DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
BULGARIA

EXECUTIVE SUMMARY

MINISTRY OF ENVIRONMENT AND WATER

in cooperation with the

Programme Coordination Unit
UNDP/GEF Assistance

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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 where 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 **Bulgarian National Review** was prepared under the supervision of the Country Programme Coordinator, **Mr. Nikolai Kouyumdziev**. The authors of the respective parts of the report are:

- Part A : Social and Economic Analysis: **Ms. Ada Bainova**
- Part B : Financing Mechanisms: **Ms. Svoboda Tosheva**
- Part C : Water Quality: **Ms. Marieta Stoimenova**
- Part D : Water Environmental Engineering: **Mr. Ivo Popov**

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1. Description of the Condition of the Danube Environment

1.1. Water Resources

The Danube River collects its waters (Annex B, map B6-1) from 46 930 kms^2 (42.3%) of Bulgarian territory (111 000 km^2 - 100%).

The evaluation of the water resources has been made by the use of data gathered over numerous years of monitoring and runoff measuring at 6 hydrometric stations along the Danube and 21 stations along its tributaries (Annex B, map B6-2), as well as data on the use of the water management systems.

Between 1935 - 1995 the Bulgarian tributaries discharged an annual 6036x10^6 m^3 to the Danube. For the same period the Danube runoff at Novo Selo was estimated at 178 000x10^6 m^3. The Bulgarian tributaries contributed a mere 3.4% to the Danube runoff formation.

The Bulgarian catchment area of the Danube basin has a poor stock of both surface and ground water. The specific surface runoff changes from 31 dm^3/s.km^2 in the high sections of the Rila Mountain and Stara Planina to 0.5 dm^3/s.km^2 in the northeast and east sections of the basin (Dobrudzha).

The total water loss through the various manners of water use is calculated at 0.66x10^6 m^3, while the water resources available are an annual 5 370x10^6 m^3. The inhabitants of the Bulgarian reach of the Danube basin numbered 3 897 255 in 1996. The river runoff was an annual 1 549m^3/inhabitant, the water available for use being a mere 1 378 m^3/inhabitant. In comparison, the average annual water available for use per inhabitant in Europe is 4 400 m^3, and in Bulgaria - 2 040 m^3.

The water resources at hand are limited and unevenly distributed over time and space. Thus, the inhabitants of the capital city rely on an annual 300 m^3, while those living in the high mountainous and semi-mountainous sections of the basin rely on 2500-3000 m^3, and those living in Dobrudzha - on 80-100 m^3. The river runoff is not evenly distributed throughout the annual hydrological cycle either: 60-80% of it is formed during the flooded season (lasting 3-4 months), while during the low precipitation phase it diminishes greatly, rendering some rivers altogether dry (in Dobrudzha).

During years of water insufficiency (with a probability of exceedance of 95% of the annual runoff), the natural water resources were 2.0 to 2.5 fold less than the above cited values.

The fact that the water resources are insufficiently and unevenly distributed over time and space has necessitated the construction of numerous runoff regulation facilities. 819 reservoirs were built with a total storage of 311x10^6 m^3, capable of storing 37.6 % of the natural river runoff. Thirty reservoirs have a volume greater than 5x10^6 m^3 and only two were constructed for multi-annual runoff regulation. In years when the runoff had a probability of exceedance of 80-95%, the water insufficiency forced many towns, such as Lovech, Pleven, and Vratsa, to adopt a water use regime. Similar restrictions were imposed on Sofia in 1994-95.

The transfer of water from and to the Danube basin is insignificant. Since 1983 an annual average of 65x10^6 m^3 has been transferred from the Strouma and Mesta River basins to that of the Iskar River. No water has been transferred from the Danube basin to other streams.

The river runoff has decreased notably in the period following 1980. Compared to the preceding period this decrease has reached 22-25% with respect to the Danube River and 25-35% concerning its tributaries. The decreased runoff is mainly the result of fluctuations in the development of the climatic factors but also of human impact from the Central and East European countries bordering the Danube, inclusive Bulgaria.

1.2. Eco-Systems and Biological Resources

The prevailing part of the Danube basin is taken up by the Danubian hilly lowlands. The peculiar climate, soil and geological conditions have fostered the development of a diversified flora and fauna.

Regrettably, the original forest-steppe and forest vegetation of mixed oak has been strongly impaired by human activity, to the extent that today it can only be found in the protected territories and in some forest sections. The only ones that have remained unaffected are the forest eco-systems in the Roussenski Lom, Vitosha, Central Balkan, etc. national parks, where more than 130 bird species nestle, 17 of whom are in the red book of endangered species.

The preservation of the biodiversity is strongly dependent on the water eco-systems. The natural state of the water ecosystems has only been preserved in the reserve territories, encompassing some of the wetlands situated in the Danube River terrace, on the islands and along the Danube tributaries. Prior to 1935 the lowlands flooded by the Danube used to reach an area of 853.4 km^2, the marshes within them - 62 km^2. The construction of dykes along the left Danube bank and the banks of its tributaries has reduced the wetlands to 17km^2.

The original biodiversity of the water eco-systems has only been well preserved in the reserves, such as Kitka, Tsibritsa, Belene (Persin), Vardim, Popina - Garvan, Srebarna, etc. The total area of the reserves in the wetlands exceeds 3 800ha. They are the home of more than 180 bird species, of which 100 nestle there permanently. The water eco-systems of the water reserves have preserved their entire range of fish species, numbering more than 64. Some tree species, such as the willow associations of the Belene Island, have also been preserved.

1.3. Human Impact and Key Aspects of Environmental Deterioration Due to Water Pollution

Human impact, largely accountable for the pollution of the Danube basin, is mainly due to combinations of toxic cumulative substances with a deferred health effect (arsenic, lead, cadmium, mangane, cobalt, chrome, nickel, phenols, halogenated hydrocarbons, spent fuels, petrol products, biological products, etc.). It is related to the following identified sources of pollution:

- insufficient and inefficient sewerage in the inhabited areas, pipes with an inadequate cross-section, lack of resources for shaft, collector and pipeline maintenance;
- fecal and household water, insufficiently treated wastewater of small businesses, workshops, laboratories, farms, discharged directly in sewers, surface water reservoirs, or more rarely, in the soil layers;
- lack of management or control over the rainwater at the industrial, farming and transport work sites, resulting in ground water pollution;
- unsatisfied efficiency of wastewater treatment plants located at businesses;
- improper storage and inadequate use of the sludge emitted by city WWTP's and LTP's at individual businesses, which contains resistant, cumulative, toxic, organic and inorganic compounds;
- accidental discharge of untreated wastewater in running streams and reservoirs;
- insufficient technical means or manpower to prevent pollution of the water during calamities (floods, droughts, earthquakes, landslides) and accidents (explosions, fires, pipeline ruptures, transport accidents);
- insufficient and inadequate control over the sanitary protected zones of potable water sources;

- improper situation of the sources of chemical, biological and microbiological pollution at risk, geological and hydro-geological (carst, old mines) zones;
- application of polluted water for irrigation of crops;
- siting of zones for intensive farming and/or farms at risk-prone points (in proximity to running streams, reservoirs and ground water).
- industrial waste, a significant part of which is hazardous waste, deposited at inadequately sited dumps;
- waste from unused plant protection substances, collected and improperly stored by the municipalities between 1991-1993;
- dumping of industrial, agricultural and mainly hazardous waste in solid waste dump sites for which no insulation or control exists;
- lack of landfills in the small population centers where waste is dumped at risk sites, such as dry ravines or river banks;
- low control over old industrial hazardous waste, insufficient monitoring, lack of unity of the government institutions in dealing with the problems on a regional level.

In addition, to the above described key issues we should point out the decreased self-purification capacity of the running streams resulting from the lower river runoff, itself affected by climate changes and human activity.

A review of the condition of potable water indicates that, beside chemical pollution, it stands the risk of being polluted with microorganisms, too.

It is also necessary to highlight some problems, which are typical of Eastern Europe:

- lack of systematic and updated information on all levels within the competent government institutions;
- insufficient access to information systems for water pollution management;
- in the event of shortfalls in the management of the water quality and quantity (accidents, calamities, omissions), the information provided is often neither relevant nor sufficient (in some cases);
- information is not readily available for the municipal staff, NGOs and community.
- there are no regional information bureaus to ensure communication about the ecological and health risks resulting from water pollution for each individual case.
- the media only provide coverage for cases of serious failure, concerning a larger population;
- there are no substantial continuous, systematic actions for prevention of water pollution in the Danube basin on the regional level. This is largely due to financial constraints.

The main problems connected to the deterioration of the environment of the Danube basin can be grouped as (ambience-related):

- master plans;
- related to the infrastructure;
- resulting from the operation of industrial enterprises;
- related to farming activities;
- related to improper actions in the protected territories;
- related to water resources management.

2. Demographic Development and Corresponding Characteristics of the Water Sector

2.1. Analysis of Demographic Data and Projections about the Urban and Rural Population in the Danube Basin

Between 1994-1996, the population in the Danube basin, similar to that of the entire country, had a progressive downward trend of development: from 3 942 769 inhabitants in the Danube basin (out of 8 427 418 country-wide) in 1994, to 3 897 255 (8 340 936) in 1996. The population in the Danube River basin constitutes 46.7% of the total population of Bulgaria. This relative share remained unchanged throughout the said period.

The prevalence of the urban over the rural population in the country varied slightly, from 67.8% in 1994 and 1995 to 67.6% in 1996. No substantial changes were noted for the Danube basin either, where this ratio was 70.6%.

In the 39 towns with more than 10 000 inhabitants which were monitored, the average number of live-born babies decreased from 9.4‰ in 1994 to 8.6‰ in 1996, showing a higher mortality rate. Some towns in the Lovech and Montana regions registered a mortality rate of 19-20‰ at an average national rate of 14‰ in 1996. The mortality rate among infants up to one year old in the Danube River basin was around 0.1-0.2‰.

The negative birth rate in the Danube River basin is a source of concern. Given the average values for Bulgaria at -3.8‰ (1994) to -5.4‰ (1996), the natural growth of the population has been twice as low (-10‰ to -11‰) as the country average, in towns such as Pavlikeni, Sevlievo, Lukovit, Troyan, Belene (Lovech region) and Knezha, Byala Slatina, Berkovitca (Montana region).

The unfavorable demographic situation shows no tendency of improvement!

2.2. Estimation of Actual and Future Water Demand

Between 1994-1996 the allocation of the fresh water remained unchanged: approx. 15% for household, 77% for industrial and 7% for agricultural needs.

The prevailing number of population centers in the Danube River basin has a central water supply (99.4-99.8 %).

Loss of fresh water, fed to the water mains, varies from 20 to 50%. The total volume of fresh water supplied for household purposes in the Danube basin changed from 591 031 000 m^3 (1994) to 621 707 000 m^3 (1996). The utilized water volume was 320 255 000 m^3 (1994) and 268 640 000 m^3 (1996). The fresh water supplied per capita of the population ranged from 412.5 l/h/day (1994) to 438.9 l/h/day (1996), while the consumption varied from 223.5 l/h/day (1994) to 189.6 l/h/day (1996). The decrease in the volume of utilized water reveals a stronger trend towards on increase of the loss from the water mains.

More than 75% of the public centers have no Public Water Treatment Plants (PWTP), a fact which is inherently connected to the deviations observed in some physical-chemical and microbiological indices (turbidity, coli-titre) of the potable water, which are not easily neutralized by the usual chlorine disinfection only. The deviation of the potable water quality from the standard coli-titre exceeds the WHO limit in 57% of the cases. Six valence chrome of a natural origin was detected in the Lom municipality, an excessive ammonia concentration was found in the town of Vratsa. A greater concentration of iron and mangane were registered in Sofia due to the obsolescent water

supply system. Nevertheless, during the studied period, there were no cases of gastro-intestinal diseases subject to official registration, as a result of the observed deviations in the potable water quality.

The obsolete water mains and the socio-economic problems at work during the studied period are the major factors accountable for the increased losses in the water supply networks. Yet another factor is the lack of an effective legislative framework to regulate and control water use.

Due to the lack of a reliable demographic and socio-economic forecast about the region, an assumption is made that in the year 2005 the water demand will reach its rate of 1990.

2.3. Estimation of Current and Future Production of Wastewater

The wastewater discharged from the public sewers and monitored economic facilities to the Danube basin for 1994 - 1996 ranged between 533 444 - 547 666 thous.m^3 (Annex A, Tables 11, 12 and 13). The discharged untreated wastewater did not change in volume over this period either: from an average of 221 738 thous.m^3 (1994) to 212 655 thous.m^3 (1996). The water was mainly conducted to surface reservoirs and river streams without any appropriate preliminary treatment.

The average quantity of wastewater per capita of the civil population in 1995 dropped to 171.8 l/h day in comparison to 224.6 l/h day in 1994. The volume of the wastewater produced by the villages did not change during 1994 - 1996.

A problem is created by the high relative share of untreated water, discharged in the stream of the Roussenski Lom River.

There is a trend towards an increase of the relative share of the population in towns above 10 000 inhabitants, connected to the city sewerage. The sewers are therefore faced with a greater load, a fact which renders the need for their resizing and reconstruction. Sewerage systems are old and pipe links are not elastic. Leakage of sewerage water is frequent, creating a risk for contamination of the existing groundwater. In some cities, such as Vidin, Cherven Bryag, Pleven, Teteven, Popovo, the collectors are either not completed or their construction has not even started.

2.4. Analysis of the Health Risk through Water Pollution and Unhealthy Conditions

A significant part of the wastewater produced by the various businesses is not treated to the necessary extent and constitutes a substantial risk for pollution of the Danube basin. Accidental discharges of high concentrations of pollutants (ammonia, organized compounds, heavy metals, and petrol products) bring on serious consequences for the environment and health.

Solid waste dumpsites are one of the main sources of pollution of the Danube basin water. A survey of the dumpsites of all the 39 population centers with more than 10 000 inhabitants along the riverbeds indicates that they do not meet modern requirements in general terms. Some of them have a spent capacity, others are in proximity to rivers or lack proper insulation, drainage systems and gas collection shafts. Both industrial and hazardous waste is dumped in them, polluting the aquifers below.

Risk dumpsites fall into two groups: 1) sources of a serious risk for environmental pollution and for the health of the population; 2) potential sources of pollutants. Sources of serious pollution are the solid waste dumpsites of Nikopol, Vratsa, Mezdra, Cherven Bryag, Lukovit, Teteven, Lovech and Levski. Potential sources of pollutants are the dumpsites of Vidin, Svishtov, Berkovitza, Troyan, Sevlievo, Byala and Dobritch

In recent years household, industrial and farming waste has started being considered as one of the major sources of pollution in the Danube basin, entailing social and health consequences.

During 1994 - 1997 the traffic of Bulgarian vessels along the Danube River suffered a drastic cut from 115 859 passenger kilometers (1993) to 31 660 (1997). The bilge waters and ballast discharged by the boats in the Danube River were reduced from 251t (1994) to 162t (1996). Nevertheless, a significant problem is created by the illegal discharge of fecal-household water, petrol products and the uncontrolled dumping of waste by the vessels sailing along the Danube.

The review of the environmental and health laws relating to the management of the risk from pollution of the Danube basin has revealed a need for its harmonization with the European directives, norms and standards in many respects.

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

The quantity and quality of water resources, viewed within the context of a considerable human activity, is shaped by the joint influence of the climate and the quantity and quality of the water returned to the reservoirs. For the time being Bulgaria does not have a comprehensive water monitoring system, capable of tracking and reporting on all economic activities and facilities.

