DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
HUNGARY

EXECUTIVE SUMMARY

Ministry of Environment
Ministry of Transport, Communication and Water Management

in cooperation with the

Programme Coordination Unit
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Preface

The National Reviews were designed to produce basic data and information for the elaboration of the Pollution Reduction Programme (PRP), the Transboundary Analysis and the revision of the Strategic Action Plan of the International Commission for the Protection of the Danube River (ICPDR). Particular attention was also given to collect data and information for specific purposes concerning the development of the Danube Water Quality Model, the identification and evaluation of hot spots, the analysis of social and economic factors, the preparation of an investment portfolio and the development of financing mechanisms for the implementation of the ICPDR Action Plan.

For the elaboration of the National Reviews, a team of national experts was recruited in each of the participating countries for a period of one to four months covering the following positions:

- Socio-economist with knowledge in population studies,
- Financial expert (preferably from the Ministry of Finance),
- Water Quality Data expert/information specialist,
- Water Engineering expert with knowledge in project development.

Each of the experts had to organize his or her work under the supervision of the respective Country Programme Coordinator and with the guidance of a team of International Consultants. The tasks were laid out in specific Terms of Reference.

At a Regional Workshop in Budapest from 27 to 29 January 1998, the national teams and the group of international consultants discussed in detail the methodological approach and the content of the National Reviews to assure coherence of results. Practical work at the national level started in March/April 1998 and results were submitted between May and October 1998. After revision by the international expert team, the different reports have been finalized and are now presented in the following volumes:

Volume 1:	Summary Report
Volume 2:	Project Files
Volume 3 and 4:	Technical reports containing:
	- Part A: Social and Economic Analysis
	- Part B: Financing Mechanisms
	- Part C: Water Quality
	- Part D: Water Environmental Engineering

In the frame of national planning activities of the Pollution Reduction Programme, the results of the National Reviews provided adequate documentation for the conducting of National Planning Workshops and actually constitute a base of information for the national planning and decision making process.

Further, the basic data, as collected and analyzed in the frame of the National Reviews, will be compiled and integrated into the ICPDR Information System, which should be operational by the end of 1999. This will improve the ability to further update and access National Review data which is expected to be collected periodically by the participating countries, thereby constituting a consistently updated planning and decision making tool for the ICPDR.

UNDP/GEF provided technical and financial support to elaborate the National Reviews. Governments of participating Countries in the Danube River Basin have actively participated with professional expertise, compiling and analyzing essential data and information, and by providing financial contributions to reach the achieved results.

The National Review Reports were prepared under the guidance of the UNDP/GEF team of experts and consultants of the Danube Programme Coordination Unit (DPCU) in Vienna, Austria. The conceptual preparation and organization of activities was carried out by **Mr. Joachim Bendow**, UNDP/GEF Project Manager, and special tasks were assigned to the following staff members:

- Social and Economic Analysis and Financing Mechanisms: **Reinhard Wanninger**, Consultant
- Water Quality Data: **Donald Graybill**, Consultant,
- Water Engineering and Project Files: **Rolf Niemeyer**, Consultant
- Coordination and follow up: **Andy Garner**, UNDP/GEF Environmental Specialist

The **Hungarian National Review** was prepared under the supervision of the Country Programme Coordinator, **Ms. Maria Galambos**. The authors of the respective parts of the report are:

- Part A: Social and Economic Analysis: **Mr. Judit Rakosi**
- Part B: Financing Mechanisms: **Ms. Klara Toth**
- Part C: Water Quality: **Mr. Gyorgy Pinter**
- Part D: Water Environmental Engineering: **Mr. Sandor Kisgyorgy**

The findings, interpretation and conclusions expressed in this publication are entirely those of the authors and should not be attributed in any manner to the UNDP/GEF and its affiliated organizations.

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Ministry of Transport, Communication and Water Management

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Summary

The National Review Summary Report of Hungary gives a coherent presentation of essential results derived from the detailed studies on:

- Social and economic impact analysis of water pollution,
- Evaluation of hot spots and analysis of water quality data,
- National targets and identification of projects for pollution reduction,
- Analysis of financing mechanisms and preparation of investment portfolio.

Considering the regional perspective of elaborating a Danube Pollution Reduction Programme, the National Review of Hungary and in particular the Summary Report focuses on transboundary problems and effects of water pollution.

1. Description of the State of the Danube Environment

In 1997 the Parliament adopted the National Environmental Programme (NEP). The starting point of the NEP is the identification of the main problems and the causes which are important for the problems to be formed. Due to the basin like character of the country the annual, average water quantity flowing through Hungary (120 billion m^3/year) per inhabitant is the highest in the world. Hungary also with respect to water is a typical transit country, water reserves both quantitatively and qualitatively depend on the interventions in the neighboring countries.

- Temporary alga development in Danube is still growing and bacterial pollution is not decreasing. The nitrate contents of Danube increases every year and extreme values exceeding even 20 mg/l are not rare. Because of river regulation and dredging, sludge has accumulated in the vicinity of some bank-filtered wells. Due to the decomposition of organic substances, iron, manganese and the dissolved organic content of water from wells has grown. In certain regions the accumulation of toxic materials in bed-deposits can be observed;
- Besides the improvement of several parameters the ortho-phosphate content in the river Tisza has greatly increased;
- The majority of tributaries are regarded polluted;
- In case of Lake Balaton recent measures have stopped the nutrient load growth. A significant factor of eutrophication is phosphorous, within it the invariable level of inside phosphor load (redissolved from the bed deposits) is decisive. If the weather is favorable for algae development, because of low nitrogen content of the lake, blue algae propagates as it can bind the nitrogen of the air. This phenomenon results in the temporary growth of the N-load of Balaton. In these periods atmospheric N load may be three times higher than of bank side load.
- The irrigation canals built in the Great Plain are often used for drainage of sewage from settlements. The use of water polluted this way is limited for irrigation.
- First of all, several years of drought and at some lakes the unjustifiable water drainage of small gradient canals have led to major water level decreases in the natural sodic lakes representing great natural values in the Great Plain; in addition, the growing quantity of in-flowing wastewater has significantly deteriorated water quality.
- A major pollution source is the fact that while 96-97% of the population lives in areas with public utility supply water, the percentage living in areas with sewers is only 57%, the gap is almost 40%.
- The majority of sewage is either not purified or if it is, not adequately. Especially the capital and some big towns lag behind. Treatment of sludge coming from wastewater treatment and its harm free disposal in general has not been solved.

2. Population Development and Water Sector Relevant Characteristics

2.1. Estimation of Actual and Future Demand for Water

The population of Hungary in 1997 was 10,135,000 of which urban population 6,382,000, rural population is 3,753,000. In long term it can be expected: 2010 year 9,908 x 10^3persons, 2020 year 9,483 x 10^3 persons.

In Hungary for the different economic activities and for the household produced total water amount is 6,279.1 10^6m^3/a. 5,302.7 10^6m^3/a (84.5% of the total) is ensured from surface water, the rest 976.4 10^6m^3/a (15.5% of the total) is ground water.

The domestic demand on raw water for almost all people of the country is ensured by the public water supply system with the exception of the households, which are in peripheries. Here lives about 3-4% of the population.

In the public water supply in Hungary the most important economic factor is the water supply system based on ground water (94.7%). The public supply systems based on surface water ensure freshwater only for some local consumers. More than 2/3 part of the total production of public water supply system serves the freshwater supply of the population, and the rest serves the other economic activities. It can be estimated that only 4% of the population is served by surface water originated water. In the water supply comfort of the population there are significant differences. Beside of the supply where the households are directly connected to the water supply system, a significant part of the population satisfies their water demand with the help of water taps which are in the courtyard of the house or even in the street. Water consumption per capita in urban areas 128 l/capita/d, in rural areas 71 l/capita/d. Average in the country: 107 l/capita/d.

In long term the population demand on raw water will grow by 35-37% until 2010-2020. The increase of the domestic water demand is first because of the demand on perfect water supply level. Because of the increase of the population water demand level in long term there will be not so big difference between the urban and the rural areas. (The per capita water demand will be equalized). By 2010 the now existing water supply differences between the catchment areas will significantly decrease. The underdeveloped areas begin to develop and the equalization will take place about at 2020. The per capita water demand will be about equalized as well.

2.2. Estimation of Actual and Future Production of Wastewater

The canalization and the sewer systems are in backwardness if compared to the water supply systems. About 45% of the population are connected to public sewer systems in the country, in urban areas the ratio is 67%, in rural areas 6%.

The population living in the area where there is no sewerage system uses of septic tanks for wastewater disposal, but about the 2/3 part of these are inefficient and are dangerous to the environment (especially for the vulnerable ground water).

The aim of the Sewerage Framework Plan of Hungary 2010 is that about 45% sewerage rate shall increase about to 68%. For the areas, where there will be no sewerage system even after the realization of the long-range plan, must in at least 23% construct professional individual wastewater treatment plants for healthy dumping of the wastewater.

2.3. Analysis of Health Hazards through Water Pollution and Unsanitary Conditions

At first it must be mentioned that the drinking water supply of Hungary is ensured by ground water.

The classification of surface water - used as drinking water - according to EU prescriptions (75/440/EEC Directive) hasn't been done yet, but according to the used technologies and operating experiences Danube, Tisza and all the tributaries can be considered as being in A2 class. There are problems only at special contamination when for some time the water can be considered as being in A3 class. Especially dangerous is the period of unexpected oil contamination and great microbiological contamination. The cleaning technologies are not always prepared for protection against this kind of contamination. From the point of view of health risk the water supply from surface water works vary in space and time. During the year the surface water works in general comply with the strict prescriptions given for water quality, so there is a minimal risk for the population. Similarly there is a minimal of risk at water works where the drinking water can be substituted with other water basis (e.g. ground water) in some contamination period. Where there is no possibility for substitution, the health risk for the population at the rate of the contamination grows.

The planned Utilisation of bank water resources shows that the surface water production will be at the same level in the future as it is now.

According to bathing water quality out of a total of 2,086.3 km river stretch, 525.5 km (25,2 %) have proven as seriously polluted, 1,185.3 km (56.8 %) as unacceptable, 342.2 km (16.4 %) as acceptable and 33.3 km (1.6 %) as excellent water quality. In settlements along these stretches lives a total population of 3,807,309 of which 628,896 (16.5 %) and 2,849,203 (74.8 %) respectively, is living by stretches of seriously polluted and unacceptable quality. The number and percentage of population settled by stretches of acceptable and excellent respectively quality is rather low: 294,609 (7.7 %) and 34,601 (0.9 %), respectively.

The following water related environmental health problems are to be highlighted related to water (NEP):

- Regarding drinking water, adequate settlement of problems of drinking water containing arsenic, bacteriological infection, nitrate contents and chlorinating by-products.
- Reduction of the threat of swimming-pool epidemics from bacteriological infection.

3. Analysis of Actual and Expected Impact of Economic Activities on Water Demand and Potential Pollution of Aquatic Systems

3.1. Industrial Activities

Some industrial plants have their own water supply system. The planned water amount produced with the help of the specific water plant, according to the source of water as follows:

- surface water	4326,2	106m3/a	(97.6%)
- ground water	148,6	106m3/a	(3.3%)
Total of own production:	**4474,8**	**106m3/a**	**(100,0%)**

From the ground water 55.5 $10^6 m^3/a$ is mining water. The industrial plants refill their own water production with water from the central water supply system and with water originated from other water plants, and it happens too, that they give some part of their own production to other consumers. Considering all of this the water amount for industry is 4695.2 $10^6 m^3/a$. From this the surface water is 4587.6 $10^6 m^3/a$ (97.7%). The cooling water is 4416.5 $10^6 m^3/a$.

The distribution of water use among the industrial branches is as follows: electricity production 92.4%, manufacturing 6.9%, construction and other activities 0,7%. Because of the industrial growth the water demand could increase, but the water saving technologies could counteract. At the same time it can be expected that in the fields of public water supply the now existing high water loss will decrease.

The industrial discharge amount according to the method of disposal is as follows: central sewerage system 28.9%, discharged directly to the rivers 63.0%, to the soil 2.2%, utilization 4.5%, other 1.4%. Besides this the industrial plants discharge wastewater, which is contaminated only with heat and doesn't need any treatment. The total amount of this is 4472.4 $10^6 m^3/a$.

In connection with the industrial wastewater discharged to central sewerage system there is a countrywide problem, namely that the industrial pre-treatment isn't solved or has not a good efficiency. This has high load to the central treatment plants, has danger of water contamination, renders more difficult or makes impossible the disposal of sludge. Only 40% of industrial wastewater discharged directly to the rivers are treated by a suitable method. The valid regulation promotes only to some extent the meeting of wastewater treatment requirements. For the plants which are being constructed in the future only those solutions will get permission which comply with the environmental and water management prescriptions. The pre-treatment of the wastewater discharged to public sewerage must be solved similarly. At some places the mining operation - where direct contamination possible - causes water quality problems and similarly, there could be problems at the environment of abandoned mines and with mines being under water - especially with the karst water resources. The contamination which occurred and nobody is responsible for may be permanent environment contamination can be very big problems. Releasing the damages has social, economical, political and judicial consequences. Because of this it became governmental task.

