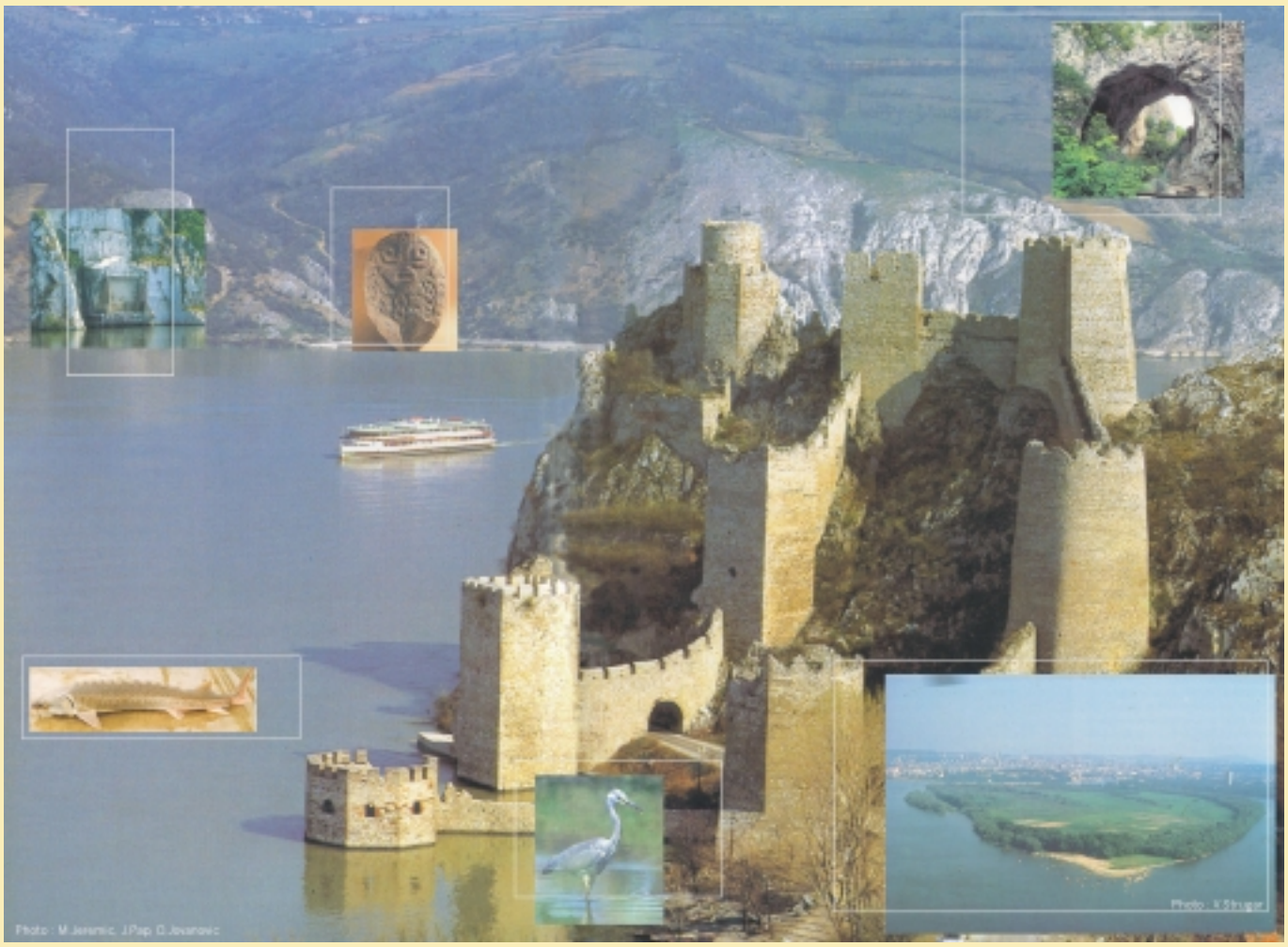
DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL PLANNING WORKSHOP
FEDERAL REPUBLIC OF YUGOSLAVIA

Novi Sad, November 24-27, 1998



FEDERAL MINISTRY FOR DEVELOPMENT, SCIENCE AND ENVIRONMENT

in cooperation with the

Programme Coordination Unit
UNDP/GEF Assistance

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Preface

The present report is based on the results of the National Planning Workshop, held in Novi Sad, FR of Yugoslavia from 24. to 27. November 1998. The main goal of the workshop and its report is to provide a comprehensive presentation of analysis concerning problems and solutions for reduction, as well as control of water pollution and its effects. The result is a national contribution to the development of the Danube Pollution Reduction Programme and a revision of the Strategic Action Plan (SAP) of the ICPDR.

The workshop was prepared by Federal Ministry for Development, Science and Development, Country Program Coordinator, Dr Zoran Čukić, facilitators Miroslav Spasojević and Aleksandar Djukić assisted by the secretariat.

The National Planning Workshop was attended by participants from various sectors: Federal and Republican Ministries for Environment, Agriculture and Water Management; Federal and Republican Hydrometheorogical Institutes; Universities; Research Institutes, NGO's, and Private Sector. A list of participants is attached to this report in Annex.

The present report was prepared by Miroslav Spasojević - Introductory part, Dr Radoje Laušević - Identification and Description of River Basin Areas and Sector Strategies, Dr Miodrag Božović - Agriculture, Branislav Božović - Industry and prof. Luka Knežić – Municipalities.

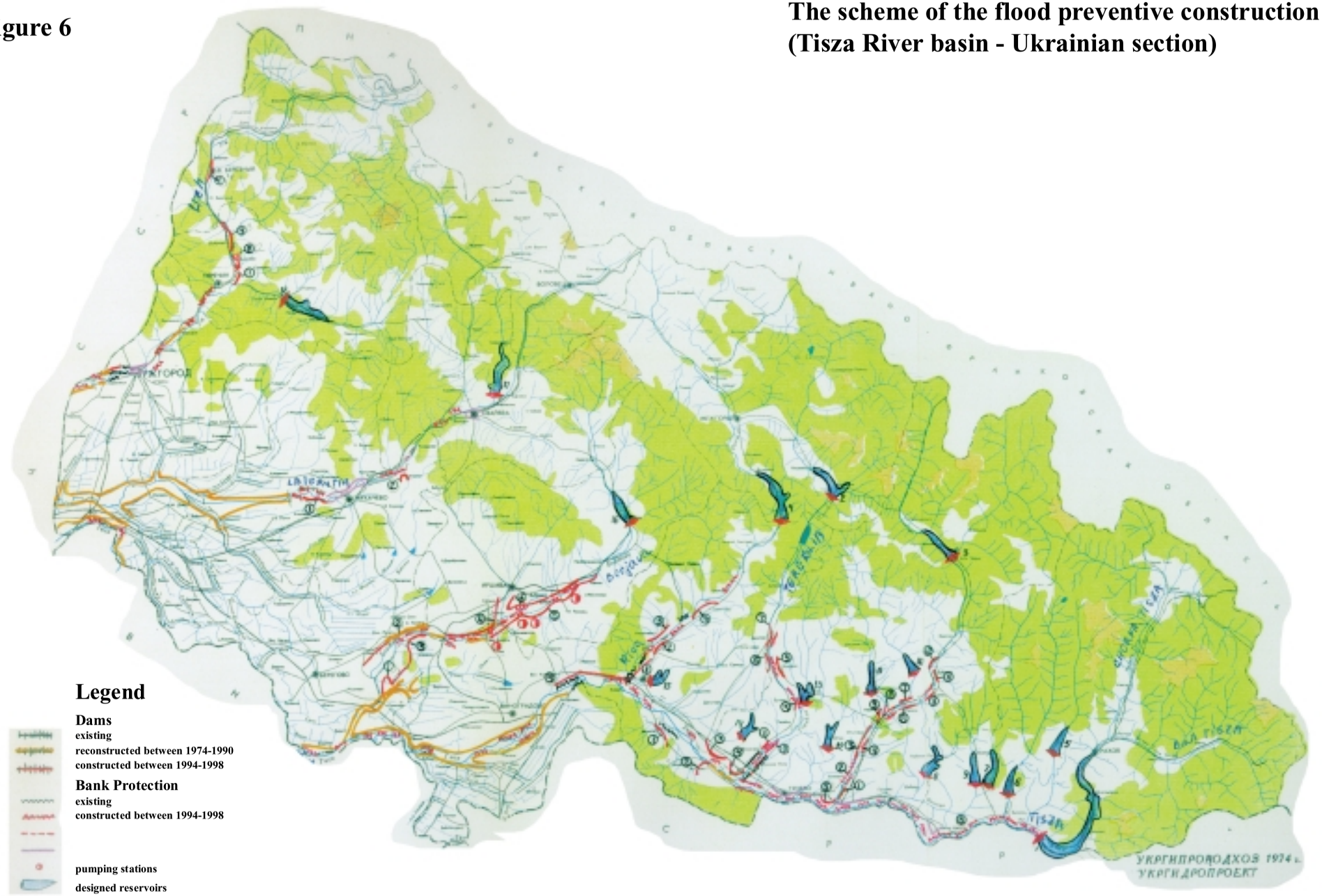
Valuable technical assistance was given by Aleksandar Djukić.

A team of international experts from UNDP/GEF, Maxime Belot and Marcela Fabianova gave assistance, support and guidance in the methodological approach and report writing. Overall conceptual guidance and technical advice was given by Joachim Bendow, UNDP/GEF Project Manager, to reinforce national initiatives.

Excellent premises and conditions for the organization of the workshop were offered by Institute for Nature Conservation of Republic Serbia – Novi Sad Department.

Figure 6

The scheme of the flood preventive construction (Tisza River basin - Ukrainian section)



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Executive Summary

In the frame of the Environmental Danube Programme of the ICPDR and with the assistance of UNDP/GEF, a team of Yugoslav experts has elaborated National Reviews, providing information on water quality, analyzing financing mechanisms, describing social and economic framework conditions and developing projects and programs for pollution reduction, improvement of water quality, sustainable management of aquatic ecosystems and protection of resources. These elements, as well as the results of the National Planning Workshop shall constitute a national contribution to the development of the Danube Pollution Reduction Programme and shall provide elements for the revision of the Strategic Action Plan (SAP) of the ICPDR.

This present report shows the results of the National Planning Workshop, which took place in Novi Sad, FR of Yugoslavia, from 24. to 27. November 1998. It is one of 11 national workshops, which have been organized in all participating countries, signatories of the Danube River Protection Convention or adhering to its principles.

The territory of the FR Yugoslavia, with the respect to its natural diversity and wealth, is ecologically one of the most important geographical regions in the Europe. Yugoslavia has a preserved biodiversity, a great wealth in bodies of water – rivers, lakes and seas. On the territory of the FR Yugoslavia there are nine national parks, 12 national reserves (scientific, special and other) and five natural reserves under international protection.

Danube River basin (DRB) in FR of Yugoslavia covers 87% (88,919 km^2) of the state territory (102,173 km^2). It represents most developed and most densely populated part of the Federative Republic of Yugoslavia (FRY), comprises the most fertile farmland, the major administrative, cultural and educational centers, the largest power-generating and industrial facilities, the main traffic corridors, as well as well known historical landmarks and nature reserves. Therefore, sustainable development of DRB represent priority and prerequisite for successful development of FRY within community of European nations. For the purpose of this workshop following river basin areas have been identified:

- **Danube River Basin (Danube Corridor) – covers 11,610 km^2**
- **Tisa River Basin – covers 8,994 km^2**
- **Sava River Basin – covers 31,046 km^2**
- **Velika Morava River Basin – covers 37,269 km^2**

In the area of environmental protection in the FR of Yugoslavia there is discord between the wishes to improve the environment and the available financial resources. The perception of natural resources, both renewable and nonrenewable, as almost free commodities whose utilization requires no expense has contributed to the irrational use with negative environmental effects.

The state of environment in the FR of Yugoslavia was especially affected in period between 1992 and 1995 by international embargo and imposed UN sanctions.

The suspension of international cooperation and technical and financial assistance for resolving environmental problems cause a special problem in environmental protection.

The medium annual precipitation rate in Yugoslavia is between 500 mm/year in the northern and 2,000 mm/year in the south-western region of the country. The greatest quantity of waters and consequently the greatest share of pollutants come to Yugoslavia from the upper fluvial territories. This is why Yugoslavia is particularly interested in cooperation with Danubian countries.

Quality control of the land surface waters comprises both general and specific control. Water quality is controlled on 95 river profiles .The control of potable water withdrawal or water in recreation zones is periodic from once a week to once a month, depending on the size of the waterworks.

Approximately 70% of the drinking water in Yugoslavia are from groundwater sources and therefore particular attention is paid to its control. The great deal of ground water resources are closely connected and influenced by water courses.

Facilities for waste water treatment are not adequately developed, neither in communities, nor in manufacturing or mining industry, and due to the high cost even existing facilities are seldom used. Even the largest cities in Yugoslavia e.g. Beograd, Novi Sad, Nis and others, do not have appropriate municipal wastewater treatment plants.

Based on the production and consumption of raw materials, it is estimated that in Yugoslavia, 8 million tons of ashes and more than 900 thousand tons of low toxic industrial waste is created by energy producing plants.

In addition, it is estimated that the volume of solid waste in Yugoslavia, as a whole equals to 0,6 kg/inhabitant/day of solid waste. Approximately half of Yugoslav population is encompassed by the system of organized solid waste collection.

According to the preliminary cadaster inventory cc. 250 thousand tons of hazardous waste is produced annually in Yugoslavia.

Environmental protection in Yugoslavia is given increased attention by the public in general, and by state institutions at all levels. Despite economic underdevelopment of the country, environmental protection and management are integral part of the national macroeconomic policy. More efficient environmental protection is made difficult due to the lack of financial resources. Thus there is disharmony between the needs and the realistic possibilities, i.e. between legislative norms and actual practices.

The main problem is lack of financial resources, and hence, in the future, without assistance of the international community, it is difficult to expect significant achievements in this area. Since there is a lack of financial resources, the most realistic strategy is to evaluate different developmental options based on their impact on the environment.

Particular causes and effects of pollution from point and diffuse sources, as well as transboundary water pollution have been analyzed in a sector approach, considering agricultural activities, industrial activities and the municipal sector. Based on the sector analysis, it has been identified as core problem ***"Inappropriate Human Activities in the Yugoslavian Part of the Danube River Basin Area".*** Direct causes of the core problem were described as "Agricultural practices not responding to environmental protection", from the agricultural sector, "Pollution as a result of inadequate industrial practices and use of resources " from the industrial sector and "Municipal activities affecting (endangering) water quality" from the municipal sector.

A number of effects of "Inappropriate Human Activities in the Yugoslav Part of the Danube River Basin Area" were identified, among them the most important are: soil pollution; initiation and intensification of erosion; water regime adversely affected; eutrophication; water resources pollution; air pollution, that could lead in further environmental consequences, such as, deterioration of protected wetlands, decrease of quality and quantity of water resources, degradation of soil and landscape and deterioration of forests and crops in zones of influence.

Considering the result of the problem analysis, the program objective was defined as ***"Water Quality Improved in Yugoslavian Part of the Danube River Basin through Sustainable Economy Activities"***, which will contribute to the overall goal of the UNDP/GEF Danube Pollution Reduction Programme: ***"Achievement of Sustainable development in the DRB"***. To achieve this objective sector objectives were stated "Environmentally Sustainable Agriculture and Land Practices Achieved", "Appropriate Industrial Practice and Resources use Adopted", and "Municipal Activities in Accordance with Water Resources Protection".

In order to identify sector strategies, each of the priority sectors were thoroughly examined:

Agriculture: FR Yugoslavia is agro-industrial country. Agriculture and agro-industrial production still hold and will maintain an important position in the whole economic structure. Participation of agriculture in gross national income amounts to 23,8%, and the participation of agro-industrial complex amounts to 52,2%.

In the sector **Agriculture** as the main causes of core problem which is stated as ***"Agricultural Practices not Responding to Environmental protection"***, direct causes, "Inappropriate crop production and land use", "Inappropriate livestock production" and "Inappropriate forest management" have been identified. In order to achieve sector objective stated as "Environmentally Sustainable Agricultural and Land Use Practices Achieved ", it is required to:

- *"adopt appropriate practices in crop and animal breeding production"* by solving technical and technological problems in manure treatment, undertaking measures for conservation and revitalization of soil through monitoring fertility and degradation process and ensuring implementation of appropriate irrigation measures.
- *"implement adequate wetlands management implemented"* through implementing transboundary cooperation in wetlands conservation, undertaking measures for increasing of protected and revitalized wetland areas and by increasing public awareness in wetland protection.
- *"introduce environmentally friendly forest management"* by forestation of eroded lands, forestation of wetlands with autochthonous species and increasing public awareness for forestation necessity.

Industry, Mining and Energy: The industry represents the activity of the vital importance for development of the national economy. However, recent period in FRY is characterized by dramatic fall-down in industrial production due to several joint processes: disintegration of former Yugoslavia reduce available market, UN economic sanctions, economic depression and transition period in FRY, decreasing of technological discipline, etc. However, some of industrial activities, together with agriculture production, preserve national economy at respectable level.

In the sector **Industry, Mining and Energy** as the main causes of core problem, which is stated as ***"Pollution as a result of inadequate industrial practices and use of resources"***, direct causes "Use of out-dated technologies", "Inadequate technological process management", "Inadequate industrial waste management", "Dissipation of mining resources" and "Unbalanced energy plants capacities and energy requirements" have been identified. In order to achieve sector objective stated as "Appropriate industrial practice and resource use adopted", it will be necessary to:

- *"apply appropriate technological process management in industry"* by ensuring selection of appropriate technologies, introducing optimal management of industrial processes, making available financing resources for new technologies and enabling adequate knowledge transfer and know-how through adequate training of managing and operational structure.
- *"achieve sustainable industrial waste management"* by enforcing the legislation in waste management through harmonization and updating existing legal regulations, stabilizing existing and build up new industrial waste water treatment plants. establishing unified database through appropriate monitoring activities and enabling access to new achievements in economic evaluation of secondary materials from industrial waste.

- *"optimize use of mining resources "* through selection of appropriate mining and ore processing technologies, implementing adequate waste water and solid waste treatment in mining, rehabilitation of areas particularly endangered by mining activities, enforcing legislation in mining activities and by implementing educational and informational programs concerning mineral resources economization.
- *"establish adequate use of power plants"* by applying optimal process management of energy plants, implementing adequate energetic plants waste treatment as well as by ensuring public participation in decision making on economizing energy use.

Municipalities: An adequate collection and treatment of domestic and industrial waste waters in urban and rural settlements, before their ultimate disposal into the water course (recipient), up to their residual pollytional load which is harmonized with the self-purification capacity of the recipient, practically cancel the related environmental problems. The same is true with the municipal solid waste if it is disposed on a proper sanitary way. However, the real situation in Yugoslav part of DRB is different from the above, which lead to environmental pollution.

In the sector **Municipality** as the main causes of sector core problem, stated as ***"Municipal activities affecting (endangering) water quality"***, direct causes "Inadequate management of waste waters in urban settlements", "Inadequate management of waste waters in rural settlements" and "Weaknesses in municipal solid waste management" have been identified. In order to achieve sector objective "Municipal activities in accordance with water resources protection" it is required to:

- *"achieve appropriate waste water management in urban areas "* through ensuring appropriate municipal waste water treatment, undertaking measures for upgrading and extending sewer systems, ensuring optimal industrial waste water pretreatment and by enforcing legal and monitoring framework.
- *"collect and dispose waste water in rural areas properly"* by improving sanitary standard in rural areas, arising public awareness upon environmental problems in rural areas through informational and educational programs and making funds available for construction of appropriate waste water disposal in rural areas.
- *"introduce adequate municipal solid waste management"* by ensuring closure and conservation of open dumps, ensuring legal and physical conditions for solid waste disposal in sanitary way, undertaking measures for primary recovery and disposal of municipal solid waste and ensuring informational and educational programs about environmental problems related to municipal solid waste.

The results of the workshop demonstrated that projects to implement the strategies for pollution reduction in the DRB are clearly needed. **Priority projects** have been identified as the following:

In the **agricultural sector**:

- Research studies on the use and processing of the farm waste;
- Construction of WWTP for large capacity farms (over 20,000 fatlings per cycle) at the locations of Vrbas (DP "Farmakop"), Žagubica ("1. decembar") and Belgrade (DP "Surčin");
- Ecological studies of the Danube basin;
- Project for reforestation of 30% of eroded soil;

In the **industry, mining and energy sector**:

- Study and the Project on Integral Rehabilitation of Mining and Smelter Complex “RTB Bor”
- W.W.T.P. and sludge disposal for Chemical industry "Prahovo"
- W.W.T.P. for Pulp and paper industry "Fopa" Vladicin Han
- Revitalization and rehabilitation of mining complex “Ajvalija – Kisnica”

In the **municipal sector**:

- Reconstruction of sewer network and construction of WWTP for the city of Belgrade (subsystems "Veliko Selo" and "Ostruznica")
- Reconstruction of sewer network and construction of WWTP for the city of Novi Sad
- Reconstruction of sewer network and construction of WWTP for the city of Nis
- Regional sewer system and WWTP Vrbas-Kula-Crvenka
- Reconstruction of sewer network and construction of WWTP for the city of Zrenjanin

1. Introduction

1.1. Background

The Yugoslav economy and society are currently undergoing through specific developmental phase characterized by transition, post-sanction and to certain extent elements of post-war situation in the close neighborhood. The scale and time frame of environmental improvements is closely linked with overcoming of these problems, particularly with success of transition process. Economic development and economic recovery are the main preconditions for global development in Yugoslavia.

With respect to economic development environmental protection in Yugoslavia is satisfactory. However, in this area as well, improvements and changes in the current system are necessary. Although the improvement of environment protection can not be placed at the top of the list of priorities, it must be included into the selection criteria for development options.

The most serious environmental problems in FR Yugoslavia are localized in specific areas- hot spots – where point sources of pollution could be cause of hazard to the local population. Pollution in hot spot areas are due to agro-industrial, industrial, mining, energy producing and municipal waste treatment activities. Very specific hot – spot area is Djerdap Reservoir (Iron Gate). Large quantities of sediments, mostly coming with incoming waters (Danube, Sava, Tisa and others), consist of inert particles on which organic mater together hazardous and toxic mater can be absorbed, are settling in this reservoir. Regarding this fact one can designate Djerdap as a settling tank of Europe.

As a result of economic situation there is discord between the wishes to improve the environment and the available financial resources. Development concept, based on underpriced inputs (raw materials and energy) which was to a greater or lesser degree implemented in almost all-Eastern European countries, led to the negative consequences in certain aspects regarding the environment. The perception of natural resources, both renewable and non-renewable, as almost free commodities whose utilization requires no expense has contributed to the irrational use.

The state of environment in the FR of Yugoslavia was especially affected in period between 1992 and 1995 by international embargo and imposed UN sanctions. Operating under conditions of closed economy, coupled by with embargoed procurement of energy, the economy and population of Yugoslavia were veered towards the utilization of their own energy sources. Wood is being used much more over its natural capacities, which led to an increase in the degree of deforestation and to instability in the biological balance of vast areas, which negatively effected the environment.

The suspension of international cooperation and technical and financial assistance for resolving environmental problems cause a special problem in environmental protection.

Environmental protection has been regulated by large number of Federal, Republican and Municipal laws and regulations. The system of legislation in the field of protection and improvement of the environment in Yugoslavia comprises a large number of laws (more than 50) and regulations (more than 100) enacted on all levels. Besides that Yugoslavia has ratified 51 international agreements and conventions and thus undertaken to perform the duties set out in them in connection with the environment.

Two Resolutions have been adopted on the federal level, that is: Resolution on the Policy of Protecting of the Environment in the FRY and Resolution of Preserving Biodiversity in FRY. Special lows regulate certain areas of environment protection, including: regime of waters, hydrometeorological matters of concern for the whole country, transport of hazardous materials, trade of explosives and poisons, pesticides, protection against ionizing radiation, production of narcotics, protection of animals against contagious diseases, protection of plants against diseases and pests when the whole country is threatened by them, etc.

Large number of laws and regulations, both on federal and republican level, requests appropriate organization, coordination and harmonization which needs an improvement at all levels.

Since that major long-term objective of FR Yugoslavia is to join to EU adequate steps has been taken to harmonize its low system with that of Union, and particularly segment which is dealing with environmental issues.

Before 1991, the cooperation between the former Yugoslavia and Danube Basin countries in its neighborhood concerning water management was intensive one, but with its disintegration, this intensity decreased and with introduction of UN sanctions, it was reduced to minimum not by volition of FRY. With alleviation of sanctions, since 1996 FRY, co-operation intensified, particularly with Romania and Hungary, and in lesser extent with Bulgaria, with the tendency to be increased.

The FR Yugoslavia is the signatory of many multilateral agreements and conventions dealing with the protection of the Danube waters directly or indirectly, including "The Convention on the Regime of Navigation on the Danube " and " The Agreement on the Protection of Waters within the Tisa Watershed".

FR Yugoslavia actively participated in the drafting of the Convention on Co-operation in the protection and Sustainable use of the River Danube" signed in Sofia in 1994, but although it is very much open to and interested in co-operation was unable to become party to the Convention.

1.2. Methodological Approach

General context of planning approach

The organization of the National Planning Workshop in Federal Republic of Yugoslavia is part of the planning process to develop the Danube Pollution Reduction Programme in line with the policies of the Danube River Protection Convention. UNDP/GEF gives its technical and financial support to organize a country-driven planning process and to assure involvement of all stakeholders at national, as well as regional level.

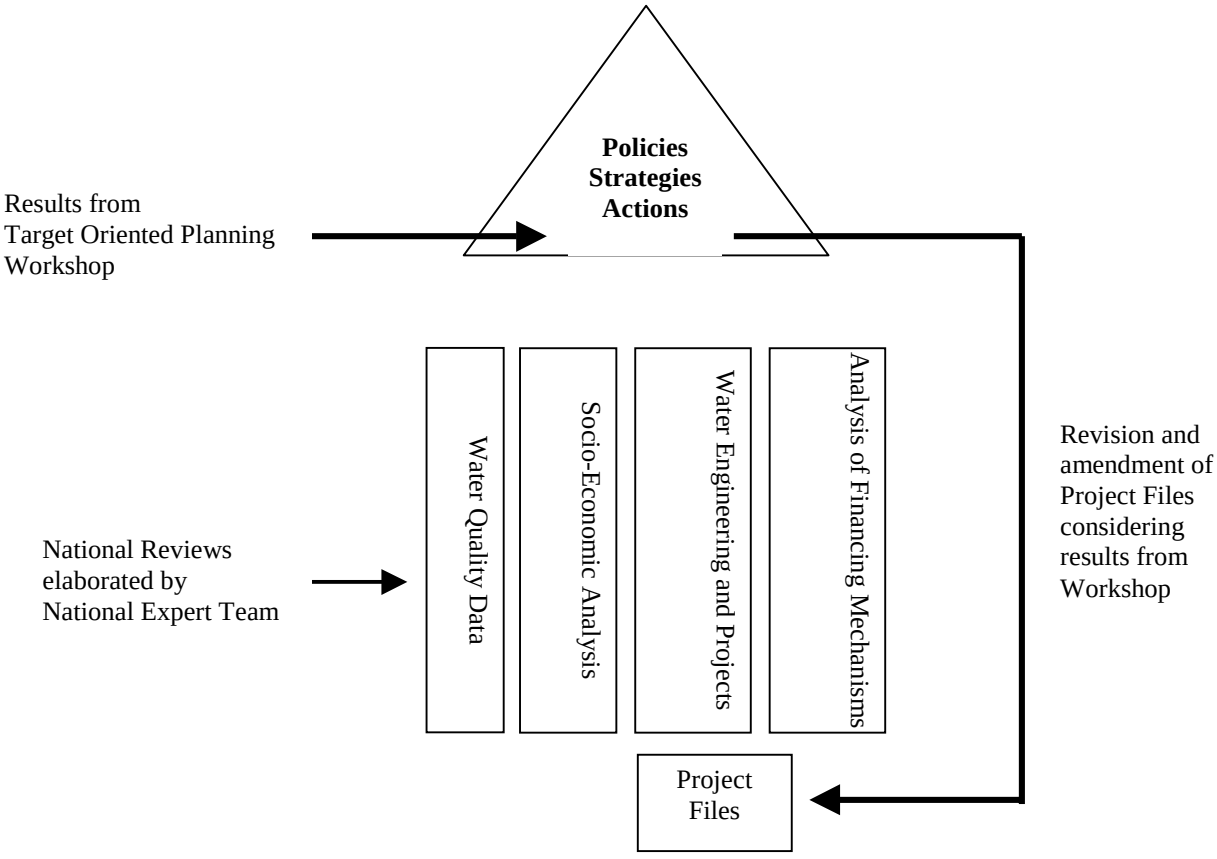
The first step of this process consisted of the elaboration of National Reviews, with particular attention to the collection of viable water quality data, the analysis of social and economic framework conditions, the definition of financing mechanisms and the identification of national priority projects for pollution reduction. For this purpose, a team of national experts for water quality data, water engineering, socio-economic analysis and financing mechanisms has been established within the Ministry of the Environment and Physical Planning, and under the guidance of the Country Programme Coordinator. The results of these studies represent the baseline information for participants of the National Planning Workshop. Moreover, they constitute the national contribution, in technical, economic and financial terms, for the elaboration of the Danube Pollution Reduction Programme with particular attention to transboundary issues and the development of an investment portfolio.

To assure wider participation in the planning process, prior initiatives have been taken to organize an NGO-Consultation Meeting, which took place in Belgrade from 27 to 29 June 1998. At this occasion, the Non-Governmental Organizations have discussed common strategies and priority measures for pollution reduction and designated their participants for the National Planning Workshop, as well as for the forthcoming regional meeting of the Danube Environmental Forum (regional NGO with the participation of all Danube countries).

Within the frame of the National Planning Workshop a multi-disciplinary team, including participants from various ministerial departments, from municipalities and regional organizations, from universities and scientific institutions and from the civil society (NGOs) has analyzed the causes and effects of water pollution and developed strategies and actions for pollution reduction and improved management of aquatic ecosystems and resources.

The workshop has been organized by using target oriented planning methodology (TOPP) and applying logical framework approach. The results constitute a comprehensive and integrated presentation of policies, strategies and actions in three main sectors: Agriculture; Industry, Tourism and Transport; and Municipality. The achievements of the workshop will contribute to national planning, with particular attention to the development of sector-related strategies and actions for pollution reduction and protection of aquatic ecosystems and resources. At the regional level, the results of the workshop will help to define transboundary issues and to develop regional strategies and actions for the revision of Strategic Action Plan of the ICPDR. Identified projects will be taken into account in the elaboration of the Danube Pollution Reduction Programme and in particular in the Investment Portfolio.

The following chart designs the functional links of the planning process at the national level:



The main characteristics of the methodological approach for the conduct of the workshop include:

- **Target oriented planning methodology,** which allows defining problems and objectives in a logical frame while taking constraints and limits into consideration. It promotes a systematic, step-by-step approach based on well-focused, task-oriented discussions. This facilitates the description of expected results and actions, the finding of innovative solutions, the definition of assumptions and of impact indicators to support, at later stage, monitoring of programme implementation;
- **Team approach**, which draws on the knowledge, ideas, experience, and judgments of the participants. The collective effort of decision-makers, planners, implementing agents, and beneficiaries is likely to lead to better results than unilateral decision making. The method builds on group interaction aimed at consensus building; it promotes communication and collaboration between participants in all stages of analysis;
- **Visualization of results** in form of colored cards, which are integrated into formal structures, presenting the various aspects of group discussion so that each stage of the analysis is clearly visible to all participants. Cards also serve as the basis for the documentation of the deliberations and the preparation of the final report;
- **Elaboration of Workshop Report,** presenting in written form the results of the workshop and strictly the charts and planning tables elaborated in consensus by the participants and taking into account the arguments and reasons developed during the discussions.

The Target Oriented Programme Planning (TOPP) methodology includes the following stages:

- Definition of River Basin Areas
- Situation/Stakeholders Analysis (with identification of assets, resources and favorable conditions)
- Problem Analysis (causes and effects of pollution)
- Analysis of Objectives (measures to reduce and control pollution)
- Definition of Actions and Important Elements (detailed description of actions to facilitate report writing)
- Identification of Existing, Ongoing and Proposed Projects (in relation to identified actions)
- Definition of Assumptions and of Impact Indicators (to monitor programme and project implementation)

2. General Frame of Analysis

2.1. Identification and Description of River Basin Areas Considering Physical, Demographic and Economic Situations

Danube river basin (DRB) covers 87% (88,919 km^2) of the state territory (102,173 km^2). It represents most developed and most densely populated part of the Federative Republic of Yugoslavia (FRY), comprises the most fertile farmland, the major administrative, cultural and educational centers, the largest power-generating and industrial facilities, the main traffic corridors, as well as well known historical landmarks and nature reserves. Therefore, sustainable development of DRB represent priority and prerequisite for successful development of FRY within community of European nations.

Average annual rainfall in the DRB in FRY is about 74.0 km^3, almost 70% of them (50.5 km^3) accounts for evapo-transpiration, while the reminder runs off. Since the annual inflow in this region is about 154.5 km^3, the total annual run-off of the Danube, at the exit from FRY, is about 178 km^3. This high inequality of all basic components of the hydrological balances, as regards time and space, represents important physical characteristic of DRB in FRY.

High $Q_{av}/Q_{min95\%}$ ratio, especially on watercourses in central and southern parts of DRB in FRY, provides ample evidence of their torrential nature and a need for protection measures from flood, and at the same time measures for flow balancing in order to provide more effective utilization of natural surface water resources. However, implementation of various, large-scale hydraulic engineering projects brought about changes in the natural biotope, thus generating adverse effects on the abundance and biodiversity.

In the Danube river basin area (RBA) in FRY, there is various terrestrial habitats, ranging from running and stagnant freshwaters, through pit bogs and marshes, bushy, grassy and forest habitats, as well as rocky, scree, sandy and glacier habitats, to agricultural and absolutely artificial habitats. Protected natural resources (the total of 390 which includes as following: 6 national parks, 64 nature reserves, 19 nature parks, 6 areas with specific features, 234 natural landmarks and 59 protected areas around stationary cultural landmarks) cover an area of 634,815 ha, or about 7.14% of the total RBA. Protected natural resources are significant for the preservation of biodiversity, natural and cultural heritage.

Many cultural landmarks from Neolithic and Roman period, through Turkish and Austro-Hungarian rule, which are situated on the banks of the Danube and its tributaries remind us that this region has been continuously inhabited for 7,000 years already.

Population growth in the Danube watershed area is already negative. Main recognized trend are general decrease in fertility, excluding Kosovo and Metohija region, and intensive migrations of the population to cities, especially pronounced in the Morava and Sava river basins, as well as in the Danube corridor. Since the last census was conducted in 1991, all data presented here regard to that year. However, one should keep in mind a fact that in meantime civil war activities in neighboring countries (Croatia and Bosnia and Herzegovina) have produced pronounced migrations of refugees, predominantly into FRY. According estimation number of refugees ranges from 450,000 to 700,000. On the other hand, in the period 1992-1994, a considerable number (the exact one is unknown) of young, able-bodied and mostly highly educated people left the country, which significantly affected the composition of population. Population density in Danube RBA is 101.4inh./km^2. Regarding settlement structure, cities accounted for 4.7%, villages for 70.8% and mixed settlements for 24.5% of the total number of settlements.. There were a total of 2,871,278 households with average of 3.62 members per household.

Presently, industry operates at much reduced capacity (55%), as compared to 1991, due to UN economic sanctions, and transition period in our country. GNP in Danube RBA in FRY amounts to about US$ 1,720. However, a dramatic fall in total GNP (for about 70% in year 1993 compared with 1990) of FRY has been recorded in all economic sectors, but the hardest hit is industrial production. Therefore, the quality of waters within the FRY is somewhat better as compared to the period of former Yugoslavia (1991 and before).

The waters of the Danube and its tributaries are used for domestic and industrial water supply, irrigation, cooling of thermal power plants, etc., but pollution significantly decreases possibility of their use. In addition, gradual pollution produces increasing of costs for the preparation of water for drinking in industrial use.

Existing wastewater treatment plants can treat only about 14% of the total quantity of municipal wastewater. However, only 8-9% of those waters is treated. The situation concerning industrial waste waters is even worse. Therefore, it can be stated in general that municipal and industrial wastes are discharged mostly without any advance treatment, or after minimum treatment. There is also no municipal solid waste disposal area that conforms to sanitary criteria (FRY of international) with respect to the selection of site, construction and method of use. A chronic shortage of funds for environmental protection, and especially for water protection control, does not give much hope for switch toward sustainable water use in near future.

The watercourses coming from the neighboring countries (Tisa, Timis, Bega, Sava etc.) are polluted already at the entry into FRY (their quality is mostly of class IV or worse and more seldom of class III). There are also several industrial hot spots (Pancevo, Baric-Belgrade, Sabac, Prahovo, etc.) with possible transboundary effects in downstream section of Danube watercourse.

Within identification of river basin areas (RBA) the approach which takes into account physical and geographical characteristics, demographic and economic activities in the basin, transboundary effects as perceives, and present organization in public water resources management is used.

The following river basin areas have been identified:

- **Danube River Basin (Danube Corridor) – covers 11,610 km^2**
- **Tisa River Basin – covers 8,994 km^2**
- **Sava River Basin – covers 31,046 km^2**
- **Velika Morava River Basin – covers 37,269 km^2**

Each of these areas has different characteristic features. In the following the physical aspects, demography and human activities in each region will be described:

(i) Danube River Basin (Danube Corridor)

Physical Aspects

The total watercourse of Danube in FRY is 583 km. On this territory it receives water from several large tributaries: Drava, Sava, Velika Morava, Mlava, Pek and Timok as right tributaries, as well as Tisa, Timis, and Nera as left tributaries. We considered here Danube RBA as Danube Corridor – without river basins of its main tributaries – Sava, Velika Morava and Tisa, which will be treated as separate river basins. Therefore, Danube Corridor RBA extents on 11,610 km^2 in Yugoslavia, which represents 12.5% of the whole Danube RBA in FRY. It comprises lowlands (Vojvodina region), hilly and mountain terrain (watersheds of rivers Timok, Pek and Mlava), as well as Djerdap gorge (Iron Gate). Danube enters FRY with average discharge of 2,263 m^3/s, while at the exit from FRY average discharge reaches extent of 5,500 m^3/s, which represents increasing by cc. 150%. Main contributors in this discharge enrichment are rivers Sava and Tisa, both of them enters

Danube on FRY territory. Minimal discharge ($Q_{min\ 95\%}$), extent the quantity of 1,800 m^3/s. Average runoff (expressed together with Tisa watershed according available data) is rather low – 9,61 l/s km^2. On this territory significant alluvium groundwater resources are recognized.

The left bank of the Danube is fully protected by an embankment, in addition to a part of the right bank, since these regions were often flooded in the past. The total length of embankments is 1,328 km. Unfortunately, regulation of river streams has also produced cutting the main streams from the former river branches, stagnant tributaries, swampy and marshy areas, all of which had an adverse effect on the biodiversity. However, earth for the construction of embankments was excavated from the bed of high water, so that the new floodable wetlands arised, so-called „kubici“ in Serbian. Presently, flooddable wetlands (F_{100}) covers $1.3 \cdot 10^6$ ha.

Very large channel network of multipurpose Hydro System „Danube – Tisa – Danube“ (DTD) in Vojvodina characterize Danube RBA as considered here. The total length of waterways along channels is over 600 km and exceeds the length along river Danube.

The Danube, its islands and the riparian zone in FRY are characterized by high biodiversity as regards species and eco-systems. Marshy and swampy eco-systems begin from Bezdan (the entry into FRY) and, with the residues of flood plain forests, extend up to the Djerdap gorge in which surroundings lies National park “Djerdap”. This national park, together with six other protected national resources extend over an area of 142,376 ha.

Demography/Social Background

In Danube RBA, considered as Danube corridor, live every forth inhabitant of FRY (2,833,954), 67.4% of them represent urban and 32.6 % rural population. Danube corridor distinguishes itself as the most densely populated part of the FRY – population density reaches 244,1 inh./km^2. As this territory has been continuously inhabited for 7,000 years already, it is reach with cultural and historical heritage landmarks.

Transboundary Effects (as perceived/produced)

Although the quality of the Danube in FRY is still tolerable, the state of its tributaries whose coming from the neighboring countries (Tisa, Sava, Bega, Timis) is much worse and requires serious interventions. Furthermore, low water quality of Danube river regarding nutrients load and high primary production at the entrance in to FRY is evident.

The largest quantities of sediments in the Reservoir Djerdap I (Irongate I) represents cross-boundary load – stem from the other countries. These deposits consist of inert particles on which organic meter together with hazardous and toxic matter can be adsorbed. Due to their significant presence one can designate Djerdap I as a settling tank of Europe. Therefore, the water quality of exit water is better compared with water that enters FRY.

The other perceived transboundary effects are the following: dump site „Ostovul Mare“ (Romania), pollution of river Drava (Croatia), accidental pollution from river transport, and floods from upstream. Simultaneously, we produce possible hazardous effects on downstream countries, caused by pollution of River Timok (CS_2 and heavy metals from copper ore processing center Bor as main pollutants), IHP „Prahovo“ (chemical industry, amines and phosphates as main pollutants)

Human/Economic activities

GNP in this RBA is similar with those of FRY average (1,576 US$). Estimated water quantity abstracted for irrigation during 1997 was $293 \cdot 10^6$ m^3/yr. Main agricultural characteristics in this RBA are the following: large pig and cattle farms, well developed irrigation and drainage systems (hydrosystem DTD) and river training, forestry, fishing and intensive agriculture. Main point sources of water pollution represent six pig farms, each with more than 20,000 fatlings per cycle.

Estimated water quantity abstracted for industrial supply during 1997 was $175 \cdot 10^6$ m^3/yr, predominantly for mining and metallurgy, food processing industry, petroleum industry, chemical industry and heavy industry. Transport (588 km of waterways on Danube, 670 in channel system DTD), energy infrastructure (hydroelectric power plants Djerdap I and II) and tourism and recreation are also well developed in this RBA. Industrial and mining wastewater discharge is estimated on $166 \cdot 10^6$ m^3/yr during 1997.

More than 80% of urban population is connected to public water supply systems where the abstraction of groundwater represents main way for water supply. Estimated water quantity abstracted for water supply during 1997 was $408 \cdot 10^6$ m^3/yr and $47 \cdot 10^6$ m^3/yr in urban and rural areas, respectively. However, less then 50 % of urban population is connected to public sewer systems. Municipal wastewater discharge was estimated on $341 \cdot 10^6$ m^3/yr for 1997. Only 5% of population is covered with wastewater treatment. Moreover, open dumps for municipal and industrial solid waste characterize this RBA.

(ii) Tisa River Basin

Physical Aspects

Only a very small part, 6% or 8,994 km^2, of the total RBA (148,973 km^2) lies within FRY territory – in its northern part. This area (Banat and Bačka) is predominantly lowland. Here, Tisa drain the Pannonian Basin which is the largest of the sediment – filled, post-orogenic basins of the Alpine region. The Miocene sediments are primarily marine limestone, whereas later Tertiary sediments consist of brackish to freshwater clays and sends. Fluvial and fluvio-glacial deposits of Pleistocene age also exist. Thick loess deposits are abundant especially along Tisa watercourse.

Average discharge (Qav) of Tisa RBA reaches extent of 794 m^3/s, which is six time more than minimal discharge ($Q_{min95\%}$) of 126 m^3/s. Average runoff (q_{av}) is extremely low – less than 1 l/s km^2, due to low precipitation (< 600 mm) and very high evapo-transpiration from this territory. Furthermore, annual precipitation is one of the lowest in FRY. Therefore, in Tisa RBA there is very low quantity of waters which originate from FRY territory.

