreements).

3.7 Environmental awareness and public participation

Environmental awareness
In general, the inhabitants of Giurgiu are not disturbed about the state of the environment. The part of the factory manufacturing sulphur chloride in Giurgiu was closed down in 1987 not so much because of public pressure in Giurgiu but because of concern in Ruse. It became a political dispute. In 1989 the whole factory was closed down (pers. comm. Giurgiu).

The process of environmental awareness of the people is very slow. Concerning water use it is recognised by the municipal authorities that water consumption is excessive. A leaking water supply distribution system forms part of the cause for this excessive consumption. The cultural habits of the population regarding water can also help explain part of this problem. The people like using lots of water to clean their clothes, food, houses and themselves. They also use the water for gardening purposes. The households do not realise what the price of pollution is and they are also not used to the fact that the supply and discharge of water has a price. At the moment the only constraints the households feel for using water is the amount of water the municipality can supply.

Although there has been a dry period throughout Romania for the last ten years, this dry period has not seriously affected Giurgiu because of Giurgiu's sufficient groundwater supply. This fact has made the likelihood of a mentality transformation concerning water use in Giurgiu perhaps less easy than in other more severely affected drought areas. On the other hand, it is accepted that the Romanian population as a whole should be educated on the same national issues. One of these issues is the necessity to use water in a more optimal manner.

The local media is used to further the environmental awareness of the local people. Monthly the local press issues an article dealing with environmental problems (pers. comm. Giurgiu).

Public participation

In december 1991 a symposium concerning the present state and the perspectives for the ecological protection in Giurgiu-Russe area was organised, with a large participation of different international organizations involved in environmental activities.

PART 4 CONCLUSION

Concluding this chapter, one needs to review the national background, the local problems and the local possibilities.

The general national background is characterised by radical changes which have taken place in the political,

economic and social fields since 1989. Keynote among these changes are:
- the setting up of a parliamentary democracy under which regular democratic elections at all levels are held;
- the restructuring of all organisations on a democratic basis; and
- the transition from a centralised to a free market economy.

The transition process has created major social upheavels with negative consequences for both the economic output and the standard of living of most of the people. Unemployment has become a real problem, and the prices of goods and services have been liberalised. As a result, these prices are now noticeably higher.
The national context specifically related to water management is characterised by two main problems: 1) the scarcity of water; and 2) the deterioration of the quality of almost all water sources. A great deal of discharaged water is inadequately treated or not treated at all. During recent years, major organisational and legal changes have occurred in the field of water management. New laws and regulations have been adopted or old laws have been revised and updated to meet international standards. This process is continuing.
Gov. Dec. 1001/1990 updates and introduces various economic instruments (prices, tariffs and penalties). The presently operating Water Fund will be used to, among others, improve the water management and support new investments in the field of water protection. The planned Environmental Fund has as its aim to rehabilitate and restore the environment where it has been severely neglected or abused.
Regarding the organisational aspects of water management, various authorities and organisations are involved at different governmental levels. The MWEP with its local BA's are responsible for the strategic/planning aspects of water management. The BA's are also responsible for monitoring the water quality of surface water and discharged waste water (along with the RBA). AR at the national level and the RBA's at the local level, are responsible for the distribution and supply of raw water as well as protection against overuse of water. Local drinking water supply is organised by the local enterprises, who are co-ordinated by the municipality, but who remain economically independent. Drinking water

quality is monitored by the Ministry of Health through its local units (institutes).

The case study of Giurgiu revealed, at the local level, several problems which need to be overcome to improve the present state of the environment and to prevent any future deterioration. The main problems many be construed as a lack of resources (financial, human) and a lack of experience. The local authorities lack experience with the new powers that they have been granted based on the new laws and regulations. Another problem is that the environmental awareness and interest of the local people are low.

Giurgiu also faces problems in that its existing treatment plant, which was operating at maximum capacity in 1989, will need to be expanded and improved. Moreover, the industrial pre-treatment systems for industrial waste water also need to be maintained properly, and if necessary, modernised. Another problem is that water losses in both the pipelines and houses/flats are unacceptably high.

Next to the problems lie the possibilities. Although the decentralisation of power to the local authorities may be regarded as a problem (lack of experience), on the other hand, it also provides a challenge and a real possibility for local levels to undertake actions to improve the environment whilst developing their area. Co-operation with other municipalities in the area or abroad is also now a real possibility. Another possibility is the active involvement of the local people in promoting both the national and local environmental objectives. The environmental efforts at local schools can be intensified; the existing contacts with the mass media can be utilised; and the embryonic environmental NGO movement could become a strong partner for change.

CHAPTER IV BULGARIA

In the first Part, a general introduction concerning the Bulgarian political, economic, and social situation and the general environmental situation is given. Part 2 focuses on aspects and policies concerning the Bulgarian water management. Part 3 deals with the specific situation in the municipality of Vidin. Part 4, finally, comprises a brief conclusion of chapter IV.

PART 1 GENERAL INTRODUCTION

In this part, political (§ 1.1) and economic (§ 1.2) changes, and social implications (1.3) that characterise Bulgaria, are briefly described. Emphasis is given to the implications of the "transition period" for the present situation and the future. (§ 1.4) contains a brief outline about the general environmental situation in Bulgaria.

1.1 Political changes

As in other Eastern European countries, a process of democratisation is occurring in Bulgaria. Access to information and knowledge is easier than during the previous regime, and public participation is slowly increasing. Local governments are getting increasing power and responsibilities. These are determined among others, by the 1991 Constitution, and the 1991 Local Self-Government and Self-Administration Act.

In the present move towards democracy, many changes take place regarding the composition of the Parliament. This makes the acceptance of new laws within the Parliament a slow and difficult process. Only the new Constitution and the most important laws (law for privatisation, law for competition, law for banking, and the law for state companies and private business) have been accepted until now (pers. comm., Sofia).

The decentralisation process creates new discussions between the national and the local level, for which the legal framework is not always clear. The dialogue between the two levels has not yet been established (pers. comm.).

The administrative structure in Bulgaria contains the following three levels starting from the smallest one: obshtina (Bulg. municipality), district, and region. At present, the executive body at the municipal level is under the directly elected mayor whilst the municipal council is the legislative body at the local level. Obshtinas now have the right to form associations in order to solve common problems, like the provision of the infrastructure. The

Self-Government Act allows the creation of municipal property. This Act might imply that the water infrastructure that is contained within a municipal territory will be owned by obshtinas, whereas other water infrastructure remains state property.

According to the Self-Government Act and the Constitution, the obshtina also has a high degree of financial autonomy. The municipal council compiles its budget on the basis of its own sources of revenues and subsidies from the state. The financing of obshtinas is nevertheless still heavily centralised: if planned expenditures are larger than planned revenues, obshtinas are entitled to receive subsidies from the central government. A Local Finance Act is now under preparation.

1.2 Economic changes

Early in 1991, an economic reform programme was set up in Bulgaria. The main objective was the move towards a market economy. Main elements of the programme were the liberalization of prices (which included a transition towards a system of floating exchange rates) and the return of land to private ownership. Other important aspects were the privatisation of State owned enterprises (May 8, 1992, Law on Transformation and Privatization of State-Owned and Municipal Enterprises constitutes the legal basis); removal of subsidies to State enterprises; banking sector reforms; and the reduction or elimination of subsidies on energy prices (Hubert Humphrey Institute, 1992).

This transition period was not without consequences. Bulgaria actually left the group of medium (per capita) income countries and entered into the group of low income countries (Hubert Humphrey Institute, 1992). Consequently, there have been important falls in output in the past two to three years, mostly due to Bulgaria's previous dependence on trade with the former Council for Mutual Economic Aid (COMECON) countries. Output (GDP) declined in real terms by 12% in 1990 and by 23% in 1991. Industrial output in real terms decreased by 28% in 1991. Another cause of the decline of industrial output was the governmental policy of price adjustments. Energy prices were raised to the level of costs for all industrial consumers by mid-1991 (household energy is still subsidized). The government announced as well, that it would no longer subsidize inefficient producers, and that a "hard budget constraint" would be applied (Hubert Humphrey Institute, 1992).

Future projections of the IMF (International Monetary Fund) indicate further declines in output in 1992 and 1993, zero growth in 1994 and positive growth from 1995 onwards (EBRD 1992).

The modified governmental economic policy also had consequences for the industrial structure of Bulgaria. The change towards a market economy created a lack of control over the production and the prices, and this led to a switch from heavy industry (which is energy- and raw material-consuming) to light industry. This might imply that industries like metal-processing, machinery, and chemical industry will loose their priority position. Bulgaria will probably develop light industry, tourism, and agriculture (Hubert Humphrey Institute, 1992).

A moratorium on external debt payments was declared in March 1990. The outstanding commercial external debt amounts to about US$ 9.5 billion. Access to foreign commercial lending sources will remain severely restricted until the foreign debt problem has been resolved.

The 1992 inflation rate was estimated to be 55% per year. Presently, the actual inflation rate amounts to 100% (the first part of 1993). According to IMF projections, the rate will decline over the next few years.

Moreover, domestic sources of investment finance are extremely limited at this moment, and tax receipts have declined sharply as a result of the overall reduction in the levels of economic activity. As a consequence, municipalities suffer from a lack of funds as well, due to the limited resources available from taxes and charges, and their dependence on funding by the central government.

1.3 Social implications

The economic restructuring leads towards a social restructuring as well. Due to the liberalization of the prices, and the decrease of the production, the social conditions are gradually getting worse. Unemployment has risen sharply, and is currently at around 15% of the labour force. This is easy to understand, because the State sector accounted for over 90% of total employment during 1991. In the current situation, out of a total population of 8.5 million people, 2.5 million persons receive pensions, and 0.5 million people are unemployed.

The life expectancy in Bulgaria has decreased, and the number of births as well. The infant mortality rate increased after 1988. For 1990 it was 14.8 per 1000 which is regarded as a high rate for West European standards (Hubert Humphrey Institute, 1992)
This present social situation explains again why government and municipal authorities have expressed concern about the impact of higher tariffs on family budgets.

1.4 General description of the state of the environment in Bulgaria

One of the major causes of pollution in Bulgaria was the excessive industrial development which comprised 37.6% of the national economy. One finds the roots of this situation in the forty-five years of centralised planned economy, with special emphasis on the development of heavy industry without environmental concern. The low prices of energy and raw materials also led to their excessive use per capita of the population.

The bad environmental situation in some of the regions in Bulgaria is one of the causes of the deteriorating health of the population. This is proved by the fact that health problems become more frequent in the so called "hot spots", where the heavy industry is concentrated (Hubert Humphrey Institute, 1992).

The pollution of the air is one of the most serious environmental problems in Bulgaria. Most air pollutants originate from coal-burning power plants, metallurgical and chemical plants and motor transport. About 41% of the population lives in 17 regions where the air quality has worsened. The main pollutants are sulphur and nitrogen oxides, dust, hydrocarbon and some specific contaminants.

The soil pollution is a serious problem as well. Concentrations of heavy metals like lead, copper, zinc, arsenic, and others represent a major risk for people, flora and fauna. About 1.2 million.ha of arable land was damaged or destroyed during the last few decades and a certain proportion of agricultural lands (1 million.ha) is eroded.

Water pollution is another cause of great concern. Contamination of especially the rivers is due to the inadequate number of waste water treatment plants near industrial enterprises, livestock breeding farms, and settlements.

PART 2 WATER MANAGEMENT

In this Part, water management in Bulgaria is described, while major attention is given to problems and policies concerning water quality and quantity management.
As Chapter IV prepares the reader for the Action Plans described in Chapter VI, the description already focusses on aspects that concern municipalities, and households' water discharge and use.
In § 2.1, the present state of the water resources will be outlined, and in § 2.2 the water supply and discharge system in Bulgaria is dealt with.
In § 2.3, first an overview is given of the major organisations that are involved in water policy and management (§ 2.3.1), followed by a description of the

tasks fulfilled by, and the links between, these organisations (§ 2.3.2).
§ 2.4 comprises an overview of the current legal (§ 2.4.1), economic (§ 2.4.2), and social (§ 2.4.3) policy instruments that are used in Bulgaria.
In each of the following paragraphs, possible environmental problems and constraints are selected, that are going to be important for the elaboration of the Action Plan for Vidin.

2.1 Present state of the water resources

The hydrological network in Bulgaria is characterised by its complexity and the lack of big internal rivers. All the rivers are flowing into the basins of the Black Sea and Aegean Sea; the flows are respectively 9.5 billion m^3 and 11.2 billion m^3. The biggest Bulgarian river is Maritza (4.1 billion m^3). From the effluents of the Danube river, Iskar has the largest basin. The ground water resources represent approximately 11.2 billion m^3 (MoE, 1992).

In general water resources are scarce in Bulgaria. There are many places in the country which suffer restrictions and are obliged to enforce regimes for water use. The situation is aggravated during the dry summer periods. Other settlements are expected to face similar problems in the future and therefore a sustainable water management based on river basin zonation is needed in order to ensure the appropriate recourse use.

The water used for supply is mostly groundwater. It has a more reliable quality and does not require special treatment. 68% of the total central water supplies in Bulgaria are groundwater, and 32% are surface water. From the total groundwater extraction, 39 % is used for potable water, while the remaining part is used for industrial, agricultural, and other activities. About $5m^3$/sec of infiltrated Danubian water is used for drinking and domestic water use (MoE, 1993).

2.2 Water supply and discharge

The national average connection rate to the water supply system is very high (more than 98%). Traditionally, water supply and sewage were provided by the Government as a social service at a nominal charge which remained unchanged for years. This led to excessive and wasteful water consumption by both domestic and industrial consumers.
Recently, however, water sales decreased drastically in some areas. This decrease might be attributed to the diminished industrial activities. At present, the average domestic consumption ranges from 114 l/day/capita, whereas the total consumption (industrial consumption included) ranges from 148 l/day/capita to 329 l/day/capita. The

production rate (indicated by the water companies) varies from 181 l/day/capita to 630 l/day/capita (pers. comm.).

The level of service of the water supply system is not always satisfactory and water shortages are sometimes encountered.

Although settlements with a population above 50,000 people usually have sewage systems, only one quarter of the sewage systems have effective treatment facilities. The quality of the system is apparently not optimal: most of the equipment in the water purification plants, the waste water treatment plants, and pumping stations is outdated; generally speaking, there is little preventive maintenance of the equipment.

The water losses estimated as a percentage of the quantity of water produced ranges from 20 to 50% in the different obshtinas. These figures are not fully reliable, however, given the almost general lack of metering devices for measuring the quantity of water produced. These losses are mainly due to the poor quality of the existing asbestos cement pipes which are used for the networks. The renewal of these asbestos cement pipes will be an important issue in the immediate future.

In addition, many waste water treatment plants under construction have not been completed. The construction of waste water treatment plants is financed by the government, because the municipalities cannot afford to pay for them. The only works on the plants that are carried out, is the construction of already started plants. Until now, no international funds have been available for the construction.

2.3 Organisational aspects of water management

In the following paragraph, an overview is given of organisations and institutions that are active in the field of water policy and research (§ 2.3.1). In § 2.3.2, the links between the bodies previously described and their working procedures are explained.

2.3.1 Overview of organisations involved

In this subparagraph, Ministries and institutions, that play an important role in the field of environmental (water) policy and research are described. A distinction is made between bodies that are in charge of strategy and planning, and bodies that also have operational tasks. Directly after the description of responsible Ministries, the connected institutions at the regional and municipal level are mentioned. Research institutions, that are

closely connected to the Ministries described, are mentioned separately at the end of this subparagraph.

Strategy and planning

Ministry of Environment (MoE)
This Ministry is in charge of the coordination of environmental protection activities and pollution control. It is also responsible for the monitoring of the (drinking-) water quality and the enforcement of effluent quality standards (for among others waste water discharges from municipal sources into water courses). Recently, the departments of the Ministry have been restructured according to the regulated media (air, water, soil, etc).

The central office of the Ministry is in Sofia, is as the Monitoring, Research and Information Centre, that is closely connected to it. The MoE administers the Environmental Protection Fund (EPF) and the Water Resources Fund. The aim of the EPF is to provide funds for environmental improvement projects. Until now, the fund has been financed from fines levied on polluters. Unfortunately, the amounts collected have been small.

(16) Regional Environmental Inspectorates (REIs)
These regional bodies are under the direct control of the MoE. They have approximately 350 employees. Its goals and functions are the same as for the MoE.

Ministry of Public Health (MoPH)
This ministry is responsible for the protection of human health, and determines and monitors ambient standards. The Directorate of Health Prophylaxis and State Sanitary Control has 100 employees in Sofia. It comprises 5 departments.

The (28) District Hygiene and Epidemiology Institutes
Under the direct control of the MoPH are the 28 District Hygiene and Epidemiology Institutes (also called Sanitary Epidemic Inspectorates), with a total staff of 1,200. Only 10 of these institutes possess laboratories. Until 1991, these institutes were subordinated to 28 district level governments, but that governmental level is now abolished. Among other tasks, the institutes collect air, water and soil ambient quality data.

National Water Council (NWC)
Also called the National Council on Water, this Council was established in October, 1992. It controls the water resource use, and has the responsibility to plan legislation. It also issues water abstraction permits for household and industrial use and enforces them. The NWC has 12 members, who represent the main water users in the economy. All water users (with the exception of private households) should normally obtain a permit from the NWC. The Council

also prepares monthly water allocation plans. This has become important, because in recent years, a number of cities and population centres have experienced drinking water supply shortages.

NWC has 6 branches for each of the river basins in the country. The total staff of these branches amounts to a total of 100. The NWC is subordinated to the Ministerial Council (pers. comm., Sofia).

