DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
UKRAINE

EXECUTIVE SUMMARY

Ministry of Environmental Protection and Nuclear Safety

in cooperation with the

Programme Coordination Unit
UNDP/GEF Assistance

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Preface

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

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

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

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

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

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

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

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

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

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

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

The **Ukrainian National Reviews** were prepared under the supervision of the Country Programme Coordinator, **Mr. Vasyl Vasylchenko**. The authors of the respective parts of the report are:

- Part A: Social and Economic Analysis: **Ms. N. Tomashes'ska**
- Part B: Financing Mechanisms: **Ms. I. Sherban**
- Part C: Water Quality: **Ms. O. Tarasova**
- Part D: Water Environmental Engineering: **Mr. A. Obodovsky**

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BOD 5	Biological Oxygen Demand 5
DWSR	Danube Southern Water Supply Region
TWR	Transcarpathian Water Region
2 TP	Official State statistic information about water use
MEPNS	Ministry for Environmental Protection and Nuclear Safety
EC (EU)	European Community (European Union)

1. Executive Summary

1.1. The State of the Danube Environment in the National Context

Less then 4% of the Danube basin is situated on the territory of Ukraine. At the same time it constitutes 20 % of the country water resources.

Danube water resources meet 6 % of Ukrainian economic needs; they totally meet Zakarpatska oblast needs, 67% of Chernivtsi oblast needs, 14% Ivano-Frankivsk oblast needs and approximately 40% of Odessa oblast needs (Information from Nat. Report, 1996).

Environmental situation in Ukraine is greatly dependent on the quality of land resources. The land fund of Ukraine is characterized by a substantial plowing up. Farming lands make up 72% of the total area, and arable land accounts for 79,5% of the farming lands.

Forest resources are limited in Ukraine. The ratio of forests to the total area is only 14,3% instead of the optimum of 20-22%. Due to the lack of funds and resources, the trend has been shaped toward reduction of recovery of forest resources. Climate, landscape and geological structure of Tisa, Prut and Siret basins cause rich and diverse vegetation. Forests cover 37% of the territory. Plants are represented mostly in the meadows - flood plains, highlands meadows, there are also marshes. Flora consists of 1300 species of plants, that is more then one third of Ukrainian flora.

There is critical hydroecological and water management situation as a result of the human activities in the Danube basin area. Analysis of the water quality of the lakes shows two tendencies:

- decrease of the soluble oxygen in all the reservoirs. It reaches maximum in - 19% in lake Kahul;
- increase of BOD5 index practically in all water bodies, maximum - 54,5% in Katlabuh. It can be explained by the growth of phytoplankton, which takes in soluble oxygen and is the reason of the BOD5 index increase too.

1.2. Population Affected by Water Pollution

Statistics show us that the state of health of the population is deteriorating. Starting in 1995 the birth rate decreased and death rate increased, negative natural growth has become bigger.

Serious sanitary-epidemic situation in Danube basin is an obvious evidence of the ecological destabilization. Lack of water protection measures brings great loss not only to the environment but also to the labor potential and economics of the country. Bacterial and virus contamination of the water can bring the epidemics of cholera, dysentery, and viral hepatitis. The problem is complicated by the wide use of chlorine in the current technologies of the drinking water preparation. In particular it is used for decontamination of the phytoplankton disintegration products. As a result of this process a big amount of toxic carcinogenic chlorine organic compounds developed. The use of hypo chlorinated water with high concentration of heavy metals, radio nuclides and compounds containing nitrogen leads to the increase of the endocrine system diseases, metabolism disturbance, nervous system diseases etc.

In recent years in DWSR, as in the whole Odessa region, a number of the negative trends is noted in the public health state: low life expectancy, huge rate of the tumor diseases, viral hepatitis, inborn deformity, endocrine pathology, diseases of the direction organs and kidneys.

The reasons for the poor public health state are not quite clear. On the one hand they are stipulated by the unfavorable ecological situation, bad conditions of labor and mode of life and low medical culture of the population; on the other hand a poor material-technical basis of the establishments, personnel problems, low level and duality of the rendered assistance are present.

1.3. Water Quality and Impact on Ecosystems

The list of the parameters observed for the Ukrainian part of Danube is as follows:

- suspended solids;
- mineral nitrogen (total nitrogen content including mineral and organic have not been analyzed);
- total phosphorus;
- BOD 5;
- copper, chromium, and zinc (has rather complete and long term observations);
- other heavy metals (has not so long observation history);
- oil;
- phenol.

The poor water quality has brought to the degradation of the Danube basin ecosystem and deterioration of the water quality. According to the level of the chemical and bacteriological pollution, water of most rivers of Danube basin can be classified as polluted.

Water pollution in Danube basin has broken natural processes of water bodies self-cleaning and has made more difficult a problem of good drinking water. Cleaning facilities of the water supply can not preserve drinking water from organic and inorganic contamination. Their combination is dangerous for human health especially in the situation of high radiation level.

As a result in Danube basin area we found a critical hydroecological and water management situation.

1.4. Hot Spot Analysis

The criteria for selection of “hot spots” were chosen and prioritized in the following order:

1. impact of pollution on human health;
2. transboundary impact;
3. economic and ecological losses due to declining bio-productivity and biodiversity of aquatic and terrestrial ecosystems caused by environmental pollution;
4. threats of irreversible damage to the natural environment;
5. possibilities of low cost measures and win-win investments;
6. ecological benefits/cost ratio or net social benefits maximization.

Based on these criteria the following types of “hot spots” were selected within the Ukrainian section of the Danube River basin:

- Municipal “hot sports”
- Agricultural “ hot spots”
- Industrial “hot spots”
- Special “hot spots”

Elimination of these hot spots will remove the most immediate threats to human health and will create better conditions for recreation, drinking water supply, fisheries and ecological functioning of river ecosystems.

1.5. Actual Foreseen Pollution Reduction Measures

The presented below as environmental policies measures (and as causes of its implementation the different real technical and institutional measures) oriented on the water pollution reduction have to improve the water quality:

- normative and legal maintenance of the new Ukrainian water legislation;
- development of the ecological norms on water quality (standards) with short and long term stages for their implementation;
- organization of the State Monitoring System of the waters;
- improvement of the water quality/quantity control through water pollution reduction control;
- establishment of the technological regulating systems of water use and pollution of water objects in sources of contamination;
- ecological and economical substantiation of charges for water use/pollution to be sure that “polluter - pays and user - pays” principle are applied in practice;
- harmonization of the Ukrainian and EU legislation;
- organization of the legislative and economical substantiation of the water resources management based on the basin principle.

1.6. Planned Projects and Investment Portfolio

The projects presented in the report were prepared by the local authorities or selected from the different state programmes. But the main problem of its implementation is a lack of the funds available. It is true for both local and state funds.

Nevertheless some of the enterprises have a willingness to obtain soft loans to improve clean technologies or to build treatment facilities.

2. Description of the State of the Danube environment

2.1. Water Resources

Less then 4% of the Danube basin is situated on the territory of Ukraine. At the same time it constitutes 20% of the country water resources.

Main water bodies of the basin are:

- Danube River and the adjoining lakes (Kahul, Yalpuh, Katlabuh, Kytai);
- Tisa River and its tributaries (Tersva, Tereblya, Rika, Borzhava);
- Latoritsa River;
- Uzh River;
- Prut with its tributary Cheremosh;
- Siret River.

Danube water resources meet 6% of the Ukrainian economy's needs; they totally meet Zakarpatska oblast needs, 67% of Chernivtsi oblast needs, 14% of Ivano-Frankivsk oblast needs and approximately 40% of Odessa oblast needs (Information from Nat. Report, 1996).