3.2. Municipal Discharges

The municipal sector represents one of the most important sectors leading to both surface and groundwater pollution. The importance of municipal sector in connection with water pollution is based on the fact that into surface water discharged municipal wastewater exceeds the 80% of total

of surface water discharged wastewater needing treatment. This amount is approximately four times as much as the industrial wastewater needing treatment, which is discharged directly into surface water and many thousand times as much as the wastewater discharge originated from agricultural point sources. The majority of sewage is either not purified or if it is, not adequately. The ratio of biologically treated municipal wastewater is less then 40%, while that of advanced treated municipal wastewater is below 3%, only mechanically treated wastewater is 44%, wastewater without treatment is 14 %. Especially the capital and some big towns lag behind.

Since only 45 % of the households are connected to the sewer system (while the 96-97% of population is supplied healthy public drinking water), the majority of household wastewater is desiccated, however, it is characteristic in Hungary, that the septic tanks are very often improperly managed, causing infiltration of wastewater into the ground. The low level of canalization significantly contributes to inappropriate desiccation of household wastewater. In areas with canalization water pollution is caused by the low level of willingness to connect to the municipal sewer system, because people can hardly afford the high sewer prices. Therefore in Hungary in general there are very low utilization of operating municipal sewer and wastewater treatment plants, causing water pollution. The public sewerage system serves the conduction of precipitation as well.

It is a basic goal that the wastewater discharging to surface water must be treated at least by biological treatment. The nutrient sensitive water resources (lakes, backwater, and reservoirs) are especially to be protected. Here must decrease the nutrient load. This needs advanced wastewater treatment. According to the EU prescriptions the wastewater sewerage and treatment must be solved at the end of 2000 on the settlements which are bigger then 15,000 inhabitant-equivalent and at the end of 2005 on the settlement which are bigger then 2,000 inhabitant-equivalent. These tasks will be completed in Hungary at 2010. Among the tasks is to solve the treatment and harmless dumping or utilization of the wastewater sludge

3.3. Agricultural Activities

The distribution of agricultural water production - 1,028.4 $10^6 m^3/a$ (100%) according to the source of water can be estimated as follows: surface water used for 935.3 $10^6 m^3/a$ (90.9 %), irrigation and fishponds, for other purposes and in some part, for irrigation used ground water (estimated) 93.1 $10^6 m^3/a$ (9.1 %). The information of water authorities, which were obliged to give data, reflects very well the situation namely the continuously decreasing agricultural water use. The agricultural water use will increase to some extent however it will show fluctuation. This will improve the utilization of capacity.

According to the available information the estimated discharged wastewater of main agricultural farms is 1.2 $10^6 m^3/a$. 10-20% of this amount is the liquid manure of animal husbandry. The majority of agricultural nutrient load is coming from diffuse sources. The importance of water contamination originating from agriculture is shown by the fact, that the 60 - 70% of nutrient load (N, P) are the result of population load, probably only 15% are the result of agriculture. Out of the total inputs in the Danube basin, about 60% of N and 40% of P stemmed from diffuse sources.

The usage of fertilizers (as a factor of agricultural non-point source pollution) decreased significantly during the last decades, total use of fertilizers in effective material decreased by 80% between 1980 and 1996 (1980: 1,399,000 tons/year; 1996: 270,000 tons/year).

The amount of agricultural wastewater comparing to the domestic and industrial wastewater discharge will remain unimportant. Changes in the property form, which happened in agriculture will result in wastewater discharge increase, but this will be in connection with the public sewerage and wastewater treatment. From water quality protection point of view the dumping of manure from animal husbandry, which is an important part of agriculture endangers the water resources. As the result of enforcement of regulation the negative effect will decrease.

3.4. Solid waste Disposals and Possible Soil and Groundwater Contamination

Collection of municipal solid waste is not full scale, (from 2/3 of household is collected regularly), selective waste collection is at low level and the technical level and state of the applied devices is very poor.

Only 30% of the 2,700 community disposal sites meet the regulations more or less and the number of illegal and legal dumpsites, which are potential pollution sources, is high. Free disposal capacity is low and no modern procedures are applied. About 20-30 % of landfills are located in areas dangerously close to groundwater or inland waters, therefore 60 % of the drinking water bases have been polluted over the past 30 years.

The main improvement is that there are so-called target support systems from the central budget to the settlements, which build regional landfills. According to NEP 10 -15 regional waste landfills have to be built annually. In spite of this good development in the building new landfills, it can't be said that the pollution from the old landfills is decreasing. It is because of no legal requirement for systematic recultivation of abandoned landfills.

The quantity of industrial waste is unjustifiably great and the survey of this waste is not satisfactory. Hazardous waste disposal capacity in Hungary is insufficient. The on-site disposal of unknown quantities of soil polluted with heavy metals and/or hydrocarbons has not been solved.

3.5. Other Water Uses

The utilization of hydropower at river sections is distributed disproportionately. Their development is very low because of natural and geographical potentiality of Hungary.

In connection with hydropower utilization it can be stated that the currently-operating power stations will work in the future too.

According to the *fishery* statistics of the Ministry of Agriculture in 1996 from the waters of Hungary 21,124 tons of fish were fished up. Out of this 13,518 tons (64%) originate from fishponds farming by intensive fish production, 7,606 tons (36% originate from natural waters and reservoirs). The GDP value of the fisheries was 1183 HUF in 1995, which is about 9,412 Million USD. This is about 0,02% of the GDP.

The total length of *navigable waterways* of Hungary is 1,622 km, of which the "always navigable" is 1,373 km. From this it is 419 km the main section of Danube, which is at the half point of the international Danube-Rhine-Main waterway.

In 1996 the productivity of transportation of goods (freight ton-kilometers of goods) on waterways is the 10% of the transportation of the country. The transportation of passengers (passenger km) is even worse because it is only the 0,1% of the total of the country (in passenger km). In 1992 the Parliament passed a law about the establishment of national public transportation ports. Nowadays the national public transportation ports are: Gyõr-Gönyü (concessional competition is going on) Csepel, RORO and container port in Nagytétény, Dunaújváros, Baja and in the future Szekszárd and on the Tisza: Szeged.

Hungary was in the recent years a real paradise of *water tourism* and could be developed in a very short time to a new branch of tourism if the necessary conditions could be ensured. In connection with the water quality used for recreation the followings must be mentioned:

- the Danube is appropriate for water sports (e.g. shipping) and for line fishing. Bathing is restricted by water quality. In some periods the water is inadequate for bathing.
- the large lakes are appropriate almost all recreation utilization (for bathing too)
- the Tisza and bigger tributaries are appropriate for rowing and other water sports and for line-fishing too. Using them for bathing depends on water quality.

Water tourism needs several further governmental decisions for starting and running in it as a new branch of tourism.

3.6. Analysis of Relevant Institutional Framework

In the part A of the Report there is a detailed documentation, listing and short analysis of the relevant institutional framework, organizations and responsibilities in different level of institutional structure:

- central government organizations,
- regional organizations, agencies performing functions of authorities,
- local self-governments,
- special institutes and organizations.

Strengthening the environmental institutional system is fundamental for the implementation of the National Environmental Programme both on the level of the National institutions and regional, local levels.

3.7. Actual Policies and Strategies

The National Environmental Programme is an intervention plan for six years (1997-2002), which should result in the solution of the current environmental problems or beginning the solutions and the prevention of future problems. There are determined specified aims and tasks in water protection.

On the base of NEP the Government has adopted the Action Plan of 1998 to NEP. In the Action Plan of 1998 to NEP there are specific programmes. In the Part A of the Report there is the documentation of the relevant, accepted ongoing programmes to reduce water pollution and to ensure sustainable human development and healthy environment in the Danube River basin.

4. Analysis of Water Quality Data and Description of Environmental Impact on Ecosystems

Water resources management has an outstandingly long tradition in Hungary. Observations and data collection on the quantity and quality of the surface water resources were always considered as important activities to assist the water management efforts.

Hydrological (water quantity) observations.

Extensive survey of watercourses started in the 18-th century. Regular observation of water levels started in 1823. An observation network of 132 gauges was in operation in 1860, where water stages together with ice phenomena were observed on a daily frequency. At present the existing hydrological surface water observation network to monitor the quantitative characteristics of the river system in Hungary consists of 2700 stations, of which 370 are considered to be basic stations. Stations of the basic network have been selected on cross boundary rivers/streams near the national borders. Basic stations are designated to each other in 20-30 km sections of major rivers, reservoirs, and large lakes, or one station for each 400-500 km^2 of territory in case of small streams and canals. Water levels are observed at each basic station together with ice phenomena. Thickness of the ice cover is measured on rivers with the formation of ice jams and on larger lakes. Flow rate is measured and registered at 185 stations, water temperatures at 87 stations and suspended sediment at 37 stations. The 12 District Water Authorities and the Water Resources Research Center VITUKI Plc carry out the tasks of the hydrological service. The hydrological service works in co-operation with different agencies of environmental protection and with the National Meteorological Service. Unfavorable aspect for water management in Hungary is that approximately 95% of the surface water resources originate from abroad. This means that special attention is paid to the border sections of rivers entering into the country, not to speak about the fact, that some of them carry significant pollution load from abroad.

Water quality observations.

The history of the measurement of water quality of Hungarian surface waters dates back to more than a century ago. The first published measurement data stem from 1873 when the water quality of the river Danube was discussed in terms of the cations and anions found in the river water. The need of the society for regular investigations on the quality of waters merged up first at the beginning of the extensive industrialization after the Second World War. The Water Resources Research Institute VITUKI made plans for the establishment of a nation wide water quality monitoring system in 1952. The Institute made measurements in 1400 stations of 130 streams and for 25 water quality constituents. The frequency of the random samplings was once a year. The water quality parameters investigated in those times are still being measured today. As a result of several modifications, the basic national water quality monitoring system was established in 1968. The number of stations was reduced to about 300 and the sampling frequency increased to 12 annually as the minimum. The national network included the 113 most important watercourses of the country, the analysis of approximately 50 water quality parameters and sampling frequencies of annually 12, 26 and 52 per year (108 samples per year in a single station). It is of importance that in this period the analytical methods were also internationally harmonized (within the so-called COMECON countries the harmonization was made on the basis of the Standard Methods of the USA). New monitoring rules were established in 1985. This included 250 stations and the sampling frequency was 52, 26 and 12, and provided continuity of records for the bulk of the stations.

4.1. The Water Quality Database

The national water quality monitoring system is in operation at present since the beginning of 1994, according to the requirements of the relevant Hungarian Standard MSZ 12749 and consists of 150 stations, the sampling frequency varies between 52 and 12, except few stations with lower frequency. In eight sections of rivers Danube and Tisza there are cross-section samplings in three verticals. Special attention is given to the 24 boarder section, where rivers enter into the country, as well as the only three sections of the leaving rivers Danube, Tisza and Dráva. The Standard precisely determines the groups of quality parameters to be determined in sampling sections and method to be applied for the classification of water quality (Table 1.). Novelty of the monitoring system is its complexity, the evaluation and processing of quality data covers also the results of the microbiological investigations carried out by the co-operating partners within the public health sector. The system is supplemented by a regional network with further 91 stations, data of which are also processed together with the data coming from the national monitoring system.

The local Environmental Protection Inspectorates carry out the field water quality monitoring activity. Data are regularly sent to the Institute of Environmental Management (KGI) in Budapest, where the water quality data bank is maintained. The applied software is under improvement to ensure better data management. Results of the monitoring activities and the water quality map are disseminated annually in the proceeding of "The Quality of Waters in Hungary", the latest volume published in 1997 contains information on the previous year.

The river systems entering Hungary are often subjected to accidental water pollution incidents. Approximately 95% of the surface water resources originate from abroad. This condition creates a continuous potential risk for water users principally from the point of view of quality, but also of quantity. The number of accidental water pollution incidents registered on national level culminated in 1987, when there were 262 cases, of which 208 affected surface waters within the country and 31 arrived from upstream foreign countries. In 1996 there were 63 domestic case and 6 arrived from abroad. Mineral oil and its products coming from different sources were responsible for most of the pollution events in each of the years. This is why Hungary is actively participating in the establishment of the Danube Accident Emergency Warning System (DAEWS). The National Center (PIAC) of the DAEWS is in operation in Budapest, its Communication and Expert Unit is working in VITUKI Plc. while Decision-making Unit is located in the Ministry for Environment and Regional Policy.

4.2. Data Quality Control, Compatibility

The importance of reliable and correct control of data for water quality/pollution monitoring is internationally recognized. The analytical quality control (QC) using check samples for interlaboratory comparison among the laboratories of the District Water Authorities started in early 1970s. The laboratories working in the field of water and pollution control monitoring are participating at present in the QualcoDanube intercalibration program, which includes the quality control of analytical determinations carried out from drinking water, surface water, wastewater, bottom sediment and sludge samples. The quality parameters covered are general parameters, nutrients, heavy metals and non-specific parameters (BOD, COD, ANA-detergents). Recently the QualcoDanube intercalibration program was extended to Danube basin level and seven of the Hungarian Environmental Protection Inspectorates participates also in this international quality control and quality assurance programme.