Bodies with important operational financial and economic tasks

Ministry of Regional Development Housing Policy and Construction (MRD) This Ministry is responsible for investment planning and implementation. It also oversees the operation of the 28 state water supply and sewage companies, and the 14 municipal water companies.

The water supply and sanitation sector

This sector (the 28 state water supply and sewage companies, and the 14 municipal water companies) consists mainly of state institutions and enterprises. All these companies possess, at present, state-property sole-ownership. These state bodies cover a whole range of functions: regulation and overview, water resources management and environmental and health protection, operations and maintenance, and investment planning and implementation.

Research Institutions

Institute of Hygiene and Occupational Disease (IHOD)

It supports the work of the MoPH by developing laboratory methods, and conducts special studies. It also proposes exposure norms and ambient standards. The Institute also has a role in collecting and organizing data from the 28 district level institutes.

Academy of Sciences

They are active in the area of environmental research and monitoring through its three Institutes of Water, Ecology and Meteorology.

2.3.2 Working procedures and co-operation between organisations.

Delegation of responsibilities

The MoE, the MRD, the MoPH, and the Ministries of Forest and Agriculture are all responsible for the protection of the environment. Representatives of these bodies are located in the provinces as well, where local authorities co-operate with them. Every municipality should have a department for environmental protection.

The directives of the MoE and the monitoring are carried out by the 16 REIs. From the total number of rivers entering into the Danube, 25 have been selected for monitoring.

Water sampling is accomplished by three organisations: the REIs, the Hygiene Epidemiology Institute and the offices of Regional Chemical Industry Management. At some of the control points, sampling takes place twice monthly and at others less than 12 times a year (MoE, 1993).

Groundwater quality is monitored by a monitoring control network that consists of 276 points distributed over the areas depending on their physical-geographical, geological-hydrological and other conditions.

Periods of sampling range from 1 to 12 times per year. Analyses are performed in the chemical laboratories of the REIs, and in the central chemical laboratory of the Institute of Hydrology and Meteorology (MoE, 1993) .

By a decision of the Bulgarian State Council, the Standard National Automated System for Environmental Protection (SNASEP) was created in 1975. Its purpose is to use modern scientific and engineering methods to obtain timely and reliable information about environmental conditions. This information is used as the basis of analyses and evaluations which can make short-term forecasts of environmental conditions (MoE, 1993).

As far as water supply and treatment are concerned, the 14 municipal water companies, which were created from the state water company networks, are now owned and controlled by their municipal councils. Through management contracts, the MRD has given managers of state water companies the freedom to define the internal structure of their companies, technical management, marketing and business development policies and financial management (up to delegated limits). The contracts define the obligations of the managers to the MRD: to elaborate a strategic development programme, to prepare a programme for technical upgrading with a secure financing plan, to prepare financial reports, to increase profit and profitability, and to prepare for privatisation.

The regional state-owned water companies still have the old structure. The average staffing ratio (7.6 employees for 1000 customers) is between the ratios in Western Europe (1 to 1000 customers) and in developing countries (10-25 to 1000 customers). New managers have been recently appointed, with a high degree of autonomy. They are now free to adapt the internal structure of the companies to the actual needs.

The water supply and waste water treatment companies, that now belong to the municipalities, constitute one company. About this combined task of the water companies, different options prevail. Some would prefer a separation between water supply and waste water treatment, because it would improve the management and financial efficiency (pers. comm., Sofia). Others (see Part III) suggest that the joined organisation of the two tasks gives the opportunity to save capital and labour costs.

Water pricing
Concerning water pricing: the water companies can now freely set their own prices, under the supervision of the MRD. In practice, a mark-up of up to 20 % is applied to the calculated anticipated average operations and maintenance costs, in order to cover other costs (interest payments, non-payments by customers, head office costs for some companies). Prices for households are set at a discount (typically around 30 %) below average cost. This discount is compensated by the payments from the industries, who are charged more.

All the water prices are defined by local authorities of the water (supply and sewage) companies, on the basis of local circumstances. For example, a levy for drinking water for the first trimester of 1993 is 2.0 leva/m^3 in Sofia, and 4.5 leva/m^3 in Razgrad (pers. comm., Sofia)[1]. At present only the drinking water is paid for, not the discharge.

The metering of the water use, to make the customers pay, has recently been improved. It was recently decided to meter each apartment in each building. Although the water meter workshops are run satisfactorily, the number of tested meters is generally rather low.

Enforcement and determination of standards for the maintenance of water quality
In the field of the determination, the setting, and the supervision of pollution charges and fines, the MoE has the total responsibility. These tasks are carried out by the 16 REIs throughout Bulgaria. Their areas of jurisdiction generally match the pattern of local administration.

Sewage flows have generally been high, because the governmental nominal charge for discharge remained unchanged for years. In addition, there was no incentive for industries to pre-treat effluent before discharging it to the municipal sewers. Another result of this policy was a shortage of funds for regular preventive maintenance. Recently, however, the withdrawal of Government subsidies (since 1989) and increasing pressure to levy realistic wa-

---

[1] The rate exchange in March 1993 is approximately 26 leva per 1 USD

ter and sewage charges have led to substantial tariff increases.

Legislative changes, that are possibly going to lead to considerable increases in the level of financing for pollution control activities at municipal and national levels are actually waiting for Parliamentary approval. These will be discussed further in § 2.4.1 and § 2.4.2.

Bottlenecks
The renovated water sector is still characterised by several difficulties:

In the National Review of Bulgaria several bottlenecks, concerning the monitoring system (in 1989), are mentioned:

1) Among the 87 standards included in Regulation N 7 - (96/12.12 1986) only 33 indices are analysed. The complete list of standards is not monitored, even at a single monitoring site.
2) The extent of monitoring does not permit an accurate evaluation of the pollution loads entering water resources.
3) Since the sampling is done by different agencies, discrepancies exist in the concentration values of some parameters. Moreover, methodological difficulties exist in the definition of general criteria for evaluation and comparison. Comparisons of results are thus extremely difficult. As a result, several data are then eliminated from the analyses.

Some more bottlenecks could be added. Geographic structures for the water management do not always agree with administrative and political structures. Moreover, some obshtinas are too small to operate and maintain their municipal water utilities efficiently.

The financial situation of the water supply and sewage companies is weak. Although water supply and sewage charges have been greatly increased over the past two years, the revenues generated are still insufficient. This results in a lack of funds for system renovations and expansion. Furthermore, as the companies are now expected to be financially self-supporting, no governmental subsidies are available to them.

The regulation and overview of the water sector as a whole is characterised by a lack of strategy and clear responsibility for co-ordination of the centre. The role of the NWC is unclear, and its capability extremely restricted. There is a functional overlap of tasks carried out by the MoPH, MoE, MRD, and NWC, in particular in monitoring ambient water quality (pers. comm.).

Finally, it appears that Regulation No 9 of October 1987, which remains the main legislation governing the obligations of the water companies towards their consumers, is institutionally outdated (pers. comm., Sofia).

2.4 Policy instruments

National environmental policy is controlled by the MoE under the legal powers set out in the Environmental Protection Act, from 1991. The Government's stated policy objective is to reduce current levels of pollution and to provide a more healthy environment for all regions of Bulgaria. However, there is no documented statement of policy objectives with a given time frame which would provide a guidance for central, regional and local authorities.

This paragraph gives an overview of legal (§ 2.4.1), economic (§ 2.4.2) and social (§ 2.4.3) policy instruments, that are actually applied by authorities and organisations to improve the overall water quality management.

2.4.1 Legal instruments

The slow process of acceptance of laws in the Parliament is not very favourable to the environment of Bulgaria. There is an urgent need to get new laws of environmental protection accepted (water, air, soil). After the acceptance of these laws, more detailed laws like the law for hazardous waste and toxic waste can be introduced. The law on water might be voted upon within June, 1993 (pers. comm., Sofia).

In this subparagraph, attention is at first given to the Bulgarian national legislation, and secondly to the international agreements that Bulgaria has signed and ratified until now.

National legislation

The most significant environmental protection acts that were, until recently, found in the environmental protection legislation were the "Law for Air, Water, and Soil Protection" (1936) (concerning water: the "Water Protection Act") and the "Law for Environmental Protection" with implementing regulations. Specific areas are designated to be protected and recultivated (MoE, 1993).

In addition, the water quality is protected by the use of some technical regulations and standards (see annex F).

Polluters, who create ecological disturbances, can be punished on the basis of civil, administrative, and criminal grounds. In practice, these legal tools are, however, rarely used, and the sanctions imposed do not correspond equally to the damages caused. In 1987 for example, 1,485 sanctions were imposed by the REIs (on the basis of administrative law), 1,536 in 1988, and 1,647 in 1989, but there was no punitive ordinance in place for the largest part of them while the fines on the rest were no more than 500 leva (approximately 20 USD), (MoE, 1993).

The existing legal basis for the enforcement of the laws and technical water quality standards seems to be insufficient.

The current Environmental Protection Act (EPA) (passed in October 1991) now sets the basic framework for environmental law in the country. The EPA specifies the major principles for environmental protection and pollution control, including the "polluter pays principle". The procedures and mechanisms for the principles to be applied have been set up in the Amendment Act (EBRD, 1992).

A number of amendments to the EPA are awaiting approval by the Parliament. Of importance for the management of the water quality are the following:

(a) The levying of charges for polluting activities within admissible limits. (see 2.4.2)

(b) Specification of the division of receipts from pollution charges and fines between the national Environmental Protection Fund and the municipal funds for environmental protection. (see § 2.4.2)

(c) Specification of activities which will be subject to Environmental Impact Assessment, and how such assessments shall be carried out.

(d) Clarifications of the duties and powers of the Ministry of Environment.

Here, we can think of duties and powers in the following fields:
- Environmental Impact Assessments;
- Collection, Spending and Control of Finances from the Environmental Protection Funds;
- Procedure for determining of Sanctions for Pollution or damage to the Environment above the Permissible Limits;
- Indices and Standards for Permissible content of Hazardous Substances in Industrial Waste Waters discharged in Municipal Sewage Systems;
- Standards for determining the Quality of Surface Water Streams and Basins;
- Quality Requirements of Waters intended for the major types of Water Uses;
- Charges for Waste Waters Discharge (EBRD, 1992).

These possible legislative changes offer prospects for significant increases in the level of financing for pollution control activities at both national and municipal levels. However, the actual amounts which will be generated will obviously depend on the acceptance by Parliament of the draft proposals of the EPA and on the ability of the regulatory authorities to assess and collect the different charges and fines.

International cooperation
As Romania and Bulgaria are both countries along the Danube, the two riparian countries have sometimes signed and/or ratified the same international agreements.

As a consequence, only a brief outline is given about conventions signed by Bulgaria. For a further description of these conventions, Chapter III should be consulted.

The Convention concerning the navigation along the Danube (Belgrade 1948) was signed and ratified by Bulgaria. The Bulgarian Government also signed the Convention on the Protection and Use of the Transboundary Rivers and International Lakes (Helsinki 1992). The Convention on the Protection of the Black Sea (Bucharest 1992) has been signed by the Government of Bulgaria. Finally, the Convention between the Romanian and Bulgarian Governments concerning the co-operation in the field of environmental protection (Sofia 1992) was ratified by Bulgaria. Bulgaria was also present at the meetings concerning the Bucharest Declaration (1985).

As was mentioned in chapter III, an important international meeting was organised in September 1991. Subsequently, in January 1992, a first task force meeting about the improvement of the water quality of the Danube and the sustainable use of the water resources in the region, was organised. During this first meeting, a working plan was adopted. It was here proposed, that the project would be subdivided into 2 phases: a preparatory phase that would

last 3 years, and a second phase (7 years) during which the investment projects would start.

The basic aims of this international project are:
- The establishment of pre-investment studies concerning the main tributaries (4 of the most important basins of the Bulgarian tributaries are studied);
- The development of strategic action plans for the (priority) regions, that will be implemented in the second phase;
- The establishment of harmonized standards and an inventory of emissions;
- The improvement of the existing monitoring systems, emergency alarm systems, data base management, and the laboratories in the countries.

Bulgaria has maintained long term relations with international NGOs like IUCN. Its relationship with the latter became more intense after the establishment of the East European Programme (EEP). A joint programme for institutional strengthening of NGO's was launched in 1991.

2.4.2 Economic instruments

As became clear in § 2.4.1, the main aim of imposing pollution charges and fines and of increasing the water price, is to increase the monies accruing to the Environmental Protection Fund and other funds. As was stated under § 2.4.1, some amendments, concerning economic fundraising, are awaiting parliamentary approval:

(a) The levying of charges for polluting activities within admissible limits.
A polluter who discharges in the environment an effluent with a concentration below certain thresholds has to pay charges related to these discharge levels. If the concentration of certain parameters is above the thresholds, penalties are to be applied. Different draft regulations have been prepared for charges to be levied on waste water discharges by all households, companies, and on municipal waste water treatment plants.

Two alternative rates of charges are included in the draft regulations, with Variant II charges at about two-thirds of the level of the Variant I charges. The charges will be collected by the water supply and treatment companies, and the revenue transferred to the Environmental Protection Fund. Revenue is projected at 0.83 million leva per year with the Variant I level of charges, and 0.55 million leva per year with Variant II charges.

In addition, the draft regulations on penalties for exceeding pollution limits propose very large increases in the amounts of fines.

The main advantage of these legislative changes will be that more funds accrue to the Environmental Protection Fund, and to the municipal funds for environmental protection.

(b) Specification of the division of receipts from pollution charges and fines between the national Environmental Protection Fund and municipal funds for environmental protection.
The incomes of the pollution charges are split in a 60:40 ratio between the national EPF and the municipal funds for environmental protection. The amounts collected from the fines might be divided in a 70:30 ratio between the national and the municipal Funds for Environmental Protection.

From 1989-1990 fines received by the EPF on the average amounted to about 20 million leva per year. Nearly three-quarters of this amount were for water pollution. Receipts have been lower since 1990 because of the reduced levels of economic activity. At present half of the sum of fines collected accrues to the Ministry and the other half to the municipalities.

Until now, the discharger had to maintain the category of the water. The current three water quality categories are now going to be replaced by a new set of five categories according to EC- and US-standards. Emission standards and pollution permits that are going to be imposed in the future will based on these five categories (pers. comm., Sofia) (see chapter II, table 2).

Another potential future source of funding for the water sector will be the levying of water-right fees. A payment of fees for all water abstractions is proposed in the draft Water Act. These fees will be paid into a Water Resources Fund.

Less attention has until now been attributed to the use of these economic charges with the objective to change the behaviour of economic agents.

2.4.3 Social instruments

In Bulgaria, it is commonly considered that the governmental authorities have a less important role in influencing the population's "awareness" of environmental issues than in the Western countries. This can partly be explained by the general lack of governmental funds in the transition period towards the market economy, the existence of other priorities, or the lack of experience in this field.

In the next paragraph, first the environmental awareness of the Bulgarian population is briefly described. Secondly,

attention is given to the role of NGO's in stimulating this environmental awareness.

Environmental awareness
In general the environmental awareness of the people in Bulgaria can be considered as not very consistent. Of major interest are mostly the alarming environmental problems such as air pollution, nuclear, contamination of food, etc. There are institutions in Bulgaria concerned with the dissemination of knowledge and information on the environment. Special attention is paid to these problems at some of the higher institutes and universities. The problem of the implementation of the existing programmes still remains.

Public participation
The first environmental groups and movements appeared in Bulgaria in the late 19th century. Their activities were mainly educational. During the former regime, environmental public organisations carried out large-scale scientific and educational activities, but, since environmental information was kept secret, they were unable to build up public awareness about health hazards stemming from pollution, or to influence governmental decisions (IUCN, 1992).

At present, the activities of NGOs are developing relatively fast in Bulgaria. Actually, more than 100 NGOs exist already. In comparison with the Western countries, the contacts between the authorities and the NGOs are not yet structured. Some NGO's are even established with commercial objectives. There is a need for a united organisation, that should have the task to make relations and responsibilities more transparent. There is no money from the Government to finance NGOs. Many volunteers are working in these organisations, but these people do not receive any salaries. Most of the NGO's do not have many experts.

It seems to be admitted by policy makers in Bulgaria, that the NGO's should have a large task in changing people's awareness about ecological problems (pers. comm, Sofia).

The following active and large environmental movements can be mentioned: the Bulgarian Society for Nature Conservation of the Rhodope Mountains, the Wilderness Fund, the Bulgarian Society for the Protection of Birds and the National Commission for Environmental Protection.

The largest environmental movement, Ecoglasnost was founded in 1987 and has always had a political role, which has not only been limited to the field of the environment. At the start, Ecoglasnost was founded to stress their opposition against the lack of information and the taboos on

environmental issues during the previous regime. At present, the relationships with the authorities are characterised by more mutual confidence.

In Bulgaria, an ecological lobby from Ecoglasnost exists within the Parliament. In this way, people involved in the environmental movement can operate politically. The problem here is, that some people taking part in this lobby, are not any more busy solving environmental problems (pers. comm., Sofia, Vidin).

Probably, the public concern for the environment has decreased recently and there has been a decrease in the membership of Ecoglasnost. A possible reason might be the fact that the population is more concerned now about economic issues, like basic needs and jobs (Eka Morgan, 1993).

PART 3 CASE STUDY: VIDIN

3.1. Location, History and Economic Development

Vidin is a medium sized town situated in the north-west part of Bulgaria, 210 km away from the capital Sofia. It has a key position alongside the Danube river close to the former Yugoslavia and Romania.