The assessments in this study are based on NSI information about towns of more than 10 000 inhabitants and about economic facilities and activities which make use of more than 36 000 m^3 water a year.

Thermal power plants employ circulatory cooling systems to which no water is added except to compensate for irreversibly lost amounts. The Kozloduy nuclear power plant (NPP) has an open-channel cooling system for its secondary circuit, allowing little, if any, water loss. The water intake structures of the NPP are in immediate proximity to the point where it discharges water from its cooling system into the Danube. The NPPs cooling system consumes an annual 2.5 - 3.0 bn m^3 of Danube River water. Once it has been used, the water is fed back into the mainstream at a distance of 100 m from the water intake.

Surface water is the primary water source in the Danube basin (Annex A, Table 1 and 5), covering 65 to 68 % of the water demand. Ground water covers 32 to 35 % of the water demand. Water diverted from the Danube River constitutes approximately 50% of the surface water consumption.

The total volume of water consumption in the catchment is estimated at an annual 1.5 m^3 (Annex A, Table 7).

3.1. Industrial Activities

The structure of fresh water consumption for 1994 - 1997 is not marked by any significant changes. (Annex A, Tables 5, 6 and 7). Industrial activities demand an annual amount of 370x106 m3 of fresh water of which 110x106 m3 should be potable (Annex A, Table 7).

3.2. Municipal Discharges

The volume of water supplied for domestic needs for 1994-6 changed within the range of 590 to 620 mn m3 per year (Annex A, table 10). Out of this amount towns were supplied with 450-505 mn m3, and villages with 116-130 mn m3 a year. The water actually utilized was 54-60 % out of the total water supplied. In the villages it was even lower - 44-52 %. The low efficiency is equally attributable to the obsolete water supply infrastructure and to the water measurement systems, which are inadequate both in terms of their organization and in the metrological methods they apply. The problem is very severe but has not been studied in depth for lack of funds.

Wastewater volume varied between 533 to 547 mn m3 per year (Annex A, Table 11). Untreated wastewater in the Danube basin took up 40 % of this total volume. Biologically treated water accounted for 39 % of the total volume of wastewater (Annex A, Table 14).

Table 18 presents a forecast on the potable water demand, to reach by the year 2010 an annual of 1.01 mn m3. The volume of wastewater for the same period is projected at 0.91 mn m3 a year. The projections are based on data of the NSI.

3.3. Agricultural Activities - Irrigation, Fertilizer and Pesticide Consumption

Irrigation

Since 1990 agriculture has been in continuous decline. The transformations in the forms of ownership, the outdated legislative and regulatory framework and the economic crisis are currently a substantial obstacle to intensive agricultural production.

Within the territory of the Danube basin irrigation systems covering 440 thous. ha of arable land have been constructed (Annex A, table 3). Danube River is a source of water for 208.83 thous. ha irrigable area. In 1994-96 some 28.3 thous. ha or less then 10% of the irrigable land was actually irrigated. New construction of irrigation facilities is not envisaged before the year 2010. The area with a potential of being irrigated is estimated at 63 % of the irrigable area, or 177 thous. ha. Irrigation systems have a low rate of efficiency of the water use, which does not exceed 50% at times. The demand for water for irrigation is estimated at an annual 530 mn m^3 of which approx. 150 mn m^3 need to be diverted from the Danube River throughout the year.

Use of Fertilizers

The total amount of fertilizers used in the Danube basin is presented in Annex A, Table 18. It illustrates that in 1995 the amount of chemical fertilizers per unit of arable land has declined if compared to 1981 as follows: nitrogen-based fertilizers - 2.8 fold, phosphorous fertilizers - 24.8 fold, potassium fertilizers - 67.1 fold. The amounts of chemical fertilizers used in Bulgaria are considerably lower than by any other country of the Danube basin.

Undoubtedly once agricultural production picks up, the use of chemical fertilizers will go up too. At the current stage of this study no reliable forecast can be made regarding the size of fertilizer consumption over a future period of time.

Use of Pesticides

During 1990 - 1996, pesticide pollution tests conducted as part of the studies within the scope of the international Danube River pollution reduction programme. There was no DDT and HCH pollution (α and β) registered. A concentration of lindane between 0.006 - 0.008 μg/l was registered at three points. The present study has not registered DDT as well as any of its derivatives, or HCH (α and β), since their application was banned 30 years ago.

No projections can be made about pesticide use in the future due to unresolved land ownership problems and the crisis in agriculture. The economically suitable price threshold for a kilo of active pesticide substance varies between 13 and 15 USD. This price has been rising over recent years and is about to reach international levels. At the same time agricultural production prices have been fluctuating greatly. No realistic forecast can be made about pesticide use in such conditions.

Fish Breeding

The total draught from the Danube River has not changed significantly from one year to another and has remained within the range of 752 - 1100 t/p.a.(Annex A, Table 9). In the period till the year 2010 this amount is likely to remain unchanged.

Hydropower Industry

Hydropower industry does not create serious environmental problems. Hydropower plants (HPPs) in the Danube basin operate under a dependent regime only, making use of the geodetic high whenever there emerges a need for water to be fed to the water supply systems, irrigation systems, etc. Beside the existing 44 HPPs in the Danube basin, there are designs for another 37, with a total capacity of 2475 Mw (Annex A, Table 4).

3.4. Solid Waste Disposal and Potential Soil and Ground Water Pollution

Solid waste dumpsites are a major source of contamination of the surface and ground water in the Danube basin.

There are currently 230 registered municipal dumpsites in operation in the Danube basin of which 39 are maintained by towns of more than 10 000 inhabitants. The total amount of accumulated waste in the Danube basin is 1 300 000 tons/p.a. Significant changes (Annex A, Table 19) are not expected till Year 2010. Most of the municipal dumpsites are not managed and can be regarded as open dumpsites, which do not meet the technical and environmental requirements (Annex A, Table 15). Only a few of them could be considered as municipal landfills.

Every town along the Danube mainstream (Lom, Svishtov, Belene, Kozloduy, Rousse, Silistra, Tutrakan) has a solid waste dumpsite lacking insulation or clay layering, drainage systems or leachiate shafts. Moreover, these dumpsites are situated at a distance of 2 ÷ 10 km away from the Danube. The Vidin and Nikopol dumpsites, situated 0.2 km away from the Danube riverbank hold a risk for the river. The dumpsite near Svishtov has depleted its capacity and holds a tangible risk of contamination.

A significant risk for contamination of the Danube River basin is involved in the practice of using the solid waste dump sites, without permission, for storage of industrial and hazardous waste: spent machine, engine and transformer oils, petrol products, paints, residues left from cleaning and maintenance of installations and facilities, pesticides with an expired lifetime, hospital waste, slaughterhouse waste, etc.

There are no landfills for hazardous waste deposition in Bulgaria that meet modern requirements and norms.

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

4.1. Water Quality Data Critical to the Trans-boundary Analysis (Danube Water Quality Model)

At present within the Bulgarian reach of the Danube basin, i.e. along the Bulgarian tributaries of the Danube River, there are 118 sampling points for monitoring water pollution in the tributaries and 21 such points on the Danube River itself.

Samples are taken from the midstream once a month in observance of a strictly defined procedure. Water volume is measured daily. Samples of Danube River water are taken from the Bulgarian bank. Only at the frontier points at Novo Selo (km. 833) and Silistra (km 375) samples are taken from the Bulgarian bank, the midstream and the Romanian bank, pursuant to the Declaration of Danubian Countries signed in Bucharest. The riverine water quality is monitored for: components with a mineral content, organic pollution, toxic and biological elements, petrol products and other hazardous substances.

A comprehensive survey of the Bulgarian reach of the Danube has not been made since 1967 and therefore the analysis of the changes of the cross sections are based on the hydrometric profiles.

Some of the hydraulic parameters of the river stream are regularly measured by all of the hydrometric stations along the Danube and by the stations along the tributaries. The hydraulic characteristics of the cross sections situated between every two gauge cross sections are computed by means of a water surface computational model for each of the computational sections.

4.2. Concentration and Loads of Nutrients and other Pollutants in the Danube River and its Tributaries

Nitrogen

During 1994 – 1997 the main Danube tributaries had high concentrations of N-NO2 and N-NH4. Some of the observed data shows that the actual concentration of N-NH4 varied between 7 and 169 mg/l by permissible concentration between 2 and 5 mg/l (II and III categories) and the observed N-NO2 concentration varied between 0.11 and 2.46 mg/l by permissible values of 0.04 - 0.06 mg/l (II and III categories).

Phosphorus

During 1994 – 1997 the main Danube tributaries had high concentrations of phosphorus P-PO4. Some of the observed data shows that the actual concentration of P-PO4 varied between 3.1 and 116 mg/l by permissible concentration between 2 and 3 mg/l (II and III categories).

COD

During 1994-1997, increased concentrations of COD were observed in the Ogosta River at the inflow of the Dabnika River downstream of “Himco” - Vratza. This is the only case in which the permissible limit has been exceeded.

Heavy Metals

Specific heavy metals were observed in the stream of the Ogosta River at the Chiprovska River before the inflow of the Belimel factory sewer on 14th September 1995, to an amount of 0.10 mg/l of As, and in the Iskar River basin at the Malak Iskar River downstream the town of Etropole on August 2nd 1994, amounting to 8,2 mg/l-Cu; and on May 7th 1996, amounting to 0,6 mg/l- Cu. The rest of the examined data indicate concentrations, lower than the permissible limit.

Oil and Other Hazardous Chemicals

The summarized findings show numerous cases in which the actual concentration at some of the tributary sections downstream the towns and industrial sources varied between 7 and 72 mg/l at a permissible level of 6 mg/l. Detailed information can be found in Section B of the National Report.

Special Interdependence

Due to the low runoff of the tributaries to the Danube River and to its broad range of fluctuations (as compared to that of the Danube River itself), the water quality data collected periodically, cannot serve as grounds for conclusions to be drawn about the impact of the non-point pollution sources. Several projects have been completed in Bulgaria treating the interdependence between land use and water quality; fertilizer sales and N&P in riverine water, detergent sales and phosphates in riverine water. No methodologies exist in Bulgaria to assess the impact of non-point sources on the overall river quality. Other indirect assessment methodologies have been used for this purpose up to now.

4.3. Trans-boundary Implications of Pollution

The comparative analysis of the results of the samples taken from the two frontier points on the Danube River (Novo Selo, km 833) and Silistra (km 375) indicate that no significant differences exist in the examined quality features of the Danube River water (Annex A, Table 17). This is a confirmation of the fact that Bulgarian tributaries have an insignificant impact (Annex A, Table 16) over the Danube River water and that the main quality content of the latter is determined above the Bulgarian reach.

The multi-annual studies in Bulgaria indicate that the wastewater directly discharged in the Danube River and its tributaries disperses over a comparatively narrow strip 300 m wide and up to 20 km long, with a ‘drop-like’ distribution.

The Bulgarian section of the Danube River with the poorest water quality is considered to be nearby Nikopol (km 597), upstream of which the rivers Iskar, Vit, Ossam and Olt discharge their waters.

Every town along the Danube mainstream (Lom, Svishtov, Belene, Kozloduy, Rousse, Silistra, Tutrakan) has a solid waste dumpsite lacking insulation or clay layering, drainage systems or leachiate shafts. Moreover, these dumpsites are situated at a distance of 2 ÷ 10 km away from the Danube. The Vidin and Nikopol dumpsites, situated 0.2 km away from the Danube riverbank hold a risk for the river. The dumpsite near Svishtov has depleted its capacity and holds a tangible risk of contamination.

A significant risk for contamination of the Danube River basin is involved in the practice of using the solid waste dump sites, with our without permission, for storage of industrial and hazardous waste: spent machine, engine and transformer oils, petrol products, paints, residues left from cleaning and maintenance of installations and facilities, pesticides with an expired lifetime, hospital waste, slaughterhouse waste, etc.

There are no landfills for hazardous waste deposition in Bulgaria that meet modern requirements and norms.

5. Identification, Description and Ranking of Hot Spots

The updating and upgrading of hot spots is necessary due to the changes in the period after the adoption and approval of the SAP (end of 1994). An overview of the current situation is given below:

The process of transition from the central planned to market orientated economy compels the Bulgarian authorities to establish new principles for their political, economic and social institutions.

The privatization of the industrial plants and the land reform are still in progress. There has been a decline in industrial output accompanied by a decrease in pollution loads.

The list of Hot Spots in the SAP contains descriptions of the emissions, which are very brief and expressed in units which prevent aggregation, incorporation into nutrient balances, or testing of investment and clean-up scenarios.

This justifies the use of a new approach and methodology for the inclusion, exclusion and ranking of “Hot Spots”.

Statements of this methodology were debated and mostly accepted by the water quality working group and are presented intact, except for some minor modifications, under the following subsections:

1. Evaluation of environmental and health hazards based on the monitoring system available;
2. Evaluation of the river water quality characteristics is based of the “source oriented approach”;
3. Evaluation of the results achieved up to now and planned projects.

One major sub-objective of the national review is to improve the descriptions of existing hot spots to facilitate their comparison and technical and economic evaluation. Specific measures for accomplishing this improvement are:

- Defining 3 categories and listing hot spots in three groups: municipal hot spots, industrial hot spots, agricultural hot spots;
- In the evaluation and ranking of the hot spots the EMIS (Emission Expert Group) reports on municipal and industrial emissions was used.

The high priority hot spots are situated along major tributaries and do not have a direct trans-boundary effect.

A second major sub-objective of the national review is to clarify, if major changes or discoveries may have occurred, which eliminate the justification for some of the hot spots to be on the list.

From the additional investigations, it was established that from the "Hot Spots" List the following could be removed:

- **The Copper Smelter Factory at Eliseina.** Presently it is included in the "hot spots" and is one of the major polluters along the Iskar River basin. The implementation of the Programme for the improvement of the environmental situation in the area of the Copper Smelter Factory at Eliseina began in 1995. The Programme is financially supported by the Japanese government.
- **WWTP Botevgrad.** The structural changes in the industry and decline of output requires revaluation of the balance of pollution and water quantities taking into consideration the business programmes of the newly privatized enterprises.

- **WWTP Pleven**. The WWTP (sludge treatment facilities) is reconstructed and rehabilitated under the IBRD Water Companies Restructuring and Modernization Project Loan following a restructuring of the Water Company - Pleven.
- **The Sugar Plants in Dolna Mitropolia** have stopped the productive activity over two years ago.
- **Sevlievo-Tannery "Sevko".** Currently a project for technological rehabilitation is under execution. EC PHARE, the National Environmental Protection Fund and the National Eco Trust Fund finance the construction of an industrial wastewater pre-treatment plant.
- **Rousse -West Industrial Zone.** The main sewer is under construction and the completion of the Pumping station is ongoing too, with the financial support of the National Eco Trust Fund.

A third major sub-objective is to justify the addition of new "Hot Spots" to the list. The following is subject to investigations:

- Municipal WWTP Lom. The population of the town according to the National Statistical Institute on 31.12.1996 is 38 582 inhabitants. According to data from the annual report-1997 of the REWI Montana the non-treated wastewater quantity is from 600 to 800 l/sec. Actually the National Environmental Protection Fund is providing financial assistance for the completion of the construction of the internal sewage network of the town. In order to prevent the health risk for the population it is necessary to deviate the wastewater collector outside the settlement, as well as to construct facilities for the primary wastewater treatment.

An evaluation of the diffuse sources of pollution is not presented now because such an assessment exists in the Applied Research Project "Nutrient Balances for Danube Countries" (November 1997). The study covers the period 1989-1992 and the tendency is reproduced in the 1994-1997 period.