Continuous activities are going on to ensure the consistency and compatibility of the water quality data. Only data that proved to be correct in both formal and professional testing are entered into the water quality database. Systematic correction of discharge data belonging to the sampling date is also going on, in close co-operation with hydrologists. Simultaneous flow measurement is not made at the

samplings, only reading of stages and using rating curves. The length of water quality records, which can be considered as homogenous, is more than 25 years, however orthophosphate and mineral oil are the exceptions among the traditional components. In respect to the new water quality indices, which were included in the analysis by the new standard in 1994, the accuracy of data on organic micropollutants remains questionable due to the low frequency of the analysis.

4.3. Preferred Water Quality Monitoring Stations

For the purpose of transboundary diagnostic analysis and basin-wide water quality simulation studies data sets and sampling sites of the existing water quality monitoring stations were analyzed. These analysis also took into consideration the results of the recently completed Phare Project EU/AR/303/91 "Development of a Danube Alarm Model" from point of view of river sections taking into account for modeling purposes. As a result of these analysis the preferred water quality monitoring stations advised for further basin-wide studies are listed in Table 2. The list contains the most important regular water quality monitoring stations at the border sections of rivers entering the country and includes all the stations, which are selected monitoring stations for the Trans-National Monitoring Network (TNMN) of the Environmental Programme for the Danube River Basin and also those stations, which participate in the Bucharest Declaration monitoring programme.

4.4. Water Quality Data of the Period between 1994 and 1997

Basic water quality data series coming from the regular water quality monitoring network between the years 1994 and 1997 were provided for further studies of the Danube River Basin Pollution Reduction Programme in Volume II of the National Review Part C: Water Quality. These 15 monitoring stations are controlling the sections where rivers are entering and leaving the territory of Hungary. Regarding the database of the period 1994-1997 and the components considered for basin-wide water quality modeling, the following additional remarks could be made:

- The number of total N data is limited even after 1994. This can be explained by financial and laboratory capacity reasons. Thus only the mineral N defined as the sum of NH_4-N, NO_2-N and NO_3-N can be used. Another solution might be the extrapolation using the ratio of total N to mineral N for the calculation of total N, for those cases when this date is lacking. Unfortunately this ratio shows high variation even in the same sampling point.
- For modeling purposes satisfactory number of total P data can be found in the database. If this is not the case, then the above mentioned extrapolation method can be used, but with much higher reliability than in case of total N.
- In respect to heavy metals the attention should be drawn to the criteria, that the Hungarian Standard MSz 12749 requests the measurement of dissolved forms.
- Another problem is that large numbers of data (of higher analytical frequency) are available only for mineral oil, phenols and anionactive detergents. Only scattered data are available for the rest of the determinants.

4.5. Effects of Pollution Loads on Ecosystem and Human Health

To assist the better understanding of the changes of transboundary water quality conditions, a ten years statistics (1988-1997) of the measured values of selected quality components were also provided. The water quality parameters cover selected items of oxygen household, nutrients, oils, metals, hydrobiological and microbiological parameters. Statistical compounds are minimum, maximum and mean values, standard deviation and probability values of 10, 90 and 95 percentiles. The results clearly show that due to the significant self-purification capacity of the big rivers like

Danube (Table 3.) and Tisza (Table 4.) there is no characteristic change in the entering and leaving water quality concerning oxygen household and slight increase can be observed in nutrient compounds. In case of special parameters (oils, some of the metals, and especially microbiological components) however there are moderate deterioration. Statistics on the water quality parameters of the Tisza tributaries Szamos, Kraszna and Maros demonstrates the entering high pollution load into the country: for example the 90 percentile probability value of COD, or Coliform belong in each case into the fifth highly polluted quality class. Several components of the group of micropollutants also belong to the IV-V quality class. Accidental pollution incidents arriving from upstream countries often cause problems in the operation of water uses and damages in the aquatic ecosystems.

Due to the untreated municipal emissions into the river in some of the upstream countries and in Hungary, the Public Health Authorities prohibited the swimming along the Danube because of the high rate of microbiological pollutants during the recent years. Effects on human health are also discussed in chapter 4.2 of the National Review Part A: Social and Economic Analysis. Water quality problems are observed first of all in the small size tributaries loaded with emissions of significant industrial plants and municipalities, like the water courses of Kösely, Lónyai Canal, Eger Creek, Zagyva, Tarna, Nádor Canal, Pécsi Víz, Ikva, etc. Water uses are often restricted along these watercourses. In case of extreme meteorological conditions causing temporal water quality deterioration in the River Tisza, problems arise at the drinking water intake of the Waterworks of Szolnok town.

4.6. Additional information related to water quality affairs

The National review provided additional information on several areas needed for the further basin-wide studies on pollution reduction measures.

River channel characteristics.

Hungary has outstandingly long tradition in hydrography, river regulation and water management. As a consequence of this long tradition there are long practical experience, wide-range knowledge and large amount of data and publications on the characteristics of the water resources in the country. Detailed information helps the possible users on the sources of river bed profiles, gradients, cross sections, hydrographs, bed load and suspended load conditions, flow measurement stations, etc.

Floodplains/Wetlands.

Extended work is going on to establish the full inventory of existing wetland areas and sites which can be still reconstructed. Remote-sensing methods are also applied in this work, which will lead to a categorization of such areas, plus the edition of an atlas on wetlands in Hungary. The most important Hungarian wetlands (Ramsar sites) of international importance are listed and the related water quality problems are indicated.

Dams and reservoirs.

The main technical characteristics of hydropower stations and their multi-purpose impoundments as well as the most important reservoirs are given. Only few data are available on the sediment trapping effects of the reservoirs.

Major water transfers.

Available data on the major water transfers from the rivers Danube and Tisza are listed, which are power station intakes for cooling water and agricultural intakes for irrigation purposes.

Sediment discharges.

Available sources of hydrological data on sediment movements are indicated. Short information is given in the recent studies on the quality of bottom sediments in the river Danube and on the sources of such information.

The National Review does not contain those data, which are publicly available in printed Yearbooks, Atlases and in other widely accessible information sources.

5. Identification, Description and Ranking of Hot-Spots

The evaluation and ranking of hot spots in the Hungarian part of the Danube basin was carried out on the basis of the general approach and methodology that was debated and mostly accepted by the water quality working group during the January 1998 National Planning Workshop. Starting point of the evaluation was the existing hot spot list of the Strategic Action Plan, which consisted of 16 municipal, 2 industrial wastewater polluting sources and 1 wetland rehabilitation problem in Hungary.

The analysis of the most important wastewater dischargers was carried out to evaluate their significance, pollution impacts and generate priority ranking. The main features considered during this analysis were: *critical emissions* discharged into the recipient water body, *seasonal variations* in the emission or in the river's water regime, *immediate cause of emissions, root causes of water quality problems* which create the pollution case, *condition of the receiving waters, vulnerability of downstream water uses,* and as a very important factor the *transboundary implications.*

As a result of the detailed evaluation concerning the above main features of the most important wastewater dischargers, assessment on priority ranking was made into three priority groups, such as high, medium or low priority. The rankings have the following special general meanings for the Danube River Basin Pollution Reduction Programme:

- *High priority* indicates that the source of emission has outstanding importance in Hungary, its impact on the recipient river could be transboundary and it could be a significant factor on basin-wide level;
- *Medium priority* indicates that the source of emission is an important wastewater discharger on national level, needs immediate investments to develop its pollution control facilities because of the significant pollution impact on the recipient water body. Most of the cases there are ongoing investments in this respect.
- *Low priority* means, that the source of emission also needs investments in the field of wastewater treatment in the close future because its national importance, but the necessary investments are scheduled not earlier then 1999/2000.

The important issue implied by the above priority groups is that only the polluting sources having *"high priority"* are proposed to be considered in the basin-wide studies of the Danube River Basin Pollution Reduction Programme.

Basic information for the analysis were provided by the Master Plan for Sewerage and Wastewater Treatment of Municipalities in Hungary, the National Environmental Program, the direct information from different local and central Authorities and Institutions dealing with water quality and pollution control affairs, and the data on important emissions into recipient waters (Hungarian contribution to the EMIS Sub-Group).

The most important wastewater discharges (hot spots) were studied in three groups. The first group consisted of *municipal hot spots.* The second group was the *industrial hot spots*. The third group contained the known *agricultural polluting sources*. Characteristic data on municipal and industrial emissions presented in this report were harmonized with the EMIS Sub-Group activities and related data inputs.

5.1. Municipal Hot Spots

The existing situation of the sewerage, wastewater treatment and impacts on the recipient waters were evaluated, covering all the significant towns in Hungary, which have wastewater load greater than 50 thousand population equivalents. The analysis ended up with a priority ranking considering the main features of evaluation standpoints outlined above.

High priority

There are five significant towns in Hungary, which were considered as high priority municipal hot spots. Three of these municipalities are situated directly along the river Danube: Budapest, Győr Dunaújváros**.** Two other high priority municipal hot spots are located directly along the river Tisza: Szolnok and Szeged. Each of these towns was also listed as "hot spots" in the Strategic Action Plan as important wastewater dischargers needing urgent pollution control investments.

BUDAPEST, the capital of the country, is outstandingly the biggest point-source wastewater discharge into Danube along the whole Hungarian stretch of the river. Nearly 20 percentage of the population of the country lives here and it is also one of the important industrial centers of the country. The combined sewer system of the capital gets significant industrial wastewater load with more or less efficient pre-treatment. The sewer system has several direct outlets into the river without the necessary treatment. The existing two biological wastewater treatment plants can manage only about 16 percentage of the total dry weather wastewater flow, the remainder is pumped into the river practically without treatment (using only screens and sand traps). The main pollution impact of the Capital on the quality of the river is the high microbiological pollution. Due to the big dilution effect of the river generally no notable change of the most important quality chemical parameters can be observed at the next regular downstream sampling site at Dunaföldvár (rkm 1560.6).

GYŐR, the center of Győr-Moson-Sopron County is the most important town in the North-Transdanubian part of the country along the common Hungarian-Slovakian stretch of the river Danube. The town has large industrial sites of national importance. The municipal wastewater treatment plant is under reconstruction and enlargement, the emission discharged from the plant into the recipient river however represents a significant pollution impact from point of view of microbiological quality parameters.

DUNAÚJVÁROS, the center of Fejér County is a significant town and industrial center of the Middle-Danube area. The sewer system of the municipality provides a nearly full supply for the population but the treatment of the collected wastewater gets only a very poor mechanical treatment. The river flow in this section provides a high dilution effect on the emission discharged into Danube, thus only the microbiological pollution impact is considerable in this respect.

SZOLNOK, the center of Jász-Nagykun-Szolnok County is located in the middle of the Hungarian catchment area of the river Tisza. It is an important municipal and industrial center of this area. The existing sewer system of the town serves nearly all of the population, practically there is no wastewater treatment. The wastewater is pumped into the river after only the applied raw mechanical screening. In spite of the considerable dilution effect of the river, there is one-class quality deterioration downstream from the effluent.

SZEGED, the center of Csongrád County is the biggest Hungarian town in the lower part of the Tisza catchment in Hungary, located near to the south national border. As the center of Csongrád County and the third biggest city in the country (except the capital), it is a significant administrative and economic power in this region, with considerable industrial production. There is no wastewater treatment plant to treat the sewage collected by the public sewer system. Though there is a considerable dilution effect of the river on the quantity of the direct emission discharge, this is the only effective transboundary pollution impact on the rivers leaving the territory of Hungary.

General information on the main characteristics and wastewater load of these hot spots is summarized in Table 5.

Medium priority

The municipal polluting sources of medium priority have outstanding national importance, because most of them are located near a relatively small recipient watercourse, or stream. This unfavorable situation usually generates local water quality problems, due to the generally small flow of the recipient and the high emission load of the wastewater discharge. National efforts are already made to improve this situation and in most of the cases investments are running, or are planned to start for the enlarging or upgrading the wastewater treatment facilities in these towns. These municipal dischargers (Table 6.) are advised to be considered as single "hot spots" on national level only.

Low priority

There are another 15 municipal wastewater dischargers, which were ranked as low priority hot spots. These are generally towns with population under 50 thousand, having public sewer system and wastewater treatment plant. The efficiency of the treatment generally needs upgrading and modernization. The emissions from these plants in most of the cases represent overload of the recipients, except in case of Danube (Vác, Baja, Százhalombatta) and River Sajó (Kazincbarcika). The municipal hot spots with low priority are listed in chapter 2.2.3 of the National Review Part C: Water Quality.

5.2. Industrial hot-spots

The analysis on the available data on industrial polluting sources resulted in three significant industrial units in the sector of chemical industry, which are advised to be considered in the regional pollution reduction studies as high priority hot spots.