Bononia was the first name of this ancient city during the 4th century A.D. During that time it was an important trading centre in the Roman Empire. Later, the city became part of the Bulgarian Kingdom and changed its name to Bdin. It became an influential administrative centre. It was declared a major city and had trading connections with Venice, Dubrovnik and other big cities. After the liberation from the Turkish occupation Vidin played an important role in bringing new and modern influences to Bulgaria. The geographical position of the town has always been of national importance. At the beginning of this century many baroque buildings were built. The town had three religious influences - orthodox christianity, islam, and judism. Unfortunately, 70% of its architectural heritage was destroyed during the socialistic period (pers. comm., Vidin).

Vidin has never been a large industrial centre. It has the following types of industries: chemical works (automobile tires, fibres, gypsum and others), machinery, pumps. These industries are located outside the town in an industrial zone. Regarding agriculture, the land has been preserved well. In the future Vidin hopes to encourage more tourism, sports, culture and light industry.

The Union of Democratic Forces is playing an important role in the decentralization process and it has a strong presence in the local authority. The principle of

self-government is already operating at the local level. There is a room for more co-operation with other municipalities in the area.

The citizens see the future development of the town as a tourist centre. The general tendency is to switch from the present industrial structure to light industry. An economic free trade zone has been planned. The aim is to increase the passenger and transport traffic through the city possibly by constructing a bridge over the Danube. Banking, commercial, sporting and recreational facilities will be attracted.

There are 71,000 residents (who actually live in the town) and 81,000 citizens (living in the outskirts of Vidin). Households (families) are 21,145. The building construction can be characterized as follows: houses up to three floors (10%), 4-5 floors (35%), 5-9 floors (35%), and 9-12 (20%). Most of the houses have little gardens. The former state policy was to construct tower blocks. Future tendency will be to build single or double family houses according to the programme for physical planning of the municipality. It is not expected that the population will increase in the near future (pers.comm., Vidin).

3.2. Water supply

The 21,145 households in Vidin are supplied by two independent water sources - 6 shaft wells and 4 wells type "Raney". The first have total capacity 100 - 140 l/s and the second ones have 700 - 800 l/s. It has not been established from where this water is replenished. There are two stations pumping the water to the town from a depth of 16-18 m (Water Company, Vidin).

Part of the water supplies also other villages from the municipality. There is only one water supply zone in the town. The total amount of water supply in Vidin is 450 to 700 l/s depending on the needs. More than half of it is supplying the 117 industrial and service companies on the territory of Vidin. The water coming out of the wells is chlorinated. It is presently within the drinking water standards (pers. comm., Vidin).

100% of the population is connected to the supply system. The development of the supply network is 140% of the development of the street net as there are streets with a double supply network. There are no problems with the water supply as the power capacity is now only operating at 50% of the total capacity.

The supply pipes are in bad condition. 25% of them are made of metal with asbestos cement coating and the rest is from

asbestos-cement. The major part of them is corroded and should be replaced. On average there are about 5,000 to 6,000 breakdowns in the system per year. The replacement of the main pipe with a cast iron one will cost about 70 million leva. There are no funds available at the moment for this purpose (pers. comm., Vidin).

3.3. Water use and measurement

The average water use is 140 l/day/capita and if one adds industrial enterprises the usage goes up to 320 l/day/capita. The average use by households per month is from 1,0000 to 15,000 l per month (pers. comm., Vidin).

The measurement of water to households is done with separate or common meters in tower blocks and separate in houses. The difference between the amount of water supplied and the amount of water measured reveals a difference of 42% which represents the average water loss per year. It is not established what percentage is caused by leakages and what percentage is due to stolen water (difficult to measure/find subscribers, illegal connections). A great deal of this is stolen water but there is no strict legislation on the stealing of water. Inspections are organised but unable to make subscribers pay. Therefore, in order to control the water meter the householders have to be present. To shut the whole block off if someone is not paying the bill is impossible. With individual houses it is possible to stop the supply because they are separate subscribers (pers. comm., Vidin).

When large water shortages threten, the Mayor has the option to issue a local regulation about the economical use of water and to sanction the persons that are not respecting it.

3.4. Waste water discharge

Vidin has one of the flattest terrains in Bulgaria. Therefore, particular problems with the installation of the sewers exist. The system is constructed according to the minimal required slope outlined in the national standards. In six streets there are specific problems in this respect and the Town Hall is taking the responsibility to improve the situation.

The present sewer-system is serving 72% of the population. The rest is using shafts (septic tanks). There is a possibility for the waste water to reach and pollute the groundwater but this process has not been studied yet.

Industrial production has gone down. Waste water from industries also decreased by about 50%. The chemical factory is operating at reduced capacity and the can factory is closed at the moment. From the total amount of water supply for industries about 75% goes into the mixed sewerage. Another part goes separately into the Danube after being treated. The waste water from the hospital goes through the main collector as the waste water from the

department for contagious diseases goes through a septic tank and is separately treated (pers. comm., Vidin).

The condition of the sewer-network is not controlled. There is no system to detect leakages in the system. Only in case of obvious breakdowns is the system repaired.

The water is discharged into the Danube after passing through a bar screen. There are two pumping stations for waste water at the two ends of the town alongside the Danube. The water is discharged nearby the river bank in the area of the little local bay. The pipes are situated at a distance of 5-6 metres above the lowest river level with energy dissipator. In fact the pipes are half of the year above the river level (pers. comm., Vidin).

3.5. Price of water supply and discharge

The pricing is heavily influenced by the energy cost which represents half of the total price. Therefore, it is planned to change the price every trimester in correspondence with the increasing energy cost.

For the first trimester of 1993 the drinking water price for households is 2.20 leva/m^3. The price of water for industries and private companies is 3.00 leva/m^3. The price is calculated on the basis of the costs. The law gives the option to water companies to raise their profit up to 20%, but the company is only using the base of 12%. For the first trimester of 1993 the cost of drinking water for the water company in Vidin is 2.46 leva/m^3. Therefore this company has financial problems. The recommendation of the Ministry of Regional Development (MRD) is that the price should not be lower than 2.46 leva/m^3. From April 1st, 1993 the price will be increased by about 30% and adopted gradually to the current costs (Water Company, Vidin, 1993).

Householders and industries pay a tax for use of the sewage system. At present it is 0.30 leva/m^3 for households and 0.60 leva/m^3 for industries (Water Company, Vidin).

Pollution taxes have not yet been introduced.

3.6. Responsible institutions

Water Supply and Sewage Company
The water company in Vidin is a state owned Limited Trade Company. The Manager has signed a 3 year contract with the MRD to reduce the financial losses of the company by 10% per year, or to increase the profit if there are no losses. The manager is free to adapt the internal structure to the actual situation.

The company is self-financing, the only responsibility is to run the water supply and sewage system but not to build new plants.

Presently the seven sub-regions of the municipality that the water company is supplying are preparing for decentralization. They are going to have separate financing to understand which ones are profitable and which ones are suffering losses. This creates some problems as until now they have been organized in one structure.

The company does not tend to separate the water supply and sewage in two units because there are no treatment plants. Being a relatively small organization they can use the same shifts for working in the pumping stations for supply and discharge.

The industrial water consumption has been reduced but the water supply capacity remains unchanged because there is no flexible system for alterations. The company maintains the same number of employees and technical equipment.

The Water Company in Vidin has 300 employees of which 10 are engineers. The average salary in 1992 was 1700 leva which does not correspond to the responsibilities and qualification of the staff. Therefore, experts tend to leave the company and to find jobs in the private sector (pers. comm., Vidin).

Municipal Inspection
There is a Department for Environmental Protection in the Town Hall. There are five working experts responsible for environmental inspection.

This inspection department was set up one year ago. Its activities have the following legal framework - Law for Environmental Protection, Order No 7, Law for the administrative violations and punishments and Local Self-Government and Self-Administration Act (see § 2.4.1.). The department is enforcing as well some regulations issued by the Town Council of Vidin (pers. comm., Vidin).

In 1992 the Town Council issued Regulation No 1 for keeping and protecting the environment and the public order in the municipality of Vidin. The Regulation is enforced by the inspection department. It is dealing with the sanctioning of the people who negatively affect the environment. The sanctions have been increased by 10-fold, compared to the situation in the 1992. In 1992 there were 324 fines paid by different companies and households for polluting the environment (Town Hall, 1992).

There are still many obstacles for the execution of the national environmental regulations and local regulations by this inspection. It does not have the proper technical means to prove the violations. The inspectorate needs a laboratory for analysis.

Every week a bulletin about the quality of the water, the air, and the soil is published in the local newspaper.

Hygiene Epidemiology Institute (HEI)
The HEI controls the quality of the water sources, and tap water. The Institute takes periodically samples from the Danube.

At present HEI controls over 100 water sources on the territory of Vidin by sanitation inspections of the seven subregions in the region of Vidin.

The Institute is making full analysis of the water every season when new sources are beginning to operate. The operating existing wells are controlled in this way once every three years. Physico-chemical analysis is also made every season. Micro-biological control occurs twice a month (on schedule and when citizens signal it).

Vidin is one of the towns that uses high quality water. Non-standard probings change from 5-7% (micro-biological). Sometimes stomach troubles arise. In 1992, 11,612 cases of such troubles were registered, but one can hardly say that these are due to the pollution of the Danube (pers. comm., Vidin).

The HEI takes samples of the Danube every third month of the year. The REI the Institute of Metereology are taking the samples the rest the other months and are publishing the results in a brochure.

In the summer the river is searched for bacteria and viruses every week. Swimming is not forbidden in principle. The bathing places are especially indicated. The probing is not at the required technical level and possible health risks exist.

The organisation does not have the required devices and equipment for sampling and chemical analysis despite the good qualification and willingness of the specialists. There is a gradual increase in the lack of facilities and substances for analysing heavy metals, micro compounds and radioactive elements. The samples are often sent to the regional center Montana for analysis and this has a negative effect on the reliability of the results.

Regional Environmental Inspectorate (REI)
The REI is situated in the city of Montana. The Inspectorate consists of 25 employees of which 6 specialists are dealing with the environmental problems of

the Danube. The REI is working in collaboration with the Hygiene Epidemiology Institute and the municipal authorities.

A representative of the REI is permanently working in the town of Vidin.

The REI is controlling the industrial waste water discharged in the municipal sewerage and into the Danube. It gives conclusions about the correspondence of its quality to the norms for discharge and sanctions the violators.

The regional inspectorate has a boat available for deep water and better facilities. Most of the samples concerning heavy metals and micro-biological elements taken by HEI are analysed there.

3.7. Environmental awareness and public participation

The people in Vidin are aware in general of the environmental situation. Because of the war in former Yugoslavia the citizens are afraid of environmental damage caused by accidents along or in the Danube with ships transporting fuel or other dangerous materials.

The public is informed by newspapers and environmental NGOs but it is difficult to influence its behaviour. In general, the people are not interested in saving water mostly because there is no shortage of water. There is no legislation determining the use of drinking water and it is common practice for the householders to water their gardens with it.

The information of the experts does not go to everyone. The relevant texts are not sufficient.

Schools
Special attention on ecology is paid mostly in the Secondary School with English Teaching. The students were involved in preparing a report about the state of the Danube. Soil, noise and water pollution are also studied. The school will take part in the Blue Danube international conference in Ruse in May' 93.

Another secondary school is applying for participation in the project: European School Network for Health Improvement (European Association, European Council and Commission). Ten schools from Bulgaria wish to enter the network.

Ecology is integrated into part of the biology programmes. As a separate subject it can be chosen in the 10th grade.

Non Governmental Organizations
Ecoglasnost in Vidin is one of the most popular environmental organizations. It was founded on January 24, 1990. In Bulgaria Ecoglasnost groups exist in almost every town along the Danube.

The organization is trying to increase the public awareness and participates in environmental issues. There have been some protesting actions against air pollution organized by Ecoglasnost in the town. Members of Ecoglastnost in Vidin are active in the international programme for Danube river restoration "NGO Danube Forum".

The organization is financed by sponsorships and donations coming as a rule not from ecological polluters. In Vidin the relationship between the local authorities and the representatives of Ecoglasnost is good. Although they occasionally have different interests, they discuss them on a friendly basis.

Ecosphera is another ecological organisation which started activities since October 1, 1992. The members of this organization are intellectuals. This NGO is non-political and self-financing. The organisation focusses on the following objectives:
1) Environmental education in schools;
2) Research about ecological pollution with the aim to assist the government in solving major environmental problems. At the moment the specialists carry out research about the discharge of waste water from industries and agriculture in the Danube.

Ecosphera is using a small laboratory financed by private companies. The specialists in this organization can participate in future projects about thedecrease of pollution.

PART 4 CONCLUSION

After 1989, Bulgaria faces a transition situation, mainly due to important political and economic changes. The main objective of these changes is connected to the move of the country towards democracy. These changes have both social and environmental implications. The shift towards a market economy is characterised by the liberalization of prices, the return of land and companies to private ownership, and privatisation of state owned enterprises. Consequently, this process has led to a reduction of the production output and to a switch from heavy industry to light industry. The unemployment rate has risen sharply (15% of the labour force). There is a great concern about the negative impact of the increasing prices and taxes on the average family budget.

Generally, water resources are scarce in Bulgaria. The water used for supply is mostly groundwater which has a reliable quality. The national average connection to the water supply system covers almost all the population (98%) whilst it is lower for the sewage system. The water supply and discharge facilities are not satisfactory; there is a very high percentage of water losses along the distribution system. The equipment in the treatment plants (when they exist) is outdated. The main organisational bodies that are active in the field of watermanagement are the Ministry of Environment, the Ministry of Public Health, the National Water Council, the Ministry of Regional Development and their regional branch agencies. The water companies deal with water supply, discharge and treatment. They are state or municipality owned and there is a possibility for their future privatisation. The water companies are now given the responsibility to set water tariffs. Their financial situation can generally be described as weak. In the field of environmental legal and economic policy instruments, many changes, especially concerning the introduction of pollution permits, charges and fines for polluting activities, are under preparation or await parliamentary approval. Environmental awareness and public participation are growing in Bulgaria but could be increased further.

Vidin is an average Bulgarian town taken as a case study a municipality along the Danube. The town is supplied with high quality of drinking water coming from the ground. It does not suffer water restrictions. The sewage system is mixed for the household- and some of the industrial waste water and is discharged into the Danube without treatment. The water use in Vidin however, is not very high. The water supply pipes are in a bad condition and losses from the water distribution system are considerable. Leakages from the sewer system and from the septic tanks of households which are not connected to the municipal sewage system have not yet been studied. The discharged water in the Danube is not monitored. Prices for drinking water do not cover the current supply costs. Pollution taxes and permit systems have not yet been elaborated. The water company, the municipal inspection, the Hygiene Epidemiology Institute and the Regional Environmental Inspectorate are the institutions dealing with water management and environmental protection in the municipality. The general environmental awareness of the people can be considered as not very high. Some schools in Vidin pay attention to ecological issues. The most popular and active NGO in the region is Ecoglasnost.

ANNEX E

PROPOSED ACTIONS AT THE NATIONAL LEVEL IN ROMANIA

Legal framework: objective 7
This set of proposals refers to reviewing the existing legislation and to elaborating new documents according to the international requirements on the basis of the local situation. With reference to water management the following proposals were made:
- the elaboration of a new Water Law taking into consideration the national importance of this resource, its scarcity and the need for good management concerning the quantity and the quality of the water;
- the improvement of the present regulations concerning the waste water discharged into the rivers and the replacement of the principle of dilution with severe control measures at the sources;
- the improvement of the present standards concerning the drinking water and waste water discharge in order to meet EC norms;
- the improvement of the present regulations concerning the price of water and the Water Fund; and
- the urgent adoption by the Parliament of the new Environmental Law which sets up a whole system of fines and penalties for non-compliance, etc. in the field of water management.

International framework: objective 6
Concerning the Danube river it was suggested to increase the co-operation between all riparian countries in order to adopt similar standards concerning the evaluation of the water quality, the discharges of waste water into the river and the protection of the whole ecological basin. The following difficulties were mentioned: the lack of experts in the field of environmental legislation and enforcement, a very long adoption procedure and no financial incentives etc.
In order to solve these problems, instruments such as the training of personnel, increasing salary levels and the simplification of the adoption procedure were suggested.

Organisational framework: objective 3
Another package of proposals was oriented towards the improvement of the organizational structure in the field of the environment, and especially in the field of water management.
The following actions were suggested:
- the clear division of responsibilities among all organisations involved in the field of water management to eliminate parallel activities and to increase their efficiency;
- to increase the power of the local environmental agencies concerning the sustainable development of the area;

- to concentrate all monitoring activities concerning the quality and the quantity of water in one organisation;
- to increase the co-operation between the central authorities and the local agencies in the field of water management;
- to ensure a good circulation of information between the national and the local level, in both directions;
- to enlarge the power of the municipality in the field of water supply and waste water treatment; and
- to increase the governmental assistance and the financial support for the local water authorities;

3 FOREIGN FUNDS

Foreign funds could be applied for to meet the following costs:
Capital costs
- the repair/replacement of the existing leaking water supply distribution pipes outside the houses/flats
- the repair/replacement of the existing leaking sewerage network
- the extension or construction of waste water treatment plants
- the installation of water meters
- the extension of the sewerage network to more streets
- the provision of adequate sampling and monitoring equipment

Public awareness and education
- the development of public awareness and educational material (e.g. brochures, videos, school books, etc.)
- the establishment of an Environmental Centre

Although sewerage and water distribution networks are usually more expensive than the treatment plants, the costs of the latter are also considerable. Foreign assistance in this action is therefore most important. Financing waste water treatment plants is clearly a more difficult task than financing water supply systems. In contrast to water supply where an identifiable commodity (safe drinking water) can easily carry a price, waste water treatment is a service that has no clear immediate benefit to the user. The treatment primarily benefits others downstream from the plant. As a result waste water treatment has a lower priority than water supply in the allocation of local funds. This low priority and the difficult link between service and payment make lending agencies somewhat reluctant to lend funds. They question whether the loans will be paid back. Yet international financial institutions will seriously consider **well-founded** projects concerning treatment plants.