In the Danube basin there are at present 35 water storages and 602 ponds, occupying an area of 56,9 km^2 and containing l,36 m^3 of water. The useful volume employed for the runoff control is of about 0,70 m^3. The total volume of the artificial water basins, distributed over the watershed area, amounts to a 41mm thick layer; over 490 m^3 of it falls annually at a resident. The Odessa region accounts for more than 70% of the total number of water storage in the Danube basin, 97% of their volume, and 98% of their-surface area. The largest number of ponds is in the Ivano-Frankovsk and Chernovtsy regions (70% in all), and the largest volume of water accumulated in them is in the Chernovtsy (34%) and Odessa (33%) regions.

2.2. Ecosystems and Biological Resources

Environmental situation in Ukraine is greatly dependent on the quality of land resources. The land fund of Ukraine is characterized by a substantial plowing up. Farming lands make up 72% of the total area, and arable land accounts for 79,5% of the farming lands.

Due to technogenic effect, physical and chemical properties of soils are being deteriorated, eroded areas were expanding through 1970-1995, the content of humus dropped from 3,5% to 3,2%.

Forest resources are limited in Ukraine. This adversely affects economics and environment. The ratio of forests to the total area is only 14,3% instead of the optimum of 20-22%. Due to the lack of funds and resources, the trend has been shaped toward reduction of recovery of forest resources.

Climate, landscape and geological structure of Tisa, Prut and Siret basins cause rich and diverse vegetable life. Forests cover 37% of the territory. Plants are represented mostly in the meadows - flood plains, highlands meadows, there are also marshes.

Flora consists of 1300 species of plants, that is more then one third of Ukrainian flora. In the mountain areas there are boreal and numeral species of plants. In the plains there are forest as well as steppe types of plants.

Due to its geographical situation and specific natural and historic conditions Tisa basin region (Zakarpatska oblast), Prut and Siret basins (Ivano-Frankivsk and Chernivtsi oblast) have a unique fauna. Quantity of species is much bigger then in other regions of Ukraine. Carpathian forests are inhabited by valuable hunting species: brown bear, red deer, European roe, wild boar, lynx, otter, badger, forest marten, fox, wolf, hare, squirrel.

Danube lakes are fresh-water with the salinity of 2-3 g/l, they have potentially big fish productivity but during the last 5 years average fish productivity has 2-2,5 times decreased.

In outfall part the Danube River within the boundaries of Ukraine (and Romania) is from ecological point of view a transient zone between fresh water and sea ecosystems especially the avant-delta section.

The Danube River has got considerable influence upon the condition of biological resources in the coastal waters area. High intensity of primary output connected with the removal of biogenes favored the 17 times increase in the phytoplankton biomass during the last 15 years. This phenomenon together with the enrichment of waters in the area with suspended organic matter resulted in extremely high concentrations (557 kg/ m^3) of Noctiluca miliaris and medusa Aurelia aurita.

The most detailed list of fish includes 98 species, among them 40 are valuable marketable species, 40 are marketable species of little value and 44 are non-marketable species.

2.3. Human Impact and Key Issues of Environmental Degradation Due to Water Pollution

Lack of the facilities of sufficient capacities and low effectiveness of the existing facilities are negative factors influencing water quality. Also should be mentioned: low capacities of the communal facilities in comparison with the amount of the wastewater, inadequate operating conditions, low technical level; lack of the local facilities for the most toxic wastewater or their low capacity that have negative influence on the central water treatment facilities and condition of the water bodies; small amount of the close cycle enterprises, low coefficient (in many enterprises and in whole branches) of close systems of the water use; lack of the wastewater quality test, testing equipment, automation equipment leading to the overloading of the water treatment facilities. In these areas there are no facilities at all or they are presented by the primitive filtration fields, which are also often overloaded.

Besides the point pollution sources a big portion of pollution comes from the diffuse sources: surface flowing from the fields, livestock production farms, polluted ground waters, the inhabited territories etc.

All factors mentioned above have brought the degradation of the Danube basin ecosystem and deterioration of the water quality. According to the level of the chemical and bacteriological pollution, water of most rivers of Danube basin can be classified as polluted.

Water pollution in Danube basin has broken natural processes of water bodies self-cleaning and has made more difficult a problem of good drinking water. Cleaning facilities of the water supply can not preserve drinking water from organic and inorganic contamination. Their combination is dangerous for the human health especially in the situation of high radiation level.

As a result in Danube basin area we found critical hydroecological and water management situation.

Analysis of the water quality of the lakes shows two tendencies:

- decrease of the soluble oxygen in all the reservoirs it reaches with maximum of 19% in lake Kahul;
- increase of BOD5 index practically in all water bodies with maximum of 54,5% in Katlabuh. It can be explained by the growth of phytoplankton, which takes in soluble oxygen and is the reason of the BOD5 index increase too.

Danube lakes are fresh-water with the salinity 2-3 g/l. They have potentially big fish productivity but during the last 5 years average fish productivity has 2-2,5 times decreased.

3. Population Development and Water Sector Relevant Characteristics

3.1. Analysis of Demographic Data and Projection of Urban and Rural Population in the Danube Catchment Areas

A number of the population depends on the natural increase and migration. The population increase (a difference between birth and death numbers) in 1997 has been reduced nearly by 1233 persons in comparison with 1991, when it was 1144.

A considerable demographic problem is a high age mortality of the region habitants (particularly at the ages of 36-65) in comparison with other, even adjacent, regions. The total death rate here exceeds the Ukrainian one by 13% and the death rates of Lvov and Ivano-Frankovsk oblasts - by 17 % and 16 % respectively.

Total number of population, urban and rural has not reduced and even increased. In 1997 population was 3,08 million, which is higher then 1991 numbers. Danube basin population today is more then 6% of the total population of Ukraine. Urban population is 1,39 million (45%) and rural - 1,69 million (55%)

Given figures can not be accepted as accurate. State Statistics Committee gives information about different oblasts. Experts have calculated population taking into account Danube basin total surface, territories covered by separate tributaries in every oblast and information on the population density. The figures were compared with information of 1991, when analysis of National Overview of Danube basin was made as a part of the preparation of International Program for the Protection and Sustainable Use of Danube River Basin. Due to the fact that the number of the population of the total basin and separate tributaries has not considerably changed, presented numbers can be accepted for the evaluation of the population in 1997.

Today there are no special forecasts of the scientific or official organizations for Danube basin region. That is why for the Danube basin population evaluation the same tendency as for the whole Ukraine is accepted. It means that with the beginning of the stabilization of the state economy insignificant increase of the population is possible and to the year of 2010 it will come to the level of 1997. By 2020 insignificant increase of the population of Ukraine is expected. Total population will increase by 3%. Urban population will increase by 4% and rural by 2% (Table 3.1.).

Table 3.1. Prognosis for population in the basin in 2010 and 2020 (thous.)

	Year 2010			year 2020		
	Total	Urban	Rural	Total	Urban	Rural
Danube basin	3077	1386	1691	3167	1441	1725

3.2. Estimation of Actual and Future Demand for Water

In Ukraine in general 70,2% of population are connected to the central water supply systems. In the cities this number reaches 95,5%; in rural areas - 19,5%. In Danube basin this figure is 82%.

In 1997 total water demand for communal needs in the Ukraine was 3765 million m^3 including urban communal needs - 2554 million m^3 and rural - 1211 million m^3. Water use in communal branch is 3396 million m^3, including urban - 2304 million m^3 and rural - 1092 million m^3.

In Danube basin total water demand for communal needs is 135,57 million m^3 or 3,6% of the total demand in the Ukraine.

The biggest water amount for communal needs is taken in Odessa oblast (lower Danube) and it constitutes 56,58 million m^3 or 42% of the total water intake in the basin. In Tisa basin water demand is 31,18 million m^3 or 23% of the total demand. In Latorytsya basin - 22,25 million m^3 or 16%. In Uzh basin - 8,85 million m^3 (6,5%). In Prut basin - 15,60 million m^3 or 11%, in Siret basin 1,11 million m^3 or approximately 1%.