River streams in this RBA are typical for lowlands – for river Tisa declination is less than 0,045‰. In order to protect this terrain from floods high embankments with the total length of 269 km protect the riverbanks, especially of river Tisa. Thus, former river branches, flooded meadows and other wetlands are mainly cut off from the main streams and significantly decreased in territory. The other important characteristic of this RBA is Hydro System DTD. In that way Tisa is linked via canals with the Danube and with Timisoara in Romania. The river is also dammed at its 63 km, near Novi Bečej, as a part of DTD irrigation system. This dam, together with backwaters from the reservoir on the Danube (Djerdap I) has slowed down the lower course of the river Tisa and caused certain changes in physical and chemical properties and the composition of biocenoses.

Demography/Social Background

In Tisa RBA live 809,755 inhabitants (year 1991), and urban population dominate over rural (57.6% and 42.2% respectively). Population density is lower than average in FRY–90.0 inh./km^2. Fertility rate in this area is the lowest for the whole Danube watershed in FRY.

Transboundary Effects (as perceived/produced)

Low water quality of Tisa and deteriorated water quality of river streams coming from Romania (Bega, Zlatica, etc.) at the entrance into FRY, primary due to high loads of biodegradable organics and nutrients represent main perceived transboundary effect. The most pronounced, although not most important in terms of eutrophication, is periodically appearance of floating macrophyte vegetation coming from neighboring countries by river streams.

Human/Economic activities

In this RBA GNP reaches highest amount in FRY – about US$ 2,500. The water from the Tisa is used for crop irrigation. Estimated water quantity abstracted for irrigation during 1997 was $75 \cdot 10^6$ m^3/yr. Large pig and cattle farms, intensive agriculture and carp ponds characterize agricultural production in this RBA. Main point sources of water pollution represent six pig farms, each with more than 20,000 fatlings per cycle. The other observed negative effect is salting of soil in some parts of this RBA.

Estimated water quantity abstracted for industrial supply during 1997 was $100 \cdot 10^6$ m^3/yr, mainly for food processing industry, petroleum and gas extraction, chemical industry, metal industry, pulp and paper industry, and textile industry. Transport infrastructure (168 km of waterways on Tisa river) is also well developed in this RBA. Industrial and mining wastewater discharge is estimated on $95 \cdot 10^6$ m^3/yr during 1997.

More than 80% of urban population is connected to public water supply systems, characterized by exclusive abstraction of groundwater. Due to excessive abstraction ground water reserves are continuously declining in the region of northern Banat – the groundwater level of the second water-bearing stratum fell at some points by 10 to 27 m during the past ten or so years. Therefore, the pollution of Tisa, which can potentially be used for domestic water supply, poses a serious problem in the region. Estimated water quantity abstracted for water supply during 1997 was $93 \cdot 10^6$ m^3/yr and $19 \cdot 10^6$ m^3/yr in urban and rural areas, respectively. Municipal wastewater discharge was estimated on $84 \cdot 10^6$ m^3/yr for 1997. Less then 50% of urban population connected to public sewer systems, while septic tanks are widely used. Furthermore, open dumps for municipal and industrial solid waste are general characteristics of this RBA.

(iii) Sava River Basin

Physical Aspects

According agreement to include Drina watershed into Sava RBA, relief in thus recognized river basin is very various – from lowlands (Srem and Macva, alongside Sava watercourse) to hilly and mountainous terrenes (river Drina watershed). River basins and streams also show diversity from river streams typical for lowlands and hilly regions (river Sava) to river streams typical for hilly and mountainous regions (river Drina and its tributaries).

Sava RBA surface of 31,046 km^2 in FRY represent about only one-third of the total Sava RBA (95,132 km^2). In FRY it includes a part of Vojvodina, part of Montenegro and the western part of central Serbia. In this section river Sava is typical lowland river, which flows throughout large alluvial valley and forms large meanders. The valley occupies the southern edge of Pannonian Basin – the largest of the sediment – filled, post orogenic basins of the alpine region. Sediments are primarily Miocene marine limestone, whereas later Tertiary sediments consist of freshwater clays, sends and gravel. Thick loess deposits also overlay Tertiary sediments.

Discharge pattern is strongly influenced by the tributaries, although 86,7% of the total watershed area represents watersheds of the tributaries. Only one of them, the largest tributary river Drina, enters more than 20% of the total discharge. Backwaters of the reservoir Djerdap I on the Danube has slowed down the lower course of the river Sava.

Average discharge (Qav) of river Sava together with Drina is 1,570 m3/s at the entrance into FRY, while minimal discharge (Qmin95%) is only fifth part – 278 m3/s. It points out torrent characteristic of river courses, especially in upper part of Drina watershed, as well as possible floods in downstream regions of Sava watershed. Therefore, riverbanks are protected by embankments of total length of 771 km. Average runoff (qav) in this RBA is rather high –16.5 l/s km2, because of very high runoff in upstream parts of Drina watershed.

River Drina watershed represent surface water resources of highest quality in the whole Danube watershed in FRY. This RBA is characterized by high biodiversity and protected ecosystems. Number of relict and endemic species are concentrated on the territory of national parks „Durmitor“ (with glacial Crno Jezero lake, river Tara watershed and river Tara Canyon), „Biogradska gora“ (with glacial Biogradsko lake), and „Tara“ (with river Drina Canyon) with several strictly protected bioreserves.

Other important recognized characteristics of this RBA are the following: pronounced erosion in upstream parts of watershed, numerous dams for hydropower and significant groundwater resources along river Sava.

Demography/Social Background

In Sava RBA live 1,354,592 inhabitants (according 1991 census), 35.1% of them represent urban and 64.9% rural population. Population density is low – only 64.6 inh./km^2, due to very scarcely inhabited regions in upper parts of Drina watershed. Migration of the population from the poorly developed upstream parts of RBA into well developed, mainly lowland areas, were characteristic in last few decades. Moreover, migrations are pronounced due to recent war in the neighborhood.

Transboundary Effects (as perceived/produced)

Several transboundary effects are perceived, as the following: decrease of flow rate due to water use in upstream countries, floods due to inappropriate operation of detention basins in upstream countries, accidental pollution, frequent floating oil spills, risk from nuclear pollution (NPP Krško, Slovenia), and pollution from petrochemical and metallurgy industry coming from upstream countries.

Human/Economic activities

GNP in this RBA amounts to US$ 1,760. There is a significant difference between upstream, poorly developed area and territory which surrounds mains stream of Sava and in Kolubara (right tributary of Sava) watershed.

Estimated water quantity abstracted for irrigation during 1997 was 38·106 m3/yr. Main agricultural activities in this RBA are the following: intensive agriculture in downstream parts of watershed (Srem and Macva), large pig and cattle farms, and, mainly in Drina watershed, trout ponds and forestry. In upper parts of watershed land is also used as pastures and grazing area. Main point sources of water pollution represent two pig farms, each with more than 20,000 fatlings per cycle.

Estimated water quantity abstracted for industrial supply during 1997 was 305·106 m3/yr, predominantly used in pulp and paper industry, chemical industry, food processing industry, mining and thermal power plants. Transport infrastructure (206 km of waterways on Sava), open coal mines, gravel abstraction and tourism and recreation are also well developed in this RBA. Industrial and mining wastewater discharge is estimated on 290·106 m3/yr during 1997.

Estimated water quantity abstracted for water supply during 1997 was 102·106 m3/yr and 50·106 m3/yr in urban and rural areas, respectively. More than 80% of urban population connected to public water supply systems. Only in this RBA surface water is used equally with ground water. The Belgrade Waterworks Authority, which operates the largest water supply system in the country, secures about 3 m^3/s by abstracting water from the Sava River more then one-third of the capacity. Municipal wastewater discharge was estimated on $114 \cdot 10^6$ m^3/yr for 1997. About 60% of urban population is connected to public sewer systems. Unfortunately, open dumps for municipal and industrial solid waste are general characteristics of this RBA.

(iv) Velika Morava River Basin

Physical Aspects

Velika Morava RBA represents the largest RBA as considered here. Its surface of 37,269 km^2 within FRY represents almost the whole RBA (total surface of 38,345 km^2). Diverse relief in this RBA which comprises hilly and mountain areas as well as wide river valleys, causes diverse types of river streams, with intensive seasonal variations of rivers flow rate. Average discharge (Q_{av}) reaches extent of 232 m^3/s, while minimal is almost seven times lower: $Q_{min95\%}$=35 m^3/s. Therefore, river banks are protected by embankments which total length is 1182 km. Average runoff (q_{av}) is rather low – 6.1 l/s km^2, mainly due to very high evapotranspiration: average evapotranspiration of 562 mm almost reaches the quantity of average precipitation (756 mm). Numerous reservoirs for water supply and hydropower, important groundwater resources along river Velika Morava and numerous thermal springs also characterize this RBA. Erosion is pronounced in upstream parts of watershed.

Demography/Social Background

In Velika Morava RBA live 4,081,046 inhabitants (according 1991 census). Rural population (56.1% of the total population) dominate over urban (43.9% of the total population). Population density of 107.8 inh./km^2 reaches average value for the whole Danube RBA in FRY. Very high population growth rate in upstream parts of watershed (part of Kosovo and Metohija region) is evident. Specific characteristic of this RBA is the fact that 40% of arable land are properties less then 2 ha.

Transboundary Effects (as perceived/produced)

Polluted rivers which enter FRY from Bulgaria (rivers: Nisava, Jerma, and Visocica) represent the only perceived transboundary effect.

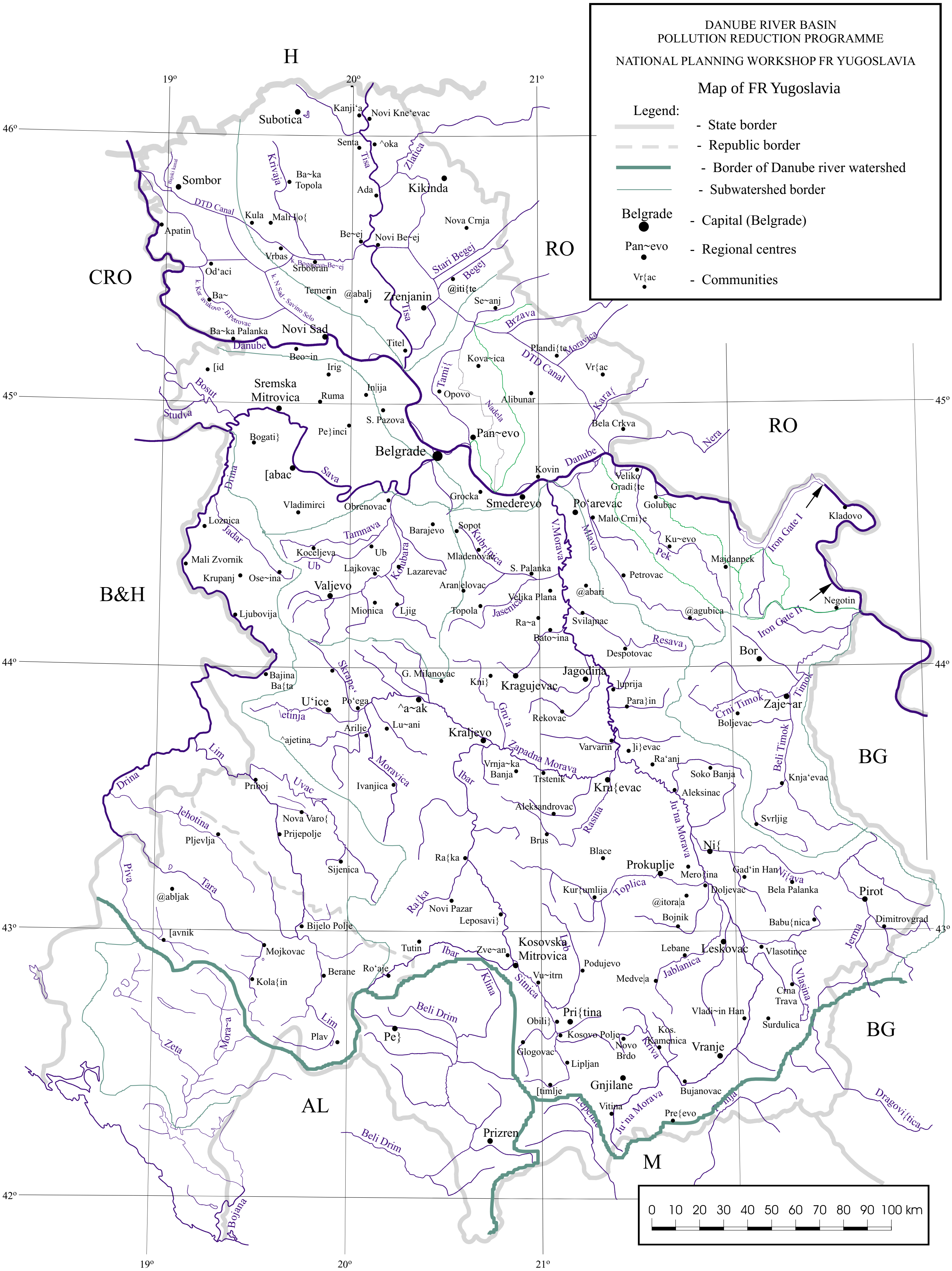
Human/Economic activities

GNP in this RBA is estimated at level of about US$ 1,350. Estimated water quantity abstracted for irrigation during 1997 was 159·106 m3/yr. Agricultural activities are characterized by non-intensive agriculture on 70% of arable land, pig and cattle farms, river training and forestry. Main point sources of water pollution represent a pig farm with more than 20,000 fatlings per cycle.

Estimated water quantity abstracted for industrial supply during 1997 was $190 \cdot 10^6$ m^3/yr, mainly used in mechanical and metal, chemical, wood, pulp and paper, textile, leather, and food processing industries. Energy production, transport infrastructure (roads and railroads corridors), gravel abstraction, and tourism and recreation also represent important activities in this RBA. Industrial and mining wastewater discharge is estimated on 180·106 m3/yr during 1997.

Estimated water quantity abstracted for water supply during 1997 was 386·106 m3/yr and 130·106 m3/yr in urban and rural areas, respectively. More than 80% of urban population is connected to public water supply systems. Ground and surface water are used for water supply. Due to great inequality in spatial distribution of water resources and water users in settlements, large regional systems of water supply are necessary. Surface water represents main supply for regional water supply systems in this RBA.

Municipal wastewater discharge was estimated on $387 \cdot 10^6$ m^3/yr for 1997., which is also the highest amount in Danube RBA in FRY. About 60% of urban population is connected to public sewer systems. Pronounced problem is conversion of number of wells in rural settlements into septic tanks after construction of a central water supply. It significantly increases the degree of ground water contamination. Only 6% of the population are covered with wastewater treatment. Generally, open dumps for solid waste characterize this RBA.


DANUBE RIVER BASIN
POLLUTION REDUCTION PROGRAMME
NATIONAL PLANNING WORKSHOP FR YUGOSLAVIA
Map of FR Yugoslavia
Legend:
- State border
- Republic border
- Border of Danube river watershed
- Subwatershed border
Belgrade - Capital (Belgrade)
Pan~evo - Regional centres
Vr{ac - Communities
0 10 20 30 40 50 60 70 80 90 100 km
H
RO
CRO
B&H
BG
AL
M
19º
20º
21º
46º
45º
44º
43º
42º
Subotica
Kanji'a
Novi Kne'evac
Senta
^oka
Sombor
Ba~ka Topola
Ada
Kikinda
Apatin
Kula
Mali I|o{
Be~ej
Novi Be~ej
Nova Crnja
Vrbas
Srbobran
Od'aci
Ba~
Temerin
@abalj
Zrenjanin
@iti{te
Se~anj
Ba~ka Palanka
Novi Sad
Titel
Beo~in
Plandi{te
Kova~ica
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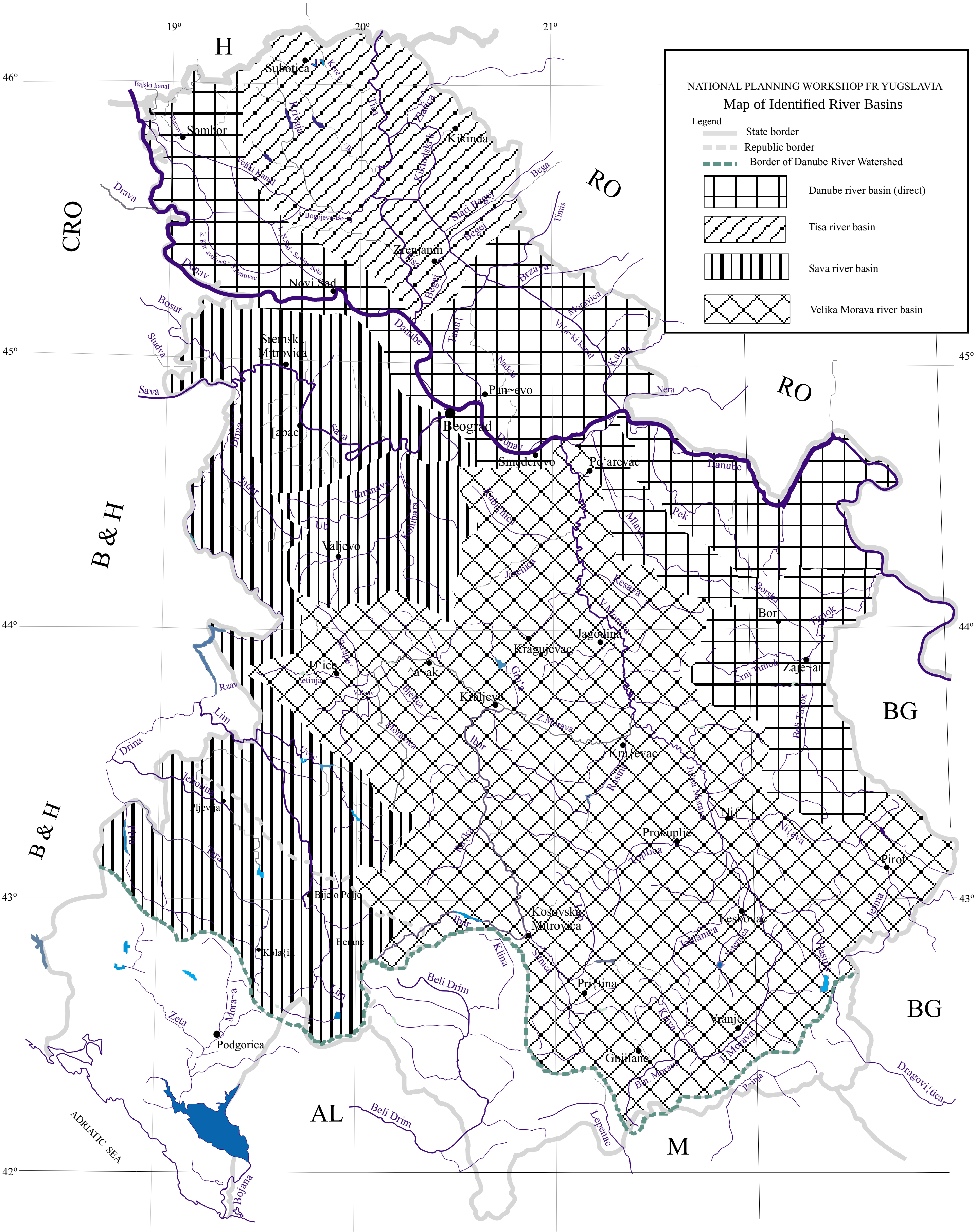
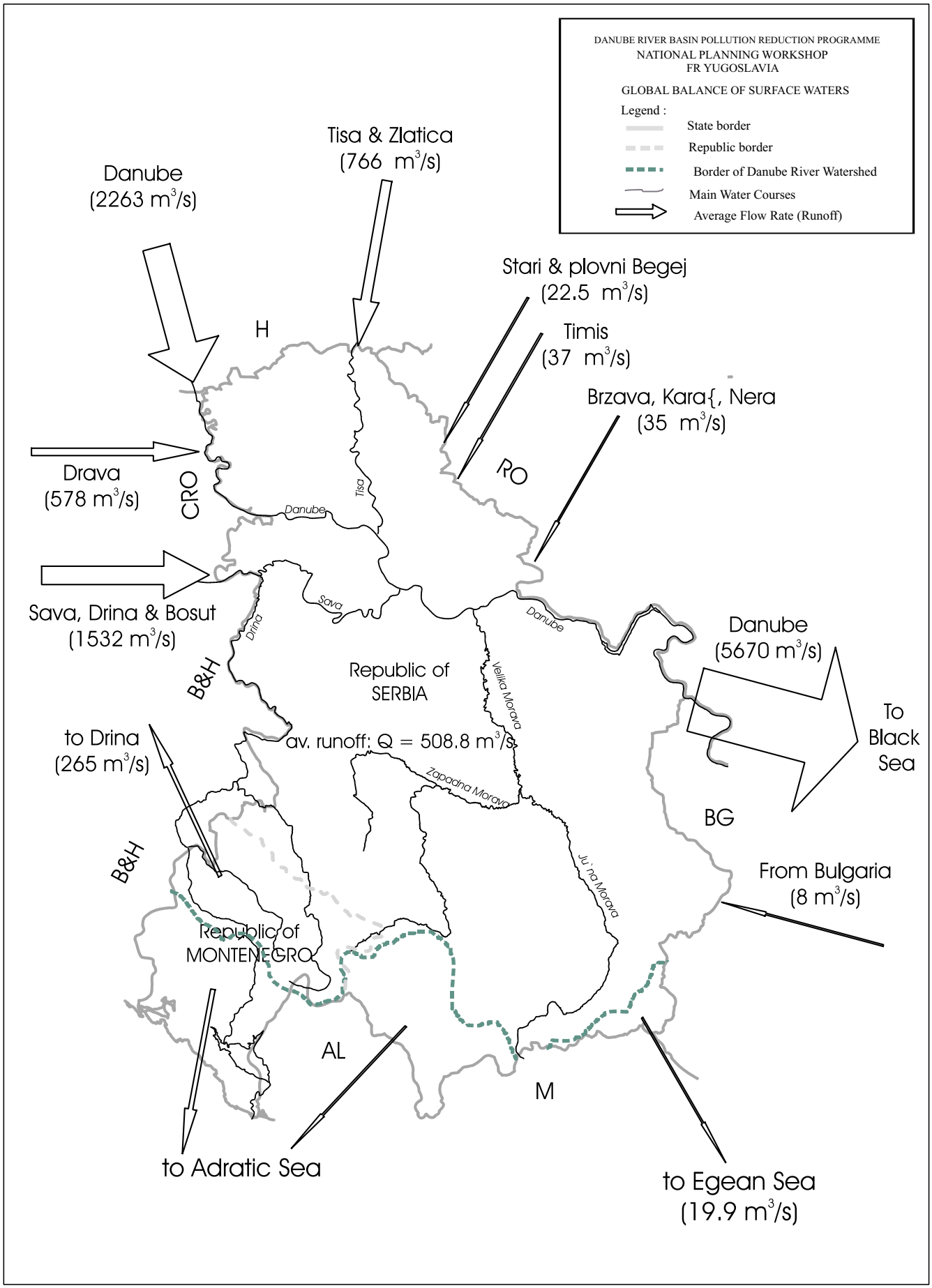
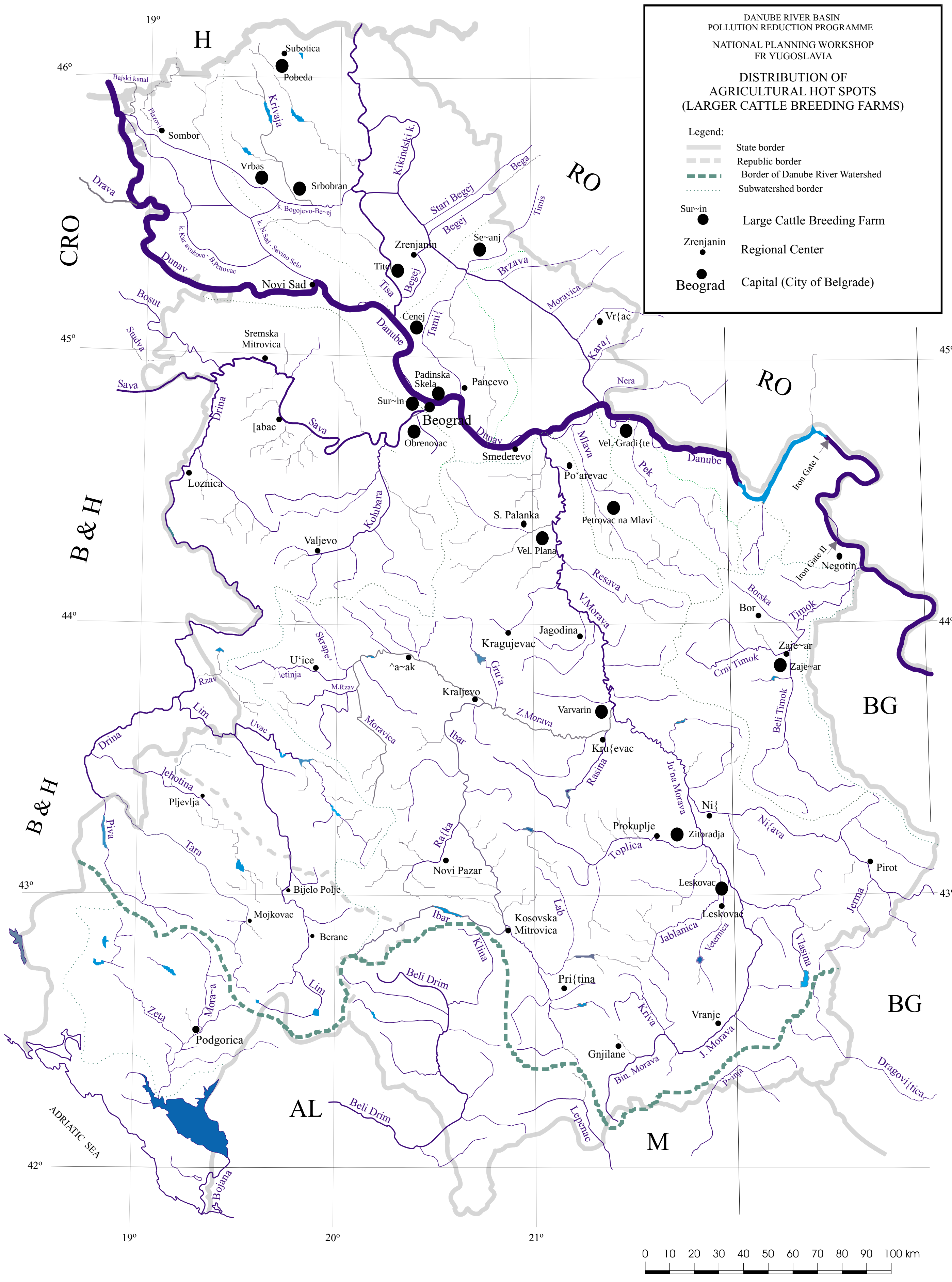
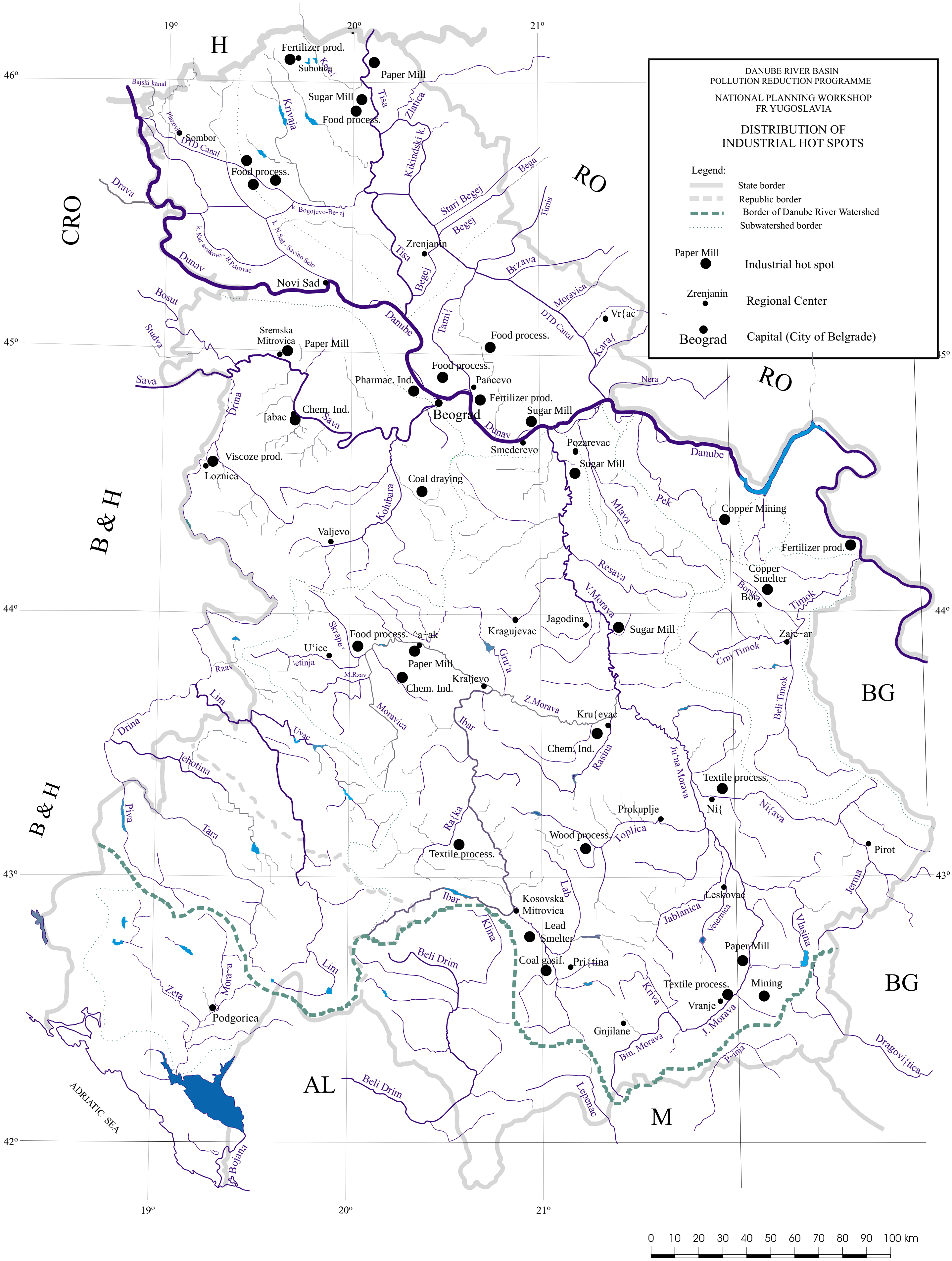
[id
Irig
Sremska Mitrovica
Ruma
In|ija
Opovo
Alibunar
S. Pazova
Pe}inci
Bogati}
Pan~evo
Bela Crkva
Belgrade
[abac
Kovin
Veliko Gradi{te
Grocka
Smederevo
Po'arevac
Golubac
Vladimirci
Obrenovac
Malo Crni}e
Kladovo
Loznica
Barajevo
Sopot
Ku~evo
Koceljeva
Ub
Mladenovac
Majdanpek
Mali Zvornik
Lajkovac
Lazarevac
S. Palanka
Petrovac
Krupanj
Ose~ina
Valjevo
Aran|elovac
@abari
Negotin
Velika Plana
Ljubovija
Mionica
Ljig
Topola
Ra~a
Svilajnac
@agubica
Bato~ina
Despotovac
Bor
Bajina Ba{ta
G. Milanovac
Kni}
Kragujevac
Jagodina
]uprija
U'ice
Po'ega
^a~ak
Para}in
Zaje~ar
Boljevac
Rekovac
Arilje
Lu~ani
Kraljevo
^ajetina
Varvarin
]i}evac
Ra'anj
Vrnja~ka Banja
Trstenik
Soko Banja
Knja'evac
Priboj
Ivanjica
Kru{evac
Aleksinac
Nova Varo{
Prijepolje
Aleksandrovac
Svrljig
Pljevlja
Brus
Blace
Ni{
Sijenica
Ra{ka
Prokuplje
Mero{ina
Gad'in Han
Pirot
Kur{umlija
Doljevac
Bela Palanka
@abljak
Novi Pazar
@itora|a
Leposavi}
Bojnik
Babu{nica
Dimitrovgrad
Bijelo Polje
[avnik
Kosovska Mitrovica
Lebane
Leskovac
Vlasotince
Mojkovac
Tutin
Zve~an
Berane
Ro'aje
Vu~itrn
Podujevo
Medve|a
Kola{in
Crna Trava
Pri{tina
Vladi~in Han
Obili}
Surdulica
Plav
Pe}
Kosovo Polje
Kos. Kamenica
Novo Brdo
Vranje
Glogovac
Lipljan
[timlje
Gnjilane
Bujanovac
Vitina
Pre{evo
Prizren
Danube
Tisa
Zlatica
Krivaja
DTD Canal
Stari Begej
Begej
Brzava
Moravica
Tami{
Nadela
Kara{
Nera
Bosut
Studva
Sava
Drina
Jadar
Tamnava
Kolubara
Kubr{nica
V.Morava
Mlava
Pek
Iron Gate I
Iron Gate II
Jasenica
Resava
Crni Timok
Timok
Beli Timok
Skrape'
Gru'a
Zapadna Morava
Moravica
Ibar
Lim
Uvac
Rasina
Ju'na Morava
Ni{ava
Toplica
Jablanica
Vlasina
Jerma
Piva
Tara
]ehotina
Lab
Sitnica
Klina
Beli Drim
Morača
Zeta
Bojana
Lepenac
Binja
Dragovi{tica



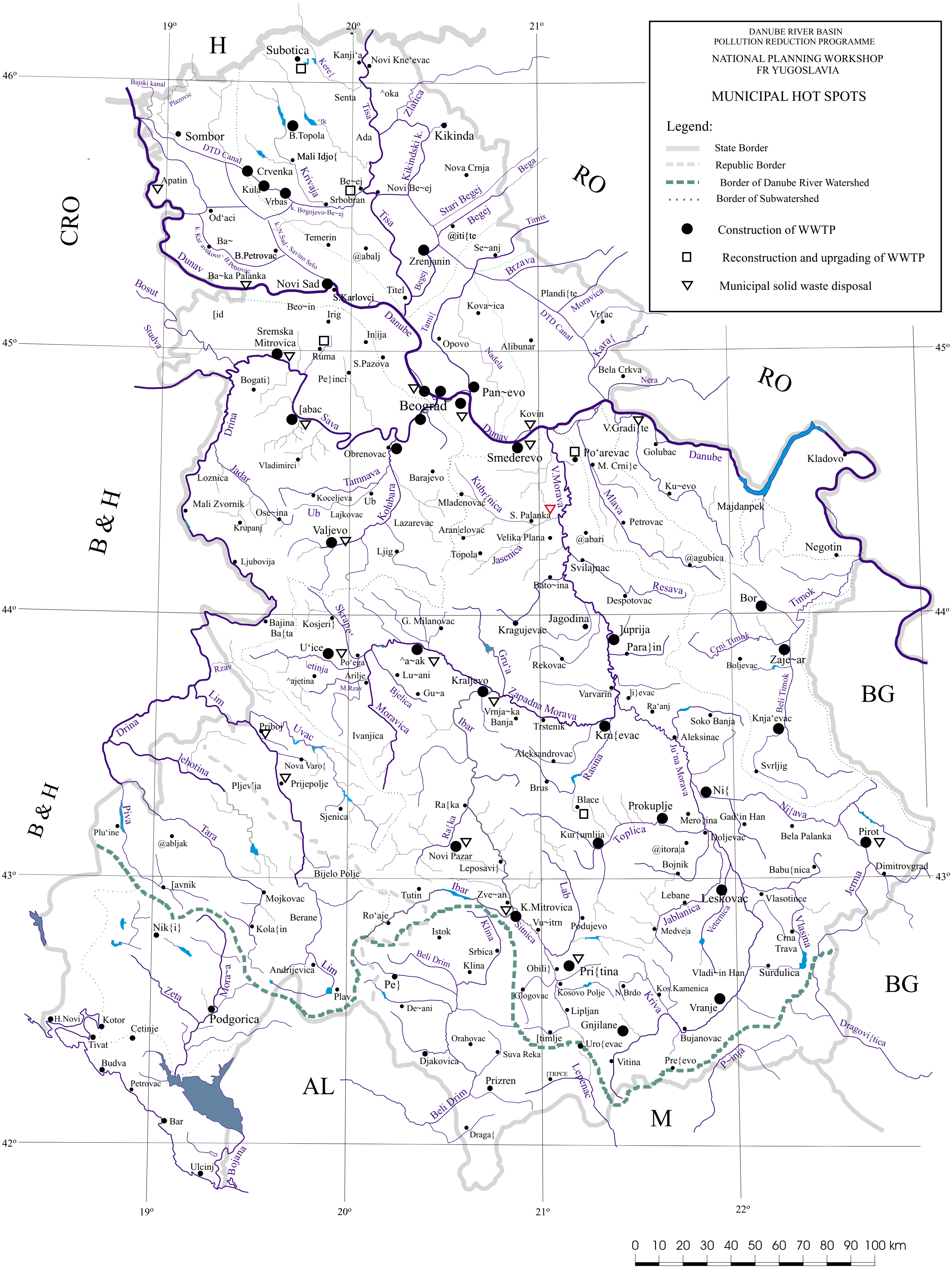
NATIONAL PLANNING WORKSHOP FR YUGSLAVIA
Map of Identified River Basins
Legend
State border
Republic border
Border of Danube River Watershed
Danube river basin (direct)
Tisa river basin
Sava river basin
Velika Morava river basin
H
CRO
RO
B & H
BG
AL
M
ADRIATIC SEA
Subotica
Sombor
Kikinda
Zrenjanin
Novi Sad
Sremska Mitrovica
Beograd
Smederevo
Valjevo
Kragujevac
Jagodina
Kraljevo
Kruševac
Bor
Prokuplje
Pirot
Kosovska Mitrovica
Priština
Vranje
Gnjilane
Podgorica
Pljevlja
Bijelo Polje
Berane
0 10 20 30 40 50 60 70 80 90 100 km


DANUBE RIVER BASIN POLLUTION REDUCTION PROGRAMME
NATIONAL PLANNING WORKSHOP
FR YUGOSLAVIA
GLOBAL BALANCE OF SURFACE WATERS
Legend :
State border
Republic border
Border of Danube River Watershed
Main Water Courses
Average Flow Rate (Runoff)
Danube (2263 m3/s)
Tisa & Zlatica (766 m3/s)
Stari & plovni Begej (22.5 m3/s)
Timis (37 m3/s)
Brzava, Kara{, Nera (35 m3/s)
Drava (578 m3/s)
Sava, Drina & Bosut (1532 m3/s)
Danube (5670 m3/s)
To Black Sea
From Bulgaria (8 m3/s)
to Drina (265 m3/s)
to Adratic Sea
to Egean Sea (19.9 m3/s)
H
CRO
RO
B&H
BG
AL
M
Republic of SERBIA
av. runoff: Q = 508.8 m3/s
Republic of MONTENEGRO
Tisa
Danube
Sava
Drina
Velika Morava
Zapadna Morava
Ju`na Morava


DANUBE RIVER BASIN
POLLUTION REDUCTION PROGRAMME
NATIONAL PLANNING WORKSHOP
FR YUGOSLAVIA
DISTRIBUTION OF
AGRICULTURAL HOT SPOTS
(LARGER CATTLE BREEDING FARMS)
Legend:
State border
Republic border
Border of Danube River Watershed
Subwatershed border
Sur~in
Large Cattle Breeding Farm
Zrenjanin
Regional Center
Beograd
Capital (City of Belgrade)
H
RO
CRO
B & H
BG
AL
M
ADRIATIC SEA
Subotica
Pobeda
Sombor
Vrbas
Srbobran
Zrenjanin
Se~anj
Titel
Novi Sad
Cenej
Vr{ac
Sremska
Mitrovica
Padinska
Skela
Pancevo
Sur~in
Beograd
[abac
Obrenovac
Smederevo
Vel. Gradi{te
Po`arevac
Loznica
S. Palanka
Petrovac na Mlavi
Vel. Plana
Valjevo
Negotin
Bor
Jagodina
Kragujevac
Zaje~ar
U`ice
^a~ak
Kraljevo
Varvarin
Kru{evac
Pljevlja
Ni{
Prokuplje
Zitoradja
Novi Pazar
Pirot
Bijelo Polje
Leskovac
Mojkovac
Kosovska
Mitrovica
Berane
Pri{tina
Vranje
Podgorica
Gnjilane
Danube
Dunav
Sava
Drina
Tisa
Begej
Morava
Iron Gate I
Iron Gate II
0 10 20 30 40 50 60 70 80 90 100 km
19º
20º
21º
42º
43º
44º
45º
46º



DANUBE RIVER BASIN
POLLUTION REDUCTION PROGRAMME
NATIONAL PLANNING WORKSHOP
FR YUGOSLAVIA
DISTRIBUTION OF
INDUSTRIAL HOT SPOTS
Legend:
State border
Republic border
Border of Danube River Watershed
Subwatershed border
Paper Mill
Industrial hot spot
Zrenjanin
Regional Center
Beograd
Capital (City of Belgrade)
H
CRO
RO
RO
B & H
B & H
BG
BG
AL
M
ADRIATIC SEA
19º
20º
21º
46º
45º
44º
43º
42º
Fertilizer prod.
Subotica
Paper Mill
Sugar Mill
Food process.
Sombor
DTD Canal
Food process.
Drava
Dunav
Novi Sad
Zrenjanin
Tisa
Begej
Stari Begej
Bega
Timis
Zlatica
Kikindski k.
Krivaja
Bajski kanal
Brzava
Moravica
DTD Canal
Vr{ac
Kara{
Tami{
Danube
Food process.
Sremska
Mitrovica
Paper Mill
Bosut
Studva
Sava
Food process.
Pharmac. Ind.
Pancevo
Fertilizer prod.
Beograd
Sugar Mill
Chem. Ind.
[abac
Sava
Dunav
Smederevo
Pozarevac
Sugar Mill
Nera
Danube
Drina
Viscoze prod.
Loznica
Coal draying
Kolubara
Valjevo
Mlava
Pek
Copper Mining
Fertilizer prod.
Resava
Copper
Smelter
Bor
Timok
V.Morava
Jagodina
Sugar Mill
Kragujevac
Zaje~ar
Crni Timok
Food process.
^a~ak
U'ice
Skrape`
etinja
Rzav
M.Rzav
Paper Mill
Chem. Ind.
Kraljevo
Gru'a
Z.Morava
Kru{evac
Chem. Ind.
Rasina
Beli Timok
Lim
Drina
Uvac
Moravica
Ibar
Jehotina
Ju'na Morava
Textile process.
Ni{
Ni{ava
Piva
Tara
Ra{ka
Prokuplje
Wood process.
Toplica
Textile process.
Pirot
Leskovac
Jablanica
Veternica
Jerma
Lab
Kosovska
Mitrovica
Lead
Smelter
Ibar
Klina
Beli Drim
Coal gasif.
Pri{tina
Paper Mill
Vlasina
Lim
Zeta
Mora~a
Podgorica
Kriva
Textile process.
Vranje
Mining
J. Morava
Gnjilane
Bin. Morava
P~inja
Dragovi{tica
Beli Drim
Lepenac
Bojana
0
10
20
30
40
50
60
70
80
90
100 km



DANUBE RIVER BASIN
POLLUTION REDUCTION PROGRAMME
NATIONAL PLANNING WORKSHOP
FR YUGOSLAVIA
MUNICIPAL HOT SPOTS
Legend:
State Border
Republic Border
Border of Danube River Watershed
Border of Subwatershed
Construction of WWTP
Reconstruction and uprgading of WWTP
Municipal solid waste disposal
H
RO
CRO
B & H
BG
AL
M
Subotica
Sombor
Kikinda
Crvenka
Kula
Vrbas
Apatin
Zrenjanin
Novi Sad
Sremska Mitrovica
Beograd
Pan~evo
Smederevo
Po'arevac
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Kladovo
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Kragujevac
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Kraljevo
Kru{evac
Ni{
Prokuplje
Leskovac
Vranje
Pirot
Novi Pazar
K.Mitrovica
Pri{tina
Gnjilane
Pe}
Prizren
Podgorica
Danube
Dunav
Sava
Tisa
Drina
Morava
Ibar
Timok
0 10 20 30 40 50 60 70 80 90 100 km

2.2. Problem Analysis

2.2.1. Core Problem

Based on the situation analysis and the problem analysis of the three main sectors the core problem for the FR Yugoslav Danube River Basin area is stated

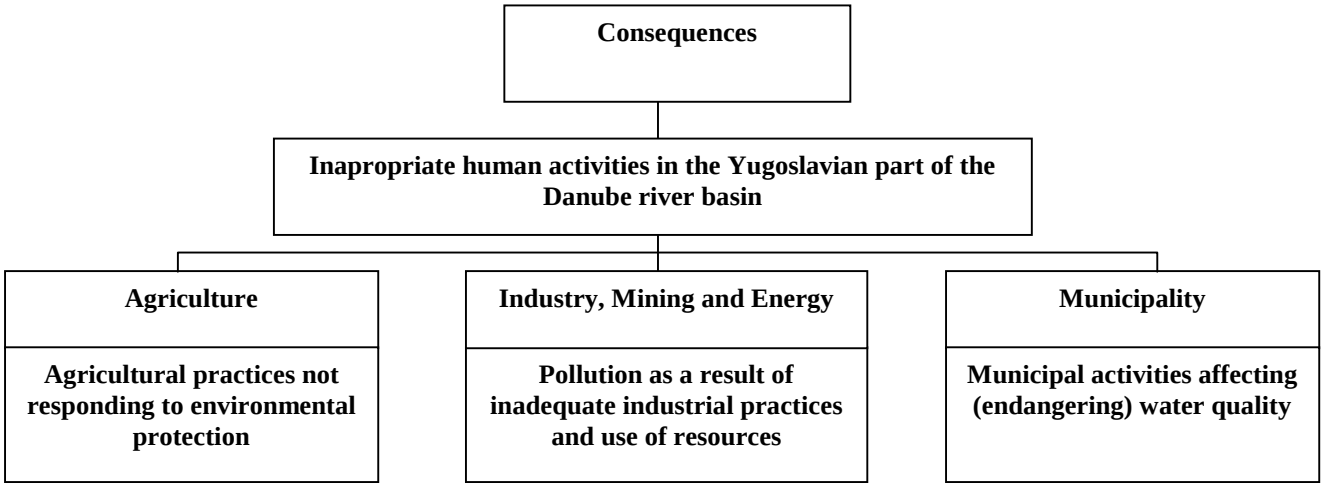
"INAPPROPRIATE HUMAN ACTIVITIES IN THE YUGOSLAVIAN PART OF THE DANUBE RIVER BASIN AREA"

2.2.2. Direct Causes of the Core Problem

The following direct causes leading to the core problem were identified

- **Agricultural practices not responding to environmental protection** due to inappropriate crop production and land use, inappropriate livestock production and forest management.
- **Pollution as a result of inadequate industrial practices and use of resources** due to use of out-dated technologies, inadequate technological process management, inadequate industrial waste management and dissipation of mining resources.
- **Municipal activities affecting (endangering) water quality** due to inadequate management of waste-waters in urban settlements, Inadequate management of waste waters in rural settlements and Weaknesses in municipal solid waste management.