High priority

OIL REFINERY of MOL Rt. in *Százhalombatta* is an important factor in the national economy and has a key role in the multiple supply for the different users of their products. This industrial complex has a direct emission discharge into the River Danube. Another important issue concerning this important industrial unit is the safety of pollution free operation of the production technology. In October 1997 a significant accidental water pollution incident was caused by this industrial plant on the river Danube in the form of an oil spill. Due to the effective pollution control measures partly carried out by the emergency unit of the industrial plant itself, there was no transboundary effect of this pollution incident.

NITROKÉMIA Rt. (NIKE Rt.) chemical complex is located in the catchment area of Lake Balaton in *Balatonfűzfő*. The emission of the industrial plant is transferred however into another catchment area, into the Séd-Nádor Creek system, which is a secondary tributary of Danube. There is an up-to-date biological wastewater treatment plant in operation, but the wastewater containing non-degradable chemical pollutants are stored in a wastewater reservoir and released periodically when the water regime of the recipient provides dilution to meet the requirements of the emission standards and permission of the local authorities. Downstream water users have frequent quality problems and complaints.

BORSODCHEM Rt., the big chemical complex situated in *Kazincbarcika***,** along the river Sajó, which is a primary tributary of the river Tisza. There is a biological wastewater treatment plant in operation, however it is overloaded and the dilution rate of the recipient river is not high enough. There are problems to meet the emission standards with that part of the effluent containing outstandingly high salt content.

General information and wastewater load data on these high priority industrial hot spots are given in Table 7.

Medium priority

Industrial units getting the medium priority ranking are considered as significant industrial sites on national level. They have direct discharges into main recipients like Danube, Tisza and Sajó Rivers, but these emissions generally do not cause significant quality changes in the recipient water bodies. Considerable water quality deteriorations were observed only in case of the small size recipient Séd-Nádor Creek (secondary tributary of Danube) due to the emissions of the Nitrogen Works fertilizer factory. Wastewater loads of the medium priority industrial hot spots are summarized in Table 8.

Low priority

The industrial units of low priority are listed in chapter 2.3.3 of the National Review Part C: Water Quality.

5.3. Agricultural Hot Spots

The area where the studies on wastewater dischargers had to face considerable problems because of inadequate data for the analysis was the agriculture. During the recent years significant changes and transitions occurred in the field of agricultural production units, as a result of privatization. The existing agricultural information systems were unable to follow these rapid changes. According to the available data on point-like agricultural emissions, the units studied generally have no major influence on the quality of recipients, thus only low priority was given to these emissions, listed in chapter 2.4.1 of the National Review Part C: Water Quality.

Nation wide data based on agricultural non-point source pollution is not available in Hungary at present. Different research studies were carried out during the last decade on small size catchment areas of creeks only, to assess the magnitude of nutrient loads originated from agricultural land runoff. The usage of fertilizers (as a factor of agricultural non-point source pollution) decreased significantly during the last decades, and the gross agricultural production showed somewhat similar tendency

The EU/AR/102A/91 Phare Project "Nutrient balances for Danube countries" carried out studies on national and Danube basin level on the magnitude and proportion of diffuse nutrient load compared to the total loads. The nutrient emissions from diffuse sources in Hungary were estimated as much as 53 kt/year in total N, representing 62 % of the total load in 1992, while similar values in total P were 7 kt/year and 42 percentage.

5.4. Proposal on Hot Spots for Transboundary Analysis

The outputs of the priority analysis resulted in a clear distinction between the national and international (basin-wide) importance of the Hungarian hot spots, listed in the Strategic Action Plan. Municipal and industrial emissions having high priority rankings are only advised for consideration in the transboundary analysis. As a consequence of the present studies, it is proposed therefore to leave out the entire medium and low priority hot spots from the list of the Strategic Action Plan due to their national importance only.

The main issues and facts studied during the priority ranking analysis of the eight high priority hot-spots are summarized in separate Tables in chapter 2.5 of the National Review Part C: Water Quality (Tables 2-14/21).

6. Identification and Evaluation of Pollution Reduction Measures

6.1. National Targets and Instruments for Water Pollution Reduction

The Hungarian National Environmental Program has general guidelines for water pollution reduction. The most important goals are that Danube and Tisza should reach the Class III level in all important parameters, the further pollution of irrigation waters should be stopped. Better control of land uses and environmental conditions on the surface should decrease the harm on vulnerable ground water resources. The pollution of nitrate and pesticides from diffuse sources should be decreased in ground waters and sensitive surface waters. These targets have not been turned into direct ambient water quality objectives for the touched river bodies.

The technical instruments as *Effluent Standards* were fixed in 1984 six categories were differentiated by law depending on the sensitivity of the recipient and the interest on the water uses. As the system was set up fifteen years ago, it can not fully serve the today's needs. The Hungarian *effluent monitoring* system is connected with the regular effluent compliance control. The effluent data coming from the legal procedure of effluent control and fining give not enough information on the real pollution load from point sources. As there are no reliable direct information on diffuse source pollution also, the weakness of data on pollution load gives the major bottleneck of water quality management planning today.

The monitoring laboratories belong to analytical intercalibration system, and some of them have been accredited according to the ISO requirements too. Their professional level, instrumentation and quality assurance are close to the needs now. The data on effluent quality is open for the public.

The National Guideline of MSz 12 749 as *In stream water quality standards* gives the general basis for classification of surface waters according their quality. There is no any legal obligation for reaching water quality targets in the surface water stretches expressed according to these quality classes.

Such legal tools as *licensing, wastewater fine, general environmental check-up, environmental supervision, legal possibility for stopping the questioned activity* are given by law. Their use is hindered by the eroded driving force of the fines connected to them, sometimes by the limited capacities of the involved authorities and by considerations of the further possibility on economic survival of the polluters.

6.2. Measures for Reduction of Water Pollution

Non physical measures

The efficiency of the water protection is strongly affected by the existing legal possibilities of authorities involved in water pollution control. There is a common agreement on the necessity of development of the legal background and administrative capacities of the authorities. The actions connected to this issue are the development program of the Hungarian water legislation and the harmonization procedure with the EU environmental legislation.

There is an ongoing activity for the development of the national water legislation. Its basis will be the river basin and the integrated river basin management concept.

The proposed basic elements of the water quality management system can be summarized as:

- Use related Water Quality Objectives (WQO), depending on the characteristic land uses and their water quality needs on the watershed,
- WQO-s should be harmonized with EC Directives,
- Clear transition of WQO-s into discharge standards,
- Prioritized, phased, achievable, affordable water quality management programs on watershed level, built up from local community wastewater management plans,
- Ownership for the objectives and improvement plans,
- Clear responsibilities and accountabilities,
- Efficient permitting and enforcement,
- Sound monitoring and reporting system,
- Simple, clear, efficient funding and charging systems,
- Adequate and technically competent staff for water pollution control,
- Legal framework to be given for the authority to provide and operate the system.

The crucial element of the concept is the full local involvement of all affected parties into a so-called Catchment Planning Commission for each catchment area. These Commissions would be responsible for setting up locally agreed WQO-s, for development management plans, preparation of annual reports on the progress of the local wastewater management plans. The Commission could work as a board drawn from representatives of all parties interested in water quality management. The responsibility of the Commission covers water quantity and quality issues in order to provide an integrated approach to water resources management according to the EC Water Resources Framework Directive. It seemed to be unrealistic to follow strictly the full institutional consequences of the river basin approach immediately, what can be reached on a step by step approach in the future.

The Environmental Charge would provide an assured revenue stream on a consistent basis. This charge would be levied on all dischargers according to the pollutant input allowed in their permits (giving possibility for them to apply for the decrease of their effluent standards when they want it). The environmental charge should cover the administrative costs of water quality management including the costs of the activity of regional water authorities, the Catchment Management Commissions. It could raise revenues for funding water protection investment programs also.

The water quality protection could not be managed without substantial contribution of the state. The State fund is needed for speeding up the pollution reduction programme, for equalization of differences in affordability from local resources.

The EU-Directives will certainly have further impacts on water pollution control policy in Hungary connected with the ongoing legal harmonization procedure. The majority of the EU directives have been built into the new proposal on Hungarian water protection legislation. The Framework Directive on Water Resources, the Nitrate Directive and the EU new agricultural policy, the Directive on integrated pollution prevention are expected to result in further development in the national water protection policy. These possible new elements are:

- The existing area distribution of the water- and environmental administration should be altered to a certain extent according to the river basin approach.
- Use related water quality objectives would be developed.
- The existing effluent standards should be revised.
- Register of protected waters should be set up.
- The existing in-stream monitoring system should be developed by increased stress on monitoring based on bio-indication.

- Specific local monitoring should be built up on protected waters, with specific regard for vulnerable groundwater resources.
- Watershed water quality management action programs should be launched.
- Specific action programs could be started on areas, where the nitrate concentration is higher than 50 mg/l from agricultural sources, as an extension of the ongoing national program on the protection of vulnerable groundwater resources.
- The surface areas of vulnerable underground drinking water resources will belong to the protection, which should have priority against agricultural activities. This could have considerable effect on the existing agricultural production profile, or agricultural State subsidy system.
- The introduction of the IPPC approach will generally change the existing effluent standards in the industry. The step by step approach is needed on this field
- The combination of the IPPC and in stream water quality approach can result considerable reduction of pollution in surface waters

Preventive measures for water pollution reduction

Having recognized that the shortages in sound wastewater management central programs were launched to reduce the pollution load mostly coming from municipal sources. These are:

National wastewater collection and treatment program has been launched for communities with the aim of reaching the 67% level of canalization for 2010. This program goes as two parallel subprograms as S*ewage treatment program of Hungary* one for the smaller settlements and the *Sewage treatment program of the capital and the cities with county status*, The basic reason for differentiation is the difference in the financial capabilities and necessary investment costs of the villages and large cities.

Separate programs were launched for the protection of existing and future wellfield areas, as:

- *Program on increasing the security of wellfield areas in use and the*
- *Program on increasing the security of future wellfield areas.*

The reason for differentiation is that the responsibility for the drinking water resources relies on the user of the resource, and the state is involved via the state grants only. In the case of future water resources the total responsibility relies on the state today.

P*rogram on municipal waste management* was started also, as the big problems were understood on the environment and the human health hazard connected to that in the municipal sector due to the lack of sound waste management.

Remedial measures

The other part of centrally organized programs is connected with several sensitive areas where the level of water contamination exceeds the tolerable level, or it is likely will exceed it without a counteraction.

These are:

- Protection program on Lake Balaton
- Program on the great Hungarian Plain
- Program on increasing the water management conditions in the Mid-Danube-Tisza Region.
- Reduction of the environmental damages at Szigetköz region
- Program on environmental remediation of contaminated areas belonging to State responsibility

- Program on the rehabilitation of the abandoned old mines
- National Environmental Health Action Program
- Program on National Ecological Network

These programs are mostly based on state grants, as the own contribution of the municipalities, or other responsible parties is not higher than 20 -50 % generally. There is a conflict between the mentioned programs, as for instance the application for grant of a community on wastewater treatment has priority development when it can be found on a vulnerable wellfield area.

6.3. Expected Regional and Transboundary Effects of the Actual and Planned Measures

The transboundary effects of the Hungarian pollution reduction measures are determined by the fact that the rivers leaving the country transport the pollution coming form countries what are in upstream position compared with Hungary, and these rivers have big self-purification capacities. It is expected that the balance of the pollution load with transboundary importance is dependent on different factors with different trends of development.

The municipal point source pollution is regarded as the major factor of transboundary pollution from Hungary. The amount of treated wastewater led into surface waters will increase. The level of organic matters and microbial pollution will likely be decreased considerably. The nutrient load will likely stagnate due to the increase of wastewater treated biologically only on one hand, and decrease of the untreated wastewater at the other.

The industrial point source pollution could be kept on the existing level due to two contradictory tendencies. The industrial production will likely increase, which can increase the industrial water uses. The effluent standards would be strictened according to the IPPC approach.

The hazardous material content of the rivers with transboundary interest can be kept on low level also with these measures.

The agricultural diffuse pollution is low today due to the limited fertilizer and other chemical use. The possible intensification of agricultural production can cause increase in diffuse pollution as the pollution reduction in agriculture can be managed on indirect way mostly so it needs more time to reach pollution reduction again. This tendency can lead to the temporary increase of the nutrient load of surface waters in Hungary.

Further effort should be taken for increasing the safety of the wetland areas and water related ecosystems with transboundary interest, as these areas have kept their nature close character due to the limited land uses connected sometimes with the political uncertainties. Today a likely consequence of the increasing international conflict in areas close to the national borders will increase the risk of damages of these important natural conservation areas (or areas worth for natural conservation).

7. Analysis of National Financing Mechanisms

7.1. Policies for Funding of Water Sector Programmes and Projects

Hungary is in the process of harmonizing its legislation with EU-normatives. The process already started at the end of 80s. By now the major legal framework and all the institutions protecting the provisions of the law have been set up. The legislation is the main pillar for environmental and water management policy in Hungary.