General water demand for the population of Ukraine is 74,0 m^3 per person per year. In Danube basin this figure is significantly smaller - 44 m^3 per person per year. But it can reach 116,5 m^3 per person per year in Danube basin. The lowest demand is in Siret basin - 4,6 m^3 per person per year.

The assumptions of the future demand of the water are presented in the Table 3.2.

Table 3.2. Projection of domestic raw water demand

	2010		2020	
	Population (thous.)	Water demand mln m^3/year	Population (thous.)	Water demand mln m^3./year
Ukraine	50893,50	3766,00	52356,23	3874,4
Danube basin	3077,30	135,67	3166,53	139,5
Danube riverbed	485,64	56,68	501,74	58,5
Tisa	795,32	31,18	817,44	32,0
Prut	1062,55	15,60	1083,98	15,9
Siret	240,47	1,11	247,33	1,1
Latoritsa	290,97	22,25	299,07	22,9
Uzh	202,31	8,85	207,94	9,1

3.3. Estimation of Actual and Futures Production of Wastewater

According to the information of State Construction Committee and "Water Supply and Sewerage Systems of Ukraine Development Program", which was approved by the resolution of the Cabinet of Ministers of Ukraine of 17 November, 1997, total number of the population of Ukraine connected to the centralized sewerage system makes 51,2% of the country population, including 75,4% of the urban population and 3,1% of the rural. Total wastewater production from the municipal economy is 3573 million m^3. In Danube basin it is 90,4 million m^3 or 2,5% of the total in the Ukraine. The biggest amount of wastewater emission is in lower part of Danube River - 37,7 million m^3 or 42% of the total amount of the municipal sewerage in the basin. In Tisa basin the wastewater emission is 20,8 million m^3 or 23% of the total quantity. In Latorytsya it is 14,8 million m^3 (16%). In Prut basin it is 10,4 million m^3 (11%).

Average wastewater production per person in the Ukraine is 70,21 m^3 a year. In Danube basin it is 29,37 m^3 per person per year. The largest water use for the communal needs is in the lower part of Danube - 77,67 m^3 per person per year. The smallest is in Siret basin - 3,08 m^3 per person per year.

It should be noted that calculation of the wastewater production per person is approximate.

The projection of the wastewater production is presented in the Table 3.3.

Table 3.3. Domestic wastewater production (mln m^3/year)

	2010		2020	
	Population (thous.)	Wastewater production	Population (thous.)	Wastewater production
Ukraine	50893,50	3573,00	52356,23	3675,9
Danube basin	3077,26	90,37	3166,53	93,0
Danube riverbed	485,64	37,72	501,74	39,0
Tisa	795,32	20,79	817,44	21,4
Prut	1062,55	10,40	1083,98	10,6
Siret	240,47	0,74	247,33	0,8
Latoritsa	290,97	14,82	299,07	15,2
Uzh	202,31	5,90	207,94	6,1

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

Statistics show us that the state of health of the population deteriorates. Starting from 1995 the birth rate decreased and death rate increased, negative natural growth has become bigger.

Serious sanitary-epidemic situation in Danube basin is an obvious evidence of the ecological destabilization. Lack of the water protection brings great loss not only to the environment but also to the labor potential and economics of the country. Bacterial and virus contamination of the water can bring epidemics of cholera, dysentery, and viral hepatitis. The problem is complicated by the wide use of chlorine in the current technologies of the drinking water preparation. In particular it is used for decontamination of the phytoplankton disintegration products. As a result of this process a big amount of toxic carcinogenic chlorine organic compounds developed. The use of hypo chlorinated water with high concentration of the heavy metals, radio nuclides and compounds containing nitrogen leads to the increase of the endocrine system diseases, metabolism disturbance, nervous system diseases etc.

In recent years in DWSR, as in the whole Odessa region, a number of the negative trends is noted the public health state: low life expectancy, huge rate of the tumor diseases, viral hepatitis, inborn deformity, endocrine pathology, diseases of the direction organs and kidneys.

In general structure of the disease rate a leading position is occupied by diseases of the respiratory organs, blood circulation system, nervous and osseous-muscular system, sensory and digestive organs. Their portion in the total disease rate makes 70%.

The reasons of such public health state are not quite clear. On one hand they are stipulated by the unfavorable ecological situation, bad conditions of labor and mode of life and low medical culture of the population, on the other hand a poor material-technical basis of the establishments, personnel problems, low level and duality of the rendered assistance are present.

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

General remarks

Projection of total raw water abstraction is for planning horizons 2010 and 2020.

The estimation is given by an expert with the help of Kiev National University staff and is based on the projection of population and current amounts of the abstracted raw water.

The estimation does not consider possible changes in economical situation in Ukraine and possible improvements in the technologies.

4.1. Industrial Activities

Water intake for industrial needs in the Ukraine in 1997 was 9125 million m^3 or 43,3% of the total intake. It reduced almost twice in comparison with 1991. In the Danube basin for the industrial purposes 173,25 million m^3 was taken or 0,82% of the total water intake in the Ukraine. It's 40% reduction in comparison with 1991. In lower part of the Danube water intake reduced by half and it was 71,6 million m^3, 1,8 times reduction in Prut basin (17,94 million m^3), 20-30% of reduction in the basins of Tisa, Latoritsa, Uzh.

According to state statistics (2TP vodgosp) the industrial wastewater discharge in 1997 decreased in comparison with the year 1991 by about 43%. The discharge of nontreated water also decreased for about 48%. Almost two times decreased discharge of normatively clean waters (44%). This can be explained by the economy collapse and lack of finance for the building and reconstruction of the wastewater treatment plants.

The decrease of total discharge of industrial wastewater can be explained by recession in industrial activity.

There are some exceptions in the Danube basin and Latoritsa and Uzh Rivers, where small increase of wastewater (19 and 36%) can be observed. At the same time in the Latoritsa and Uzh Rivers basins the discharge of polluted (insufficient treated) water is observed (104% and 133% accordingly). This means that the existing treatment plants can not provide needed treatment level.

The tendency of increasing of insufficiently treated water (for 20%) discharge and decreasing of normatively clean discharge (for 37%) is typical for the whole Ukrainian part of the Danube basin.

Table 4.1. Projection of abstraction of raw water for industrial purposes (mln m^3/year)

	Year 2010		Year 2020	
	Total abstraction	Industrial demand	Total abstraction	Industrial demand
Ukraine	25030,40	11013,20	32098,50	15728,02
Danube basin	2276,40	1001,40	2670,12	1308,30

Table 4.2. Industrial discharge (mln m^3/year)

	2010				2020			
	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated
Ukraine	10915,00	8200,00	1944,00	771,00	6260,00	3936,00	1917,00	406,40
Danube basin	165,68	124,40	29,50	11,77	115,13	72,39	35,26	7,47

4.2. Municipal Discharges

Investigations show the decreasing tendency in the whole Danube basin regarding the municipal discharges. For example in the Tisa basin the wastewater discharge decreased by 10,35 mln m^3 or 28%.

The discharge of normatively clean water has decreased almost two times - in 1991 it was 67,63 mln m^3 and now - 34,20 mln m^3. This tendency can be observed for all Danube tributaries.

Table 4.3. Municipal wastewater discharge (mln m^3/year)

	1991				1997			
	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated
Ukraine	4000,60	92,60	2182,00	1726,00	3573,00	61,50	2160,00	1352,00
Danube basin	156,03	3,62	85,08	67,33	90,37	1,55	54,64	34,20

Table 4.4. Municipal wastewater discharge (mln m^3/year)

	2010				2020			
	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated
Ukraine	4000,60	92,60	2182,00	1726,00	3573,00	61,50	2160,00	1352,00
Danube basin	156,03	3,62	85,08	67,33	90,37	1,55	54,64	34,20

4.3. Agricultural Activities

In 1997 in Ukraine there was a two times decrease (46%) of total wastewater discharge from agriculture in comparison with 1991.