SCHEME OF PROBLEM



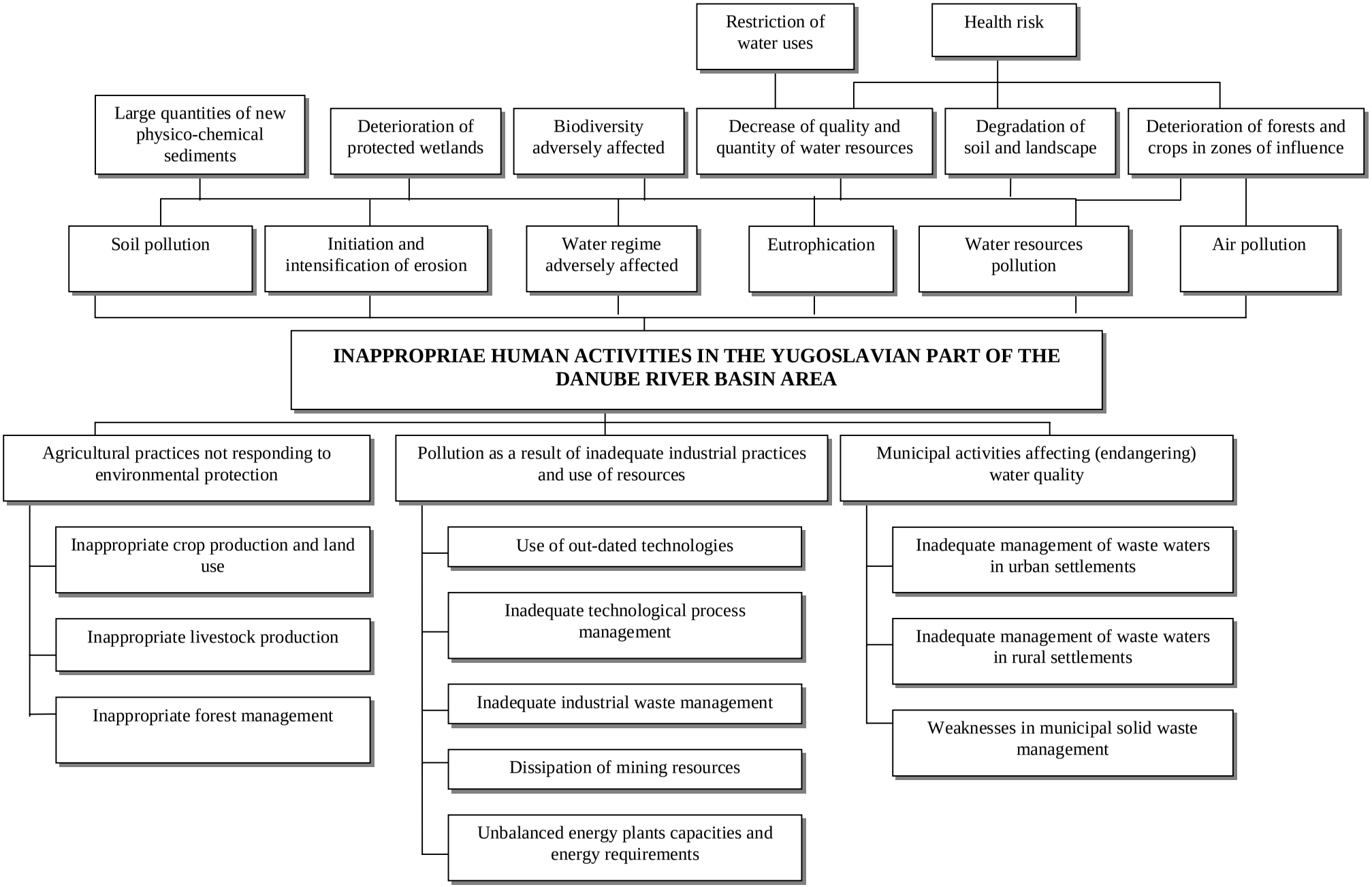
2.2.3. Effects of the Core Problem

These following direct consequences of the core problem have been identified

- **Soil pollution** is an effect of inappropriate human activities in all three sectors, mostly caused by inadequate industrial waste management, by dissipation of mining resources, by weaknesses in municipal solid waste management and by inappropriate agricultural land use;
- **Initiation and intensification of erosion** is again result of combined activities in all three sectors, but most direct causes are inappropriate forest management and inappropriate land use;
- **Water regime adversely affected** is caused by inappropriate forest management, inadequate industrial waste management, inadequate management of wastewater in urban and rural areas;
- **Eutrophication** is an effect of inadequate management of wastewater in urban and rural areas and inappropriate land use and livestock production;
- **Water resources pollution** is cumulative effect of inappropriate human activities but in closest connection with inadequate management of wastewater in urban and rural settlements, weaknesses in municipal solid waste and industrial waste management;
- **Air pollution** is an effect of use of out-dated technologies, unbalanced energy plants capacities and energy requirements and inappropriate forest management.

Eutrophication combined with water resources pollution and soil pollution endangers biodiversity, leads to decrease of quality and quantity of water resources. Initiation and intensification of erosion and air pollution leads to deterioration of forest and crops in zones of influence, as well as to deterioration of wetland. All mentioned effects and particularly decrease of quality and quantity of water resources, degradation of soil and deterioration of forest leads to restriction of water uses and create health risk.

General Problem Analysis



2.3. Analysis of Objectives and Identification of Priority Sectors

2.3.1. Description of Objectives

Objective analysis conducted in the each of three sector groups enabled the participants with an opportunity to convert their perception of existing situation into positive vision about desired state. The means-ends relationship analysis between the proposed main activities (first envisaged as measures to be undertaken in the sector analysis) expected results and sector objectives led the experts who participated in the WS to the following statement of the program objective:

"WATER QUALITY IMPROVED IN YUGOSLAVIAN PART OF THE DANUBE RIVER BASIN THROUGH SUSTAINABLE ECONOMY ACTIVITIES"

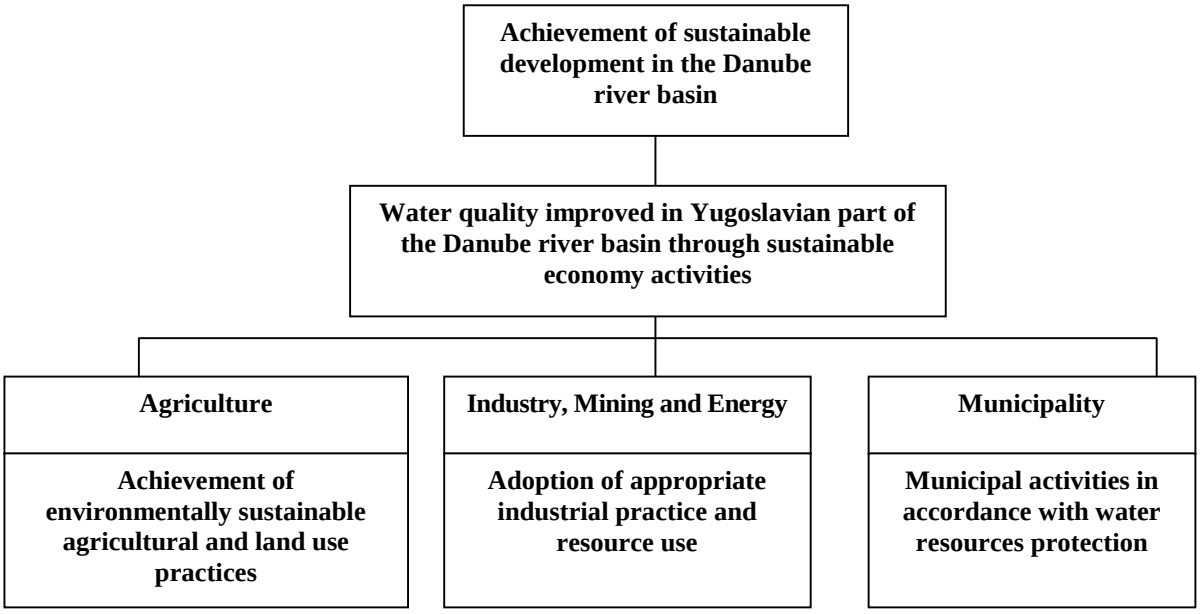
This program objective contributes to the overall objective of the UNDP/GEF Danube Pollution Reduction Program, which was defined as follows:

"ACHIEVEMENT OF SUSTAINABLE DEVELOPMENT IN THE DANUBE RIVER BASIN"

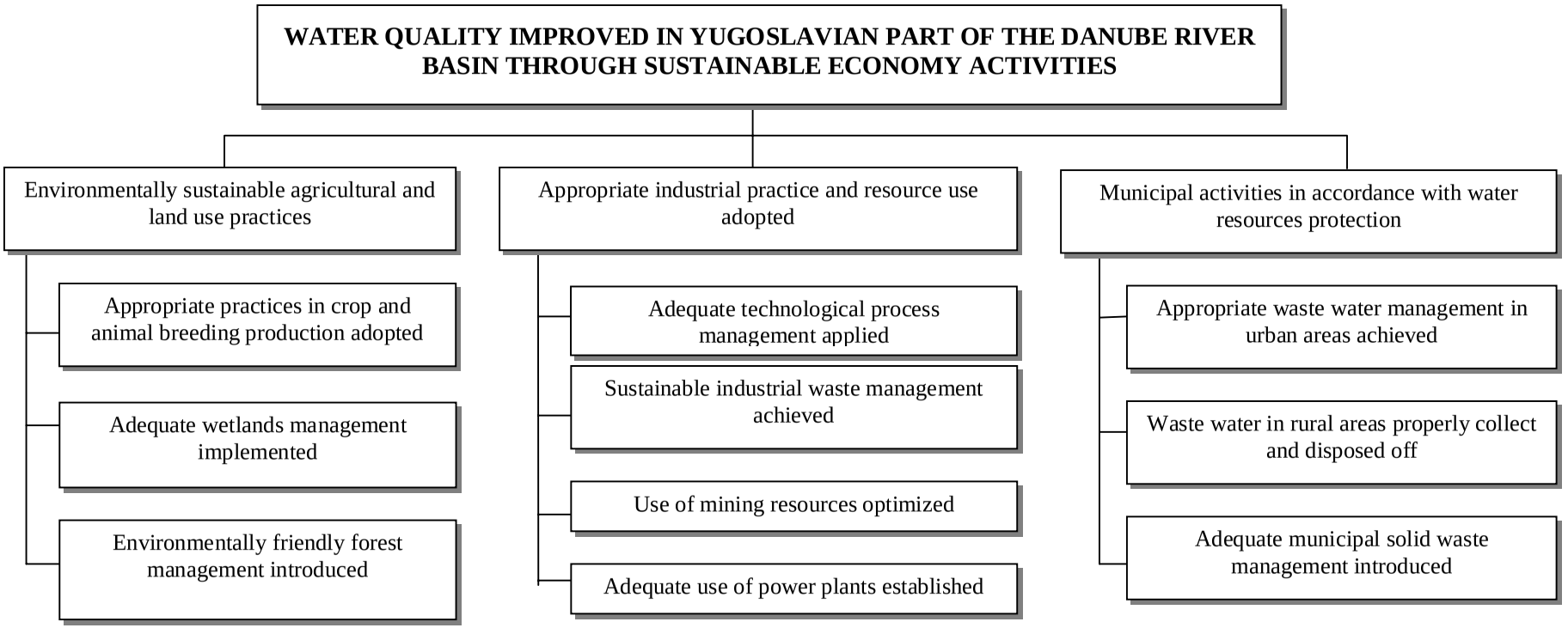
In order to assure improvement of water quality in Yugoslavian part of the Danube River Basin through sustainable economy activities, specific objectives have been identified for the following sectors:

- **Agriculture:** Achievement of environmentally sustainable agricultural and land use practices;
- **Industry, Mining and Energy:** Adoption of appropriate industrial practice and resource use;
- **Municipalities:** Municipal activities in accordance with water resources protection;

SCHEME OF OBJECTIVE



Global Hierarchy of Objectives



2.3.2. Identification of Priority Sectors

In order to achieve the program objective, measures have to be undertaken in the following priority sectors:

1. Agriculture

Agriculture was in past, it is now, and it is expected to be one of the leading and strategic sectors of our economy. It is one of the major pillars for our prosperity in the coming years. Its particular importance has been demonstrated during economic blockade, in the first half of this decade, when we were able to overcome great economic and social problems primarily owing to strong agricultural and our own energy resources. Although it is a part of economy with probably longest tradition in our country due to extensive development trends and the lack of environmental knowledge and awareness at all levels mistakes have been done with negative consequences for the whole environment. That is why introduction of "Environmentally sustainable agriculture and land use practices" will have positive economic and social impact for the all population. In order to achieve sector objective, it is required to:

- adopt appropriate practices in crop and animal breeding production;
- implement adequate wetlands management;
- introduce environmentally friendly forest management;

2. Industry, Mining and Energy

From the early 50-ies Yugoslav State started to direct its mayor investments in industry, first in heavy and latter in light industry. This was often at the account of the other sectors of economy, mainly agriculture and forestry, channeling their profits for the development of industrial sector and energy producing plants. High rates of growth (more than 8% /an. in 1950's), without appropriate legal framework, underpriced resources, lack of environmental knowledge and awareness led to serious environmental consequences in areas of industrial concentrations (Subotica, Sabac, Pancevo, Smederevo, Kragujevac, K.Mitrovica,, Bor , Majdanpek, …). Now country is in process of economic transition and industry in restructuring and rehabilitation and it is expected that many industrial sectors will be privatized. This process has to be undertaken in such manner to allow smooth transition to environmentally friendly industrial, mining and energy production activities. Regarding industry, to achieve sector objective, it is necessary to:

- apply adequate technological process management;
- achieve sustainable industrial waste management;
- optimize use of mining resources;
- establish adequate use of power plants;

3. Municipalities

The third main cause of water pollution in Yugoslav DRB is municipal sector. Settlements with over 15.000 inhabitants, including the largest ones, make only 2,2% of the total number of settlements within the DRB in FRY, but they are producing more than 90% of the total municipal pollution load, discharged into recipients. In order to reach the objective in the municipal sector, it is necessary to:

- achieve appropriate waste water management in urban areas
- collect and dispose properly waste water in rural areas
- introduce adequate municipal solid waste management

2.3.3. Important Assumptions for Program and Sector Objectives

The identification of objectives, led to the necessity to describe important assumptions. These are factors that are important for the success of the program but they cannot be envisaged as activities to be undertaken within the frame of the program as they lie outside its scope and not under its direct control. Therefore, they could also be described as external factors. However, they are pre-conditions that will ensure the success of the program and the sustainability of its results.

The following assumption for the program objective has been identified:

- **Sustainable consumption patterns achieved**

  Classical concept of economic development is practically exhausted and it has to be transferred in concept of sustainable development .One of the basic elements of this concept is to achieve sustainable consumption patterns i.e. to reach a balance between consumption and what are natural resources offering. Realization of this concept, is one of the elements, which will allow reaching above stated objective.

- **Sustainable behavior achieved**

  Sustainable behavior as a new life style will be attained through sophisticated and combined approach which will include scientific, technical, educational, legal, cultural and various forms of social changes to be introduced. All this has to be assisted and supported through various institutional forms strongly supported by relevant national institutions.

The following important assumptions for the sector objectives are necessary to achieve the program objective:

For Sector Agriculture

- **Integrated resources management achieved**

  Integrated resource management has been modernized, but its implementation is uncertain, and so far, not enough successful. This problem may be solved in the process of economic restructuring, and responsibility for enforcing measures lies upon the national institutions in charge of the resource management.

For Sector Industry, Mining and Energy

- **Sustainable economic activities enforced**

  Economic development of industrial sector should be in accordance to a basic principals of sustainable development i.e. harmonization of policies, economic development, rational use of natural resources and environment in the country. Although the principles of sustainable development are already introduced in some adopted strategic documents, legal and institutional framework should be developed in that direction.

For Sector Municipalities

- **New social and economic environment created (SOM)**

  The new social and economic environment in the country means that outer wall of sanctions is not in force any more, that the process of transition is going on, that the present economic position is improved, that the modern technologies are introducing and that foreign investments and credits are available again.

- **Waste management remains priority for government (SOM)**

  In all federal and republican strategic documents it is already stated that the development of individual economic sectors and the country as a whole should be adjusted to the requirements of the environmental protection, while at the same time satisfying the need to improve the current state, especially in the area of water protection and environmental protection in general.

2.3.4. Impact Indicators for Program and Sector Objectives

Impact indicators were developed for the program and the sector objectives. They define the contents of the objectives in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place). They should give an adequate picture of the situation. Furthermore, they should be measurable in a consistent way at an acceptable cost.

The following impact indicators for the **program objective** has been determined

- **Available water resources for human use and economic activities according to EU water quality standards increased 60% (versus 19991) in Yugoslav part of DRB by the year 2020.**

  Extensive, but not sustainable, economic development through the 70-ies and first half of the 80-ies, followed by migrations from rural areas to larger municipalities, without adequate scientific, technical, legal and social approach created situation that resulted in shortage of quantity and quality of water resources. Introducing sustainable economic development strategies will result in substantial increase (60%) of available water resources for human and economic activities, which will correspond to EU standards, by the year 2020.

The impact indicator for the agriculture sector have been identified as follows:

- **Diffuse pollution emission reduced by 30% (versus 1991) according to EU standards by adopting environmentally sustainable agricultural practices in Yugoslav part of DRB by the year 2020**

  This will lead to significant diminishment of the negative impact on the water quality in FRY DRB, to the improvement of general conditions either for the preservation of biodiversity or the development of environmentally grounded agriculture. It is of particular importance since the livestock production is traditionally export oriented sector and it is expected that it will go through intensive recovery followed by large increase of production i.e. possible diffuse sources of pollution could be multiplied.

The impact indicator for the industry, mining and energy sector have been determined as follows:

- **Industrial production increased while industry, mining and energy pollution reduced according to national and EU environmental standards by adoption of environmentally friendly technologies up to 2020 in YU DRB**

  Existing Yugoslav standards in the field of sustainable development harmonized with EU standards will provide appropriate framework for implementation of environmentally friendly technologies in industry in FRY part of DRB. At the same time the emission of pollution from industry and mining plants will be reduced leading to improvement of environment protection. Data will be provided through appropriate database of industrial plants and by ministries of industry and water management.

The impact indicator for the municipal sector have been identified as follows:

- **Significant pollution reduction in natural water courses and canals and at the same time improvement of water quality to one class higher (according to EU standards) compared to year 1991, in Yugoslav part of DRB**

  The quality of natural waters has been regularly measured by the responsible institutions for water quality monitoring i.e. Federal Institute for Hydrometeorology and Institute of Hydrometeorology of Republic of Serbia. All collected data have been presented each year in the form of the annual reports. This indicator do not consider water quality improvement of the surface water resources which already have high water quality in year 1991(class I or II), but assumes that in these water resources water quality will remain in the same water quality class. This will mean that the improved economic situation with much more industrial, agro-industrial, mining and other economic activities will not create more pollution since sustainable concept of development in the meantime have been introduced.

Program Planning Matrix

Summary of Objectives and Results	Impact Indicators	Important Assumptions
➢ **Overall Objective:**	➢	➢
➢ **Program Objective:** Water quality improved in Yugoslavian part of the Danube River Basin through sustainable economy activities	➢ Available water resources for human use and economic activities according to EU water quality standards increased 60% (versus 19991) in Yugoslav part of DRB by the year 2020	➢ Sustainable consumption patterns achieved (PO) ➢ Sustainable behavior achieved (PO)
➢ **Sector Objectives:** **1 Agriculture:** Environmentally sustainable agricultural and land use practices achieved **2. Industry and mining: A**ppropriate industrial practice and resource use adopted **3 Municipality:** Municipal activities in accordance with water resources protection	➢ 1 Diffuse pollution emission reduced by 30% (versus 1991) according to EU standards by adopting environmentally sustainable agricultural practices in Yugoslav part of DRB by the year 2020 (SOA)	➢ Integrated resources management achieved (SOA) ➢ Sustainable economic activities enforced(SOIM) ➢ New social and economic environment created (SOM) ➢ Waste management remains priority for government (SOM)
➢ **Results / Outputs:** **1. Agriculture** 1.1 Appropriate practices in crop and animal breeding production adopted 1.2 Adequate wetlands management implemented 1.3 Environmentally friendly forest management introduced **2. Industry, mining and energy** 2.1 Adequate technological process management applied 2.2 Sustainable industrial waste management achieved 2.3 Use of mining resources optimized 2.4 Adequate use of power plants established **3. Municipality** 3.1 Appropriate waste water management in urban areas achieved 3.2 Waste water in rural areas properly collected and disposed off 3.3 Adequate municipal solid waste management introduced	➢ 2 Industrial production increased while industry, mining and energy pollution reduced according to national and EU environmental standards by adoption of environmentally friendly technologies up to 2020 in Yugoslav part of DRB (SOIM) ➢ 3 Significant reduction of pollution emission from municipalities and at the same time improvement of water quality of natural water courses and channels to one class higher (according to EU standards) compared to year 1991 in Yugoslav part of DRB (SOM)	➢ Appropriate forest management remains as priority for the government (1.3) ➢ Strategy of economy development adopted (2.1) ➢ Rationalization of energy consumption remains priority for the government (2.4) ➢ Waste management strategy established (3.1-3.3) ➢ Incentives for agricultural production ensured (1.1) ➢ National strategy of mineral resources utilization set (2.3) ➢ Favorable economic conditions achieved (3.1-3.3) (These assumptions will be described within the sector strategy)

PO - Program Objective SOA - Sector Objective Agriculture SOI - Sector Objective Industry, Mining and Energy SOM - Sector Objective Municipality

3. Sector Strategies

3.1. Agriculture

3.1.1. Situation Analysis

3.1.1.1. Importance of the Sector and Activities Leading to Water Pollution and Environmental Degradation

The basic assumption for management and development of agriculture, as an important branch of economy, is objective evaluation of natural resources and those created by human activities FR Yugoslavia is an agro-industrial country. Agriculture and agro-industrial production still hold and will maintain an important position in the whole economic structure. The participation of agriculture in the gross national income is 23,8%, and the participation of agro-industrial complex is 52,2%. Before the economic sanctions were imposed in 1992, agriculture had a significant role in the country's balance of payments and trade. DRB in FRY represents 92% of arable land and even higher percentage of total national agricultural production. The land under cultivation makes 63,190 km^2 (61,4%) of the complete territory of FR Yugoslavia. 10% of population is engaged in agriculture as the only activity. Farming, fruit-growing, vine-growing and cattle-breeding is differently territorially represented in highland and plain areas by the categories of the exploitation of agricultural land (Tab.1.). In the field of the agrarian reform the first significant step was made in 1991 by reprivatization (turning back the land estates to the former owners) of the agricultural land.

Table 1

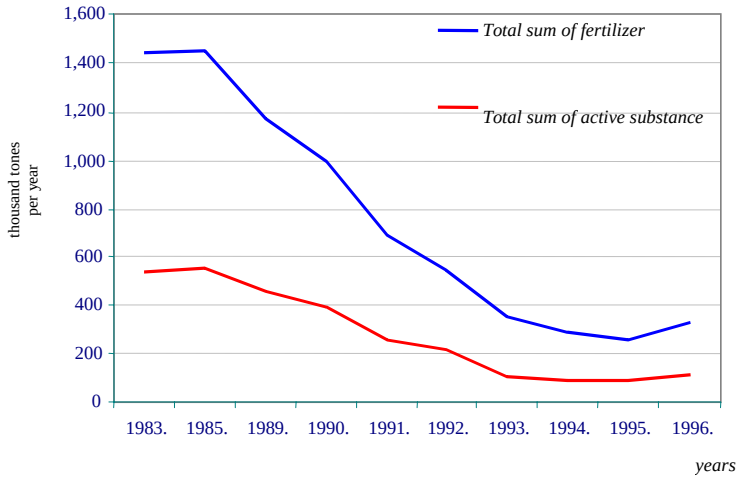
	Agricultural areas of FR Yu (×1,000 ha)	Mountain area 53.40% (×1,000 ha)	Valley area 46.60% (×1,000 ha)
TOTAL	6,319	3,375	2,944
Cultivable areas	4,902	2,178	2,724
Plowed fields and gardens	3,718	1,248	2,470
Orchards	267	179	88
Vineyards	89	56	33
Meadows	828	695	133
Pastures	1,361	1,181	180
Pools, ground covered with reeds and fish ponds	56	16	40

In FR Yugoslavia 0.60 ha of the agricultural land goes to one citizen. Regarding landowning, the private property dominates (83% of area) over state property (17%). Private estates smaller them 2 ha are managed by 40% of households and the estate size more than 5 ha are managed by only 20% of households. The average size of private parcels is from 0.20 ha to 0.90 ha.

From the standpoint of modern agricultural production, the diffusion of small parcels represents an obstacle for introduction of more intensive agricultural production, but at the same time an advantage from the aspect of organizing "organic agriculture" as an environmentally rational way of the managing of an agrocomplex. It is particularly important that agricultural production on individual estates is rounded by the system "land - plant - animal - land". FR Yugoslavia is in possession of significant capacities for the production of mechanization, but the present degree of exploitation of those capacities is very low because of the long period of economic crisis and blockade.

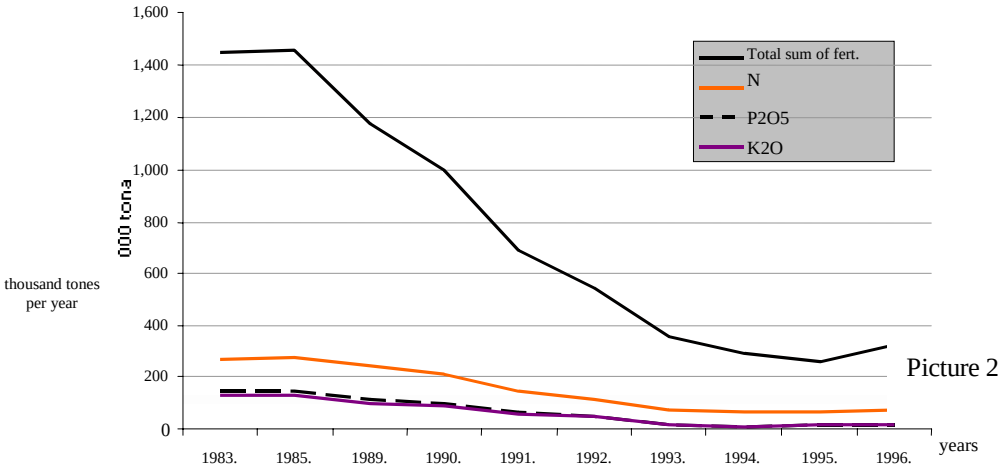
The Consumption of Mineral Fertilizers and Pesticides

The current average consumption of mineral fertilizers has significantly decreased due to the economic sanctions and amounts around 83 kg/ha of the land under cultivation. In the periods of the greatest consumption (middle 1980's) it amounts 295 kg/ha (Picture 1.). It is obvious that there was neither risk of the land drainage with mobile forms N nor P nor greater erosion to surface and ground waters. The exception was irrational consumption in particular cases and on small areas in the close vicinity of = settlements and watercourses, especially on the land of private farmers.



Picture 1

The participants of the workshop agreed that the rationalization of agrochemical use is important, and it have to be planned and controlled in the whole region, and in this respect EU standards have to be followed. The consumption of pesticides lessened from 3 kg/ha of the land under cultivation in year 1985 to under 1 kg/ha of the land under cultivation in the period 1993-1997 (Picture 2). As a consequence, remains of pesticides in land are negligible and in surface and ground water resources pollution is practically eliminated. The cases of local nature are exceptional (inappropriate and uncontrolled implementation, or inadequate discharge of wrapping material).



Picture 2

The control of the presence of heavy metals (Pb, Cd, Hg, As, Cr, Ni, Cu, Zn) in the lands in Serbia showed that their presence ranges in the limits of normal concentration.

In the areas under pastures as well as in the zones of wetlands, ponds, reed grounds, and natural fishponds, which make 1/3 of the whole agricultural land, mineral fertilizers and protective chemicals, have never been used.

Influence of the Agricultural Plant Production on the Quality of Land

Significantly high production of crops of 20,822,000 tons per year combined with low consumption of the mineral fertilizers represents a kind of land degradation, since the longer-term production is done on the account of the natural land potential. Besides, the changes of the land are influenced by erosion, land pollution caused by industrial and urban waste, changing of chemical and physical characteristics (souring) and salting under the influence of ground waters.

Due to land slope, irrational timbering, non-existence of zones of protecting forests, erosion has endangered around 2/3 of agricultural land. Due to the change of physical and chemical structure and low pH value of land negative effects are registered on 50% of agricultural area. Such phenomena are continually observed, and adequate land-reclamation measures are taken for their prevention.

Cattle Breeding Fund and Production of Manure

In the DRB area in FRY, 2,500,000 potential heads are bred. General characteristics of managing with cattle breeding fund area are:

- small number of potential heads per hectare (the highest value is in Vojvodina, only 0.22-0.24 potential heads per hectare)
- low selection productivity
- non-existence of technological program for composting manure on large cattle breeding farms
- limitation of available agricultural areas for the disposition of manure
- encircling of production on individual farms which gives the possibility for organizing the production of food with preserved natural and biological value on preserved natural areas.

Consequences of Cattle-Breeding Agricultural Production

On pig farms of great capacity (about 20,000 fattened animals per year), mostly under state ownership just as on medium and small animal farms, technological cycle of production is not rounded by the treatment of composting the manure. At the same time, reprivatization of agricultural areas surrounding area for its ultimate disposition as organic fertilizer is lessened. This is particularly notable in Vojvodina. (map - distribution of larger pig farms).

Policy and Legislation

The development policy dealing with agriculture is led by the Government of FRY through the Federal Ministry of Agriculture, as well as the governments of both republics - through the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia and the Ministry of Agriculture, Forestry and Water Management of the Republic of Montenegro. On the local level, there are technical advisory services established throughout municipalities. Still, some areas in Yugoslavian part of DRB are not adequately provided with professional personnel.

The national strategy in agriculture is partly in charge of some other state institutions and bureaus:

- the Federal Ministry of Development, Science and Environment;
- the Federal Ministry of Health and Social Policy;
- the Ministry of Health of the Republic of Serbia;

- the Ministry of Health of the Republic of Montenegro;
- the Ministry of Environment of the Republic of Serbia;
- the Ministry of Environment of the Republic of Montenegro.

The legislation in the field of agriculture is mainly harmonized with the regulations of EU, but the economic situation caused by economic sanctions and transition period has greatly disrupt its implication. The general characteristics of the present state of Yugoslav agriculture are:

- reciprocal disproportion of the plant and cattle production;
- the diffusion of small individual estates;
- low level of the consumption of mineral fertilizers and pesticides;
- the obsolescence of mechanical equipment;
- the ever-present danger of water pollution being caused by animal farms and
- great economic insecurity of agricultural production.

In spite of a difficult economic situation in Yugoslavia, great endeavors are being invested in:

- the construction of infrastructural institutions (the Gene Bank);
- the control of fertility;
- the revitalization of the irrigation system;
- the preservation of biodiversity;
- the creation of forest bases;
- the establishment of the information system and
- the planning of other important projects.

3.1.1.2. Current Strengths/Assets

The main activities in this sector leading to the pollution can be summarized as: crop production and inappropriate land use, production of waste in livestock production and inadequate forestry practices. The process of transition and the economic situation can, more or less, intensify particular ongoing activities, or bring about the appearance of new ones.

Several assets have been identified in order to overcame the negative consequences of above activities:

- **Machinery and equipment**

  As for the cultivation of land, the care of crops and harvesting, Yugoslavia is in possession of around 414,000 tractors and 4,900 combine harvesters. At first sight it is a good state of equipment (1 tractor per 11.5 ha and one combine per 198 ha), but the level of obsolescence is high, and the level of proper functioning of the machinery is low. Along with the bad state of equipment with additional tools (1-2 tools per tractor and malfunctioning irrigation systems (on only 2% of the agricultural land), it certainly makes a problem for the planned development of agriculture without negative impacts on the environment, but Yugoslavia has industrial capacities for the restoration of the mechanical equipment.

- **Legal regulations**

  The legislation defining agricultural production is important. Beside the legal regulations concerning agricultural land, there are other regulation such the Regulation of the Highest Allowed Concentrations of Discharged and Harmful Substances in Land and the Irrigation Water and other rules that regulate the field of agriculture. The agricultural services are organized, as well as the training of personnel and the regular control of land

fertility. Certainly there is a need for harmonizing our with the EU regulations, but at this moment the main problem is disregard of the existing regulations, which comes as a consequence of the long period of difficult social and economic situation in Yugoslavia.

- **Technical and scientific know-how**

  Existing technical and scientific know-how has been probably the most reliable support for further improvement of agriculture in FRY. There is a significant number of experienced professionals and scientists and capable, ambitious, well educated young men, as well, engaged in the field. The majority of them have been quite familiar with the latest achievements in agricultural practice and science.

- **Available arable land and space**

  Significant arable land area (over 60% of FRY territory) together with existing climate characteristics made good preconditions for high agricultural production. Although the problems are evident in some areas (salting of soil, erosion, etc.) available arable land remains to be a main potential for further development of agriculture in Yugoslavia.

3.1.1.3. Analysis of Transboundary Effects

The natural space is indivisible, and makes a whole with transboundary effects of all environmental factors on a larger area. Such an area is the Danube river basin. It is reasonable that such an environmental whole should be included in a uniform area plan a control on the global level with the agreement of all the countries of the Danube basin.

The following transboundary effects have been considered:

- **Input of nutrients and sediments**

  At the entrance profiles of the River Tamiš, the River Tisa, River Bega and of the River Danube too, coming from the neighboring countries, the increasing muddiness of water, the high contents of nutrients and a considerable level of organic pollution were established. Such quality of water represents an endangering factor for fish breeding in fishponds, for hydrological stability of wetlands and the maintenance of biodiversity, as well as for the use of waters for irrigation.

3.1.2. Sector Problem Analysis

3.1.2.1. Core Problem

The core problem for this sector was defined as:

“AGRICULTURAL PRACTICES NOT RESPONDING TO ENVIRONMENTAL PROTECTION”

The sector problem is defined as practices in agriculture, which have negative impact on the environment. Such a practice is a result of necessity, for in the condition of economic isolation, agricultural production is organized on the principle of the possible, but also on disregard for regulations, plans and programs.

3.1.2.2. Causes Leading to Environmental Problems

There are three important causes originating from agriculture and forestry, which bring environment pollution and degradation.

The following direct causes of the sector core problem have been identified:

- Inappropriate crop production and land use
- Inappropriate livestock production
- Inappropriate forest management

These problems have other direct causes. An explanation of each of these problems together with their cause-effect relation will be given below:

(i) Inappropriate crop production and land use

Inappropriate crop production could initiate and intensify erosion and induce eutrophication, and thus adversely affect water regime and biodiversity. The main causes of this problem are:

a. Inappropriate land preparing

There are not appropriate conditions for land preparing and environmentally sound organization of agricultural production. Existing mechanical equipment is insufficient because it is mostly out of use. Bad quality of existing mechanical equipment can't provide conditions for appropriate land preparing and heavy machinery is more in use which causes land compression. Agricultural production organization is based on the current market needs. Order of sowing corps is not good because of inappropriate preparation technologies and land cultivation, and lack of appropriate regulative. Soil control is insufficient because of incomplete information system.

b. Wetlands drying

In the past period wetland management is mostly characterized by their partly drying and inappropriate forestation, which significantly reduce their area. Forestation by inadequate species is favored, especially by fast growing species, so natural wetland forests are changed. Law regulation of swampy zones protection is made, but the resources for enforcement of these measures are missing. Also, there is unlawful forest cutting, because of incomplete and insufficient control.

c. Unbalanced agricultural production and land use with livestock production

There are no plans regulating natural connection between plant growing and cattle breeding. Plant production is organized in restrictive conditions, which results in overexploitation of biopotential of land. There is a minimal use of mineral fertilizer and organic fertilizer is not used enough. Mechanical equipment for organic fertilizer utilization is old or not available. Unbalanced order of cattle breeding is making hardly possible rational technological connection with plant growing. Uncompleted law regulation, lack of finances, inadequate training and low conscience of necessities of environment protection is the reasons for incorrect application of agricultural technologies.

(ii) Inappropriate livestock production

The main effect of this problem is pollution of water resources with biodegradable organics and nutrients which induce eutrophication.

The main causes of Inappropriate livestock production are:

a. Unbalanced agricultural production and land use with livestock production

There isn't obligation ascribed by law for using organic fertilizer in plant growing, and for it there are no plans obligation for their use. Manure is most often inadequately stored in inappropriate stores. Liquid manure is poured out in to lagoons, which are representing constant danger of water pollution. There is no adequate technical equipment for disperse of manure on agricultural land and using it as natural fertilizer in plant growing. Using of manure is often inadequate or incorrect because of lack of control and knowledge.

b. Inappropriate manure production and waste waters treatment on animal farms

On big farms there is a high production of manure. High production of manure is not adequately treated in cultivation systems, which are old and inadequate. We are mostly talking about old, out of use, unfunctional technological actions with small and limited capacity. In small farms, manure is stored on smaller stores. After natural process of separation, manure is dispersing on surrounding limited land area. Small distances from settlements and changes of ownership on agricultural lands are limits for using adequate solutions in cultivating technology and using organic fertilizer.

(iii) Inappropriate forest management

The main effect of this problem is initiation and intensification of erosion, change of water regime and reduction of biodiversity. The main causes for Inappropriate forest management are:

a. Uncontrolled forest cutting

Unlawful forest cutting is often and it caused significant degradation of forests in some areas. Ownership on these natural resources has not adequate law regulation. Some improvements of Law regulation has been made, but control of its enforcement is insufficient and penalty policy is inadequate. Public awareness of need for protection of natural forest areas is not developed enough to stop further irrational and unlawful forest cutting.

b. Environmentally inappropriate replacement of nature forest by planted ones

On wider areas forestation is intensive with fast-growing species of trees. Such forestation is not followed by appropriate professional analyses and plan activities, so plated forests sometimes endanger natural forests. Foreign species are being imposed on account of domestic tree species. Those changes in domestic forest ecosystem endanger biodiversity of wider areas, change existing biocenotic relations, spread new herb diseases, etc.

3.1.2.3. Environmental Effects

The participants of the workshop have declared a number of examples as the consequences/effects of the main problem of this sector. By analyzing all proposed effects they agreed that there are four main consequences which involve all the others.

The environmental consequences of inappropriate activities are the following:

- **Initiation of erosion**

  The erosion of land influences mudding and increases sedimentation in water basins, decreases the productivity of land, and it can be more or less intensified depending on the land slope and the width of the plant layer.

- **Reduction of biodiversity**

  The change of environmental conditions, especially if they are as rapid and intensive as water-pollution and drainage of wetlands, timbering disagree with normal development of natural species that live in such environments. The rapid changes of life conditions leads to their extermination, which impacts badly the whole environment of endangered area.