Foreign funding for municipal projects can be applied for in two main ways:
1) through negotiations with international financial institutions at the national level.
2) through direct contact with municipalities and NGO's abroad.

3.1 Negotiations with international financial institutions

In the first case, municipalities do not have a central role in obtaining these funds. Negotiations with international financial institutions take place at the national level. The national government delegates responsibility to certain ministries to conduct these international negotiations.

Involved in these international negotiations are most often the Ministry of Finance, the Ministry of Foreign Affairs, the Ministry of Agriculture, the Ministry of Industry and the Ministry of the Environment. It is important, for the establishment of contacts with international lending institutions, that networks exist within the country, between the different ministries that are involved in the negotiation process.
Although the municipalities do not perform a central role in these negotiations they can influence the decision outcome by preparing well-founded plans for the extension and improvement of their waste water treatment system, detailing how local funds will also be used to pay for the costs. A well-founded plan will increase the interest of the national government in proposing a particular project to international financial institutions. Municipalities could join together in developing these plans to be presented to the national government.
International organisations, in coming to a decision to provide a loan, are particularly influenced, not only by the desirability of the project and the efficiency of its design, but also by the financial arrangements made for loan repayment. They examine the history of the enterprise and if relevant, how the organization serviced and repaid similar loans in the past. Thus, in addition to a description of detailed information about the existing and planned infrastructure, the plan needs to include the organisational and financial aspects of its future maintenance. This information about future operations and maintenance is particularly important, because their costs may influence the future reliability regarding the repayment of the loan.
It is also important that the plan contains arguments that may lead to the conviction that the investment forms a local priority. At the same time, it is preferable that the investment plan is integrated into a national water resources plan.

In addition to formulating well-founded plans, another means for municipalities to positively influence the decision outcome of these international negotiations is to develop a strategy to structurally respond to the requests for information from (Western) consultancy bureaus. This may not only prove beneficial in eventually receiving foreign assistance but will also save time for the officials. These foreign consultancy bureaus should be charged standard rates for the information provided.

One of the main objectives of international assistance programmes is the so called "institution-building". For this reason, training of local staff often is explicitly provided for in loan and grant agreements.

International programmes and organisations can provide loans and/or grants. Grants and loans are usually given for different purposes: grants for pre-investment studies,

institutional development work, etc.; and loans for capital projects and/or other forms of implementation.

The following international financial institutions and programmes could be of assistance in financing various costs: the World Bank, the United Nations Development Programme (UNDP), the United Nations Environmental Programme (UNEP), the Global Environmental Facility (GEF), the European Bank for Reconstruction and Development (EBRD), UNICEF and the World Food Organisation.

World Bank
The World Bank is probably the most active body in making loans for water supply, waste water collection and disposal.[2] A questionnaire that is developed by the World Bank to provide guidance in preparing feasibility reports is distributed to organisations seeking loans that concern sewage projects. The World Bank can raise grant finance for pre-investment studies using internal sources such as trust funds and by persuading member states to furbish technical assistance funds. The Bank normally limits loans to the foreign exchange costs of the project. The funds are normally available in "hard" currencies and should also be paid back in these currencies.
The Bank is primarily interested in large scale projects to solve a set of integrated problems in a relatively large area. Consequently, municipalities should contact the national government to bundle plans to be eligible for the Bank's funds. Usually between 30-50% of the total costs will be financed by the Bank. The rest needs to be raised by the lending country itself. The minimum amount which the Bank provides is 1.5×10^6 because of administrative costs (pers. comm. R. Holland).

UNDP
The United Nations Development Programme finances pre-investment studies for research and development, for institution building and for training projects in many fields, including water supply and waste water disposal. The objective of these studies is to produce a "bankable" project that will attract investment from an international, regional, or bilateral source. Where the WHO has been appointed by the Executing Agency for a UNDP-assisted project, the pre-investment study is normally carried out by a firm, or internationally experienced consultants. Their terms of reference are derived from the approved government request (Project Document) to UNDP,

---

[2] The **International Development Association** (IDA) finances the same general types of projects as the World Bank, but on terms that generally place a much lighter burden on the balance of payments of the borrowing country.

which may have been prepared with the assistance of a WHO team. Such a team may be financed by WHO or UNDP, but normally the government provides facilities such as office accommodation, transport or secretarial services.

UNEP
The United Nations Environmental Programme, as a special programme for environment created within the United Nations' structures is mainly oriented towards the creation of a common framework for information, negotiation and assistance in the field of environment. Infoterra-as a complex information system could assist different countries, organisations or even municipalities within countries in order to receive information concerning the main environmental problems and possible solutions. It could also facilitate the co-operation and the exchange of experience, exchange of data etc. UNEP also participate with funds in different programmes developed at the regional and international level (e.g. GEF).

Global Environmental Facility
The GEF began as a French/German initiative resulting from a G-7 meeting. This facility is jointly managed be the World Bank, the UNDP and the UNEP. The GEF is an assistance fund for carrying out different environmental projects without reimbursement and is primarily orientated towards solving regional problems involving more than one country.

EBRD
The EBRD is orientated mainly to assist the Central and Eastern European countries in the reconstruction process. One of its fields of attention is the improvement of the environment. Another area of attention is the improvement of the institutional and physical infrastructure for the development of the private sector. The renovation and construction of water supply, discharge and treatment systems falls under both of these fields. The EBRD also has a considerable Danube Delta programme under its auspices. Like the World Bank, the EBRD can arrange grants for feasibility studies, in addition to providing loans for capital costs.

UNICEF and World Food Organisation
Other international organisations and programmes, including the UNICEF and the World Food Organisation, also provide assistance in the field of waste water projects especially for the smaller projects.

3.2 Direct contact with municipalities and NGO's abroad

In the second case, municipalities can attempt to obtain funds from municipalities and NGO's abroad. Initiating and developing bilateral co-operation with municipalities abroad can be described as the "twin city" concept. In contrast to

the procedure followed in negotiations with international financial institutions, municipalities have more room for manoeuvre in these municipal bilateral contacts. The process of twinning cities is quite common in the West to exchange information and experience. In the West many cities are twinned with cities in developing countries as a part of development co-operation. The cities exchange information and experience. Public awareness is increased and funds are transferred. Opportunities for twinning Western cities with Eastern European cities could seriously be considered.
For the establishment of an Environmental Centre in Vidin, funds can also be received from municipalities in the neighbouring riparian countries of Romania and Serbia.
The public awareness and educational costs can be partly met by applying for funds from international NGO's such as the IUCN and the WWF.

CHAPTER V FROM PROBLEMS TO SOLUTIONS

1 INTRODUCTION

From the description of the situation in Romania and Bulgaria it becomes clear that the actual pollution of the Danube as a result of discharged household waste water is a problem which has many causes. For the formulation of solutions it is essential to know what these causes are and how they are interrelated.
A problem analysis resulted in the construction of a problem tree, which is representative for both the Romanian and the Bulgarian situation. §2 will explain how different problems are related to each other and to the pollution of the Danube by household waste water. This problem analysis gives a clue to the solutions, which will be presented in §3. Concrete actions will be elaborated in Chapter VI. In §4 it is explained why the Action Plans will be directed towards the municipal level and §5 will contain a conclusion.

2 ANALYSIS OF COMMON PROBLEMS

The discharges of household waste water cause pollution of the Danube because the waste water contains pollutant levels above admissible limits. The main causes of this problem can be found in the technical (§2.1), organisational (§2.2), legal (§2.3) and international (§2.4) field. However, upon further analysis, it becomes apparent that these different causes find their origin in similar economic, organisational and social problems (see also Annex D.)

2.1 Technical cause

Discharges of household waste water with pollutant levels above admissible levels have as a main technical cause lacking or inadequate treatment facilities. At present it is difficult to solve this because of underlying technical, economic and social problems.

The technical problem is a lack of means for proper maintenance of existing treatment facilities. This problem results from a shortage of spare parts, a lack of (adequately educated) personnel and a lack of money. One can speak about a braindrain in research institutes, particularly in Bulgaria.

The main economic problem is an overall lack of funds[1], which decreases the possibilities to improve the treatment of waste water from households.
A lack of local financial resources is connected to the fact that the prices for water are too low. An increase of charges is restricted by the low income of the people.
The lack of funds creates a situation in which little or nothing can be done to improve the

[1] The general availability of funds cannot be obtained within the water sector only. In this respect, the overall macro economic situation and the (staat waarin de keysectors zich bevinden Sorry, Marc) of keysectors (that generate overall and sectoral economic growth), are of crucial importance. However, a detail;ed sectoral and/or macro economic analysis of these aspects goes beyond the scope of this project.

present situation, which implies in many cases higher costs in the future. Foreign funds could play an important role in preventing these future costs. There is however a lack of foreign financial support as well. This is caused, among others, by a lack of knowledge, on a local level, about how to apply for funding. The local level does not come with project proposals, which can be used at the national level for application for certain projects. This results in a lack of means for the Government to apply for projects and thus foreign funds.

A combined social and technical problem is the excessive water quantity that is used or lost at several spots within the entire system. This problem contributes directly and indirectly to the fact that present treatment facilities are lacking or inadequate.
The excessive use of water by households and leakages in households causes a bigger flow of waste water that enters into the treatment plant. Consequently, a need for a costly enlargement of the plant is created. Moreover, it is more difficult, technically, to purify diluted water.
Excessive water use or losses may also cause future water shortages. Furthermore, the exploitation of new water resources normally leads to higher costs. This implies that money is lost for other efficient investments in the field of sewage treatment. Leakages within households and the water distribution system also increase the costs within the water sector. Allowing excessive use and leakages to persist, increases supply costs for all consumers with little or no offsetting benefit.
At present, it is difficult to have all leakages in the households repaired, because there is a lack of spare parts, skilled people and money to do so. Apart from that, people are not aware of the big water losses resulting from leakages and the effects these losses (can) have. Water companies are not creating incentives for people to use less water, since they are obtaining a profit from selling the water. All these things, combined with the fact that the water price is too low, maintains the present situation with many leakages. The negative economic effects of high water use and high water losses are particularly important, since the water sectors in Romania and Bulgaria are already constrained by a considerable lack of funds.

The main social problem is the fact that the environment has a low priority as a result of a lack of environmental awareness and a lack of interest in the environment. This creates a situation in which environmentally unfriendly behaviour is not perceived as something negative. Because the environment has a low priority (on a national, local and individual level), money is not easily spent on environmental problems on all three levels. Moreover, payments for (prevention of) pollution are not obvious at the household level, since economic problems dominate over environmental problems. Apart from that, there is a lack of knowledge on the costs pertaining to the prevention of pollution and the possible costs of pollution in the future.
A lack of awareness and a lack of interest in the environment are caused, among others, by the absence of a systematic educational programme and the minor place the environment had in society until now. Without a supply of information, it is difficult for people to grasp problems (like the effects of pollution of the Danube by household waste water), which are at a distance. NGO's are at present limited in their possibilities to increase public awareness because of a lack of money and power.

2.2 Organisational causes

At present the local level has problems with the management of increased responsibilities. This leads to a suboptimal use of their possibilities in reducing the pollution of the Danube by

household waste water.
The management problems at a local level are enlarged by a lack of Governmental support. This, in its turn, is caused by a lack of personnel, a lack of experience and the absence of project proposals from the municipalities. The last has a negative effect on the interest of the Government for developments at the local level.

Discharge of too polluted household waste water is possible because of th insufficient application of sanctions. This is caused by legal and organisational problems. The legal problem is the fact that existing regulations are not strict enough. The organisational problem is insufficient control.
A lack of control is caused by not enough and/or bad monitoring equipment. In addition, it is difficult to manage the inspection, since inspectors have to work under difficult circumstances for low salaries. In Romania there is, as a result of these low salaries, a lack of inspectors. In Bulgaria, the inspectors feel threatened whilst doing their job. This results in a situation in which the chance of being caught and punished decreases. If the discharger is caught for illegal discharges, the penalties and fines they need to pay are too low compared to the costs and efforts for ensuring proper treatment.

In general, it can be said that many tasks concerning water management (e.g. monitoring, inspection) are duplicated by different organisations, both at the national and the local level. This results in a suboptimal use of possibilities to improve the present situation.

2.3 Legal causes

In both Romania and Bulgaria there are not sufficient specific regulations in the field of water management. This results in the fact that present water management is not efficient and effective enough. A new Water Law is under preparation in both countries. However, this is a very slow process because of a lack of experience at the Ministerial level and complicated procedural steps. Romania also has to deal with a profound lack of experience in the field of environmental legislation and environmental economics. Furthermore, low salaries result in a lack of economic and legal experts in the MWFEP. Complicated procedural steps also play a role in the fact that the new Romanian Environmental Law has not yet been adopted.

Discharge of too polluted household waste water is possible as a result of the fact that present regulations are not strict enough (e.g. too low penalties and fines in Romania and lacking penalties and fines in Bulgaria).

2.4 International cause

At the international level we can distinguish among several problems contributing to the pollution of the Danube by household waste water discharges. The main problem is however the suboptimal international co-operation in the field of water management. This has four main causes. First, the international programmes have only recently started. Second, the international agreements on water management of the Danube are still under negotiation. Third, there is a lack of harmonized standards concerning the quality of Danube. Fourth, the municipalities do

not use the opportunities they have to gain financial resources and experience through increasing international co-operation at the municipal level.

3 WAYS TOWARDS SOLUTIONS

On the basis of the problem analysis, it becomes possible to formulate several general solutions, which are formulated in terms of objectives for future water management policies. The parallel between the kind of problems and kind of objectives (solutions) is clarified by placing the objectives in an economic, technical, organisational, social, legal or international framework.

General objectives for Romania and Bulgaria

Economic framework

Objective 0
To initiate fund-raising activities to finance water pollution prevention and water conservation measures.
- Specifically relevant for the municipal level.

Technical framework

Objective 1
To improve the quality of the waste water discharged into the Danube.
- Specifically relevant for the municipal level.

Objective 2
To decrease the quantity of waste water coming from households.
- Specifically relevant for the municipal level.

Organisational framework

Objective 3 (R)
To improve the existing organisational structure in the field of environment (especially in the field of water management) and to increase the
co-operation between all responsible parties.
- Specifically relevant for the national level.

Objective 4 (R)
To increase the role and power of the local authorities and to develop the co-operation between municipalities and institutions within the country in the field of water management.
- Specifically relevant for the municipal level.

Objective 5 (B)
To improve the organisation in the field of environmental protection and water management.
- Relevant for both the national and the municipal level.

Social framework

Objective 6
To raise public awareness and public concern for the environment.
- Specifically relevant for the municipal level.

Legal framework

Objective 7
To improve the existing legislation in the field of the environment, and especially in the field of water management.
- Specifically relevant for the national level.

International framework

Objective 8
To increase the international co-operation in the field of water management.
- Relevant for both the national and the municipal level.

4 WHY CONCENTRATE ON THE MUNICIPAL LEVEL

The action plans in chapter VI will explain how the objectives can be reached. Only those objectives which are relevant for the municipal level will be elaborated. In this paragraph a motivation for this choice will be given.

Romania
The central target group for the Romanian Action Plan will be the municipality, which implies that the objectives relevant for the municipalities will be elaborated. By writing an Action Plan for Giurgiu we hope to create a plan which can be used by other municipalities in Romania for a reduction of pollution of the Danube by household waste water. The municipality has been chosen as a central target group for four reasons additional to the ones mentioned in Chapter I.

The first reason is that the objectives which require national actions are, to a certain extent, already being dealt with. During the research period, the group identified problems concerning water management, which appeared identical to the ones mentioned in documents resulting from environmental studies (e.g. the Environmental Strategy Paper and the EC-Phare studies). Proposals for solutions to the problems were mentioned in these reports. In appendix E a list of proposed actions is presented to support the existing efforts at the national level. The actions refer to objectives 3, 6 and 8.

A second reason for choosing the municipality as a target group is that the national government has a shortage of funds implying that the local governments have to find their

own means of gaining revenue for projects.

A third reason is that the Governmental policy contains proposals to enlarge the power of the municipality in the field of drinking water supply and waste water treatment.

The last reason is that we agree with both the Agenda 21 document of the UNCED and the Fifth Environmental Action Programme of the EC that local governments provide a large opportunity to promote sustainable development. As service providers the municipalities have specific statutory environmental duties and responsibilities. The municipal government is also the level of elected government which is closest to the citizen. As sustainable development can only be successful with public participation, a local democratic mandate can provide a firm basis for this participation. Moreover, local government is entrusted with the task to put the "big ideas" into practice at the grass-roots level. Finally local authorities also have a role in influencing national government policy (Bosworth, 1993).

Our Action Plan is aimed at influencing the policy-making process at the municipal level, strengthening and adding upon the existing plans of the municipalities.

Bulgaria

The present Action Plan will mainly focus on the municipality of Vidin, which creates the possibility to use it as a tool (a model) for other riparian municipalities as well. The general motivation for this approach is related to the following six facts, which were found in the analysis of the present state of the country:

First, an action plan for the national level can hardly be suggested at present. Almost the whole legislation, from constitution to specific laws, is in the process of change. The creation of an Action Plan for the national level poses great uncertainties because the new legal framework still has to be voted in by the Parliament.