The total discharge in the Danube basin also decreased by 38% but at the same time the insignificant increasing of insufficient treated water discharge is found (8%).

The decreasing of normatively clean water discharge is typical for the whole Danube basin (from 33 to 42%).

Table 4.5. Abstraction of raw water for agriculture (mln m^3/year)

	1991			1997		
	Total abstraction	For agricultural purposes (irrigation)	Share from total abstraction in the Ukraine, %	Total abstraction	For agricultural purposes (irrigation)	Share from total abstraction in the Ukraine, %
Ukraine	33813,00	1967,00	5,81	21091,00	1139,00	5,40
Danube basin	2676,36	186,17	0,55	1957,61	133,88	0,63

Table 4.6. Agricultural wastewater discharge (mln m^3/year)

	2010				2020			
	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated	Total	Normatively clean without treatment	Polluted (without treatment + insufficient treated)	Normatively treated
Ukraine	3273,00	3129,00	138,60	5,330	1761,00	1646,00	111,70	3,060
Danube basin	124,12	118,70	5,22	0,240	89,40	83,70	5,68	0,150

4.4. Solid Waste Disposals and Possible Soil and Groundwater Contamination

40 mln m^3 of sludge is produced from wastewater treatment plants at present time. Sludge should be stored on the special sludge landfields. After disinfection measures and environmental impact assessment it can be used as fertilizers (in reality only about 5% or 2 mln m^3 was utilized). There are no data at present time on dumpsites in Danube basin. There are no facilities in the region for preparation of wastewater treatment sludge for utilization. There are no incineration facilities or other facilities for solid waste disposal in the region. This is one of the most serious problems because of the landfields and dumpsites, which are serious source of diffuse pollution in the region. In many cases it severely affects ground water quality as for example in Bolgrad district of Odessa region (as was reported by Odessa State Ecological Inspection). The future activity for pollution reduction from these pollution sources must be directed on inventory of pollution sources, assessment of the size of diffuse pollution and introduction of ecologically friendly technology for the solid waste processing and disposal.

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

Evident improvement of water quality in the Ukrainian section of the river Danube and its tributaries comparing to 80's reflects the economic difficulties in most of the countries of Central Europe as well as successes in introduction of harmonized environmental policies in all riparian countries of the Danube River basin.

In Ukraine section of the Danube River basin the water quality was monitored by following variables.

Maximal content of suspended solids is observed during the summer seasons and because the rivers are not covered with ice during winter periods. Small peak in springtime is related to the spring flood events.

Monitoring data are presented only for mineral nitrogen meanwhile the total nitrogen content including mineral and organic has not been analyzed.

Average annual concentration of mineral nitrogen (sum of mineral) in the Danube water varied between 1,39 and 0,51 mg/L with maximal concentrations 2,8 mg/L (Vilkovo and Izmail, 1996). By the monitoring data of the State Ecological Inspection the annual average nitrogen content was 9 mg/L. mostly as nitrates.

It is evident that the portion of ammonia and nitrites decreased significantly during the last three years. The highest concentrations of nitrates were recorded in 1994 and 1995 reaching 13 - 14mg/L. Usually the highest nitrogen content is accompanied by high water discharges.

The content of mineral nitrogen in the major Danube tributaries ranges between 0,10 and 6,0 mg/L for Tisza River, 0,92 - 4,2 mg/L for Uzh River and 0,37 - 5,9 mg/L for Prut River. Long term trend of mineral nitrogen is reversibly related with water level. The prevailing concentrations are between 2,5 and 4,3mg/L with domination of nitrates and ammonium. The less abundant are nitrites.

The monitoring data are presented only for total phosphorus (data of the hydrometeorological station) for a period 1994 -1996.

Average concentration of total phosphorus in the Danube water varies between 0,14 - 0,47mg/L, with a range of 0,06 -1 mg/L. While in 1994 the changes of total phosphorus followed the changes of river discharges, later on its level became more stable. The phosphorus content in the major Danube tributaries is evidently lower than in Danube.

The most comprehensive monitoring data exist for BOD 5. That creates a good base for long-term trends assessment of organic pollution.

Long term trend of BOD 5 changes reveals the evident decrease of this variable. It can be explained by reduction of discharges of easily oxidized organic matter with industrial discharges due to decline of industrial output. Seasonal BOD 5 variations in 1997 show increase of readily available organic matter during high water periods.

BOD5 is rather stable in the Danube tributaries: 2 - 5,3 mg/L for Tisza River (primarily 4 mg/L), 2 - 5,7 mg/L with average 2,64 mg/L for Uzh, and 2 - 5,3 mg/L (average 2,65 - 3,75mg/L) for Prut.

Hydrometeorological monitoring network in Ukraine has rather complete and long-term observations only for copper, chromium, and zinc. At the same time ecological inspections monitor copper, zinc, manganese, lead, nickel, chromium and iron. Long term trends in heavy metals contents are relatively stable for copper and chromium and slightly less stable for manganese and zinc. During the last two years the content of zinc and manganese has increased significantly.

Seasonal variations of the heavy metals contents are very typical with elevated concentrations during spring-summer. That might be explained by corresponding variations of suspended solids content and other natural processes in water bodies. According to the water quality criteria maximum allowable concentrations of copper and chromium are 1 μ per L, and 10 μ per L for zinc, lead, and manganese.

Table 5.1. Annual average concentrations of heavy metals in the water of the river Danube, PPM

Year	Fe	Cu	Zn	Mn	Pb	Ni	Cr
1994	0.2442	14.417	26.653	14	10.236	1.4958	6.4347
1995	0.2493	14.292	24.139	14.611	10.722	1.4806	6.2472
1996	0.2255	12.879	24.864	13.212	11.227	1.5	6.7758
1997	0.23889	10.4306	30.0556	22.5556	10.5	1.575	6.29444

Variations of the heavy metals content in the major tributaries of the river Danube are much more significant, especially for zinc (65 - 132 μ/L in Tisza, 0 - 92 μ/L in Prut) and chromium (2,1 - 39 μ/L for Tisza, 1,6 - 75,8 μ/L for Uzh, 0 - 48 μ/L for Prut). While there are no available data on copper concentrations in Tisza and Uzh, the data on copper content varies significantly in water of the river Prut nearby the city Chernivtsi. These elevated levels of the heavy metals (comparing to the existing standards) affect the water quality for recreation and fisheries uses.

Oil pollution has been monitored by ecological inspections as well as by hydrometeorogical stations. Elevated level of oil pollution in Kiliya Branch of the river Danube has in the most of cases transboundary origin, including the impact from the river Prut. Concentrations of oil products in the Danube water varies were between 0 and 0,30 mg/L with average concentrations 0,08 - 0,11mg/L (data of the State Committee on Hydrometeorology). According to existing assessment criteria the oil polluted water (more than 0,05 mg/L) is not acceptable for fish reproduction, when pollution events occur regularly.

Phenol pollution is much more serious because the minimal concentrations of these compounds are equal or higher than maximum allowable concentrations for fisheries and sanitary-hygienic uses. Seasonal variations of phenol contents are not significant with small peaks during spring and summer flood events. Big share of phenol pollution is released from the territory of Ukraine at the section between Reni and Vylkove.

There are no available data on content of phenol compounds in the major tributaries of Danube.

In Ukraine the latest developments in environmental legislation and steps towards approaching the European environmental legislation contributed to the improvement of water quality. At the same time lack of sufficient financial resources does not allow Ukraine to maintain the municipal wastewater treatment facilities at the proper level, to improve water treatment in rural areas and small towns, to mitigate bacteriological pollution of surface and ground waters within the Ukrainian Section of the river Danube. Considering future industrial and socio-economic development in the region the necessary measures should be undertaken to prevent further pollution and environmental degradation of the Ukrainian section of the Danube River basin.