- **Eutrophication**

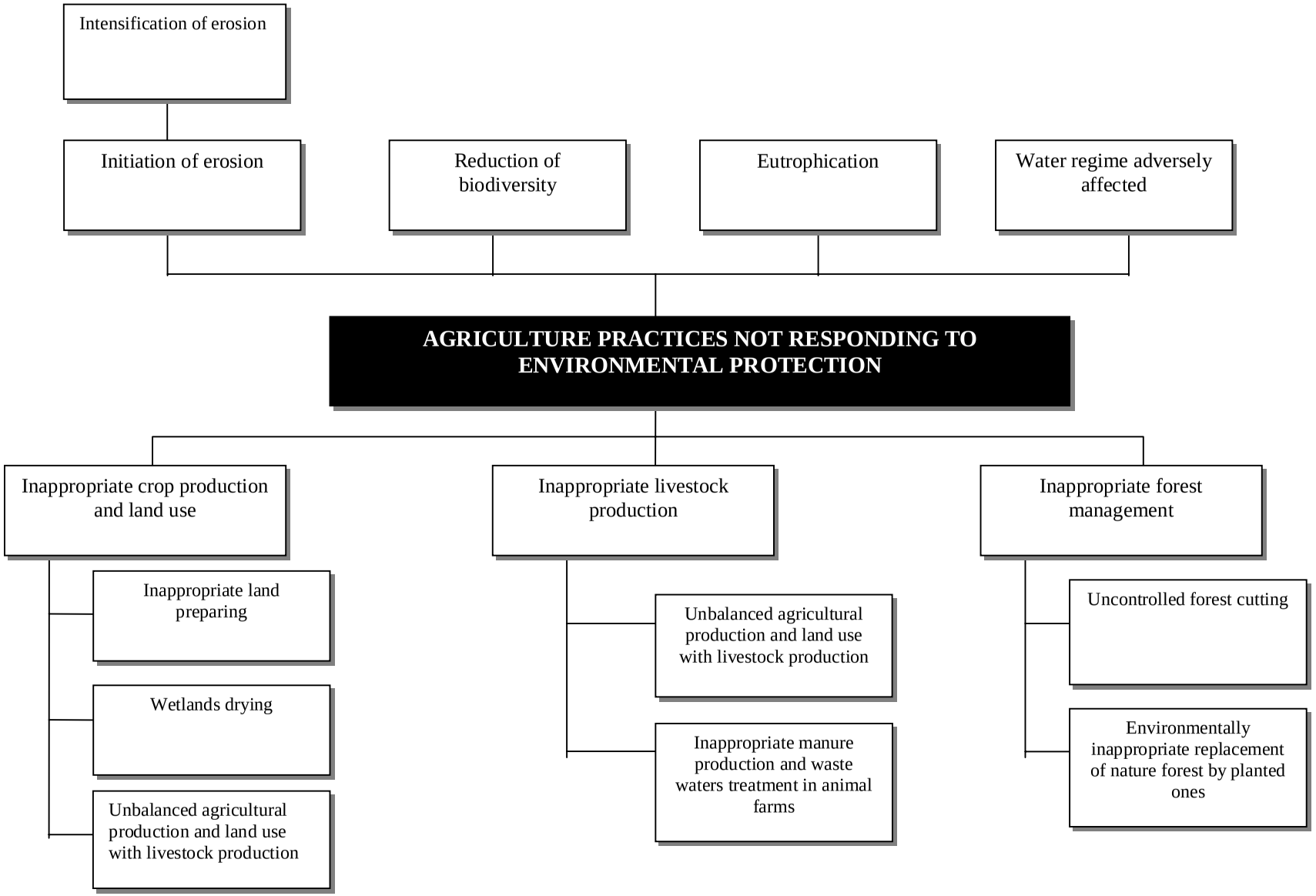
  Either from erosion process or the flow of manorial wastewater into recipients, the concentration of nutritious substances in water considerably increases. Favorable hydro-ecological conditions and present nutrients are sufficient for intensifying the primary production of algae, which changes the chemical and physical characteristics of waters, and leads to a series of other negative impacts on environment.

- **Water regime adversely affected**

  The change of water regime, on one hand, diminishes water resources, decreases the quality of waters, the usability of water in the agricultural production, and, on the other, increases the erosion, the degree of moisture, lifts the level of ground waters and causes salting of agricultural land.

Problem Hierarchy

1. Agriculture



3.1.3. Objectives, Expected Results, Actions and Related Projects

The participants of the workshop have marked as the sector objective:

"ENVIRONMENTALLY SUSTAINABLE AGRICULTURAL AND LAND USE PRACTICE ACHIEVED"

and formulated a number of items defining and declaring the sector objective.

In order to achieve the sector objective, the following results have to be accomplished

- Adoption of appropriate practices in crop and animal production
- Implementation of adequate wetland management
- Introduction of environmentally friendly forest management

Each of the stated results will be realized by undertaking individual activities, as identified by the participants of the workshop. For each activity, the existing projects that are in the phase of realization were marked; the proposals and plans were also given in order to have the main goal realized and to diminish the pollution in the Yugoslav part of the Danube basin.

(i) Adoption of appropriate practices in crop and animal production

By introducing new equipment and market policy the adequate conditions for environmentally acceptable and justifiable practice in agricultural production will be made.

In order to achieve this result, several activities have to be undertaken in the following fields:

- Manure treatment
- Conservation and revitalization of soil
- Irrigation practices

It is necessary to:

- **solve technical and technological problems in manure treatment.** By efficient cooperation at all levels and by the adequate planning of locations for farm-building, the problem of composting and disposition of manure and implementation of organic fertilizers in the plant production will be solved. It is necessary to introduce new technologies for discharge and composting of manure, to optimize existing capacities, to accept modern methods of animal breeding based on principles of environmental protection, to ensure trained personnel for managing, maintaining and realization of new technological methods. It is also important to secure external financing sources through different modes of cooperation.

  As the first step in attaining the main goals it is necessary to develop the appropriate technological solutions for manure treatment. Rational managing of quality of manure includes, first of all, improvement of technological process of its treatment on farms with big and middle capacity.

  By introducing adequate technological solutions in treatment of manure, high nutritive values would be preserved through significant production of valuable natural organic fertilizers. At the same time, appropriate mechanical equipment have to be introduced in order to facilitate utilization of organic fertilizers in fertilization process.

  Although a remarkable progress have been made in the field of domestic animals health protection in the past decades, there is a need for it's further improvement, especially concerning further improvement of livestock production in FRY and it's balancing with agricultural production.

On some locations where appropriate conditions for distribution of liquid manure are not existing, alternative solutions have to be introduced such as liquid manure dosing in aqua polycultures for live stock production.

It is necessary to optimize manure production and farms capacities with ambient conditions in order to achieve environmentally justified intensive development of agriculture and livestock production.

According to the programs of harmonious development of plant and cattle production on the national level and national program of domestic animals health protection, location plan for new farms would be made.

- **undertake measures for conservation and revitalization of soil through monitoring of fertility and degradation process.** Establishing a manifold cooperation among all responsible institutions in realization of monitoring in all responsible sectors of agriculture will enable the realization of all planed activities in order to eliminate negative impact of agriculture on environment of the Danube basin. This includes the defining of the ownership over land, the specification of the existing legislation and its promotion in agreement with the EU standards, the provision of qualified services for the control of pollution and advisory service in order to promote the production according to world standards.

  It is necessary to continue and extend adequate prospects of agricultural land in order to evaluate present characteristics of soil (class, i.e. bonnity), define changes and severity of degradation processes.

  It is necessary to develop appropriate soil conservation and revitalization prospects in order to protect agricultural land from the observed degradation processes.

  Implementation of above mentioned prospects should be carried out in accordance to the priority lists created by using specific criteria (degree of degradation, cost, environmental inpact, etc.).

  Appropriate information system for monitoring in agricultural land should be developed, as a continuation of the already started activity. This system will support environmentally sound planing and creation of the national policy for agriculture land management.

  Different stimulate mechanisms (financing mechanisms, supply with adequate equipment, etc) should be establish in order to enable local services to conduct adequate monitoring of land fertility and land degradation. Conduction of measures for fertility control and introduction of new technologies in agricultural production would bring a rational use of organic fertilizers and chemicals.

  In the frame of the national program for land management, programs for protection of inundations, flood plains and wetlands will take place. It is also important do develop and realize programs for creation of artificial wetlands and protective forest belts.

  By establishing cooperation between countries of Danube River basin soil resources management activities on the regional level would be coordinated and more effective. Norms, regulations and methods of work would be coordinated.

  Adequate educational programs for farmers have to be defined and realized with purpose to arise their interest for the more effective use of organic fertilizers.

  In order to achieve appropriate use of chemicals in plant production it is necessary to develop appropriate educational programs for farmers, as well as to enforce soil monitoring by the local services, as it mentioned earlier.

- **ensure implementation of appropriate irrigation measures.** Renewed mechanization and adequate implementation of irrigation measures are an important activity for the rational managing water potential indispensable for adequate development of agricultural production. It is important to create a new irrigation inventory, perform reparations, estimate the energy consumption of the existing system, search for the new sources of finance, train personnel for efficient management and develop an irrigation network for private producers.

  In the frame of the national agricultural program a selection of adequate technologies for use of water potentials in agriculture, train personnel and plans for development of irrigation systems would be made.

  Hydro-meliorative plan would include detailed inventories of areas with high level of groundwater which endanger soil and agricultural production.

  It is necessary to conduct adequate plan of hydro-meliorative and irrigation activities according to the available water resources, plant production, structure of land properties, etc. Particular attention will be paid on introduction of more effective irrigation methods.

  It is necessary to develop National irrigation policy harmonized with water resources management, agricultural production and environmental protection. It will provide necessary framework for implementation of adequate irrigation and other melioration measures, monitoring of water quality, education of farmers for rational use of water and it's protection.

  It is necessary to improve monitoring of water quality for irrigation by improvement of regulation concerning water quality, better organizing work of sampling stations, etc.

For this result the following projects have been identified:

Existing/On-going Projects

- *Inventory of soil fertility and soil concentration of toxic and hazardous material in Serbia*. The project has been cut short because of the economic situation. 50% of the planned program has been realized. It is necessary to provide financial means for the continuation of the realization of this project.
- *Revitalization of existing irrigation systems*

Planned Projects

- Develop programs for local and regional agricultural services, education, and technical support
- Revitalization of low alkalinity and acid soils in Serbia
- Revitalization of eroded soils in the Timok river basin
- Quality control of surface and ground fresh waters within the irrigation system

Proposed Project(s)

- Construction of wastewater treatment plants for large capacity farms (over 20,000 fatlings per cycle). The realization of model project for the manure and wastewater treatment will solve the problem of a greater number of large capacity farms in the region of Vojvodina (fig. 2.1-3 in National Review, part B, map of larger pig farms in FRYu) on the locations: Vrbas, (DP "Farmakop"), Krivaja (PP "Krivaja"), Čenej (DP "Čenej"), Čoka (PK "Čoka"), Kikinda (PDP "Jedinstvo"), Gunaroš (DP "Pobeda"), Bečej (PIK "Bečej"),Beograd (PKB "Vizelj" and DP "Surčin"), Obrenovac (DP "Dragan Marković"); in Morava region on the locations Žagubica (DP "1. decembar") and Petrovac na Mlavi (DP "Petrovac") and in Timok region on the locations Zaječar (PD "Zaječar").

- *Construction of waste water treatment system for mini farms*. Through the systems of the model character the manure treatment and its disposition on medium and small capacity farms, which are the most numerous, will be solved, too. By introducing modern technological methods the significant preconditions of the development of the organic agriculture in a wider area of the Yugoslav part of the Danube basin would be achieved.
- Introduce information system on Yugoslav soil resources
- Organic agriculture development program in rural areas
- Harmonization and legislation development based on the EU directives on pesticides
- Long term program for irrigation system development (800,000 ha)
- Research studies on the use and processing of farm wastes

(ii) Implementation of adequate wetland management

By implementation of greater degree of cooperation with surrounding countries a long-term program of wetland management will be provided.

In order to achieve this result, several activities are required in the following areas:

- Transboundary cooperation in wetlands conservation
- Increasing of wetland areas
- Public awareness

It is necessary to:

- **implement transboundary cooperation in wetland conservation.** Implement transboundary cooperation in wetland conservation, draft a program of the personnel exchange and specialization, harmonize work methods, and provide financial means for the realization of joint researches. By establishing of Regional wetlands centers appropriate framework for international cooperation in this field will be enforced, and programs concerning protection of wetlands of communion interest can be developed and realized.

  As the first step in regional (transboundary) cooperation it is necessary to undertake measures for establishing transboundary wetland areas and subsequently elaborate joint activities on their protection. Regional cooperation also includes realization of plans for establishing new green corridors, or coordination of activities on monitoring and maintaining of existing ones.

  At the same time regional cooperation will provide necessary framework for preparation and realization of adequate programs for protection of endangered species. Different modes of cooperation, including state, local and NGO level have to be enforced.

  Similar to the above, regional cooperation can provide appropriate framework for conducting more efficient and reliable monitoring programs of migratory species and activities on their protection.
- **undertake measures for increasing for protected and revitalized wetland areas.** Undertake measures for increasing of protected and revitalized wetland areas, which is supposed to ensure the preservation of ornitofauna, the preservation of the ambient conditions for the development of the marsh flora and fauna, preserve the area and enable scientific tourist visits, establish an adequate legal frame, and speed up the restoration of already endangered areas. As the first step in attaining the main goal, it is necessary to adopt appropriate National wetland management strategy which will enable their adequate protection and break with previous management practice, which was mainly based on measures such wetlands drying and reforestation.

It is necessary to continue already started activities on enlargement of wetland areas protected by law. Adoption of the national wetland management strategy would also provide appropriate framework for realization of adequate monitoring activities in parallel with realization of other wetland protection programs.

It is important to conduct appropriate activities in order to evaluate if the specific wetlands are endangered with input of nutrients. If it is the case, then the appropriate measures have to be adopted and realized (technical measures, legislation, etc.) keeping in mind that every wetland is a unique ecosystem. Input of new allochthonous species in to protected wetlands would be stopped, and existing ones would be reduced in the aim of protection of domestic species.

- **increase public awareness in wetland protection.** It is necessary to support all organizations which will take care of wetlands, raise public awareness of their significance, of the need for their preservation, establish proper communication through media, organize centers that will make available publications and educational platforms.

  As a first step, it is necessary to create National wetland information system (YUWIS) which will facilitate conduction of different activities of wetland management. Also it is necessary to enable and educate stuff that will maintain information system for taking care of protect measures.

  It is necessary to continue and extend already started activities on creation of database of wetlands biodiversity in order to set appropriate and reliable source of information to scientists, professionals and wider public.

  In order to make public more familiar with the significance of wetlands and the need for their protection it is necessary to define appropriate educational programs, organize meetings on wetlands protection necessity, provide access to information concerning wetlands to wider public, etc.

  It is necessary to provide appropriate training of stuff responsible for management and protection of wetlands in order to improve wetlands protection and public awareness.

  Through support of non government organizations whose activities are preserving and protection of wetlands, wider public can be involved in realization through different activities on wetlands protection, realization of educational programs, publishing activities and cooperation with media.

For this result the following projects have been identified:

Existing/On-going Projects

- *Biodiversity of Yugoslavia*
- Making an autochthonous plan of animal genetic pool preserving biodiversity in the Balkans. The project is in the phase of realization, and 80% of the project has been performed.

Planned Projects

- *Ecological studies of major channel of the DTD channel system and sustainable development of channel regime*
- *Ecological studies of the Danube basin*
- *The study of biodiversity of protected wetland areas in the new part of the Danube.*

Proposed Project(s)

- *Qualification and quantification of pollution of DTD Channel Net of Banat (Yugoslav-Romanian-Hungarian region) and proposal of possible actions*
- *Sustainable use of the DTD channel system as water transportation corridors - pollution control in Banat (Yugoslav-Romanian-Hungarian region)*
- *Channel net of irrigation by the DTD hydrosystem as a potential: green corridors, wetland connection, endangered species refugium and biodiversity basis of Banat region*
- *Establishing ReWeC (Regional Wetland Center)*
- *Organizing national NGO wetland meeting and choosing a NGO focal point for the Government - NGO cooperation in wetland cooperation*

(iii) Introduction of environmentally friendly forest management

The conditions for the correct managing of the forest fund will be established by the training program for development, exchanging personnel, and the training and introducing of new regulatory mechanisms. In order to achieve this result, several activities are required in the following areas:

- eroded lands
- wetlands
- public awareness

It is necessary to:

- **reforest eroded lands.** It is expected that reforestation will significantly diminish the process of erosion on the slopes, create proper conditions for the development of the forest fond in all areas where necessary. It is necessary to ensure the finances for the activities necessary for the restoration of forests in the areas with erosion through national, regional and local sources.

  As the first step, it is necessary to make inventory of eroded terrenes, as a continuation of already started activity. This inventory would bring adequate base for law regulation and preparation of programs and plans for reforestation.

  It is necessary to elaborate and realize measures for reforestation in order to create wind protection forest areas. This measure will significantly reduce eolian erosion in some parts of the country.

  Different stimulation mechanisms have to be establish in order to stimulate land owners for forestation. Cooperation between individual farmers and big forestry enterprises should be enforced. It is necessary to improve existing legislation and regulation concerning forestry and control and penalty policy. Particular attention has to be paid to the stimulation of farmers to reforest their own land and stop eroding processes.
- **reforest wetlands with autochthonous species.** It is expected that proper circumstances will be established for the development of all wild-growing forests, introduce environmentally grounded methods for forest management in wetlands, ensure the participation of all NGOs and provide suitable legal frames for the financing of environmentally justified forest management.

  As a consequence of forestry practice in the past period significant areas have been reforested with monocultures. In order to increase biodiversity and environment protection it is necessary to elaborate and conduct measures to convert these forests into autochtonous plant associations.

It is necessary to introduce, wherever is environmentally and economically justified, atochtonous tree species on previously deforest lands. Production of reproductive material of autochtonous tree species would be financially stimulated as well as planting of autochthonous reproductive material.

Establishing national genofond centers of autochthonous tree species would create important elements for reintroduction of autochthonous species on areas with plant growing alchothonous species.

- **Increase public awareness for reforestation necessity.** It is necessary to develop programs for the popularization of reforestation , introducing environmentally sound forest management, ensure the participation of NGOs, participation of media, and coordination of realization of the foreseen program.

  As the first step, it is necessary to present through electronic and printed media planned and ongoing projects concerning reforestation. Presentations should focus on their goals and positive impacts on environment, as well as on the experiences from already finished forestation activities.

  In order to increase public awareness it is important to popularize set-aside principles in forest management.

  It is necessary to continue and intensify organization of educational summer camps (mostly conducted by NGOs), which are very efficient way to popularize forests, their revitalization and reforestation.

  Support of NGO forestation activities through professional assistance in selection of adequate methods of forest practice, coordinating activities and financial support can bring significant effects in popularization of activities necessary for conducting of planned works on reforestation of endangered areas.

For this result, the following projects have been identified:

Existing/On-going Projects

- *Complete forest inventory of Yugoslavia*

Planned Projects

- *Protection of birch (Betula Pendula) autochthonous forest in Debeli Lug region, Majdanpek.*
- *Project for reforestation of 30% of eroded soil*

Proposed Project(s)

- *Special purposes inventories for water supply resources protection*
- *Project for reforestation by autochthonous tree-species in Srem region*

In order to achieve the sector objective the projects proposed with ***high priority*** are as follows:

- Construction of wastewater treatment plants for large capacity farms (over 20,000 fatlings per cycle) in the locations of Vrbas (DP "Farmakop"), Žagubica ("1. decembar") and Belgrade (DP "Surčin")
- Ecological studies of the Danube basin
- Project for reforestation of 30% of eroded soil
- Research studies on the use and processing of farm wastes

3.1.4. Important Assumptions for the Sector

Important assumptions are factors that are significant for the success of the program but they lie outside of scope of the program and not under its direct control. Therefore, they are external factors necessary to ensure the success of the program and the sustainability of its results. The group of experts from the workshop has performed an analysis of the important assumptions for this sector. Regardless of the anticipation of the whole set of activities with important elements and projects, the participants have established a series of external conditions, which have the key importance for the accomplishment of the planned activities, results, and objectives.

At the **activity** level, the following assumptions have been identified:

- **Effective cooperation for adequate farm location planning achieved**
  The main obstacle in adequate location planning is in connection with the ownership of agricultural land. Reforms are failing to keep up with the times and many problems occur: economic, legal, political, etc. The clarification might be triggered at the state as well as the regional and local level.
- **Effective cooperation between all sectors for monitoring**
  The problem may be hinted if it comes to different interests and opinions in setting, functioning and purpose of monitoring. The ministries in charge within their competence may perform harmonization of different opinions.
- **Financial funds for upgrading and updating equipment available**
  In the course of the difficult economic situation, the existing machinery was used up greatly. The current market value does not allow its reparation. The assumption will be achieved if favorable market conditions emerge, and if the economic situation improves.
- **Yugoslavian position in international community improved**
  The economic sanctions imposed by the international community have heavily exhausted its economical resources. The economic and market isolation has significantly used up current production capacities.
- **Sanctions effectively applied**
  The legislation has been modernized, but its implementation has been very unsuccessful. The responsibility for not conducting proper measures of the penalty policy lies on the state institutions of competence, which can both solve the problem and improve legal system.

For this sector at the **results/output** level the following assumption have been identified:

- **Incentives of agricultural production ensured**
  Economic exhaustion of the country during the sanctions has caused the change in finance policy, i.e. the subvention of agricultural production. The parities have not been established, and the potentials of agriculture have been heavily exhausted. The assumption will be achieved when favorable economic conditions, adequate preconditions for the restoration of agriculture and favorable state loan policy have been established.
- **Appropriate forest management remains as priority for the government**
  The good forest basis represents the assumption for the forest resources management. The Government through competent institutions relying on adequate financial and penalty policy should carry out such management.

3.1.5. Impact Indicators for Sector Results

Impact Indicators were developed for sector objectives and sector results. They define the contents of the objectives and results in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place). They should give an adequate picture of the situation. Furthermore, they should be measurable in a consistent way at an acceptable cost.

The following impact indicators were identified for the results/outputs:

For the result 1:

- **Pollution emission from all pig farms capacity of more than 20,000 fallings and from 70% of all other animal breeding farms is reduced according EU standards by adopting balanced crop and animal breeding production in Yugoslav part of DRB up to year 2020.**

  This is the most important condition for preventing the negative influence on the Danube basin, especially in Vojvodina region (farms: DP "Farmakop", PP "Krivaja", DP "Čenej", PK "Čoka", PDP "Jedinstvo", DP "Pobeda", PIK "Bečej", PKB "Vizelj", DP "Surčin", DP "Dragan Marković"), in Morava region (DP "1. decembar", DP "Petrovac") and in Timok region (PD "Zaječar"). By solving the problem of larger farms, considerable production of organic fertilizers will be made possible. Data on quality of effluents from farms will be provided by institution responsible for natural waters quality monitoring.

For the result 2:

- **Wetlands restored and biodiversity preserved on 12 areas of national heritage reservations in Yugoslav part of DRB by applying appropriate wetland restoration management by the year 2015**

  This will bring about considerable preservation of the existing genofund, restoration of the destroyed and revitalization of many migratory bird habitats among which there are many wetlands and winter homes. Data on preservation and restoration of wetlands will be provided by institution responsible for environment protection.

For the result 3:

- **Erosion reduced on 100,000 ha in the Velika Morava River Basin by adoption sustainable forestry management up to year 2015**

  Steep land slopes in the riverbed of the Morava are most affected by erosion. It causes mudding and sedimentation in the treated parts of the basin. By taking care of this area the most endangered part will be repaired, as well as the forest vegetation of autochthonous type. Data and information will be provided by ministries responsible for forestry and water management.

3.2. Industry, Mining and Energy

3.2.1. Situation Analysis

3.2.1.1. Importance of the Sector and Activities Leading to Water Pollution and Environmental Degradation

The industry represents the activity of the vital importance for development of the national economy. However, recent period in FRY is characterized by dramatic fall-down in industrial production due to several joint processes: disintegration of former Yugoslavia reduce available market, economic sanctions of UN Security Council against FRY, economic depression and transition period in FRY, decreasing of technological discipline, etc. However, some of industrial activities, together with agriculture production, preserve national economy at respectable level.

Taking into account above mentioned recent processes in industrial development in FRY, one must differentiate period before 1991 (starting of mentioned processes) and after 1991, regarding to activities with negative environmental consequences.

According to the Draft of the Republic of Serbia Water Economy Master Plan (1996) and Draft of the Republic of Montenegro Water Economy Master Plan (1998), total waste water emission (municipal and industrial) in DRBA in FRY was about 40 m^3/s (or about $1.25 \cdot 10^9$ m^3/yr) during 1991. In terms of organic biodegradable pollution it represents loading of about 13.5 million of population equivalents (PE = 60 g BPK_5/day). The quantity of nitrogen in waste waters is estimated on level of 110 t/day, while 31 t/day of phosphorus entered watercourses. Waste waters also contribute with about 1,500 t/day of suspended solids.

According available data, during 1997 industrial waste waters discharge was $731 \cdot 10^6$ m^3/yr in DRB in FRY. The composition of wastewater depends on the type of raw materials used and the technological process. The specific pollution parameters include: temperature, pH, suspended substances, organic substances, nitrogen, phosphorus, nitrates, sulfates, potassium, calcium, fluorides, arsenic, nickel, chromium, chlorides, lead, zinc, copper, phenols, carbon-hydrates, cyanides, titanium, silicates, mercaptanes, sulfides, oils, fats, etc. The main industrial water polluters in FRY are mining centers, petrochemical industry, production of fertilizers and household chemical industry.

In the Yugoslav part of DRB there are about 120 industrial waste water treatment plants, most of which provides only certain degree of treatment, usually inadequate, so as to meet the requirements for waste water discharge into public sewerage. Only about twenty larger industrial plants, located on the banks of the Danube and its tributaries, have the facilities for full treatment of waste water, but some of these plants operate only in part. About ten industrial waste water treatment plants are under construction; the degree of construction is over 50%. For about ten of them the design documentation is nearing completion.

The Law regulates wastewater control, while Rules prescribe frequency of control, control methods, parameters, etc. Rules also prescribe the criteria for waste disposal locations and management, environmental impact assessment analysis, methodology to assess the risk of chemical accidents and of environmental contamination, treatment of wastes having hazardous characteristics, etc.

In this sector, several stakeholders are identified: **institutional organizations**, **polluters**, and **public sector groups**. Within **institutional organizations** several ministries (for industry, mining, energy, water-management, agriculture, human health and environment) are recognized. In their framework inspectorates follow topics according Low. Governmental institutions for environmental protection and biodiversity control also represent institutional organizations. The main **polluters** are the following: industrial enterprises, mining enterprises, as well as power

(thermal and hydro) plants. **Public sector groups** represent affected groups. Presently, there are several foundations and private agencies which deal with biodiversity protection. Furthermore, many NGOs are involved in activities for natural and cultural heritage preservations. In all strategic documents it is stated that the development of individual economic sectors and privatization are prerequisite for further economic development. It is also insisted on so-called „sustainable development", while emphasis is placed on the development of all social segments, coupled with the preservation of the existing natural and cultural values.

3.2.1.2. Current Strengths/Assets

The following industrial activities were identified as main source of water pollution in Danube RB in FRY:

- Use of obsolete technologies,
- Inadequate management of technological processes
- Inadequate treatment of industrial waste
- Inadequate mining activities
- Inadequate use of power plants

All above mentioned industrial activities, contributing to water pollution in DRB, are pronounced in last few years. During that period, majority of commercial and technological relations with foreign partners was broken, due to UN sanctions and economic blockade. Furthermore difficult economic situation and transition period in FRY favored industrial practices which has neglected necessity of proper industrial waste treatment, but the water quality was not deteriorated only due to significant fall down of all industrial activities in that period. However, there are several current strengths which can lead to recovering of industrial activities, followed by reduction of environmental pollution. The main identified assets within described industrial activities leading to pollution are as follows:

- **Transfer of technology**

  Transfer of technology is one of the most important and efficient way to overcame obsolescence of technology. Although industrial activities were depressed in last few years there are still significant number of industrial plants capable for implementation of appropriate technological innovations, as well as to make transfer of technology within the country.

- **Local know-how**

  Yugoslav experts are still well educated and trained for management of technical plants and technological processes, in spite of period of sanctions. There is a significant number of experienced professionals and scientists engaged in the field. The majority of them have been quite familiar with the latest achievements in different fields of industrial practice and science.

- **Standards and technical legislative**

  FRY had quite well developed standards and technical legislative in different fields of industrial activities (mainly relied on DIN and ISO standards). At the present time, adoption of ISO 9000 standards and preparation for implementation of ISO 14000 standards are in progress in many industrial plants.

- **Local waste treatment equipment**

  Basic data about industrial wastewater treatment facilities are given in situation analysis. In order to improve waste treatment it will be necessary to improve efficiency of existing treatment plants as well as to construct the new ones. Special attention should be given to existing or planned pre-treatment facilities for industrial plants connected to public sewer systems.

- **Available finances**

  Although existing financing resources are not sufficient for solving the environmental problems caused by industrial pollution, better allocation of them (i.e. solving the problems on "hot spots") could improve environmental protection more effectively. Through application of “polluter pays” model (already adopted by Ministry of Environmental Protection of Republic of Serbia) the preconditions for more efficient industrial pollution reduction will be made.

- **Controlled conditions of excavation**

  Mining activities in Yugoslav part of DRB are going on in several restricted locations and the plans for future excavation are well developed. The biggest mines (open coal mines in region of Kolubara, Kosovo and Kosltolac, copper mine near the city of Bor, etc.) already implement some measures for pollution reduction and monitoring, but they have to be improved in the future.

- **New methods for ore concentration and ore processing**

  In the period before 1990 Yugoslavia had adequate technologies for ore concentration and processing. At the present time situation is much worse, due to the long period of economic depression and economic sanctions. Under better economic conditions it could be revitalized by using existing capacities of machine production and by implementing of new technologies.

- **Rational use of resources and energy**

  Rationalization of energy and resources use is pronounced in all strategic documents concerning social and economic development in Yugoslavia. Implementation of this principle is hindered by difficult economic situation.

- **New energy sources – alternative**

  In Yugoslav part of DRB several alternative energy sources could be utilized, especially geothermal energy (sources have been identified on several localities), solar energy and, in northern parts of FRY, wind energy. However, implementation of new technologies to use these energy sources will be necessary.

3.2.1.3. Analysis of Transboundary Effects

The watercourses coming from the neighboring countries (Tisa, Timis, Bega, Zlatica, Bosut, Sava, Nisava, Jerma, Visocica) are polluted already at the entry into FRY (their quality is mostly of class IV and more seldom of class III). There are also several industrial hot spots in FRY with possible transboundary effects in downstream section of DRB.

The following main transboundary effects have been considered:

- **Organic and toxic pollution**

  The large amount of sediments (consist of adsorbed organic, hazardous and toxic matters on inert particles) in the Reservoir Djerdap I (Irongate I) represents cross-boundary load comes from the other countries. Therefore, the quality of Danube water leaving FRY is better compared with water that enters FRY. Frequent floating oil spills, risk from nuclear pollution (NPP Krsko is Slovenia and NPP Paks in Hungary), and pollution from petrochemical and metallurgy industry coming from upstream countries are pronounced on river Sava. There are also several industrial hot spots within FRY with possible transboundary effects on downstream countries: mining complexes “Trepca” (Velika Morava RB), “Bor” and “Majdanpek” (Danube Corridor RB) – emission of heavy metals, phenols, etc.

- **Nutrients**

  Low water quality of river Danube and, particularly, river Tisa, as well as deteriorated water quality of river streams coming from Romania (Bega, Zlatica, etc.) at the entrance into FRY, primary due to high loads of nutrients represent main perceived transboundary effect. There are also several industrial hot spots within FRY with possible transboundary effects on downstream countries: Petrochemical Industry "Zorka" Sabac and Chemical Industry "Prahovo" (emission of phosphates and nitrates).

3.2.2. Sector Problem Analysis

3.2.2.1. Core Problem

The core problem for this sector was defined as:

"POLLUTION AS A RESULT OF INADEQUATE INDUSTRIAL PRACTICES AND USE OF RESOURCES"

Regarding industrial practices with direct negative environmental impacts, one must differentiate two significantly different periods in FRY economy:

- period before yr. 1991, characterized by gradual industrial development followed by positive economic effects, but without adequate legal and technical measures for environmental protection, and
- period after yr. 1991, characterized by disintegration of former Yugoslavia, civil war activities in some of republics of former Yugoslavia, dramatic economic depression and transition period in FRY, decreasing of technological discipline, etc. However, legal framework (set of the rules regarding resource use and water quality protection) was improved in this period.

3.2.2.2. Causes Leading to Environmental Problems

The following direct causes of the sector core problem have been identified:

- Use of outdated technologies
- Inadequate technological process management
- Inadequate industrial waste management
- Dissipation of mining resources
- Unbalanced energy plants capacities and energy requirements

(i) Use of outdated technologies

This problem was further pronounced by declining of FRY economy and UN sanctions. Effects of this problem are excessive pollution emission per unit product into water resources, soil and air, and they differ depending on industrial field/activity. This problem has the following causes:

a. Inadequate access to new technologies

This problem is caused by existing barriers (UN sanctions, technological barriers) or selection of inappropriate technologies. This may be caused by insufficient knowledge and lack of experience of management staff.

b. Lack of funds for new technologies

This is a chronic problem of economy in FRY in past few years. Insufficient financing resources and, at the same time, inappropriate allocation of existing funds is great obstacle for introduction of new technologies.

(ii) Inadequate technological process management due to poor organization of production

One of the main effects of long period of difficult economic situation was decreasing of working discipline and poor organization of production. Due to this, existing industrial plants operate with low efficiency in terms of resource and energy consumption, as well as pollution emission per unit product, regardless of applied technology process. This often led to accidental pollution emission to air, water and soil from industrial plants, sometimes creating the health risk. This problem has following causes:

a. Pressure of economic situation

This problem produces unbalanced use of resources due to the need for maintenance the minimum of industrial production. The lack of funds and low wages produce low level of working discipline which very negatively affect efficiency and productivity of industrial plants.

b. Insufficient skills of senior staff

Under difficult and unstable economic conditions migration of senior and operational staff is pronounced. The low working discipline and insufficient training are additional causes of insufficient skills of senior staff.

c. Insufficient training of operational staff

Providing additional training for operational staff is very efficient way to increase efficiency and productivity of industrial processes, and at the same time the risk from accidents is lowed. However, appropriate additional training of operational staff is obtained in small number of industrial capacities in FRY. Insufficient financing resources due to inappropriate allocation is the main cause of this problem.

(iii) Inadequate industrial waste management

Inadequate industrial solid and liquid waste treatment and disposal directly affect environment through pollution of water resources and pollution of soil. Measures which should be undertaken for adequate industrial waste management are not fulfilled jet. This problem is caused by:

a. Insufficient treatment of industrial waste waters

This problem is caused by bad operation of existing wastewater treatment plants and the fact that there are not enough WWTPs in FRY. Although some industrial waste water treatment facilities exist, due to unfavorable economic conditions and inefficient operation, emission of pollution from industrial plants is unacceptably high. Weaknesses in maintenance, lack of spare parts, insufficient financing resources and insufficient skills of operators are chronic problems in industrial waste management. In order to solve this problem upgrading of existing and construction of new industrial wastewater treatment plants will be needed in the future.

b. Inappropriate legislative for hazardous industrial waste

At the present time inappropriate open dumps for industrial solid waste disposal are predominantly used in Yugoslav part of DRB. Absence of spatial (physical) plan for industrial solid waste dump location, and inadequate penalty policy are main causes of this problem.

c. Lack of polluters control (monitoring)

This problem has a several causes: insufficiency of appropriate database of industrial pollutants, inadequate compensation and contribution, and inadequate level of public awareness on problems related to industrial waste. It will be necessary to ensure appropriate monitoring system to enforce penalty policy for industrial polluters.

(iv) Dissipation of mining resources

Dissipation of mining resources produces increase in geochemical mobility of pollutants from destructured rock masses in mining zones, and thus induces water resources and soil pollution. It is caused by:

a. Pressure of economic situation

Difficult economic situation in the country produce pronounced requirements for exploitation of mineral resources which prices are depressed. Price of mineral resources do not include all costs of exploitation and environmental protection (protection of water resources and atmosphere from pollution and revitalization of mine areas).

b. Inappropriate technologies for ore preparation and exploitation

Use of inappropriate technologies for ore preparation and exploitation is leading to non-optimal use of available mineral elements. Therefore, high amount of useful elements are emitted in environment as significant pollutants. Adequate maintenance of exiting equipment and introduction of new technologies will significantly decrease pollution emission.

c. Unfavorable legal framework

Legal and economic situation in past period is based on cheap natural resources. This, together with non-implementation of legislative and lack of compensation and contribution, as well as non-harmonization of legal framework with international standards led to unfavorable legal framework for pollution reduction from mining activities.

(v) Unbalanced energy plants capacities and energy requirements

Unbalanced energy plants capacities and energy requirements lead to more excessive usage of natural resources leading to unacceptably high pollution emission, mainly in air. It is due to:

a. Pressure of economic situation

Difficulties in national economy produce pronounced requirements for production of best-selling export article – energy. Therefore, the use of main energy source – lignite excavated from open coal mines and disposal of large quantities of ash on open dumps produces more excessive land and landscape degradation with other possible adverse impacts on the environment.

b. Non-rational use of energy sources

For a long period prices of energy has been depressed and non-rational energy consumption was not sanctioned. Policy of cheap energy and mineral resources, which characterize past period in economic development of FRY, significantly influence public awareness about the need for rational energy consumption and environment protection.

c. Inadequate investments in renewal and revitalization of plants

Existing equipment and facilities for energy production is mainly rather old and overexploited. Present pressure on power plants to produce more energy together with lack of financing resources for renewal and revitalization (mainly due o inadequate allocation of funds) increase risk of accidents.

3.2.2.3. Environmental Effects

Environmental effects of core problem depend on a industrial activity. The environmental consequences of above mentioned inappropriate industrial activities can be summarised as follows:

- **Water resources pollution**

  Industrial pollution produce several important environmental consequences, expressed as decreasing of quality and quantity of surface water resources, endangering of ground water sources, pronounced eutrophication processes, and deterioration of protected wetlands and recreation areas. As pronounced sources of specific types of industrial pollution following industries can be emphasized: biodegradable organic pollution coming from food processing industry (especially sugar mills and breweries), chemical industry is source of non-organic (basic chemical plants), organic pollution (pulp and paper industry) and nutrients (agrochemical and detergent industry), toxic matters usually comes from ore processing plants, textile, metalwork and wood industry and thermal pollution comes from thermal power plants with open cooling system.

- **Soil pollution**

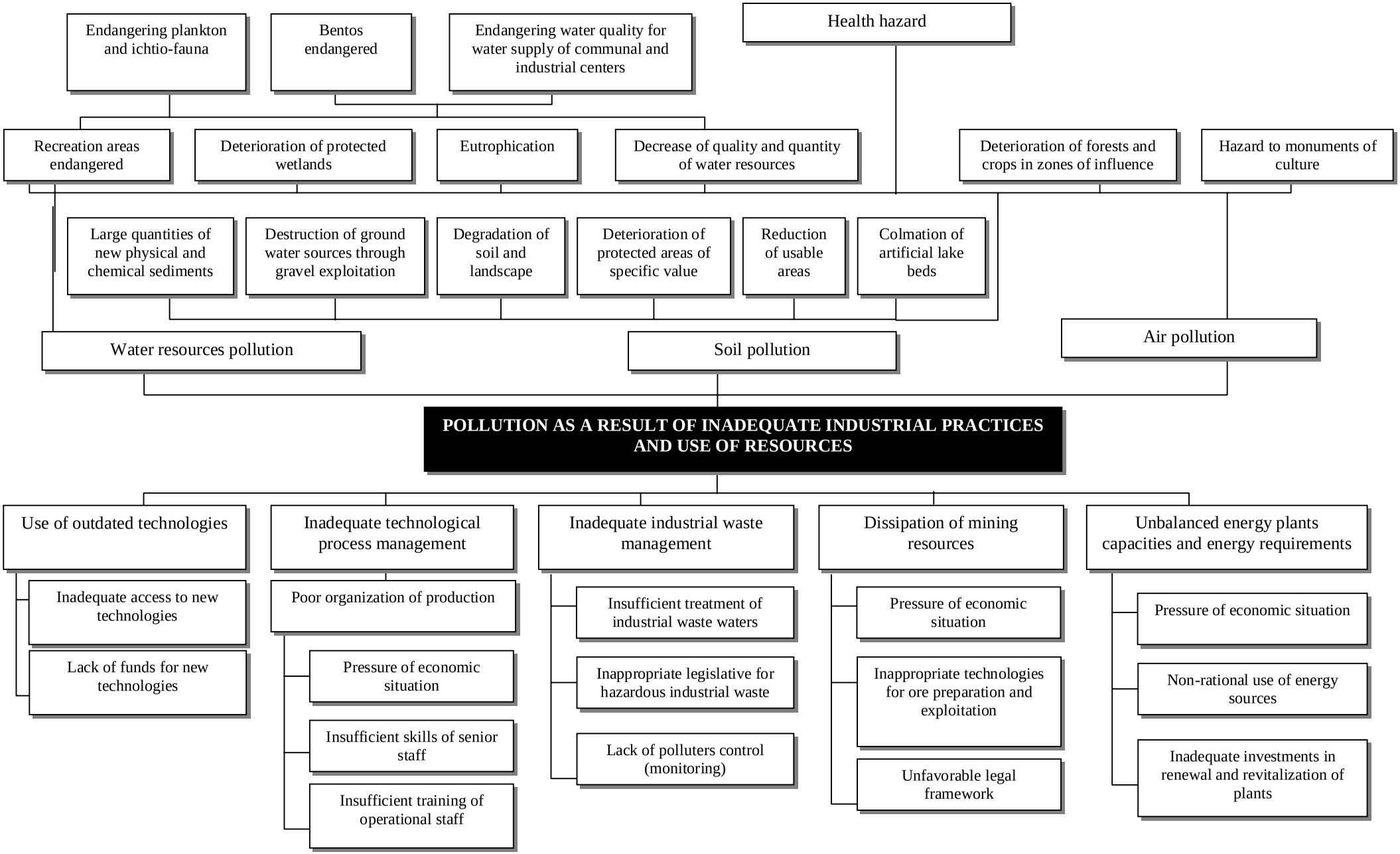
  Pollution of soil is expressed through deposition of large quantities of newly formed physical and chemical sediments (reservoir sediments, mining waste dumps, ash dumps), destruction of ground water sources thorough gravel exploitation (especially in Velika Morava RB), degradation of soil and landscape, and finally, reduction of usable areas.

- **Air pollution**

  Industrial pollution emitted in air is specially pronounced in neighborhood of large mining centers (Trepca in Velika Morava RB, Bor in Danube Corridor RB), industrial plants (Chemical industry in Loznica) and cement plants (Kosjeric in Velika Morava RB, Beocin in Danube Corridor RB). It produces significant health hazards, negative impact on forests and crops.

Problem Hierarchy

2. Industry



3.2.3. Objectives, Expected Results, Actions and Related Projects

The following sector objective have been identified

"APPROPRIATE INDUSTRIAL PRACTICE AND RESOURCE USE ADOPTED"

In order to achieve the sector objective, the following results have to be accomplished

- Application of appropriate technological process management in industry
- Achievement of sustainable industrial waste management
- Optimization of use of mining resources
- Establishment of adequate use of power plants

(i) Application of appropriate technological process management in industry

Application of appropriate technological process management will ensure optimal use of existing and future industrial equipment, and at the same time pollution emission reduction. Positive economic effects will increase available financing resources for further technological management improvement. In order to achieve this result economic sanctions against FRY have to be abandoned. Government and ministries have already prepared appropriate basis for adoption of strategy of economy development. In order to achieve this result, several activities have to be undertaken in the following fields:

- technologies
- management of processes
- financial resources
- knowledge and know-how transfer

It is necessary to:

- **ensure selection of appropriate technologies.** Before industrial equipment renewal, it is necessary to conduct appropriate activities in order to ensure application of adequate technologies and harmonize social and economic development. Scientific, academic and professional institutions should be involved in these activities and the cooperation between ministries of industry, science and environment in this field is necessary.

  As the first step, it is necessary to make detailed analyses of present state of industrial resources, industrial equipment, level of exploitation of applied technologies, as well as technological process management. In these analyses, special attention have to be paid on environmental issues.

  It is necessary to elaborate comparative studies of contemporary technologies in different fields of industrial activities. Beside economic and technological parameters special attention should be given on environment protection.

  Government and responsible ministries have to take in to account results of analyses and studies mentioned before, and to incorporate them in strategic development plans, which will influence the selection of appropriate technologies.

  In order to harmonize urban planning with accepted technology development strategy institutions who are responsible for implementation of Physical plan of R. of Serbia and R. of Montenegro have to pay attention on harmonization between application of strategic economy development plan and plans for disposition of industrial plants with respect to environment protection.

- **introduce optimal management of industrial technological processes**. Introduction of optimal management of industrial technological processes in FRY is facilitated by the fact that existing industrial plants and industrial production is mostly relied on Western Europe technologies. The activities have to be directed to improve standards for optimal industrial management by adoption of EU and international standards in this field.

  It is necessary first to elaborate current technological processes management in different fields of industrial activities.