Some adverse impacts on the river morphological process in the Bulgarian stretch of the Danube River commpel the inclusion of localization of intensive riverbed and bank erosion and some conservation sites to the hot spot list too.

Proposed New "Hot Spots"

1. The Danube River bed from km 844 to km 347 is subject to intensive erosion processes (Annex B) which necessitate new bathymetric survey. The last one can be dated to 1967!
2. The Danube River bank at Long Tzibritza Section (km 710) being subject to intensive erosion needs urgent fortification.
3. The Danube River Bank at km 542 to km 536 (Yantra River estuary) being subject to intensive erosion urgently requires fortification.
4. Restoration of the water regime of the wetlands Persin and Vardin.
5. Restoration of the biodiversity in the Belene Island.

A fourth major sub-objective of the national review is to develop and apply a format for ranking hot spots (following proposed criteria) from the perspective of the scope and seriousness of the problem.

5.1. Ranking of Hot Spots

The following paragraphs a ranking on the basis of criteria involving *size of load, dilution factor, ambient water quality at the source of emissions, nearby downstream use of water and transboundary implications.*

In determining hot spots and critical sections of the Bulgarian tributaries, we have been guided by the following:

- extent of the pollution of the examined river section at minimum water quantities (section category);
- character and type of water use in the section and after it;
- specific features of production capacity and distribution in time, if the pollution from an industrial enterprise(s) has led to the identification of a hot spot;
- hot spot location at the river section;
- degree of treatment of the discharged wastewater;
- duration of water quantities in the riverine section;
- perspective development of activities in the adjacent territory and urbanization of the water catchment as a whole.

Taking into consideration the extent of pollution of separate sections of the Bulgarian tributaries of the Danube River, linked with the impact of separate hot spots, the hot spots are classified for priority improvement of the state of the riverine waters. A lists with classified hot spots is presented in Annex A. Map C6-2 (Annex B) shows the hot spots from the municipal and industry group. On the same map are shown the towns, which have constructed WWTP also when the treatment effect is insufficient.

There are hot spots of high priority where different projects for their remediation are currently underway (WWTP Samokov, WWTP Gabrovo and WWTP Veliko Tarnovo).

Note: Agriculture has not been included in the ranking due to the incomplete progress of land ownership reform, privatization of animal breeding facilities, and lack of information on the business plans of the new owners.

5.2. Municipal Hot Spots

Each municipal hot spot has a fiche format summarizing information which are attached in (Annex A, Tables 20 - 23). The Hot Spots are classified by priority in one of the follow three groups: with high, middle and low priority.

5.3. Industrial Hot Spots

A Summary of Information about the Industrial Hot Spots is given in Annex A, Table 21.

5.4. Agricultural Hot Spots

Pollution from animal-breeding farms has diminished significantly with the decline of this activity. Due to the privatization in the sector, some of the big animal-breeding farms were closed. In some of them the number of animals was reduced. The existing private animal-breeding farms are smaller and with a limited capacity. With the rise of the price of chemical fertilizers the solid manure from cattle-breeding farms after composting is almost entirely used for fertilization.

The more significant animal-breeding farms identified as “Hot Spots” are presented in Annex A, Table 22.

6. Identification and Evaluation of Measures Addressed at Curbing Pollution

Bulgaria has faced considerable economic difficulties since 1991, marked by a sharp decline in total output and value-added and a dramatic rise in unemployment.

Bulgaria's economic situation at the outset of the reforms was more difficult than in other transitional economies. Its high dependence on trade with the former Soviet Union and the other CMEA countries - 70 percent of foreign trade - left it extremely vulnerable as CMEA trading arrangements broke down.

The slight growth of the economy in 1994 and 1995, caused by the positive impact of the realized export was blocked in 1996 due to the total absence of structural reforms in the economy, a vital support to the transition towards a market economy. The resulting economic crisis lead in the beginning of 1997 to hyperinflation whose dramatic peak occurred in February and March of the same year.

As in many other transitional economies, the Bulgarian government grants for environmental protection are very limited. The Ministry of Environment and Waters (MOEW) relies heavily on pollution fines, with revenue earmarked for the National and Municipal Environmental Protection Funds. In early 1994 World Bank assisted MOEW in devising a concept for a debt-for-environment swap. As a result of the implementation of the concept and the ensuing convention between the Swiss and the Bulgarian government, the National Eco Thrust Fund was created in 1997.

6.1. National Targets and Tools for Curbing Water Pollution

The Bulgaria Environmental Strategic Study, conducted in 1992 by MOEW and World Bank experts, identified the following priorities in the area of water management:

- reducing industrial pollution, especially by toxic substances such as heavy metals;
- completion of municipal wastewater treatment plants (WWTPs) at an advanced stage of construction, upgrading of existing municipal and stock-breeding WWTPs;
- construction of municipal WWTPs in towns with a developed sewerage system.

The priorities in the area of potable water supply consist of identifying additional sources of fresh water and increasing the capital city's wastewater treatment capacity, eliminating the problems stemming from the inadequate water pricing and use, and from the obsoleteness of the existing water supply infrastructure.

The Bulgaria Environmental Strategic Study Update and Follow-Up from 1994 laid an emphasis on problems relating to water pollution, more specifically on the content of nitrates, heavy metals and petrol substances in potable water. Recommendations were made, involving a revision of the standards on wastewater discharge, development of a licensing system, modification of the fee system and introduction of environmental audit for the major pollution sources.

All projects related to the Strategy for Water Resources Management in Bulgaria feature the issue of water quality as a priority. Moreover, water quality will be of topmost priority in the pending National Programme on Water, which will involve measures on water quality on the national level.

Setting water quality as a topmost priority ensures :

- a sustainable water resources management
- satisfaction the water needs of the aquatic and terrestrial eco-systems and their sustainable existence

6.1.1. National Targets

The highly polluted sections of the main river valleys will serve as targets for the water protection activities by the year 2020 as follows:

- Yantra River downstream of Gorna Oriahovitza
- Ossam River downstream of Troyan
- Yantra River downstream of Gabrovo
- Roussenski Lom River downstream of Razgrad
- Ossam River downstream of Lovetch
- Ogosta River downstream of Vratza
- Iskar River downstream of Novi Iskar
- Rossitza River downstream of Sevlievo
- Yantra River downstream of Veliko Tarnovo

6.1.2. National Tools

For the quality of surface water in Bulgaria to meet the standards for pure and slightly polluted water by the year 2020, there should be an investment climate in place and the following main principles should be observed in carrying out any water protection activities:

- measures for curbing water pollution
- improvement of the current legislation
- improvement of the current technical regulations and guidelines
- improvement of the current financial mechanisms applied to environmental problems

6.2. Actual and Planned Projects and Policy Measures

6.2.1. Measures for Curbing Water Pollution

The measures for curbing water pollution could be summarized as follows:

- greater investments for construction of sewerage networks and completion of the main sewers leading to the WWTP, and for rehabilitation, reconstruction and modernization of the old sewerage networks;
- construction of municipal WWTP (MWWTP) on a phased basis - in the most polluted riverine sections; initial completion of the facilities for mechanical water treatment together with the corresponding sludge treatment facilities; giving priority to towns whose sewerage networks are nearer completion (such as. Gorna Oryahovitza, Lovech, etc.)
- design and construction of WWTP for breeding farms and industries discharging directly into the surface water;
- design and construction of local treatment plants (LTP's) for industries discharging into municipal sewers;
- rehabilitation, reconstruction and modernization of the existing WWTP, and improvement of their maintenance (e.g. Vratsa, Sofia, Razgrad).
- reduction of the number of municipal solid waste (MSW) dump sites and opening of regional or local sites;
- initiate monitoring and development of a methodology to assess the impact of non-point sources to the river basins;
- elaboration of requirements for reporting and tracking of generic wastes generation;

- drawing an inventory of the historically damaged industrial sites and estimating the cost of their rehabilitation, including risk assessment and ranking of the problems by priority;
- the projected rates of industrial growth require the application of innovative technologies, involving a closed water cycle, a repeated use of wastewater as a way to minimize its quantity and improve its quality; curbing of toxic and heavy metal emissions generated by industries through the application of the "best available techniques" and win-win practices".

Preventive Measures

Several projects, dealing with curbing pollution generated by industries are under way, funded by foreign or local donors.

Beside the direct discharge of wastewater by industries into municipal sewers and surface water reservoirs, another significant source of river basin pollution is the generation and management of hazardous waste. Annex A, Tables 24 - 25 presents the projects designed for construction of IWWTP by priorities at points, defined as 'hot spots'.

Curbing of Water Pollution Generated by Municipalities

As mentioned above, municipal discharges of waste waster are among the principal sources of river basin pollution. In the Danube basin there are 39 towns having more than 10 000 inhabitants. Within the same area there are 12 MWWTP in operation (Sofia, Pleven, Veliko Tarnovo, Gabrovo, Vratsa, Razgrad, Varshets, Dobrich, Botevgrad, Pravets, Elin Pelin, Borovets) another 4 under construction (Borovets, Troyan, Strazhitsa, Samokov) and 13 with a completed design and stalled construction due to financial constraints (Gorna Oryahovitza, Popovo, Lovech, Montana, Sevlievo, Cherven Bryag, Levski, Pavlikeni, Berkovitca, Mezdra, Belogradchik, Silistra, Etropole). That makes a total of 29 existing plants with the need for at least 9 additional ones (Tables 22 - 23 and 24 - 25). Furthermore, both for the MWWTPs in design and for those under construction, an evaluation of the existing technical documents will need to be made in view of adapting them to the current conditions and modern treatment technologies.

Table 26 provides a list of prioritized projects, each focusing on a particular hot spot and having as its goal the curbing of water pollution inflicted by municipal wastewater discharge.

Prevention of Pollution from Agricultural Point Sources

In order to ensure efficient measures for reduction of the water pollution generated by agriculture it will be necessary to combine old activities with new practices, guaranteeing a good quality of the agricultural products coupled with a minimum harm to the environment.

The more significant animal-breeding farms identified as "hot spots" in the Ogosta basin are as follows:

- **pig farm, Studeno Buche village,** owned by "Agropromstroy" Montana. The capacity of the farm is 20 000 animals (of 100 kg.). Wastewater is treated mechanically and stored in open precipitation ponds, which need reconstruction and upgrading.
- **animal-breeding farm Vratza,** The farm is property of the Ministry of Defense. Wastewater is discharged without treatment. A WWTP should be constructed.

The more significant animal-breeding farms in the Iskar basin are as follows:

- **Inter co-operative enterprise "Pig complex", Knezha.** A biological treatment facility should be constructed.

The more significant animal-breeding farms identified as “Hot Spots” in the Yantra basin are as follows:

- **Pig-breeding farm, Samovodene village.** After being stored in precipitation ponds the wastewater is discharged in the Yantra River and pollutes it.
- **Pig breeding farm "Geran", Lyaskovetz.** After precipitating the wastewater is discharged in the Yantra River and pollutes it.

At the date of drawing of this report no data were available on the capacity of these farms, as would allow their ranking, quantification of their benefit, or the filling-in of project files.

Prevention of Pollution from Agricultural Non-Point Sources

The transition period had been marked by a very sharp decline in use of fertilizers. For the last years (1994 - 1997) the total amount of fertilizers used decreased 5 times compared to 1980 - 1981. This sizable drop and unbalanced use of nitrogen is a major factor for the decline in the staple crops output in recent years. Given the current conditions, agriculture is unlikely to produce significant pollution in the area.

Use of Pesticides

The economic reforms in the ‘90ies gave rise to new problems in pesticide regulation. The measures needed to regulate pesticide use and to reduce the harmful environmental and health impact can be summarized as follows:

- introduction of adequate crop rotation to assist restrict the application of chemical preparations through a more economical land use;
- application of biological plant protection against pests;
- use of pesticides with a greater technological effectiveness and applied in smaller quantities per unit of area;
- application of an integrated plant protection system (integrated pest management;
- harmonization of the Bulgarian plant protection legislation with the EU’s.

In addition, it should be pointed out that because of the heavy decline of agricultural output, farming activities are currently not a threat to the environment. At the same time once the reform is accomplished and agricultural output rises as expected, Bulgaria should start working towards solving the problems intensive agriculture will create.

Curbing of Water Pollution through an Improved Land Management

The current size of the impact agricultural activities exercise on water marks the need for an urgent design of projects in support of the reform and to ensure the recovery of agricultural production while curbing its potential as a pollutant.

Remedial Measures

The following sections of the Danube mainstream are subject to an irreversible erosion process and have been defined as hot spots:

- the Danube River bed from km 844 to km 347 is subject to intensive erosion processes calling for regular bathymetric surveys;
- the Danube River bank at Long Tzibritza section (km 710) is subject to intensive erosion and needs urgent fortification;
- the Danube River bank at km 542 to km 536 (Yantra River estuary) is subject to intensive erosion and needs urgent fortification;
- the Danube River bank at km 480 to km 490 (near to the town of Rousse) is subject to intensive erosion and needs urgent fortification;
- the Persin and Vardin wetlands, which need to have their water regime restored;
- the Belene Island, which needs to have its biodiversity, restored.

At the time the current report was drawn there were no data which would allow the identification of new projects or the completion of a project file for the hot spots mentioned above.

6.2.2. Improvement of the Current Legislation

Initiatives on the amendment and modification of the current water protection legislation have been actively implemented in recent years. MOEW has drafted a law on water based on the principle of integrated and sustainable water resources management, where water is viewed as a limited resource with a certain capacity of recovery.

The adoption and enforcement of this law will ensure the implementation of a modern approach, leading to an integrated and sustainable water resources management in Bulgaria. A regulatory framework is under way, approximated to the EU's. Another legislative initiative involves the elaboration of surface and ground water quality standards.

6.2.3. Improvement of Technical Regulations and Guidelines

According to Bulgarian legislation the protection, integrated management and use of water resources is currently governed by the Water Law of 1969. Protection of water from pollution is additionally governed by the Prevention of Air, Water and Soil from Pollution Law of 1963 and the corresponding rules for its application.

Setting up of national requirements and norms on water quality, harmonized with those of EU is a process of high importance. Once accomplished, this process will ensure improved environmental conditions and protection of the human health and optimal conditions for the existence of aquatic and land sensitive environments.

6.3. Planned Measures and Projects' Performance with a Particular Focus on the Transboundary Impact

The main macro-economic indices shaping the current conditions and setting the trends in Bulgarian economic development since the early 90ies, show a sizable decline of the GDP (about 45%). The macro-economic picture grows gloomier once we take into account the burden of the domestic and foreign debt, the inflation rate and the state of the Bulgarian financial system. The sharp cut in investment activities is coupled with a highly restricted volume of real investments, impeding the progress of the structural reform. The government allocates no more than 2-3% of its budget for investments.

Conflict of interests between the economic, social and environmental sectors is inevitable, especially because of the scarcity of resources for tempering social pressure and reduction environmental harm. Therefore many plants will continue operating despite the pollution they cause, since the social (and economic, in the case of many production processes) price for their shutdown is unaffordable. Such plants should strive to optimize the maintenance of their fixed assets and implement new technologies, relying on lower water consumption. In the long term, implementation of environmentally friendly manufacturing processes should be encouraged.

A study of the large water consuming sub-sectors of the industry, indicates that the forecasted trends of product variations are between 1.1 and 4.5 % for the next 15 years.

The trend projections till the year 2 000 are somewhat more optimistic, although production is envisaged to reach less than 70% of the total industrial output of 1985; electricity and heating production - about 85%, coal industry - 90%, ferrous industry - 65%, food industry 40%.