6. Identification, Description and Ranking of Hot Spots

For many years the human pressure on water quality of the Danube River itself and rivers and streams of its basin exceeded the limits, within which the sustainable functioning of ecosystems of the Danube River basin occurred. Deteriorated water quality affected many water uses, especially human health and recreation.

Economic crisis in most of post-Soviet countries mitigated the impact of human activities on the environment of the Danube River basin resulting in large-scale experiment on ecosystem of the region.

Rather realistic expectations of pollution reduction became partly true but not to the extent proportional to decrease of industrial and agricultural activities in Ukraine. For example pesticide load per ha in Ivano-Frankivsk region decreased almost by 10 times. By twenty percents decreased the areas of cultivated lands. Transition to market economy and slow transition from state to private land ownership imposed political problems.

Existing municipal sewer system and wastewater treatment plants as a rule are overloaded and have outdated technological equipment. Poor maintenance of technological equipment results in frequent accidents with significant discharge of untreated wastewater directly in the river.

The Danube riverbed is enriched by plants and animals that live and develop in the river first of all in pelagic zone. The total volume of the plankton flow, besides nutrients, determines the efficiency of the mouth of the delta, the scale of influence on the Black Sea. The average annual volume of this flow at the top of the delta is about 1.340.000 tons, of which bacteria make up 80,8 %, phytoplankton - 11,1 % and zooplankton - 8,1%.

The zone of direct influence of Danube waters on the Black Sea is selected on the boundary of detection of freshwater algae, which continues to grow in marine water. Depending on the estimate of the river runoff, the area of the zone varies and the maximum size of the surface of the pelagic zone reaches 100.000 km^2.

The increasing of diversity, density and biomass of hydrobionts in the zone of transformation in comparison with adjacent areas can be considered as a manifestation of “edge effect” on the boundary of coexistence of brackish water and marine fauna. Usually in this zone total biomass and production of hydrobionts are higher 2-5 times.

Regular blooming of the sea in a surface layer up to a depth of 10 m has been noted. The total phytoplankton biomass is more than 400.000 tons within an area of about 40.000 km^2 in the summer time.

Among the animal population of the ecoton “river-sea” - there is an absolute prevalence of noctiluca, Noctiluca scintillans, making up to 90 % of the density and biomass of pelagic organisms. In 1988 to the south from Sfintu Gheorghe branch within area of about 3.400 km^2 super high biomass of this organism (125-560 kg/m^3) was registered.

The comparison of quantitative measurements of distribution of hydrobionts from the Danube riverbed up to the sea allows stating the following conformity to natural laws:

on the average, the biomass of hydrobionts is 5-10 times higher in the sea than in the river (phytoplankton - 4,8 times, mesozooplankton - 14,3 times, macrozoobenthos - 8,1 times); in delta water bodies lower numbers and biomass of hydrobionts have been observed in comparison with adjacent zones - river branches and sea-coast

The intensive sedimentation (or silting) and reduction of current in the river delta are the main reasons for this type of distribution of aquatic organisms.

The existence of many species of fish in a coastal complex, and also migrations, for example, of herring and sturgeon from the sea into the river, is illustrated by the existence of a high productive "river-sea" ecoton in the zone of the river mouth of the delta.

The fish fauna of the delta is remarkably rich, with 91 species belonging to 30 families. The majority of these (44) are freshwater species, the other being migratory species that occur in the Black Sea and mainly come to the delta during the breeding season

After the construction of the Kakhovka dam on the Dnipro River (1955-58), Danube became one of the last rivers, where the sturgeons (starred sturgeon, Acipenser stellatus and great sturgeon, Huso huso) continued to spawn.

The most important problems resulting from the environmental degradation in the Danube River basin are as follow:

- impact on human health;
- impaired functioning of aquatic and terrestrial ecosystems;
- economic and social losses due to environmental pollution;
- transboundary impact.

The criteria for selection of "hot spots" were chosen and prioritized in following order:

1. impact of pollution on human health;
2. transboundary impact;
3. economic and ecological losses due to declining bio-productivity and biodiversity of aquatic and terrestrial ecosystems caused by environmental pollution;
4. threats of irreversible damage to the natural environment;
5. possibilities of low cost measures and win-win investments;
6. ecological benefits/cost ratio or net social benefits maximization.

Based on these criteria the following "hot spots" were selected within the Ukrainian section of the Danube River basin:

- *Municipal "hot spots"* include Chernivtsy WWTP, Uzhgorod WWTP, Kolomyia WWTP, Mukachevo WWTP, Izmail WWTP, small settlements of resort areas; small settlements of the Odessa Regions
- *Agricultural " hot spots"* include v. Lisky, social farm "Pogranychnyk", collective farm "Put Lenina", Kylia.
- *Industrial "hot spots*" include Rakhiv Cardboard Factory, Velyky Bychkiv Timber processing plant
- *Special "hot spots"* include crude oil transit pipeline "Druzhba", car traffic of transboundary highways of Zakarpattia Region; abandoned ships in the Ukrainian Danube Delta.

Elimination of these hot spots will remove the most immediate threats to the human health and will create better conditions for recreation, drinking water supply and fisheries and ecological functioning of river ecosystems.

7. Identification and evaluation of pollution reduction measures

The municipal wastewater discharges into rivers have major impact on river water quality in terms of nutrient loads and bacteriological pollution. There are Wastewater Treatment Plants of Izmail, Reni, Kylia, Vilkovo, Uzhgorod, Chernivtsi. Ukrainian municipal wastewater treatment systems have very special features compared to many European countries: many industrial enterprises directly discharge their wastewater into municipal sewer system. That is why municipal wastewater discharges potentially are the source of serious pollution with heavy metals and persistent organic micropollutants.

Reduction of agricultural pollution will require careful feasibility studies with consideration of inevitable economic growth in the Danube River basin. Current economic crisis and transition to market economy and private ownership dramatically changes the sectoral industrial and agricultural structures. The overall fertilizer use, pesticide application decreased sometimes 10 fold comparing with 80's. The major reasons for these reductions are high prices of these goods and low income.

Agricultural engineering measures can, if duly implemented, substantially (sometimes by 30-40%) scale down content of pesticides, fertilizers, by-products and substances in the surface flow coming from arable land. This is effected by a number of engineering arrangements having a protective (nature-protective) character: plugging and cultivation of soils against slopes (hills), plugging, that retains a cut-off layer of land, retention of snow and thawing water, stripe like positioning of agricultural plants to be cultivated, terracing of slopes (hills) as well as use of granulated fertilizers, their local in-bring, environmentally justified and sound norms and techniques to utilize pesticides etc. All measures and projects are presented as state or regional programmes with the figures showing the total funds for the region or state.

Major successes in industrial pollution reduction will be achieved through the managerial measures and enforcement of existing environmental legislation and regulatory measures. Structural changes in industrial sector during transition to market economy are difficult to predict at present time. Under existing legislation and regulations industrial enterprises with a significant environmental impact must perform self-control of discharged pollutants within the regulatory procedure. From this point of view of enforcement of legislation additional support will be necessary for capacity building of the regional state inspections of the Danube River basin especially for the Tisza River basin (Veikiy Bichciv Timber processing Plant, Teresva Timber processing Plant), for the Prut River basin (Luzhany Distillery Plant) and for Danube (Izmail Cardboard Plant).

There are no data, on present time, on dump sites in Danube basin. There are not any facilities in the region for preparation of wastewater treatment sludge for utilization. There are not any incineration facilities or other facilities for solid waste disposal in the region. This is one of the most serious problems of the region. The future activity for pollution reduction from these pollution sources must be directed on inventory of pollution sources, assessment of the size of diffuse pollution and introduction of ecologically friendly technology for the solid waste processing and disposal, particularly for the construction of the polygon for storage of solid waste in Chernivtsi.

Ukraine will need external financial support to carry out the needed assessment and introduction of new technology in the field of solid waste disposal.