  On the basis on results of these analyses, it is necessary to elaborate and conduct appropriate activities in order to introduce up-to-date managing standards ISO 9000 and 14000. Specialized agencies and government institutions have to assist industrial sector in order to facilitate implementation of new managing standards.

  Application of environmentally friendly technologies have to be a priority, and responsible ministries have to take care about that. Different stimulate mechanisms for application of environmentally friendly technologies should be provided.

- **make available financial resources for new technologies.** Introduction of new foreign, or development of domestic technologies is hindered by difficult economic situation in the country, which affect all industrial plants. Process of privatization will contribute to raise of interest for investments in Yugoslav economy, but appropriate financial mechanisms and financial security have to be established by government.

  As the first step in attaining the main goals it is necessary to provide appropriate environment for finance/investments, through different activities such improvement of legislation, stabilization of financial flows etc. Government and responsible ministries together with financial institutions should coordinate their activities.

  It is necessary to provide appropriate custom and taxation policy by government to stimulate introduction and implementation of new technologies, especially "environmentally friendly" ones.

  In order to revitalize and develop domestic industrial capacities it is necessary to promote and support national innovation potentials.

- **enable adequate knowledge transfer and know-how through adequate training of managing and operational structure (staff).** One of the main consequences of period of difficult economic situation in FRY and UN sanctions is lack of information about new technologies and processes management, and consequently increase of lagging in the fields of application and management of new industrial technologies. At the same time significant number of young and well educated people have left the country. For these reasons, adequate knowledge transfer and training of operational stuff must be intensified through appropriate activities on government level, as well as by training and exchanging of knowledge between industrial enterprises and experts.

  It is necessary to improve institutional capacities concerning know-how transfer through better cooperation of governmental institutions, scientific institutions and industrial enterprises.

  It is important to establish diverse means of international cooperation concerning industrial activities and knowledge transfer. Government and responsible ministries should provide appropriate framework and stimulate these activities.

  Through organizing of seminars, educational and training courses adequate knowledge transfer in the field of technological process management will be intensified. These activities should be carried out through international cooperation, as well on national level.

  In the framework of different modes of international cooperation specific training and exchange of experts in the different fields of industrial activities will be intensified, which will provide more effective exchange of knowledge.

It is necessary to establish appropriate system of permanent education and specialization in different fields of industrial activities. Beside technological and technical issues, special attention should be paid on environment protection.

For this result, the following projects have been identified:

Proposed Project(s)

- *Project "Transfer of knowledge", with sub-projects:*
  a. *Management of hazardous waste*
  b. *New technologies on waste treatment*
  c. *Management of hazard situations*
- *Project - Study „Transition from existing chemical industry to environment friendly technologies"*.

(ii) Achievement of sustainable industrial waste management

In order to achieve this result, several activities are required in the following areas:

- legislation enforcement
- industrial WWTP
- database
- access to new knowledge

It is necessary to:

- **enforce the legislation in waste management through harmonization and up-dating existing legal regulations.** Industrial waste management legislation, including hazardous waste, is established in FRY, but penalty policy regarding industrial pollution is not adequate. In order to improve industrial waste management, further improvement of legislation and penalty policy is necessary.

  As the first step, it is necessary to elaborate comprehensive comparative study of national and EU standards and regulations in different fields of industrial activities.

  In addition to government and ministries, environmental agencies and institutions have to be strengthened in order to facilitate introduction of industrial waste management (monitoring of polluters, issuing of certificates, etc.).

  On the basis of results of conducted comparative studies of national and EU standards mentioned before, government and governmental institutions together with other competent institutions should adopt strategy on harmonizing existing legislation and regulation with up-to date standards.

  According to adopted strategy, government and responsible ministries have to introduce and upgrade legislation and regulation concerning industrial waste management and penalty policy. Penalty policy has two main tasks: to adequately penalize industrial polluters and to stimulate industrial plants to introduce (or improve) waste management.
- **stabilize existing and build up new industrial waste treatment plants**. Although significant number of industrial waste water treatment plants exist in FRY, at the present time, as a consequence of difficult economic situation, great number of them operate with low efficiency. Adequate industrial waste water treatment is particularly important for food-processing industry and main hot-spots in chemical industry with possible transboundary effects (this was one of most important criteria for proposing projects for this result).

Revitalization of existing and building of new industrial W.W.T.P.s is obligation of industrial plants, but government have to support them in these activities, by stimulating them for building of industrial W.W.T.P.s or introduction of new cleaner technologies. Particularly, attention has to be paid on pre-treatment of industrial wastewater discharging into public sewer systems.

In order to provide more effective environment protection, especially protection of water resources, it is necessary to introduce adequate contributions and penalty policy for industrial polluters.

It is necessary to elaborate and update plans for prompt actions on industrial "hot spots" in order to diminish their adverse impacts on environment.

In the present time weaknesses in sludge treatment on industrial WWTPs are evident, so it is necessary to conduct activities which will ensure appropriate sludge treatment and disposal. It is important to investigate, in every particular case, characteristics of sludge and treatment process in order to determine possible use of sludge or methods for it's ultimate disposal.

In addition to governmental institutions and industrial enterprises it is necessary to provide public and NGO participation in activities on pollution reduction from industrial capacities (information dissemination, cleaning of polluted areas, participation in decision making process, etc).

In order to provide more effective and economic environment protection, it is necessary to enable knowledge transfer in the field of recycling of industrial waste. As the first step it is necessary to provide access to new knowledge in economic valorization of secondary materials from industrial waste.

It is necessary to update inventory of industrial waste production in the country which can be used as a source of secondary material.

In order to achieve more effective industrial waste utilization, it is necessary to evaluate major types of useful waste, taking in to account specific criteria (economic, technological, environment protection, etc.).

It is necessary to provide access to adequate technologies for industrial waste utilization through international cooperation. Responsible ministries and specialized agencies should provide appropriate support for these activities.

- **establish unified database through appropriate monitoring activities.** Activities on the establishing of appropriate monitoring depend on a quality of unified database, which have to be updated on the regular basis. Existing data bases have to be modernized and updated, through application of appropriate criteria and standards for recipients and industrial effluents, harmonized with EU standards. Government and ministries have to ensure appropriate "information flow" from industrial polluters to governmental institutions responsible for industry and environment protection. Control of polluters have to be established through appropriate water quality monitoring and establishing modern referent laboratories.

  As the first step it is necessary to continue and extend already started activities on industrial effluents and recipient monitoring. Government and governmental institutions should provide appropriate programs and support for these activities.

  Government should adopt location criteria for hazardous industrial waste disposal. Special attention have to be paid on existing waste dump sites with hazardous waste and methods for their sanation and recultivation.

  Responsible ministries, together with governmental and scientific institutions should elaborate national strategy of pollution from industrial plants emission control. As an important part of this activity is conduction of comparative study of existing national and international (especially EU) standards.

Present legislation and regulation concerning recipient water qaulity have to be improved through harmonization with international and EU criteria.

It is also necessary to improve regulation concerning industrial effluents criteria, on the basis of national strategy of emission control from industrial plants.

It is important to establish international cooperation concerning transboundary "hot spots" on different levels, including NGO sector.

For this result, the following projects have been identified:

Proposed Project(s)

- *Chemical industry:*
- *W.W.T.P. and sludge disposal for Chemical industry "Prahovo"*
- *W.W.T.P. and sludge disposal for Chemical industry "Zorka" Sabac*
- *Pulp and paper industry:*
- *W.W.T.P. for Pulp and paper industry "Fopa" Vladicin Han*
- *W.W.T.P. for Pulp and paper industry in city of Novi Knezevac*
- *Sugar mil industry:*
- *W.W.T.P. for Sugar mill in city of Crvenka*
- *W.W.T.P. for Sugar mill in city of Senta*
- *W.W.T.P. for Sugar mill in city of Cuprija*
- *W.W.T.P. for Sugar mill in city of Vrbas*

(iii) Optimization of use of mining resources

The need for optimization of mining resources use is a consequence of changed policy in the sector of mining, which in the past was based on low prices of mineral and other natural resources. Low prices of mineral resources in the past induce their non-rational exploitation and excessive pollution of ground and water resources.

In order to achieve this result, several activities are required in the following areas:

- mining and processing activities
- waste water treatment in mining
- rehabilitation of mining areas
- legislation
- education

It is necessary to:

- **select appropriate mining and ore processing technologies.** At the present time in FRY part of DRB, applied technological processes in mining and ore preparation are obsolete. In new strategic plan for use of mineral resources (done by Ministry for mining and energy) some activities on introduction of new technologies are given: selection of new technologies for ore excavation in order to reduce superfluous excavation, selection of new technologies for ore preparation (flotation and concentration) in order to improve extraction of valuable elements and reduction of pollution emission, etc.

  As the first step in attaining the main goals, it is necessary to conduct comprehensive analysis of mining sector with special attention on available mining resources, current mining technologies, technological process management, environment protection, etc.

On the basis of previously mentioned analysis, responsible ministries should develop a priority list of mineral resources exploitation, taking in to account different criteria: economic, technological, etc.

On the basis on results of these analyses, it is necessary to elaborate and conduct appropriate activities in order to introduce up-to-date managing standards ISO 9000 and 14000 in mining companies. Professional and government institutions have to assist mining sector in order to facilitate implementation of new managing standards.

Together with implementation of up-to-date managing standards it is necessary to implement new technologies and obtain knowledge transfer. Government should provide appropriate framework and different simulate mechanisms for these activities.

Government and responsible ministries should provide appropriate framework for continuos knowledge transfer on international and national level in order to achieve more effective mining activities and environment protection.

- **implement adequate waste water and solid waste treatment in mining.** Mining activities in Yugoslav part of DRB have induced significant environmental problems, especially in vicinity of large open coal mines and exhausted ore dumps. Mining enterprises are responsible for application of different operations for mining waste treatment and disposal. These activities always include analysis (feasibility study) for use of mineral components from waste. Positive economic effects of using waste as resource can be partly directed to improvement of mining waste water treatment. Mining enterprises are at the present time in difficult economic situation, so government should support realization of this activity.

  As the first step it is necessary to make detailed inventory of polluters concerning mining process by responsible governmental institutions. Although some data on pollution from mines already exists, they have to be updated and extended.

  In order to improve waste management in mining and to improve effectiveness it is necessary to introduce technologies for recuperation of minerals from mining waste waters. Different modes of support for those activities should be provided.

  In order to provide more effective use of different materials it is necessary to provide measures for utilization materials from waste. As the first step it is important to establish measures for economic evaluation in waste materials use.

  It is necessary to conduct measures for disposal of hazardous chemical waste in proper way through sanation of existing waste dumps and establishing new ones. Special attention has to be paid on environment protection.

  At the present time mining wastewater treatment is insufficient, so it is necessary to elaborate and conduct measures for appropriate waste water treatment. Realization of measures should be in accordance with priority lists composed on the basis of inventory of polluters mentioned above.

- **rehabilitate areas particularly endangered by mining activities.** Activities on rehabilitation of areas endangered by mining activities are especially important at open coal pits (Kolubara, vicinity of Belgrade, Kostolac), copper mine and exhausted ore dump (cities of Bor and Majdanpek), lead and zinc mine (Trepca) and mine Ajvalija Kisnica. As investments for rehabilitation are exceeding financing possibilities of mining enterprises (which are, at the present time, in a difficult economic situation), government should support these activities.

  As the first step, it is necessary to make detailed inventory of particularly endangered or already devastated areas by mining activities. This inventory will provide necessary basis for following activities on recultivation of endangered and devastated areas, as well as for activities on environment protection.

Measures for protection of watercourses in mining areas will be conducted in endangered areas (appropriate river training, protective diaphragms, etc), including measures for protection of watercourses from runoff from open exhausted ore and ash dumps (collection and treatment of runoff, recirculation, etc.).

It is necessary to conduct appropriate measures on groundwater resources protection, such as protective wells, protective diaphragms, recirculation, etc. Conduction of these measures is particularly important on ash and exhausted ore dumps located on lowlands in vicinity of watercourses.

It is necessary to conduct appropriate technical and biological measures for rehabilitation and recultivation of sites devastated by mining activities. These measures have to be conducted according to priority list composed by using specific criteria (degree of devastation, health hazard, social and economic impact, environmental impact, etc.).

Some preserved natural areas and national parks are in vicinity of mining complexes (national parks "Djerdap" and "Kopanonik") so activities on rehabilitation should be carried out with respect to preserving natural parks environment.

- **enforce legislation in mining activities.** Activities on improvement of legislation in mining activities include acceleration of privatization process and introduction of concession for mineral resources exploitation (as it is stated in new Mining Law). This will be most important finance resource for revitalization and modernization of mining, revitalization of devastated sites by mining activities and improvement of wastewater treatment from mining plants. The basis is setting up real prices of mineral resources.

  It is necessary to continue already started activities on improvement of legislation and regulation concerning mining activities. The acceleration of privatization and introduction of concessions (as it is already stated in Mining Law) will provide necessary financial resources for revitalization of mines and environment protection.

  It is necessary to strengthen institutional capacities of environmental agencies in order to achieve more efficient mining practices and improve environment protection. These measures include active involvement of experts for mining and ore processing in decision making process and improvement of monitoring system.

  Introduction of up-to date managing standards ISO in mining have to be facilitated by appropriate activities like governmental support, improvement of legislation and regulation, support from specialized agencies, etc.

- **implement educational and informational programs concerning mineral resources economizing.** Through this activity, the already established public opinion that the mineral resources are cheap and inexhaustible, have to be changed.

  It is important to introduce permanent educational system concerning mineral resource importance through organizing of seminars, training courses, etc. These activities have to cover particularly part of population which are involved in mining activities as well as governmental institutions which are responsible for planning of mining activities.

  At the same time, through educational programs incorporated in regular school programs, the importance of economizing of natural resources use (especially mineral) have to be bring to public.

  It is important to provide public involvement in decision making process concerning mineral resources utilization on local, national and regional levels (especially concerning transboundary "hot-spots") through organizing public discussions on related topics and active involvement of NGOs in these activities.

For this result, the following projects have been identified:

Planned Projects

- *Study and the Project on Integral Rehabilitation of Mining and Smelter Complex "RTB Bor"*. The project is considered by the city of Bor and will include WWTP, landscape rehabilitation and reclamation.
- *Rehabilitation and revitalization of deteriorated landscape in cooper mine "Majdanpek" - exhausted ore dump "Valja Fundata"*
- *Rehabilitation and recultivation of open coal mine "Kolubara"* (Near Belgrade).

Proposed Project(s)

- *Revitalization and rehabilitation of mining complex "Ajvalija – Kisnica"* (near city of Pristina).
- *Revitalization of river Porecka Reka in National Park "Djerdap" (Irrongate).* Project deal with a protected area of DRBA (Danube Corridor) endangered by mining activities of copper mine "Majdanpek".
- *W.W.T.P., landscape rehabilitation and recultivation of mining and smelter complex "Trepca"* (at the city of Kosovska Mitrovica).
- Feasibility Study: *Recuperation of valuable components from exhausted ores from mines and industrial plants.*

(iv) Establishment of adequate use of power plants

This sector in FRY is in quite good condition, but it suffers from pressure from the market for production of more energy (for domestic use and for export). Adequate use of power plants should bring benefits to environment protection by: more rational use of natural resources, reduced influence of power facilities and infrastructure, and reduced impact on environment from energy production by-products and waste (particularly ash). In order to achieve this result, several activities are required in the following areas:

- process management
- waste treatment
- public participation

It is necessary to:

- **apply optimal process management of energy plants.** Activities on introduction of optimal process management of energy plants will be ensured by application of new technologies. Activities have to be directed to achieve more efficient production of energy and reduction of energy losses, as well as reduction of energy consumption per unit product, according to contemporary international and EU standards.

  As the first step in attaining the main goals it is necessary to continue and extend already started activities on analysis of current energy production process.

  On the basis of previously mentioned analysis, appropriate programs for rationalization of energy use in different categories of energy consumers will be establish.

  Appropriate measures for revitalization of existing power plants will be introduced according to priority list and economic strength of the country. Introduction of partly privatization of energy production sector or introduction of foreign investments in this sector will accelerate conduction of these measures.

An important part of revitalization and modernization of energy production is introduction of contemporary managing standards in sector of energy production management.

In order to provide more rational use of natural resources and energy it is necessary to continue and intensify investigations of possible energy production from alternative sources, especially solar and geothermal energy. However, introduction of energy production from alternative sources will depend on access to new technologies.

- **implement adequate energetic plants waste treatment.** Adequate treatment and disposal of waste from energy plants is of particularly importance for environment protection, especially through reducing of air pollution, groundwater/soil pollution and surface water pollution (thermal pollution from power plants with open cooling system). Through this activity appropriate waste management in energy plants will be established and appropriate disposal of waste (ash).

  It is necessary to conduct further investigations of cooling water recirculation systems in thermal power plants in order to provide reduction of energy losses and, at the same time reduction of negative impacts of cooling waters on watercourses.

  Measures, such recirculation, for improvement of hydraulic transport of ash have to be introduced in order to reduce water consumption. Adequate penalty policy have to be introduced in order to accelerate implementation of these measures.

  By using specific criteria, including ones concerning protection of water resources, new locations for ash ponds will be select. Appropriate measures for protection of ground and surface water resources will be conducted.

  Although some measures for environment protection on ash ponds are already implemented, it is necessary to improve them. Measures such recirculation, protective wells, treatment of leachate and runoff from ash ponds should be realized together with extension of system for water and air quality monitoring.

  In order to reduce negative impact of reservoirs on environment it is necessary to continue and extend investigations in this field. Special attention have to be paid on improvement of management of reservoirs for hydro-power plants.

  It is necessary to improve and extend monitoring system for treatment of waste waters coming from energy production activities (lignite excavation, cooling systems, disposal of ash, etc.).

- **ensure public participation in decision making on energy saving practices.** Public participation should be established on several levels. Ministry for energy has adopted Strategic plan of saving energy and Council of experts is established. One of tasks of this Council is to promote and stimulate innovations and energy saving practices. In order to achieve this result, producers of energy and government have to ensure public participation in decision making concerning energy saving practices, as well as to provide information services about energy saving practices.

  As the first step, it is important to raise public awareness through dissemination of information concerning strategic policy in energy production. These activities include organization of seminars and discussions, educational programs, and providing information in electronic and printed media.

  It is necessary to introduce public information services concerning energy saving practices and affirm their work through media.

  It is necessary to involve NGO sector in decision making process through strengthening of NGO sector, support for different activities of NGOs and active involvement of NGOs in public discussions and other meetings concerning impacts of planned activities in the sector of energy production and use.

In order to enable in the future more active public participation in decision making process it is necessary to introduce appropriate educational programs in regular schools concerning importance of energy production and rational energy use.

For this result, the following projects have been identified:

Proposed Project(s)

- Study: *Rehabilitation of termoenergetic sector in respect to minimization of waste*
- *W.W.T.P. and landscape rehabilitation of Thermo power plant "Obilic A" and "Oblic B"* (near the city of Oblic, vicinity of Pristina town)
- *W.W.T.P. of Termo power plant "Drmno"* (city of Kostolac, vicinity of Belgrade)
- *W.W.T.P. and rehabilitation of ash dump site of Termo power plant "TENT A" and "TENT B"* (city of Obrenovac, vicinity of Belgrade).

Out of the all above mentioned projects, the following four are identified as **"high priority projects"**:

- Study and the Project on Integral Rehabilitation of Mining and Smelter Complex "RTB Bor"
- W.W.T.P. and sludge disposal for Chemical industry "Prahovo"
- W.W.T.P. for Pulp and paper industry "Fopa" Vladicin Han
- Revitalization and rehabilitation of mining complex "Ajvalija – Kisnica"

3.2.4. Important Assumptions for the Sector

Important assumptions are factors that are significant for the success of the program but they lie outside of scope of the programme and not under its direct control. Therefore, they are external factors and they necessary to ensure the success of the program and the sustainability of its results.

At the **activities** level, the following assumptions have been identified:

- **Intellectual property rights system adequately developed**
  Right choice of appropriate technologies depend on scientific and technological knowledge. It is necessary to develop adequate legal framework for protection of intellectual property rights, in order to stimulate transfer of knowledge.
- **Financial resources available on time**
  Conduction of almost all activities listed earlier assumes that sufficient financial resources are available for their realization in future industrial development. This assumption will be achieved when economic blockade of FRY is abandoned and Yugoslav economic reforms achieved.
- **Secondary education system adopted to the needs of economy**
  Difficult economic situation pronounce migration of well educated and capable professionals and scientists out of the country. Technological lagging decreased possibility of knowledge transfer. Ministries of Education and Science have to ensure conditions for appropriate education and transfer of contemporary knowledge. The other institutions for science and education, like universities, should be involved in this process.

- **Regulations are effectively enforced**

  Existing legislation has been, during the time, updated, but its application is hindered. Penalty policy is not adequate (penalties for pollution emission are low) and do not stimulate reduction of pollution emission from industrial sources. It is necessary to improve legal framework and to develop institutional capacities in this field through adoption of adequate penalty policy and enforcing strictly control of industrial polluters.

- **Modern personal management introduced**

  Personal management of industrial processes and plants in Yugoslav part DRB at the present time is not well developed. Ministries responsible for industrial sector and water management should provide appropriate support for introduction of modern personal management, especially in the fields of introduction of new environmentally friendly technologies and industrial waste management.

- **Rehabilitation and revitalization programs of particularly endangered sites (hot-spots) established**

  A number of mining sites suffer from devastation of wide areas by exploitation and increased pollution emission from degraded land. Existing regulative expect that owner of mine have to rehabilitate devastated area, but owners usually do not respect regulations. Realization of already developed programs for rehabilitation and recultivation of mines are necessary to provide adequate methods for rehabilitation. Ministries responsible for industry and mining should take care over realization of those programs.

- **Mineral resources realistic prices set**

  In past period prices of mineral resources were depressed in order to stimulate industrial development. Introduction of realistic prices of mineral resources should bring several benefits: stimulation of more effective use of mineral resources and raised funds for introduction of new technologies and environment protection. Appropriate measures should be undertaken including harmonization of legislation, introducing concessions and other stimulative mechanisms. Government and ministries responsible for industry and mining should conduct these measures.

- **Active participation of public achieved**

  Public participation in decision making process concerning industrial activities is not on a high level. In order to achieve more harmonized and environmentally grounded (i.e. sustainable) development public participation in decision making process should increased, especially in the fields of strategy of development, energy and resources use and environmental protection. Government and governmental institutions responsible for industrial development and environmental protection should provide information to public and ensure adequate participation of public and NGOs in decision making process.

For this sector at the **results/output** level the following assumption have been identified:

- **Strategy of economy development adopted**

  National strategy of economic development have been adopted, but its realization is hindered by economic sanctions and prolonged period of difficult economic situation. By abandoning the economic blockade of FRY and by performing economic reforms, FRY will achieve preconditions for realization of adopted economic development strategy

- **National strategy of mineral resources utilization set**

  This strategy has long-term character and by its adoption appropriate framework for rational and effective use of natural resources should be established. Environment protection, especially reduction of pollution emission from industry to water and soil should be one of priorities in strategy. Government and ministries for industry and water management are responsible for adoption and application of this strategy.

- **Rationalization of energy consumption remains priority for government**

  National program of rational energy consumption do not consider environmental aspects of energy production, but only technical methods for decreasing energy consumption. Existing power plants are rather old and overexploited, and thus risk from accidents is increasing. Government should define priorities in energy rationalization and involve public in decision making process.

3.2.5. Impact Indicators for Sector Results

Impact Indicators were developed for sector objectives and sector results. They define the contents of the objectives and results in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place). They should give an adequate picture of the situation. Furthermore, they should be measurable in a consistent way at an acceptable cost.

The following impact indicators were identified for the results/outputs:

For the result 2.1

- **Quality of industrial and mining effluents improved, particularly in respect to phosphorous content, according to EU standards by the year 2020 in Yugoslav part of DRB**

  By the harmonization of national with EU standards in the field of water quality and reduction of pollution emission the necessary framework for introducing appropriate technologies and improvement of industrial processes management is established. Data on water quality of industrial effluents will be provided by institution responsible for water quality monitoring.

For the result 2.2

- **Application of industrial waste management achieved in 80% of industrial waste water treatment plants leading to increased quality of ground water and reduced health risk generated by polluted water by the year 2015 compared to the year 1991 (based on medical statistics) in Yugoslav part of DRB**

  By the means of appropriate industrial waste management significant decrease of pollution emission in surface and groundwater resources will be achieved, which will lead to reduction of health risk. Data and information about introduction of waste management will be provided by ministries responsible for industry and environment protection, and medical statistics data will be provided by ministry of health.

For the result 2.3

- **By revitalization of devastated sites (as result of mining activities) on 10,000 ha, soil erosion reduced and new arable land created in lower part of the Danube River Basin in FRY, by the year 2020**

  Introducing adequate measures in mining devastated areas of excavation and exhausted ore disposal sites significant reduction of erosion and pollution of natural waters is achieved. Those measures include rehabilitation, remediation and recultivation of devastated areas, creation of new arable land and landscape improvement. Relevant data about results of undertaken measures will be provided by ministries of environment protection and water management.

For the result 2.4

- **Energy consumption reduced by 20% per unit product by adoption of new low-energy technologies by the year 2015 in Yugoslav part of DRB**

  Optimized energy consumption is one of basic premises for sustainable development of the country, as well as a way for improvement of resources use efficiency. Relevant data about energy consumption and energy use rationalization will be provided by ministries for energy and industry.

3.3. Municipality

3.3.1. Situation Analysis

3.3.1.1. Importance of the Sector and Activities Leading to Water Pollution and Environmental Degradation

Since riparian area of the Danube river and its main tributaries is the most densely populated (101.4 inhabitants per km^2) and the most developed part of FR Yugoslavia and since the population living within DRB makes almost 90% of the total population of the country, the importance of this sector is very high. Its` significance is additionally supported by the fact that a great number of small industrial enterprises are located within the biggest cities, whose waste waters, after pretreatment (at present mostly without it), have been disposed in the public sewer systems.

There is a large discrepancy between the observed quality of surface waters and the quality defined by the Regulation on Classification and Categorization of National Watercourses. This is the reason why basic strategic task of the National Water Pollution Control Program until the year 2021. is decreasing the emission of pollution and gradual bringing the two together.

The concept of construction of high capacity central municipal wastewater treatment plants (WWTP) has been adopted also, as the techno-economically optimal one. This concept implies collection of all wastewater within the cities (from households, public institutions and industries within them) into the common sewerage systems. It is regulated that the last ones have been adequately pretreated previously.

It is important to emphasize that in the consideration of national water pollution control strategy the attention has been given to the reduction of the biodegradable organic load and microbial pollution, as well as to the control of emission of toxic substances, when industrial waste waters are concerned. Inadequate attention has been given so far to the nutrients (nitrogen and phosphorus) removal. For the first time in this country this kind of treatment will be applied in the municipal WWTP for the city of Sabac, located at the river Sava, which is under construction.

Due to difficult public welfare and economic situation (Gross national product is about 1,500 USD at present), current industrial activity in the country has been hardly depressed and the total amount of industrial wastewater significantly reduced. It is to be expected that, with the improvement of the economic situation position of the industry will be improved and the problem of the increased amount of its` waste waters and their adequate treatment will arise again. The majority of the existing WWTPs have been oversized in capacity and special attention during coming period should be given to the use of their excess capacity.

The largest part (around 88%) of the 7000 settlements within the DRB in FRY are mostly of rural type with population of less than 2,000. Settlements with 2,000 – 10,000 inhabitants (mostly of rural or mixed type) make next 9.8% of the total number of settlements, and only 15-20% of them have public sewers system. However, although comprising almost 98% of the total number of settlements in the DRB, these two groups (except several of them located in vulnerable zones) have no priority in solving the problem because of their "diffuse" character and because of the high specific investment coast for construction of WWTP-s with so small capacities. At present, wastewater from these settlements are either discharged directly into the natural watercourses or into inappropriate septic pits. Settlements with over 15,000 inhabitants, including the largest ones, make only 2.2% of the total number of settlements within the DRB in FRY, but they are producing more than 90% of the total municipal pollution load, discharged into the recipients.

The annual production of municipal wastewater in the DRB in FRY has been estimated at about 600,106 m^3 (20m^3/s). In average, 60% of all urban inhabitants, living in DRB in FRY are, at present, connected to the public sewer systems. The percentage varies from 35% in Kosmet to 85%

in Belgrade. Almost 40% of all sewer systems are of combined type, while more than 60% of them are of separate type. Less than 10% of the total amount of the municipal wastewater is undergoing some kind of treatment, before being discharged into the recipients. Approximately 2.5% of this amount is undergoing only primary and about 7% primary and secondary treatment, while tertiary treatment for removal of nitrogen and phosphorus is not applied at all, since recently. On the territory of DRB in FRY there are all together 37 WWTPs, with the total capacity around 2,200,000 PE. However, most of these WWTP-s are not in regular operation and their efficiency is lower then it is commonly practiced. There are also around 20 WWTP-s under construction, with the total design capacity of 2,000,000 PE and the degree of their completion varies from 10% to 60%.

Another major source of contamination of surface and ground waters from municipalities is inadequate management of their solid wastes. There is almost 200 larger solid waste disposal sites within the area, with no one conforming major criteria for sanitary landfill, with respect to the selection of the site, construction and the method of use. The great majority, of them are disorganized open dumps and the process of their sanitation and recultivation started few years ago. An additional problem is that approximately 80% of those dumps are located in the immediate vicinity of watercourses and, sometimes, on their very banks. Since there is no liner (plastic or impervious clay) underneath the disposed waste, the leachate penetrates into the alluvial soil and even ground water, polluting them. The following table provides the basic data on major dumps, located in the Danube corridor.

Settlement	Approximate distance from the river (m)	Number of inhabitants served	Estimated volume of dump (m^3)
Apatin	600	19,000	137,000
Backa Palanka	700	28,000	200,000
Batajnica (Belgrade)	1,500	400,000	960,000
Vinca (Belgrade)	800	1,000,000	2900,000
Smederevo	1,200	66,500	470,000
Kovin	10	14,600	110,000
Veliko Gradiste	900	6,700	54,000

Additional problem is that the process of the introduction of a integrated municipal solid waste (MSW) management, with separation and processing of the waste components (materials recovery), is at it's very beginning.

As a conclusion, it should be said that the key factors causing pollution of the Danube, as far as the municipalities are concerned, are:

- Untreated or inadequately treated municipal waste waters from cities and settlements along the river: Apatin, Backa Palanka, Novi Sad, Belgrade, Pancevo, Smederevo, Kovin, Golubac, Donji Milanovac, Kladovo, and Negotin.
- Great number of disorganized open dumps of municipal and industrial solid wastes, sometimes containing even hazardous waste, on the banks of the Danube and it's tributaries.
- Insufficient number and inadequate equipping of inspection authorities, overlapping of the competencies of them and of the institutions and the obsoleteness and ambiguity of some regulations.
- A chronic shortage of funds for environmental protection and especially for water pollution control.

A number of documents relating to the policy and strategy in the sectors which are directly linked to the protection and quality of water, and have implications for sustainable development and preservation of biodiversity, have been brought about in FRY. The major among these documents have been listed in the National Review, part A ("Social and Economic Analysis in Relation to Impact of Water Pollution"), page 60.

In FRY there are the following three groups of stakeholders: polluters, affected groups and organizations and institutions.

The population of the country produces wastewater and solid waste in their households, in commercial districts, in public institutions and in recreational facilities. The main problems are non-rational use of drinking water, low awareness of the detrimental effects of the wastewater and solid waste and low interest in primary separation of solid waste components.

Small and medium size industries, located within the settlements discharge their waste waters into the municipal sewers, usually without any pretreatment, introducing toxics into the waste water and interfering with efficient operation of the WWTP-s.

Special problem has been lack of the service for household, medical and industrial hazardous waste collection and ultimate disposal and usually uncontrolled disposal of this kind of waste on the existing open dumps.

Due to their dual role, drinking water supply and collection and disposal of municipal wastewater, public waterworks and sewerage companies belong, at the same time, to the affected groups and to the polluters as well. They have been introducing pollution load into the watercourses and they have been using their water for preparing drinking water.

Individual users, including inhabitants, various civil associations, owners of land nearby the watercourses, recreation and tourist resorts are at most affected by the adverse effects of the water pollution. The main health risks are caused by discharge of wastewater and leachate from dumps not adequately treated or not treated at all.

As mentioned above, public waterworks and sewerage companies belong to this group of stakeholders also. Low quality of raw water requires more resources, needed to operate and maintain the existing treatment plants for drinking water and to invest in construction of the new ones.

The institutions of the federal republican and local governments are the policy makers and are implementing this policy through law enforcement and through realization of programs and projects at different levels.

These institutions in FRY are as follows:

1. Federal Ministry for Development, Science and Environment,
2. Federal Ministry for Labor, Health and Social Policy,
3. Ministry of Agriculture, Forestry and Waters of Republic of Serbia,
4. Ministry of Environmental Protection of Republic of Serbia,
5. Ministry of Agriculture, Forestry and Water Management of Republic of Montenegro,
6. Ministry of Environmental Protection of Republic of Montenegro
7. Federal Institute of Hydrometeorology,
8. Institute of Hydrometeorology of Republic of Serbia.

The republican and local institutes and bureaus implement the legislation concerning all elements of the environment: water, air and soil and perform the supervision of the environmental protection.

The mechanisms of financing the programs and projects relating to the water quality and water management improvement in FRY are defined by federal regulations and determined in greater detail by the member republics, which are directly responsible for their financing. The necessary funds for such purposes are collected in the both republics, in accordance with the decrees enacted by their governments. The funds are collected through republic budgets and transferred to the ministries of agriculture, forestry and water management. In the Republic of Serbia, these funds are directed to the Agrarian Budget and those earmarked for capital projects, relating to water quality improvement, are managed by the Ministry. In addition, the Government of the Republic of Serbia has founded "Srbijavode", Public Water Management Enterprise, which is engaged in the realization of these projects and in the maintenance of water management facilities, earning its` income by collecting fees for the use of water management facilities and systems.

3.3.1.2. Current Strengths/Assets

The main activities in this Sector leading to pollution can be summarized as follows:

- Wastewater production in urban settlements,
- Waste water production in rural settlements and
- Production of municipal and household solid waste.

There are several assets to rely on in future, after the adequate measures have been undertaken, in order to overcome the negative consequences of the above activities.

- **Financing sources**

  Although limited (at present, about 20 millions USD per year), the available financing sources could become a significant asset in solving the problem, primarily by their better and more rational allocation. Also, they could be even enriched by the introduction greater, adequate charges for disposal waste waters into municipal sewers or natural watercourses, depending on their pollution load and economic water tariffs. Moreover, they could be relatively enlarged by the introduction of integral management of water resources, by ownership transformation and more strict financing policy.

- **Technical & scientific know-how**

  Existing technical and scientific know-how has been probably the most reliable support for further improvement of water management in FRY. There is a significant number of experienced professionals and scientists and capable, ambitious, well educated young men, as well, engaged in the field. The majority of them have been quite familiar with the latest achievements in this part of engineering and science.

- **Legislation**

  The relevant legal framework for sound environmental management of water resources and ecosystems has been established in this country and, by its` existence only, presents one of the pillars of the protection of water resources. The main problems, however, are consistent implementation of the existing laws and regulations, which has not been yet achieved and further upgrading of the framework. It is necessary to harmonize the legislature with EU regulations.

- **Available water resources for seasonal addition of fresh water into watercourses**

  One of the strategic tasks in the sector of water management in the country has been the development of an adequate system of multipurpose impounding reservoirs, in order to insure more effective use of water throughout the year. There are 60 large (20 larger than 10 millions m^3) and about 100 small reservoirs in the country and, besides for domestic and industrial water supply, they have been used for flow balancing, irrigation, power generation and sediments retention.

- **Machine & electro industry producing waste water processing devices**

  Although being fairly developed before 1990; like the other industrial branches, the production of machine and electro equipment for wastewater treatment has been depressed at present. However, under better economic conditions it could be easily revitalized due to existing capacities of machinery production with respect to its` equipment and skilled personnel. Introduction of the economic stimulation for the producers of this kind of equipment is necessary.

- **Wastewater treatment plants**

  The basic data about existing and under construction WWTP-s are given in Situation Analysis. In order to improve situation in this sector it is necessary to continue construction of the new and reconstruction and extension of the existing plants, construction of the industrial waste water pretreatment plants, upgrade work and technological discipline in all of them and introduce more rigorous control of their effects. It is also necessary to continue construction of the sewer networks in the settlements without it and extension of the existing networks, to establish the reference laboratory to insure adequate monitoring and to introduce atmospheric water treatment.

3.3.1.3. Analysis of Transboundary Effects

The following transboundary effects have been found to be a especially important:

- Effects on biodiversity
- Limited use of waters due to quality reduction
- Eutrophication

These three effects have been correlated very closely and they should considered with that fact in mind. The deterioration of the water quality by pollution, especially by introduction of main nutrients (N and P) into them, is accelerating eutrophication process and result of it is reduction of biodiversity in the ecosystem. Introduction of nutrients and other polluting substances with inadequately treated municipal wastewater and improper disposal of municipal solid waste in the DRB in FRY is only part of the general problem. The effects of the upstream pollution should be taken into the account also, although it is difficult to differ the two by simple measuring N and P contents in the Danube water on the border lines, due to the space and time dislocations of the three processes. Limited use of water for irrigation, recreation, touristic activities and water supply because of its` low quality, as a consequence of the pollution along the course of the Danube river, has very negative economic impacts in all countries along it.

It is estimated that the total emission of nitrogen and phosphorus in the DRB in FRY is about 43,000 t/year and 14,000 t/year, respectively.

3.3.2. Sector Problem Analysis

3.3.2.1. Core Problem

The core problem for this sector was defined as:

“MUNICIPAL ACTIVITIES AFFECTING (ENDANGERING) WATER QUALITY”

The core problem is result of municipal population every day living activities whose consequences are production of wastewater and solid waste and activities of the industrial enterprises, located within the urban area and their production of wastewater and solid waste.

3.3.2.2. Causes Leading to Environmental Problems

An adequate collection and treatment of the both, domestic and industrial waste waters in urban settlements, before their ultimate disposal into the water course (recipient), up to their residual pollution load, which is harmonized with the self-purification capacity of the recipient, practically cancel the core problem. The same is true with the solid waste if it is disposed on a proper sanitary way.

However the real situation is quite different from the above and following direct causes of the sector core problem have been identified:

- Inadequate management of waste waters in urban settlements
- Inadequate management of waste waters in rural settlements
- Weaknesses in municipal solid waste management

(i) Inadequate management of waste waters in urban settlements

Inadequate management of wastewater in urban settlements is a source of biodegradable organic, suspended solids, nutrient, microbiological and toxic/hazardous pollution which adversely affect water quality of surface and groundwater resources and create health risk. The main causes for inadequate management of wastewater in urban settlements are:

a. Low efficiency of wastewater treatment plants

Low efficiency of waste water treatment plants it is, on the other side, caused by insufficient pretreatment of industrial waste waters, improper operations of the plants, insufficient monitoring and/or improper collection and discharge of atmospheric waters. Insufficient pretreatment of IWW is the result of either low efficiency of existing IWWPP-s or nonexistence of these plants at all (usually because of the lack of funds). Improper operation of the WWTP-s could be consequence of the outdated technology applied, improper capacity of the WWTP and/or its` poor maintenance. Poor maintenance of a plant could be caused by low level of working discipline, lack of skill and technical knowledge and/or lack of spare parts. Insufficient monitoring may be result of insufficient number of monitoring stations and/or unreliable laboratories for wastewater examination.

b. Discharging municipal wastewater without treatment

The negative environmental effects of the raw wastewater discharge into the recipient could be magnified if there is no adequate sewer network, sufficient monitoring and/or proper collection and discharge of atmospheric waters. The reasons for this magnification may be disrespect of the regulations and/or lack of funds.

(ii) Inadequate management of waste waters in rural settlements

The main effect of this problem is health risk through the pollution of water resources (especially groundwater). The main causes for inadequate management of wastewater in rural settlements are:

a. Use of inadequate septic pits

It has become a common practice in rural areas to use septic tanks with permeable bottom in order to avoid care about their regular emptying. It happens also that inhabitants in rural areas, after obtaining water supply network in their village, use their old wells as a septic pits. The reasons for such behavior are disrespect of the regulations, low level of sanitary standard and/or lack of information. Low level of sanitary standard is a consequence of level of economic development, while the other two reasons are caused by low level of public awareness.

b. Inadequate environment attitude of the population

Inadequate environmental attitude of the population is usually caused by the lack of information and/or by low level of knowledge about the environmental problems, the both being the consequence of low level of public awareness.

(iii) Weaknesses in municipal solid waste management

Inadequate municipal solid waste management is significant source of toxic and hazardous pollution of soil and water resources and health risk. In Yugoslav part of DRB weaknesses in municipal solid waste management are evident, and they are caused by:

a. Inadequate environment attitude of the population

Inadequate environmental attitude of the population is a result of the lack of information and/or low level of knowledge about environmental problems, the both being caused by the low level of public awareness.

b. Inadequate disposal of hazardous municipal waste

There is no organized service for collection, processing and ultimate disposal of this kind of waste (households, hospitals and health facilities).

c. Inadequate disposal of integral municipal solid waste

There are three main reasons for such situation: improper MSW collection system, lack of proper sanitary landfills and existence of unsanitated open dumps sites. The inproperness of the MSW collection system is a consequence of almost total absence of the primary separation of the waste components and recycling, while the other two reasons are generally result of the lack of funds.

3.3.2.3. Environmental Effects

The environmental consequences of inappropriate activities are the following:

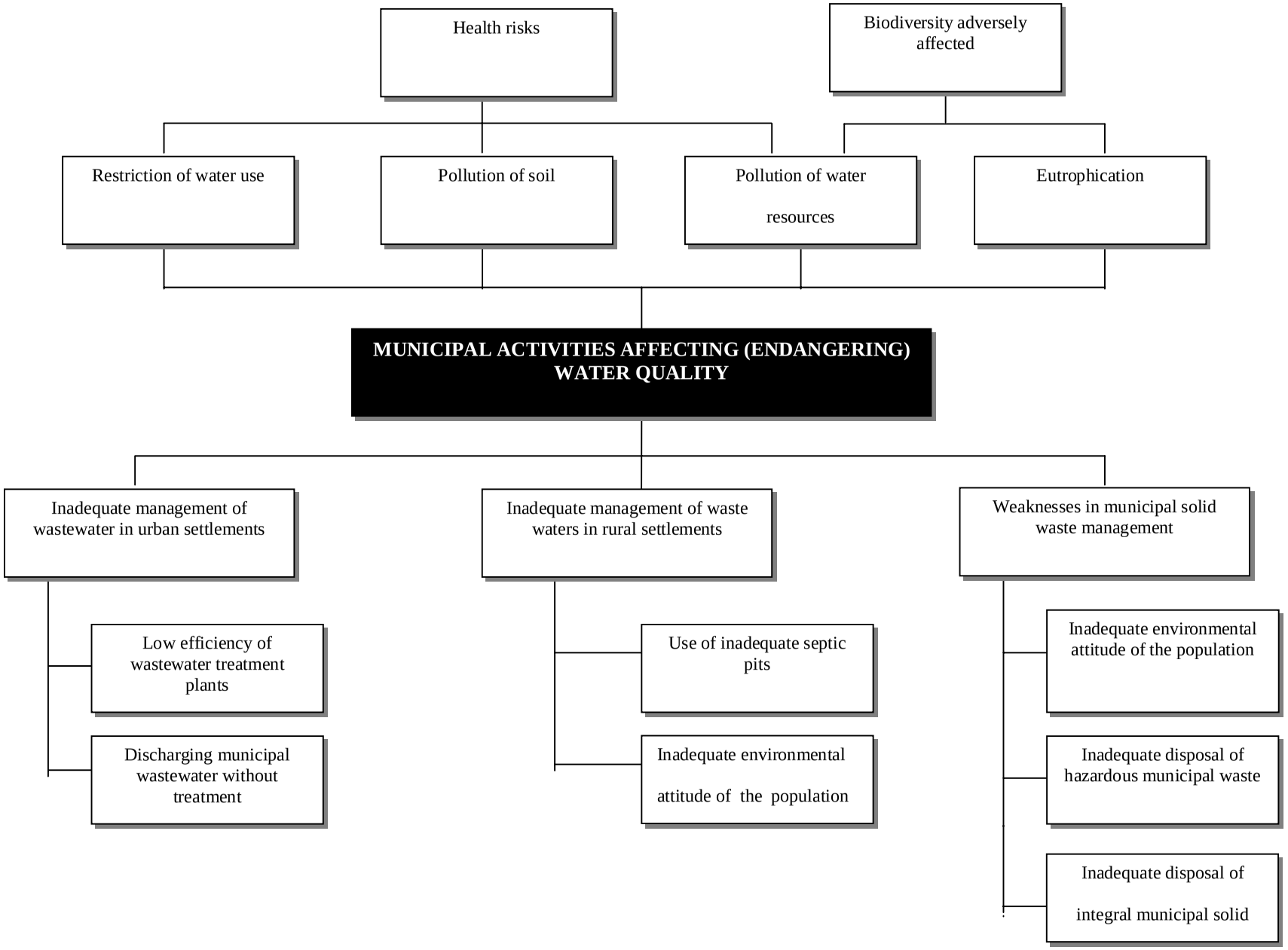
- Restriction of water use
- Pollution of soil
- Pollution of water resources
- Eutrophication

The inappropriate activities with respect to the environment, which are taking place in municipalities, have several main negative consequences. The direct effects are pollution of water resources and soil and, as a result of it, restricted multipurpose use of water and finally acceleration of the eutrophication process and reduction of biodiversity.