Second, several proposals and drafts have already been made by the national authorities and international organisations like the World Bank. These strategies are quite detailed and well justified. Therefore, adding something new to the already existing proposals becomes very difficult.

Third, the organisational structure within the whole country has been rebuilt. There are some ideas on how to redivide the tasks in Bulgaria. Although the national scheme is still not clear, the division of responsibilities in the local units is more obvious. The water companies will get more power, and perhaps they will be privatised. Thus, the water and sewage companies have to economise their operations and they have to find a new structure, which fits into the national framework. Therefore, the organisational objectives concerning the municipal level will be dealt with in the Action Plan.

Fourth, the present economic difficulties have created a situation, where it is more realistic to focus on the municipal level. The national budget is not balanced and there is little money for new projects. Social, industrial and agricultural topics presently receive more attention. On a local level, environmental problems can, however, be put on the list of high priority issues. This is even the case in municipalities where at present the inhabitants are not interested in such issues. If the municipality, together with the water and sewage company, prepares a

feasible well-founded project proposal for local investments, the chance to obtain governmental support could be increased significantly.

Fifth, a process of decentralisation is going on in Bulgaria. The municipalities have been given power (Self-Governmental Act) to manage their future development. On the one hand this creates new opportunities but on the other hand it results in difficulties and confusion. Local governments do not have experience and means (financial, legal, technical) for proper management. The Action Plan should give support in the process of decentralisation.

Finally, it should be realised that the achievement of large scale targets requires small scale adaptations of the measures regarding the special, local circumstances. The body, who is responsible for these activities, is the municipality.

5 CONCLUSION

An analysis of the problem of pollution of the Danube by household waste water reveals its interdisciplinary character. Both in Romania and Bulgaria main causes can be found in four fields: the technical, the organisational, the legal and the international. Upon further analysis it becomes clear that these main causes find their origin in mostly economic, social and organisational problems. Additionally, the definition of solutions to the problems requires an interdisciplinary approach. Since problems were quite similar for both Romania and Bulgaria, it was possible to formulate similar general objectives for future water management policies.

In order to reach the objectives, active participation at both the national and the local level is required. The Action Plans, will focus on actions which need to be implemented at the local level. Action plans for the national level are not prepared because of several reasons (e.g. there already exist many proposals for the national level, increased power of the municipalities, etc.).

CHAPTER VI ACTION PLANS FOR GIURGIU AND VIDIN

1 INTRODUCTION

On the basis of the problem analysis this chapter presents two Action Plans, one for Giurgiu and one for Vidin. The Action Plans consist of a list of actions classified into four frameworks: economic, technical, organisational and social/communicative. Each action includes the time scale and the responsible body. Short term refers to 1-5 years, whilst long term means longer than 5 years. Due to the various difficulties the municipalities are facing at present very specific periods will not be suggested within the Actions Plans.
The Action Plans are followed by the explanations of each action. These explanations provide details about what the action entails, and which organisations are involved. Each explanation refers to one or more of the objectives presented in chapter V. It is mentioned in some of the explanations that the effectiveness of the actions could be increased by combining them with other actions. In some of the explanations, further questions are mentioned because necessary information is still missing. Some of the explanations that are relevant for both municipalities, will be developed further in annexes (e.g. fund raising possibilities and technical specifications concerning the construction of a new waste water treatment plant). If explanations concerning similar actions are of interest for both Giurgiu and Vidin, this will be mentioned in the explanation.

The two Action Plans are preceded by one common preliminary action with its explanation. This action refers to the different ways in which funding can be obtained for the objectives of the municipality in the field of water management. This action is a prerequisite for many of the following actions, and will therefore also be often referred to in the explanations of the other actions.

2 COMMON ACTION FOR GIURGIU AND VIDIN COMPRISING POSSIBLE FUNDING SOLUTIONS FOR THE ACTION PLANS

Action 0

Create a fund raising plan to meet the objectives of the municipalities in the field of water management, and specifically: 1) to improve the treatment of waste water and 2) to reduce the water use.

Explanation Action 0
One of the biggest problems, if not the biggest problem, that the municipality has to face in order to improve the waste water treatment and to reduce water use, is the

lack of financial resources[1]. Funds are needed for several activities which can be divided into capital costs, operations and maintenance, and public awareness (and education) activities.

Capital costs
- the repair/replacement of the existing leaking water supply distribution pipes outside the houses/flats
- the repair/replacement of the existing leaking sewage network
- the extension or construction of waste water treatment plants
- the installation of water meters
- the extension of the sewage network to more streets and single family houses
- the provision of adequate sampling and monitoring equipment

Operations and maintenance
- the repair/replacement of any future leakages (after modernisation) of the water supply pipes outside the houses/flats
- the repair/replacement of any future leakages (after modernisation) of the sewage network[2]
- the operations and maintenance of the waste water treatment plants (spare parts, improvement of working conditions and raising salaries)
- the repair/replacement of leaking faucets and taps in the households
- the installation of water saving devices in the households

Public awareness and education
- the development of public awareness and educational material (e.g. brochures, videos, school books, etc.)
- the establishment of an Environmental Centre

A detailed funding plan, describing for which purposes funds need to be gathered and how these funds can be obtained, needs to be produced. The division mentioned above and the following overview provide some guidelines as to how this could be done. This action should be completed in the short term because the lack of funds is a bottleneck that threatens the success of almost all the other actions. The successful completion of this action will assist in fulfilling objectives 1, 2, 4, 5 and 6.
The responsible bodies for creating and promoting this plan are for:
Giurgiu; ELTIS, local City Council, MWFEP, Government.
Vidin; the Water and Sewage Company in Vidin, the local Town Hall, MoE, and MRD.

[1] As was already mentioned in chapter V (§2 1) funds cannot be generated within the water sector only. The general macro-economic setting and the existence of growth-enhancing key-sectors within the economy play an even more important role here.

[2] A distinction is made between existing leakages and future leakages (after modernisation) for both the water supply distribution system and the seweraye network. The reparation/replacement of existing leakages falls under capital costs. It can be assumed that the historical lack of preventive maintenance has resulted in the existing system needing extensive and costly improvements, costs which can not be classified as routine operations and maintenance.
Once the system has been modernised any future repair/replacement of leaking pipes should be considered as costs for operations and maintenance.

Broadly speaking one can state that there are three main sources of funding: local, national and international. In the overview in annex G these three sources of funding will be described as well as appropriate destinations for these funds.

3 ACTION PLAN FOR THE MUNICIPALITY OF GIURGIU

Economic framework

1. Gradually increase the local price for drinking water supply and waste water treatment in order to cover the costs and influence the reduction of the water used in households.
   term: short term
   resp: ELTIS, City Council

2. Prepare a well-motivated list of projects concerning the water management and promote it to the national authorities.
   term: short term
   resp: City Council (Env. Com.)

Technical framework

3. Install water meters in each individual house not yet having one and in each new tower block.
   term: long term
   resp: City Hall, ELTIS

4. Extend the sewage network connected to the households. Repair/replace the leaking sewage network and to properly maintain it in the future.
   term: long term
   resp: ELTIS, City Hall

5. Repair/replace the leaking water supply distribution system (in the streets) and properly maintain these pipes in the future.
   term: long term
   resp: ELTIS, City Hall

Organisational framework

6. Support the privatisation of existing units in the field of repairs and servicing for the household sector.
   term: short term
   resp: City Hall

7. Adopt and enforce local ordinances concerning the water supply and the water use in specific situations.
   term: short term
   resp: City Council, the Mayor

8. Improve the quality of the control of discharge of pollutants and improve the enforcement of sanctions.
   term: short and long term
   resp: City Council (Env. Com.), BA, ELTIS

9. Increase the cooperation with other municipalities in Romania in the field of environment and especially in the field of water management. Create a common fund with other municipalities within the judet for financing big investments in the field of water management (e.g. a common treatment plant to deal with P and N).
   term: short and long term
   resp: City Council (Env. Com.)

10. Co-operate with foreign municipalities in the field of water management.
    term: short and long term
    resp: City Council, the Mayor

11. Improve the working conditions for personnel responsible for operations and maintenance of the sewage network, the supply system and the waste water treatment plant.
    term: short term
    resp: ELTIS, City Hall

Social/communicative framework

12. Initiate a programme for public information in which the local environmental authorities, NGO's and mass media are involved.
    term: long term
    resp: City Council (Env. Com.)

13. Initiate an optional environmental education programme in schools at all levels.
    term: long term
    resp: City Council (Env. com.), local schools

4 ACTION PLAN FOR THE MUNICIPALITY OF VIDIN

Economic framework

1. Introduce a flexible pricing system for drinking water supply favourable for economizing customers and stimulating the installation of a separate water meter in households.
   term: short term
   resp: Town Hall, water company

Technical framework

2. Construction of a municipal waste water treatment plant with phosphate and nitrate removal:

a) elaboration of project proposal and financial management programme;
   term: short term
   resp: Town Hall, MRD

b) Step by step creation of required funds and construction operations;
   term: long term
   resp: Town Hall, MRD

3. Extend the sewage network to include most of the households in the municipality of Vidin:
   term: long term
   resp: Town Hall, MRD

4. Replace in stages the obsolete water supply network with pipes from reliable materials and set up an appropriate maintenance and repair system for the existing network:
   term: long term
   resp: Town Hall, MRD

Organisational framework

5. Establish co-operation and a clear division of tasks between different institutions dealing with water management and environmental protection.
   term: short term
   resp: REI

6. Enhance the role of the REI in the preparation of emission and pollution permits for municipal waste water treatment.
   term: short term
   resp: Town Hall, REI

7. Create conditions to attract highly educated personnel in the institutions dealing with water management and environmental protection.
   term: short and long term
   resp: Town Hall, water company, HEI, REI

8. Acquire sufficient equipment for monitoring discharge and water quality of the Danube.
   term: short term
   resp: REI

9. Organise the detection and control of the main causes for water losses in the municipality (illegal connections, leakages in households).
   term: short term
   resp: water company, Municipal Env. Inspectorate

Social/communicative framework

10. Initiate at the municipal level the establishment of an Environmental Centre in Vidin as a border area with Serbia and Romania with the aim to provide information about environmental problems concerning the three countries.
    term: long term
    resp: Town Hall, REI, NGO's

11. Initiate the establishment of a twinning programme with a town in western Europe to exchange information and provide assistance (sister-cities).
    term: short term
    resp: Town Hall, NGO's

12. Stimulate the study of the pollution of the Danube and water management within the school curricula and in optional subjects.
    term: short term
    resp: local schools directorates

13. Increase the number of people involved in environmental NGO's and develop the activities carried out by these organisations.
    term: short term
    resp: local NGO's

5 EXPLANATIONS OF ACTIONS FOR GIURGIU

Action 1

Price for drinking water supply and waste water treatment
Although the price of the drinking water has substantially increased since 1990, it is still too low to cover all the costs of water supply, discharge and treatment. Moreover, the price is clearly not sufficient to ensure the future development of the system. Due to the big economic difficulties the population is facing during this period, the increase of the water price should be instituted in steps. The water price will also need to be permanently readjusted according to the inflation rate. In the near future it is expected that the price of water will slightly increase due to the scarcity of this resource and due to the big investments required in order to maintain the water resources at the level of quality required by the standards. In Giurgiu the building of a new waste water treatment plant and the extension of the sewage network will require big investments which could partially be supported by increasing the local price of the water (see also Action O, annex G).
The price elasticity of drinking water is relatively low, and in this respect a slight increase of the price will have a small influence in changing people's attitude towards their water use. This economic instrument should therefore be used together with other instruments among which the communicative instrument will play an important role (Action 12).

Action 2

Preparation and promotion of well-motivated water projects
As mentioned earlier (see Action O, annex G) the local authority needs to prepare investment proposals and to promote them to the responsible national bodies. The responsible authorities at the national level will include these proposals in large investments programmes and will promote them to international organisations and financial institutions in order to be taken into consideration for future financial assistance. The preparation of the project list should be the result of co-operation of all local organisations dealing with environmental problems.
This is a short term action because it does not require any major funds. The successful completion of this action is a prerequisite for many of the other actions as this action concerns the provision of adequate financial resources.
Objective 4 is the specific objective which this action can help attain.
If this action is undertaken in combination with Action 9 the effectiveness of the action will increase. More co-operation with other municipalities in the region in preparing and promoting project proposals will be advantageous. This is because the bundling of smaller projects to cover a larger region usually proves beneficial in negotiations with international lending agencies.

Action 3

Installation of water meters
Increasing the price of drinking water, penalties for overconsumption or introducing the tax for sewage discharge and treatment can work effectively only if the water actually used is measured properly.
This is also more legitimate. Increasing the water price without giving individual households the opportunity to reap the benefits of a reduction in their personal water use is ethically impossible. The necessity of meters use must be in advance explained to the citizens (see Action O, annex G).

In Giurgiu individual houses possess meters. However, consumption of water in tower blocks is measured "collectively" without direct stimulation to reduce water use in specific flats. Therefore, a possible long term solution will be the installation of meters for each household. Before installation of meters the real "technical" conditions must be researched. There are some tower blocks where the pipes supply water parallel for the kitchens and the bathrooms. In this case two meters for each flat would be necessary and then both initial costs and costs for maintenance and measuring would be double.
In general, this solution is costly and needs significant organizational works (see Action O, annex G). Positive experience from other Eastern European countries (Hungary) proves the effectiveness of this action. Within 2 years, users had their expenses for purchase of meters repaid because the bill for water dropped significantly. These results should be considered in the building plans of future houses and tower blocks.
Local authorities in co-operation with ELTIS should decide whether, and if yes, how to set up a programme on the installation of meters. This programme would also be aimed at setting up a market with measuring equipment as well as to stimulate good service for reparations and maintenance (Actions 4 and 6). As the problem of the use of meters is quite complex and similar in all regions, cooperation with other municipalities could be very useful (Action 9).
This action is related to objective 2.

Questions:
- Is it technically possible to measure the actual water use in each flat in the tower blocks?
- What will be the estimated price of meters and their installation?
- Are there, at present, sufficient capacities for controlling already installed meters and for installing new ones?

Action 4

Extension of sewage network and repair/replacement of sewage network
The leaking sewage network needs to be repaired or partially replaced because a danger exists of ground water pollution. This threat exists especially for the ground water obtained from private wells, which are not so deep. This is a long term action because it will require big financial investments. Moreover, other costly actions such

as the construction of a new waste water treatment plant should receive a higher priority, as the environmental returns would be higher.

The number of connections of households to the sewage network needs to be increased in Giurgiu. At the moment only 30% of the single family houses in Giurgiu are connected to the centralised sewage system. This percentage should be increased as much as is economically feasible because it will increase the service charges collected for operations and maintenance.[3]
In order to increase the number of connections two conditions need to be fulfilled: 1) lateral sewers need to be built along the streets not yet having them; and 2) connections need to be constructed from the single family houses (those now possessing septic tanks) to the lateral sewers in the streets. Both of these measures are capital costs (see Action O, annex G and annex I).

This action is a long term one because this project requires high capital costs, funds which are not available in the short term. ELTIS will be the responsible party to calculate the level of special assessments needed to connect the single family houses to the lateral sewers in the streets.
The City Council will co-ordinate this process and establish clear priorities according to the local plan for the future development of the town. The completion of this action will assist in the achievement of objectives 1 and 4.

Action 5

Repair and replacement of leaking water supply distribution system (see also Action 4 Vidin)
The leaking water supply distribution system requires repairs or replacement because of the losses which it causes. These losses could be divided in actual water losses and the economic losses.
Concerning the actual water losses, measures should be taken to conserve water because of its nature as a scarce resource. Although Giurgiu has no water scarcity problem at the moment, water conservation measures should be taken in Giurgiu as well. This is because there is a scarcity of water in Romania as a whole and the citizens of Giurgiu should take this into account with their own water use. Furthermore, if the underground resources are being "mined" the possibility exists that the sources will eventually dry up if they are not used sustainable.
Regarding the economic losses it can be noted that the costs of supplying this lost water can not be charged. These costs are borne by ELTIS, who could more efficiently use these lost funds for other investments (i.e. contributing to the construction of a waste water plant). Furthermore, the legitimacy of campaigns to

[3] It is understood that in distant areas of very low density housing, the cost-benefit analysis of constructing lateral sewers with connections to the households will often be negative. These houses should continue to use the septic tank system for the disposal of their household waste water.

reduce water use within the households will be minimal if the households realise that ELTIS suffers from major water losses in the distribution pipes in the streets.

This action is a long term action because of the high capital costs (see Action O, annex G). ELTIS will be the responsible party. The successful completion of this action will help in reaching objectives 1, 2 and 4.

Action 6

Support the privatisation
At present almost all the units which provide services for the population to maintain and repair the water installations inside the apartments are state owned. Only a few of them belong to small private owners and they are faced with many difficulties such as: lack of spare parts on the market, high level of taxes, etc.. The units belonging to the state are facing similar problems, such as the lack of spare parts, and the quality of reparations is not always very good. Concerning the level of prices the differences are not very substantial, in the private units they are slightly higher.
In the near future, it will be very efficient if the local authorities will encourage the privatisation of these units to increase the quality of reparations and to accelerate the interventions in emergency cases. In this respect, the City Hall could support the privatisation of these units through a local protective policy, reduction of income taxes and reduction of rent for the space, support in receiving small loans for future development etc. Although in the first stage of this process the prices for these services will increase, in the long term when the process of privatisation will advance and a real competition will exist between these units it is expected that the prices will decrease and the quality of the reparations will substantially improve.

Questions:
- How many private units already exist in Giurgiu?
- Which is the position of the local City Hall concerning the privatisation of these units and what has already been undertaken to encourage this process at the local level?
- What is the present price for these services in the state and in the private sector?