Economic Regulatory Tools for Water Resources Rational Use, Protection, and Restoration currently are under development in Ukraine. Ukraine introduces payments for natural resources use and allocation of these revenues to the environmental protection, conservation and restoration measures and fines for environmental pollution based on the "polluters pay" principle. Ukraine has implemented the payment for special water use, which implies differentiation of water users and regulates water uses through issuing permits and licensing

7.1. National Targets and Instruments for Reduction of Water Pollution

According to the Water Code of Ukraine the purpose of the water resource management policy in Ukraine in an improvement of the water quality and rational use of water for providing of sustainable different water use as well as revived and sustainable existence of water ecosystems.

The short term objectives (for period to 2000) of water resources management should be:

- normative and legal maintenance of the new Ukrainian water legislation;
- development of the ecological normative on water quality (standards) with short and long term stages for their implementation;
- organization of the State Monitoring System of the waters;
- improvement of the water quality/quantity control through the water objects pollution reduction control;
- establishment of the technological regulating systems of water use and pollution of water objects in sources of contamination;
- ecological and economical substantiation of charges for water use/pollution to be sure that "polluter - pays and user - pays" principle is applied in practice.

The long-term objectives (for period to 2015) should be:

- harmonization of the Ukrainian and European Community's (EC) legislation;
- organization of the legislative and economical substantiation of the water resources management based on the basin principle.

7.2. Technical Regulation and Guidelines

The status of regulatory documents and pollution control is identified and approved at the level of the Cabinet of the Ministers in a form of amendments or detailing of acting legislative norms.

There are several documents in Ukraine dealing with the monitoring, control etc. presented in the Water Quality Report.

The following standards are established in the area of water resources use, protection, and restoration:

1. standards of ecological safety of water usage;
2. ecological standard of water quality in water bodies;
3. standards of maximum allowable discharge of polluting substances;
4. industrial technological standards of generation of substances that are discharged into water bodies;
5. water usage technological standards.

Other standards in the area of water resources use, protection, and restoration could be established by legislation of Ukraine.

7.3. Actual and Planned Projects and Policy Measures.

All data are available on the state level (Ministries and State Agencies) and are integrated. The data present the necessary funds for the measures but not for the projects. The information about the projects is available only on the local level.

Actual and planned projects and policy measures concerning emission control projects, WWTP, flood plain control are presented in chapter 8.3. as Summary Tables and more details are described in the Water Quality Report.

Pilot projects for assessment of overall agricultural pollution in the Odessa region at the territory along the river Danube with following expanding of activities throughout whole Danube River basin are considered as useful ones. The problem will be among the most urgent because existing statistical data are not valid. Cost estimates for a project are USD 500.000.

7.4. Expected Results of Planned Measures and Projects with Particular Attention to Transboundary Effects (quantified)

The projects proposed by the local authorities had no quantitative parameters characterizing the effect of the measures. That is why it is impossible to point out any characteristics here.

8. Analysis of National Financing Mechanisms

8.1. Policies for Funding of Water Sector Programmes and Projects

The general policy and strategy of financing programmes and projects concerning environmental renaissance of water basins and water management is based on general principles of "Basic Guidelines of State Policy of Ukraine in the Sphere of Environment Protection". The main clause "Natural Environment Protection and Nuclear Safety" was separated in the State budget from 1994 to finance nature protection expenses linked with reproduction and support of the natural resources in due conditions.

The main integral parts of mechanism of realization of the state environmental policy are the following:

- State institutional infrastructure of nature protection policy execution;
- Legislative-juridical mechanism of production activities regulation of legal and physical persons as for protection, usage of natural (water) resources and wastes;
- Economic mechanism of nature usage (water usage) and nature protection activities;
- Mechanism of realization of interstate, national, regional, branch and local nature protection programmes.

8.1.1. Water Supply and Municipal Wastewater Treatment

The water supply and wastewater treatment are under the control and management of the local authorities. That is why the main sources of the financing of the different measures are the different local possible funds. Only if 70% of the necessary funds is allocated from the local budgets, 30% of funds can be allocated from the State budget. The sources to finance construction (updating, expansion) of urban wastewater treatment plants include the following:

- local budgets, including their environmental items, formed from the share of payments for special use of nature, in particular, water resources;
- target-oriented environmental funds in local budgets, formed from the share of payments (charges) for pollution of environment, including water resources;
- own funds of enterprises and organizations concerned (share participation);
- State environmental fund in the state budget formed from the share of payments for environmental pollution;
- limited funds of the Cabinet of Ministers reserve fund in case of emergency.

8.1.2. Industrial Wastewater Treatment

In accordance with the Ukrainian legislation the polluters are responsible to take all necessary measures to prevent any damage to the environment. One of their obligations is to construct all necessary wastewater treatment facilities to minimize the hazardous contaminants. The pollution producer bears full economic burden. The sources of investment for treatment (preliminary treatment) of wastewater at industrial enterprises can be the following:

- state centralized investment provisioned for development of the corresponding industry;
- own costs of enterprises and organizations;
- funds of the Government reserve fund (in case of emergency).

In the situation of slow process of privatization, there are practically no large industrial private enterprises in the country requiring wastewater treatment.

8.1.3. Improvement of Agricultural Practices

There are no special funds or credit institutions to finance measures on regulation of pollution in the agricultural sector.

8.1.4. Waste Management

Treatment of hazardous waste is regulated with the special current legislation.

Disposal of waste, including hazardous one, is charged with corresponding payment (according to the rates approved by the Government).

Pollution of surface reservoirs is also charged with corresponding payment according to the rates approved by the Government.

Sources of finance, standard model and procedure of funds involvement to perform water protection measures at state agricultural (processing) enterprises are similar to industrial enterprises.

8.2. Funding Mechanisms for Water Sector Programmes and Projects

8.2.1. Centralized National Institutions and Banks

In the current economic situation and complicated financial situation of the enterprises, the National banking system is not fully able to finance projects with large infrastructure (including projects in the water sector). The water sectors programmes mostly financed from the state budget are based in the list of measures formed as a State Programme for the Improvement. The funds of such programmes more often come from the state budget through the relevant ministry or the state committee. For the time being all state bodies (ministries or state bodies) have the accounts in the National Bank of the Ukraine and all payments from the State budget are going through the State Treasures.

At present National Agency for Reconstruction and Development acts in Ukraine. This Agency realizes on behalf and on a commission of the Government contacts with international finance institutions, foreign investors.

8.2.2. International Cooperation in Establishing Development Banks and/or Funds to Finance Water Sector Projects

For the time being there is no international assistance in the establishment of the special banks or funds for the water sector. The Ministry for the Environmental Protection takes actions to establish the Environmental Fund as a jurisdictional entity for the collection of any environmental fees and charges and for the financing of the different environmental projects.

8.2.3. Actual Cost and Price Policy

8.2.3.1. Water and Wastewater Tariffs and Charges

Norms of payments for special water usage have started to develop a system of water supply for all water users from 1992 in Ukraine. These norms are developing on the basis of new methodological approaches to economic evaluation of the system of water provision (rental conception) and distribution of expenditures between all participants of water supply complex.

Methodological evaluation for determination of norms mentioned is rent conception of economic evaluation of water resources. In accordance with the latter this evaluation consists of two parts:

- for compensation (expenses for maintenance of these resources in due conditions);
- economic evaluation of water as natural resource with determination of its level of deficiency of water resources. Economic evaluation of deficiency of water is equal to the increase of availability for usage water resources.

The whole economic evaluation of water usage is equal to the sum of two payment rates:

- for usage of water as a natural resource and formation of available water resources for use in the system of water supply;
- for water intake, treatment and distribution among water users in system of water feed (water supply).

8.2.3.2. Public and Private Sector Expenditures (Cost) for Wastewater Treatment and Environmental Protection of Aquatic Ecosystems

Direct payment is introduced for pollution dependent on quantity and quality of pollutants. This payment includes: payment for emissions into atmosphere, payment for water pollution and payment for wastes disposal.