While pollution of water is the result of the both, discharge of untreated or partially treated wastewater and drainage of leachate from unsanitary dumps of MSW into the watercourses, pollution of soil is the consequence of the second occurrence mostly. Moreover, unsanitary MSW dumps are usually reason for pollution of groundwater resources also.

Problem Hierarchy

3. Municipality



3.3.3. Objectives, Expected Results, Actions and Related Projects

On the basis of the consideration of direct, indirect and sub-causes of the Sector Core Problem, the following sector objective have been identified:

"MUNICIPAL ACTIVITIES IN ACCORDANCE WITH WATER RESOURCES PROTECTION"

It means that all municipal activities with environmental consequences should be harmonized with the assimilation capacity of the ecosystem.

In order to achieve the sector objective, the following results have to be accomplished

- Achievement of appropriate wastewater management in urban areas
- Proper collecting and disposal of wastewater in rural areas
- Introduction of adequate municipal solid waste management

(i) Achievement of appropriate wastewater management in urban areas

Settlements in urban areas are the main polluter of the watercourses in DRB in FRY, and they have been introducing in them about 90% of the total pollution load.

In order to achieve this result, several activities are required in the following areas:

- Municipal wastewater treatment,
- Sewer systems,
- Industrial wastewater pretreatment and
- Legal and monitoring framework.

It is necessary to:

- **ensure appropriate municipal wastewater treatment,** by fulfillment several requirements. First, it is required to accomplish a multipurpose water resources use, by coordinated exercising of engineering, economic, environmental and social principles. For the insufficient number of the existing treatment plants it is necessary to improve operational efficiencies, by undertaking adequate measures. It is also required to ensure construction of the new WWTPs, with the contemporary technologies applied in them and according to an optimal priority list of construction, in parallel. All these measures should be supported by the adequate legislative and financial elements. In order to ensure appropriate municipal wastewater treatment it is required to introduce integral water resources management, which will enable their more rational and effective use, as for instance, simultaneous surface waters use for water supply and for adequately treated wastewater disposal, which enables their multipurpose and more rational and effective use.

  Yugoslav law regulations have to be harmonized with EU directives, as a continuation of the already started activity, having in mind present conditions in the country, the economic situation especially. For industrial wastewater it is necessary to set up effluent standards, discharged into the municipal sewers, in order to ensure their adequate pretreatment and so the efficient operation of the central WWTPs.

  Financing mechanisms for new plants construction have to be established, including self-contributions, donations, concessions, governmental participation and external financial sources through various modes of cooperation. Stimulate mechanisms for WWTP equipment production have to be established as well, in order to revitalize this branch of industry, which was significantly progressing during the period before the war, by ensuring convenient economic and legal conditions for further development of this kind of industry.

Adequate training for WWTP operators have to be ensured, through organization of suitable courses and seminars, held by experienced engineers and professionals, already available in the country, with adequate financial stimulation for the operators to take part in them and to obtain the certificate for passing the final exam.

Priority lists for WWTP-s construction has to be elaborated, on the state level, in accordance with the total pollutional load, introduced into the recipient, its self-purification capacity, its category and importance, local personnel and financial resources, possibilities for self-contribution collection, etc.

In this context, it is important also to upgrade existing WWTP-s operation and efficiency, by better maintenance and management, necessary reparation and reconstruction, applied technology improvement and adequate pretreatment of industrial wastewater, disposed into the municipal sewer network.

New WWTP-s have to be constructed by the priority order accepted, applying contemporary technical and engineering achievements and experience and, in general, their phase construction (primary, secondary and then tertiary and sludge treatment).

Proper waste sludge treatment and ultimate disposal have to be ensured, after the adequate primary and secondary wastewater treatment have been realized and find out optimal local solution for its ultimate disposal (on agricultural land, joint composting with municipal solid waste, energy recovery ,etc.).

- **undertake measures for upgrading and extending sewer systems,** because, at present, percentage of the urban population, connected to the sewers, is unsatisfactory, because the great part of the networks is too old and because during sewers construction were used numerous different materials. In order to improve sanitary conditions in the municipalities, to reduce watercourses pollution and to ensure an efficient operation of the central WWTPs, it is very important to reconstruct, upgrade and extend existing and to construct new sewers.

  For this activity it is important to make inventory of existing sewer networks and develop priority lists for their reconstruction an extension, as a first step in attaining the main goals, mentioned above and as the basis for estimation of the amounts of various necessary materials, total funds required and time period needed in order to accomplish the activity.

  Financing mechanisms for sewer network construction have to be provided, including self-contributions, donations, concessions, governmental participation and external financial sources through different modes of cooperation.

  It is important also to promote production of equipment and materials, as an activity closely connected with the production of the equipment for WWTPs and practically the same what has been said about it previously it is valid in this case, too.

  Sewer systems have to be constructed according to the established priority lists but taking into account local conditions, financial sources available and the extent of the ecological damage done due to the present condition of the networks.

  Moreover, quality and flow rate control systems have to be introduced for atmospheric waters in accordance with the type of the existing sewer system (combined or separated) and with the actual local conditions.

- **ensure optimal industrial wastewater pretreatment.** Because this activity is very closely connected with the previous two activities, as maintenance and operational life of the sewers and, especially efficient operation of the central WWTPs are strongly dependent upon successful realization of this activity. Total number of the existing IWWPPs is rather insufficient and operational efficiency of the majority of them is not satisfactory.

Therefor for this activity it is important to make the inventory of industrial polluters located in the settlements and of existing IWWPPs, as a very first step of the activity, the results obtained being the basis for all other steps within it.

The priority lists for industrial wastewater pretreatment plants (IWWPP) has to be elaborated, in accordance with kind of the industry, the amount of its wastewater, its toxicity and its biodegradable organic pollutional load (high organic pollution could be considered as to be in favor to the efficiency of the central WWTP).

Quality control of the pretreated industrial effluents has to be ensured. This control has been carried out by the authorized institutions several times per year already, but there is enough space for its better organization and improvement.

It is necessary to conduct programs for education of the IWWPP-s operators, in analogy to the similar programs for WWTPs operators, but with very significant role of the management of the industry involved, in this case.

Measures for achieving optimal capacity have to be undertaken through upgrading of the existing and construction of the new IWWPP-s. This should be done in the strict accordance with the inventory and priority lists and with balanced operational optimizations and reconstructions of the existing and constructions of the new IWWPPs.

- **enforce legal and monitoring framework.** This activity has been a prerequisite for the previous three because an appropriate municipal wastewater management and an optimal industrial wastewater pretreatment, before their joint treatment in the central WWTPs are highly dependent upon its successful accomplishment. Some of the required important elements of the activity have been explained previously.

  For this activity it is important to compose the inventory of objects discharging wastewater into sewer network and to make programs for industrial wastewater control in settlements as it was already explained.

  In addition it is important to establish sampling sites for flow rate measurements, Data on wastewater flow rate, together with data on discharged wastewater quality, are the basis for determining the wastewater discharge fee.

  Quality control through establishing the referent laboratory has to be ensured. The referent laboratory (no one does not exist in the country, at present) is an indispensable element of any proper wastewater quality control system and numerous disputes in past were caused by the lack of this kind of institution.

  It is also required to apply polluter pays principle. The taxes for polluters will be determined by the authorities, according to the total pollution load, introduced into the sewer network or into the watercourse and the other relevant data.

  Moreover, appropriate wastewater monitoring has to be introduced and monitoring of the efficiency of IWWPP-s conducted as it was explained above.

For this result, the following projects have been identified:

Existing/On-going Projects:

- *"Development of the new methods in urban drainage" and*
- *Project of the WWTP for the city of Valjevo (in construction).*

Planned Projects:

- *Projects of the WWTP-s for the cities of Sabac, Nis and Blace.*

Proposed Project(s)

- *Projects of the WWTP-s for the cities of Belgrade ("Veliko Selo", "Ostruznica", "Batajnica" and "Banatski sistem"), Novi Sad and Zrenjanin and projects of the regional sewer system and WWTP Vrbas-Kula-Crvenka, reconstruction and upgrading of the sewer systems in the cities of Belgrade and Novi Sad.*

(ii) Proper collecting and disposal of wastewater in rural areas

Two crucial problems in rural areas, when collection of wastewater and their ultimate disposal are concerned (the percentage of the total rural population, connected to the sewers, has been estimated to be only about 40%) are insufficiently developed sewer networks and a great number of improperly built septic pits(usage of permeable bottom pits or abandoned wells as pits). In addition, the environmental attitude of the rural population is highly inadequate.

In order to achieve this result, several activities are required in the following areas:

- rural areas
- public awareness
- funds availability

It is necessary to:

- **improve sanitary standard in rural areas** by coordinated efforts of the both, local authorities and individuals in financing, maintenance of the existing and construction of new sanitary facilities and in rural settlements development in general.

  It is important to establish program for rural settlements development, in accordance with contemporary achievements in city planning.

  Rural population has to be stimulated for sanitary infrastructure construction, through a persistent and continuous explanation of the significance of this activity for their health and well-being.

  It is also required to establish program for an increase the sanitation level in rural settlements, providing an adequate management of water supply, wastewater and solid waste through upgrading and enlargement of the existing and construction of the new sanitary facilities and better organization of the systems.

  Individual households sanitation measures have to be assisted in rural areas, with professional advice, with offering standard project documentation without charge, with financial support whenever possible and similar.

  Moreover, it is required to establish the maintenance services for septic pits for their regular emptying, which will eliminate further construction of improper pits and continuation of water resources pollution in such way.

  Measures for sanitary control in rural areas have to be undertaken by the activity of local health and sanitary authorities, with the help of corresponding state authorities.
- **arise public awareness upon environmental problems in rural areas through information and educational programs.** Arising of public awareness upon environmental problems in rural areas should be accomplished through the realization of adequate informational and educational programs in local media and in schools.

  It is important to evaluate sanitary problems in rural settlements and define the solution for them, by the activity of appropriate and relevant public health and engineering organizations and main results obtained present to the public in a popular way.

Educational programs for rural population have to be defined, which are attractive enough for public and which will arise their interest for the problem and for its solution. Meetings on environmental protection necessity have to be organized as well, and the main features of the previously defined programs presented to the public.

Environmental topics have to be included into the media electronic and printed, as a complementary element to the previous one.

In order to make public more familiar with the matter and to demystify the accompanying problems and their solutions it is required to establish mobile exhibitions on possible environmental solutions.

- **make funds available for construction of appropriate wastewater disposal in rural areas,** as an unavoidable activity, especially important because of difficult economic situation in the country at present. It is obvious that the necessary amount of funds can be provided by the use of all possible sources only.

  It is important to determine the real taxes for rural settlements planning, in accordance with the present average income of the inhabitants, as to be the one among several sources of necessary funds.

  Municipal and community self- contribution funds have to be introduced, as the next source of funds, but after an increase of the level of public awareness upon environmental problems, achieved previously.

  It is also required to regulate concession conditions and terms, in order to attract domestic and foreign investors capital for construction of the necessary facilities and plants.

  Financing mechanisms for construction of appropriate individual wastewater treatment facilities have to be introduced by supplying loans under favorable conditions. Donations of former local inhabitants have to be stimulated, being now well-off citizens of foreign countries, primarily.

For this result, the following projects have been identified:

Proposed Project(s):

- *"Development of methods for proper sanitation of individual households" and*
- *The sanitation of Belgrade suburb Kaludjerica.*

(iii) Introduction of adequate municipal solid waste management

MSW management problem is the one among few top environmental problems in the country because of existence of numerous inadequately formed and controlled open dumps, the majority of them being located in the vicinity of the Danube river and its tributaries and because of lack of properly located and formed sanitary landfills (construction of the first one in the country has started last year). In order to achieve this result, several activities are required in the following areas:

- existing open dumps
- legal and physical condition
- primary recovery and disposal of municipal waste
- information and education

It is necessary to:

- **ensure closing and conservation of open dumps.** It is estimated that there are about 200 open dumps in the country, the great majority of them being very low regulated, presenting so very significant pollutional sources of natural waters. Although the activity on designing and constructing proper sanitary landfills has been rather vivid lately, an additional problem is disposal of MSW until completition of the new fills. The solution was found in continuing disposal of MSW on a dump during its sanitation process, but in a relatively sanitary way(compacting, covering with inert material, etc.), until the new sanitary landfill is prepared for use(sanitation through time).

  For this activity, it is required to make open dumps inventory list, as the basis for later preparation of the sanitation priority list. The inventory list should contain all necessary data (size, duration of use ,etc.) about each dump registered.

  In order to ensure an optimal realization of the action and usage of the funds, available closing up and sanitation priority list has to be established. Methodology for dumps closing up and sanitation has to be elaborated, which will be applied in all future actions of this kind throughout the country. Financing funds have to be available, using the same approach as in the case of collection, treatment and disposal of wastewater in municipalities and in rural settlements.

  It is also required to make pilot project for urban dumps recultivation, as the basis for the elaboration of methodology for closing up and recultivation of dumps and to realize activities according the priority list.

  In addition, monitoring of activities on closing up and conservation of open dumps have to be ensured in order to control and coordinate the process on the state level and to correct it if necessary.

- **ensure legal and physical conditions for solid waste disposal in sanitary way.** The activity should go on in parallel with the previous one and their accomplishment will provide conditions for the start of the next phase of the integrated MSW management introduction process.

  For this activity, it is necessary to standardize existing law regulations, concerning the both, sanitation and recultivation of existing open dumps and construction of new, proper sanitary landfills.

  Scientific and technical knowledge on solid waste management have to be improve, through organization of courses and seminars, where existing experienced professionals and experts will convey their knowledge and experience to the younger people from the branch. Methodology for proper choice of sanitary landfills location has to be developed, as a prerequisite for better solution of this very important element, with numerous technical, political and social implications.

  Construction priority list has to be established, taking into account all relevant factors, in order to obtain an optimal sequence of construction. In this context it is necessary to construct sanitary landfills according to the adopted priority list. Collection and transportation systems of MSW have to be improved by better organization and acquisition of new vehicles and other necessary equipment. In addition it is also required to ensure the financing mechanisms, using the approach described previously.

- **undertake measures for primary recovery and disposal of municipal solid waste.** The lack of public awareness upon significance of this activity and of an adequate organization and technical base for its accomplishment should be overcome by financial stimulation of inhabitants to participate in it. This should be done by organization of an adequate network of "buy back" stations and by construction and operation of a plant for material resources recovery.

It is important to develop public interest for primary separation of the MSW components, by their direct financial stimulation to bring waste paper, glass, metals and plastics, separated at home, to the closest station and to sell them.

"Buy back" stations have to be establish for primary separated MSW components by the inhabitants, (for instance, at the city market places) for taking over MSW components from inhabitants. Services for taking over hazardous household waste have to be established, from citizens, after collection of certain minimal amounts of this kind of waste at their homes.

It is also important to establish legal and financial framework for material resources recovery plants (MRRP) construction for material resources recovery plants (MRRP) construction, which will insure disposal of the obtained secondary raw materials to the corresponding industries and an adequate profit for the investors.

In this context MRRP-s have to be constructed preferably at the location of the city landfill and so enable secondary separation of MSW components in situ and their joint processing with the primary separated components by inhabitants.

- **ensure information and educational programs about environmental problems related to municipal solid waste.** The programs will be realized across electronic and printed local media and by their introduction into schools plans and programs. In this context it is important to Make programs for public education about the matter, which are attractive enough and which will arise their interest for the problem and for its solution.

  The environmental topics have to be brought through media to the public, and present the programs to them as well as into the schools, as to start the ecological education of the youngest generations on time. Scientific and professional meetings have to be organized about the matter as a contribution to better scientific and technical knowledge on solid waste management.

For this result, the following projects have been identified:

Existing/On-going Projects

- *The sanitation and recultivation projects for the open dumps in the cities of Valjevo, Pirot, Smederevo, Apatin, Kraljevo and Sremska Mitrovica*
- *The construction projects for sanitary landfills in the cities of Cacak, Uzice, Vrnjacka Banja, Smederevska Palanka, Sremska Mitrovica and Kraljevo*

Planned Projects

- *The sanitation and recultivation project for the open dump in the city of Belgrade (Batajnica)*
- *The pilot project for recycling (primary separation and material resources recovery) of the MSW components.*

Proposed Project(s)

- *The sanitation and recultivation projects for the open dumps in the cities of Belgrade(Vinca), Sabac, Kovin, Backa Palanka and Veliko Gradiste.*

In order to achieve the sector objective by reducing the pollution load from municipalities the projects proposed with ***high priority*** are as follows:

- Reconstruction of sewer network and construction of WWTP for the city of Belgrade (subsystems "Veliko Selo" and "Ostruznica")
- Reconstruction of sewer network and construction of WWTP for the city of Novi Sad

- Reconstruction of sewer network and construction of WWTP for the city of Nis
- Regional sewer system and WWTP Vrbas-Kula-Crvenka
- Reconstruction of sewer network and construction of WWTP for the city of Zrenjanin

3.3.4. Important Assumptions for the Sector

Important assumptions are factors that are significant for the success of the program but they lie outside of scope of the programme and not under its direct control. Therefore, they are external factors and they necessary to ensure the success of the program and the sustainability of its results.

Having defined the objectives in the municipal sector, several important assumptions were identified, having a crucial influence on the success of the program and the activities undertaken. These assumptions concern external factors, that are not under the direct control of the program. The important assumptions are a prerequisites for the achievement of the results and the objectives.

At the **activities** level, the following assumptions have been identified:

- **Modern personal management introduced**

  Proper maintenance of the sewer networks and WWTPs will increase efficiency of the sewerage systems in general and will decrease operation expenses. An adequate operation of the industrial wastewater pretreatment plants will contribute to better functioning of the sewerage systems also.

- **Effective cooperation of all shareholders achieved**

  In order to achieve the sector objective it is necessary to accomplish very close cooperation of all stakeholders involved, namely the institutions of the federal, republican and local governments, professional and consulting organizations, population, civil associations, NGOs, public water supply and sewerage companies, local industry, hospitals, municipal services, etc, many of them belonging to the both, polluters and affected groups.

- **Financial resources available on time**

  An adequate operation and maintenance of all existing sewerage systems will be constantly achieved and their possible enlargement and construction of the new ones will be accelerated by the fulfillment of this assumption.

- **Municipal services organized for realization of integral municipal waste management**

  Unification of all municipal services (water supply, wastewater collection, treatment and disposal, solid waste collection, processing and disposal) into integrated waste management system (system for complete management of all kinds of municipal wastes) insures much more rational and techno-economically optimal operation of the municipality.

- **Population living standards upgraded**

  This assumption is especially significant in the case of FRY. It should be assumed that the present GNP, amounting about 1,500 USD, will reach at least double value.

- **Sanitary infrastructure in rural areas effectively achieved**

  Due to extremely important role of individual engagement and self contribution in fulfilling this assumption, it is closely connected to the previous one. In other words, an increase in GNP will obviously motivate individuals to improve their sanitary standard also.

- **Information transparency of rural population concerning decision of neighboring municipalities achieved**

  Through of realization of adequate informational and educational programs about environmental problems, the public awareness will be increased. They will understand that environmental problems have no limits and that their solutions in the municipalities contribute to the sanitary standard in rural areas and vice versa.

- **Sanctions are effectively applied**

  The effective application of the sanctions will be realized through the improvement of the existing laws and regulations by making them more realistic and by harmonizing them with the EU directives. Their effective application also will become easier to conduct after the population living standard is upgraded.

For this sector at the **results/outputs** level the following assumptions have been identified:

- **Waste management strategy established**

  The environmental problems in urban and rural areas are essentially the same and achieved state waste management strategy should be all-inclusive. The ideal achievement would be establishment of the state integrated waste management system. There are many possibilities for the environmental cooperation of the municipalities and the neighboring rural settlements (for instance, use of adequately treated waste sludge from WWTPs in agriculture). It was mentioned previously that integrated waste management ensures much more rational and techno-economically optimal functioning of municipality in general.

- **Favorable economic conditions achieved**

  The major condition for improvement of economic situation in the country is revitalization and increased industrial production. However it means also an increased pollution of the environment. between two opposite results of the economic improvement it is necessary to find an optimal place for environmental protection.

3.3.5 Impact Indicators for Sector Results

Impact Indicators were developed for sector objectives and sector results. They define the contents of the objectives and results in operationally measurable terms (quantity, quality, target groups, partner institutions, time period and place). They should give an adequate picture of the situation. Furthermore, they should be measurable in a consistent way at an acceptable cost.

The following impact indicators were identified for the results/outputs:

For the result 1:

- **In settlements with more than 5,000 PE appropriate wastewater management is introduced according to EU directives and it is noticed on increase of quality of effluents from municipal WWTPs (25mg/l BOD5, 35 mg/l SS) in the Yugoslav part of DRB by the year 2020.**

  The appropriate wastewater management means construction of the new and extension of the existing sewer network and construction of WWTPs with primary and secondary treatment of wastewater, operated efficiently by qualified operators. Data and information will be provided by the institutions responsible for natural waters quality monitoring.

For the result 2:

- **Increase of 70% of rural population with adequate degree of sanitation in the Yugoslav part of DRB and at the same time the number of diseased by hydric diseases is reduced on 80% by the year 2020 compared to 1991 (based on medical statistic)**

  During the assigned period of time building of the permeable septic pits, which are at the present time usually used in the rural areas of the country, will be forbidden. Regular medical checkup of the population and medical statistics will provide the information.

For the result 3:

- **By sanitation and recultivation of all open dumps and disposal of municipal solid waste on sanitary landfills only, it is noticed reduction of emission of pollution into surface and groundwater to 90% compared to the basis year 1991 in the Yugoslav part of the DRB at the year 2020**

  The objective will be achieved by constructing an adequate number of lined landfills (plastics of impervious clay) only and appropriately treating of the collected leachete before its ultimate disposal. Data collected through regular water quality monitoring will confirm the achievement.

Annexes

1. Identification of River Basin Areas

2. Situation Analysis

3. Problem Analysis

4. Objective Analysis

5. Sector Planning Matrix

6. Activities and Important Elements

7. Results and Projects

8. Workshop Organization

Annex 1.
Identification of the River Basin Areas

1.1. Danube River Basin

1.2. Tisa River Basin

1.3. Sava Basin Area

1.4. Velika Morava River Basin Area

Identification of the River Basin Areas **1. Danube River Basin in FR Yugoslavia** **Annex 1.1**

Physical-Geographical Characteristics	Socio-Demographic Characteristics	Transboundary Effects as Perceived	Human/Economic Activities in the Basin
Relief ➢ Lowlands (Vojvodina) ➢ Hilly and mountain (watershed of Timok, Pek and Mlava) ➢ Djerdap gorge (Iron Gate) **Numerical parameters** ➢ Surface area 11,610 km^2 ➢ Qav=2263 m^3/s at the entrance into FR Yu ➢ Qa>5500 m^3/s at the exit from FR Yu ➢ Runoff q_{av}=9.6 l/s km^2 (together with Tisa watershed) ➢ $Qmin_{95\%}$=1800 m^3/s ➢ Length of embankments 1328 km **Characteristics of the river basin and streams** ➢ Flood areas $F_{100}=1.3\ 10^6$ ha ➢ Flood meadows and other wetlands ➢ 600 km of waterways along river Danube and 600 km along canals ➢ Canal network of Hydro system "DTD" ➢ Diverse types of river streams **Other characteristics** ➢ Alluvium groundwater resources ➢ Secondary salting of soil ➢ National park "Djerdap"	➢ 2,833,954 inhabitants (year 1991) ➢ 67.4 % urban ➢ 32.6 % rural ➢ Population density 101.4 inh./km^2 ➢ Cultural and historical heritage	➢ Reservoir Djerdap I (Irongate I) is a settling tank of Europe ➢ Floods ➢ Pollution of River Timok ➢ Accidental pollution from river transport ➢ Dump "Ostovul Mare" ➢ Low water quality of Danube river and high primary production at the entrance in to FR Yu ➢ Pollution of river Drava	**Agriculture** ➢ Pig and cattle farms ➢ Irrigation and drainage systems ➢ River training ➢ Forestry ➢ Fishing ➢ Protection of wetlands ➢ Intensive agriculture **Industry** ➢ Mining and metallurgy ➢ Food processing industry ➢ Transport infrastructure ➢ Petroleum industry ➢ Chemical industry ➢ Heavy industry ➢ Energy infrastructure ➢ Tourism and recreation **Municipalities** ➢ More than 80% of urban population connected to public water supply systems ➢ Less then 50 % of urban population connected to public sewer systems ➢ 5 % of population covered with waste water treatment ➢ Abstraction of groundwater for water supply ➢ Open dumps for municipal and industrial waste

Physical-Geographical Characteristics	Socio-Demographic Characteristics	Transboundary Effects as Perceived	Human/Economic Activities in the Basin
Relief ➢ Lowlands **Numerical parameters** ➢ Surface area 8,994 km^2 ➢ Qav=794 m^3/s ➢ Runoff q_{av}<1 l/s km^2 ➢ $Qmin_{95\%}$=126 m^3/s ➢ Length of embankments 269 km **Characteristics of the river basin and streams** ➢ Former river branches, flood meadows and other wetlands ➢ 163 km of waterways along river Tisa ➢ Canal network of Hydro system "DTD" ➢ River streams typical for lowlands **Other characteristics** ➢ Groundwater resources ➢ Salting of soil	➢ 809,755 inhabitants (year 1991) ➢ 57.6 % urban ➢ 42.2 % rural ➢ Population density 90.0 inh./km^2	➢ Low water quality of Tisa river at the entrance in to FR Yu ➢ Deteriorated water quality of river streams coming from Romania (Bega, Zlatica, Timis, etc.) at the entrance in to FR Yu ➢ Floating macrophyte vegetation coming from neighboring countries by river streams ➢ High loads of nutrients of rivers coming from neighboring countries	**Agriculture** ➢ Pig and cattle farms ➢ Intensive agriculture ➢ Carp ponds **Industry** ➢ Food processing industry ➢ Transport infrastructure ➢ Petroleum and gas extraction ➢ Chemical industry ➢ Metal industry ➢ Pulp and paper industry ➢ Textile industry **Municipalities** ➢ More than 80% of urban population connected to public water supply systems ➢ Less then 50 % of urban population connected to public sewer systems ➢ Abstraction of groundwater for water supply ➢ Open dumps for municipal and industrial waste

Physical-Geographical Characteristics	Socio-Demographic Characteristics	Transboundary Effects as Perceived	Human/Economic Activities in the Basin
Relief ➢ Lowlands (Srem and Macva) ➢ Hilly and mountain (river Drina watershed) **Numerical parameters** ➢ Surface area 31,046 km^2 ➢ Qav=1570 m^3/s at the entrance into FR Yu ➢ Runoff q_{av}=16.5 l/s km^2 ➢ $Qmin_{95\%}$=278 m^3/s ➢ Length of embankments 771 km **Characteristics of the river basin and streams** ➢ River streams typical for lowlands and hilly regions (river Sava) ➢ River streams typical for hilly and mountain hilly regions (river Drina and tributaries) **Other characteristics** ➢ Erosion in upstream parts of watershed ➢ Numerous dams for hydropower ➢ Groundwater resources along river Sava	➢ 1,354,592 inhabitants (year 1991) ➢ 35.1 % urban ➢ 64.9 % rural ➢ Population density 64.6 inh./km^2 ➢ Migration of the population due to recent war in the neighborhood	➢ Decrease of flow rate due to water use in upstream countries ➢ Floods due to inappropriate operation of detention basins in upstream countries ➢ Accidental pollution ➢ Risk from nuclear pollution ➢ Pollution from petrochemical and metallurgy coming from upstream countries	**Agriculture** ➢ Intensive agriculture in downstream parts of watershed (Srem and Macva) ➢ Pig and cattle farms ➢ Trout ponds ➢ Forestry **Industry** ➢ Open coal mines ➢ Pulp and paper industry ➢ Food processing industry ➢ Mining ➢ Transport infrastructure ➢ Power plants ➢ Gravel abstraction ➢ Tourism and recreation **Municipalities** ➢ More than 80% of urban population connected to public water supply systems ➢ About 60 % of urban population connected to public sewer systems ➢ Ground and surface water used for water supply ➢ Open dumps for municipal and industrial waste

Identification of the River Basin Areas 4. Velika Morava River Basin in FR Yugoslavia Annex 1.4

Physical-Geographical Characteristics	Socio-Demographic Characteristics	Transboundary Effects as Perceived	Human/Economic Activities in the Basin
Relief ➢ Hilly and mountain ➢ Wide river valleys **Numerical parameters** ➢ Surface area 37,269 km^2 ➢ Qav=232 m^3/s ➢ Spec. runoff q_{av}=6.1 l/s km^2 ➢ $Qmin_{95\%}$=35 m^3/s ➢ Precipitation 756 mm ➢ Runoff 194 mm ➢ Evapotranspiration 562 mm ➢ Length of embankments 1182 km **Characteristics of the river basin and streams** ➢ Diverse types of river streams ➢ Intensive seasonal variations of rivers flow rate **Other characteristics** ➢ Numerous reservoirs for water supply and hydro power ➢ Groundwater resources along river Velika Morava river ➢ Thermal springs	➢ 4,081,046 inhabitants (year 1991) ➢ 43.9 % urban ➢ 56.1 % rural ➢ Population density 107.8 inh./km^2 ➢ High population growth rate in upstream parts of watershed ➢ 40 % of arable land are land properties smaller then 2 ha	➢ Pollution from Bulgaria (rivers: Nisava, Jerma, and Visocica)	**Agriculture** ➢ Non intensive agriculture on 70 % of arable land ➢ Pig and cattle farms ➢ River training ➢ Forestry **Industry** ➢ Mechanical and metal industry ➢ Chemical industry ➢ Energy infrastructure ➢ Food processing industry ➢ Transport infrastructure ➢ Gravel abstraction ➢ Forest industry ➢ Textile industry ➢ Leather industry ➢ Tourism and recreation **Municipalities** ➢ More than 80% of urban population connected to public water supply systems ➢ About 60 % of urban population connected to public sewer systems ➢ 6 % of population covered with waste water treatment ➢ Ground and surface water used for water supply ➢ Regional water supply systems (surface water ➢ Open dumps for solid waste

Annex 2.

Situation Analysis of Activities Leading to Water Pollution in Specific Areas

2.1. Agriculture

2.2. Industry, Mining and Energy

2.3. Municipality

Situation Analysis **1. Agriculture** **Annex 2.1**

Activities leading to water pollution	Current Strengths and Assets	Environmental Consequences of Economic activities	Transboundary effects	Causes leading to inappropriate activities	Measures to be undertaken
➢ Inadequate agriculture production	➢ Machinery and equipment ➢ Legal regulations ➢ Technical &scientific know-how	➢ Land erosion ➢ Reduction of wetlands ➢ Reduction of biodiversity	➢ Input of nutrients and sediments	➢ Inadequate preparation of the soil ➢ Inadequate preparation ➢ Inappropriate fruit ripening ➢ Compaction of soil ➢ Drying up of wetlands ➢ Growing of plantation forests ➢ Insufficient information for the public	➢ Implementation of regulations ➢ Adequate farming methods ➢ Anti-erosion measures ➢ Financing resources ➢ Protection of wetlands ➢ Objective Public informing (public opinion) pressure
➢ Inappropriate animal farming	➢ Available arable land	➢ Eutrophication		➢ Production of slurry and waste waters in animal farms ➢ Location of farms ➢ Capacity of farms ➢ Fertilization and manure treatment	➢ Implementation of regulations ➢ Adequate treatment of slurry (manure) ➢ Controlled disposal on farming land ➢ Sources of financing ➢ Subsidies
➢ Inadequate production of fish		➢ Eutrophication ➢ Endangerment of autochthonous species		➢ Inadequate management of fish ponds ➢ Inadequate monitoring ➢ Inadequate emptying of fishponds	➢ Adequate emptying of fishponds ➢ Application of regulations ➢ Prohibition import autochthonous species of fish in open waters ➢ Monitoring ➢ Recirculation of waters in fishponds
➢ Inadequate management of forests	➢ Legislation and regulation ➢ Available land and space	➢ Erosion		➢ Inadequate cutting of forests ➢ Replacing natural forests with planted forests	➢ Application of regulations ➢ Resources of financing ➢ Reconstruction of natural forests ➢ Planting autochthonous species of trees

Activities leading to water pollution	Current Strengths and Assets	Environmental Consequences of Economic activities	Transboundary effects	Causes leading to inappropriate activities	Measures to be undertaken
➢ Use of obsolete technologies	➢ Transfer of technology ➢ Local know-how	➢ Water resources pollution ➢ Eutrophication ➢ Jeopardy (reduction of) biodiversity) ➢ Air pollution ➢ Soil pollution ➢ Health hazards	➢ Organic and toxic pollution ➢ Nutrients	➢ Lack of finances for new technologies ➢ Inadequate allocation of funds	➢ Introduction of new technologies ➢ Determination of financial sources ➢ Activation of national know-how ➢ Innovation of existing technologies ➢ Introduction of higher charges for industrial use of water ➢ Privatization ➢ Change of fiscal system
➢ Inadequate management of technological processes	➢ Standards and technical legislative			➢ Poor organization of production ➢ Pressure of economic situation ➢ Insufficient managerial skills of top officials ➢ Insufficient training of operatives	➢ Training of manufacture organizing staff
➢ Inadequate treatment of industrial waste	➢ Existing production plants ➢ Local waste treatment equipment ➢ Available finances	➢ Formation of the new physical and chemical sediment in “Djerdap” reservoir		➢ Lack of waste treatment plants ➢ Lack of monitoring ➢ Obsolete legislation ➢ Lack of spatial plan for selection of location	➢ Building plants for the treatment of waters ➢ Revitalization and maintenance of existing plants ➢ Forming a database of industrial pollution ➢ Environmental education ➢ Objective public information (public opinion) ➢ Dangerous industrial solid waste deposits ➢ Waste minimization ➢ Harmonization of legislation with EU and world standards

Activities leading to water pollution	Current Strengths and Assets	Environmental Consequences of Economic activities	Transboundary effects	Causes leading to inappropriate activities	Measures to be undertaken
➢ Inadequate mining activities	➢ Controlled conditions of excavation ➢ New methods for ore concentration and ore processing			➢ Irrational use of resources ➢ Increased concentration of plants	➢ Rehabilitation and revitalization of destructed and endangered areas ➢ Introduction of concessions in mining ➢ Recuperation of useful materials from waste waters and sludge
➢ Inadequate use of power plants	➢ Rational use of resources and energy ➢ New energy sources – alternative			➢ Increased energy requirements ➢ Irrational use of power plants ➢ Irrational use of space ➢ Inadequate planning and designing of systems	➢ Planning energy requirements ➢ Adequate planning and designing of systems ➢ Rational use of resources ➢ Search for new energy sources (solar, wind, geothermal) ➢ Defining real prices of energy ➢ Education of population

Activities leading to water pollution	Current Strengths and Assets	Environmental Consequences of Economic activities	Transboundary effects	Causes leading to inappropriate activities	Measures to be undertaken
➢ Production of waste waters (urban)	➢ Financing sources ➢ Technical & scientific know-how	➢ Organic and inorganic pollution ➢ Nutrients	➢ Effects on biodiversity ➢ Limited use of waters due to quality reduction ➢ Eurofication	➢ Inefficient operation of waste processing devices ➢ Inadequate control of waste waters ➢ Low efficiency of devices for Pretreatment of waste waters industrial ➢ Lack of devices for the pre-treatment of waste waters ➢ Poor maintenance of waste water processing plants ➢ Inadequate (obsolete) capacity and technology ➢ Inadequate staff structure in municipal sewage co. and in WW processing plants ➢ Inadequate work & technology discipline	➢ Integral management of water resources ➢ Introduction of greater (adequate) charges for release of WW and water pollution ➢ Ownership transformation (privatization) ➢ Seasonal addition of fresh water ➢ Introduction of economic water tariffs ➢ More strict Fines-policy ➢ Introduction of more rigorous work control (effect) of WWTP ➢ Establishment of reference laboratories ➢ Construction of industrial waste water Pretreatment Plants ➢ Economic stimulation for producers of equipment and devices for WWTP ➢ Reconstruction and extension of WWTP ➢ Upgrading of work and technological discipline ➢ Construction of sewage collector systems in urban settlements
				➢ Release of waste waters without treatment ➢ Insufficient development of sewer systems ➢ Disregard of regulative ➢ Inadequate channeling and draining of atmospheric water ➢ Lack of monitoring	➢ Construction of waste water treatment plants ➢ Harmonization of legislature with EU regulations ➢ Introduction of atmospheric water treatment ➢ Adequate monitoring

Activities leading to water pollution	Current Strengths and Assets	Environmental Consequences of Economic activities	Transboundary effects	Causes leading to inappropriate activities	Measures to be undertaken
➢ Waste water production in rural settlements	➢ Legislation ➢ Available water resources for seasonal of fresh water ➢ Machine & electro industry producing waste water processing devices ➢ Waste water treatment plants	➢ Underground pollution ➢ Health risks		➢ Use of permeable septic pits	➢ Abandoned on use of draining septic pits ➢ Construction of water-tight septic pits in rural settlements
➢ Production of solid waste		➢ Health hazards ➢ Pollution of water resources		➢ Inadequate solid waste management ➢ Disrespect for regulations ➢ Inadequate waste dumps location ➢ Inadequate dangerous waste disposal ➢ Inadequate environmental attitude of the population ➢ Insufficient information for the public (lack of the public opinion)	➢ Find financial resources ➢ Rehabilitation of waste dumps and construction of sanitary dumps ➢ Introduction of integral solid management system ➢ Education of the public in the spirit of environment protection ➢ Unbiased public information (public opinion pressure)

Annex 3.