The environmental protection and water management permits all sectors of the national economy, therefore the legislation and mechanisms of their financing are extremely complex. General rules for environmental protection and water management – including finance – are provided in two framework laws:

- Act No LIII of 1995 on general rules of environmental protection.
- Act No LVII of 1995 on water management.

The objective of the law on environmental protection is to harmonize the relationship between Human Being and his environment, to oblige Individual to protect the elements of his environment and to introduce economic and social development that suits to preserve the natural heritage and environmental assets for future generations. The law defines the necessary information, documentation, research and financial basis for environmental protection.

The main argument in favor of a new act on water management included the changes in property conditions. The act reduced the role of the state, and gave more power, wider responsibilities and functions to the local self-governments. The new regulation covers all management functions related to water, starting from the comprehensive, complex development of water resources till the control of water related losses. The new law is capable of meeting the expectations of society for water management and offering a wide scope for modernization of market economy.

In 1997 the Parliament adopted a Decree on the National Environmental Programme (NEP). The Programme is considered as the national strategy for environmental development, due to the fact that it defines the targets to be reached, conditions, the key area of implementation and the financial sources for accomplishment. The Parliament emphasized the importance of co-operation with local self-governments, the participants of scientific and economic sphere, as well as with the civil organizations during implementation of the Programme and made the Government responsible for the execution.

The particular water sector programmes of the NEP – with governmental estimation of investment values – are demonstrated in Table 9.

7.2. Funding Mechanisms for Water Sector Programmes and Projects

The national sources for funding of water quality and water management programmes and projects are very wide, among them the largest ones are the Central Environmental Protection Fund and the Water Management Fund. They co-finance investment projects of municipalities and commercial organizations. Sources can also be obtained from the ministerial budgets. From the budget of Ministry of Internal Affairs labeled and target-related subsidies are available for water supply and wastewater treatment of municipalities. The budget of Ministry of Environment and Regional Policy provides subsidies for regional development that may serve water sector projects. All of the named sources are available for the organizations in a way of application. Apart from those there are investment projects of water quality and water management development that completely financed by the State, out of the budget of MTCWM and MERP.

The Central Environmental Protection Fund is a special state fund established and regulated by law. The minister of Environment and Regional Policy is responsible for administration of the fund. General objective of the fund is to stimulate of forming an environmentally friendly economic structure, prevent the environmental hazard, reduce the environmental damages, protect and maintain the natural values, support efficient solution of environmental problems and improve the public awareness for the protection of environment and natural values. In 1998 the planned revenue of the CEPF is 50 % higher than the fact was in 1997, due to the newly adopted environmental fees. In 1998 the sum of revenues and expenditures of the fund are 24,660 MHUF, (120 MUSD) and 23,402 MHUF, (114 MUSD respectively).

The Water Management Fund is the other designated state fund that can be used for financing of water sector projects. The minister of Transport, Communication and Water Management is responsible for administration of the fund. The overall purpose and role of the fund are defined partially in the act on water management, and in the decree of minister of MTCWM on the Water Management Fund, i.e., to support and finance the water management tasks of public interest. Those tasks are especially the protection against the harm of waters, economical use of water resources of drinking water quality, stimulation of the economical utilization of water resources and protection of the water resources.

In 1998 the planned revenue of the WMF is 18 % higher than the fact was in 1997, due to the increased unit charges on water abstraction (water users' fee). The value of balanced revenues and expenditures of the fund are 5,225 MHUF, (25,4 MUSD) in recent year.

Types of financial assistance that can be provided by the central special state funds are the following:

- non-repayable grants;
- repayable subsidies with no interest, or less than the bank-interest rate, i.e., soft loans,
- loan guarantees;
- subsidies on interest.

A municipal investment on wastewater treatment – as usual – might be financed from the following typical sources:

- non-repayable grants from the national budget (target-related subsidy, up to 40 % of the overall value of investment);
- subsidies from the Water Management Fund (up to 30 % of the overall value of investment);
- subsidies from the Central Environmental Protection Fund (up to up to 30 % of the overall value of investment);
- subsidies from regional development sources (up to up to 30 % of the overall value of investment);
- loans from Hungarian Development Bank, or loans from international institutions mediated by HDB or other commercial banks;
- loans from commercial banks;
- own sources of the municipalities, e.g., 30 % share from the charged wastewater fine, depreciation, etc.

Sources a)–b)–c)–d) are considered as governmental (central) sources and cannot surplus 50 -100 % of the total investment value, depending on the level of underdevelopment of the settlement (town, village) or other governmental priorities.

Availability of sources e) – f) (i.e., bank loans) are assured, but readiness of organizations taking them is highly theoretical. Commercial banks examine the investment projects strictly from point of view of viability. The public utility companies (or their owner the municipalities) cannot generate sufficient sources for development (investment) through the water and sewer service prices. Part of the reason for this is the low depreciation rate, fixed by laws, and the undervalued assets of the companies. Therefore they are not able to produce their own necessary contribution, as own equity. The only exemption is the capital city Budapest. Partially because of this reason those organizations cannot elaborate a financially viable plan for the future operation of the planned infrastructural investment. As a result the commercial banks do not qualify for the municipal wastewater treatment project as financially viable. It has to be noted that recently any further increase of prices on services would cause extreme social stresses.

The other reason of poor loan-taking activity of the municipalities is that the share of loans in their annual budget is limited in 15 % of the Balance Sheet Total. This limit is established in law.

An industrial wastewater treatment plant has less variety of sources for financing a new investment:

- subsidies from the Water Management Fund (up to 50 % of the overall value of investment in form of soft loans, or interest-subsidy);
- subsidies from the Central Environmental Protection Fund (up to up to 30 % of the overall value of investment in form of soft loans);
- subsidies from regional development sources (up to up to 30 % of the overall value of investment in form of soft loans);
- loans from Hungarian Development Bank, or loans from international institutions mediated by HDB or other commercial banks;
- loans from commercial banks;
- own sources of the industrial unit.

Subsidies from designated state funds are available in form of soft loans, or loans free of interest.

Effluent charges saved do not occur as a source of investment in case of municipal, industrial and other commercial wastewater treatment or pre-treatment, mainly because of the lack of forcing by legislation, and the low level of wastewater fining.

In Hungary there are no special funds, credit institutions for financing of pollution control measures exclusively in the agricultural sector.

The reform of the banking sector in Hungary started in 1987. From that year the function of central monetary organ (Hungarian National Bank) and the function of commercial banks have been separated.

In the end of 70s the Government already realized the necessity of presence of foreign capital in banking sector, due to opening up the Hungarian economy toward the Western countries. However the majority owner of the commercial banks remained the state until the beginning of 90s.

The Act on Financial Institutions of 1991 prescribed to decrease the share of Hungarian Government in the commercial banks to 25 %, but until 1995 no significant move has been made. The intense privatization took place from 1995.

According to the opinion of the BANKWATCH expert, with the last of the state-owned banks to be privatized by the end of 1997, all of Hungary's large banks are either majority or minority foreign-owned. The progress that Hungary has made in privatizing its banks should not diminish the other achievements that have helped to restructure the sector to its present form, currently the most advanced in the region. The financial health of most of the formerly troubled banks has been restored. Legal, accounting and regulatory frameworks to Western standards have been adopted, modern payment system is in place.

The Hungarian banking sector is evolving towards a more universal model. This has also been encouraged the regulatory framework. The Financial Institutions Act took effect at the beginning of 1997 and harmonized earlier rules of the banking law to EU norms. Among other changes, the minimum capital requirement for universal bank has been doubled to HUF 2,000 Million (USD 10 Million). At the end of 1996 the Parliament also approved new legislation on mortgage institutions and mortgages notes. A new securities law allows bank to deal directly in State securities and derivatives and by 1999 in all securities. Given its OECD membership, Hungary has also agreed to allow foreign banks to open branches as of January 1, 1998.

A new Code of Foreign Exchange provides full convertibility for current account transactions and a growing degree of liberalization of capital movements. All these developments contribute to further reductions of the banks' transaction costs and provide an opportunity to introduce new financial product.

The Hungarian Development Bank (HDB) started its activity in 1992. The bank is one of the tools in hand of Government to create conditions that promote economic growth and implement tasks related to the modernization and integration to EU.

The economic climate for investment and development programmes has become more favorable due to the increasing amount of domestic and foreign fund available and the improvement in the terms and conditions offered to fundraisers. The HDB contributed to the successful achievement of the above objectives by considerably expanding its business and activities, and by generating earnings well ahead of plans. The new Act on Credit Institutions serves, as a basis for the transformation of the Bank into a unique credit institution with a special status in the Hungarian banking sector.

The HDB has been very successful in raising fund in international capital markets on favorable terms and in using these to finance projects aimed at the development of the national economy. Under the agreement concluded with Kreditanstalt für Wiederaufbau special banking products have been launched, e.g., a long-term credit facility for financing infrastructural development projects of municipalities, a novel product in the Hungarian market.

The Hungarian banking sector is entirely prepared to participate in transferring loans of the international financing institutions to the domestic municipal and commercial sector for financing water sector investments projects. It is necessary to emphasize, there is no shortage in credit facilities in the Hungarian banks. The municipalities themselves are not entirely prepared for meeting the financial requirements of the Hungarian and international financial institutions.

7.3. Actual Cost and Price Policy

Prices of drinking water from waterworks and the wastewater treatment services belong to the officially fixed/limited prices. The pricing authorities are either the Government (MTCWM) or the municipality, depending on ownership.

Definition of price for drinking water has different procedures for every type of companies. The majority of the existing public water utilities (over 80 %) are owned by the municipalities, a minor part, the regional networks, owned by the State. Where the municipality is the owner of the water work, then the pricing authority is the self-government itself, in case of state-owned Waterworks the MTCWM is acting as the pricing authority.

The process of definition of prices is the following: the state-owned Waterworks present their price proposals to the MTCWM, according to the guidelines of the ministry. The proposal presents the detailed operational costs (taking into consideration for instance the forecasted energy price for the next year, and the planned inflation rate, etc. The profit cannot be higher than 3 % over the inflation. After approval by the ministry of the proposal, the guidelines and the whole pricing

mechanism and the prices itself (by waterworks) going to be published in the official journal of MTCWM. This procedure is proposed to follow for the municipalities in their price approval process, but they are not obliged by law to follow it.

Because of the high number of small municipality owned waterworks, the differences among water prices can reach up to 1:10. Considering the social consequences of this situation the Government assures a system of subsidies in order to eliminate the impact of the extremely high prices on the population. The annual amount of the subsidy is not exceeding the 2-3 % of the total income of all of the waterworks in the country.

Pricing for industrial use regulated predominantly by instruments of economic nature. Industrial water use has a major impact on the country's water resources management, in that this amount to around 70 % of the total freshwater use. Water consumption has increased three-fold during a period of 30 years (1960-1990), although the trend has reversed from the early 90s due to economic recession. Further reasons of declining industrial water use are various attempts on water conservation, restructuring of industry and the change to market economy.

The recent price policy for state-owned waterworks does not allow more than 3 % profit above inflation.

The financial weakness of the sector is largely caused by the inability of customers to pay higher fees for water and sewer services. The problem is, however, made worse because of the costs of operation are increased due to the fragmented nature of the sector and could be reduced if the sectors were rationalized.

Budgetary compensation – as it was described above – does exist. For the budgetary compensation in 1998 is allocated 3,500 Million HUF and to obtain it the municipality has to apply for. The utilization of these subsidies depends on the application activity of municipalities.

Consumers (public utilities, industrial and agricultural users) carrying out water abstracting activities are subject to the water permit and they are obliged to pay a user charge on water abstraction to the Water Management Fund.

The existing sewer fine and wastewater fine are supposed to promote the adoption of "polluter pays principle" in water pollution control and fining. The recent regulatory instruments include the possibility of levying fines for surpassing the limit values set forth in legal provisions. The operators of industrial and other commercial plants discharging harmful pollutants into the public sewer are obliged to pay a sewer fine. The treatment plant operators pay wastewater fine for discharging effluents into the surface water.

Both types of fines are defined in terms of pollutant concentration. Progress means that in the second year the polluter pays two times more than in the first year unless starting pollution control investments or measures.

The wastewater fine and sewer fine as well are far too low to have any real incentive effects. The amount of fines is far less than the cost of mitigation or elimination.

The ministries concerned are in the process of elaborating more efficient regulatory systems in order to protect the water quality and quantity.

The actual policy of the Hungarian Government (criteria of normativity) does not include significant economic and financial incentives for pollution reduction measures, and the role of existing incentives also declining.

However a number of tax allowances (faster depreciation, exemption of wastewater collection and treatment operations from corporate tax in certain circumstances) and the more favorable VAT rate (i.e. 12% after environmental and water services, while the major part of goods and services have 25% VAT rate) are still in force. Nevertheless these are not sufficient to stimulate and enable investment and development of sewer systems and wastewater treatment because of their intrinsically high costs.