As the basis for methodology of norms determination "Method of Determination of Temporary Payment Norms and Payments Fulfillment for Pollution of Environment", which defines amount of payment for pollution value of environmental-economic loss was used. Amount of money that is necessary to "obtain" from each ton of emissions, discharge of disposed wastes for creation of source for environmental activities financing which should be independent from the state budget and economic condition of enterprises that pollute environment, is respectively defined.

Economic base of payment for pollution consists of the following:

- One, who pollutes, and product consumer have to pay (compensate) economical losses from negative environmental impact to human health, objects of municipal and public utilities (housing fund, city transport, green plantations etc.), agricultural lands, water, forest, fish and recreation resources, industry's fixed assets etc.;
- payments for pollution became a basis for creation of non-budget local and republican environment protection funds (90 and 10 per cent correspondingly); that gave possibility to create source of financing of environment protection measures and works independent from the state and local budgets.

By the decisions of the Parliament base level enterprises with losses and of low profitability may be released from payment for pollution of environment completely or partially.

For joint and other ventures situated on the territory of Ukraine with foreign investment, which sell all their products for foreign currency, payment for discharge of pollutant within and over limits is paid in foreign currency proportionally to the volume of sales of products for currency.

8.2.3.3. Cost structure and Cost coverage for Wastewater Management

As of December 1998 the change rate was 3,5 Hrv for 1 USD. Four categories of payments are implemented for usage of water resources:

- from surface water (they are equal in general 3,4 - 3,6 copecks per cubic meter (cop/m^3), changing from 1,44 cop/m^3 for Danube up to 8,64 cop/m^3 for rivers of Pryazov'ya);

- from subterranean sources (they are equal in general at level of 5 - 6 cop/m^3, with deviations from 2,88 cop/m^3 to 9,0 cop/m^3);
- for needs of hydropower stations (0,7 cop/ 100 m^3);
- for needs of water transport (0,14 copecks per 1 place-day of operation for passenger fleet and 1,25 copecks per 1 ton-day for cargo fleet).

Payment is not carried out for water that is used for drinking and for domestic-household needs of population and in some other concrete cases. The following lowering coefficients to the normative payment are set taking into account economic conditions of water users and necessity of the state subsidy to some separate sectors of national economy for the period till 1999:

- for agricultural producers (irrigation inclusive) - 0,2;
- for ponds and lakes farms (fish-breeding) - 0,1;
- for thermoelectric and nuclear plants - 0,5;
- for housing and communal services - 0,1;

Ministry of Environmental Safety of Ukraine has initiated in 1997 revision of lowering coefficients to the water payment norms keeping in mind determination of more adequate value of payment to the real cost of water and increase of returns to the budget. In particular, it has advised the following change of coefficients:

- for agricultural producers from 0,2 to 0,3 (0,5);
- for ponds and lakes farms from 0,1 to 0,5;
- for housing and communal services from 0,1 to 0,2 - 0,3;

The amount of actual payment for special use of water resources is below the planned one. In addition, the main bulk of revenues is allocated to meet other urgent social needs of the state in the transition period. Due to the difficult financial situation of the enterprises, transfers of payment for pollution of environment are substantially below the planned level (about 50%). Thus, the actual payments and real budget expenditures do not cover the total cost of necessary works. The lowest level of payments for both water consumption and reservoir pollution is in the industrial sector. Ability of the population to pay for public utilities is registered on level of 50-60%. The population with low living standard is provided by the state with certain compensation for their public utilities costs.

8.2.3.4. Economic and Financial Incentives for Investments and Operation of Treatment Facilities and Protection of Aquatic Ecosystems

Reform of economic system and transition to market relations should not just raise efficiency of the national economy but also encourage elimination of subsidies for use of such natural resources as energy, mineral resources, in particular water, and improvement of environment through austerities on responsibility for the mass irrational use of natural resources. Unfortunately, there are no practical examples of financing stimulation concerning return of fine sanctions of enterprise for the environmental measures of the same enterprise. The reason for this is absence of a mechanism of such self-offset.

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

The ongoing and proposed projects are presented in the tables below. The projects were prepared by the local authorities or were included in the state programmes submitted by the responsible state bodies.

Table 8.1. Compilation of actual investment portfolio (Million US$)

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
TRANSCARPATHIAN REGION																			
1.	Complex longterm programme of antiflood measures in Ukraine (Zakarpatya region)	23,8	11,9	1998 1999 2000							2,9 9,5 11,4								
2.	Erection of the embankment on the Tysa River (Tyachiv)	1,74	0,87	1997-1999		0,36 0,2													
3.	Automatically controlled information measuring system for flood forecasting and Tysa River water resources management - 1st stage (ACIM - Tysa)	2,9	1,45	1997-1999		0,7 0,8												0,5	
	a) erection of center for information acquisition and processing with technological support in Uzhgorod																		
	b)equipment for information exchange																		
ODESSA REGION																			
1.	Complex longterm programme of antiflood measures in Ukraine (Odessa region)			1994-1998															
1.1.	Danube bank stabilization in emergency sites	0,094	0,047					0,094											
1.2.	Renewal of emergency parts of Danube check dams	0,121	0,06					0,121											

Table 1 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
1.3.	Regulation of river and channel beds	0,146	0,073					0,146											
1.4.	Estimation of Danube river side flood areas	0,02	0,01					0,02											
1.5.	Cataloguing of water resource of the region	0,06	0,03					0,06											
CHERNIVTSI REGION																			
1.	Implementation of the extended project of sewer erection designated for Luzhany industrial area waste water discharge and implementation of waste water purification technology at Luzhany Pilot Distillery Plant.	2,7	1,35	1992-1999	1,27 0,08														
2.	Creation of the range for storage of solid waste products in Chernivtsi (2nd phase)	3,3	1,65	1996-2000									0,9					2,4	
IVANO-FRANKIVSK REGION																			
1	Complex longterm programme of antiflood measures in Ukraine (Ivano-Frankyvsk region) 1994-2000 p.																		
2.	Including Prut river	44,9	22,45	1998-2000															
				1998 1999 2000		0,62 3,10 5,18											- 4,0 6,0	- 3,0 5,0	

Table 1 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
3.	Prut's tributaries	22,0	11,0	1998-2000															
				1998 1999 2000		0,20 1,40 2,40											- 2,0 3,0	- 1,0 1,0	
4.	WWT facilities with the daily capacity of 100 m^3 (Vorokhta)	0.04	0.02	1998					0,03			0,01							
5.	WWT facilities with the daily capacity of 700 m^3 (Kuty)	1.6	0.8	1998-2000				0,06 1,0	0,01										

Table 8.2. Compilation of planned investment portfolio (Million US$)

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
TRANSCARPATHIAN REGION																			
1	Extension and reconstruction of Waste Water Treatment Facilities of Uzhgorod (3 turn)	50,0	25,0	1998-2005														25,0 $US	
2.	Reconstruction and repair of WWTP (Mukachevo)	0,297	0,148	1998-2000						0,05									
3.	Sewage channel on the Pryashivska Str., Mukachevo city	0,691	0,34	1998 1999 2000 2001 2002-2005						- 0,3 0,391									
4.	Second stage of the WWTP Mukachevo city	2,418	1,2	1998 1999 2000 2001 2002-2005						0,1 1,2 1,3 1,4 1,418									
5.	Reconstruction of the sewage system of the Khust city	0,091	0,045	1998 1999 2000						0,055 0,036									
6.	Pumping station of the industrial zone of the Khust city	0,141	0,07	1998						0,141									
7.	Second stage of the WWTP with 15000 cub.m/day capacity in the Khust city	8,343	4,17	1998 1999 2000 2001 2002-2005						- 0,21 0,3 0,62 7,213									