Action 7

Adoption and enforcement of local ordinances
On the basis of the new law concerning the local authorities adopted in November 1992 by the Romanian Parliament, their role and power are substantially increased. In this respect, the Mayor has the right to issue local ordinances in specific situations, ordinances which are compulsory for that specific area and for a limited period of time. A possible field in which the Mayor could use his powers is water use in the households or in other sectors, especially in very dry periods (water supply is stopped or rational in some periods or between some hours). The implementation of this local legal instrument should be accompanied and in many cases prepared through an intensive information campaign to make the local population aware about

the importance and the necessity of the new measures. An efficient and well oriented information campaign will substantially increase the effectiveness of the measure and will actively involve all the responsible agents in the implementation process (Action 12). Taking into consideration the scarcity of water in Romania and its unequal distribution throughout the country, it is necessary and strongly suggested for the local authorities to use this legal instrument, set up on the basis of the law.

Questions:
- What are the exact limits of power for the local authorities in this field?
- Did the local authority already use the newly acquired rights?

Action 8

Improve the quality of the control and improve the enforcement of sanctions
In the short term the tasks of the Environmental Commission[4] should be defined clearly. A joint programme for all the organisations involved in the control of discharges and the enforcement of sanctions should be elaborated to avoid double work. In the long term a permanent evaluation of the activities (control and enforcement) should be undertaken.

The new Environmental Law and the new draft of the Water Law contain many provisions concerning the improvement of the inspection activities both at the national as well as the local level. In this respect, at the local level the BA and the RBA will continue to play a major role. At present the BA controls all the activities developed at the local level, their impact on the environment and enforces the sanctions on the basis of the law. The RBA controls the specific modalities in which different buyers respect the provisions included in the contract concerning the raw water intake from different sources and the quality of the surface waters after the waste water discharges. The new Environmental Commission set up under the City Council will co-ordinate all inspection activities developed at the local level by different bodies.

At present the BA is facing a lot of difficulties such as: a lack of qualified personnel and a lack of adequate measurement equipment. Similar difficulties, especially the lack of equipment could be found at the RBA. The level of salaries is low and the

[4] For the first time according to the new regulation on the responsible bodies acting at the municipal level, an Environmental Commission was set up. This commission is co-ordinated directly by the Mayor and includes representatives of all organisations involved in the field of environmental protection (BA, RBA, ELTIS, local NGO's, industries and public). One of the main tasks of the commission is to ensure the co-ordination of a permanent and objective control of all the activities which can have an impact on the environment, and support the enforcement of the sanctions whereever this is necessary The commission is not oriented mainly towards coercive actions and is also in charge with defining the real possibilities and actions which should be undertaken by different polluters in order to improve their activities and achieve the environmental standards.

quality of control, is substantially diminished. In order to improve the quality of control measures such as the gradual increase of the salaries and provision of modern equipment combined with permanent public information, about the role and the importance of this control, should be seriously considered. Taking into consideration the fact that the polluters (mainly industries, but also ELTIS in this specific case) do not have at present sufficient funds to improve their activities, realistic programmes concerning the gradual decrease of the pollution levels and implementation of new and clean technologies should be set up in a long perspective.

In this respect the sanctions should be enforced gradually and permanently combined with supporting actions. Only when the polluters do not undertake any kind of measures in order to improve their activities do the sanctions need to be enforced drastically.

Action 9

Co-operation with other municipalities in Romania. Common funding

At present the local authority is receiving new responsibilities and more power in co-ordinating all the activities developed at the local level. In this respect it is important to increase the co-operation among the local authorities in various fields and to combine efforts regarding different activities.

Possible actions could also be developed in the field of water management such as: information campaigns, educational programmes, organisation of environmental excursions, chemical waste collection campaigns, symposia and meetings with specialists, exchange of experience, etc.. These actions could be oriented towards the improvement of the local rivers quality, reducing the water use in the households, influencing people's habits and encouraging environmental friendly attitudes (many activities described in the Action 12 could also be developed between different municipalities).

Taking into consideration the lack of funds the municipalities are facing with at present and the necessity to start big investments to improve the state of the water resources, a possible co-operative project within the judet would be to create a common assistance fund. A part of the local resources of each municipality could be transferred in this common fund and big investments, such as the building of a new waste water treatment plant could be carried out. The City Councils through the Environmental Commission would be in charge with the administration and distribution of this fund, according to the list of priorities commonly agreed on by all the actors involved in the field of water management and representatives of the public. The new investments carried out by this system will improve the existing situation not only for one municipality, but for several municipalities within the same area. For other investments which refer to only one municipality (such as the extension of the water supply or sewage network) the funds could be used on a rotation basis or according with the local list of priorities.

Questions:

- Has the municipality previously initiated this type of action or created common funds?

- Did the City Hall include in its strategy the development of the co-operation with other neighbouring municipalities?

Action 10

Co-operate with other municipalities abroad
The action involves the initiation and development of bilateral co-operation with municipalities abroad ("twin-city" concept). (See also Action O, annex G). Giurgiu is already involved in a twinning project with a municipality in France. New projects could be started and the French twinning project could be intensified. Information exchange and exchange of experience on the following three issues should be central points of the twinning projects:
1. water management
2. raising environmental awareness
3. the role the municipality can play in water management and raising awareness.

The Mayor, representatives of the City Council and ELTIS as well as representatives from people working on the programme for public information (Action 12) could form a committee. This committee can organise and maintain the twinning project(s). The choice of twinning municipalities should be based on the information needs of Giurgiu and similarities between the municipalities.
Short term: initiate twinning projects, develop the projects
Long term: develop the project

This action concerns the objectives 3, 4 and 6.
The choice of the municipality can determine if twinning contributes to reaching one or more objectives. This is illustrated by mentioning several (dis)advantages of twinning with municipalities in the Netherlands and Germany.

Co-operation with a Dutch municipality has three main advantages and three main disadvantages. The first advantage is that Dutch municipalities are operating in a decentralised system. Exchange of experience and information on this issue should therefore not be a problem (objective 3). The second is that bodies dealing with water management have a lot of experience since water management always has had an important place in society (objective 4). The third advantage is that the Dutch have numerous experiences with NGO's and projects dealing with raising public awareness (objective 6).
Differences between the Dutch municipalities and Giurgiu cause information to be less useful. The first disadvantage is that Dutch municipalities are less constrained by economic problems than Giurgiu. Second, water management in these municipalities is organised differently. Discharge and supply are under the responsibility of two different bodies. Third, in the Netherlands the scarcity of water is not (yet) important on a national scale. In Germany discharge and supply are (on a municipal level)

ANNEX C

EXPLANATION ON THE MINISTRY OF WATERS, FORESTS AND ENVIRONMENTAL PROTECTION (MWFEP)

The MWFEP represents the national authority, in this respect it is responsible for the future sustainable development of the country. It co-ordinates the research activities in this area and establishes relations with NGO's, social groups and the public (Gov. Dec. 792/1992; Draft Environmental Law). The MWFEP represents Romania in relevant environmental international bodies.
The MWFEP consists of three general directorates (GD's). Each of them is headed by a Secretary of State, the Minister co-ordinates the activities of the Secretaries of State. The Secretaries deal respectively with water resources, forestry and environmental protection. Each directorate is divided into divisions, which are headed by directors.

Below, the specific responsibilities of the different GD's in the field of water management, will be explained. It should be noted that the GD's have many other responsibilities but they are not within the scope of this project and thus not mentioned.

The GD for "Water resources" is responsible for:
- strategic planning and co-ordination with regard to water management;
- drafting laws and issuing administrative regulations;
- interministerial co-ordination in the field (especially protection against floods); and
- the organisation of hydrological and meteorological measuring (quantitative aspects of water resources).

The GD for "Environmental Protection", consists of three directorates. First, the Directorate for Monitoring, which is responsible for the environmental monitoring system and for the assessment of monitoring data collected by the BA's. This Directorate supervises the BA's monitoring tasks and collects the data for national surveys. Second, the Directorate for Environmental Impact Assessment, Permits and Authorisation, which is responsible for:
- the elaboration of the strategy in the field of environmental protection,
- drafting laws, regulations and norms for future implementation of the national strategy,
- issuing permits and authorizations for different activities in order to maintain all the economic activities within the legal framework.

Third, the State Inspection, which coordinates all control activities at the national and local level in the field of environmental protection. Local inspectors from the BA's control all economic activities which take place in their area and report the results of their investigations to the State Inspection on a regular basis. For severe pollution problems, as well as for the improvement of the economic activities in the priority areas, the state inspectors participate directly in the control activities. They also suggest where measures are needed for an improvement of the situation.

ANNEX D

OVERVIEW OF WATER PRICES IN ROMANIA

This table can give only an indication of the price differences between the different users and sources. The actual price is because of present inflation rates irrelevant.

Table C-1: Price of raw water in lei as used by RBA's.
These prices are based on Gov. Decision 1001/90, which has been into force since 1-1-1991. At that time 180 lei equalled 1 U.S. dollar.

	Price of raw water (lei/1000m^3):		
User	inland water	Danube river	Groundwater
Industry	300	35	370
Agriculture (e.g. farms)	300	35	200
Pisciculture Irrigation	50	6	100
Domestic	110	20	85

ANNEX E

PROPOSED ACTIONS AT THE NATIONAL LEVEL IN ROMANIA

Legal framework: objective 7

This set of proposals refers to reviewing the existing legislation and to elaborating new documents according to the international requirements on the basis of the local situation. With reference to water management the following proposals were made:

- the elaboration of a new Water Law taking into consideration the national importance of this resource, its scarcity and the need for good management concerning the quantity and the quality of the water;
- the improvement of the present regulations concerning the waste water discharged into the rivers and the replacement of the principle of dilution with severe control measures at the sources;
- the improvement of the present standards concerning the drinking water and waste water discharge in order to meet EC norms;
- the improvement of the present regulations concerning the price of water and the Water Fund; and
- the urgent adoption by the Parliament of the new Environmental Law which sets up a whole system of fines and penalties for non-compliance, etc. in the field of water management.

International framework: objective 6

Concerning the Danube river it was suggested to increase the co-operation between all riparian countries in order to adopt similar standards concerning the evaluation of the water quality, the discharges of waste water into the river and the protection of the whole ecological basin. The following difficulties were mentioned: the lack of experts in the field of environmental legislation and enforcement, a very long adoption procedure and no financial incentives etc.
In order to solve these problems, instruments such as the training of personnel, increasing salary levels and the simplification of the adoption procedure were suggested.

Organisational framework: objective 3

Another package of proposals was oriented towards the improvement of the organizational structure in the field of the environment, and especially in the field of water management.
The following actions were suggested:

- the clear division of responsibilities among all organisations involved in the field of water management to eliminate parallel activities and to increase their efficiency;
- to increase the power of the local environmental agencies concerning the sustainable development of the area;
- to concentrate all monitoring activities concerning the quality and the quantity of water in one organisation;
- to increase the co-operation between the central authorities and the local agencies in the field of water management;
- to ensure a good circulation of information between the national and the local level, in both directions;

- to enlarge the power of the municipality in the field of water supply and waste water treatment; and
- to increase the governmental assistance and the financial support for the local water authorities;

ANNEX F

TECHNICAL REGULATIONS AND STANDARDS IN BULGARIA

The present Bulgarian system of river quality standards is based upon Regulation Number 7 (8 August 1986) for Indices and Standards for Establishing the Quality of Flowing Surface Water. The standards included in the Regulation Number 7 do not differ much from the European standards.

- Order No. 7 defining indices and standards for the quality of running surface water;
- Order No. 8 defining indices and standards of sea-coast water quality;
- Order No. 2 limiting contents of contaminating substances in the sewerage of towns and villages;
- Order setting up sanitation-protected zones around water sources and water supply structures;
- Regulations and sanitation requirements for waste water in irrigation;
- Order No. 68 defining surface water pollution;
- Order about ground water observation;
- Order about water economy cadastre;
- Order about water usage;
- Order about drinking water usage regulations for state economic organisations;
- Order about the contamination of groundwater; and
- Sanitary-technical standards and regulations for water supply building and construction in residential and industrial areas (MoE, 1993).

ANNEX G SOURCES OF FUNDING FOR THE ACTION PLANS

There are three main sources of funding which can be utilised to finance the action plans. They are divided into local, national and international sources.

1 LOCAL FUNDS

To begin with it is commonly acknowledged that although international financial institutions can provide grants/loans for capital projects, they expect that the recurring costs for operations and maintenance will be the responsibility of the beneficiary. Local funding is therefore almost always required for operations and maintenance of the supply, discharge and treatment systems. But even where foreign funds can be obtained for capital projects, the ability of local municipalities to collect local funds is essential because these foreign funds are almost always loans which need to be repaid. For these reasons the local authorities need to develop well-founded plans to obtain local funds for the supply, discharge and treatment systems (Okun and Ponghis, 1975).

Local sources of funding can be arranged by combining three main types of sources:
i) general taxation
ii) service charges
iii) private contributions due to individual household's cost/benefit analysis

1.1 General taxation

General taxation measures should be used to help pay or repay any capital costs[1]. These taxation measures are legitimate because an adequate collection and treatment of waste water, in addition to a proper functioning of the water supply distribution system, is a public necessity. An adequate water supply, discharge and treatment system is part of the necessary infrastructure to attract new industries, commercial enterprises and housing estates. This will provide opportunities in the long term for economic development and new employment prospects benefiting the entire local population, not only the users of the centralised water supply and sewage system. Thus with general taxation measures the entire community is taxed for the investment in the future well-being of the whole community (Okun and Ponghis, 1975). These general taxation measures are therefore also legitimate for financing the actions regarding public awareness and education. The local municipal administration in co-operation with the water companies will be responsible for calculating the appropriate level of taxation for both the capital and public awareness (and education) costs.

1.2 Service charges

Service charges can be used to help finance the capital costs and/or some of the operations and maintenance costs. Although service charges form an additional option (next to general taxation measures) to pay and repay the capital costs, service charges are probably a more legitimate option than general taxation for paying the operations and maintenance costs. This

[1] The connections of single family houses to lateral sewers in the streets (where special assessments should apply - see point (c)) should not be paid with general taxation measures

is because operations and maintenance centres on the day-to-day functioning of the system and less so on a community investment for the future (as is the case with capital costs). In this respect the present daily users of the system should be paying for the operations and maintenance costs.
Service charges should be used to pay for the following specific operations and maintenance activities:
- the repair/replacement of any future leakages (after modernisation)
of the water supply pipes outside the houses/flats
- the repair/replacement of any future leakages (after modernisation) of the sewerage network
- the operations and maintenance of the waste water treatment plants
(spare parts, improvement of working conditions)

There are three methods to implement these service charges:
i) charges related to water use
ii) charges related to quantity and composition of the waste water
iii) charges related to dwelling units or waste fixtures

These three methods will now be described in more detail.

i) Charges related to water use

In cases where water supply is metered and responsibilities for water supply and sewage treatment fall under the same authority (as is the case in Giurgiu and Vidin), an increase in the water rate would be relatively simple to impose and collect. A positive aspect of a dual dependence on the water meter (for measuring both supply and treatment costs) could be that the meters are properly maintained and read.
Two inequities in this charging system do need to be taken into consideration. First, when a large portion of the drinking water supply is used for gardening purposes, the use of the waste water system is much less than the figures for the water supply would lead one to believe. Special allowances would need to be calculated in these situations. Second, it is inequitable when large industrial users employ a private water supply but use fully the centralised sewerage system. An adequate metering of the private water supply is necessary in this case (Okun and Ponghis, 1975).

These comments lead to the following recommendations. Single family houses presently possess meters. These houses can be charged for treatment based on measurements for water supply minus allowances for gardening purposes. Households in flats can not use this system until they possess individual meters. Furthermore, the installation of the meters in individual flats will depend on the results of research into the technical and economic possibilities of installing these meters. Also of importance is that accurate measurements of the water supplied to industries from the Danube need to be provided to the water companies. The water companies should be the responsible party for implementing this system of service charges in houses/flats with individual meters. The water companies should also calculate the allowances for gardening purposes.

The specific pricing of water supply, discharge and treatment in houses/flats with meters can be managed by making choices in three major characteristics of tariff design.

Single, two-part or multi-part tariffs
Single part tariffs have only one type of charge. An example would be a charge based on one price per unit of metered water use. If a customer were to pay a fixed monthly charge plus the price for metered water use, the result would be a two-part tariff. When other elements are added one can speak of a multi-part tariff. Combined water use/waste water tariffs are usually multi-part tariffs. This is, however, not the case in the least complex situation when water is sold at one price per metered unit and the costs for waste water discharge and treatment are a uniform percentage surcharge on the water bill (UNDTC, 1991).

Block or increasing rate tariffs
Uniform rates for metered water use imply that the customer pays the same amount for water irrespective of how much water is used. Non-uniform rates are also possible by using either increasing block rates or increasing rate tariffs.
An example of an increasing block rate is shown in table 6.1.

Table 6.1: Increasing Block Rate

Water use/ billing period (cubic meters)	Block price (lei or leva/cubic meter)
0-5	0,50
5-10	0,70
10-50	0,95
over 50	1,20

Thus, a customer whose use is 17 cubic meters, should pay 2,50 for the first 5 cubic meters (5 times 0,50), 3,50 for the second 5 cubic meters (5 times 0,70), and 6,65 for the last 7 cubic meters (7 times 0,95). The total bill will be 12,65 lei/leva.

An increasing rate tariff is another non-uniform rate. Yet, unlike block rates where the user pays different amounts for different blocks of water, under an increasing (or progressive) rate tariff the user pays the same price for all the water used. The rate does, however, increase with increasing use.
An example of an increasing rate tariff is shown in table 6.2.