7.4. Actual and Planned Public and Private Investments for Water Quality and Wastewater Management Projects

Recently the state continues to be the major investor in the area of wastewater treatment investments. See Table 10.

Hungary's first priority among the water sector programmes is the Wastewater Treatment Programme. There has been elaborated a special decision of the Government about the support of mentioned programme. The Governmental support is manifested in form of subsidizing the projects from ministerial budget and stimulating and supporting wide involvement of international financial institutions. In financing of water sector projects participate the World Bank, the European Investment Bank, and the EU-PHARE, the negotiations of EBRD have not been successful yet.

Actual financial assistance in water management sector is provided by the EU PHARE Programme, the EIB and the World Bank. There are several ongoing and completed programmes, financed by PHARE sources. The preparation of World Bank loans and EIB loans is continuing, but still in stage of negotiation of contracts. The implementation of contracts in neither cases has been started yet.

According to information provided by senior officials of MTCWM the EIB conducts negotiations on financing of investments of municipal wastewater treatment plant via Hungarian commercial banks. EIB requested governmental guaranties for financing certain municipal projects and the Hungarian government agreed on. All details of the contract negotiations are qualified as bank secret. It is only known that municipalities of Debrecen, Székesfehérvár and Szolnok are involved.

According to the information received from MTCWM the following planned World Bank projects exist with water management relevance within the Environment Sector Programmes:

a. Wastewater treatment plant of Dunaújváros. Planned sum of investment: 10.7 M USD, out of that WB share is 2.4 M USD. Planned implementation period: 1998-2001.
b. Wastewater treatment plant of Budapest (North and South Budapest together). Planned sum of investment: 56.5 M USD, out of that WB share is 17.6 M USD. Planned implementation period: 1998-2001.

Due to the fact that the Hungarian Government first priority in water sector investment is the municipal wastewater treatment support, all the international investors joined that. As a consequence in industrial and mining projects, as well as in agricultural measures and projects there are no international investments even in preparatory stage.

8. Development of National Pollution Reduction Programme and Investment Portfolio

8.1. Project Identification, Description and Cost Estimation

The basis of our proposal on hotspots is the analysis of the water quality in Hungary, and the changes when the rivers enter and leave the country. As it can be seen in chapter 4.5., the effects of pollution loads on ecosystem and human health are basically influenced by the self purification capacity of the big rivers leaving the country. This is the reason why we can not speak about big changes in water quality of the big transboundary rivers in Hungary.

The methodology for hot spot selection was discussed on the occasion of the pollution reduction Workshop in January 1998. We considered the preferences of the Strategic Action Program and the National Environmental Program, the analysis of the critical emissions. The changes of these emissions in the year and their trends were analyzed also. We differentiated low-, medium-, and high priority hotspots.

The low priority hot spots are very important pollution sources on local level due to the specific nature of the emission and the low dilution capacity of the recipient. They can cause problems for the local water users and for the groundwater resources nearby. Their proper pollution reduction needs to be solved according to the requirements of EU on wastewater treatment.

The medium priority hot spots are important not only local but on national level. Their effect is limited in transboundary context. They are priorities of the national programs on water pollution reduction.

The high priority hot spots can cause effect on water uses and water related ecosystem beyond the Hungarian border. The details of these hot spots can be found in the project files attached.

The results of this ranking reflect the general situation in Hungary as the major tasks on water pollution reduction can be found in the municipal sector. We propose that 6 projects should belong to this category.

The biggest oil and chemical industrial plants belong to the industrial hot spots. They have their wastewater treatment facilities, but they have to be developed, or reconstructed mostly together with their industrial sewer systems. There is one industrial hot spot - the BORSODCHEM Company – where a special problem needs to be solved owing to the high salt pollution of the recipient.

We proposed 1 high priority hot spot with “intersectoral” nature. This proposal focuses on the rehabilitation of the water-related ecosystems in the Hungarian- Croatian transboundary region.

All this high priority hot spots are introduced in the project files attached. Personal interviews were carried out with site visit together with senior decision makers of the polluters in the time of project preparation in all cases. They were ready for further co-operation, and eager for further discussion on the financial terms of project implementation. We can conclude that the key issue of investment into water pollution reduction at the high priority hotspot is the bankability of the projects.

The cost estimation of the high priority hotspots is summarized in table 10. We can conclude that the total investment cost is 33,018 million HUF (160.94 USD). The secure source is only 13,673.00 million HUF (66.64 million USD), non-secured is 19,345.00 million HUF (94.30 million USD).

8.2. Institutional Planning Capacities in Public and Private Sectors

The law enforcement should be increased in Hungary as a basic element of the institutional capacity in Hungary as we stated before. New regulation is needed in the field of water quality planning, effluent standards related to the in stream water quality and to the technology used. The effluent monitoring capacity should be strengthen also via widening role of self-monitoring and quality assurance.

Wastewater treatment should be obligatory for all municipal polluters also. Personal responsibility should be given for the water pollution caused. River basin organizations should be set up as holders of responsibility for the good quality of waters. The awareness of public should be increased towards water quality issues.

The introduction of the wastewater discharge fee would be a major step on water quality protection, as it would increase the interest of polluters in pollution reduction.

The design capacity is basically available on the field of civil engineering in Hungary. The big State owned design institutes have gone into small private design enterprises. These companies are very active on the field of wastewater treatment plant and sewerage design. Design quality assurance should be increased. These planing bureaus are in good connection with the local governments, which are the most important stakeholders of the water pollution reduction. They have got experiences for co-operation with the foreign consulting companies, investors and donors.

8.3. Implementation capacities in public and private sectors.

There is a boom in the civil engineering construction sector in Hungary today, due to the considerable amount of State support in the field of municipal sewerage and wastewater treatment development. This situation has given the possibility for development of strong construction companies, which are basically capable to solve all the emerging tasks. These companies are owned by foreign capital due to the privatization procedure going on in Hungary. The regulation on public procurement is in rule. The raw materials and machinery needed in the water protection business are available from home production and from import. The choice of the contractor depends on the decision of the investor. It is not unusual that foreign goods are the winners of competition when value and price evaluated together.

Annexes

Table 1/1 The water quality classification system
(Hungarian Standard MSZ 12749)

Component group	Parameter	Unit	Classes				
			Excellent I	**Good II**	**Tolerable III**	**Polluted IV**	**Heavily polluted V**
Oxygen regime	Dissolved oxygen	mg/l	7	6	4	3	<3
	Oxygen saturation	%	80-100	70-80 100-120	50-70 120-150	20-50 150-200	<20 >200
	BOD-5	mg/l	4	6	10	15	>15
	COD-Mn	mg/l	5	8	15	20	>20
	COD-Cr	mg/l	12	22	40	60	>60
	TOC	mg/l	3	5	10	20	>20
	Saprobic index	-	1,8	2,3	2,8	3,3	>3.3
Nutrients	N- NH4	mg/l	0,2	0,5	1	2	>2
	N- NO2	mg/l	0,01	0,03	000.	000.	>0.30
	N- NO3	mg/l	1	5	10	25	>25
	P- PO4	μγ/λ	50	100	200	500	>500
	Total phosphorus	μγ/λ	100	200	400	1000	>1000
	Chlorophyll-a	μγ/λ	10	25	75	250	>250
Microbiology	Total coli	i/ml	1	10	100	1000	>1000
	Fecal coliforms	i/ml	0,2	1	10	100	>100
	Fecal streptococci	i/ml	0,2	1	10	100	>100
Inorganic Micropollutants	Aluminium	μγ/λ	20	50	200	500	>500
	Arsenic	μγ/λ	10	20	50	100	>100
	Boron	μγ/λ	100	200	500	1000	>1000
	Cyanides total	μγ/λ	10	20	50	100	>100
	Zinc	μγ/λ	50	75	100	300	>300
	Mercury	μγ/λ	0,1	0,2	0,5	1,0	>1.0
	Cadmium	μγ/λ	0,5	1,0	2,0	5,0	>5.0
	Chromium	μγ/λ	10	20	50	100	>100
	Chromium (VI)	μγ/λ	5	10	20	50	>50
	Nickel	μγ/λ	15	30	50	200	>200
	Lead	μγ/λ	5	20	50	100	>100
	Copper	μγ/λ	5	10	50	100	>100

Table 1/2 The water quality classification system
(Hungarian Standard MSZ 12749)

Component group	Parameter	Unit	Classes				
			Excellent I	Good II	Tolerable III	Polluted IV	Heavily polluted V
Organic	Oil compounds	μγ/λ	20	50	100	250	>250
micropollutants	Phenol	μγ/λ	2	5	10	20	>20
	Anionactive surfactants	μγ/λ	100	200	300	500	>500
	Benzo/a/pyrene	μγ/λ	0,005	0,007	0,010	0,050	>0.050
	Chloroform	μγ/λ	5	10	30	100	>100
	Carbon tetrachloride	μγ/λ	1	2	3	10	>10
	Trichlorethylene	μγ/λ	3	5	10	50	>50
	Tetrachlorethylene	μγ/λ	3	5	10	50	>50
	Lindane	μγ/λ	0,1	0,2	0,5	2,0	>2.0
	Malation	μγ/λ	0,1	0,2	0,5	2,0	>2.0
	2,4 D	μγ/λ	0,5	1,0	2,0	5,0	>5.0
	MCPA	μγ/λ	0,2	0,3	0,5	2,0	>2.0
	Atrazine	μγ/λ	0,5	1,0	2,0	5,0	>5.0
	PCB	μγ/λ	0,001	0,05	000.	0.02	>2.00
	Pentachlorphenol	μγ/λ	2	5	10	20	>20
Radioactivity	Total b activity	Bq/l	0,17	0,35	0,55	0.01	>1.10
	Cézium137	Bq/l	0,011	0,100	0,220	0,440	>0.440
	Stroncium90	Bq/l	0,003	0,01	0,055	0,110	>0.110
	Tricium	Bq/l	8,3	50	165	330	>330
Other parameters	Hidrogen ion conc.	pH	6.5-8.0	8.0-8.5	6.0-6.5 8.5-9.0	5.5-6.0 9.0-9.5	<5.5 >9.5
	Conductivity	μΣ/χμ	500	700	1000	2000	>2000
	Iron	mg/l	0,1	0,2	0,5	1,0	>1.0
	Manganese	mg/l	0,1	0,1	0,1	0,5	>0.5

Table 2. Preferred water quality monitoring stations for basin-wide studies

No.	River	Monitoring site	River km	TNMN	Bucharest Declaration
1	2	3	4	5	7
1.	Duna	Medve	1806.0	Yes	Yes
2.	Duna	Szob	1708.0	Yes	Yes
3.	Duna	Dunaföldvár	1560.0	Yes	
4.	Duna	Hercegszántó	1435.0	Yes	Yes
5.	Rába	Szentgotthárd	202.6		
6.	Ipoly	Ipolytarnóc	179.0		
7.	Sió	Szekszárd-Palánk	13.0	Yes	
8.	Dráva	Drávaszabolcs	68.0		
9.	Tisza	Tiszabecs	757.0		
10.	Tisza	Tiszasziget	162.5	Yes	
11.	Sajó	Sajópüspöki	123.5	Yes	
12.	Bódva	Hidvégardó	63.7		
13.	Hernád	Tornyosnémeti	102.0		
14.	Bodrog	Felsőberecki	46.0		
15.	Szamos	Csenger	45.4		
16.	Kraszna	Mérk	42.2		
17.	Berettyó	Pocsaj	71.5		
18.	Maros	Nagylak	50.6		

Table 3/1 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Danube)

Component group	Parameter	Unit	Duna Gyorzamoly 1806.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Hercegszántó 1435.0 Rkm	Ipoly Ipolytarnóc 179.0 Rkm	Dráva Drávaszabolcs 68.0 Rkm	Rába Szentgotthárd 202.6 Rkm	Sió csat. Szekszárdpalán k 13.0 Rkm
			Middle	Left bank	Middle	Right b.	Left bank	Middle	Right b.	Middle				Left bank
Oxigen regime	Dissolved oxygen	mg/l	8,1	8,4	8,2	8,3	9,0	70,0	8,8	8,7	7,1	8,5	8,5	5,9
	Oxygen saturation	%	76	76	76	76	84	85	84	83	68	82	86	56
	BOD-5	mg/l	4,1	6,1	5,9	6,0	5,6	5,5	5,8	5,5	7,4	5,6	6,6	***14,3***
	COD-Mn	mg/l	5,1	7,1	5,8	6,0	6,8	6,8	6,9	6,0	8,4	6,6	7,5	***19,9***
	COD-Cr	mg/l	17,0	23,3	19,6	19,9	25,6	27,0	26,3	24,0	29,5	17,5	29,2	***70,7***
	TOC	mg/l	8,2	5,8	5,5	5,8				7,3	7,7			
	Szaprobic index	-	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Nutrients	N-NH4	mg/l	000.	0.01	000.	000.	000.	000.	000.	000.	***0.03***	000.	0.01	***0.07***
	N-NO2	mg/l	000	000	000	000	000	000	000	000	***000.***	000	***000.***	***000.***
	N-NO3	mg/l	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.02	0.04	0.07
	P-PO4	µγ/λ	160	170	147	138	136	131	129	141	***591***	132	72	***1131***
	P- total	µγ/λ	326	256	221	211	236	233	229	237	***804***	285	341	***1088***
	Chlorophyl-a	µγ/λ	61	55	55	57	***114***	***132***	***106***	***127***	17	22	***91***	***77***
Microbiology	Total coli	i/ml	92	***168***	***293***	***268***	***492***	***395***	***290***	***352***	***340***	***369***	***145***	***155***
	Faecal coliforms	i/ml	***24***	***93***	***49***	***35***	***121***	***59***	***49***	***34***	***80***	***73***	***28***	***21***
	Faecal streptococci	i/ml	***10***	***14***	9	8	***18***	***16***	***13***	***12***	***49***	***16***	***15***	7