6.3.1. Reduction of Nutrient Emissions

Annex A, Table 26 presents a summary of the amounts of nutrient reduction expected to be achieved as a result of the projects for curbing of water pollution from municipal wastewater discharges and industrial wastewater discharges:

The data currently available do not permit to quantify the reduction of nutrient emissions as a result of the projects for curbing water pollution inflicted by agriculture.

6.3.2. Hazardous Substances

Data on hazardous waste generation shows that the top industrial generators and the generic wastes generators are jointly responsible for 82 % of the total generation in the area. If the proposed projects are implemented, and assuming they have an overall effectiveness of 80%, the problem concerning hazardous waste will be solved to an extent of 65% and more.

As mentioned above, there are currently about 230 municipal dumpsites in operation in the Danube basin. If we assume that the existing 39 towns with more than 10 000 inhabitants are likely to open their own landfills in the future, the remaining 190 dump sites should be reduced in number, giving way to regional landfills, servicing groups of villages. If total number of dumpsites is reduced by at least 50%, and modern landfilling designs and technologies are applied, the negative impact on water pollution will be reduced by more than 50%.

6.3.3. Microbiological Contamination

The review of data related to microbiological contamination shows that the information currently collected is very insufficient and does not permit the assessment of the magnitude of the problem. Considering that not all of the WWTP provide disinfection as required, this fact takes on the shape of a real problem of high importance.

There are two ways to study and improve the situation: first, to ensure collection of relevant data from the National Monitoring System and to study the real state of the river basins; second, to study the state of the disinfection facilities of the existing plants and to introduce the necessary improvements both to the existing as well as to the WWTPs in design.

The existing information on microbiological contamination does not permit to quantify the effects of the on-going or planned projects.

6.3.4. Adverse Environmental Effects

The comparative analysis of the results of the samples taken from the two frontier points on the Danube River (Novo Selo, km. 833) and Silistra (km. 375) indicate that no significant differences exist in the examined quality features of the Danube River water. This shows once again that the Bulgarian tributaries have an insignificant impact on the Danube River water and that its main quality content is determined above the Bulgarian section.

Due to the geographic characteristics of the Bulgarian reach of the Danube basin there are no trans-boundary implications, caused by pollution of the Bulgarian rivers. Only a few small rivers of the Nishava basin spring in Bulgarian territory and flow into Yugoslavia. The Timok River is the opposite case, springing and developing its catchment almost totally in Yugoslavian territory, and shaping the border between the two countries only towards the end of its course. At the discharging points of the Bulgarian rivers into the Danube there have not been observed any adverse or polluting effects. The pollution of the Danube mainstream itself has a local effect only and a practically insignificant impact. Erosion problems of the Bulgarian bank of the Danube are inflicted by the operation of "Iron Gate" I and II, by climate variations and their impact on the hydrological regime of the mainstream, and by human activities along the entire Danube basin, especially in its downstream section.

The ongoing and the planned projects and activities for water pollution reduction are of local concern relevant to the respective catchment area. They are also addressed to prevent pollution in order to reduce the risk of uncontrolled or emergency releases of pollutants. Some of them must be considered also as pilot or demonstration projects.

7. Analysis of National Financing Mechanisms

7.1. Funding Policies

The national water sector funding policy is designed to help implement the guidelines of the strategy for integrated water management in Bulgaria and to meet the specific objectives of the Danube region, in recognition of the fact that the national economic and environmental policy is shaped by a currency board, entailing the respective implications for central government and local budgets and foreign donors.

The funds in support of the operations addressed at implementing the strategy could be raised by means of identifying new internal sources of funding and procuring more effective external funding. Presently our estimates show that the funds allocated for water management and pollution reduction take up roughly 0.3% of the GDP. In a currency board environment the central government budget provides limited funding; hence a major task of the national policy is to come up with sustainable and flexible internal funding tools for the water management and water pollution reduction programmes. This can be achieved by:

- **devising a self-financing mechanism;**
- **improving the licensing procedures;**
- **devising adequate administrative structures for water fee collection and revenue management.**

The s**trategy for the Danube River basin** is centered around the priorities set with respect to the water use of the water-dependent industries, the process of industrialization and the social development of the region. Currently the region is confronted by many severe economic, social and environmental problems. All of the local industries involved in power generation, machine building, chemistry, paper and cardboard manufacturing, tanning etc. have been affected by the economic crisis. According to studies and economic analyses the magnitude of the crisis is much stronger felt in this region of Bulgaria than in others.. Funds for purchasing equipment to curb pollution are very restricted on the regional and national level alike.

External funding sources are of vital importance.

7.1.1. Water Supply

The funding policy with respect to water supply is market-based, i.e. it envisages adapting tariffs to the current costs structure.

7.1.2. Municipal Wastewater Treatment

Funds for these operations will be generated through total fee collection, central government/local funds and foreign aid.

7.1.3. Industrial Wastewater Treatment

The policy in this area is largely based on the ‘polluter pays’ principle.

7.1.4. Improvement of Agricultural Practices

Agriculture is still a key structural sector of the Bulgarian economy, generating about 13.9% of its Gross Value Added (1997). The problems related to agricultural production are enormous. New private farms lack any own resources to restrict pollution and have a limited access to formal domestic and external sources of funding.

7.2. Funding Tools for Wastewater Sector Programmes and Projects

Funding for the above programmes and projects is ensured through the central government budget, the national and municipal environmental funds, the National Environmental Trust Fund, foreign donors and some very limited private financial sources.

7.3. Actual Cost and Pricing Policy

The trend in this respect is to gradually achieve coverage of the costs through the prices charged for water use.

The Ministry of Regional Development and Public Works is responsible for managing the water supply systems, municipal wastewater treatment plants and sewerage systems.

Municipalities are responsible for managing public works, including the water resources structure and the water supply infrastructure. Municipalities and the respective central institutions share the responsibility to enforce compliance with the legislation on water management.

Each consumer pays for the potable water he has used. Since the abolishment of the integrated pricing system in 1991, each water company has been determining its own water use tariff. The inflation rate in the country has brought to a dramatic rise in water prices in nominal terms: in 1991 potable water sold for BGL 4/m^3 while in n the first half of 1997 its price varied between BGL 310 - 520 (USD 0.2 - 0.3 at an exchange rate of BGL 1 718 for USD 1 on 30.06.1997) and between BGL 430 - 620 in April 1998 (USD 0.24 - 0.34 at an exchange rate of BGL1 800/USD 1 on 30.04.1998).

7.3.1. Water and Wastewater Tariffs and Charges

The water and wastewater tariffs and charges vary as per municipality. They are a weak potential source of funding for wastewater treatment activities.

The current Water Act does not have special provisions for funding of water sector programmes and projects.

Sanctions for pollution or damage to the environment above the accepted norms are tied to the average minimum salary for the country at the date of verification of the violation.

Sanctions are imposed on legal persons polluting water streams and basins in excess of the permissible norms for the country. Penalties are specific for each polluting substance used above the norm.

The penalties and fees collected in 1994 brought in BGL 75 918 000 (USD 1 346 064) and BGL 106 675 000 (USD 60 160) in 1996, incl. BGL 36 696 000 (USD 650 638) in 1994 and BGL 40 177 000 (USD 230 346) for the water sector in 1996.

The charges for the issuance of permits for wastewater discharge are determined as a percentage of the average minimum wage. Water discharge up to 100 m^3/day entails a charge of 30% and amounts over that limit - 55%.

7.3.2. Public and Private Sector Expenditures for Wastewater Treatment and Environmental Protection of Aquatic Systems

Private sector expenditures are not reported statistically.

The information available on public investments is shown in Annex A, Table 27.

7.3.3. Cost Structure and Cost Coverage Regarding Wastewater Management (considering revenues and subsidies)

Water companies charge prices for potable water, provisionally clean water, wastewater and treated wastewater in some cases.

The price per m^3 of potable water is determined on the basis of the total cost, comprising: the cost of materials, energy and fuels, hired services and certain repair works, depreciation, salaries, social insurance, management.

Water meters are not used consistently throughout the country (they are mainly used for measuring large water quantities). There are no tariffs for household wastewater treatment, nor for water supply from wells, which are privately owned.

The Ministry of Environment and Waters has drafted a proposal, entailing a system of tariffs for water treatment as a new source of funding. The tariffs will be calculated per cubic meter and will be linked to the quality of the discharged wastewater.

The information provided by the Ministry of Regional Development and Public Works indicates that the revenue collected from potable water fees could cover costs almost entirely (not forgetting that water companies cannot afford the necessary investment costs).

The fee collection from the population is only 70 to 80 %.

7.3.4. Economic and Financial Incentives for Making Investments, Managing Treatment Plants and Protecting Aquatic Systems

The Ministry of Environment and Waters issues special permit related to the equipment, which is imported by order of the international agreements of which the Republic of Bulgaria is a party.

At present commodities imported for environmental projects are not subject to import duties.

The Bulgarian tax laws provide some special privileges or tax exemptions for environmental projects and activities. More specifically, these are the Profits Tax Law, Economic Activity of Foreign Persons Law and the Protection of Foreign Investments Law.

As of June 2, 1998 commodities of an environmental nature are VAT-exempt.

Economic and financial incentives are gradually becoming an important tool for investment in and management of WWTP, though there is still a lot to be done in this field.

7.4. Actual and Planned Public and Private Investment in Water Quality and Wastewater Management Projects

The actual and planned private investments for water quality and wastewater management projects have not been statistically reported, rendering projections about the future private investment portfolio very difficult to be made.

The information available on the size of the actual public portfolio is from 1996.

Bulgaria's economic potential in terms of water sector financing may be measured by the size of investments of 1996 (last official information available) and the State Budget Law of January 1st, 1998 where total expenditures allocated for environmental projects for 1997 were at BGL 6 263 000 000 (USD 3 558 523).

7.4.1. Municipal Projects

The State Budget Law of January 1st, 1998 provides information about the projects for urban WWTPs, their duration and expenditures for 1997 (Annex A, Table 28).

7.4.2. Industrial and Mining Projects

In the industrial sector the expenditures for environmental protection in 1996 amounted to BGL 13 729 533 000 (USD 78 715 359). Expenditures were structured as follows:

- 84% of the total expenditures for environmental protection and restoration (excluding monitoring or control devices) in industry were for manufacturing plants;
- 7% for mining and quarrying;
- 8% for the energy production;
- 1% for construction.

Access to sources of investment for industrial and commercial WWTPs depends greatly on the ownership of the enterprises. In case the enterprise applies for a loan, it needs to prove its potential to generate a sufficient revenue to repay the loan. Very rarely a state enterprise will be granted a commercial loan for the purchase of a WWTP only. Most of the state enterprises are heavily in debt and cannot put up the necessary security for a loan. Commercial banks usually apply short-term lending and strictly observe the requirements for securing and economic justification of the loans. There are no specialized lending institutions dedicated to industrial pollution control.

Private companies may purchase WWTPs on a commercial basis. They have a limited access to loans and are faced with the same problems as state enterprises.

7.4.3. Agricultural Measures and Projects

In agriculture the expenditures for environmental protection and restoration in 1996 (excluding monitoring and control devices) amounted to BGL 1071307 000 (USD 6 142 110).

Agricultural pollution deserves special attention. Production in that sector has diminished tremendously. Private farms do not have financial resources and are hardly expected to obtain any from the commercial banks. Public sources are also limited. Some external funding may be obtained but few agricultural entities could meet the requirements, put up by donors.

8. Development of National Pollution Reduction Programme and Investment Portfolio

In the updating process of the National Review as well as during the National Planning Workshop a number of ongoing and planned projects have been outlined, but due to the fact that there is no documentation about them, i.e. it is still just an idea and the project shall start from zero, or the proposed topic is a matter of strategy, such projects are excluded from the set of Project Files. It does not mean that their realization is less important or not attractive for Bulgaria or for a potential donor.

Below some comments relevant to the different groups of problems are provided, but not only to those, which are included in the set of the Project Files.

The aim has been to prepare in first place Project Files for all of the Hot Spots, but it was not possible, because for some of them there were no existing documentation. Other attempt for preparation was to include Project Files of each group - agriculture, industry and municipal Hot Spots. Unfortunately, Hot Spots for the agriculture were not possible to be clearly define given the stage of agrarian reform in the country and the overall level of information regarding this topic. It means that this field should be consider as a virgin one and in relatively close future it is very likely to expect a pretty good number of projects related to agriculture and environment. Of course initial study of the field is recommendable to start as soon as possible.

In this set of problems dealing with agriculture it is important also to mention the findings of the National Planning Workshop. The projects identified for the agricultural sector are:

- *Adaptation of the EU methods for assessment the pollution load from non-point sources;*
- *Development of a hydrometric system for the Karaissen irrigation system;*
- *Restoration of the Belene Island wetland;*
- *Restoration of the Vardim wetland.*

As it can be observed, these projects also have the same characteristics mentioned above. In other words there is no existing documents to organize them into Project Files. On the other hand, these are obviously pressing problems that require solution shortly, so funding at least for feasibility studies in the beginning would be very necessary and very welcome. It could be outlined that the first one should be “Adaptation of EU methods….”, because it can identify a set of urgent problems that require immediate solutions.

Another field that is close to the agriculture these includes the erosion problems that occur especially at the Danube River itself. Problems are obvious, but so that to find the right solution a thorough study is necessary, including scientific, technical and economic aspects.

The following areas of interest, defined as Hot Spots along the Danube River course were pointed out in our reports:

- *The Danube River bed from km 844 to km 347 is subject to intensive erosion processes, which necessitates regular bathymetric survey.*
- *The Danube River bank at Long Tzibritza Section (km 710) being subject to intensive erosion needs urgent fortification.*
- *The Danube River Bank at km 542 to km 536 – Yantra River estuary being subject to intensive erosion urgently requires fortification.*
- *Restoration of the water regime of the wetlands Persin and Vardin.*
- *Restoration of the biodiversity in the Belene Island.*

The existence of certain repetition of the problematic area only confirms their importance.

Speaking about the industrial sector there are some similarity but also some particular issues. All of the identified Hot Spots are included in a set of Project Files. On the other hand there are some general problems, which could not be evaluated. It is well known that in Bulgarian industry there are really good opportunities to obtain very encouraging results implementing new techniques and improvements within the production processes. In this context it could be very beneficial if Bulgaria can participate in the UNIDO programme on Transfer of Environmentally Sound Technology (TEST) in the Danube River basin. Implementation of Environmental Management System in the industries and certification for compliance of ISO 14 000 or other similar directives are also necessity.

Other pressing need that could not be organized in Project Files is the problem with contaminated industrial sites as a result of activities undertaken in the past. That is f problem that deals both with the environmental conditions in the country and also with the process of privatization.

If we consider the results of the National Planning Workshop relevant to the industrial sector the following projects have been consider as a priority:

- Inventorying past pollution upgradeable data base;
- Remediating past environmental damages in Kremikovtzi (metallurgical plant);
- Constructing a WWTP in the sugar factory-Gorna Oriahovitza on the Yantra River;
- Completing and putting under operation the WWTP in the pharmaceutical plant - Razgrad on the river Roussenski Lom;
- Training of managers on introducing environmental management system in enterprises.

Again there is a certain overlapping with the Hot Spots defined in the reports, but also some concrete problems are to be solved. The importance of the topic “past environmental damages” is obvious, so further study, inventory and ranking is really necessary. Training programmes are also important but there was no basis to include the project into the Project Files.