Problem Analysis

3.0. General Problem Hierarchy

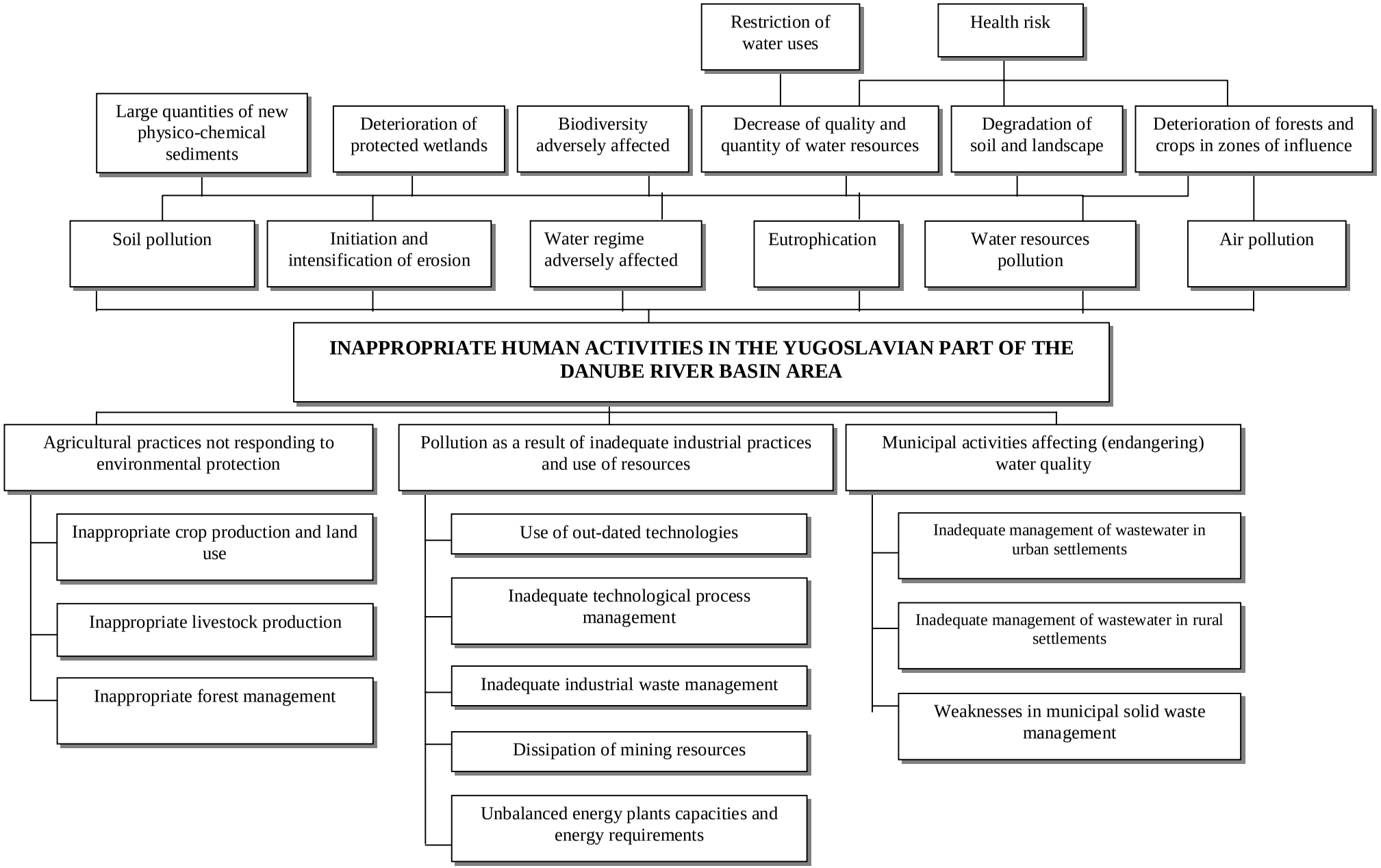
3.1. Agriculture

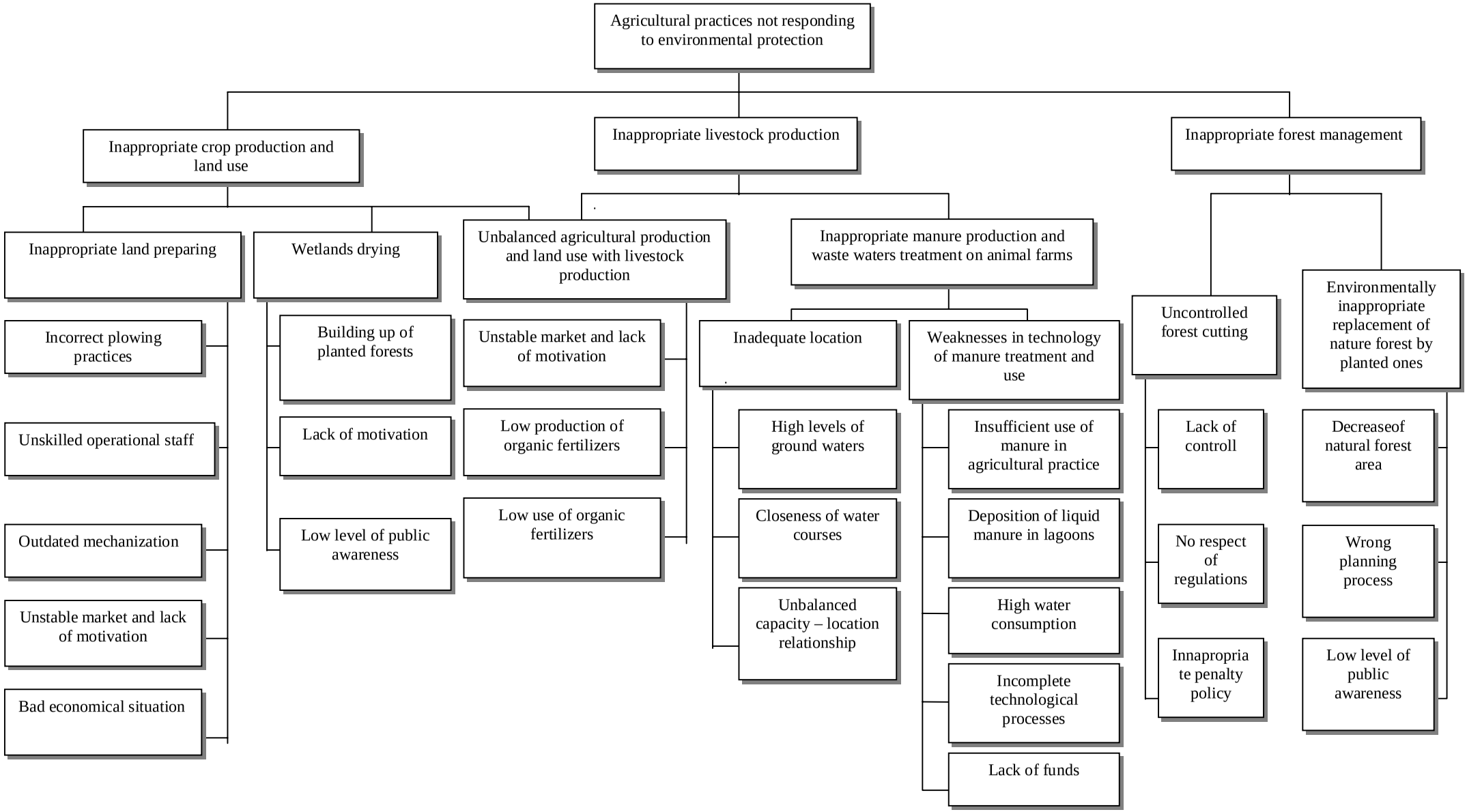
3.2. Industry, Mining and Energy

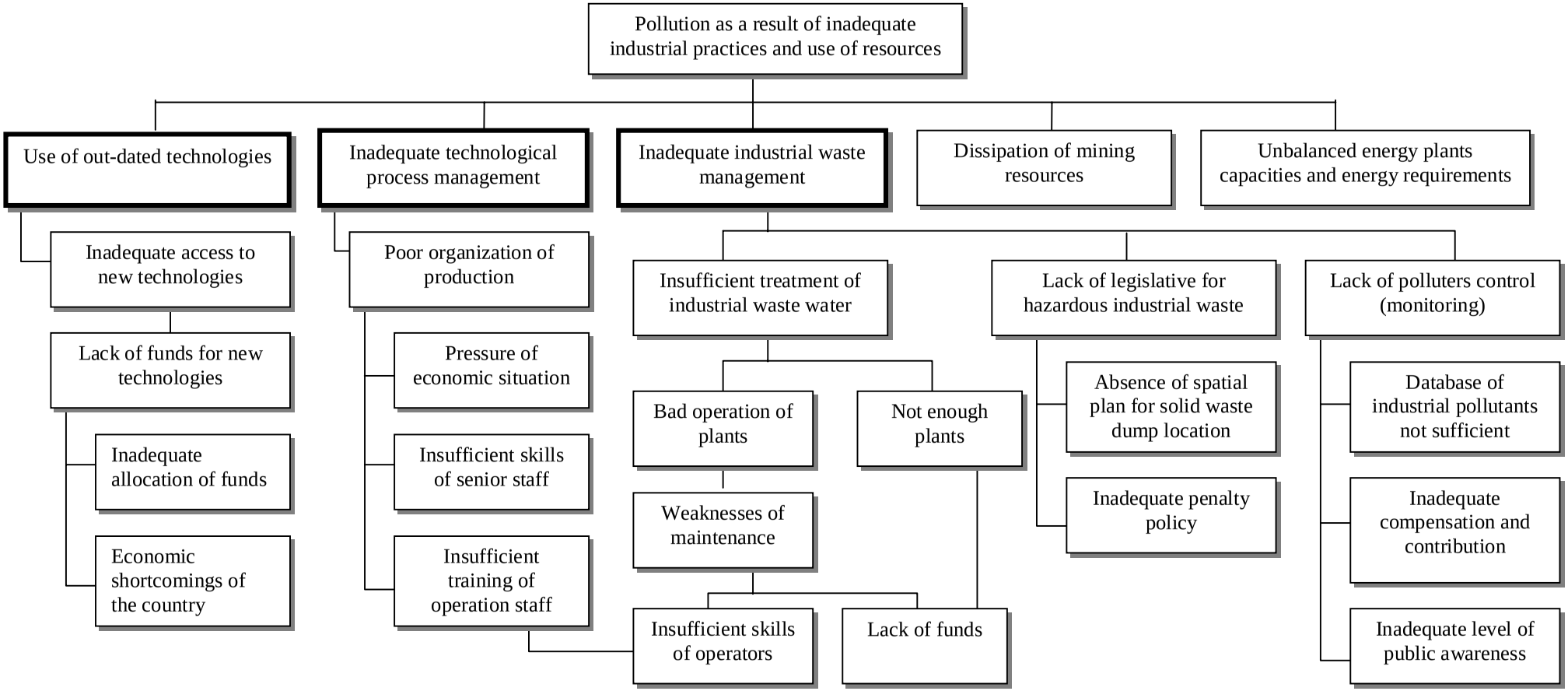
3.3. Municipality

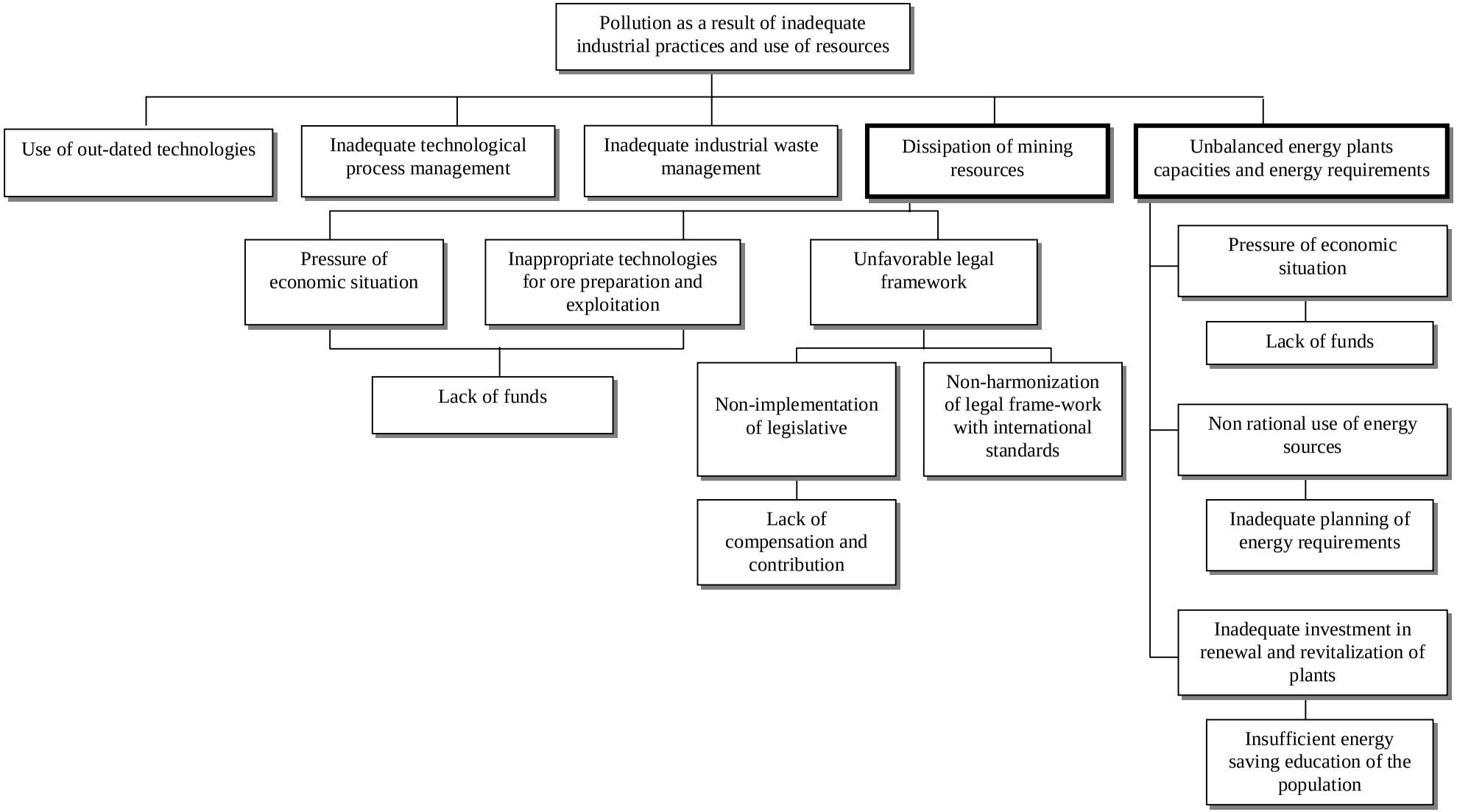
General Problem Hierarchy

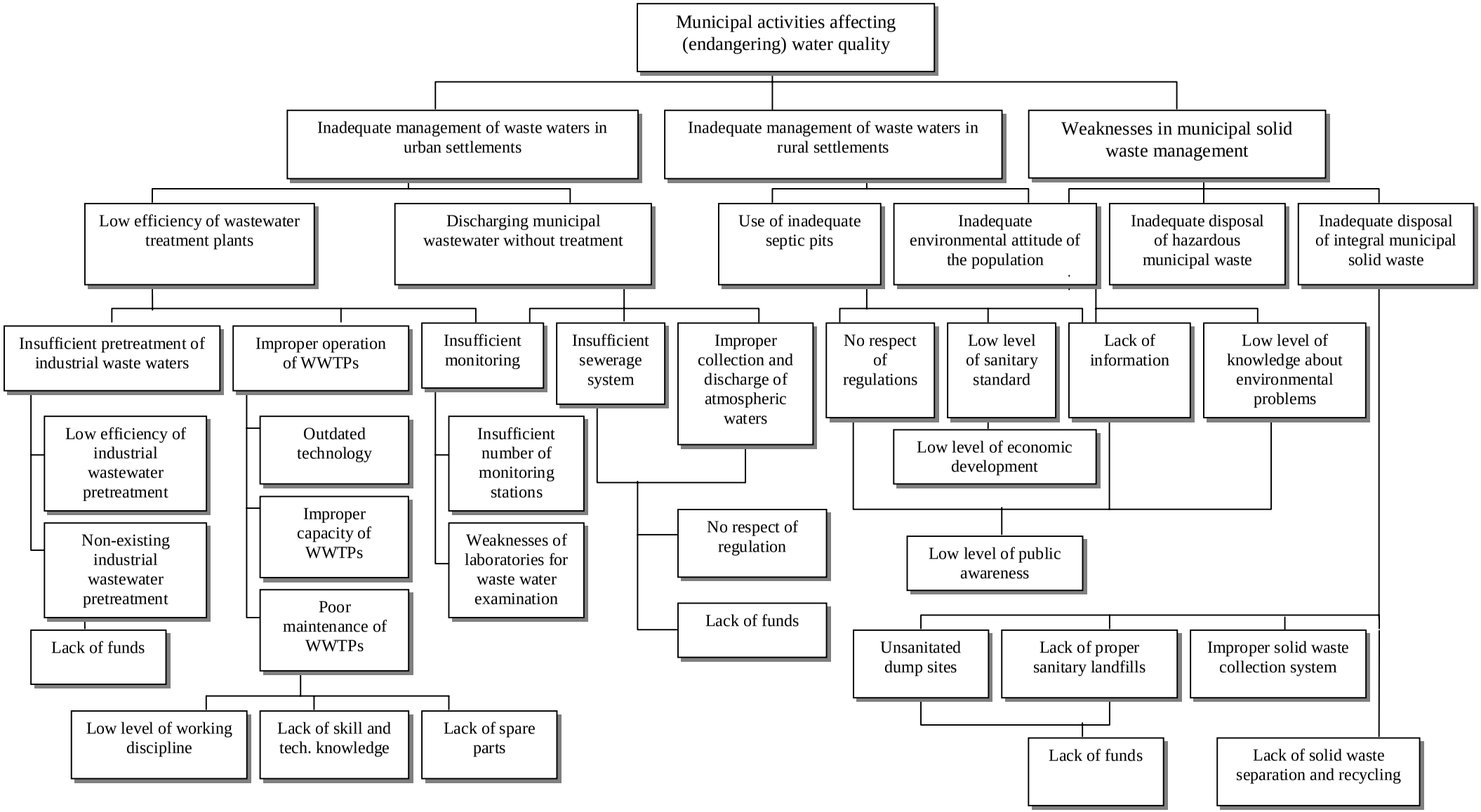
Annex 3.0




Agricultural practices not responding to environmental protection
Inappropriate crop production and land use
Inappropriate livestock production
Inappropriate forest management
Inappropriate land preparing
Wetlands drying
Unbalanced agricultural production and land use with livestock production
Inappropriate manure production and waste waters treatment on animal farms
Uncontrolled forest cutting
Environmentally inappropriate replacement of nature forest by planted ones
Incorrect plowing practices
Unskilled operational staff
Outdated mechanization
Unstable market and lack of motivation
Bad economical situation
Building up of planted forests
Lack of motivation
Low level of public awareness
Unstable market and lack of motivation
Low production of organic fertilizers
Low use of organic fertilizers
Inadequate location
Weaknesses in technology of manure treatment and use
High levels of ground waters
Closeness of water courses
Unbalanced capacity – location relationship
Insufficient use of manure in agricultural practice
Deposition of liquid manure in lagoons
High water consumption
Incomplete technological processes
Lack of funds
Lack of controll
No respect of regulations
Innapropria te penalty policy
Decreaseof natural forest area
Wrong planning process
Low level of public awareness


Pollution as a result of inadequate industrial practices and use of resources
Use of out-dated technologies
Inadequate technological process management
Inadequate industrial waste management
Dissipation of mining resources
Unbalanced energy plants capacities and energy requirements
Inadequate access to new technologies
Lack of funds for new technologies
Inadequate allocation of funds
Economic shortcomings of the country
Poor organization of production
Pressure of economic situation
Insufficient skills of senior staff
Insufficient training of operation staff
Insufficient treatment of industrial waste water
Bad operation of plants
Weaknesses of maintenance
Insufficient skills of operators
Not enough plants
Lack of funds
Lack of legislative for hazardous industrial waste
Absence of spatial plan for solid waste dump location
Inadequate penalty policy
Lack of polluters control (monitoring)
Database of industrial pollutants not sufficient
Inadequate compensation and contribution
Inadequate level of public awareness


Pollution as a result of inadequate industrial practices and use of resources
Use of out-dated technologies
Inadequate technological process management
Inadequate industrial waste management
Dissipation of mining resources
Unbalanced energy plants capacities and energy requirements
Pressure of economic situation
Inappropriate technologies for ore preparation and exploitation
Unfavorable legal framework
Lack of funds
Non-implementation of legislative
Non-harmonization of legal frame-work with international standards
Lack of compensation and contribution
Pressure of economic situation
Lack of funds
Non rational use of energy sources
Inadequate planning of energy requirements
Inadequate investment in renewal and revitalization of plants
Insufficient energy saving education of the population


Municipal activities affecting (endangering) water quality
Inadequate management of waste waters in urban settlements
Inadequate management of waste waters in rural settlements
Weaknesses in municipal solid waste management
Low efficiency of wastewater treatment plants
Discharging municipal wastewater without treatment
Use of inadequate septic pits
Inadequate environmental attitude of the population
Inadequate disposal of hazardous municipal waste
Inadequate disposal of integral municipal solid waste
Insufficient pretreatment of industrial waste waters
Improper operation of WWTPs
Insufficient monitoring
Insufficient sewerage system
Improper collection and discharge of atmospheric waters
No respect of regulations
Low level of sanitary standard
Lack of information
Low level of knowledge about environmental problems
Low efficiency of industrial wastewater pretreatment
Non-existing industrial wastewater pretreatment
Lack of funds
Outdated technology
Improper capacity of WWTPs
Poor maintenance of WWTPs
Low level of working discipline
Lack of skill and tech. knowledge
Lack of spare parts
Insufficient number of monitoring stations
Weaknesses of laboratories for waste water examination
No respect of regulation
Lack of funds
Low level of economic development
Low level of public awareness
Unsanitated dump sites
Lack of proper sanitary landfills
Improper solid waste collection system
Lack of funds
Lack of solid waste separation and recycling

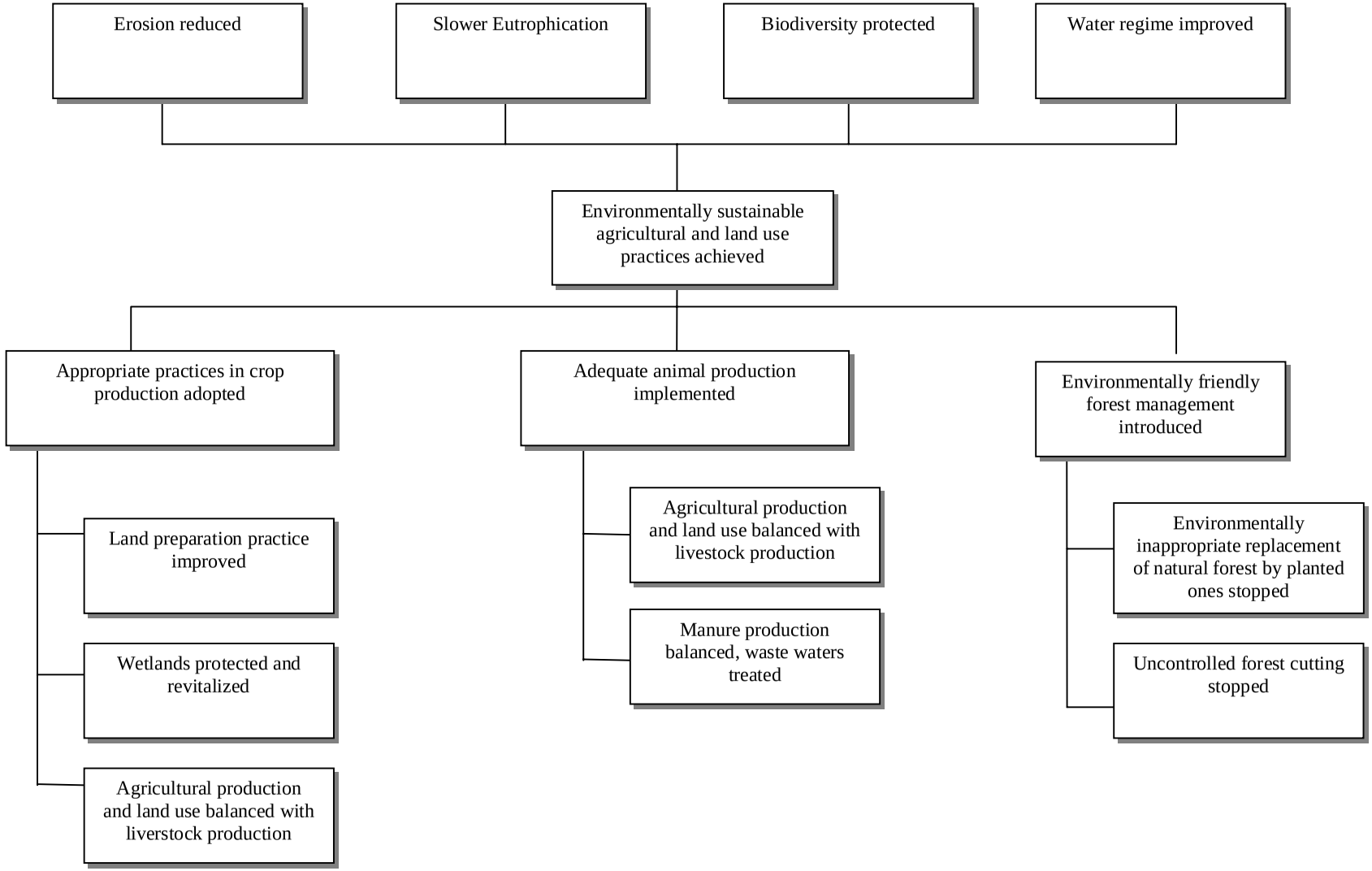
Annex 4.

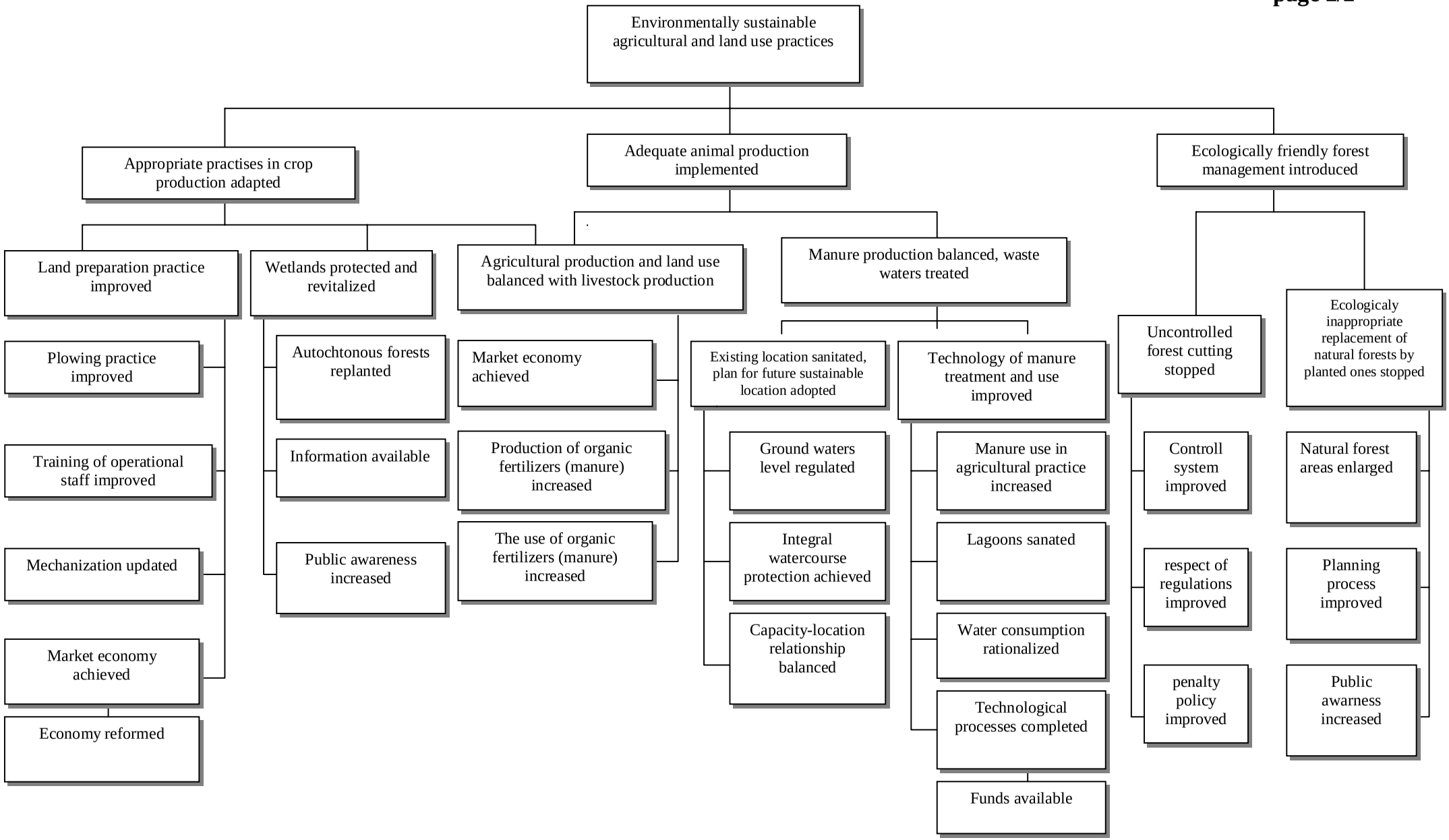
Objective Analysis

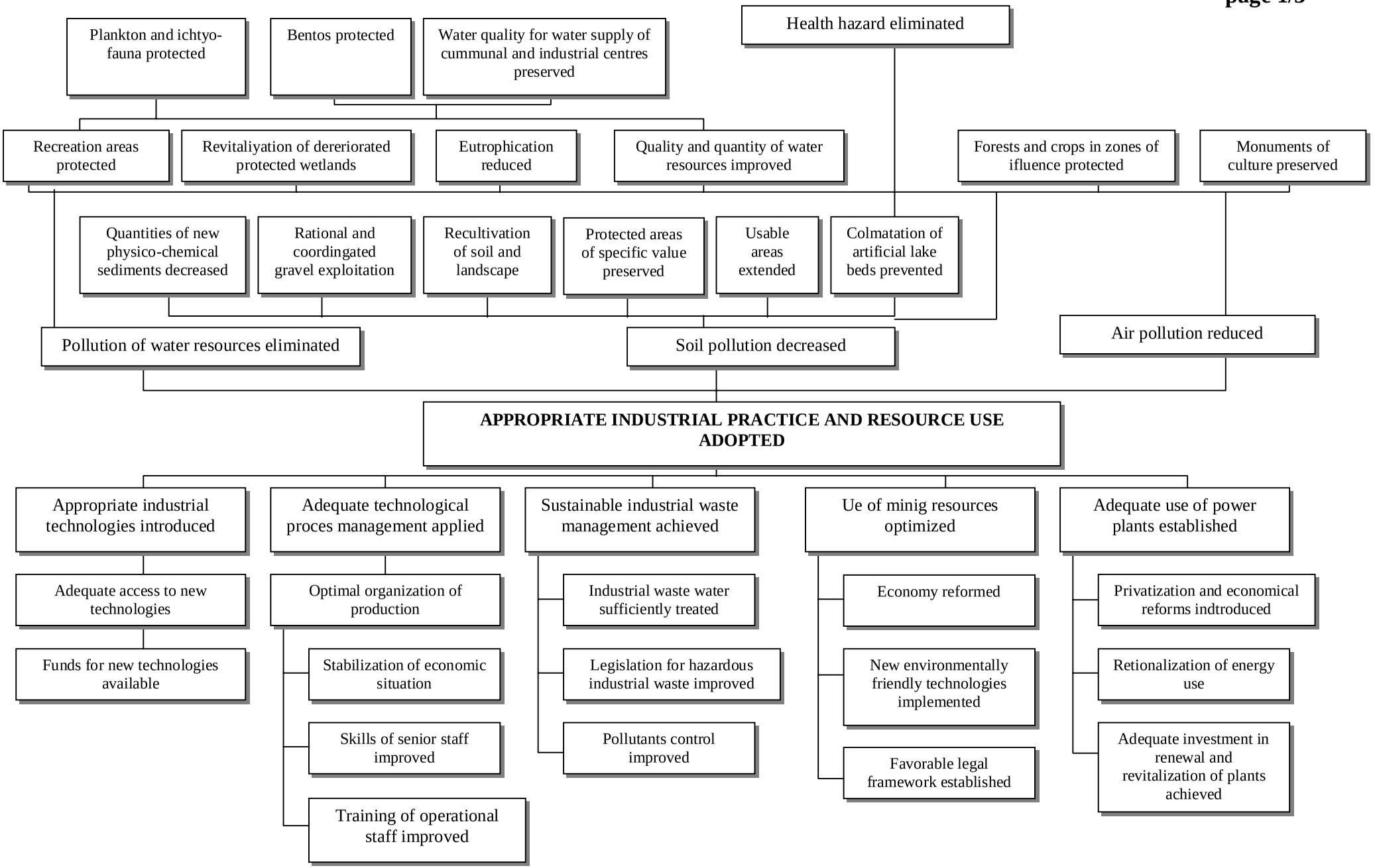
4.1. Agriculture

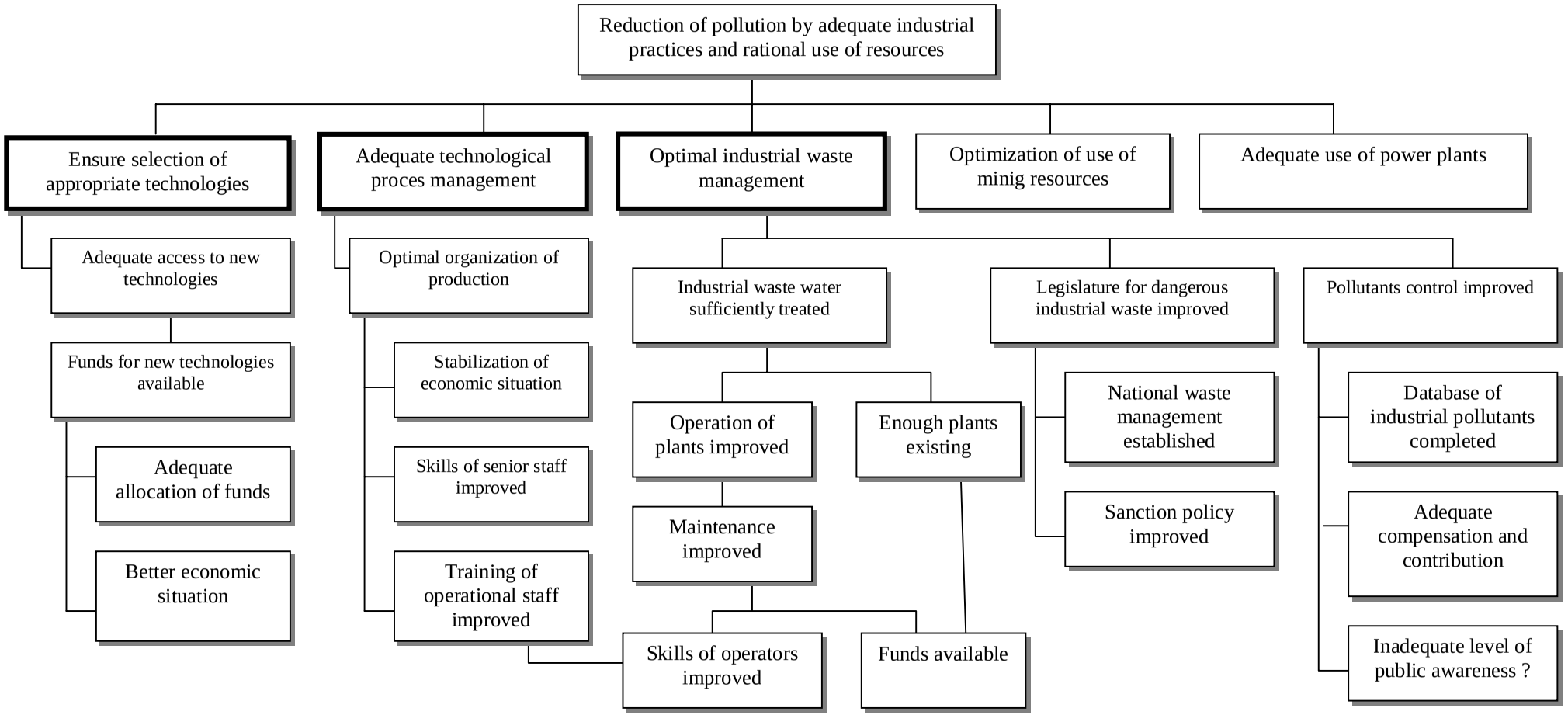
4.2. Industry, Mining and Energy

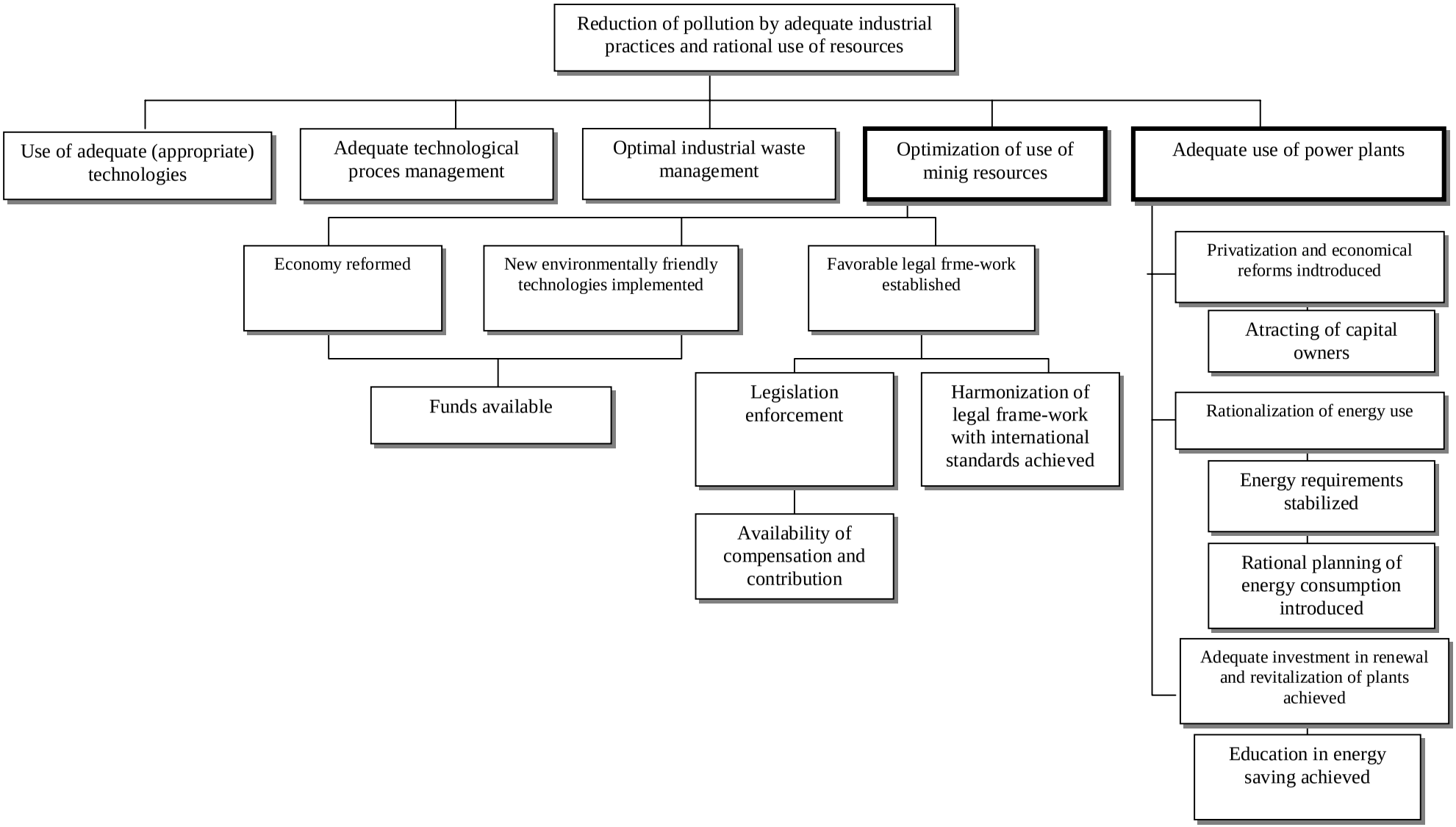
4.3. Municipality

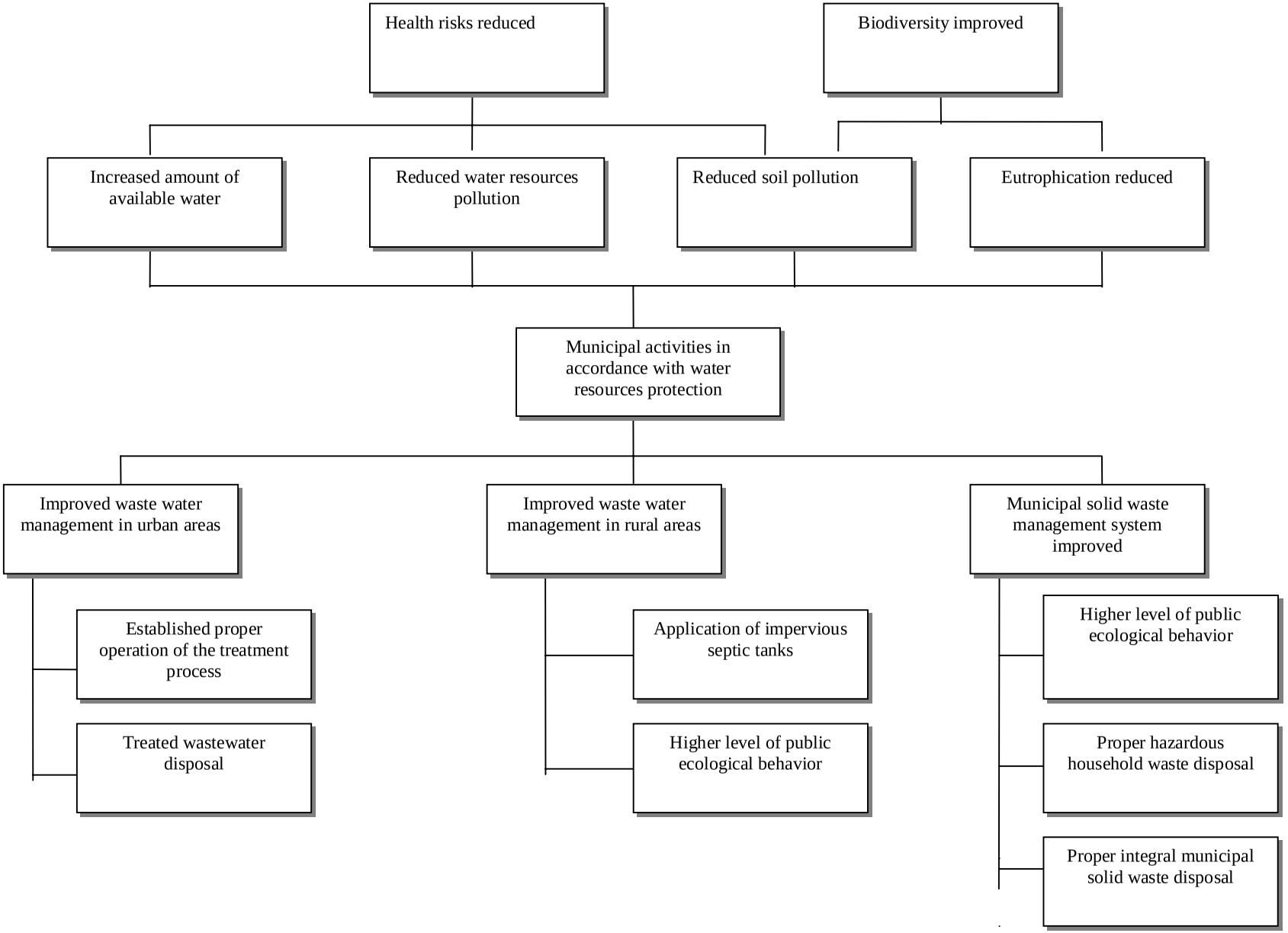

Erosion reduced
Slower Eutrophication
Biodiversity protected
Water regime improved
Environmentally sustainable agricultural and land use practices achieved
Appropriate practices in crop production adopted
Adequate animal production implemented
Environmentally friendly forest management introduced
Land preparation practice improved
Wetlands protected and revitalized
Agricultural production and land use balanced with liverstock production
Agricultural production and land use balanced with livestock production
Manure production balanced, waste waters treated
Environmentally inappropriate replacement of natural forest by planted ones stopped
Uncontrolled forest cutting stopped

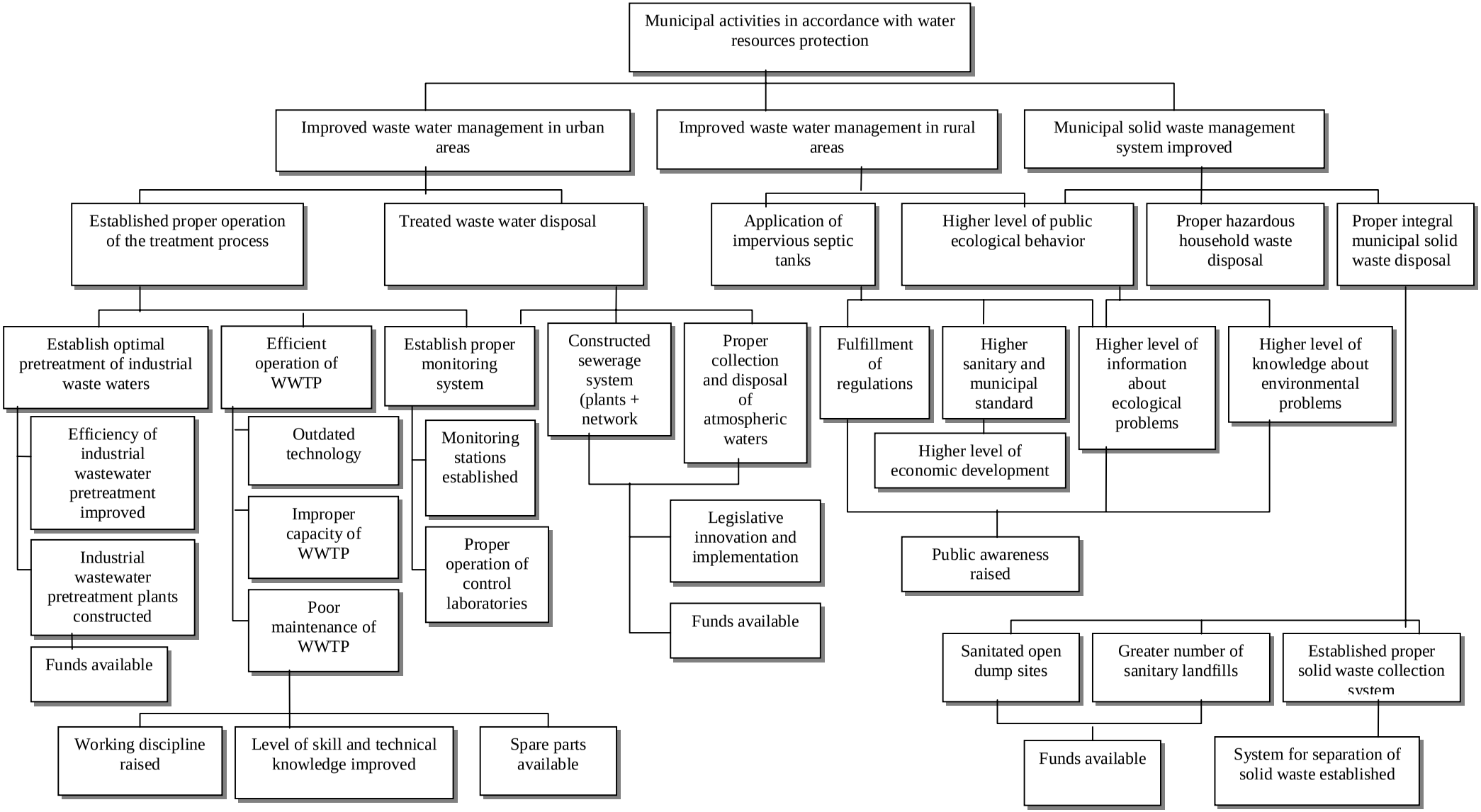

Environmentally sustainable agricultural and land use practices
Appropriate practises in crop production adapted
Adequate animal production implemented
Ecologically friendly forest management introduced
Land preparation practice improved
Wetlands protected and revitalized
Agricultural production and land use balanced with livestock production
Manure production balanced, waste waters treated
Uncontrolled forest cutting stopped
Ecologicaly inappropriate replacement of natural forests by planted ones stopped
Plowing practice improved
Training of operational staff improved
Mechanization updated
Market economy achieved
Economy reformed
Autochtonous forests replanted
Information available
Public awareness increased
Market economy achieved
Production of organic fertilizers (manure) increased
The use of organic fertilizers (manure) increased
Existing location sanitated, plan for future sustainable location adopted
Technology of manure treatment and use improved
Ground waters level regulated
Integral watercourse protection achieved
Capacity-location relationship balanced
Manure use in agricultural practice increased
Lagoons sanated
Water consumption rationalized
Technological processes completed
Funds available
Controll system improved
respect of regulations improved
penalty policy improved
Natural forest areas enlarged
Planning process improved
Public awarness increased


Plankton and ichtyo-fauna protected
Bentos protected
Water quality for water supply of cummunal and industrial centres preserved
Health hazard eliminated
Recreation areas protected
Revitaliyation of dereriorated protected wetlands
Eutrophication reduced
Quality and quantity of water resources improved
Forests and crops in zones of ifluence protected
Monuments of culture preserved
Quantities of new physico-chemical sediments decreased
Rational and coordingated gravel exploitation
Recultivation of soil and landscape
Protected areas of specific value preserved
Usable areas extended
Colmatation of artificial lake beds prevented
Pollution of water resources eliminated
Soil pollution decreased
Air pollution reduced
APPROPRIATE INDUSTRIAL PRACTICE AND RESOURCE USE ADOPTED
Appropriate industrial technologies introduced
Adequate technological proces management applied
Sustainable industrial waste management achieved
Ue of minig resources optimized
Adequate use of power plants established
Adequate access to new technologies
Funds for new technologies available
Optimal organization of production
Stabilization of economic situation
Skills of senior staff improved
Training of operational staff improved
Industrial waste water sufficiently treated
Legislation for hazardous industrial waste improved
Pollutants control improved
Economy reformed
New environmentally friendly technologies implemented
Favorable legal framework established
Privatization and economical reforms indtroduced
Retionalization of energy use
Adequate investment in renewal and revitalization of plants achieved


Reduction of pollution by adequate industrial practices and rational use of resources
Ensure selection of appropriate technologies
Adequate technological proces management
Optimal industrial waste management
Optimization of use of minig resources
Adequate use of power plants
Adequate access to new technologies
Funds for new technologies available
Adequate allocation of funds
Better economic situation
Optimal organization of production
Stabilization of economic situation
Skills of senior staff improved
Training of operational staff improved
Industrial waste water sufficiently treated
Operation of plants improved
Maintenance improved
Skills of operators improved
Enough plants existing
Funds available
Legislature for dangerous industrial waste improved
National waste management established
Sanction policy improved
Pollutants control improved
Database of industrial pollutants completed
Adequate compensation and contribution
Inadequate level of public awareness ?