Table 6.2: Increasing Rate Tariff

Water use/ billing period (cubic meters)	Price (lei or leva/cubic meter)
0-5	0,70
5-10	0,80
10-15	0,90
15-20	1,00
20-25	1,20
over 25	1,40

In this example a user whose use is 17 cubic meters would pay 1,00 per cubic meter for all of the water used (17 times 1,00). The total bill would be, in this case, 17,00 lei/leva (UNDTC, 1991).

Seasonal differentials
It may be advantageous to vary the price of water seasonally. Both demand and the cost of supply will be higher in hot, dry weather. To meet the extra costs and to reduce water use, the rates of water could be increased during the summer months (UNDTC, 1991).

In the case of Giurgiu and Vidin, the following recommendation about tariff design can be made for the metered households:

To adopt a multi-part tariff containing an increasing tariff rate and having different prices for different seasons.

A tariff with separate elements for use and discharge/treatment is an effective manner to let households clearly realise the costs of both their water use and water pollution. An increasing rate tariff is the clearest way to make households aware that their water use should be reduced to more acceptable levels. An increasing rate tariff has an advantage over the block rates in that an increasing rate is easier to calculate. Finally there should be differences in rates according to seasons to promote the reduction of water use for non-productive purposes (i.e. "flushing through" to keep the water cold in the summer months).

Although this tariff design is the most environmentally correct, it may become an administrative nightmare. Due consideration should therefore be given to providing sufficient administrative support. A computerised billing system could be a long term goal.

ii) Charges related to quantity and waste water composition

From ordinary households the strength of the waste water can be expected to be constant. This is not the case with industries where volume indices will not be adequate to measure the burden of the waste water on the system. Based on the composition of the waste water certain

industries will be required to pay more for the increased costs of treatment so that households and other less polluting industries are not laden with the extra costs of pollution not caused by themselves (Okun and Ponghis, 1975).
In Romania, the BA is the responsible body to calculate the different levels of charges for the different substances mentioned in the authorised permits. In Bulgaria, the REI will in all likelihood become the responsible body.

iii) Charges related to dwelling units or waste fixtures

Where no meters exist a flat charge for water supply per month could continue to be levied according to the number of rooms in the dwelling or the number of inhabitants in each dwelling. Instead of the number of rooms or inhabitants one could use as a basis the number of water closets, sinks and bathrooms. It can be assumed that the volume of water used and waste water produced is roughly proportional to the number of drains provided (Okun and Ponghis, 1975). It seems more legitimate to calculate on the basis of waste fixtures than on the number of rooms as this presents a clearer link to the water use and discharge systems. The water companies should continue to be responsible for collecting the service charges.

1.3 Private voluntary contributions

Private voluntary contributions based on individual household's cost/benefit analysis should be used to pay the costs of the following:
Capital costs;
- the connection of the single family houses to the lateral sewers in the streets

Operations and maintenance costs;
- the repair/replacement of leaking faucets and taps in the households
- the installation of water saving devices in the households

Regarding the capital costs, special assessments need to be calculated for the connections from the single family houses to the lateral sewers in the streets. The owners of the single family houses should pay for these connections themselves (in labour and/or cash) because it is widely recognised that the values of their properties will rise if they decide to connect their houses to the centralised sewage system (Okun and Ponghis, 1975). They will come to their decision based on an individual estimation of the costs and benefits. Other members of the community should therefore not be expected to foot the bill for these individual household improvements. It should be the responsibility of the water companies to calculate the special assessments.

Concerning the operations and maintenance costs it should be the responsibility of the individual household to install water saving devices, and to repair leaking faucets and taps. Once again it will be an individual weighing up of the pros and cons of undertaking these actions. This process can, of course, be influenced by increasing the price of drinking water, and through intensive public education programmes.

1.4 Final comments local funds

The necessity to arrange for local funds will certainly conflict with the existing paying capacity of the local inhabitants. The present and future paying capacity of the local population will therefore need to be taken into consideration in determining levels of taxation and service charges. Tax and service charges which increase in phases should therefore be considered. Moreover, the period of tax collection for recovering the capital costs should not be too short: 40 years is the usual Dutch situation.

Research questions to assist the municipal authorities in determining the appropriate level of taxation and service charges are the following:
1. What is the willingness of the inhabitants to pay for water use, discharge and treatment?
2. What are the consequences of higher prices for water use, discharge and treatment on the standard of living and purchasing power of the local population?
3. What is the most efficient and legitimate distribution of the burden of the total costs incurred between households and other sectors (industries, agriculture, commercial enterprises)?

2 NATIONAL FUNDS

Although it is far from assured of success, subsidies for the waste water discharge and treatment sector, especially for capital costs, can be applied for with the Environmental Protection Fund in Bulgaria and the Water Fund in Romania. The possibility of success in this endeavour can be considered low because support from the fund is limited and other more urgent priorities in the countries exist. Furthermore, subsidies have proved inefficient and ineffective in environmental policy because one creates a situation in which the polluter gets paid.

3 FOREIGN FUNDS

Foreign funds could be applied for to meet the following costs:
Capital costs
- the repair/replacement of the existing leaking water supply distribution pipes outside the houses/flats
- the repair/replacement of the existing leaking sewerage network
- the extension or construction of waste water treatment plants
- the installation of water meters
- the extension of the sewerage network to more streets
- the provision of adequate sampling and monitoring equipment

Public awareness and education
- the development of public awareness and educational material
(e.g. brochures, videos, school books, etc.)
- the establishment of an Environmental Centre

Although sewerage and water distribution networks are usually more expensive than the treatment plants, the costs of the latter are also considerable. Foreign assistance in this action is therefore most important. Financing waste water treatment plants is clearly a more difficult task than financing water supply systems. In contrast to water supply where an identifiable commodity (safe drinking water) can easily carry a price, waste water treatment is a service that has no clear immediate benefit to the user. The treatment primarily benefits others downstream from the plant. As a result waste water treatment has a lower priority than water supply in the allocation of local funds. This low priority and the difficult link between service and payment make lending agencies somewhat reluctant to lend funds. They question whether the loans will be paid back. Yet international financial institutions will seriously consider **well-founded** projects concerning treatment plants.

Foreign funding for municipal projects can be applied for in two main ways:
1) through negotiations with international financial institutions at the national level.
2) through direct contact with municipalities and NGO's abroad.

3.1 Negotiations with international financial institutions

In the first case, municipalities do not have a central role in obtaining these funds. Negotiations with international financial institutions take place at the national level. The national government delegates responsibility to certain ministries to conduct these international negotiations. Involved in these international negotiations are most often the Ministry of Finance, the Ministry of Foreign Affairs, the Ministry of Agriculture, the Ministry of Industry and the Ministry of the Environment. It is important, for the establishment of contacts with international lending institutions, that networks exist within the country, between the different ministries that are involved in the negotiation process.
Although the municipalities do not perform a central role in these negotiations they can influence the decision outcome by preparing well-founded plans for the extension and improvement of their waste water treatment system, detailing how local funds will also be used to pay for the costs. A well-founded plan will increase the interest of the national government in proposing a particular project to international financial institutions. Municipalities could join together in developing these plans to be presented to the national government.
International organisations, in coming to a decision to provide a loan, are particularly influenced, not only by the desirability of the project and the efficiency of its design, but also by the financial arrangements made for loan repayment. They examine the history of the enterprise and if relevant, how the organization serviced and repaid similar loans in the past. Thus, in addition to a description of detailed information about the existing and planned infrastructure, the plan needs to include the organisational and financial aspects of its future maintenance. This information about future operations and maintenance is particularly important, because their costs may influence the future reliability regarding the repayment of the loan.
It is also important that the plan contains arguments that may lead to the conviction that the investment forms a local priority. At the same time, it is preferable that the investment plan is integrated into a national water resources plan.

In addition to formulating well-founded plans, another means for municipalities to positively influence the decision outcome of these international negotiations is to develop a strategy to

structurally respond to the requests for information from (Western) consultancy bureaus. This may not only prove beneficial in eventually receiving foreign assistance but will also save time for the officials. These foreign consultancy bureaus should be charged standard rates for the information provided.

One of the main objectives of international assistance programmes is the so called "institution-building". For this reason, training of local staff often is explicitly provided for in loan and grant agreements.

International programmes and organisations can provide loans and/or grants. Grants and loans are usually given for different purposes: grants for pre-investment studies, institutional development work, etc.; and loans for capital projects and/or other forms of implementation.

The following international financial institutions and programmes could be of assistance in financing various costs: the World Bank, the United Nations Development Programme (UNDP), the United Nations Environmental Programme (UNEP), the Global Environmental Facility (GEF), the European Bank for Reconstruction and Development (EBRD), UNICEF and the World Food Organisation.

World Bank

The World Bank is probably the most active body in making loans for water supply, waste water collection and disposal.[2] A questionnaire that is developed by the World Bank to provide guidance in preparing feasibility reports is distributed to organisations seeking loans that concern sewage projects. The World Bank can raise grant finance for pre-investment studies using internal sources such as trust funds and by persuading member states to furbish technical assistance funds. The Bank normally limits loans to the foreign exchange costs of the project. The funds are normally available in "hard" currencies and should also be paid back in these currencies.

The Bank is primarily interested in large scale projects to solve a set of integrated problems in a relatively large area. Consequently, municipalities should contact the national government to bundle plans to be eligible for the Bank's funds. Usually between 30-50% of the total costs will be financed by the Bank. The rest needs to be raised by the lending country itself. The minimum amount which the Bank provides is 1.5×10^6 because of administrative costs (pers. comm. R. Holland).

UNDP

The United Nations Development Programme finances pre-investment studies for research and development, for institution building and for training projects in many fields, including water supply and waste water disposal. The objective of these studies is to produce a "bankable" project that will attract investment from an international, regional, or bilateral source. Where the WHO has been appointed by the Executing Agency for a UNDP-assisted project, the pre-investment study is normally carried out by a firm, or internationally experienced consultants.

---

2 The **International Development Association** (IDA) finances the same general types of projects as the World Bank, but on terms that generally place a much lighter burden on the balance of payments of the borrowing country.

Their terms of reference are derived from the approved government request (Project Document) to UNDP, which may have been prepared with the assistance of a WHO team. Such a team may be financed by WHO or UNDP, but normally the government provides facilities such as office accommodation, transport or secretarial services.

UNEP

The United Nations Environmental Programme, as a special programme for environment created within the United Nations' structures is mainly oriented towards the creation of a common framework for information, negotiation and assistance in the field of environment. Infoterra-as a complex information system could assist different countries, organisations or even municipalities within countries in order to receive information concerning the main environmental problems and possible solutions. It could also facilitate the co-operation and the exchange of experience, exchange of data etc. UNEP also participate with funds in different programmes developed at the regional and international level (e.g. GEF).

Global Environmental Facility

The GEF began as a French/German initiative resulting from a G-7 meeting. This facility is jointly managed be the World Bank, the UNDP and the UNEP. The GEF is an assistance fund for carrying out different environmental projects without reimbursement and is primarily orientated towards solving regional problems involving more than one country.

EBRD

The EBRD is orientated mainly to assist the Central and Eastern European countries in the reconstruction process. One of its fields of attention is the improvement of the environment. Another area of attention is the improvement of the institutional and physical infrastructure for the development of the private sector. The renovation and construction of water supply, discharge and treatment systems falls under both of these fields. The EBRD also has a considerable Danube Delta programme under its auspices. Like the World Bank, the EBRD can arrange grants for feasibility studies, in addition to providing loans for capital costs.

UNICEF and World Food Organisation

Other international organisations and programmes, including the UNICEF and the World Food Organisation, also provide assistance in the field of waste water projects especially for the smaller projects.

3.2 Direct contact with municipalities and NGO's abroad

In the second case, municipalities can attempt to obtain funds from municipalities and NGO's abroad. Initiating and developing bilateral co-operation with municipalities abroad can be described as the "twin city" concept. In contrast to the procedure followed in negotiations with international financial institutions, municipalities have more room for manoeuvre in these municipal bilateral contacts. The process of twinning cities is quite common in the West to exchange information and experience. In the West many cities are twinned with cities in developing countries as a part of development co-operation. The cities exchange information and experience. Public awareness is increased and funds are transferred. Opportunities for twinning Western cities with Eastern European cities could seriously be considered.

For the establishment of an Environmental Centre in Vidin, funds can also be received from municipalities in the neighbouring riparian countries of Romania and Serbia.
The public awareness and educational costs can be partly met by applying for funds from international NGO's such as the IUCN and the WWF.

ANNEX H WASTE WATER TREATMENT TECHNIQUES

The following techniques are commonly used in waste water treatment:

Mechanical treatment removes particulate matter primarily by sedimentation in a settling tank. The addition of chemicals (to the flow from the settling tank) for precipitation enhances sedimentation, leading to *chemically-enhanced mechanical treatment* requiring practically no additional capital costs but still leading to significant upgrading.
Traditional biological treatment incorporates an aeration basin after the settling tank in order to allow bacteria to oxidize a substantial fraction of the remaining organic wastes.
Biological-chemical treatment enhances biological treatment by adding chemicals to the flow from the settling tank to improve primarily the efficiency of phosphorus removal by precipitation.
Advanced (biological-chemical) treatment incorporates an anoxic basin (oxygen is absent, but nitrate is available) for denitrification, and also sometimes an anaerobic tank for biological P removal. Chemicals may be added for increasing efficiency and improving economy. This method is the most expensive of the treatment options in terms of capital costs and requires careful management by specially trained staff.
In the next two tables one can see the efficiency and the costs of the different treatment methods.

Table 1 The efficiency of different types of treatment options (Preparatory Committee for Ministerial Conference, Lucerne, 1993)

Treatment processes	Removal Rates (%) for			
	BOD	Total Phosphorus	Total Nitrogen	Suspended Solids
Mechanical (primary)	30	15	15	60
Chemically-enhanced mech.	60	80	30	80
Traditional biological (sec.)	70-90	30	30	80-90
Biological-chemical (sec.)	90-95	90-95	35	90-95
Advanced	95-97	90-95	70-85	97

Table 2 The costs of construction and maintenance of different types of treatment options compared to the mechanical treatment. The index is put on 1.0 for mechanical treatment (Preparatory Committee for Ministerial Conference, Lucerne, 1993)

Treatment processes	Typical Costs (Mechanical Treatment=1)		
	Capital Costs	Annual OMR Costs*	Total annual Costs**
Mechanical (primary)	1.0	1.0	1.0
Chemically-enhanced mech.	1.1	1.6	1.3
Traditional biological (sec.)	1.5	1.7	1.6
Biological-chemical (sec.)	1.7	2.7	2.0
Advanced	2.4	3.0	2.6

Note: **OMR = Operation, Maintenance and Replacement (including dewatering and anaerobic stabilization for sludge treatment)*
***OMR plus amortization of capital costs (12% interest rate over 20 years of economic life)*

Biological treatment is a very efficient treatment method but at the same time a sensitive one. The bacteria decay the pollutant substances when the circumstances are kept suitable for them. This requires continuous control and skilled employees. It is possible that a whole biological treatment breaks down due to the poisoning of bacteria. This kind of trouble can be avoided by installing an alarm system that detects sudden concentrations of dangerous chemicals. It is also advisable to organise a chemical-waste collection system or to make agreements with involved industries to be careful with their discharges.

ANNEX I

FACTORS TO BE CONSIDERED WHEN DESIGNING A SEWERAGE

The period of design: To what extent are the future predictions of the population going to affect the plans? For Vidin this will be relevant because there are plans to attract new industries. The presence of a sewage system will in its turn benefit the efforts to attract them. In Giurgiu there is a tendency of the population to go back to their former residences because of the worsening employment situation. In Giurgiu, there is thus perhaps less a need for a higher sewerage capacity. The urgency of the situation also affects the period of design. In this respect there has to be a consideration for intermediate solutions for the short term (like collection from septic tanks).

The quantity and quality of the waste water: The quality of the waste water is rather constant in cities like Giurgiu and Vidin, with populations over 50.000, and not too many industries. This allows a smaller capacity of the sewage system. In Vidin, however where there is a predicted increase in industrial activity one should account for an increase in the waste water quantity. If the predictions do not come through there will be a too high capacity and not enough income for the maintenance and repayments. Variations in waste water quantity in a community are dealt with either by pumping stations or by storage reservoirs.

Separate or combined system: Another factor there is the rainwater that could be collected in the same pipes or in separate storm sewers. In the former case the sewers have to carry much greater volumes of waste water to the plant, thereby increasing the size of the plant and the pipes required and the cost of treatment. When the capacity is exceeded the untreated water has to be discharged into the Danube. It depends on the frequency of rainfall if it is, or is not seen as a problem to discharge untreated water in these cases. Another disadvantage of this combined system with too low capacity is the unhygienic circumstances that appear when the system overflows with a mixture of rain water and domestic waste water.

Collection system lay out: The transport of sewage is much more complicated than the supply of drinking water. Drinking water is supplied under pressure which makes it possible for the pipes to go up and down. Sewage is, however, is more dependent on gravity and pump stations are required where gravity is not available. Adequate topographic and geographic maps of the area are required to design the most economical routing of the sewers.

The population to be served: It depends on the population density of sewerage. The current ratio of the connected households to the common sewerage system is far from the desired stage in both Giurgiu and Vidin. Especially in nearly villages in the near future it is not expected to introduce the common network. When one thinks about the proper treatment of waste water (objective 1), and the transportation of it, the sewage from septics should also be mentioned. Many households use septic tanks for their waste water. The municipality (MRD still the responsible body) has to elaborate a study dealing with this topic; how to improve the present situation in this area.