Another very important problem is connected with so called “generic hazardous wastes”. Establishment of a system for tracking and monitoring of their generation and management would have a significant impact on reduction of health and environmental risks.

Finally, but not at last place the major part of the Defined Municipal Hot Spots have been included into the set of the Project Files. The ones, which remain out, did not exist as a document. That was the only reason not to combine them together with the others. It is an interesting fact that all the Hot Spots are WWTP. It reflects the current situation in the country when new waste legislation is under elaboration, so very soon the problems related to the solid waste management will occupy their corresponding place.

For the moment it is most important to look for an optimal solid waste management infrastructure. How to reduce the number of refuse sites and substitute them with smaller number of well engineered landfills is a question that needs a thorough study. Any assistance in this regard will be very helpful.

Other great problem is the state of the municipal sewerage systems. The level of performance is quite low, the joints are not water tight, so the sewers either drain the areas they cross (increase of the flow transported to WWTP, weak sewage), or the sewers leak with all the adverse effects caused by this phenomena. This is also a potential field for future projects, which for the moment are in latent state.

During the National Planning Workshop the following problems have been outlined as a priority:

- *Construction of a solid waste landfill in Pleven on the river Vit;*
- *Construction of MWWTP in Gorna Oriahovitza/Liaskovetz on river Yantra;*
- *Construction of WWTP in Popovo on river Roussenski Lom;*
- *Completion of the sewers in Sofia on river Iskar.*

As in all previous cases there is a repetition of some of the projects, but also certain differences are observed. In this case only structural projects have been suggested, but as in the other cases there is still no basis to include all of them to the Investment Portfolio as a project files.

Concluding, it is important to note that the Project Files, given in the Investment Portfolio volume, provide a good basis for an initial orientation about the part of the problems that need solution. At the same time it is important to underline that some very important and pressing problems could not be included into a Project Files due to the reasons mentioned above. It means that every real case must be analyzed carefully independently of the fact whether the project is organized into a file or not. Bulgaria needs assistance on its way for accession to EC and Danube River Pollution Prevention Programme as well as other similar programmes could be a real tool for that.

Annex A

Tables

Table 1 Potential and residual water resources of the Bulgarian section of the Danube catchment up to 1994

Section [1]	Potential Resources	Water Losses	Residual Resources
-	10^6 m^3	10^6 m^3	10^6 m^3
West	3274	350	2924
Central	2562	295	2267
East	200*	20	190
For the catchment	6036	665	5381

* Excluding ground water in the Dobrudja region

(1) WEST: from the west frontier of the Republic of Bulgaria to the catchment of the Iskar river (incl.); CENTRAL: from the catchment of the Iskar river to the catchment of The Yantra river (incl.); EAST: from the catchment of the Yantra river to the east border of the Bulgarian catchment of the Danube river.

Table 2 Water consumption from Danube River

(Master plan for the integrated use and protection of the water resources - 1983)

Section [1]	Irrigation Supply		Water supply		Total
	Area	Total	Domestic	Industrial	
	10^3 *ha*	$10^6 m^3$	10^6 m^3	10^6 m^3	10^6 m^3
West	96.50	248.4	15.7	34.2	298.3
Central	31.21	84.7	24.4	83.5	192.6
East	81.12	137.8	83.4	80.0	301.2
For the catchment	208.83	470.9	123.5	197.7	792.1

Table 3 Irrigation systems during 1985

(Summary*)*

Section [1]	Fit for Irrigation	With Irrigation Systems	
-	10^3 *ha*	10^3 *ha**	*%*
West	65.5	19.7	30.4
Central	58.7	17.9	37.4
East	85.7	6.4	7.5
For the catchment	208.9	44.0	21.1

Table 4 Characteristics of built hydropower plants

Location	HPP	N	$E_{average\ operation.}$
-	no.	KW	Mln. KWh.
At tributaries - Total	44	130037	333.9

Planned construction (with a completed design)

Location	TPP	N_{design}	E_{design}
-	no.	KW	mln. KWh.
Tributaries (small TPP's)	36	58 335	282.68
At the Danube	1	402 000	2193.0
Total	37	460 335	2475.68

Table 6 Water supply sources of water for the monitored economic facilities in the Danube Basin, 1994-1996 (in $m^3.10^3$)

River basin	Branches (by NACE)	Total	Surface water	From the Danube river incl.	Ground-water	Total	Surface water	From the Danube river incl.	Ground-water	Total	Surface water	From the Danube river incl.	Ground-water
Year		1994				1995				1996			
Danube	Agriculture, forestry, fish-breeding	34614	20697	8310	13917	37657	20308	8300	17349	30839	17320	7000	13519
	Mining, and quarrying	2782	2458	0	324	2270	2110	0	160	14441	11361	1191	3080
	Manufacturing	229748	140850	54027	88871	252240	160043	72670	92142	229325	144728	60740	83139
	Others industrial activities	47599	46586	46473	991	47492	46066	46046	1426	56777	54729	54041	2048
	All industrial activities	280129	189894	100500	90186	302002	208219	118716	93728	300543	210818	115972	88267
	Other activities	10216	2890	0	7096	14080	2459	0	11426	12691	6170	4910	6299
	Total	324959	213481	108810	111199	353739	230986	127016	122503	344077	234308	127882	108085

Table 6 Actual water demand of the monitored economic facilities in the Danube River basin, 1994 - 1996 (in $m^3.10^3$)

River basin/ Year	Branches (by NIS)	Public needs	Agriculture	Irrigation	Industrial purposes	Irretrievably used	Cooling water	Other industrial purposes
Danube 1994	Agriculture,forestry,fish-breeding	1495	39248	15639	1139	664	51	424
	Mining, and quarrying	611	40	20	1347	0	0	1347
	Manufacturing	42465	1371	309	261308	49871	127279	84158
	Others industrial activities	888	0	0	59236	2225	47779	9232
	All industrial activities	43964	1411	329	321891	52096	175058	94737
	Other activities	21662	239	95	9276	2883	3099	3294
	Total	67121	40898	16063	332306	55643	178208	98455
Danube 1995	Agriculture,forestry,fish-breeding	1895	37963	10864	1127	443	80	604
	Mining, and quarrying	508	23	10	1328	70	30	1228
	Manufacturing	40321	1153	282	299676	48456	133859	117361
	Others industrial activities	743	0	0	56181	2080	45540	8561
	All industrial activities	41572	1176	292	357185	50606	179429	127150
	Other activities	25860	715	278	11169	3071	4379	3719
	Total	69327	39854	11434	369481	54120	183888	131473
Danube 1996	Agriculture,forestry,fish-breeding	1482	33146	10395	1132	426	120	586
	Mining, and quarrying	814	24	10	13890	463	0	13427
	Manufacturing	46858	810	195	262662	47349	121279	94034
	Others industrial activities	1664	0	0	65511	3609	53547	8355
	All industrial activities	49336	834	205	342063	51421	174286	115816
	Other activities	20162	408	237	8702	886	1249	6567
	Total	70980	34388	10837	351897	52733	176195	122969

Table 7 Water demand in the monitored economic facilities (excluding HPP and NPP; in $m^3.10^3$)

Years	Water used			Fresh Water Used for :		
	Total	Fresh Water Inclusive		Utilities and Households	Agricultural	Industrial
		Total	Potable Water			
1994	1516	356	81	54	34	268
1995	1548	368	108	54	33	281
1996	1504	363	96	56	28	279

Table 8 Quantities of fish caught in the Danube during 1995 by data of the State Fisheries Inspectorate with the Ministry of Agriculture, Forests and Agrarian Reform – MAFAR (in Kg.10^3)

Year	Regional Fisheries Inspectorate (RFI)		Total draught Kg.10^3
-	Danube River at the town of...		At the section
-	Lom	Rousse	-
1995	120.0	632.3	752.3
1996	176.5	946.3	1122.8
1997	158.8	823.2	982.0

Table 9 Navigation along the Danube – cargo traffic, 1993 - 1997

Years	1993	1994	1995	1996	1997
Total carrying capacity - tonnes	4 740 991	4 614 274	4 513 995	4 484 206	4 580 230
Total power - kWh	834 749	762 140	764 112	758 550	759 904

Table 10 Summarized information on water supply to the population in the Bulgarian reach of the Danube dasin

Parameters	Years	1994	1995	1996
The relative share of the population connected to the central water supply system %	Total	99.4	99.8	99.4
	In towns	100	100	100
	In villages	98.2	99.6	97.9
Total quantity of water supplied within the Danube basin for household purposes in $m^3.10^3$	Total	591 031	584 689	621707
	In towns	474 596	452 556	505512
	In villages	116 435	131 933	116195
Total quantity of utilized water in the Danube basin in m3.10^3	Total	320 255	206 645	268 640
	In towns	267 262	203 493	214 072
	In villages	52 993	57 152	54 568

* *there are no summarized data for 1997*

Table 11 Wastewater discharged from the monitored economic facilities and from the public sewerage to surface reservoirs and aquifers within the Danube basin, 1994 ($m^3.10^3$)

Year	Branches (by NIS)	Discharged total	Non treated	Treated	Mechanical	Biological	Other Methods
1994	Agriculture, forestry, fish-breeding	19308	15339	3969	2309	1485	175
	Mining and quarrying	1680	555	1125	0	0	1125
	Manufacturing	122655	38670	83985	71689	6946	5350
	Others industrial activities	30266	22272	7994	7854	0	140
	All industrial activities	154601	61497	93104	79543	6946	6615
	Other activities	4960	4720	240	50	0	190
	From MWWTP	354575	140182	247680	1853	212540	0
	Total	533444	221738	275720	83755	220971	6980

(continued)

Year	Branches (by NIS)	Discharged total	Non treated	Treated	Mechanical	Biological	Other Methods
1995	Agriculture, forestry, fish-breeding	22303	14839	7464	5360	1847	257
	Mining and quarrying	1536	514	1022	0	0	1022
	Manufacturing	153788	39900	113888	52111	8158	53619
	Others industrial activities	29352	21664	7688	7611	0	77
	All industrial activities	184676	62078	122598	59722	8158	54718
	Other activities	6066	5518	548	332	6	210
	From MWWTP	334621	130845	203776	1850	201926	0
	Total	547666	213280	334386	67264	211937	55185
1996	Agriculture, forestry, fish-breeding	17829	13799	4030	2039	1797	194
	Mining and quarrying	13083	7341	5742	4783	0	959
	Manufacturing	119640	24997	94643	39207	8592	46844
	Others industrial activities	33988	25607	8381	8331	0	50
	All industrial activities	166711	57945	108766	52321	8592	47853
	Other activities	8741	8653	88	88	0	0
	From MWWTP	340267	132258	208009	10791	197218	0
	Total	533548	212655	320893	65239	207607	48047

Table 12 Wastewater discharged by the monitored economic facilities
(excluding HPPs and NPPs; in $m^3.10^3$)

Years	**Generated**	**of which: discharged**					
		Total	**Of which: discharged yet untreated**				
			Total	Surface water areas	In Aquifers	In public sewerage	
						Without the Sofia WWTP	with the Sofia WWTP
1994	203270	192811	105745	65968	1038	20721	18347
1995	223993	213630	103449	64181	688	18748	19832
1996	212925	196765	102893	63257	791	19870	18975

Table 13 Wastewater discharged from the public sewerage (in $m^3.10^3$)

Years	Total	Untreated	Treated	
			Total	through biological methods inclusive
1994	228014	76329	151685	149832
1995	215778	73358	142420	140570
1996	226288	77313	148975	147105

Table 14 Summarized information on wastewater in the Danube River basin – relative share (%) of untreated and biologically treated water

Basin	Year	% of untreated waste water	% of biologically treated water out of the total waste water quantity
Total for the	*1994*	*41,6*	*41,4*
	1995	*38,9*	*38,7*
Danube basin	*1996*	*39,8*	*38,9*

Table 15 Data on the state of the solid waste landfills in towns with over 10 000 inhabitants in the Danube basin

Number of SW landfills	Of them by the type of waste (number)			Waste by years Tonnes $.10^3$			Without facilities for (number)			Involving a risk for pollution (number)
-	SW	SW and Industrial	SW and Industrial and Hazar-dous	1995	1996	1997	Layering	Drain-age	Collecting shaft	-
38	11	10	17	1141	1012	1314	22	28	24	23

Table 16 Average annual values of basic water quality indicators (1996)

River	**Indicator**							
Mouth or output	DO	Permanga-nate oxidability	BOD_5	NH_4-N	NO_3-N	Dissolved substances	SS	Phosphates
Maximum permissible concentration of the Third category		40	25	5.0	20	100		
Danube	9.7	4.5	3.7	0.35	1.85	267.3	46.6	0.06
Ogosta	8.4	5.4	3	0.61	6.23	476.2	50.4	0.56
Iskar	10.9	8.5	5.3	1.24	3.28	314.7	73.6	0.31
Vit	10.7	6.7	4.1	0.73	2.31	314.7	37.2	0.26
Ossam	10.7	8	4.2	0.57	3.45	393.7	47	0.18
Yantra	8.3	5.6	4.9	0.37	2.58	310	38.4	0.06
Russenski Lom	8.1	9.9	11.3	1.07	8.6	638	502.4	1.24

Table 17 Fluctuations range of indicators examined for the frontier points of the Bulgarian section of the Danube river

Indicator in mg/l	Novo Selo, km. 833	Silistra, km.375
BOD_5	1.4-1.7	2.0-4.5
$N\text{-}NO_3$	0.4-2.9	0.7-3.0
$N\text{-}NO_2$	0.01-0.09	0.01-0.09
$N\text{-}NH_4$	0.02-0.52	0.07-0.44
$P\text{-}PO_4$	-	0.01-0.10

Table 18 Fertilizers used in the area of the Danube River basin

Year	N (tons)		N kg/ha	P_2O_5 (tons)		P_2O_5 - kg/ha	K_2O (tons)		K_2O - kg/ha
-	Used	Need	Used	Used	Need	Used	Used	Need	Used
1981	515833		10.99	423180		9.016	125978		2.684
1995	129545	307504	2.760	12426	228444	0.268	156	84940	0.003
1996	151883	307504	3.236	12824	228444	0.276	187	84940	0.003
1997	179538	307504	3.877	16828	228444	0.363	1864	84940	0.04

Table 19 Estimated potable water need of the population in the Danube basin

Population	**Quantity of water need estimated in m^3/day**	
Year	to the year 2000	to the year 2010
3897255	**941048.**	**1011366.**

Estimated volume of the fecal-household water discharged by the population in the Danube basin

Population	**Calculated quantity of the fecal-household water in $m^3.10^3$/day**	
Year	to the year 2000	to the year 2010
3897255	**846.943**	**910.230**

Estimated quantity of solid waste generated by the population in the Danube basin

Population	**Average annual quantity in tonnes.10^3**
Period	2000 - 2010
3897255	**1247.122**