Reduction of pollution by adequate industrial practices and rational use of resources
Use of adequate (appropriate) technologies
Adequate technological proces management
Optimal industrial waste management
Optimization of use of minig resources
Adequate use of power plants
Economy reformed
New environmentally friendly technologies implemented
Favorable legal frme-work established
Funds available
Legislation enforcement
Harmonization of legal frame-work with international standards achieved
Availability of compensation and contribution
Privatization and economical reforms indtroduced
Atracting of capital owners
Rationalization of energy use
Energy requirements stabilized
Rational planning of energy consumption introduced
Adequate investment in renewal and revitalization of plants achieved
Education in energy saving achieved


Health risks reduced
Biodiversity improved
Increased amount of available water
Reduced water resources pollution
Reduced soil pollution
Eutrophication reduced
Municipal activities in accordance with water resources protection
Improved waste water management in urban areas
Improved waste water management in rural areas
Municipal solid waste management system improved
Established proper operation of the treatment process
Treated wastewater disposal
Application of impervious septic tanks
Higher level of public ecological behavior
Higher level of public ecological behavior
Proper hazardous household waste disposal
Proper integral municipal solid waste disposal


Municipal activities in accordance with water resources protection
Improved waste water management in urban areas
Improved waste water management in rural areas
Municipal solid waste management system improved
Established proper operation of the treatment process
Treated waste water disposal
Application of impervious septic tanks
Higher level of public ecological behavior
Proper hazardous household waste disposal
Proper integral municipal solid waste disposal
Establish optimal pretreatment of industrial waste waters
Efficient operation of WWTP
Establish proper monitoring system
Constructed sewerage system (plants + network
Proper collection and disposal of atmospheric waters
Fulfillment of regulations
Higher sanitary and municipal standard
Higher level of information about ecological problems
Higher level of knowledge about environmental problems
Efficiency of industrial wastewater pretreatment improved
Industrial wastewater pretreatment plants constructed
Funds available
Outdated technology
Improper capacity of WWTP
Poor maintenance of WWTP
Monitoring stations established
Proper operation of control laboratories
Legislative innovation and implementation
Funds available
Higher level of economic development
Public awareness raised
Sanitated open dump sites
Greater number of sanitary landfills
Established proper solid waste collection system
Working discipline raised
Level of skill and technical knowledge improved
Spare parts available
Funds available
System for separation of solid waste established

Annex 5.

Sector Planning Matrix

5.1. Agriculture

5.2. Industry, Mining and Energy

5.3. Municipalities

Sector Planning Matrix **1. Agriculture** **Annex 5.1**

Summary of Objectives and Activities	Impact Indicators	Important Assumptions
➢ **Program Objective:**	➢ (PO)	
➢ **Sector Objective:** Environmentally sustainable agricultural and land use practice achieved	➢ Diffuse pollution emission reduced by 30% (versus 1991) according EU standards by adopting environmentally sustainable agricultural practices in Yugoslav part of DRB by the year 2020. (SO-A)	➢ Integrated resources management achieved (SO-A)
➢ **Results / Outputs:** 1.1 Appropriate practices in crop and animal production adopted 1.2 Adequate wetlands management implemented 1.3 Environmentally friendly forest management introduced	➢ 1.1 Pollution emission from all pig farms capacity of more than 20,000 fallings and from 70% of all other animal breeding farms is reduced according EU standards by adopting balanced crop and animal breeding production in Yugoslav part of DRB up to year 2020.	➢ Incentives of agricultural production ensured (1.1) ➢ Appropriate forest management remains as priority for the government (1.3)
➢ **Activities:** 1.1.1 Solve technical and technological problems in manure treatment 1.1.2 Undertake measures for conservation and revitalization of soil through monitoring of fertility and degradation process 1.1.3 Ensure implementation of appropriate irrigation measures 1.2.1 Implement transboundary cooperation in wetlands conservation 1.2.2 Undertake measures for increasing of protected and revitalized wetland areas 1.2.3 Increase public awareness in wetland protection 1.3.1 Reforest eroded lands 1.3.2 Reforest wetlands with autochthonous species 1.3.3 Increase public awareness for Reforestation necessity	➢ 1.2 Wetlands restored and biodiversity preserved on 12 areas of national heritage reservations in Yugoslav part of DRB by applying appropriate wetland restoration management by the year 2015 ➢ 1.3 Erosion reduced on 100,000 ha in the Velika Morava River Basin by adoption sustainable forestry management up to year 2015	➢ Effective cooperation for adequate farm location planning achieved (1.1.1) ➢ Effective cooperation between all sectors for monitoring (1.1.2) ➢ Financial funds for upgrading and updating equipment available (1.1.2-1.1.3) ➢ Yugoslavian position in international community improved (1.2.1) ➢ Sanctions effectively applied (1.3.1)

PO - Program Objective SO-A - Sector Objective of Agriculture

Sector Planning Matrix **2. Industry, Mining and Energy** **Annex 5.2**

Summary of Objectives and Activities	Indicators	Important Assumptions
➢ **Program Objective:**	➢ (PO)	➢ Sustainable consumption patterns achieved(SOP)
➢ **Sector Objective:** Appropriate industrial practice and resource use adopted	➢ Industrial production increased while industry, mining and energy pollution reduced according to national and EU environmental standards by adoption of environmentally friendly technologies up to year 2020 in Yugoslav part of DRB (SO-I)	➢ Sustainable economic activities enforced (SOIM)
➢ **Results / Outputs:** 2.1 Appropriate technological process management in industry applied 2.2 Sustainable industrial waste management achieved 2.3 Use of mining resources optimized 2.4 Adequate use of power plants established	➢ 2.1 Quality of industrial and mining effluents improved, particularly in respect to phosphorous content, according to EU standards by the year 2020 in Yugoslav part of DRB	➢ Strategy of economy development adopted 2.1 ➢ National strategy of mineral resources utilization set 2.3 ➢ Rationalization of energy consumption remains priority for government 2.4
➢ **Activities:** 2.1.1 Ensure selection of appropriate technologies 2.1.2 Introduce optimal management of industrial technological processes 2.1.3 Make available financial resources for new technologies 2.1.4 Enable adequate knowledge transfer and know-how through adequate training of managing and operational structure (staff) 2.2.1 Enforce the legislation in waste management through harmonization and up-dating existing legal regulations 2.2.2 Stabilize existing and build up new industrial waste treatment plants 2.2.3 Establish unified database through appropriate monitoring activities 2.3.1 Select appropriate mining and ore processing technologies 2.3.2 Implement adequate waste water and solid waste treatment in mining. 2.3.3 Rehabilitate areas particularly endangered by mining activities 2.3.4 Enforce legislation in mining activities 2.3.5 Implement educational and informational programs concerning mineral resources economizing 2.4.1 Apply optimal process management of energy plants 2.4.2 Implement adequate energetic plants waste treatment 2.4.3 Ensure public participation in decision making on energy saving practices	➢ 2.2 Application of industrial waste management achieved in 80% of industrial waste water treatment plants leading to increased quality of ground water and reduced health risk generated by polluted water by the year 2015 compared to the year 1991 (based on medical statistics) in Yugoslav part of DRB ➢ 2.3 By revitalization of devastated sites (as result of mining activities) on 10,000 ha, soil erosion reduced and new arable land created in lower part of the Danube River Basin in FRY, by the year 2020 ➢ 2.4 Energy consumption reduced by 20% per unit product by adoption of new low-energy technologies by the year 2015 in Yugoslav part of DRB	➢ Intellectual property rights system adequately developed 2.1.1 ➢ Financial resources available on time 2.1.1 – 2.4.3 ➢ Secondary education system adopted to the needs of economy 2.1.4 ➢ Regulations are effectively enforced 2.2.1 ➢ Modern personal management introduced 2.2.3 ➢ Rehabilitation and revitalization programs of particularly endangered sites established (hot-spots) 2.3.3 ➢ Mineral resources realistic prices set 2.3.4 ➢ Active participation of public achieved 2.4.3

PO - Program Objective SO-I - Sector Objective Industry, Mining and Energy

Sector Planning Matrix **3. Municipality** **Annex 5.3**

Summary of Objectives and Activities	Impact Indicators	Important Assumptions
➢ **Program Objective:**	➢ (PO)	
➢ **Sector Objective:** Municipal activities in accordance with water resources protection	➢ Significant reduction of pollution emission from municipalities and at the same time improvement of water quality of natural water courses and channels to one class higher (according to EU standards) compared to year 1991 in Yugoslav part of DRB (SO-M)	➢ Waste management remains priority for government (SO-M) ➢ Sustainable behavior achieved (SO-M) ➢ New social and economic environment created (SO-M)
➢ **Results / Outputs:** 3.1 Appropriate waste water management in urban areas achieved 3.2 Waste water in rural areas properly collected and disposed 3.3 Adequate municipal solid waste management introduced	➢ 3.1 In settlements with more than 5,000 PE appropriate waste water management is introduced according to EU directives and it is noticed on increase of quality of effluents from municipal WWTPs (25mg/l BOD5, 35 mg/l SS) in the Yugoslav part of DRB by the year 2020.	➢ Waste management strategy established (3.1-3.3) ➢ Favorable economic conditions achieved (3.3-3.3)
➢ **Activities:** 3.1.1 Ensure appropriate municipal waste water treatment 3.1.2 Undertake measures for upgrading and extending sewer system 3.1.3 Ensure optimal industrial waste water pretreatment 3.1.4 Enforce legal and monitoring framework 3.2.1 Improve sanitary standard in rural areas 3.2.2 Arise public awareness upon environmental problems in rural areas through information and educational programs 3.2 3. Make funds available for construction of appropriate waste water disposal in rural area 3.3.1 Ensure closing and construction of open dumps 3.3.2 Ensure legal and physical conditions for solid waste disposal in sanitary way 3.3.3 Undertake measures for primary recovery and disposal of municipal solid waste 3.3.4 Ensure information and educational programs about environmental problems related to municipal solid waste	➢ 3.2 Increase of 70% of rural population with adequate degree of sanitation in the Yugoslav part of DRB and at the same time the number of diseased by hydric diseases is reduced on 80% by the year 2020 compared to 1991 (based on medical statistic) ➢ 3.3 □ By sanitation and recultivation of all open dumps and disposal of municipal solid waste on sanitary landfills only, it is noticed reduction of emission of pollution into surface and groundwater to 90% compared to the basis year 1991 in the Yugoslav part of the DRB at the year 2020	➢ Modern personal management introduced 3.1.1 ➢ Effective cooperation of all stakeholders achieved 3.1.1-3.3.3 ➢ Financial resources available on time 3.1.1-3.3.4 ➢ Municipal services organized for realization of integral municipal waste management 3.1.4, 3.3.2 ➢ Population living standards upgraded 3.2.1, 3.3.2 ➢ Sanitary infrastructure in rural areas effectively achieved 3.2.1 ➢ Information transparency of rural population concerning decision of neighboring municipalities achieved 3.2.2 ➢ Sanctions are effectively applied 3.1.4, 3.2.1, 3.3.2

PO - Program Objective SO-M- Sector Objective of Municipalitie

Annex 6.

Activities and Important Elements

6.1. Agriculture

6.2. Industry, Mining and Energy

6.3. Municipality

Result 1.1. Appropriate practices in crop and animal production adopted

Activities	Important Elements
➢ 1.1.1. Solve technical and technological problems in manure treatment	➢ Develop Technological solutions for manure treatment originated from piglet farm of various capacity ➢ Introduce liquid manure in fertilizing processes ➢ Create national programme in domestic animals health protection ➢ Introduce liquid manure in aquaculturing ➢ Optimize manure production and ambient quality surveillance in intensive production ➢ Location plan for new animal farms adopted
➢ 1.1.2. Undertake measures for conversation and revitalisation of soil trough monitoring of fertility and degradation processes	➢ Evaluate characteristic and soil bounty ➢ Develop soil conservation and revitalisation prospects ➢ Implement soil conservation and revitalisation prospect ➢ Create national informational system for monitoring in agriculture land ➢ Ensure monitoring of fertility and degradation proces of soil ➢ Create artificial wetland programs and protective forest belts ➢ Establish and standardise regional cooperation within the Danube river basin with a headoffice for soil management ➢ Education of farmers concerning use of organic fertilizers improved ➢ Appropriate use of chemicals in plant production achieved
➢ 1.1.3. Ensure implementation of appropriate irrigation measures	➢ Make adequate choice of irrigation technology ➢ Make inventory of high level ground waters ➢ Plan hydro-meliorative irrigation objects ➢ Create nationalwide irrigation policy ➢ Monitor irrigation waters quality

Result 1.2. Adequate wetland management implemented

Activities	Important Elements
➢ 1.2.1. Implement transboundary cooperation in wetland conservation	➢ Establishe regional wetland center ➢ Undertake measures for establishing transboundary wetland areas ➢ Establishe green corridors ➢ Protect endangered species ➢ Monitor and protect migratory species
➢ 1.2.2. Undertake measures for increasing of protected and revitalizes wetland areas	➢ Adopt national wetland management strategy ➢ Enlarge wetland areas protected by the law ➢ Enhance wetland monitoring ➢ Reduce nutrient input in wetland areas ➢ Undertake measures for reducing allochthonous species
➢ 1.2.3. Increase public awareness in wetland protection	➢ Create National wetland information system YUWIS ➢ Create database of wetland biodiversity ➢ Improve public information concerning wetland areas protection ➢ Provide training for management authority stuff ➢ Support NGO activities on wetland protection

Result 1.3. Environmentally friendly forest management introduced

Activities	Important Elements
➢ 1.3.1. Reforest eroded lands	➢ Make inventory of eroded terrains ➢ Plant wind-protective forest belts ➢ Stimulate land owners for forestration ➢ Enforce legal framework in forestry
➢ 1.3.2. Reforest wetlands with autochtonous species	➢ Convert plantation monocultures into autochtonous plant associations ➢ Reintroduce autochtonous species ➢ Stimulate production of reproductive material of autochtonous species ➢ Establish national genofond centers of autochtonous treespecies
➢ 1.3.3. Increase public awareness for reforestation necessity	➢ Present ongoing and planned projects ➢ Popularize set-aside principles in forestry ➢ Organize educational summer-camps ➢ Support NGO-forestration activities

Result 2.1. Appropriate technological process management in industry applied

Activities	Important Elements
➢ 2.1.1 Ensure selection of appropriate technologies	➢ Analyze existing industrial resources ➢ Elaborate comparative study of contemporary technologies ➢ Choose technology development strategy ➢ Adjust (harmonize) urban planning with accepted technology development strategy
➢ 2.1.2 Introduce optimal management of industrial technological processes	➢ Analyze current technological processes management ➢ Introduce up-to-date managing standards ISO 9000 and 14000 ➢ Stimulate implementation of “environmentally friendly / sound” technologies
➢ 2.1.3 Make available financial resources for new technologies	➢ Provide appropriate environment for finance/investments (financial mechanisms) ➢ Introduce stimulating custom and taxation policy ➢ Promote national innovation potentials
➢ 2.1.4 Enable adequate knowledge transfer and know-how through adequate training of managing and operational structure (staff)	➢ Strengthen institutional capacity concerning know-how transfer ➢ Establish diverse means of international cooperation ➢ Train managing and operative stuff ➢ Train and exchange experts ➢ Introduce permanent education system

Result 2.2. Sustainable industrial management achieved

Activities	Important Elements
➢ 2.2.1 Enforce the legislation in waste management through harmonization and up-dating existing legal regulations	➢ Elaborate comparative study of national and EU standards and regulations ➢ Strengthen the institutional capacity for environmental agencies ➢ Update and harmonize existing law regulations with up-to date standards ➢ Introduce and upgrade legislation mechanisms
➢ 2.2.2 Stabilize existing and build up new industrial waste treatment plants	➢ Providing appropriate financial support ➢ Introduce meaningful contributions and enforcement / punishment legislation / policy ➢ Produce “hot spots” impact diminishing programs for prompt actions ➢ Ensure appropriate sludge use, treatment and disposal ➢ Enable public and NGO participation in activity implementation ➢ Enable access to new knowledge in economic valorization of secondary materials from industrial waste ➢ Update inventory of possible secondary materials ➢ Evaluate the major types of useful industrial waste ➢ Implement valuable international experience concerning industrial waste utilization
➢ 2.2.3 Establish unified database through appropriate monitoring activities	➢ Update effluent and recipient monitoring ➢ Set location choice criteria for hazardous industrial waste disposal ➢ Elaborate emission control national strategy ➢ Harmonize (standardize) recipient quality evaluation criteria ➢ Set industrial effluent input criteria ➢ Establish international cooperation in trasboundary “hot spots”

Result 2.3. Use of mining resources optimized

Activities	Important Elements
➢ 2.3.1 Select appropriate mining and ore processing technologies	➢ Analyze current mining technologies ➢ Develop a priority list of mineral resources exploitation ➢ Introduce up-to-date standards ISO 9000 and 14000 into mining practices ➢ Implement useful experiences and knowledge transfer ➢ Facilitate knowledge transfer
➢ 2.3.2 Implement adequate waste water and solid waste treatment in mining	➢ Make inventory of polluters concerning mining processes ➢ Recuperate mineral resources from waste waters and exhausted ore ➢ Undertake measures for economic evaluation in waste material use ➢ Dispose hazardous chemical waste ➢ Apply mining waste water pretreatment process
➢ 2.3.3 Rehabilitate areas particularly endangered by mining activities	➢ Make inventory of areas particularly endangered by mining activities ➢ Undertake measures in mining area water bodies ➢ Implement protective measures for ground waters and springs ➢ Sanate and revitalize deteriorated locations of exhausted ore dumps ➢ Undertake environmental protection measures for special natural resources
➢ 2.3.4 Enforce legislation in mining activities	➢ Activate existing law regulations concerning concessions and mineral resources ➢ Strengthen institutional capacities for environmental agencies ➢ Introduce up-to-date ISO standards
➢ 2.3.5 Implement educational and informational programs concerning mineral resources economizing	➢ Introduce permanent education system concerning mineral resources importance ➢ Establish education programs for different age groups ➢ Include public in decision-making process and make it multi-level (local, regional and global)

Result 2.4. Adequate use of power plants established

Activities	Important Elements
➢ 2.4.1 Apply optimal process management of energy plants	➢ Analyze current level of energy production process ➢ Establish program of economizing with energy use ➢ Introduce revitalization measures of existing plants ➢ Introduce up-to date standards in energy production management ➢ Investigate possibilities of alternative energy resources
➢ 2.4.2 Implement adequate energetic plants waste treatment	➢ Investigate cooling waters re-circulation process ➢ Introduce restriction measures in hydraulic transportation of ash ➢ Select and prepare locations for ash ponds ➢ Up-to-date measures for sanation and recultivation of ash ponds ➢ Reduce negative environmental impact of reservoirs and artificial lakes ➢ Monitor activities concerning water treatment from energy production processes
➢ 2.4.3 Ensure public participation in decision making on economizing energy use	➢ Raise public awareness and disseminate information concerning strategic policy in energy production ➢ Implement public information services concerning importance of energy economizing and means to achieve it ➢ Introduce NGOs into decision making on multi-level energetic policy and strategy ➢ Apply permanent education programs in schools

Result 3.1. Appropriate waste water management in urban areas achieved

Activities	Important Elements
➢ 3.1.1 Ensure appropriate municipal waste water treatment	➢ Introduce integral water resources management ➢ Harmonize law regulations with EU ➢ Set effluent standards for industrial waste waters discharged into municipal sewage ➢ Establish financing mechanisms for plant construction ➢ Stimulate mechanisms for WWTP equipment production ➢ Train WWTP operators ➢ Elaborate construction priority lists ➢ Upgrade existing waste water treatment plants ➢ Construct new WWTP ➢ Ensure proper ultimate sludge disposal
➢ 3.1.2 Undertake measures for upgrading and extending sewer systems	➢ Make inventory of sewer installations develop priority lists for reconstruction and building sewer systems ➢ Provide financial mechanisms for sewer system construction ➢ Promote production of equipment and materials ➢ Construct sewer systems according to established priority lists ➢ Introduce quality and flow rate control systems for atmospheric waters
➢ 3.1.3 Ensure optimal industrial waste water pretreatment	➢ Make inventory of industrial pollution in settlements ➢ Elaborate priority lists for industrial waste waters pretreatment ➢ Control quality of pretreated industrial waste waters ➢ Conduct programs for pretreatment operators education ➢ Undertake measures for achieving optimal capacity through upgrading of existing and construction of new industrial WWPTP
➢ 3.1.4 Enforce legal and monitoring framework	➢ Compose the inventory of objects discharging into sewer system ➢ Make programs for industrial waste water control in settlements ➢ Establish sampling sites for flow rate measurements ➢ Ensure quality control through establishing of referent laboratory ➢ The apply polluter pays principle ➢ Introduce appropriate waste water monitoring ➢ Conduct monitoring of the efficiency of industrial W.W.P.T. P.

Result 3.2. Wastewater in rural areas properly collected and disposed

Activities	Important Elements
➢ 3.2.1 Improve sanitary standards in rural areas	➢ Establish program for rural settlement development ➢ Stimulate the population for sanitary infrastructure construction ➢ Develop of rural settlements sanitation ➢ Assist individual household measure s in rural areas ➢ Establish the maintaine services for septic pits ➢ Optimize collection waste water treatments ➢ Introduce measuares of sanitary control
➢ 3.2.2 Arise public awareness upon environmental problems in rural areas through information and educational programs	➢ Evaluate problems and find the solutions for sanitary conditions in rural settlements ➢ Programs for rural inhabitants education ➢ Organic talks/lectures on enviromental protection necessity in rural areas ➢ Implement eco topics into media ➢ Establish mobile exibitions on posible ecological ecological problems solutions
➢ 3.2.3 Make funds available for construction of appropriate waste water disposal in rural areas	➢ Determine the exact tax money ammounts for rural settlements planning ➢ Introduce municipal and community self-contribution funds ➢ Regulate concession conditions and terms ➢ Stimulate donations ➢ Introduce financing mechanisam for construction of iappropriate individual waste water treatment

Result 3.3. Adequate municipal solid waste management introduced

Activities	Important Elements
➢ 3.3.1 Ensure closing and conservation of open dumps	➢ Make open dumps inventory list, ➢ Elaborate methodology for dumps closing up and sanitation, ➢ Establish closing up and sanitation priority list, ➢ Make available financing funds, ➢ Make pilot project for urban dumps recultivation, ➢ Realize activities according the priority list and ➢ Ensure monitoring of activities on closing up and conservation of open dumps.
➢ 3.3.2 Ensure legal and physical conditions for solid waste disposal in sanitary way	➢ Standardize existing law regulations, ➢ Improve scientific and technical knowledge on solid waste management, ➢ Develop methodology for proper choice of sanitary landfills location, ➢ Establish the construction priority list, ➢ Ensure the financing mechanisms, ➢ Construct sanitary landfills and ➢ Improve collection and transportation systems of MSW.
➢ 3.3.3 Undertake measures for primary recovery and disposal of municipal solid waste	➢ Develop public interest for primary separation of the MSW components (paper, glass, metals, plastics), ➢ Establish "buy back" stations for primary separated MSW components by the inhabitants, ➢ Establish service for taking over hazardous household waste, ➢ Establish legal and financial framework for material resources recovery plants (MRRP) construction and ➢ Construct MRRP-s.
➢ 3.3.4 Ensure information and educational programs about environmental problems related to municipal solid waste	➢ Make programs for public education about the matter, ➢ Bring the environmental topics through media to the public, ➢ Bring the environmental topics into the schools, ➢ Organize scientific and professional meetings about the matter.

Annex 7.

Results and Projects

7.1. Agriculture

7.2. Industry, Mining and Energy

7.3. Municipality

Results	Projects		
	Existing	**In Preparation**	**Proposed**
➢ 1.1 Appropriate practices in crop and animal production adopted	➢ Inventory of soil fertility and soil concentration of toxic and hazardous material in Serbia ➢ Revitalization of existing irrigation systems	➢ Develop programs for local and regional agricultural services – education and technical support ➢ Revitalization of low alkalinity and acid soils in Serbia ➢ Revitalization of eroded soils in the Timok River Basin ➢ Quality control of surface and ground fresh waters within irrigation system	➢ Construction of waste water treatment plants for large capacity farms (over 20,000 fatlings per cycle) ➢ Long term program for irrigation system development (800,000 ha) ➢ Construction of waste water treatment system for mini farms ➢ Introduce information system on Yugoslav soil resources ➢ Organic agriculture development program in rural areas ➢ Harmonization and legislation development based on EU directives on pesticides ➢ Research studies on the use and processing of farm wastes
➢ 1.2 Adequate wetland management implemented	➢ Biodiversity of Yugoslavia ➢ Make autochthonous plant and animal genetic pool for preserving biodiversity in Balkan	➢ Ecological studies of major canal of D-T-D canal system and sustainable development of canal regime ➢ Study of biodiversity of protected wetland areas in new part of Danube ➢ Ecological studies of Danube Basin	➢ Establishing REWEC (Regional Wetland Centre) ➢ Qualification and quantification of pollution of D-T-D canal net of the Banat (Yugoslavia-Romania-Hungary region) and proposal of possible solutions ➢ Organizing national NGO wetland meeting and choosing NGO Focal point for government-NGO cooperation in wetland cooperation ➢ Sustainable use of canal D-T-D system as water transportation corridors – pollution control in Banat (Yugoslavia-Romania-Hungary region) ➢ Channel net of irrigation D-T-D hydrosystem as a potential: green corridors, wetland connection, endangered species refugium and biodiversity basis of Banat region
➢ 1.3 Environmentally friendly forest management introduced	➢ Complete forest inventory of Yugoslavia	➢ Protection of birch *(Betula Pendula)* autochthonous forest in Debeli Lug Region Majdanpek ➢ Project for forestation of 30% of eroded soils	➢ Reforestation by autochthonous tree species in Srem Region ➢ Special purpose inventory for water supply resources protection

Results	Projects		
	Existing	**In Preparation**	**Proposed**
➢ 2.1. Adequate technological process management in industry introduced	➢	➢	➢ Project "Transfer of Knowledge": A) Management of hazardous waste B) New technologies on waste treatment C) Management of hazard situations ➢ Project: "Transition from existing chemical industry to environment friendly technologies"
➢ 2.2. Sustainable industrial waste management achieved	➢	➢	➢ W.W.T.P. for Sugar mill in city of Crvenka ➢ W.W.T.P. for Sugar mill in city of Senta ➢ W.W.T.P. for Sugar mill in city of Cuprija ➢ W.W.T.P. for Sugar mill in city of Vrbas ➢ W.W.T.P. and sludge disposal Chemical industry "Prahovo" ➢ W.W.T.P. for Pulp and paper industry in city of Novi Knezevac ➢ W.W.T.P. and sludge disposal Chemical industry "Zorka", Sabac ➢ W.W.T.P. for Pulp and paper industry "Fopa", Vladicin Han
➢ 2.3. Use of mining resources optimized	➢	➢ Study and the Project on Integral Rehabilitation of Mining and Smelter Complex "RTB Bor" ➢ Rehabilitation and revitalization detoriated landscape in coper mine "Majdanpek" – exhausted ore dump "Valja Fondata" ➢ Rehabilitation and recultivation of open coal mine "Kolubara" (near Belgrade)	➢ Revitalization and rehabilitation of mining complex "Ajvalija – Kisnica" near city of Pristina ➢ Revitalization of river Porecka Reka in National park "Djerdap" (Irongate) – Danube endangered by mining activities of copper mine "Majdanpek" ➢ W.W.T.P., landscape rehabilitation and recultivation of mining and smelter complex "Trepca" at the city Kosovska Mitrovica ➢ Feasibility Study: Recuperation of valuable components from exhausted ores from mines and industrial plants
➢ 2.4. Adequate use of power plants established	➢	➢	➢ Study: Rehabilitation of termoenergetic sector in respect to minimization of waste ➢ W.W.T.P. and landscape rehabilitation of Thermo power plant "Obilic A" and "Oblic B" (near the city of Oblic, vicinity of Pristina town) ➢ W.W.T.P. for Termo power plant "Drmno" – city of Kostolac ➢ W.W.T.P. and rehabilitation of ash dump site of Termo power plant "TENT A" and "TENT B" (city of Obrenovac, vicinity of Belgrade)

Results	Projects		
	Existing	**In Preparation**	**Proposed**
➢ 3.1. Appropriate waste water management in urban areas achieved	➢ W.W.T.P. for the city of Valjevo ➢ Development of new methods in urban drainage	➢ W.W.T.P. for the city of Sabac ➢ W.W.T.P. for the city of Nis ➢ W.W.T.P. for the city of Blace (upgrading)	➢ W.W.T.P. for the city of Belgrade (Veliko Selo) ➢ W.W.T.P. for the city of Novi Sad ➢ W.W.T.P. for the city of Belgrade (Ostruznica) ➢ W.W.T.P. for the city of Zrenjanin ➢ W.W.T.P. for the city of Belgrade (Banatski system) ➢ W.W.T.P. for the city of Belgrade (Batajnica) ➢ Regional sewer system and W.W.T.P. Vrbas-Kula-Crvenka ➢ Reconstruction and upgrading of sewer system of the city of Belgrade ➢ Reconstruction and upgrading of sewer system of the city of NoviSad
➢ 3.2. Waste waterin rural areas properly collected and disposed	➢	➢	➢ Development of methods for proper sanitation of individual households ➢ Sanitation of Belgrade suburb Kaludjerica
➢ 3.3. Adequate solid waste management introduced	➢ The sanitation and recultivation projects for the open dumps in the cities of: Valjevo, Pirot, Smederevo, Apatin, Kraljevo and Sremska Mitrovica ➢ The construction projects for sanitary landfills in the cities of: Cacak, Uzice, Vrnjacka Banja, Smederevska Palanka, Sremska Mitrovica and Kraljevo	➢ The sanitation and recultivation project for the open dump in the city of Belgrade (Batajnica) ➢ The pilot project for recycling (primary separation and material resources recovery) of the MSW components.	➢ Sanitation and recultivation of the open dump “Vinca” ➢ Sanitation and recultivation of the open dump Sabac ➢ Sanitation and recultivation of the open dump Kovin ➢ Sanitation and recultivation of the open dump Backa Palanka ➢ Sanitation and recultivation of the open dump Veliko Gradiste

Annex 8.

Workshop Organization

8.1. Agenda of the Workshop

8.2. List of Participants

8.3. Evaluation of the Workshop

GEF- Danube Pollution Reduction Program
National Planning Workshop
24.-27. November 1998, Novi Sad, FR Yugoslavia

TUESDAY **24. November**

10.00-11.00	Plenary	Workshop opened Objectives of program and workshop Presentation of participants Program and planning process Brief introduction to Target Oriented Program Planning
11.00-11.30		Coffee break
11.30-13.00	Plenary	Presentation and discussion on Identification of river basins areas: Physical-geographical characteristics, Social-demographic characteristics, Transboundary effects as perceived and Human/Economic activities in the basin
13.00-15.00		Lunch break
15.00-16.30	Plenary	Situation analysis: methodology and exercise applying a method
	Small groups	Situation analysis: Activities leading to water pollution, Potentialities, Negative environmental consequences, Transboundary effects, Causes leading inappropriate activities and Measures to be undertaken
16.30-17.00		Coffee break
17.00-18.00	Plenary	Presentation of Situation analysis
19.30		Cocktail in City hall

Wednesday **25. November**

8.30 -10.00	Plenary	Problem analysis: methodology and exercise applying a method
	Small Groups	Problem analysis: causes and effects, drawing problem tree
10.00-10.30		Coffee break
10.30-12.30	Small groups	Problem analysis (continued)
12.30-14.30		Lunch break
14.30-16.00	Plenary	Discussion on the problem analysis

Wednesday continued

16.00-16.30		Coffee break
16.30-18.00	Plenary	Objective analysis: methodology, exercise applying a method
	Small groups	Objective analysis: drawing objective tree
Thursday		**26. November**
8.30-10.00	Plenary	Program Planning Matrix: methodology, exercise applying a method
	Small groups	Planning Matrix: Objectives, Results, Activities
10.00-10.30		Coffee break
10.30-12.30	Plenary	Presentation and discussion on Results and Activities
12.30-14.30		Lunch break
14.30-16.00	Plenary	Important elements of activities: methodology, exercise applying a method
	Small groups	Activities, Important elements, Projects
16.00-16.30		Coffee break
16.30-18.00	Plenary	Presentation and discussion of the results of working groups: Activities, Important elements, Projects
Friday		**27. November**
8.30-10.00	Plenary	Important assumptions: methodology, exercise applying a method
	Small groups	Important assumptions for Sector objective, Results, Activities
10.00-10.30		Coffee break
10.30-12.30	Plenary	Objectively verifiable indicators (OVI): methodology, exercise applying a method
	Small groups	OVI for Sector objective and Results
12.30-14.30		Lunch break
14.30-16.00	Plenary	Presentation of Sector Planning Matrix Presentation of Program Planning Matrix Evaluation of the Workshop End of the workshop

GEF - DANUBE POLLUTION REDUCTION PROGRAM

National Planning Workshop

24-27 November 1998, FR Yugoslavia, Novi Sad

List of participants

No	Name	Organization
1.	Aleksndar Pinkulj	Federal Bureau for Development and Economy Policy
2.	Bakir Zahirović	Ecological Movement of Vojvodina (NGO)
3.	Bogoljub Bogdanović	Ministry for Agriculture, Forestry and Water Management of the Republic of Serbia, Belgrade
4.	Božo Dalmacija	Institute of Chemistry, University of Novi Sad
5.	Božović Branislav	Mountaineer Associaton of Vojvodina (NGO)
6.	Branimir Andjelić	"Energoprojekt" – Hidroinzenjering, Belgrade
7.	Branislav Babić	Faculty of Civil Engineering, Belgrade
8.	Branko Kostić	Mountaineer and Ecological Movement, Sremska Mitrovica (NGO)
9.	Dragan Tripković	Federal Hydrometeorological Institute, Belgrade
10.	Dragi Stevanović	Facultu of Agronomy, Zemun
11.	Dragica Branković	Institute for Nature Protection of Serbia, dept. Novi Sad
12.	Dušan Jovanović	Ministry for Agriculture, Forestry and Water Management of the Republic of Serbia, department Novi Sad
13.	Hristina Radovanović-Jovin	Provincial Economy Bureau, Novi Sad
14.	Ivanka Brković–Popović	Institut for Water Resources Development "Jaroslav Černi", Belgrade
15.	Lazić Dada	Public Enterprize for Water Supply and Sewerage, City of Novi Sad
16.	Ljiljana Budakov	Institute for Nature Protection of Serbia, dept. Novi Sad
17.	Luka Knežić	Faculty of Technology and Metallurgy, Beograd
18.	Mila Komarčić	Public Health Institute of R. Serbia "Dr Milan Jovanovic", Belgrade
19.	Milan Božović	Federal Ministry for Development, Science and Environment
20.	Milica Dostanić	"Lola" Institute, Belgrade
21.	Milija Jovičić	Institut for Water Resources Development "Jaroslav Černi", Belgrade
22.	Milorad Filipović	Federal Bureau for Development and Economy Policy
23.	Miloš Kostić	Ecological Society "Gradac" (NGO), Valjevo
24.	Miodrag Božinović	University of Novi Sad
25.	Miroslav Tanasković	Public Health Institute, Belgrede
26.	Pavle Kilibarda	Public Enterprize "SRBIJAVODE", V.P.U. Dunav, Novi Sad
27.	R. Kljajić	Hydrometeorological Institute of Republic of Serbia, Belgrade
28.	Radoje Laušević	Serbian Ecological Society, Belgrade (NGO)
29.	Radojka Bugarski	Hydrometeorological Institute of Republic of Serbia, dept. Novi Sad
30.	Radoslav Mandić	Institute for Nature Protection of Serbia
31.	Slavko Kulačin	Public Enterprize for Water Supply and Sewerage, City of Novi Sad

32.	Slavko Maksimović	Federal Hydrometheorological Institute
33.	Stanimir Kovcin	Faculty of Agronomy, N. Sad
34.	Tanasije Zlatković	Public Enterprize for Water Supply and Sewerage "NAISSUS", Nis
35.	Tioslav Petković	Federal Hydrometheorological Institute, Belgrade
36.	Zoran Čukić	(Country Programme Coordinator)
37.	Miroslav Spasojević	(Facilitator)
38.	Aleksandar Djukić	(Facilitator)

EVALUATION OF THE WORKSHOP

Evaluation of workshop			
Organization	**Method**	**Results**	**Personal contribution**
• good, too little time, intensive work	• first time that I am involved into such method, rather confusing in a beginning, but day after day more acceptable , it needs perhaps more than 4 days	• good, could have been better if the method had been explained previously	• I am not completely satisfied with my personal contribution, I should change my attitude
• very good, needs more time, organization of group work should be improved, more team decision making about important elements	• interesting and practical	• it is hard to evaluate in this moment	• satisfactory
• time was too short for accepting the new method, ambient was great	• better preparation of participants is essential	• a lot of effort, a lot of facts, relatively satisfactorily	• I leave to my dear new fried Max to evaluate my contribution
• accommodation, catering and ambient was adequate to such kind of meetings	• I am satisfied, considering it is my first contact with such a method, it takes a bit more time to get it all, I would be happy to have a chance to participate again in such a workshop	• Insufficient	• Perhaps a little, but I will try to implement this method in future
• the participants should have been informed about the method of planing and decision making in advance, not step by step, perhaps a sort of demonstration of the method could have helped	• repulsive in a begging, but in the end rather interesting and efficient, bravo	• we reached the goal for significantly shorter time compared to classical methods (discussions and plenum)	• if I had more time, I could have done more even in other groups
• we should have respect the time-table more precise	• very interesting though new for me	• acceptable, could have been better if the preparations were undertaken	• satisfied, considering being inexperienced in this sort of approach to problem defining

Workshop Organisation **Annex 8.3**

Organization	Method	Results	Personal contribution
• we should have been more precise about the time-table, we should have been informed in advance about the demands and methodology	• understandable, enables relevant conclusions	• so-so, taking into account the totally new methodology	• big opportunity, but not utilized due to new methodology
• very good	• interesting, funny, but productive	• it is hard to tell in this moment, I guess that all this effort would result with some quality	• satisfied
• good, hard work, demanding time-table, enough time for gatherings	• suitable for group work, enables complex approach to specific problems	• we could done better, although it has been done a lot	• moderate – due to new method for me
• very good	• good, constructive, though unnecessarily complicated, to much insisting on definitions and explanations	• modest	• satisfactory, in terns when we have been asked to much for uncertainty we are facing
• the participants should have been informed more detailed in advance	• acceptable but an example in a beginning could serve some good	• not complete, it is a question if the participants are actually able to answer all demanding tasks they had been given	• due to new method, small
• high level of organization, which does not mean it could not have been better	• good	• incomplete due to lack of time, but it is obvious that method leads to the goal	• thanks to decent attitude of the other participants, I felt equal, in spite of diverse professions and education level
• bad preparations, good organization, enough room for brain work	• very interesting, applicable in solving every days problems	• good	• modest
• extraordinary, inspiration, accommodation excellent as well as moderators	• excellent, particularly for a nation with a strong epic heritage like ours	• unfinished but good	• maximal considering the preparations
• high level	• acceptable for heterogeneous groups	• it could be better	• team work with a lot of both personal participation and harmonization
• time unsuitable	• interesting, efficient, dynamic and funny	• depending on group, good, better and the best, generally, I expected more	• I tried to do my best (with oscillations)

Workshop Organisation **Annex 8.3**

Organization	Method	Results	Personal contribution
• accommodation and communication among colleagues excellent	• useful experience	• satisfactory, probably could been better	• satisfactory
• very good	• considering wide range of professions in groups, method enables harmonization	• personally, I am satisfied with the achieved, considering it is the first time I am n this kind of workshop	• moderate
•	• interesting, but groups and topics should have been set in advance	• I hope good enough for project proposing	• I am satisfied, as far as I understood
• excellent	• acceptable, but it should have been better if it had been explained in written form previously to participants	• rather satisfactory, considering the lack of time and simultaneous learning and implementation of new method	• I am satisfied
• very good	• very interesting and efficient, I would like to join such workshop again, also I will try to apply this experience in my professional work, useful for large groups since it enables repeating and clearing up the problems	• I believe – good	• Satisfied
• so-so, considering circumstances	• maximally demanding	• incomplete, but good, taking into consideration lousy preparations	• It could be better, very good collaboration
• so-so, accommodation excellent as well as food	• very interesting and useful	• after such thorough planing and good methodology, the results are inevitable	•
• so-so	• excellent, applicable in education	•	•
• good, accommodation excellent as well as working environment	• very interesting, I hope very successful, I would like to learn more about:	•	•