Table 3/2 90% duration values in selected monitoring stations (1988-1997)

(Water system of the River Danube)

Component group	Parameter	Unit	Duna Gyorzamoly 1806.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Hercegszántó 1435.0 Rkm	Ipoly Ipolytarnóc 179.0 Rkm	Dráva Drávaszabolcs 68.0 Rkm	Rába Szentgotthárd 202.6 Rkm	Sió csat. Szekszárdpalánk 13.0 Rkm
			Middle	Left bank	Middle	Right b.	Left bank	Middle	Right b.	Middle				Left bank
Inorganic	Aluminium	µγ/λ	***298***	96	86	91	74	88	86	89	111	81	55	
Micropollu-tants	Arzenic	µγ/λ	0,6	3,3	3,0	3,6				2,6	3,0			
	Boron	µγ/λ												
	Cianides total	µγ/λ												
	Cianides free	µγ/λ												
	Zinc	µγ/λ	***247***	54	39	62	32	25	27	18	67	38	31	91
	Mercury	µγ/λ	***0.01***	000.	000.	000.	000.	000.	000.	000.	000.	000.	***0.01***	
	Cadmium	µγ/λ	0.02	0.01	0.01	0.01	0.01	0.01	0.01	000.	0.02	000.	000	***0.04***
	Chromium	µγ/λ	16,2	2,6	2,8	2,1	1,6	1,2	1,0	1,4	1,7	1,0	1,2	3,8
	Chromium(VI)	µγ/λ												
	Nickel	µγ/λ	17,4	4,8	4,4	4,3	4,0	2,8	2,4	4,8	5,8	1,7	3,7	6,4
	Lead	µγ/λ	15,0	4,7	4,7	4,3	1,4	1,5	1,2	1,7	6,0	5,2	0,6	6,9
	Copper	µγ/λ	35,2	6,7	5,6	5,9	5,1	5,3	4,6	5,1	5,2	5,0	5,6	17,2

Table 3/3 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Danube)

Component group	Parameter	Unit	Duna Gyorzamoly 1806.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Hercegszántó 1435.0 Rkm	Ipoly Ipolytarnóc 179.0 Rkm	Dráva Drávaszabolcs 68.0 Rkm	Rába Szentgotthárd 202.6 Rkm	Sió csat. Szekszárdpalán k 13.0 Rkm
			Middle	Left bank	Middle	Right b.	Left bank	Middle	Right b.	Middle				Left bank
Organic Micropollu-tants	Oil compounds	µγ/λ	***219***	100	***107***	96	***<u>432</u>***	***<u>402</u>***	***<u>478</u>***	***<u>343</u>***	***114***	***232***	***426***	***197***
	Phenol	µγ/λ	3	5	5	4	6	6	7	6	7	7	7	***11***
	Anionactive surfactants	µγ/λ	98	121	123	110	68	69	69	61	187	89	79	189
	Benzo/a/pyrene	µγ/λ												
	Chloroform	µγ/λ												
	Carbon tetrachlo-ride	µγ/λ												
	Trichlor ethylene	µγ/λ												
	Tetrachlor-ethylene	µγ/λ												
	Lindane	µγ/λ												
	Malation	µγ/λ												
	2,4 D	µγ/λ												
	MCPA	µγ/λ												
	Atrazine	µγ/λ												
	PCB	µγ/λ												
	Pentachlor-phenol	µγ/λ												

Table 3/4 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Danube)

Component group	Parameter	Unit	Duna Gyorzamoly 1806.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Szob 1708.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Dunaföldvár 1560.0 Rkm	Duna Hercegszántó 1435.0 Rkm	Ipoly Ipolytarnóc 179.0 Rkm	Dráva Drávaszabolcs 68.0 Rkm	Rába Szentgotthárd 202.6 Rkm	Sió csat. Szekszárdpalánk 13.0 Rkm
			Middle	Left bank	Middle	Right b.	Left bank	Middle	Right b.	Middle				Left bank
Radioactive	Total b aktivity	Bq/l	000.	000.	000.	000.	000.	000.	000.	000.	000.	000	000.	000.
Parameters	Cézium137	Bq/l												
	Stroncium90	Bq/l												
	Tricium	Bq/l												
Other parameters	Hydrogen ion conc.	pH	8,5	8,5	8,5	8,5	8,7	8,7	8,6	8,6	8,2	8,4	8,1	8,6
	Conductivity	μΣ/χμ	430	490	460	469	452	450	450	457	516	384	549	***1177***
	Iron	mg/l	000.	000.	000.	000.	000.	000.	000.	000.	***0.01***	000.	000.	000.
	Manganese	mg/l	***000.***	000.	000.	000.	000	000	000	000	***000.***	***000.***	***000.***	***000.***

Table 4/1 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Tisza)

Component group	Parameter	Unit	Tisza Tiszabecs 757.0 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Sajó Sajópüspöki 123.5 Rkm	Bódva Hídvégardó 63.7 Rkm	Hernád Tornyosnémeti 102.0 Rkm	Bodrog Felsoberecki 46.0 Rkm	Szamos Csenger 45.4 Rkm	Kraszna Mérk 42.2 Rkm	Berettyó Pocsaj 71.5 Rkm	Maros Makó 24.3 Rkm	Maros Nagylak 50.6 Rkm	Maros Nagylak 50.6 Rkm
			Middle	Left bank	Middle	Right b.	Middle								Middle	Right b.
Oxigen regime	Dissolved oxygen	mg/l	9,2	6,5	6,3	6,3	6,5	8,5	4,5	6,2	7,3	***1,4***	6,3	7,1	7,4	7,6
	Oxygen saturation	%	90	77	69	74	64	84	48	68	71	***14***	65	69	82	81
	BOD-5	mg/l	4,1	3,1	5,7	4,3	***11,9***	6,5	9,5	6,2	***10,1***	***11,3***	6,7	***10,4***	7,0	7,1
	COD-Mn	mg/l	5,6	6,2	8,4	6,1	***33,2***	8,8	11,1	7,4	***20,1***	***20,7***	13,6	13,7	8,5	12,7
	COD-Cr	mg/l	17,3	27,4	29,8	27,6	***75,0***	27,7	36,6	21,1	***55,3***	***59,7***	35,9	***52,3***	***62,6***	***53,6***
	TOC	mg/l		8,6	8,5	8,7										***11,2***
	Szaprobic index	-	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	***0.03***	0.03	0.03
Nutrients	N-NH4	mg/l	000.	000.	0.01	000.	0.01	0.01	***0.04***	0.01	***0.02***	***0.09***	***0.02***	***0.02***	0.01	0.01
	N-NO2	mg/l	000	000	000	000	***000.***	000	***000.***	000	000	***000.***	***000.***	***000.***	000	000
	N-NO3	mg/l	0.02	0.02	0.03	0.02	0.03	0.05	0.04	0.03	0.02	0.03	0.02	0.06	0.03	0.03
	P-PO4	μγ/λ	65	100	157	117	***213***	158	***573***	111	152	***920***	135	140	85	83
	P- total	μγ/λ	161	337	395	389	284	274	***702***	201	272	***1073***	***443***	***450***	***420***	***489***
	Chlorophyl-a	μγ/λ	9	43	***85***	47	17	28	24	16	***206***	71	11	***229***	***182***	***83***
Microbiology	Total coli	i/ml	***1383***	***1360***	***1999***	***11300***	***900***	***813***	***2790***	***478***	***1728***	***8440***	***476***	***535***	***2200***	***794***
	Faecal coliforms	i/ml	***294***	***92***	***264***	***1050***	***95***	***120***	***370***	***31***			***86***	***163***		***108***
	Faecal streptococci	i/ml	***18***	***37***	***73***	***64***	***20***	***42***	***110***	8			8	***34***		***84***

Table 4/2 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Tisza)

Component group	Parameter	Unit	Tisza Tiszabecs 757.0 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Sajó Sajópüspöki 123.5 Rkm	Bódva Hídvégardó 63.7 Rkm	Hernád Tornyosnémeti 102.0 Rkm	Bodrog Felsoberecki 46.0 Rkm	Szamos Csenger 45.4 Rkm	Kraszna Mérk 42.2 Rkm	Berettyó Pocsaj 71.5 Rkm	Maros Makó 24.3 Rkm	Maros Nagylak 50.6 Rkm	Maros Nagylak 50.6 Rkm
			Middle	Left bank	Middle	Right b.	Middle								Middle	Right b.
Inorganic Micropollutants	Aluminium	µg/l	276	41	59	37	334	291	562	414	342	443		51	125	39
	Arzenic	µg/l		4,1	3,4	3,7	3,9		3,7							3,8
	Boron	µg/l		378	298	293	110		220							199
	Cianides total	µg/l	0,0	5,6	3,9	4,3	0,0		0,0		7,4	7,0				4,0
	Cianides free	µg/l														
	Zinc	µg/l	***127***	24	24	26	***183***	***186***	***221***	***179***	***319***	***167***		32	29	25
	Mercury	µg/l		000.	000.	000.	000	000.	000.	000		***0.01***		000.	000.	000.
	Cadmium	µg/l	0.01	000.	000.	000.	000	000.	000.	000.	***0.02***	0.02		000.	0.01	000.
	Chromium	µg/l	7,1	7,4	4,8	2,9	2,4	2,7	5,9	3,1	6,3	3,9		29,7	13,3	33,4
	Chromium(VI)	µg/l														
	Nickel	µg/l	7,6	3,6	3,8	3,0	2,7	3,2	8,0	3,8	6,9	7,5		4,4	2,9	2,8
	Lead	µg/l	8,8	0,6	0,9	0,6	2,6	4,5	4,1	3,9	8,6	10,5		0,9	0,9	0,9
	Copper	µg/l	5,8	8,3	6,2	6,4	9,1	10,3	13,9	10,7	48,9	5,5		8,6	6,3	8,2

Table 4/3 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Tisza)

Component group	Parameter	Unit	Tisza Tiszabecs 757.0 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Sajó Sajópüspöki 123.5 Rkm	Bódva Hídvégardó 63.7 Rkm	Hernád Tornyosnémeti 102.0 Rkm	Bodrog Felsoberecki 46.0 Rkm	Szamos Csenger 45.4 Rkm	Kraszna Mérk 42.2 Rkm	Berettyó Pocsaj 71.5 Rkm	Maros Makó 24.3 Rkm	Maros Nagylak 50.6 Rkm	Maros Nagylak 50.6 Rkm
			Middle	Left bank	Middle	Right b.	Middle								Middle	Right b.
Organic Micropollutants	Oil compounds	µγ/λ	0	***140***	***129***	***108***	***338***	***166***	***439***	***298***	90	***144***	***345***	***185***	***230***	***248***
	Phenol	µγ/λ	0	3	6	3	2	0	2	0	8	10	7	8	4	5
	Anionactive surfactants	µγ/λ	40	59	109	57	55	41	84	48	144	215	99	105	70	69
	Benzo/a/pyrene	µγ/λ														
	Chloroform	µγ/λ					3,2		6,2							
	Carbon tetrachloride	µγ/λ					***10***		***115***							
	Trichlorethylene	µγ/λ					1,0		2,8							
	Tetrachlor ethylene	µγ/λ					3,2		1,8							
	Lindane	µγ/λ					000									
	Malation	µγ/λ							000.							
	2,4 D	µγ/λ														
	MCPA	µγ/λ														
	Atrazine	µγ/λ					0.01		0.01							
	PCB	µγ/λ														
	Pentachlorphenol	µγ/λ														

Table 4/4 90% duration values in selected monitoring stations (1988-1997)
(Water system of the River Tisza)