Table 20 The hot spots of the main Bulgarian tributaries of the Danube River

River basin	Most polluted sections	Sources of pollution	Indicators above maximum permissible concentration at minimum water quantities
Ogosta (st.Kobiliak)	River Varteshnitza below town Vratza	Plant "Himko Vratza" and Municipal waste water treatment plant	$N\text{-}NO_2$ -0.09-0.15mg/l $N\text{-}NH_4$ 10-12 mg/l
Iskar	Upstream the town Novi Iskar	Poor operation of Sofia WWTP	BOD5=15-17 mg/l $N\text{-}NO_2$ up to 0.18 mg/l $N\text{-}NH_4$ up to 7.3 mg/l
Vit	Downstream the town	45% of the sewage of the town of Pleven are discharged untreated 45%	BOD5= 38 mg/l/'94 N-NO2=0,395 mg/l/'95 N-NH4=14,2 mg/l/'95 PO4= 1,3 mg/l/'94 SS=277 mg/l/'94 Oils '94&'95
Osam	Downstream the town of Troyan	Laminates factory and industrial and waste waters of Troyan	BOD5=60-68mg/l
	Downstream the town Lovetch	Industrial and sewage waters of the town Lovetch	BOD5=28-30mg/l $N\text{-}NO_2$=0.10-0.14mg/l
Yantra	Downstream the town Gabrovo	Sewage system of Gabrovo	BOD5=30-39mg/l $N\text{-}NH_4$=6.0-11.3mg/l
	Downstream the town V.Tarnovo	Sewage system of V.Tarnovo	BOD5=13-17mg/l $N\text{-}NO_2$=0.11-0.14mg/l
	Downstream the town Gorna Oriahovitza (st.Varbitza)	Sugar plant, Sewage system of Gorna Oriahovitza and Liaskovetz	BOD5=140-160mg/l $N\text{-}NO_2$ =0.19mg/l $N\text{-}NH_4$= 8.13mg/l
	River Rositza - Downstream the town Sevlievo	Industrial and sewage water of the town Sevlievo	BOD5=14-16mg/l $N\text{-}NH_4$= 8.0mg/l
Russenski Lom	River Beli Lom - Downstream the town Razgrad	Antibiotic plant Industrial and sewage water of the town Razgrad	BOD5=25-27mg/l $N\text{-}NO_2$ = 0.11mg/l $N\text{-}NH_4$ = 6.20mg/l

Table 21 Industrial hot spots

No	Location	River Basin	River	Priority
1	After IWWTP-Gorna Oriahovitza	Yantra River Basin	Yantra River	High
2	After IWWTP for Fertiliser plant "Chimko"-Vratza	Ogosta River Basin	Debnika River	High
3	After IWWTP for Pharmaceutical plant "Antibiotic" Razgrad	Rusenski Lom River Basin	Beli Lom River	High
4	After IWWTP-for Metallurgical plant Kremikovtsi	Iskar River Basin	Lessnovska River	Medium
5	After IWWTP- for Elatsite Mining	Iskar River Basin	Malak Iskar River	Low

Table 22 Agricultural hot spots

No	Location	River Basin	River	Priority
1	After Pig farm, Studeno Buche vi	Iskar River Basin	Buchka	-
2	After Military animal-breeding complex Vratza	Ogosta River Basin	Leva	-
3	After Inter co-operative enterprise "Pig complex", Knezha	Iskar River Basin	Iskar	-
4	After Pig-breeding farm in the village of Samovodene	Iantra River Basin	Iantra	-
5	After Pig-breeding farm "Geran"- town of Liaskovetz	Iantra River Basin	Iantra	-

Table 23 Remedial actions of high priority

1. **The Danube River bed from km 844 to km 375** is subject to intensive erosion processes which necessitates regular bathymetric survey.
2. **The Danube River bank at Long Tzibritza Section (km 710**) being subject to intensive erosion needs urgent fortification.
3. **The Danube River Bank at km 542 to km 536** – Yantra River estuary being subject to intensive erosion urgently requires fortification.
4. **Restoration of the water regime of the wetlands Persin and Vardin**.
5. **Restoration of the biodiversity in the Belene Island.**

Table 24 List of the municipal wastewater treatment plants

No	Name	River Basin	River	Priority
1	MWWTP-Gorna Oriahovitz and Liaskovetz	Yantra River Basin	Yantra River	High
2	MWWTP-Troyan	Ossam River Basin	Ossam River	High
3	MWWTP-Lovetch	Ossam River Basin	Ossam River	High
4	MWWTP-Vratza	Ogosta River Basin	Debnika River	High
5	MWWTP-Sofia	Iskar River Basin	Iskar River	High
6	MWWTP-Sevlievo	Yantra River Basin	Rossitza River	High
7	MWWTP-Montana	Ogosta River Basin	Ogosta River	Medium
8	MWWTP-Popovo	Rusenski Lom River n	Popovska River	Medium
9	MWWTP-Slivnitza, Kostinbrod	Iskar River Basin	Blato River	Medium
10	MWWTP-Russe		Danube River	Low
11	MWWTP-Levski	Ossam River Basin	Ossam River	Low
12	MWWTP-Svishtov		Danube River	Low
13	MWWTP-Vidin		Danube River	Low
14	MWWTP-Lom		Danube River	Low
15	MWWTP-Silistra		Danube River	Low

Table 25 List of the industrial wastewater treatment plants

No	Name	River Basin	River	Priority
1	IWWTP-Gorna Oriahovitza	Yantra River Basin	Yantra River	High
2	IWWTP for Fertiliser plant “Himko”-Vratza	Ogosta River Basin	Ogosta River	High
3	IWWTP for Pharmaceutical plant ”Antibiotic” Razgrad	Rusenski Lom River Basin	Beli Lom River	High
4	IWWTP for Iron and Steel Works Kremikovtsi	Iskar River Basin	Lessnovska River	Medium
5	IWWTP- for Elatsite Mines	Iskar River Basin	Malak Iskar River	Low

Table 26 Expected amounts of the nutrient emission

No	Name of WWTP	River basin	Reduction of BOD_5- T/a	Reduction of N - T/a	Reduction of P - T/a
Municipal Waste Water Treatment Plants (MWWTP)					
1.	MWWTP G.Oryahovitsa	Yantra River	8,456	130	13
2.	MWWTP Troyan	Ossam River	1,840	80	13
3.	MWWTP Lovech	Ossam River	1,382	177	2
4.	MWWTP Vratsa	Ogosta River	782	131	22
5.	MWWTP Sofia	Iskar River	5,823	145	629
6.	MWWTP Sevlievo	Yantra River	1,078	82	15
7.	MWWTP Montana	Ogosta River	2,473	200	22
8.	MWWTP Popovo	Russenski Lom	1,235	50	25
9.	MWWTP Russe	Danube River	12,306	716	362
10.	MWWTP Svishtov	Danube River	818	56	21
11.	MWWTP Silistra	Danube River	516	22	12
	Total:		**36,709**	**1,789**	**1,136**
Industrial Waste Water Treatment Plant (IWWTP)					
1.	IWWTP Sugar Factory G. Oryahovitsa	Yantra River	6,460	180	0.5
2.	Chimko Vratsa	Ogosta River	22	85	3
3.	Antibiotic Razgrad	Russenski Lom	253	16	2
4.	Kremikovtsi Sofia	Iskar River	113	-	-
	Total:		**6,848**	**281**	**5.5**
	Grand Total:		**43,558**	**2,069**	**1,141.5**

Table 27 Expendetures for the water sector: basic items 1994, 1996

(in BGL'000, counter value in USD)

Item	1994	cv in USD	1996	cv in USD
1. Total Investments	5609780	99464	18159712	10 4 114
1.1. for the water resources	2482128	44 009	6751329	38 707
1.2. for waste water treatment plants	1070886	18987	4147045	23 776
1.3. for urban treatment stations	367784	6520	1469513	8 425
1.4. for circulating water supply	306802	5439	1702973	9 763

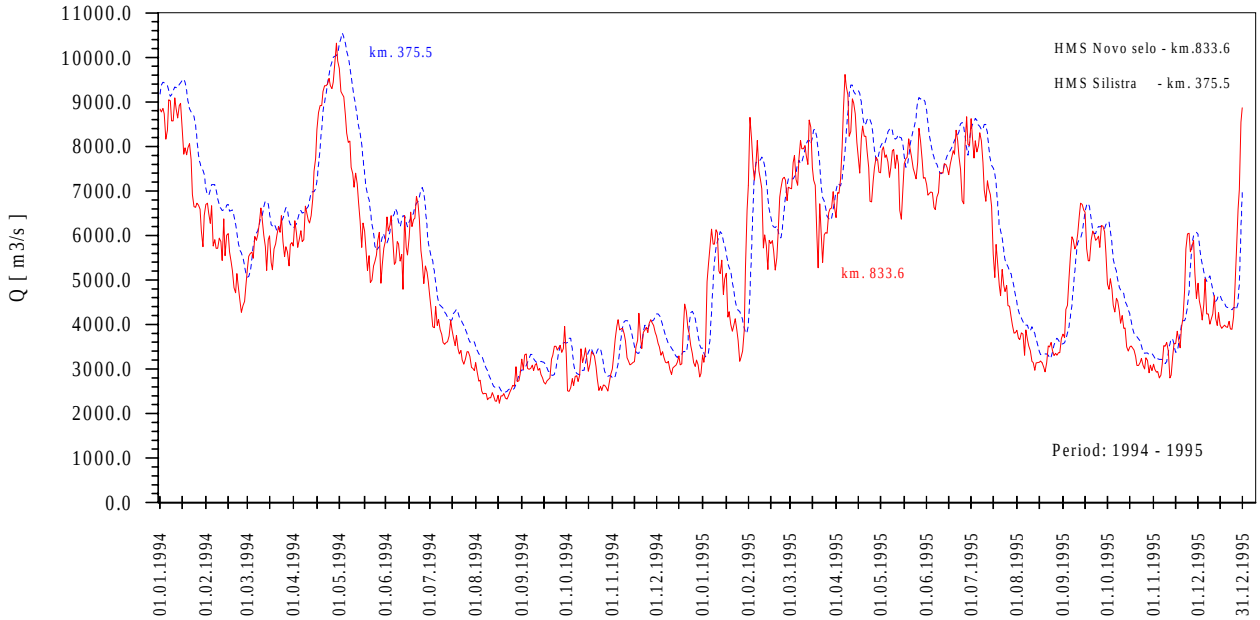
Table 28 Major projects for town wastewater treatment plants at the Danube River basin: duration and expenditures in 1997

Name of region or municipality	Duration of Project	Expenditures in BGL '000 (cv USD)
1.Region of Lovetch		
1.1. Municipality of Veliko Turnovo	1973/99	45 000 (25 568)
1.2.Municipality of Strajitza	1991/00	100 000 (56 818)
2.Region of Montana	1990/99	450 000 (255 682)
3.Region of Rousse		
3.1.Municipality of Dulovo	1987/99	100 000 (56 818)
3.2.Municipality of Isperih	1985/99	220 000 (125 000)
3.3.Municipality of Razgrad	1993/2002	50 000 (28 409)
3.4.Municipality of Rousse	1992/98	60 000 (34 091)
4. Region of Sofia - Municipalities		
4.1. Samokov	1991/99	1200 000 (681 818)
4.2. Samokov - Borovets	1991/98	300 000 (170 455)
4.3. Kubratovo	1993/98	200 000 (113636)

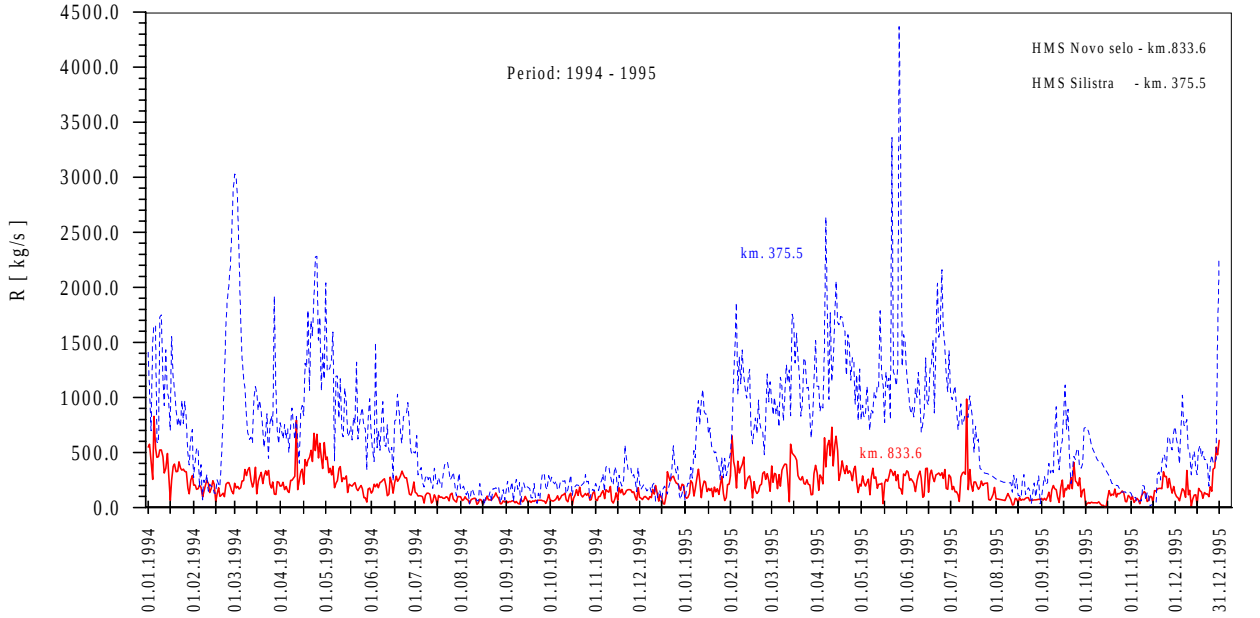
Source : The Law for the State Budget, January 1, 1998