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
8.	Re construction and repair of WWTP (Svalyava)	0,051	0,025	1998-2000															
9.	Reconstruction and repair of WWTP (Beregovo)	0,058	0,029	1998-2000															
10.	Reconstruction and repair of WWTP (Vynogradiv)	0,120	0,06	1999						0,120									
11.	Reconstruction and repair of WWTP (Chop)	0,014	0,007	1998						0,014									
12.	Reconstruction and repair of WWTP (Tyachiv)	0,147	0,073	1999						0,147									
13.	Reconstruction and repair of WWTP (Irshava)	0,066	0,033	2000						0,066									
14.	Reconstruction and repair of WWTP (Berezny)	0,016	0,008	1999						0,016									
15.	Reconstruction and repair of WWTP (Mizhgir'ya)	0,006	0,003	1998-						0,002									
16.	Reconstruction and repair of WWTP (Volovets)	0,038	0,019	1999						0,038									
17.	The collecting channel in Olbrachta St.	0,713	0,356	1998- 1999 2000 2001 2001-2005						- 0,2 0,22 0,293									
18.	Canalization pumping station (Svalyava)	0,59	0,3	1998-2005						0,05 0,32 0,22									
19.	The 2nd phase of treatment facilities with daily capacity of 7,000 m^3	3,893	1,95	1998-						0,21 0,66 3,023									

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
20.	Construction of the sewage system in the rural area of the region with total length 46,3 km	4,44	2,22	1998 1999 2000 2001 2002-2005						0,384 0,672 1,373 2,016									
21.	Automatically controlled information measuring system for flood forecasting and Tysa River water resources management - 2nd stage (ACIM - Tysa).	1,8	-	1998 1999 2000															
22.	Complex utilization of timber with introduction of environmentally friendly technologies in Teresva Woodprocessing Enterprise.	10,0	5,0	1998-2000															
23.	Complex utilization of timber with introduction of environmentally friendly technologies in Velykobychkiv Wood Chemistry Enterprise	10,0	5,0	1998-2000															
24.	Construction of local area canalization networks in the villages of the region (the total length is 46.3 km	4,44	2,22	1998-2005						- 0,384 0,672 1,373 2,016									

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
ODESSA REGION																			
1.	Construction of Vilkovo Wastewater Treatment Facilities.	13,0	6,5	1999-2003				12,2				0,8							
2.	Extension of the Wastewater Treatment Facilities in Kiliya	9,0	4,5	1999-2002				8,4				0,6							
3.	Extension of the Wastewater Treatment Facilities in the Izmail Paper Factory (city WWTP)	7,2	3,6	1999-2003	3,0			3,2	0,8	0,2									
4.	Creation of the Wastewater Treatment Facilities in Reni.	5,6	2,8	1999 - 2003	1,5			3,0	0,9	0,2									
5.	Priority measures on protection against flooding and improvement of sanitary and epidemic situation in Vilkovo.	1,7	0,85	1998 2000				1,5	0,2										
6.	Kiliya protection against flooding (emergency measures).	3,8	1,9	1999-2005				3,0	0,6	0,2		3,4							
7.	Vilkovo city-channels erek reconstruction	4,8	2,4					4,0	0,4	0,4									
IVANO-FRANKIVSK REGION																			
1.	Extension and reconstruction of the Kolomiya city WWTP up to 45000cub.m/day capacity	16,6	8,8	1999-2003					5,0		6,6	3,3						2,0	
2.	Construction of the silt treatment facilities of the WWTP Kolomiya city	13,4	6,7	1999-2000				5,0			7,0	0,4						1,0	

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
3.	Additional engineering networks and facilities for the processing for the Kolomiya WWTP	9,3	4,6	1999 - 2000				5,0 4,3											
4.	Reconstruction of WWTP (Otynia)	0,4	0,2	1998-2000				0,4											
5.	Reconstruction of WWTP (Pechenizhyn)	0,2	0,1	2005-2008				0,18		0,02									
6.	Erection of WWTP(Hvizdtsi)	0,2	0,1	2004-2007				0,15		0,05									
7.	WWTP (Kovalivka), shareholder- Kovalivka	0,16	0,08	2005-2007				0,06		0,1									
8.	Measures on the elimination of the consequences of the flood on the drinking water facilities Knyazhdvir for Kolomiya city(river bank protection)	4,8	2,4	1999 2000				2,8 2,0											
9.	River bank protection on the Prut around the pumping station 2 Kolomiya city	0,9 0,4		1999 2000				0,4 0,5											
CHERNIVTSI REGION																			
1.	Sanation, design and demo reconstruction of water and canalization system of the old building- up part of Chernivtsi aimed at improvement of water supply and reduction of soil displacement risk	0,7	0,35	1999							0,23						0,25		

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
2.	Erection of the 2nd branch of pressure collecting channel between main pumping station and city canalization treatment facilities (Magala)	7,6	3,8	1999-2001															
3.	Erection of sewage collecting channel between Storozhynetska Str. and the gallery situated in Chernyakhovskogo Str.	2,8	1,4	2000-2008									2,8						
4.	Erection of the gallery division between Gastello St. and active bore situated in Chernyakhovskogo St.	0,9	0,45	2000-2001									0,9						
5.	Expansion and reconstruction of Chernivtsi sewage system including increase of daily capacity up to 200,000 m^3	3,2	1,6	1998-2004							1,0	1,2	1,0						
6.	Design and erection of the 2nd branch of sewage pipe canal across the Prut River near main canalization pumping station	0,4	0,2	1998-2000									0,4						
7.	Reconstruction and repair of WWTP (Vyzhnytsya)	0,2	0,1	1998-2000	0,05	0,005					0,05	0,05							
8.	Reconstruction and repair of WWTP (Putyla)	0,1	0,05	1999-2001								0,1							
9.	Reconstruction and repair of WWTP (“Cheremsh” Sanatorium)	0,2	0,1	1999-2000								0,2							

Table 2 continued

No	Type/name of Project or Programme	Total Capital Requirements		Funding Period	National Funding Sources											International Funding			Remarks
					Equity	Envir. Fund	Water Manag Fund	Public Loans			Public Grants			Comm. Bank Loans	Others	Organisation	Grant	Loan	
								Central Budget	Reg. Budget	Local Budget	Central Budget	Reg Budget	Local Budget						
		(MNC)	(MUS$)		(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)	(MNC)		(MUS$)	(MUS$)	
10.	Construction of the polygon for storage of solid waste in Chernivtsi (2nd stage).																		
11.	Processing and raise of environmental safety of mud formations in “Vodokanal” enterprise (Chernivtsi)	2,0	1,0	1993-2000							1,1							0,5	

9. Development of National Pollution Reduction Programme and Investment Portfolio

9.1. Project Identification, Description and Cost Estimation

The actually retained and new proposed projects for pollution reduction and investment portfolio for priority projects are presented in the summary tables of the Chapter 8.3.

9.2. Institutional Planning Capacities in Public and Private Sectors

It is well known after some reviews of the national environmental policy and implementation mechanism done with the World Bank assistance in 1992 that the Ukrainian Environmental Management System has enough gaps especially in the field of the policy implementation.

The development of the policy preparation and implementation are one of the key issues considered under the ongoing project “Environmental Policy Development and Capacity Building” financed by the Institutional Development Fund of the World Bank. The key topics of this project are to prepare Ukraine for the harmonization with the environmental legislation and management practice used in the EU and some other well-developed Western countries.

The results of this project will have an influence on the follow up procedures of the decision and policy making as well as on the implementation mechanism.

9.3. Implementation Capacities in Public and Private Sectors

Since the former USSR age Ukraine has a lot of national construction companies, which have enough good experience on the construction business. The lack of finance and economical crisis have destroyed some of them but the rest of the companies, which act now on this market, have enough capabilities to cover the Ukrainian needs.

There are some joint construction companies using western technologies, partly the western investments and local manpower. Sometimes the local authorities or private companies use fully foreign companies for the construction including manpower.