One possibility is the partial or total storage and transportation of sewage. From the water pollution control, this solution is the most favourable one;µ if storage and transportation satisfy the following requirements:

- Properly isolated tanks, not only under construction, but under operating conditions as well;
- The sewage collected and transported should not get into streams or other environmentally sensitive receptors;
- The proper treatment and disposal of the collected-transported sewage has to be ensured. In the future the waste water treatment plant is the most suitable place to deal with the sewage collected from septics;

The drawback of this method is that it is highly energy - and material consuming, thus expensive. (Csiti, A., 1992).

Another solution can be the infiltration of partially treated sewage into the soil. Preceding the siccative filter bed septic tanks usually provide a certain degree of treatment. The purification efficiency of properly designed, constructed and operating septic tanks is about 30-40% regarding biodegradable organic matter and 60-70% for suspended solids. The disadvantage of this measure is the rising nitrate content of the ground water, which in turn harmfully affects the drinking water supply.

A very old approach but one that has recently been studied again (Niemczynowicz, 1991) is to use the partially treated sewage from the septic tanks as a fertilizer for arable land. This approach deserves special interest because it is obeying the principles of sustainable use of materials. Moreover, it is a method which does not automatically take over technical developments from the rich western countries.

ANNEX J

SOME ASPECTS CONCERNING WASTE WATER TREATMENT IN THE NETHERLANDS

Introduction

In the Netherlands, water treatment and water supply have a long tradition. The organisational structure, which is recognized as complicated, evolved in a country with many culturally separate institutes. Thus, there are many institutes and companies involved in the water supply, the water treatment, water quality control and water management, i.e. the Ministry of Traffic and Waters, Rijkswaterstaat, Netherlands Waterworks Association (VEWIN), KIWA, RIZA, RIVM, Heidemij, Grontmij, DHV, Haskoning, Waterschappen (regional waterboards) and Zuiveringsschappen (provincial treatment-organisations). The number of involved institutes requires many laws and regulations. On the other hand, the institutes produce many future plans, reports and papers. Regarding the water treatment, a province has to deal with the following laws and plans:
-Het nationaal milieubeleidsplan (national environmental management plan):
-De derde nota waterhuishouding (third nota on water management);
-Het provinciaal waterhuishoudings plan (provincial water management plan);
-De notities riolering van VROM (nota's on sewerage from VROM); and
-De wet op waterhuishouding (law on water management).

Recently, there is a tendency to re-organise and simplify this organisational structure. The main plan in this respect is to put the responsibilities for water supply and treatment under the same organisations. Now in Holland, regional waterboards are responsible for the supply of water, whereas the provinces take care of the treatment and the surface water quality. One responsible institute makes it possible to charge one fee for supply and treatment of water. The integration of the costs for treatment in the price for water use will increase the water price (now $\pm f1.50/m^3$) four- or fivefold. This could influence people to economize on water use whereas the costs for treatment will decrease.

It would require another report to make a complete summary of the Dutch water management. Moreover, this falls beyond the scope of our report. For this reason we will give an impression in this annex about the past and present situation of water treatment in Amsterdam. Subsequently, we will give a description of the water treatment system in the town of Rhenen.

Waste water treatment in Amsterdam

The city of Amsterdam has had a very close relation to water ever since its existence. For this reason, they have recognized problems of water pollution already in the 15th century. During that time measures were taken to stop the dumping of the cadavers and food remainders into the canals. In 1847 a doctor, dr. Sarphati, took the initiative to collect waste in the city. His goals were to improve health, to improve agriculture and to increase employment rates. It was not so successful until in 1866 a cholera epidemic killed 1150 people. This disaster made the municipal council aware of the necessity of waste collection. The waste and faeces were collected and sold to the farmers outside the city as a fertilizer.

The first concrete plans to build a sewage system were not accepted because the municipality did not want to lose the income from selling the collected waste. During the following decades, several factors made the need for sewerage very urgent: (1) There had always been the possibility to flush through the canals with water from the lateral lakes and the sea. They used the natural tides to let water come in at high water and to let the polluted water flood away during low tide. After the construction of the North Sea-canal and the building of the "Oranjesluizen" this was not possible any more. (2) The introduction of water closets. The selling of faeces became less profitable because they were more diluted now. (3) There was an increase of the inhabitants from 270,000 in 1870 to 500,000 in the year 1900.
Despite this, Amsterdam had to wait until 1907 for the municipal council to make the decision to build a sewerage. The first sewerage came into use in 1913. It covered only the new parts of the city and most of the inner town still dropped all their waste into the canals. During the period from 1935 to 1940 most of these parts were provided with a sewerage. Some of the streets in the old centre had to wait until 1987 before they were connected.

Very soon after the first sewerage network was installed, the people started thinking of how to clean the waste water. They recognised that the city would increase in population. The first waste water treatment plant was opened in 1926. It treated the waste water from 8,500 households. One year later another one was opened in Amsterdam-West for 25,000 inhabitants (i.e.). Already in 1930 the capacity of this plant was increased to 70,000 i.e. In 1941 it treated 180,000 i.e., and in March 1993 the new plant has a capacity of 390,000 i.e. Nowadays, together with the two other plants in Amsterdam the total capacity is 1,400,000 i.e.

Changes and problems with water treatment through the years
In 1927 Amsterdam had 735,000 inhabitants. This is not much less than the present population: 750,000 inhabitants. The capacity of the waste water treatment plants also had to increase because the people used more water. A booklet, published to honour the opening of the new treatment plant in Amsterdam-West mentions three main examples of cultural changes during these years: We are washing our clothes differently from how our grand parents did, we eat differently and our sexual behaviour is different. This greatly depends on what ends up in the sewage system: e.g. food leftovers, detergents and condoms.

All these changes in the past gave different problems in the treatment of waste water. Some of these problems and other problems, due to obsolete techniques and poor operation, are mentioned below.

The mixed sewage system dating from 1910 to 1930 in the first district was built horizontally and not on an angle. The pipes were always filled with rotting water because of they sagged. The pumping capacity to remove the rainwater after rainfall was too small as was the carrying capacity of the system. This resulted in overflowing of the system with rotting water about 40 times per year. Unless most of this water was collected in rain depots, this overflow gave a lot of extra pollution. It lasted until 1960 before there were some improvements on this problem. The city started to replace the horizontal sewerage only after 1970 when stricter rules were introduced in the new water law. This huge project to replace all of the obsolete sewerage

network will be finished in 2050. In that year the overflow frequency will be only 5-10 times per year.

During the years after World War II, the people started to use synthetic detergents. The traditional green soap (on the basis of fat) did not cause problems. Only on the "washing days" Monday and Tuesday did the bacteria need to work a little harder. The new synthetic detergents poisoned the bacteria that had to break down the polluting substances. The result was a low efficiency and on top of that, there was a severe foam formation. Another negative effect of the new detergents was a decreased oxygen dissolving capacity of the water. To obtain the same aeration they had to put in one and a half times as much oxygen which led to considerably higher costs. The solution came with the law on goods: detergents with branched carbon chains were banned.

The faeces and later the sludge have always been seen as a valid compound. But for different reasons it has often been difficult to sell it. It was too thin when the water closet was introduced; in 1935 the market collapsed; in the war there was no demand; and nowadays; the sludge contains too many heavy metals.
Since 1927 the sludge has been used to produce methane. This gas was used to heat the buildings and fermenting tanks of the plant. In 1930 155,000 m^3 methane was produced. Especially during the war this methane was very useful because there was a general shortage of fuels. The production of this gas and the deliverance to the gas-network of the city was profitable until the introduction of natural-gas in 1966. After that year, the gas was burned in the open air. Now, the sludge from the three waste water treatment plants in Amsterdam is fermented in a central bioreactor at the plant in Amsterdam-East.

The present equipment of the sewage treatment plant in Rhenen:
Rhenen is a city of 25,000 inhabitants next to the river Rhine in the province of Utrecht. Before 1980 the sewage of Rhenen and the nearby villages of Amerongen, Elst and Leersum was discharged untreated in the Rhine. Now the water is treated in a modern plant in four steps. We chose this treatment plant for a visit to see a Dutch representative plant. Furthermore, Rhenen's size, level of industrialisation and proximity of the river are comparable to the situation in Giurgiu and Vidin.
The plant is planned for 35,000 i.e. It cost *f*45,000,000.-- and is owned by the province. The sewerage network though is owned and maintained by the municipality. Households pay an amount of *f*90-- per i.e. per year to the province for the treatment and a similar amount to the municipality for the sewerage. These taxes are raised every year.
The domestic part of the sewage is 60-70%. Only one industry has its own treatment plant. Not only the sewage is collected but also the rain water. This causes a fourfold increase in the water flow when it is raining. The maximum capacity is 1,600 m^3/hour but the mean treated amount is 400 m^3/hour.

There are rules for the effluent but it is not always possible to clean the water according to the standards. This is not such a problem since the province is also responsible for the quality of the water. In practice this means that they do their best. It is possible that the whole active sludge is poisoned by a high concentration of chemicals in the waste water. Treatment is then not possible any more and the waste water has to be discharged until the sludge is recovered. This happened only once in Rhenen up until now, when the sludge was inactivated by alkalies

after the cleaning of the pipes of one industry. The responsible polluter had been a factory of soft drinks that had cleaned all the pipes with a sodium hydroxide solution. The pH had been so high that even the pH-meters of the equipment broke down. One batch of sewage had to be discharged untreated. Usually chemicals are collected from the industries and nowadays even from the houses. These kind of accidents are difficult to avoid however.

Since the introduction of detergents without phosphates, there has been a significant decrease in the phosphate content of the waste water. In Rhenen this decrease was 30% during the last 5 years. The heavy metal content of the waste water is also diminishing whereas the BOD stays constant.

The treatment appears in four steps:

1) sand removal
In this step sand is removed.

2) filtration
Dirt is removed by a screen (a kind of filter). The dirt is mainly plastics, rubber(s), and non-biodegradable paper.

3) biological treatment
The treatment with activated sludge is completed in a so called Pasveer channel. At the beginning of the channel the sewage is aerated and in the mean time mixed vigorously with the activated sludge. This aeration of the sludge is the most costly part of the treatment process since it requires a lot of electricity. As the channel goes on the oxygen will be consumed by bacteria that eat (remove) the organic material. The BOD is diminished with 98% in this channel (from 200 mg/l down to 2-3 mg/l).
At a certain point all the oxygen will be consumed and the anaerobic bacteria acinetobacter starts to grow. This bacteria grows well on fatty-acids, formed in the anoxic zone and it samples phosphates. In Rhenen the removal of phosphates is 20-25% (from 8 mg/l it removes ± 2 mg).
Ammonia is oxidized to nitrates in the aerobic part. The removal of ammonia is approximately 98% (from 40 mg/l to 1-2 mg/l). The formed nitrates are partially denitrificated in the anaerobic zones. At the end, the total nitrates are less than 10 mg per litre.
Since there are changes in the flow (during rainfall) and concentration, the control of the system is very important. It takes continuous attention to put in as much oxygen as is necessary for diminishing the BOD to a certain extent and in the mean time to keep an anaerobic area for the P- and N-removal. The system is very flexible and controlled by computers.

4) sedimentation
In the settling tank the sludge is removed from the treated water. The effluent is discharged in the river Rhine that flows on the other side of the street. The quality of the effluent remains worse than the water in the Rhine. After settling of the sludge a portion of it is removed and

pumped back to the biological treatment channel. The remaining of sludge is concentrated and disposed. Formerly it was used as a fertilizer but not any more since there are rumours of a too high heavy metal content. The disposal of the sludge is rather costly: *f*240,-- per thousand kilo.

ANNEX K

LIST OF QUESTIONS

This list gives an overview of the questions that we used during our excursion in Romania and Bulgaria. They were used as a guide when we talked to the experts in the different institutes.

TECHNICAL QUESTIONS (water supply, water consumption, waste water discharge)

What is the contribution of the household pollution to the total pollution in the municipalities?

What is the proportion of nutrients and of organic compounds in sewage?
What is the amount of waste water which goes into the Danube with or without treatment? (at the country and municipal levels)

Are industries (and which) connected to the central sewage system?

What is the percentage of the population of the municipality served by a sewerage?

In case of heavy rainfalls or emergency overflow of the sewer system; is this water discharged into the coastal waters?

Is the discharge point of the effluent located in the coastal waters?

Is this a tourist area? Is there an indication about the expected growth of tourism until 2000?

How many waste water treatment plants are there along the Danube? Perhaps a sub-specification per county?

What does the present treatment facility consist of?

Are the present waste water discharge facilities sufficient?

Are there any difficulties in keeping the treatment plant in operation?

Is there any plan to extend or rebuild the existing treatment plant?

What is the percentage of the streets that is provided with a sewerage?
Have estimates been made about the amount of water lost in households due to leaking taps and faucets?

Are there materials available to repair leaking taps and faucets? Is there a shortage of experienced plumbers?

Does a systematic long-term system of leakage detection of small leakages in the supply-system exist?

Is there a method to identify illegal connections to the pipelines?

Are improvements or extensions of the drinking water supply systems now being undertaken?

What is the water use per capita?

In Giurgiu the average consumption is higher during winter due to continuous pumping (to prevent freezing). Is this water pumped back in the circle?

What is the percentage of the population served by a drinking water network?

Is groundwater or surface water used as a source of the raw drinking water?

Are sources of raw drinking water polluted?

Is the drinking water treated before it is distributed? How is it done?

Does the quality of the drinking water meet the standards?

ECONOMIC QUESTIONS

What are the economic conditions in the country and in the municipality in particular?

What are the national financial resources for investment in infrastructure and for rehabilitation and modernisation of the existing water (treatment and supply) infrastructure?

What is the budget of the municipalities that can be spent to improve the use, supply, and treatment of the water that flows into the Danube?

Is there any estimation of the amount of money that the municipality will receive in the future in order to fulfil these tasks?

Are there investment possibilities (for example by loans from the World Bank and other banks), in order to improve the water supply system and the water management?

Are there any estimates of the "environmental costs" of environmental pollution caused by household wastes?

What are the exact annual treatment costs for municipal water supply, and what is the contribution of household sewage to these costs?

How much would it cost to replace the present municipal water supply systems (if any), or only to improve the existing supply system? Is there any cost-benefit analysis of replacement of the system, compared to the status-quo?

What are the estimates of the implied economic costs of shortages of drinking water?

What are the costs of the installation of better leakage detecting systems?

Do people receive bills for their water use, waste water discharge and treatment together? How much (in %) do they pay for water discharge?

What is the future taxation policy for water use, treatment, and supply?
Would it be possible to create one taxation system that includes the price of water use and of water supply?

What is the current water price? How are the costs for discharge for households exactly calculated (according to the drinking water use or differently)?

Is there any estimation of the price elasticity of water demand?

What is the logical basis for the taxation, taking also the future and the current environmental damage into account?

Taking into account the current and estimated future purchasing power of the national/municipal inhabitants, is it feasible to make the inhabitants pay a levy according to the quantity of water they consume? If not, would there be any possibility in the future? How could this be phased in?

ORGANISATIONAL QUESTIONS

Who is responsible for supply and discharge facilities?

What is the organisational model of the organisation dealing with environment and specifically water?

What are the relations between the responsible bodies and how are they linked to the relevant ministries?

What kind of inspection exists for controlling water use and water quality?

How many people work in inspections? Do they have a lack of equipment?

Under which directives and regulations are the responsible organisations functioning?

What are the expectations about future institutional developments?

What are the present institutional constraints with respect to:
- day to day operations;
- short-term and long-term maintenance; and
- future investments.

Can you give a short description of desirable organisational changes to improve operational and/or financial management of the organisation.

How is the organisation financed?
- by national government;
- by regional government;
- by local government;
- own resources (sales, taxes, etc.); and
- other.

Are there any problems in obtaining skilled employees?

Do Giurgiu and Vidin have a twin-city abroad? If not would this cooperation be useful in future?

What is the activity of the Romanian-Bulgarian Commission? Does it include the Danube water quality? What was the title and the date of the symposium organised by this Commission?

Does the Ecological Youth of Romania have a filial in Giurgiu? Are there other environmental NGO's? What are their activities especially regarding education? How are they financed?

What is the position of the green parties? Do they have seats in the parliament and in the town?

LEGAL QUESTIONS

What standards are used for evaluation of the Danube water quality?

What is the international legal framework for the pollution of the Danube relevant for the municipalities?

What are the legal, economic and communicative instruments that can be used within the legal framework?

Is bathing in the Danube forbidden because of bad water quality?

Are the following principles taken into consideration?
- stand still, best practical means, best technical means, pollution reduction at the source, the polluter pays.

What are the possibilities to install a levy system within the current legal framework?

[illegible]

What types of penalties are available if people illegally tap drinking water?

The branch agencies in Romania can issue permits for waste water dischargers on limits of allowed pollution and can collect penalties. Does it work in Giurgiu?

Are the Romanian norms for the use of drinking water in households set at the national or the local level?

What are the legal powers of the municipalities, the provinces and the national government to independently introduce laws concerning water supply, use and treatment?

Is it possible to shut people off the water supply if they do not pay their bills?
In Giurgiu it was mentioned that ELTIS prepares a new regulation in this respect? What is its content?

CULTURAL, DEMOGRAPHIC

What is the cultural background of the local population?

How is the water used?

How many inhabitants are living in both towns?

What is the expected growth in population of the municipality? And of the industrialisation?

How many people are unemployed? What is the percentage of highly educated people?

How many households are in the towns?

What are the future perspectives for the physical planning of the towns?

Are people aware of the problems they cause by the use and the pollution of the water?