Annex B

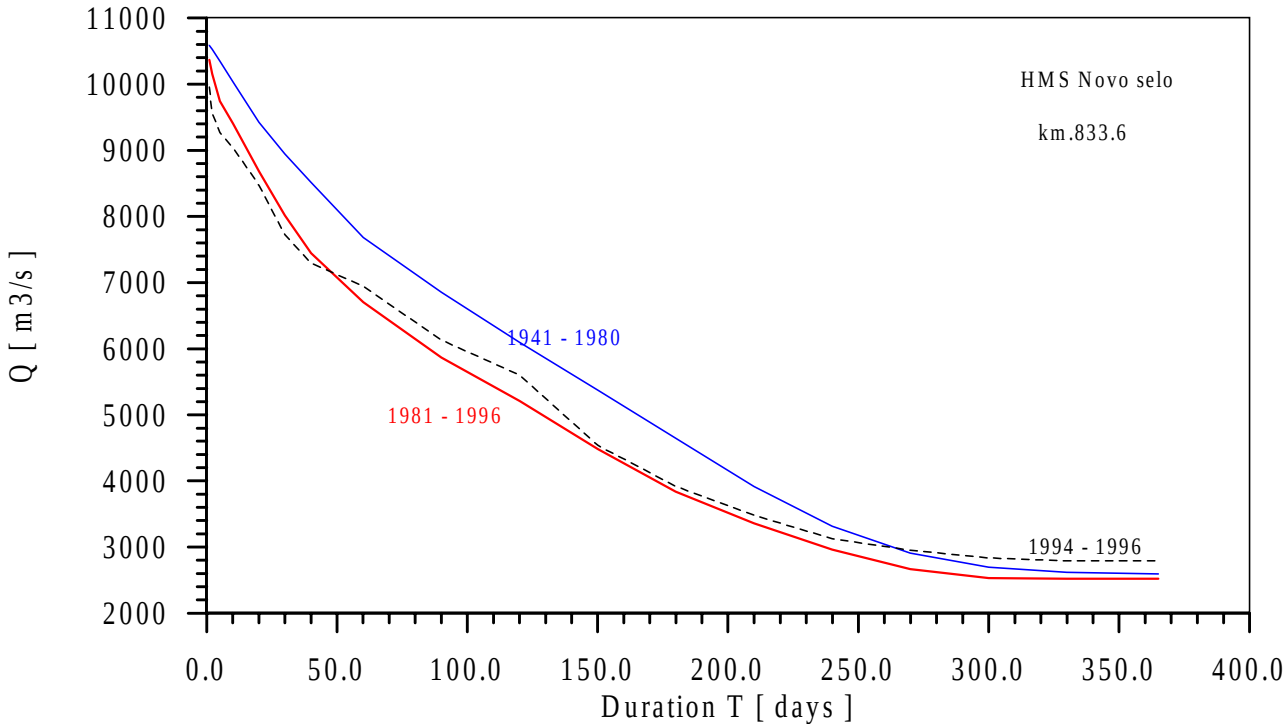
Maps and Graphics

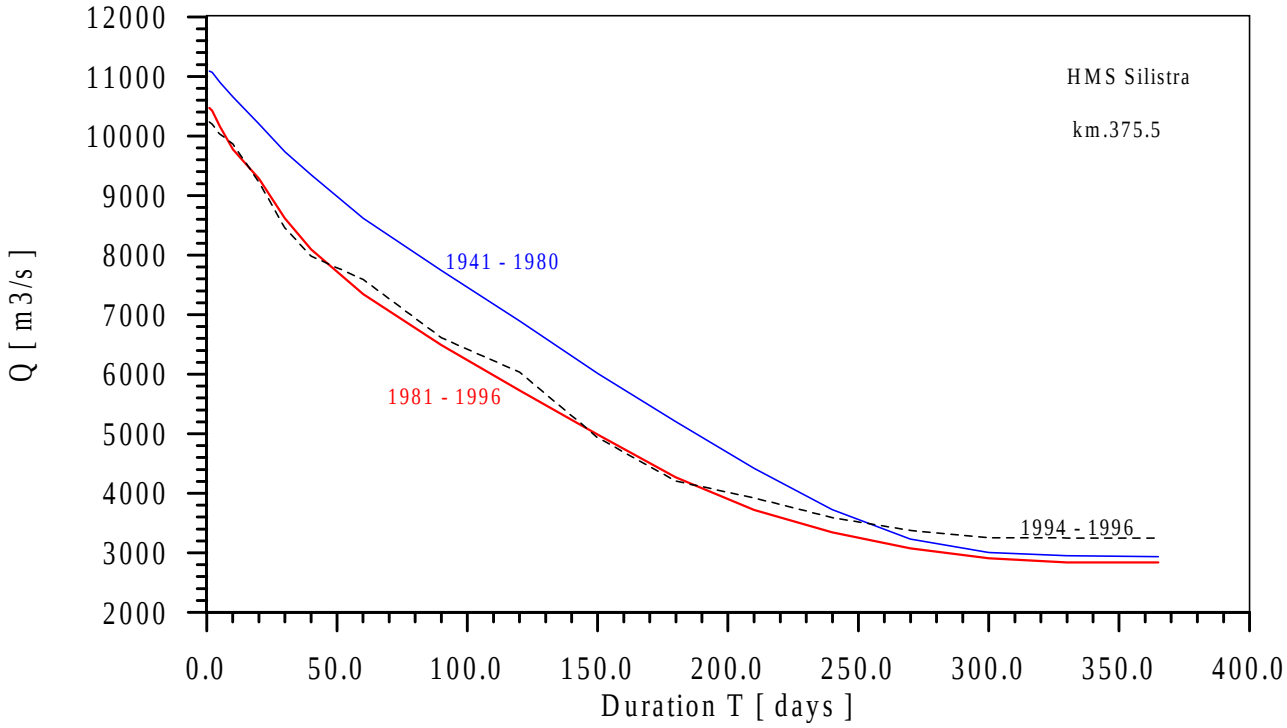


Hydrographs of the Runoff. Danube River at the towns of Novo Selo (km.833.6) and Silistra (km.375.5)

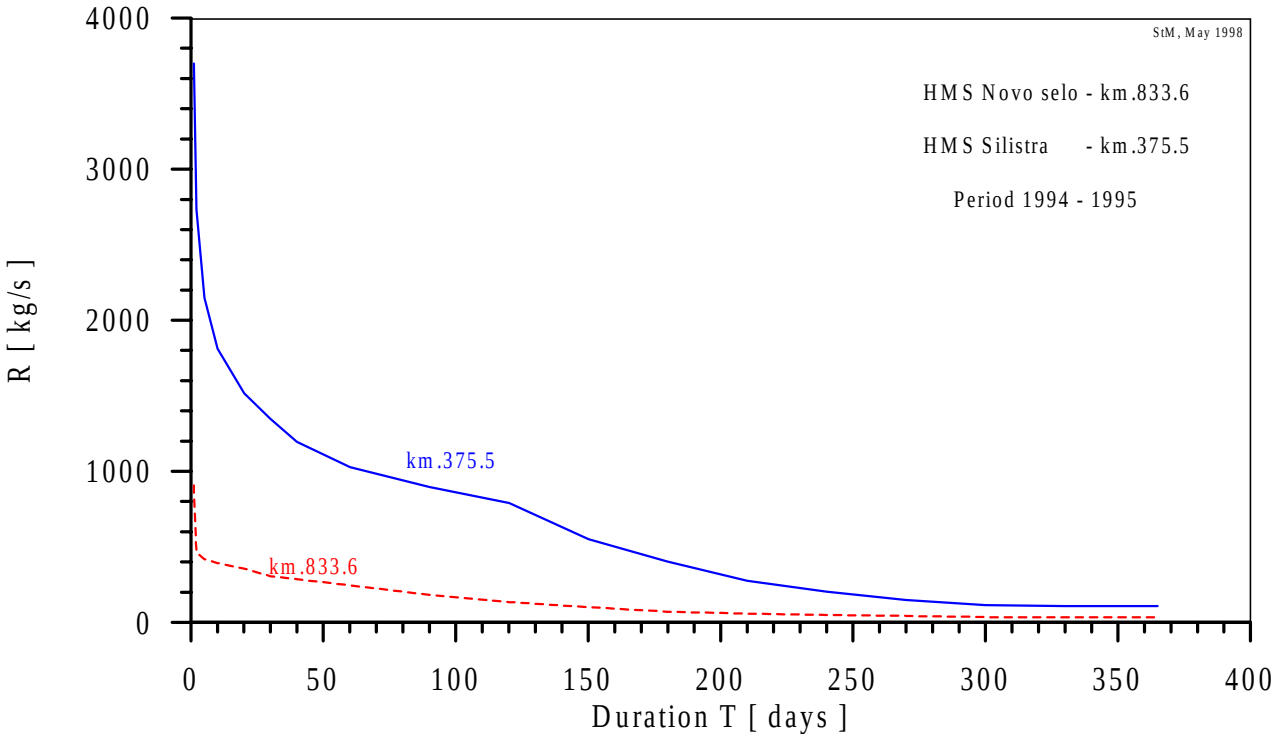


Hydrographs of the Suspended Sediment Load. Danube River at the towns of Novo Selo (km.833.6) and Silistra (km.355.5)

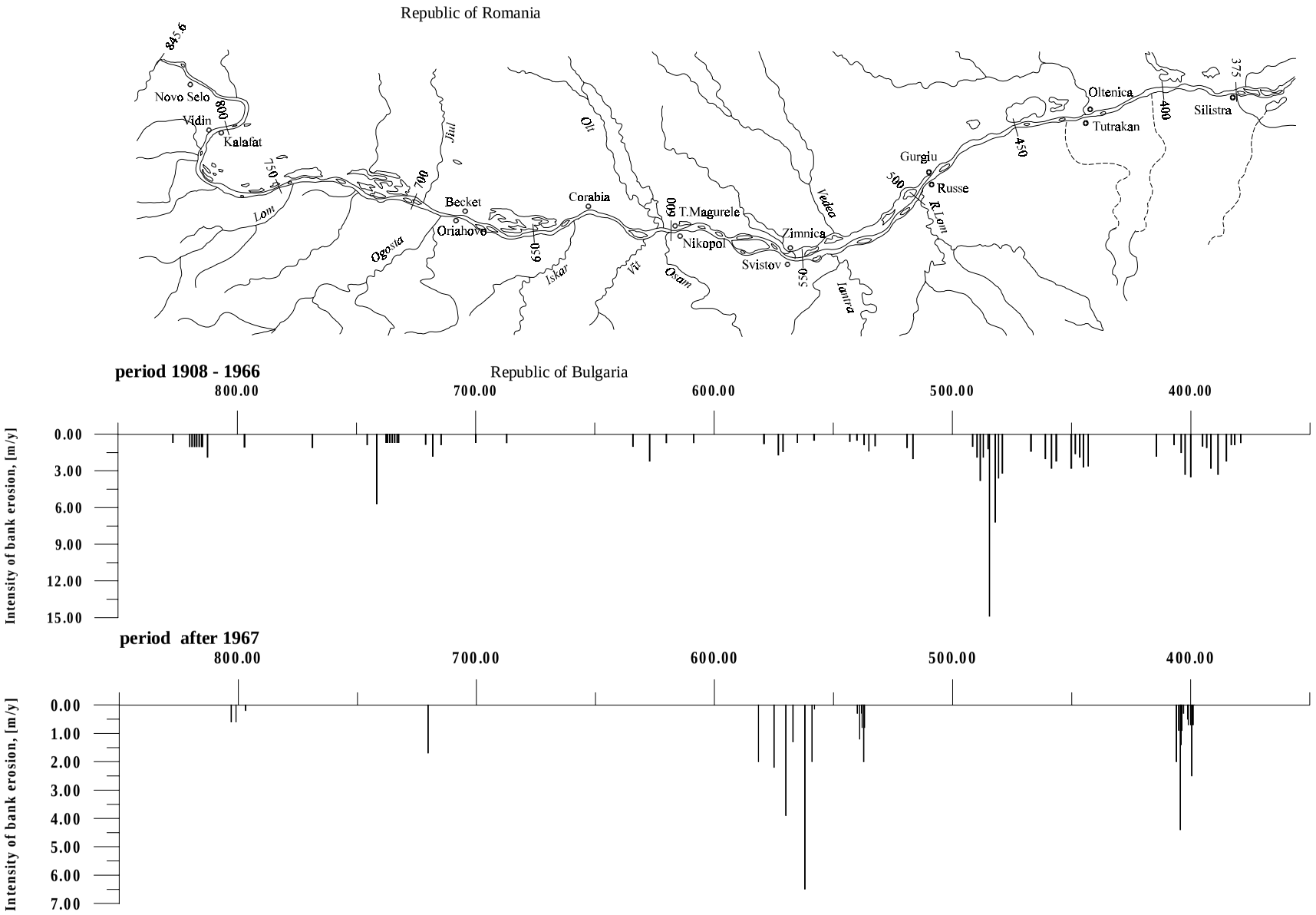




Runoff Duration Curves. Danube River at the towns of Novo Selo (km.833.6) and Silistra (km.355.5)



Suspended Sediment Runoff Duration Curves. Danube River at the towns of Novo Selo (km.833.6) and Silistra (km.355.5)



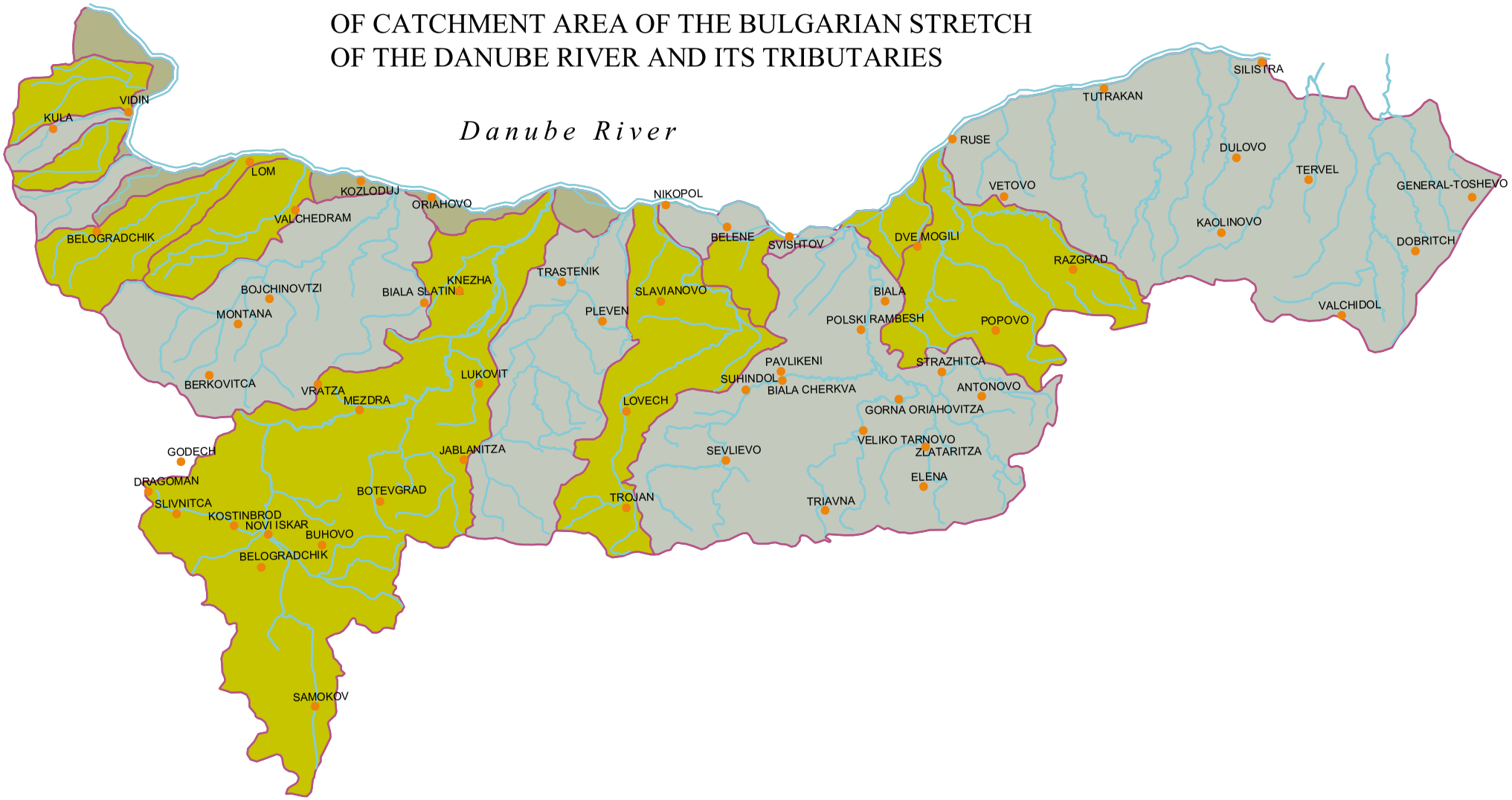
Intensity of the Bulgarian bank erosion (Sources of information: VODPROECT-1970, Dr.St.Modev-1985)

Left Bank...

Right Bank...