Component group	Parameter	Unit	Tisza Tiszabecs 757.0 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Tisza Tiszasziget 162.5 Rkm	Sajó Sajópüspöki 123.5 Rkm	Bódva Hídvégardó 63.7 Rkm	Hernád Tornyosnémeti 102.0 Rkm	Bodrog Felsoberecki 46.0 Rkm	Szamos Csenger 45.4 Rkm	Kraszna Mérk 42.2 Rkm	Berettyó Pocsaj 71.5 Rkm	Maros Makó 24.3 Rkm	Maros Nagylak 50.6 Rkm	Maros Nagylak 50.6 Rkm
			Middle	Left bank	Middle	Right b.	Middle								Middle	Right b.
Radioactive Parameters	Total b aktivity	Bq/l	000.	000.	000.	000.	000.	000.	000.	000.	000.	000.	000.	000.	000.	000.
	Cézium137	Bq/l		000	000	000										000
	Stroncium90	Bq/l														
	Tricium	Bq/l														
Other parameters	Hydrogen ion conc.	pH	8,0	8,1	8,1	8,1	8,0	8,1	8,0	7,9	8,0	8,0	7,9	8,2	8,3	8,1
	Conductivity	µΣ/χµ	339	509	607	490	543	576	674	406	760	954	719	998	744	713
	Iron	mg/l	000.	000.	000.	000.	000.	000.	000.	000.	0.01	0.01	000.	000.	000.	000.
	Manganese	mg/l	***000.***	000	***000.***	000	***000.***	***000.***	***000.***	***000.***	***0.01***	***0.01***	***0.01***	***000.***	000	000

Table 5 Characteristics and wastewater load of high priority municipal hot spots

No.	Municipality	Area Code No.	Population		Main recipient	Ww Discharge m3/d	Ww. treatment Technology, Capacity:m3/d
			1000 inhab.	Sew.%			
1	2	3	4	5	6	7	8
1	Gyõr	1	127	88	Danube	37 300	Biol: 80 000
2	Budapest: North	2	1 886	90	Danube	60 000	Biol: 82 000
	South					70 000	Biol: 72 000
						700 000	None
3	Dunaújváros	4	57	96	Danube	6 200	Mech: 12 700
4	Szolnok	10	78	96	Tisza	13 700	None
5	Szeged	11	166	67	Tisza	34 700	None

No.	Municipality	Main Recipient	Raw water Load inTPE	Wastewater Discharge	Total load discharged into Recipient waters (T/a)			
			(thousand)	(Tm3/a)	BOD	COD	N	P
1	2	3	4	5	6	7	8	9
1	Gyõr	Danube	212	16 597	2 300	4 600	423	63
2	Budapest: North	Danube	286	20 867		1 020	524	103
	South		295	21526		1 500	715	50
	Untreated		2 255	174 607		69 299	3 490	
3	Dunaújváros	Danube	**88	**4380	**680	**1700	**160	**25
4	Szolnok	Tisza	101	*5004	*785	*1935	*186	*30
5	Szeged	Tisza	**186	**14500	**2200	**5130	**540	**90

Table 6 Wastewater load of selected medium priority municipal hot spots

No.	Municipality	Main Recipient	Rawwater Load inTPE	Wastewater Discharge	Total load discharged into recipient waters (T/a)			
			(thousand)	(Tm3/d)	BOD	COD	N	P
1	2	3	4	5	6	7	8	9
1	Székesfehérvár	Gaja Creek	211	8 564	302	572	257	36
2	Szombathely	Sorok-Perint	112	9 125	119	319	137	46
3	Zalaegerszeg	River Zala	112	5 800	20	226	46	6.4
4	Nagykanizsa	Cigény Ch.	107	6 200	33	363	36	12
5	Pécs	Pécsi-víz Cr.	150	17 000	219	766	122	49
6	Nyíregyháza	Canals VIII-IX	45	4 311	51	365	221	18
7	Miskolc	Sajó	200	19 528	222	986	388	130
8	Debrecen	Kösely	209	19 581	458	1 672	544	321
9	Békéscsaba	Élővíz Ch.	53	5 189	144	581	58	36

Table 7 Characteristics and wastewater load of high priority industrial hot spots

No.	Location & discharger	Area Code No.	Main recipient	Sector	Wastewater Discharge m3/d	Treatment Technology	Ww fine M Ft
1.	2	3	4	5	6	7	8
1	Százhalombatta MOL	4	Danube	Oil refinery	62 200	Biological	0.26
2	Balatonfűzfő: NIKE Rt.	4	Séd-Nádor	Chemical ind.	13 700	Biological	17,93
3	Kbarcika: Borsodchem	8	Sajó	Chemical ind.	13 500	Biological	0,12

No.	Location and discharger	Main Recipient	Total Load Discharged into Recipients (T/a)						
			BOD	COD	N	P	TDS	O&G	Hg
1	2	3	4	5	6	7	8	9	10
1	Százhalombatta: MOL	Danube		2494.2	8.0			101.7	
2	Balatonfűzfő: NIKE Rt.	Séd-Nádor	770.0	1180.0	835.8	12.0	17 410	14.3	
3	Kbarcika: Borsodchem	Sajó	82.0	130.4	123.4		7 350	3.6	✶

Table 8 Wastewater load of medium priority industrial hot spots

No.	Location and discharger	Main recipient	Total load discharged into recipients							
			T / a				Kg / a			
			BOD	COD	N	P	Cd	Ni	Cu	Cr
1	2	3	4	5	6	7	8	9	10	11
1	Győr: Szeszip.V.	Danube		198.8	0.1					
2	Lábatlan:Piszke Paper	Danube		712.1	0.1					
3	Nyergesújfalú: Viscosa	Danube		192.7	1.6					
4	Budapest:Buszesz	Danube		188.5						
5	Csepel Works		126.0				4.1	120.7		606.4
6	Dunaújváros:Dunapack	Danube		5636.4	1.0					
7	Dunaferr			2682.4	287.1					
8	Pétfürdő:Nitrogen Works	Séd-N.		192.5	727.1					
9	Sajóbábony: WasteMan.	Sajó		155.7	60.0		1.0			
10	Tiszaújváros: TVK Rt.	Tisza		128.5	2.0	0.3		3.0		
11	Szolnok: TVM Rt.	Tisza	27.6	108.0	89.2	16.9		6.0	798.0	30.0
12	Neusidler Paper			957.0	1.9	0.1				

Table 9/1 National programmes of the water management sector

Name of the national programme	Period of implementation (years)	Preliminary volume of the programme 1 USD = 205.18 HUF	
		In Million HUF	in Million USD
1	2	3	4
1. Sewage canalization and treatment programme of Hungary	1996 - 2010	603,000.00	2,950.00
2. Sewage treatment programme of the capital (Budapest) and the cities of county status	1995 - 2010	80,000.00	3989.90
3. Protection of ecological condition of Lake Balaton and improvement of water quality	1996 - 2010	4,000.00 – 6,000.00 annually	19.50 – 29.24 annually
4. Programme on protection of drinking water wellfield areas (Phase I)	1996 - 2004	9,200.00	44.80
5. Programme on protection of drinking water wellfield areas (Phase II)	1998 - 2010	100,000.00	487.40
6. Protection of future drinking water wellfield areas	1994 - 2003	4,780.00	23.30
7. Programme on Great Lowland	1994 - 2006	200.00 annually	0.90 annually
8. Programme on water supplement of the hilly area of Mid-Danube-Tisza region	1998 - 2006	350.00 annually	1.70 annually

Table 9/2 National programmes of the water management sector

Name of the national programme	Period of implementation (years)	Preliminary volume of the programme 1 USD = 205.18 HUF	
		in Million HUF	in Million USD
1	2	3	4
9. Programme on improving of conditions for RSDB-Decision of Government (Phase I)	1997 - 1999	125.00 for three years	0.61 for three years
10. Programme on improving of conditions for RSDB - Decision of Government (Phase II)	2000 - 2003	1,200.00	5.90
11. Catchment management planning programme (integrated land and water management)	1997 - 2005	100.00 annually	0.50 annually
12. Rehabilitation of oxbow lakes	1998 - 2006	100.00 annually	0.50 annually
13. National remediation programme of contaminated areas	1997 - 2005	1,000.00 – 7,000.00 annually	4.90 – 34.00 annually
14. Improvement of the quality of drinking water in Hungary	1998 - 2010	50,000.00	243.70

Source: Central Budget, 1998.

Table 10/1 Anticipated/proposed funding scheme of projects

Name of the project/allocation of capital cost	Equity of project owner	Central Environ-mental Fund	Water Manage-ment Fund	Public grant Central Budget	Internatio-nal grant/ PHARE grant	Internatio-nal loan	Non-secured funding sources	
	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million USD
1. BUDAPEST NORTH Municipal WWTP								
Land	**78.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction & machinery	**1,603.00	0.00	0.00	**706.00	0.00	3,308.00	3,308.00	16.13
Planning & supervision	**921.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-0001.	**2,602.00	0.00	0.00	**706.00	0.00	3,308.00	3,308.00	16.13
2. BUDAPEST SOUTH Municipal WWTP								
Land	**1,294.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**79.00	0.00	0.00	**1,434.00	0.00	2,867.00	2,867.00	13.97
planning & supervision	**48.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-0002.	**1,421.00	0.00	0.00	**1,434.00	0.00	2,867.00	2,867.00	13.97
3. DUNAÚJVÁROS Municipal WWTP								
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**426.80	0.00	0.00	**690.00	**387.00	**460.00	0.00	0.00
planning & supervision	**218.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-003.	**645.00	0.00	0.00	**690.00	**387.00	**460.00	0.00	0.00

Secured funding sources* * Partly secured funding sources*

Table 10/2 Anticipated/proposed funding scheme of projects

Name of the project/allocation of capital cost	Equity of project owner	Central Environ-mental Fund	Water Manage-ment Fund	Public grant Central Budget	Internatio-nal grant/ PHARE grant	Internatio-nal loan	Non-secured funding sources	
	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million USD
4. GYŐR Municipal WWTP								
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**503.00	780.00	0.00	**407.00	650.00	0.00	1,430.00	6.97
planning & supervision	**17.00	0.00	0.00	243.00	0.00	0.00	243.00	1.18
Total for Project H-004.	**520.00	780.00	0.00	***650.00	650.00	0.00	1,673.00	8.15
5. SZEGED Municipal WWTP								
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**420.00	227.00	171.00	**203.00	269.00	0.00	667.00	3.25
planning & supervision	**60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-0005	**480.00	227.00	171.00	**203.00	269.00	0.00	667.00	3.25
6. SZOLNOK Municipal WWTP								
Land	30.00	0.00	0.00	0.00	0.00	0.00	30.00	0.15
construction & machinery	705.00	210.00	105.00	840.00	0.00	0.00	1,860.00	9.07
planning & supervision	210.00	0.00	0.00	0.00	0.00	0.00	210.00	1.02
Total for Project H-0006.	945.00	210.00	105.00	840.00	0.00	0.00	2,100.00	10.24

Secured funding sources* * Partly secured funding sources*

Table 10/3 Anticipated/proposed funding scheme of projects

Name of the project/allocation of capital cost	Equity of project owner	Central Environ-mental Fund	Water Manage-ment Fund	Public grant Central Budget	Internatio-nal grant/ PHARE grant	Internatio-nal loan	Non-secured funding sources	
	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million USD
7. BORSODCHEM Industrial WWTP								
land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**90.00	90.00	60.00	0.00	0.00	300.00	450.00	2.20
planning & supervision	**60.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-0007	**150.00	90.00	60.00	0.00	0.00	300.00	450.00	2.20
8. MOL Plc., Development of the Industrial WWT system								
land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	**3,000.00	500.00	500.00	0.00	0.00	5,000.00	6000.00	29.24
planning & supervision	**1,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total for Project H-0008	**4,000.00	500.00	500.00	0.00	0.00	0.00	6000.00	29.24
9. NITROKÉMIA Industrial WWTP								
Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction & machinery	60.00	300.00	120.00	0.00	60.00	600.00	1,140.00	5.55
Planning & supervision	60.00	0.00	0.00	0.00	0.00	0.00	60.00	0.30
Total for Project H-0009	120.00	300.00	120.00	0.00	60.00	600.00	1,200.00	5.85

Secured funding sources* * Partly secured funding sources*

Table 10/4 Anticipated/proposed funding scheme of projects

Name of the project/allocation of capital cost	Equity of project owner	Central Environ-mental Fund	Water Manage-ment Fund	Public grant Central Budget	Internatio-nal grant/ PHARE grant	Internatio-nal loan	Non-secured funding sources	
	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million HUF	Million USD
10. WETLAND AREA OF DANUBE-DRAVA OKOREGION								
land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
construction & machinery	0.00	324.00	108.00	21.60	0.00	86.40	972.00	4.74
planning & supervision	0.00	0.00	0.00	0.00	108.00	0.00	108.00	0.53
Total for Project H-0010	0.00	324.00	108.00	21.60	108.00	86.40	1,080.00	5.27
***TOTAL FOR PROJECTS #1 - #10:	**10,883.00**	**2,431.00**	**1,064.00**	**4,544.60**	**1,474.00**	**12,621.40**	**19,345.00**	**94.30**

Secured funding sources* * Partly secured funding sources*

Total for Project Portfolio:	**Million HUF**	**33,018.00**
	Million USD	**160.94**
Non-secured:	**Million HUF**	**19,345.00**
	Million USD	**94.30**
Secured:	**Million HUF**	**13,673.00**
	Million USD	**66.64**