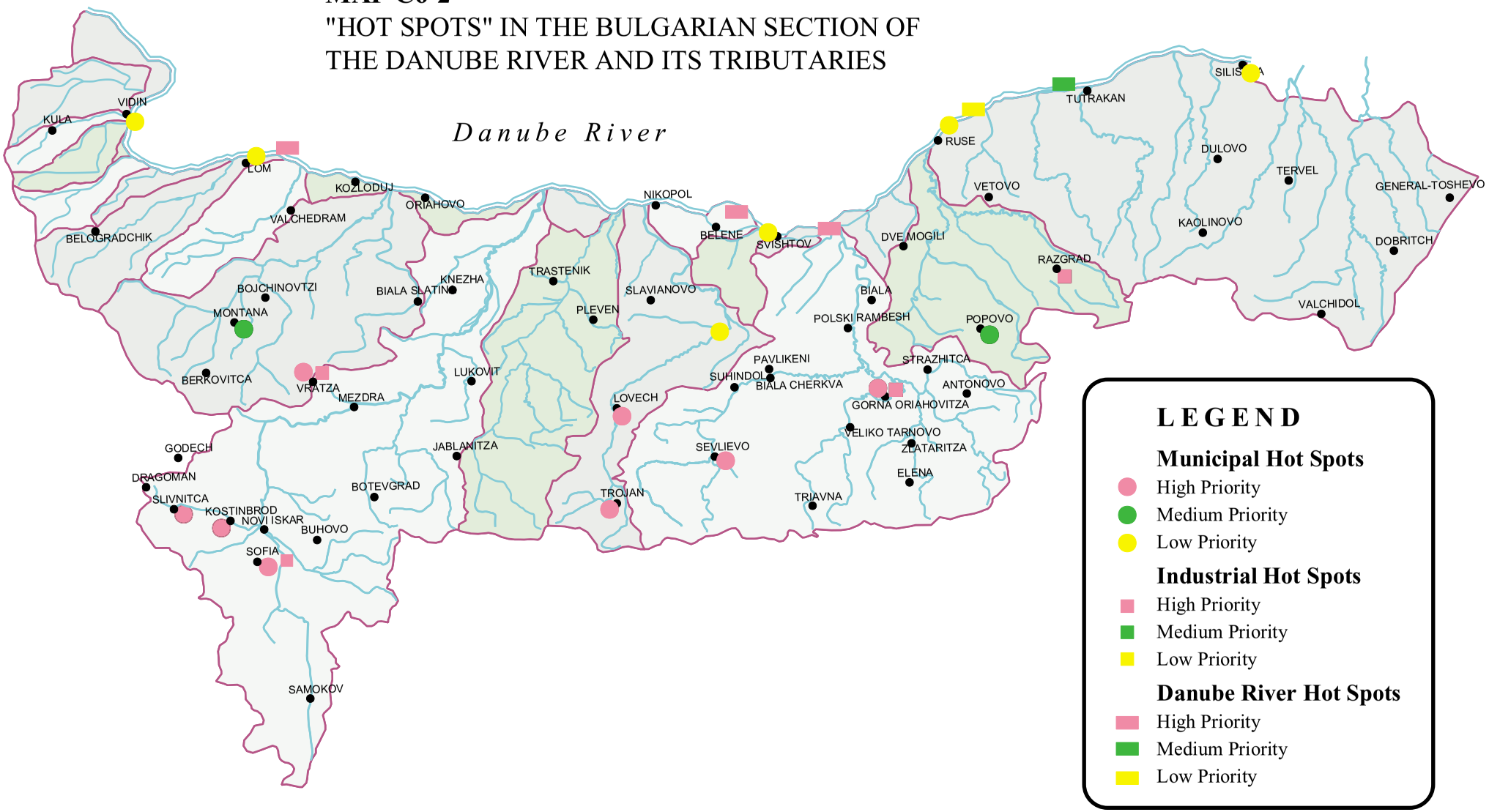
MAP C6-1

OF CATCHMENT AREA OF THE BULGARIAN STRETCH
OF THE DANUBE RIVER AND ITS TRIBUTARIES



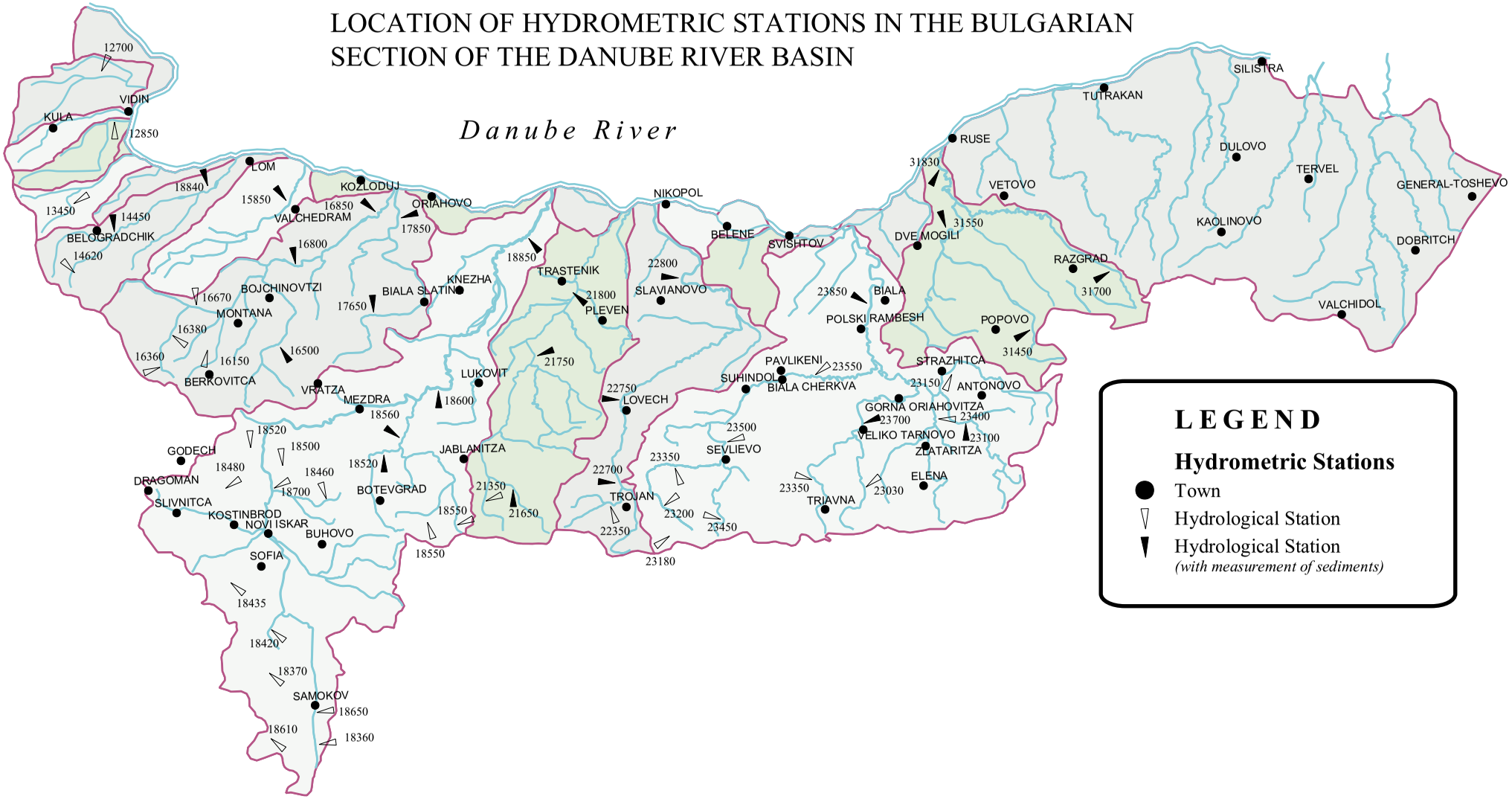
MAP C6-2

"HOT SPOTS" IN THE BULGARIAN SECTION OF THE DANUBE RIVER AND ITS TRIBUTARIES

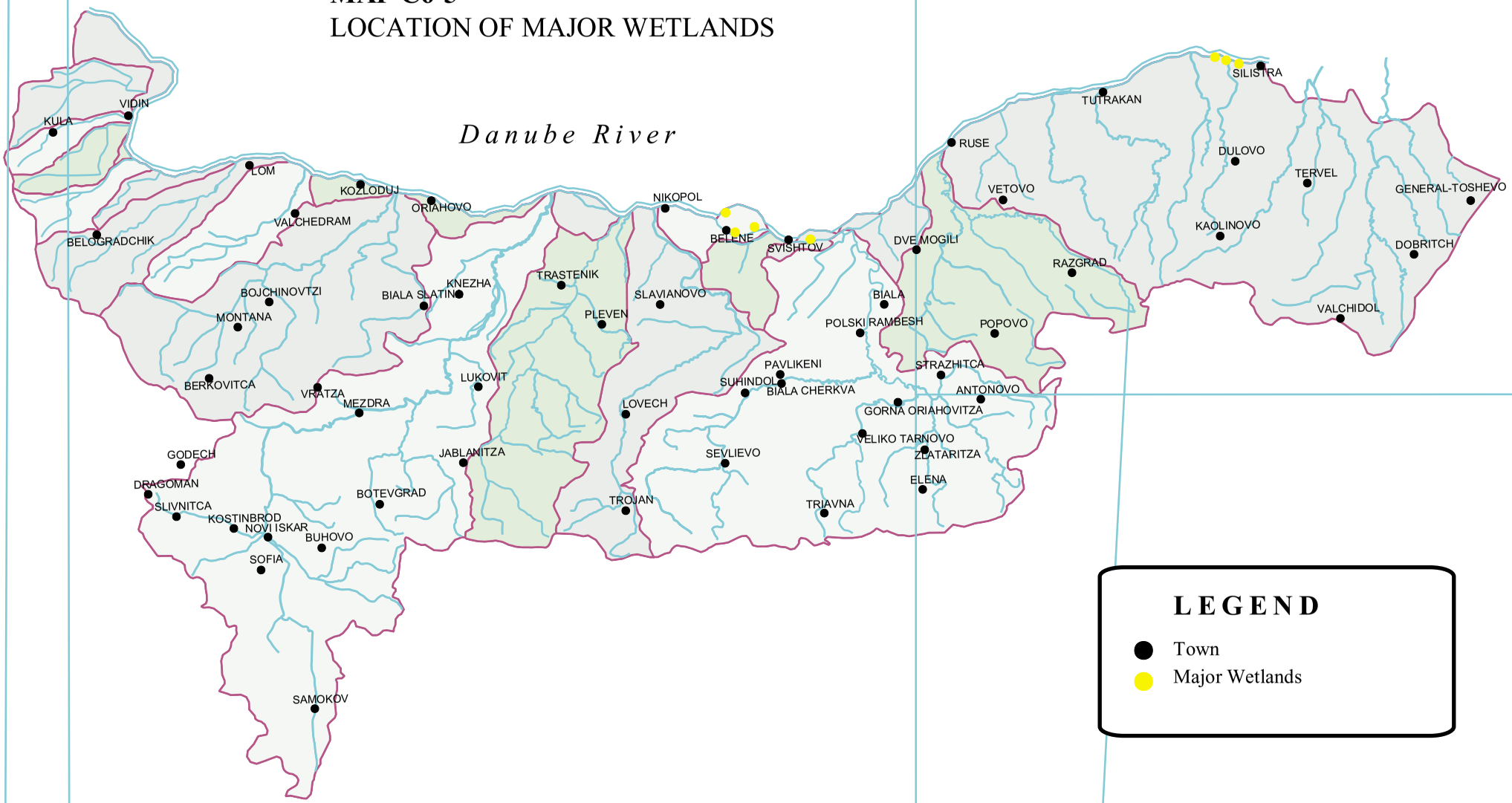


MAP C6-3

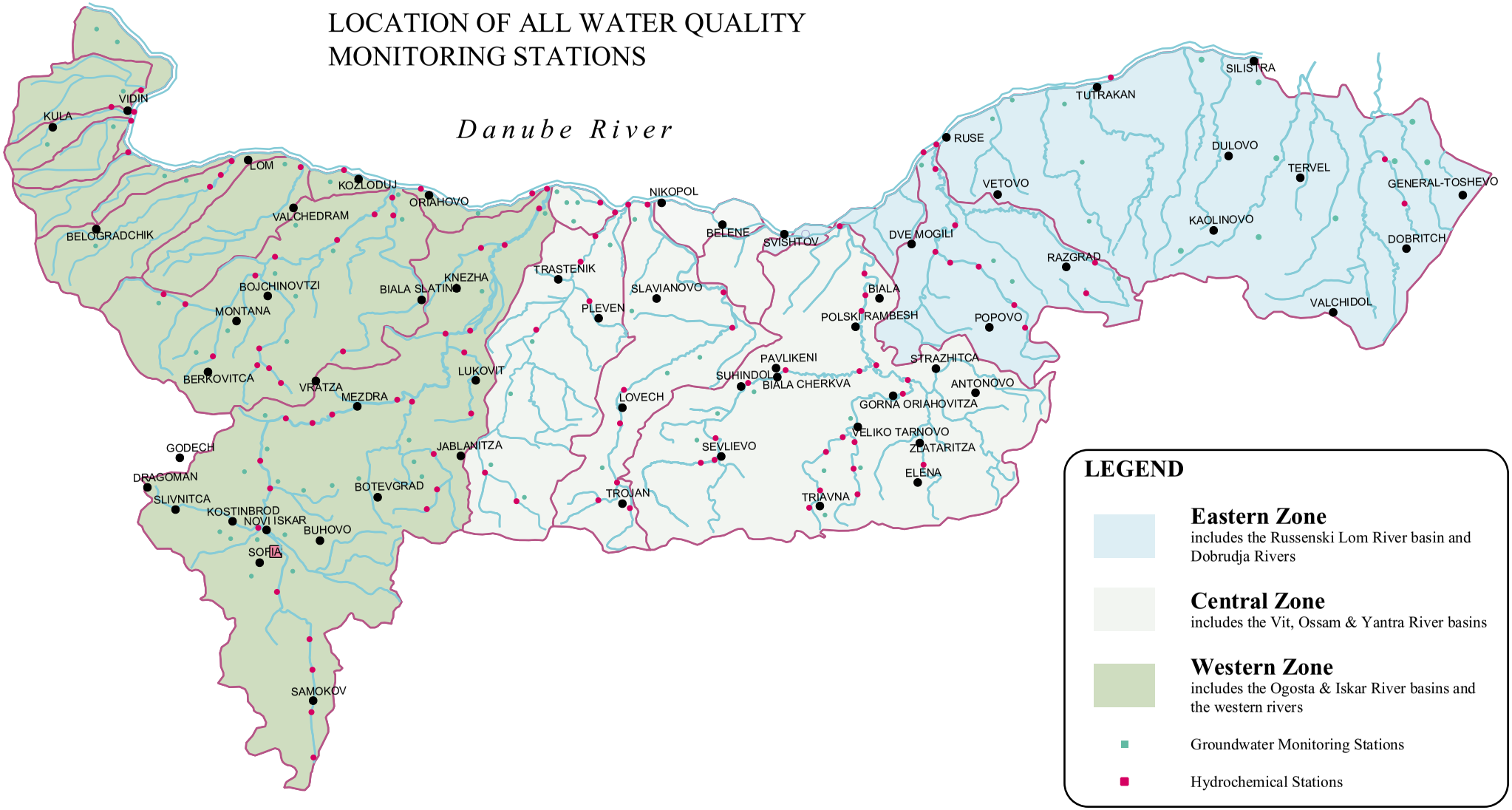
LOCATION OF HYDROMETRIC STATIONS IN THE BULGARIAN SECTION OF THE DANUBE RIVER BASIN



MAP C6-5
LOCATION OF MAJOR WETLANDS



MAP C6-6
LOCATION OF ALL WATER QUALITY MONITORING STATIONS



MAP C6-9

A DIAGRAM OF THE RIVER NETWORK

CATCHMENT AREA OF THE BULGARIAN STRETCH OF THE DANUBE RIVER AND ITS TRIBUTARIES